Survive or thrive: creating options for sustainable communities in rural Scotland

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Declaration

I hearby declare that this thesis has been composed by myself and that it embodies the results of my own research. Where appropriate, I have acknowledged the nature and extent of work carried out in collaboration with others.

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Abstract

Environmental and socio-economic crises are creating compelling needs for radical social change. This project investigated the options and barriers for three Scottish rural communities (Fintry, Killin and Kinlochleven) to become sustainable and thrive in a future resource-constrained world. A unique, holistic and mixed methods approach was used to assess baseline sustainability, envision and model futures and develop possible options for sustainability. Central to this investigation was the development of a strong and holistic model of a sustainable community: the sustainable community design (SCD). This framework shaped the assessment of each community's baseline sustainability. Sustainability was measured for the ten aspects of the SCD using a scorecard approach with a basket of indicators populated by primary data (collected in a household survey) and secondary data (national statistics). Sustainable consumption was analysed using the Resources and Energy Analysis Programme (REAP) to generate each community's ecological footprint (EF) and results were compared to current estimates of per capita world biocapacity to gauge sustainability. Even the most sustainable community was only sustainable in three out of ten of the SCD's aspects and this community had the highest EF. Although the most deprived community had the lowest EF, it was unsustainable in all ten SCD aspects. The results reflected the heterogeneity of rural communities and complexity of sustainability measurement. The SCD scorecard approach for sustainability measurement was shown to be sensitive and robust and can be applied to rural communities across Scotland.

Future visions were created in focus groups, in which participants were asked to envision what their community would need to thrive in 2030 under the scenario of peak oil and a low carbon economy. Vision ideas and examples of best practice and technological innovation were used to create narrative scenarios for modelling transport, food and energy futures. The scenarios' EFs were calculated in REAP for three discrete levels of change: a marginal change, a step change and radical transformation. The results suggested that radical transformation is required for communities to become sustainable. Key features are likely to be re-localised and highly co-operative societies, which utilise technological innovations (such as electric cars powered by renewable energy) and share resources to maximise opportunities for living in rural areas. A community's transformation is likely to be bespoke and require local control, requiring changes to governance and supportive policy. Key barriers identified were availability of affordable technological innovations, energy injustice, power to achieve self-determination, community governance, property rights and sustainability literacy. A process model, incorporating the SCD scorecard approach, was proposed for furthering sustainable community development and research. In taking an interdisciplinary and mixed methods approach, this study has pioneered a novel approach to the holistic enquiry of the options for creating sustainable rural communities.

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List of Abbreviations

The abbreviations listed below are detailed in full only on their first appearance in the text.

ACORN	A Classification Of Residential Neighbourhoods
AFN	Alternative food network
ASHP	Air source heat pump
BedZED	Beddington Zero Energy Development
BOS	Bristol On-line Survey
CAP	Common Agricultural Policy
CAR	Car travel scenario
CARES	Community and Renewable Energy Scheme
CCF	Climate Challenge Fund
CCS	Carbon capture and storage
CES	Community Energy Scotland
CF	Carbon Footprint
CfE	Curriculum for Excellence
CHP	Combined heat and power
COA	Census Output Area
COICOP	Classification of Individual Consumption According to Purpose
CSA	Community supported agriculture
CSE	Centre for Sustainable Energy
DECC	Department of Energy and Climate Change
DEFRA	Department of Environment, Food and Rural Affairs
DPSC	Development Pathway to Sustainable Communities

DTI	Department of Trade and Industry
EAK	Environmental Action Killin
ECCE	Electric cars powered by conventional electricity
ECPR	Electric cars powered by renewable electricity
EF	Ecological Footprint
EFBS	Environmentally friendly behaviour scale
EFPS	Environmentally friendly purchasing scale
EIA	Environmental Impact Assessment
ESDS	Economic and Social Data Service
ESRC	Economic and Social Research Council
ESS	European Social Survey
EU	European Union
fairshare	The estimated per capita share of world's available biocapacity in 2008 (1.8gha/cap, GFN, 2012)
FAO	UN Food and Agriculture Organization
FC	Food consumption scenario
FDC	Final demand category
FDP	Food domestic production scenario
FDT	Fintry Development Trust
GDP	Gross Domestic Product
GFN	Global Footprint Network
gha	global hectares
gha/cap	global hectares per capita
GHG	Greenhouse gas
GROS	General Register Office for Scotland

GSHP	Ground Source (or Air Source) Heat Pump
I-O	Input-Output
IPCC	Inter-governmental Panel on Climate Change
ISEW	The Index of Sustainable Economic Welfare
JMT	John Muir Trust
KAT	Killin and Ardeonaig Trust
KCC	Killin Cutting Carbon
KCT	Kinlochleven Community Trust
KLDT	Kinlochleven Land Development Trust
LA	Local Authority
LCA	Life Cycle Analsyis
LDT	Long distance travel
LEADER	Liaison Entre Actions de Développement de l'Économie Rurale - "*Links between actions of rural development*"
LFAs	Less Favoured Areas
LLTNP	Loch Lomond and Trossachs National Park
LMO	Land Management Options
MIOT	Monetary input-output table
MRIO	Multi-region input-output model
Mtoe	Megatonnes of oil equivalent
NERC	Natural Environment Research Council
NTS	National Trust for Scotland
ONS	Office of National Statistics
OPL	One Planet Living
OST	Office of Science and Technology

PIOT	Physical input-output table
PKMS	Passenger kilometres
PT	Personal travel scenario
PV	Photovoltaic
QFintry	Fintry questionnaire number
REAP	Resources and Energy Analysis Programme
RP	REAP Petite
RPI	Retail Prices Index
RPP2	Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027 - The Draft Second Report on Proposals and Policies (Scottish Government, 2013a)
RT-Alcan	Rio Tinto Alcan Ltd
SCA	Sustainable community agriculture
SCD	Sustainable community design
scorecard	“Traffic-light” sustainability assessment for each aspect of the SCD
SCROL	Scotland’s Census Results OnLine
SDC	Sustainable Development Commission
SEI	Stockholm Environment Institute
SEPA	Scottish Environment Protection Agency
SIMD	Scottish Index of Multiple Deprivation
SLS	Survey Link Scheme
SNP	Scottish National Party
SNS	Scottish Neighbourhood Statistics
SRC	Short rotation coppice
SSE	Scottish and Southern Energy

SSSI	Site of Special Scientific Interest
STAR	Small Town and Rural Development Group
SWOT	Strengths, weaknesses, opportunities and constraints
TTM	Transition Towns Movement
WCED	World Commission on Environment and Development
WF	Weighting factor
WF^{cat}	Weighting factor for each age/gender category
WRI	Scottish Women's Rural Institute

Foreword

This research project has been a personal journey. I started with the desire to further understand what might happen to rural communities and the challenges posed by our current impending crises, with the hope that with this understanding I might be able to do something about it. With the arrival of two children during the course of the study, I have discovered that my desire to live a green lifestyle has been thwarted by the pressures of living as a modern family and the "lock-in" infrastructures of our economy, education provision and individualised society. We take "unsustainable" short-cuts in our daily lives and are caught in the trap of working punishing hours to be able to afford to live where we do, whilst not having the time to properly enjoy it. Whilst the reality is that we probably shouldn't live where we do, what would become of the rural community in which we reside if we all moved away? What I have come to understand during the research is that I cannot change communities. The change has to come from within the communities themselves. I now understand more fully the complexity and nature of society and the limitations of self. I still hope for a different future, where wisdom, morality and the concept of self as being part of community are restored.

Chapter 1 Introduction and research objectives

1.1 Introduction

In Scotland, the current pattern of economic development, growth in consumption and utilisation and pollution of the Earth's resources is unsustainable (Moffatt *et al.*, 2001, Loh, 2002, Daly and Farley, 2004). We do not know how far we can exceed the planet's carrying capacity, before society passes a tipping point and our life-support systems spiral into an irreversible decline (Inter-governmental Panel on Climate Change, IPCC, 2007, WWF, 2010).

However, the "greening" of political agendas in the last decade suggests that the awareness of the impact of society on the planet is increasing. For example, in 2005, sustainable development became a political goal (Scottish Executive, 2005a). Since 2007, when the Scottish National Party (SNP) became the governing administration, the focus has been on climate change rather than sustainable development. In 2009, the Climate Change (Scotland) Act (Scottish Parliament, 2009) set the challenging goal of an 80% reduction in carbon emissions by 2050. However, the transformational change in Scottish society required to meet the SNP's goals has not yet happened (Scottish Government, 2013a).

Over the last century, Scottish society has undergone unprecedented change. In particular, society is far more dominated by individualism, consumerism and materialism with the role of communities diminishing (Beck, 1992, Borgström *et* *al.*, 1999, McIntosh, 2001). Consumerism and materialism are used as a means for developing individual well-being, in the absence of community belonging (McIntosh, 2001, Kasser, 2008) and the divide between rich and poor is ever increasing (Meadows *et al.,* 2004, Harvey, 2005).

Rural areas and the wild landscape dominate Scotland (Habron, 1998), yet only 20% of the Scottish population reside in rural communities (Scottish Government, 2010a). The rural population has a higher dependence on fossil fuels than urban areas for heating homes and transportation to access often distant goods, services and jobs (Scottish Government, 2010a). The Scottish landscape is diverse, but the majority of agricultural land qualifies for support from subsidies (Scottish Government, 2012a). Rural communities have fewer young adults and higher numbers of retirement age people and holiday homes (Scottish Government, 2010a, Scottish Government, 2010b). All these factors combine to create socio-economic challenges for sustaining rural communities. The combination of environmental pressures, the climate crisis, economic challenges, technological changes and increasing dissatisfaction with individual lifestyles provides drivers for the evolution of a new type of sustainable society in rural Scotland.

Achievement of sustainability has to be driven at all levels by strong and resolute leaders (with appropriate and radical policy interventions), citizens and communities creating their own enhanced well-being and life-styles. Creating sustainable communities that meet climate change and sustainable development goals may require one of the most radical changes to Scottish society since the depopulation of rural areas with the industrial revolution and the Clearances of the eighteenth and nineteenth centuries. There is a need to understand the potential for thriving and sustainable Scottish rural communities and the barriers and enablers to creating them.

Communities are heterogeneous and have multiple aspects; considering only one aspect or community risks misinterpretation or revealing only part of the truth by missing important factors that act as enablers or constraints for community development. Thus, understanding the options for creating sustainable communities requires an integrative and holistic research approach. This project is interdisciplinary in nature, contributing to the ESRC thematic priority of "Environment and Human Behaviour" and the NERC research priorities of mitigating the impacts of climate change and identifying and providing sustainable solutions to the challenges of socio-economic and ecological crises, thus creating sustainable communities.

1.2 Research objectives

The purpose of this research is to measure holistically the sustainability of three rural Scottish communities, investigate how rural communities might thrive in a resource-constrained future with realisation of concomitant socio-economic and ecological global and local crises and understand opportunities for facilitation of transformational change. Therefore, the objectives of this study are to:

1) Define a sustainable community and develop a holistic framework to encapsulate the multiple dimensions of a sustainable community:

a) Define key terms such as strong sustainable development, sustainable communities, resilience, social capital, power, '*dualchas'* and justice; and

b) Drawing on these definitions, models and practical examples of sustainable communities, and observations from this study, identify the integral aspects of community to create a Sustainable Community Design (SCD) framework and define sustainability for each aspect of the SCD (sustainability goals).

2) Understand the opportunities and challenges for and gaps in knowledge with regard to the sustainability of rural Scottish communities:

   a) Research the status, history and geography of rural Scotland;

   b) Identify and assess the impact of and opportunities and challenges arising from global and national forces, including:

      i) socio-economic paradigms,

      ii) ecological crises,

      iii) government policies and

      iv) property rights; and

   c) Identify gaps in knowledge in the sustainability of rural Scottish communities.

3) Measure the extent of sustainability in a range of case study communities in rural Scotland:

a) Define criteria for case studies and select appropriate examples, based on their history and geography;

b) Design a methodology that is sufficiently sensitive to identify the degree of sustainability of and permit discriminatory analysis between case study communities;

c) Establish a robust set of indicators for measuring the sustainability of each aspect of the SCD and identify appropriate data collection methods (questionnaire, observation (field work) or secondary data sources);

d) Create a mechanism for scoring and illustrating the degree of sustainability across multiple non-commensurate indicators and aspects of community;

e) Collect and analyse data for each case study community and measure the degree of sustainability for each aspect of the SCD; and

f) Analyse the degree of freedom and capability which communities have to develop sustainably (identify and analyse injustice, including rights to renewable energy).

4) Envision future states to identify the community's view of sustainability and options for sustainable development:

a) Design a method for obtaining community visions of community sustainability in a resource-constrained future; and

b) Using participatory focus groups identify community visions for a thriving community in a resource-constrained world in 2030.

5) Model different future states to identify the extent of change required:

   a) Where possible, develop a modelling methodology to create scenarios of different futures states to measure the sustainability of consumption (ecological footprint, EF) of these scenarios;

   b) Using insights from the community visions and current technological innovations, construct scenarios to detail different scales of change to create three levels of change (marginal, significant and transformational, Handmer and Dovers, 1996);

   c) Populate the scenarios with community data and estimate the EF of the different scenarios for transport, food and energy consumption; and

   d) Estimate the impact of a switch to 100% renewable energy generation of the EF.

6) Evaluate the methodology:

   a) Assess whether the results are reasonable and robust and evaluate the effectiveness of the methodology;

   b) Identify limitations of the methods used to assess sustainability (baseline assessment, focus group design and modelling design); and

   c) Evaluate the benefits of using an interdisciplinary approach.

7) Drawing on lessons from all three communities, explore the opportunities, constraints and options for achieving sustainable communities:

    a) Recommend options for creating sustainable communities;

    b) Identify opportunities for resolving overarching issues, in particular, energy (in)justice, but also, the inter-linked issues of governance, property rights, capability, power, well-being and sustainability literacy;

    c) Propose means to enact change and assess the potential for the SCD to be used as a tool for creating sustainable communities; and

    d) Identify recommendations for policy and future research.

A summary table of how and where in this document each objective was addressed is given at the start of Chapter Three. A list of abbreviations can be found on page xxxiii.

This study's aim was to increase our knowledge of evolving rural communities in Scotland. The results are useful for Scottish policy-makers and community workers in understanding the contribution of rural communities to achieving a sustainable Scotland and to provide information for them to evaluate and instigate possible solutions.

Chapter 2 The literature Review

The literature review addresses the first two objectives of this study (Chapter One, page 3). In the first four parts of section one of this chapter (2.1.1 to 2.1.4) sustainable development and sustainability are defined, determinants of pro-environmental behaviour are explored and the integral inter- and intra-dependent aspects of a sustainable community are identified. A review of the literature and practical examples enabled the creation of a Sustainable Community Design (SCD) framework. Please note that the development of the SCD, which is presented in this chapter, has been an iterative process and the SCD has been refined throughout this eight year study based on participatory learning and issue identification and analysis. The final part of section one (section 2.1.5) considers the concept of resilience, mechanisms of transition to more sustainable futures, and justice.

Future global crises of resource shortages and climate change, together with local injustices and communities that are economically just "surviving", create a web of drivers and impetus for a more just and sustainable rural society (Hopkins, 2006, Holmgren, 2009). The multiple global and local forces creating future crises are considered in section two. The third section provides an overview of the nature of rural Scotland and the current Scottish Government's policies for sustainable development and addressing climate change that will further impact rural communities. These drivers of change set the context for envisioning focus groups and modelling in this study. Injustice in rural Scotland is identified.

Finally, in section 2.4, the gaps in knowledge of sustainable communities in rural Scotland are highlighted, justifying the remaining research objectives for this study.

2.1 Sustainable development, sustainable communities and justice

Sustainability and sustainable development have multiple meanings that can be adapted to an author's needs. "*Sustainability is a contested and chaotic concept, often accused of meaning everything and nothing, and used to justify almost anything*" (Shucksmith and Rønningen, 2011, p277). The definition of sustainability is dependent on the party making the interpretation. For example, for farmers, sustainability is economic; for indigenous people, sustainability is soil sustainability; and for ecologists, sustainability is maintaining biodiversity (Robinson, 2008). The first part of this section aims to clarify the meaning of sustainability and sustainable development and its application in terms of this study of rural communities, so that a sustainable community can be defined (section 2.1.1.1) and, using this with examples of philosophies and best practice (section 2.1.3), enunciated in a workable framework (the SCD, section 2.1.4) for this study.

Sustainable communities exhibit resilience and have undergone transition, which are outlined in section 2.1.5. The principles of justice and a framework for analysis are considered in the final part of section 2.1.5, as achievement of sustainable communities requires a just and fair society and needs to be tailored to the context of the community. In order to address injustice an appreciation of the meaning of justice and a means of identifying underlying causes is required. This review of justice facilitates the analysis of injustice in rural Scotland (specifically, energy injustice) later in this study.

2.1.1 Sustainability and sustainable development

Sustainability is a noun derived from the verb sustain. Sustain means to "*keep (something) going over time or continuously*" (ODCE, 2001). Thus, sustainability can be used for good or bad "things". In this research "things" are communities. The sustainability of communities is examined in the context of "keeping Scottish rural communities going over time" or "creating Scottish rural communities that are not just *surviving* but *thriving*" (italics for emphasis), given the resource, ecological and economic crises that are imminent or being enacted now.

The clarification of the difference in meaning between sustainability and sustainable development is important, because in this research the former is achieved as a result of the latter. Handmer and Dovers have provided two definitions to clarify the terms. "*Sustainability is the ability of a human, natural or mixed system to withstand or adapt to endogenous or exogenous change indefinitely. Sustainable development is therefore a pathway of deliberate change and improvement which maintains or enhances this attribute of the system, while answering the needs of the present population.*" (Handmer and Dovers, 1996, p485).

However, these definitions do not fully encompass the meaning of sustainable development as defined in the Brundtland Report ("*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*", World Commission on Environment and Development, WCED, 1987, p43) and politically recognised and further defined at the Earth Summit in Rio de Janeiro in 1992 (UN, 1992). Since 1992, sustainable development has evolved slowly into a strategy for managing the pressures of environmental change, social injustice and an unfairly distributed economy and the WCED definition has been incorporated into national strategies, such as the Scottish Government's (Scottish Government, 2012e, see page 98).

The 27 Principles of the Rio Declaration on Environment and Development (UN, 1992) still apply and provide a sound foundation for a better future. The principles can be distilled into seven overarching principles for determining policy, namely: "*the precautionary principle, equity, the proximity principle, sustainable yield of renewable resources*, [minimal] *exploitation of non-renewables only within a closed cycle*, *waste should not exceed assimilative capacity, and the polluter pays principle*." (Moffatt *et al.* 2001, p14, Daly and Cobb, 1990, Moffatt, 1996b). These principles are important for interpreting the original definition and provide a means to assessing sustainability, but there are still multiple interpretations of sustainable development in terms of: application of principles, type of development, philosophical basis, spatial focus, governance, use of technology, policy, and role of civil society (Baker, 2006, Table 2.1). Therefore, clear definition is essential for this study of community sustainability.

The difference in philosophical bases and application of principles have been illustrated by the "*opposing paradigms*" (Neumayer, 2003) of 'weak' and 'strong' sustainable development. In essence, weak sustainable development is anthropocentric and allows replacement of natural capital with man-made or manufactured capital, whereas strong is ecocentric (where nature has intrinsic value and rights and humans are a part of nature, Pepper, 1996) and does not allow substitution (Pearce, 1989, Neumayer, 2003). The concept of being able to replace life support systems with man-made capital is a fallacy (Daly, 1995, MacDonald *et al.* 1999, Daly and Farley, 2004) and so the weak definition is insufficient and largely rhetoric, whilst the strong definition is transformational (Handmer and Dovers, 1996, Moffatt, 1996b, Moffatt *et al.*, 2001).

Furthering these concepts of weak and strong sustainable development, the "*Ladder of Sustainable Development*" (Baker, 2006, p30-31, Table 2.1) has four models (or levels) of sustainable development, which provide a holistic framework for clarifying the different interpretations and discourses. As the levels, depicted as rungs of a ladder (rows in Table 2.1) go from bottom to top, the philosophy underpinning the definitions changes from anthropocentric to ecocentric. In its weakest (neoliberal) form (bottom rung of the ladder) sustainable development is just "*pollution control*", where the development is "*exponential market-led growth*", with a mobile globalisation of resource exploitation and production (to where production is cheapest regardless of

Table 2.1 The "*Ladder of Sustainable Development*" (from Baker, 2006, p30-31)

Model of sustainable development	Normative principles	Type of development	Nature	Spatial focus	Governance	Technology	Policy integration	Policy tools	Civil society—state relationship
Ideal model	Principles take precedence over pragmatic considerations (participation; equity, gender equality, justice; common but differentiated responsibilities)	Right livelihood; meeting needs not wants; biophysical limits guide development	Nature has intrinsic value; no substitution allowed; strict limits on resource use, aided by population reductions	Bioregionalism; extensive local self-sufficiency	Decentralization of political, legal, social and economic institutions	Labour-intensive appropriate, Green technology; new approach to valuing work	Environmental policy integration; principled priority to environment	Internalization of sustainable development norms through on-going socialization, reducing need for tools	Bottom-up community structures and control; equitable participation
Strong sustainable development	Principles enter into international law and into governance arrangements	Changes in patterns and levels of consumption; shift from growth to non-material aspects of development; necessary development in Third World	Maintenance of critical natural capital and biodiversity	Heightened local economic self-sufficiency, promoted in the context of global markets; Green and fair trade	Partnership and shared responsibility across multi-levels of governance (international; national, regional and local); use of good governance principles	Ecological modernization of production; mixed labour- and capital-intensive technology	Integration of environmental considerations at sector level; Green planning and design	Sustainable development indicators; wide range of policy tools; Green accounting	Democratic participation; open dialogue to envisage alternative futures
Weak sustainable development	Declaratory commitment to principles stronger than practice	Decoupling; reuse, recycling and repair of consumer goods; product life-cycle management	Substitution of natural capital with human capital; harvesting of biodiversity resources	Initial moves to local economic self-sufficiency; minor initiatives to alleviate the power of global markets	Some institutional reform and innovation; move to global regulation	End-of-pipe technical solutions; mixed labour- and capital-intensive technology	Addressing pollution at source; some policy coordination across sectors	Environmental indicators; market-led policy tools and voluntary agreements	Top-down initiatives; limited state-civil society dialogue; elite participation
Pollution control	Pragmatic, not principled, approach	Exponential, market-led growth	Resource exploitation; marketization and further closure of the commons; nature has use value	Globalization; shift of production to less regulated locations	Command-and-control state-led regulation of pollution	Capital-intensive technology; progressive automation	End-of-pipe approach to pollution management	Conventional accounting	Dialogue between the state and economic interests

environmental cost), the view of nature is strongly anthropocentric and governance focuses on "*command-and-control state-led regulation of pollution*" and there is no civil society / state interaction. At the opposite extreme (top rung of the ladder) is the "*ideal model"* where normative principles ("*participation, equity, gender equality, justice, common but differentiated responsibilities"*) are enshrined in international law and behaviour, consumption is limited to "*meeting needs not wants*" and within biophysical limitations. The ecocentric philosophy is embedded into resource use and policy (Baker, 2006, p30-31) with the economy embedded within the ecosphere and resources, energy, waste and degraded energy all part of the economic whole (Daly, 1968, Shah and Peck, 2005). Spatially it is bioregional with "*extensive local self-sufficiency*" and civil society is a crucial part of the state with empowered communities and equitable participation (Baker, 2006, p30-31).

Unlike other more simplistic descriptions of sustainable development that focus on the three pillars or domains of sustainable development (economy, society and environment), Baker's "*Ladder*" is useful as it provides a holistic summary of the many different aspects of the state and society that need to be a aligned to achieve the concept of strong sustainability (the "*ideal model*") and in the lower rungs of the ladder summarises the key features of society that is failing to achieve sustainability. Therefore, Baker's (2006) "*ideal model"* can provide a means of assessing the inadequacies of the present by providing a conceptual framework for a sustainable society. In this research, Baker's (2006) "*ideal model"*, rather than weaker definitions of sustainable development, has been used for the definition of a sustainable community and the "*Ladder*" has been useful for interpreting different levels of development that increasingly reflect the ultimate definition of sustainability.

2.1.1.1 Sustainable behaviour

Although Baker's "*ideal model*" defines the high level attributes of a sustainable society, it does not describe why a 21st century Scot may behave unsustainably and how and what might create pro-environmental behaviour. Consumption and materialism are destructive of not just the planet but societies too (Kasser, 2008). Therefore, behaviour change from materialistic consumerism to sustainable consumption is an essential part of reducing humanity's ecological impacts and for human well-being. Scotland's unsustainable EF provides a moral justification for addressing profligate consumption, but moral reasoning alone is unlikely to create transformational behaviour change (Whitmarsh *et al.*, 2011). Even with pro-environmental attitudes, behaviour can be contradictory. For example, there is a widely held belief amongst the general public that the climate is already changing (Brown *et al.*, 2005), but in a survey of 3,000 UK participants, carbon reduction was not considered in everyday decision-making, despite awareness of the link between climate change and specific actions such as flying (Whitmarsh *et al.*, 2011). In a Scottish Executive (2005b) survey, 77% of respondents agreed that people in Scotland need to change their behaviour so that future generations can continue to enjoy a good quality of life and environment, but only 46% agreed that they personally needed to change their behaviour. This is the so-called '*value-action*' gap, where moral values are contradictory to behaviour towards the environment (Stoll-Kleemann *et al*., 2001, Scottish Executive, 2005b, Key and Kerr, 2011, 2012). Therefore, pro-environmental behaviour requires resolution of a conflict between acting either in one's own interest or in the long term interest of the planet (Nordlund and Garvil, 2002). However, barriers, such as lack of suitable alternatives to driving and flying, constrain the ability of even the most knowledgeable and motivated individuals to act. Education alone is insufficient to create pro-environmental behaviour (Whitmarsh *et al.*, 2011).

The pro-environmental behaviour model (Figure 2.1) helps explain behavioural determinants. The model is based on the "*New Environmental Paradigm*" (NEP, Dunlap & Van Liere, 1978, Dunlap *et al*. 2000), "*Value-Belief-Norm*" theory (VBN, Stern *et al*., 1999, Stern, 2000) and theory and research by Joireman, Nordland and Garvill (Nordlund and Garvill, 2002, Joireman *et al*., 2003, Nordlund *et al*., 2010). VBN incorporates the NEP, which was developed to measure generalised beliefs about the environment and human relationships to it (i.e. environmental attitudes, Dunlap & Van Liere, 1978, Dunlap *et al*., 2000). VBN has three value categories, namely "*altruistic*" (unselfish concern for the welfare of others, which is supported in other research, McMakin *et al*., 2002, Widegren, 1998), "*biospheric*" (the value of animals and habitats) and "*egoistic*" (self-enhancement, which is negatively associated with environmental beliefs, Stern, 2000, p412). From these underlying values, ecocentric/anthropocentric attitudes (NEP) are developed. These, in turn, are moderated by other factors (the individual's perception of adverse consequences for valued objects and

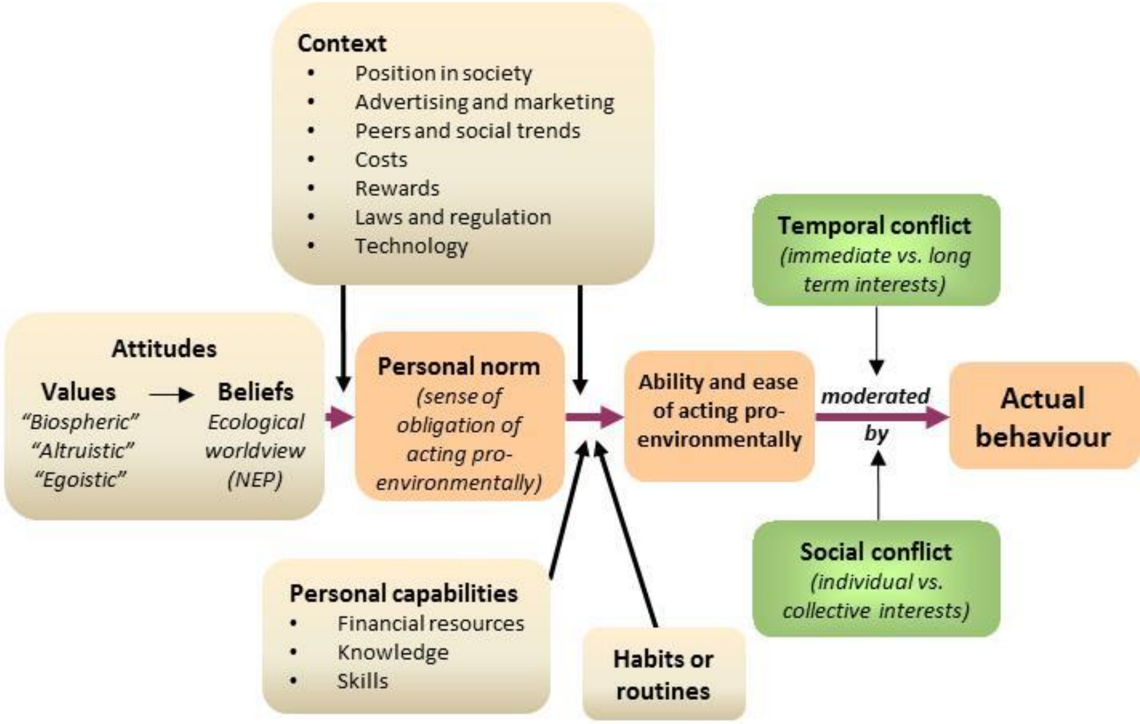


Figure 2.1 A model for pro-environmental behaviour showing how behaviour is influenced by underlying values and beliefs (attitudes), the social, personal, technological, institutional and cultural context, capabilities, habits and social and temporal interests (adapted from Dunlap *et al*. 2000, Stern, 2000, Nordlund and Garvill, 2002, Joireman *et al*., 2003, Nordlund *et al*., 2010)

ability to reduce threats) before creating a sense of obligation to act pro-environmentally, termed the "*personal norm*" (Stern, 2000, p412). Based on VBN and their Swedish study of 1,400 individuals, Nordlund and Garvill (2002) concluded that four key factors (attitudes, contextual factors, personal capabilities and habits) influence pro-environmental behaviour and if any of these factors, except attitude, are particularly strong, then the correlation between attitude and behaviour is likely to be weaker. In addition, pro-environmental behaviour is influenced by temporal conflicts, whereby collective well-being concerns which have delayed as opposed to immediate consequences “*may be insufficient to motivate* [pro-environmental] *behaviour*” (Joireman *et al*., 2003, p17). Continuing patterns of consumption are frequently “lock-ins” based on previous choice or circumstance (e.g., type of house or car you buy), or products available (and their dependent products), creating institutional lock-in, or are a result of sheer habit.

However, this model (Figure 2.1) inadequately recognises the important role (a) of the influence of corporate marketing and lobbying (Sanne, 2002, see below) and (b) of social-symbolic choices (Jackson, 2005b). “*Consumer goods are a part of the social fabric of our lives and play key roles in identity formation, social cohesion and the pursuit of personal and cultural meaning*” (Jackson, 2005b, p19).

2.1.1.1.1 The influence of the economic system on behaviour

The fallacy that consumption is a way to achieve well-being and a human need is reinforced by the economic system (businesses, advertising, regulation, taxation and economic policies, compensation (providing the means to spend) and lobbying), forming a mutually reinforcing “*econocracy*” (Sanne, 2002, p281, Figure 2.2, note that econocracy is not a real word but is a descriptor of the power relationships in the global economy and is used as such hereafter). The econocracy is derived from corporate influence on democracy, whereby both people and governments are beholden to corporate interests; businesses create or remove jobs and create the main income for government in the form of taxation. The global mobility of capital, which was legalised by governments in international agreements, facilitates the econocracy in favour of corporate interests, as governments are tied to territorial regions and businesses may be transnational. Commercial media are businesses themselves and are beholden to business for advertising revenues (Hamm, 2010) and *"promote consumption by making the consumerist lifestyle the social norm"* (Sanne, 2002, p281), thus impeding pro-environmental behaviour (Figure 2.1, Figure 2.2).

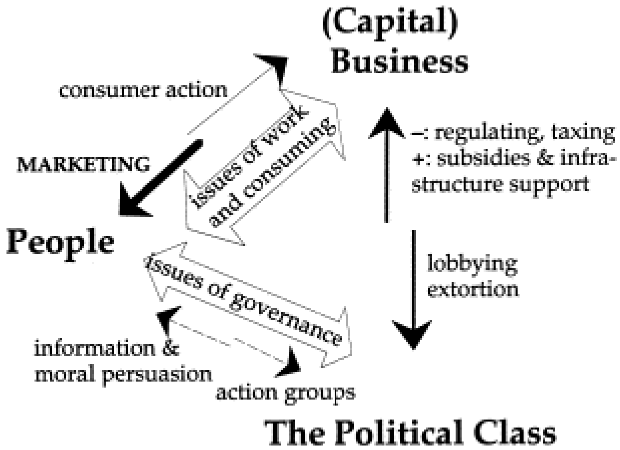


Figure 2.2 The "econocracy" (from Sanne, 2002, p281) illustrating the role of economics in and the structure of neoliberal society

The environment has no part in the econocracy, in contrast to models of sustainable development. The econocracy illustrates the extent of structural change that is required, the scale of the challenge and the extent to which corporate power "*…runs through the whole social body*" (Foucault, 1994, p120, Sanne, 2002, Gray and Bebbington, 2007, Hobsbawm, 2011).

Thus, although in the UK we are better off than in previous generations, we are "*…'locked-in' to unsustainable patterns of living by a combination of perverse incentives, institutional structures, social norms and sheer habit*" (Jackson, 2005a, p1). Projects targeted at altering individual behaviour are unlikely to create sustainable consumption. Sustainable consumption is likely only to be achieved through a radical change to the whole system (Sanne, 2002). Marketing and consumerism, and the forces behind them, have the power to influence, determine and repress society (Foucault, 1994, Hobsbawm, 2011). This challenges a predominant discourse in sustainable development that the consumer is at fault for wanting goods that are unnecessary.

Neoliberalism is the term used by some commentators to describe the UK economic policy choices implemented since Thatcherism (Harvey, 2005, 2006a, Cooper *et al.*, 2010). At the macro-economic level, neoliberalism assumes infinite growth, leading to unsustainable consumption, damage to the ecosphere and loss of renewable and non-renewable resources (Meadows *et al.*, 1972, Daly and Farley, 2004, Meadows *et al.*, 2004, Jackson, 2005a, Peck *et al.* 2009, Peck 2010). Neoliberal policy has been criticised for reinforcing materialism (which has increased since the Second World War) socially, culturally and economically (Harvey, 2005, 2006a, Cooper *et al.*, 2010) and for creating social disintegration and individualism (Jackson, 2002, Kasser, 2002). However, social disintegration may also be influenced by advances in technology and communications (Putman, 2000, Field, 2003). With the global technology revolution social interactions have changed from local and in the present to "*indefinite spans of time-space*" (Giddens, 1991, p21), so weakening social ties. Combined, neoliberalism and technological innovation have significantly changed society and fuelled consumerism.

Materialism could be said to encourage unsustainable consumption and individualism (Sanne, 2002) and materialism and individualism undermine the capacity to challenge unsustainable consumption and so are barriers for rural communities to become more sustainable (Borgström *et al.*, 1999, Furlong and Cartmel, 1997, Beck, 2000). The difference in society between an individual and community focused approaches in government and policy has been illustrated by the Department of Trade and Industry (DTI) Foresight Programme in future scenarios. Community and regionalisation are features that diametrically oppose consumerism and globalisation (Figure 2.3, Office of Science and Technology, OST, 2002, Dutton *et al.*, 2005).

Figure 2.3 The difference between consumerism and community: contextual futures scenarios used in the DTI Foresight Programme (from OST, 2002 and Dutton *et al*., 2005)

2.1.1.1.2 Materialism as a pseudo-satisfier of needs

Not only is consumption perceived to be a way to achieve well-being at a policy and at a theoretical level by some economists (Distaso, 2005), it also can be considered an evolutionary adaptation for display and status definition (Jackson, 2003) and a means of creativity and meaning through purchase of symbols (material goods provide social symbols in our society, Jackson, 2005b, Jackson and Michaelis, 2003). Therefore, consumption is part of our personal identity and social identity. This perception of consumption as a satisfier of actual human needs or wants or false needs has been termed "*retail therapy*" (now a common phrase in the English language), where acquisition of material goods is used to counteract stress and grief and to fill deficits in self-esteem (McIntosh, 2001, p183). Critics of "*retail therapy*" view this as a social and psychological pathology, as "*retail therapy*" replaces social support networks and does little to alleviate or address the long term emotional problems of those practising "*retail therapy*".

Humans are social and our well-being depends on our ability to act within and obtain support from social groups. Increasing consumption is detrimental to our well-being, families and communities, as it increases individualism and destroys social capital (defined in section 2.1.4.8). This is mutually reinforcing as lack of social support networks cause people to turn to "*retail therapy*" (materialism) to fill the emotional gap in times of crisis (Kasser, 2008). At the individual level, excessive consumption can be a sign of dissatisfaction with life and materialism does not necessarily enhance quality of life (Kasser, 2002). Therefore, consumer behaviour can be deeply flawed and obsessive. Like other psychopathological behaviour, it requires an individual to run harder and faster to stay in the same place (Jackson, 2002, Kasser, 2002).

However, if socially valued material wealth is to be replaced, alternative meaning structures are needed to maintain individuals' perceived well-being. Self-esteem would have to be developed in alternative ways. Social support has been found to be essential for breaking habits and devising new social norms; changes in individual behaviour should be encouraged by community level interventions, and reinforced by strong and appropriate policy (Jackson, 2005b). The evidence that communities can make changes more effectively than individuals is compelling (Wolf *et al.,* 2009, Dobson, 2010).

2.1.2 Definition of a sustainable community

Communities of people may be physical place-based communities (of dwelling, work or past-time, for example, a village, a business organisation, or a rugby club, respectively), or virtual communities, where there is common interest but no common shared place. The latter have come to the fore, facilitated by modern electronic communications. In this research, the case study communities that are studied are those that are place-based and based on where people dwell. This is important as sustainable communities require people to be "rooted" where they live and to be ecologically aware and have their psyche embedded in their landscape (Key and Kerr, 2011, 2012).

Communities are not static phenomena, but are complex, dynamic and constantly changing. They represent an on-going process, created by the action of living (Ledwith, 2005). Communities are affected by individuals' chosen lifestyles and behaviours, including those that are directly related to the individual and those that are not and may vary in spatial scale (local to global), in nature (virtual or physically juxtaposed) and temporally. Communities shaped or impacted by behavioural choices may be ones in which the individual belongs, ones in which the individual is not necessarily a member, but with which the individual interacts directly, or ones which are remote and are impacted as a result of an individual's consumption or pollution in our globalised world. Moreover, an individual has multiple competing biographies (lives) based on the multiple communities to which he or she belongs or aspires. The allegiance of an individual to any particular community may change at any time, depending on the circumstances in which the individual finds him or herself (Beck, 2000).

Sustainable livelihoods or lifestyles can be said to be those which do not adversely affect and, more likely, help actively in "*keeping communities going over time*" (sustaining the community, ODCE, 2001). A sustainable community has been defined in the Egan Review (Egan, 2004), but this did not include the inter- and intra-generational aspects of the original WCED (1987) definition. Therefore, for this study:

> *Sustainable communities are those communities that continue to evolve and develop sustainably, whereby their development does not harm, and potentially enhances, the environment, and enables*

> *ethical and equitable distribution of resources and opportunities today (intra-generational) and in the future (inter-generational). Sustainable communities take on the economic, social, ecological and ethical aspirations and aspects of sustainable development, as defined in the WCED (1987) definition, and sustainable communities are those achieving Baker's (2006) "ideal model"*.

Note that in this strong definition, sustainable communities are not just aspiring (i.e. in the process of sustainable development), but are actually achieving the "*ideal model*".

2.1.3 Sustainable communities in practice: frameworks and examples

Building a sustainable community design (SCD) framework, which is derived from the literature review and is capable of facilitating discriminatory analysis, is objective 1b of this study. There are a number of practical frameworks for defining aspects of a sustainable community, for example, McIntosh's "*Triune Basis of Community*" (McIntosh, 2008), the ten principles of One Planet Living (OPL, Figure 2.4, BioRegional, 2013, OPL, n.d.), the aspects of permaculture ("*seven petals of the permaculture flower*", Figure 2.5, Holmgren, 2002, pxx) and the Egan Review's "*components of sustainable communities*" (Figure 2.6, Egan 2004, p19).

The "*Triune Basis of Community*" ("*Community with the Earth*" "*Community with Spirit/Self/God*" and "*Community with one another*", McIntosh, 2008, p48) alludes to normative aspects of community, which is absent in many definitions of sustainable communities. The importance and significance of the links between the land, spirituality, community and emotions is described in section 2.3.2.1. Although this normative approach is difficult to apply in the SCD, the philosophy underpins sustainability goals defined for some of the aspects of the SCD.

Five of the ten OPL principles relate to sustainable consumption and set goals for this, namely zero carbon, zero waste, sustainable materials, local and sustainable food and sustainable water (Figure 2.4, Bioregional, 2013), but the remaining principles do not capture as many aspects of community as comprehensively as the Egan Review and the permaculture principles (Figure 2.5 and Figure 2.6).

The ethical principles of permaculture ("*Care for the earth, Care for people and Set limits to consumption and reproduction, and redistribute surplus*", Holmgren, 2002, p1) are comparable to sustainable development, but appear to be less utilitarian and more normative and ecocentric. The permaculture design principles provide guidance for sustainable living and have formed the basis of the Transition Towns Movement (TTM, Hopkins, 2006, 2008). The principles are equivalent to stronger definitions of sustainable development in that renewable resources should be used in preference to non-renewable resources. All resources should be considered as highly valuable and should be conserved, rather than treated as usable commodities in a through-put economy; non-renewable resources are especially precious (Pearce, 1989, Daly, 1995, Neumayer, 2003, Daly and Farley, 2004).

Figure 2.4 BioRegional's One Planet Living Principles (from BioRegional, 2013)

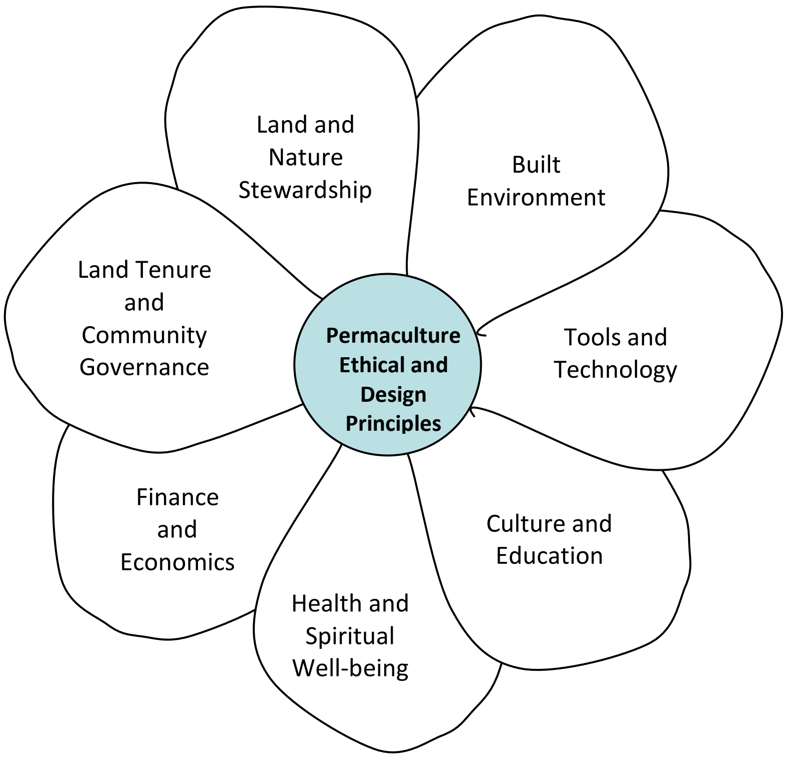


Figure 2.5 The Seven Petals of the Permaculture Flower (from Holmgren, 2002, pxx)

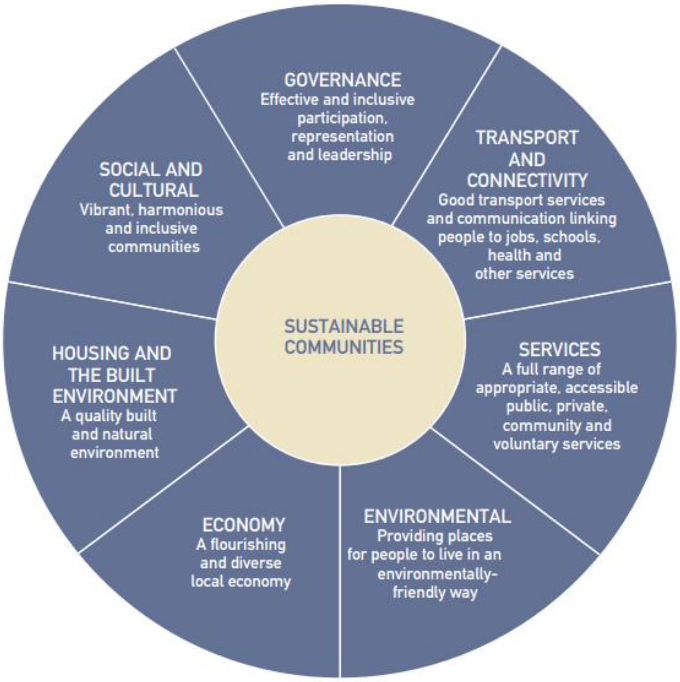


Figure 2.6 The Egan Review's "*Components of sustainable communities*" (from Egan, 2004, p19)

Permaculture takes a holistic and co-operative approach, in contrast to the weaker forms of sustainable development which are reductionist and neoliberal. Permaculture aims to create a sustainable culture (as opposed to industrial, Table 2.2), whose energy base is renewable and which has cyclical material flows, stores resources (with negative feedback loops), rather than consumes them (with positive feedback loops), has distributed networks of organisation, rather than central control, and whose thinking is holistic (Holmgren, 2002).

The principles of permaculture are similar to OPL principles and appear to provide a sound foundation for sustainable living. However, the permaculture principles still do not capture all the basic (practical) elements of community (Holmgren, 2002, BioRegional, 2013). The Egan Review's (2004) "C*omponents of sustainable communities*" framework details the essential aspects of community, but fails to capture the importance of sustainable consumption (Bioregional, 2013), renewable energy (as already noted, a feature of sustainable cultures, Table 2.2, Holmgren, 2002) and power to act (identified, for example, by Foucault, 1994, Harvey, 1996, Kaplan, 2000, Ledwith, 2005, Didham, 2007).

Table 2.2 Comparison of industrial and sustainable cultures (adapted from Holmgren, 2002, pxxviii).

Aspect of culture	Industrial	Sustainable
Energy base	Non-renewable	Renewable
Material flows	Linear	Cyclical
Natural assets	Consumption	Storage
Organisation	Centralised	Distributed networks
Scale	Large	Small
Movement	Fast	Slow
Feedback	Positive feedback loops (i.e. ever increasing growth)	Negative feedback loops (i.e. checks and balances)
Focus	Centre	Edge
Activity	Episodic change	Rhythmic stability
Thinking	Reductionist	Holistic
Gender	Masculine	Feminine

Three communities were identified as communities that have had their sustainability assessed: Findhorn Foundation and Community (Findhorn Foundation) and the Isle of Gigha, both of which are in rural Scotland, and Beddington Zero Energy Development (BedZED) in London.

The Findhorn Foundation, founded in 1962, is on the Moray Firth in the north-east of Scotland, was established with a goal of sustainability and is part of the Global Ecovillage Network. It has its own wind-turbine, market gardens, eco-houses and “Living Machine” sewage system and has become an educational centre for sustainable living (Findhorn, n.d.). It has an EF of 2.7gha/cap, which is half that of Scotland and only 50% more than the fairshare of available biocapacity (1.8gha/cap, Tinsley and George, 2006, SEI, 2011a, GFN, 2012). Residents generally use public transport or cycle to access facilities in the nearby town of Forres, but they still have a relatively high transport EF due to their average air travel being 8,400 km/capita/year. Their EF is inflated by including the features of our current society attributed to public services, capital investment (e.g., road and factory building) and government, which equate to 1.0 gha/cap, which is higher than it would be if all of Scottish society was sustainable (Tinsley and George, 2006). Although the EF suggests that the community is sustainable, it is atypical of Scottish communities, as it is built upon a community of common interests (living sustainably), rather than one which has transformed itself from an established community representative of the general population. Therefore, although the community's consumption, wind-turbine, market gardens, eco-houses, "Living Machine" and sustainability educational centre are all sound examples of sustainable living, it does not reflect a typical Scottish community.

The Isle of Gigha, off the west coast of Scotland, also has sustainable development as its goal and is working towards this. The community is a traditional island crofting community and succeeded in 2002 in a community buy-out. The community had become disempowered under a series of different and remote landlords, but, since 2002, is re-empowered and rejuvenated with community land ownership and renewable energy (Didham, 2007). Participatory decision-making was enacted from the start using a "*stirring*" committee (whose members consisted of two for, two against and two undecided as to the buy-out, Didham, 2007, p19) to investigate the buy-out and the whole community was involved in the decision-making process. Since the buy-out, residents are far more engaged in community activities and in the community decision-making processes. For example, a windfarm development was a decision made by the whole community.

Priorities for the community following the buy-out were conservative and focused upon repaying the £1 million loan and improving the inadequate housing stock (in 2002 75% was classed as being "below tolerable standard" and 23% "in serious disrepair", Isle of Gigha Heritage Trust, n.d.). With renovated properties and new homes, the population has increased from 96 to 156 with the potential for new crofts and tourism (Didham, 2007). Renewable energy has played a key feature in the development of the community. The "Dancing Ladies of Gigha" (three 225kW wind turbines) was Scotland's first community owned and grid connected windfarm and in 2009 the loan for the windfarm was paid off, which means that all income from the turbines goes to the community. In 2011, they secured planning for a fourth turbine (Isle of Gigha Heritage Trust, n.d.).

The community's EF has not been measured, so there is no measure of sustainable consumption. However, when planning for sustainable development, not only was the building of the vision of the future participatory, but so too was the selection of indicators to measure the success in achieving sustainable development and the development of a three-five year local development plan (Didham, 2007). Based on Didham's analysis, sustainable development is occurring on the Isle of Gigha. In this example, community empowerment and regeneration came initially from the buy-out. The wind energy provides community income to continue community development. Working together to create a new destiny and better future for the future of Gigha has led to increases in residents' perception of their own self-worth. Didham (2007) sees this as an example of the power of social processes on the well-being of individuals. He argues that community reclamation of the power and ability to shape the future of their communities is integral to the success of sustainable development. An islander was quoted as describing "*the change in the community's outlook as the most significant change on the island*." (Didham, 2007, p283). The importance of this example is that it illustrates that opportunities for creating sustainable development in Scotland relates to the whole nature of the community, from power to participation, vision, income, energy and housing.

Therefore, the Isle of Gigha could be said to be in the process of developing sustainably (rather than sustainable) and, although Findhorn may be an example of a sustainable community, it is atypical of a rural Scottish community. In the literature alternative descriptions, examples of or attempts to measure the sustainability of rural Scottish sustainable communities were lacking. Therefore, the purpose of this study was to investigate the options for rural Scottish sustainable communities and suggest means to initiating sustainable development.

The examples and the three frameworks described above are a starting point for describing the nature of a rural Scottish sustainable community. However, comparing the frameworks (which were available at the start of this study) to the examples, none of them fully capture the essence of the example communities.

The OPL framework (Figure 2.4) encapsulates sustainable consumption (zero carbon, zero waste, sustainable transport, sustainable water, sustainable materials and local and sustainable food), but misses governance and education (characteristics of the two other frameworks). Both the Permaculture Flower (Figure 2.5) and the Egan Review's Components of sustainable communities (Figure 2.6) lack reference to sustainable consumption. All three frameworks lack social capital, power, renewable energy and participation, which were characteristics of the experience on the Isle of Gigha (Didham, 2007). Therefore, none of the frameworks cited are adequate on their own to use to measure community sustainability holistically and so a consolidated framework was developed for use in this study.

2.1.4 The sustainable community design (SCD)

The sustainable community design (SCD) has been developed, not just from the examples and frameworks cited in the previous section, but also has been refined during the course of this eight year study. The initial overarching design was created using insights from the examples described in the previous section, Baker's (2006) "*ideal model"*, the philosophies of permaculture and OPL, the Egan Review's (2004) "*components of sustainable communities*", McIntosh's (2008) "*triune basis of community*". Based on issues identified and analysed in this study and from the literature review (described later) the additional aspects of power, property rights and energy to fuel life were emphasised and incorporated in a process of iterative refinement (NB: property rights are incorporated within the aspect of governance and land tenure).

The SCD has multiple aspects, in which all need to be developed for a community to flourish (be sustainable), as each part is interrelated. Failure of one aspect impacts the whole system (Schuler, 1996, Ledwith, 2005). Thus, the SCD can be considered as a representation of a community and as a system with feedback mechanisms and connectivity. In its final form (Figure 2.7), the SCD acts as a framework of a strong sustainable Scottish rural community, whose aspects are defined and further illustrated using examples from the literature in the following sections.

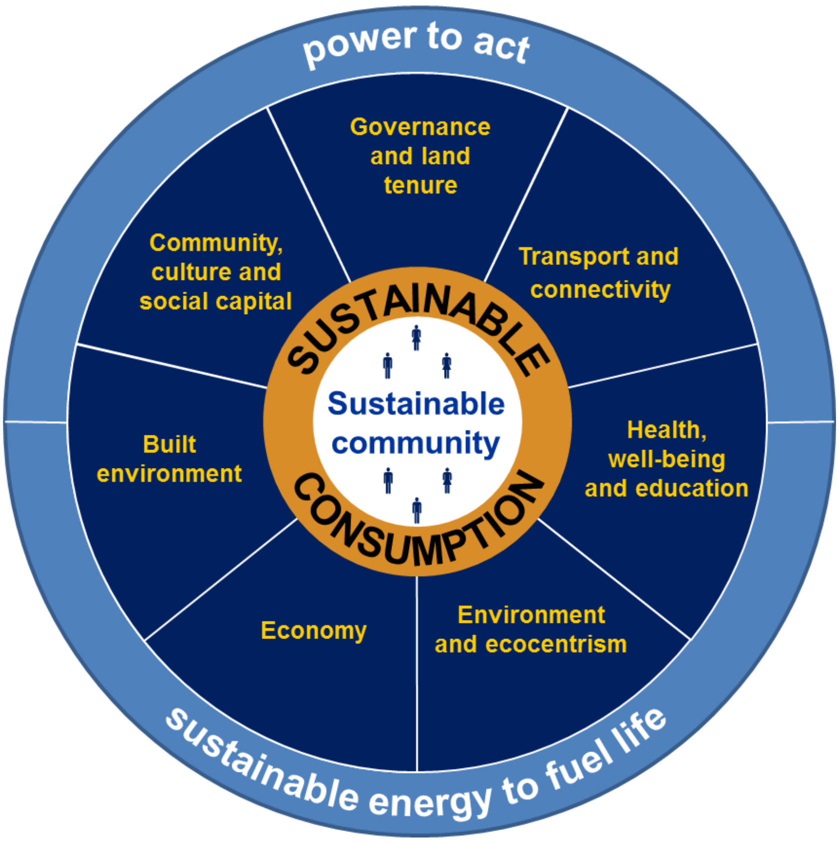


Figure 2.7 The sustainable community design (SCD, adapted from Holmgren, 2002, Durney and Desai, 2004, Egan, 2004, Didham, 2007, McIntosh, 2008, BioRegional, 2013, OPL, n.d.)

2.1.4.1 Sustainable consumption

Sustainable consumption encompasses both consumables and food and requires consumption and production to be carbon neutral and zero waste, and have local and sustainable food and sustainable water (OPL, n.d.). The literature to explain the link (or gap) between environmental attitudes and behaviour (i.e. consumption) is explored separately in section 2.1.1.1. The Scottish EF suggests that reductions and changes to current consumption in Scotland is required (SEI, 2011a, see page 63).

Zero waste requires all resources to be used within a closed cycle, where "waste" is reused, composted or recycled. Renewable resources are used in preference to non-renewable and these only within natural limits and where impact on biodiversity is minimal (Holmgren, 2002, BioRegional, 2013, OPL, n.d.). Scotland's Zero Waste Plan aims to achieve waste targets by 2050 that appear to equate to sustainability for waste at the "*ideal model*" level (Baker, 2006, Scottish Government, 2010d, 2013).

Sustainably produced food requires reduction in food waste, a change in diet, changes to consumer food choices, changes to agricultural production (sustainable agriculture) and transformation of food production and supply with a significant amount being locally produced (Holloway *et al.*, 2007, Audsley *et al.*, 2009, Frey and Barrett, 2007, Berners-Lee *et al.*, 2012, OPL, n.d.). However, patterns of food consumption and agricultural practices are complexly inter-linked; reduction in one area may inadvertently cause increases in another (Audsley *et al.*, 2009). For example, one of the biggest sources of greenhouse gas (GHG) emissions is the change in land-use and deforestation for agriculture. Changing diet to a vegetarian diet, whose production methods may have a lower EF and emit fewer GHG emissions (UN Food and Agriculture Organization, FAO, 2006, Frey and Barrett, 2007, Berners-Lee *et al.*, 2012), may actually increase GHG emissions if more land is deforested to meet increased demand for soya and pulses (Audsley *et al.*, 2009). Sustainable food production is not just about carbon or ecological footprints, but also biodiversity. Both agri-environment and organic production have heterogeneous production methods and encourage biodiversity (Robinson and Sutherland, 2002, Fuller *et al.*, 2005, Green *et al.*, 2005, Hole *et al.* 2005). However, between organic and non-organic production methods, no significant difference in GHG emissions and EF has been found (Frey and Barrett, 2007, Audsley *et al.*, 2009). However, for non-organic production these are likely to be under-estimates as they exclude GHG emissions due to soil erosion and for organic production over-estimates as they exclude carbon (GHG) capture through use of green manures and composting (Audsley *et al.*, 2009).

Changing diet is likely to reduce ecological impact as vegetarian food has been found to have less GHG emissions than a meat diet (Berners-Lee *et al.*, 2012). A vegan diet has less impact than a vegetarian diet due to the absence of dairy products (FAO, 2006). Elimination of food waste in production (up to point of sale) and preparation (from supermarket to dinner plate) would significantly reduce the food EF, as a study in Cumbria has found that 36% of food produced is wasted (16% in production, transportation and storage prior to sale and 19%

by the consumer prior to consumption, measured calorifically, Berners-Lee *et al.*, 2012).

In Scotland, the majority of food consumed is delivered to consumers via supermarkets. 80% of food in the UK is pre-processed and 30% of meals are pre-prepared (Levidow and Psarikidou, 2011). In general, larger supermarkets offer better options for healthy eating than smaller ones (which are more often found in rural communities, Dawson *et al.*, 2008). Supermarkets are very good at efficiently transporting food from international industrial producers to local consumers, but they are not resilient. They undermine the ability of local producers and distributers to proffer their goods to local consumers and remove the beneficial link between consumer and producer (Curtis, 2003, Holloway *et al.,* 2007). Community enterprises, which transform food production and supply so that its production has a net positive impact on the environment, local economy and peoples' well-being (i.e. organic, fair-trade, local, fossil fuel independent and alternative food networks, AFNs), create more sustainable consumption and community resilience (see section 2.1.5.1, Pretty *et al.,* 1995, Holloway *et al.*, 2007). Farm shops, farmers markets, box delivery schemes, community supported agriculture (CSA) and community gardens are examples of AFNs. Farm shops, which maintain the distinction and distance between producer and consumer, tend to be less sustainable than CSA where consumers are more connected with the growth of their food (Holloway *et al.*, 2007). The rising cost of fossil fuel derivatives, water and energy combined with agricultural policy reform (e.g., LEADER) encourage more adventurous and entrepreneurial farmers to engage in sustainable and co-operative agricultural practices (Shucksmith and Herrmann, 2002, Levidow and Psarikidou, 2011).

Sustainable water consumption requires minimal use of freshwater with a positive impact on local water resources and supply. This entails implementation of water use efficiency measures, re-use and recycling, minimal use of drinking water not destined for human consumption, minimal water extraction and pollution, sustainable sewage management and restoration of natural water cycles (OPL, n.d.).

2.1.4.2 Governance and land tenure

Participation is a fundamental part of the Universal Declaration of Human Rights adopted by the UN General Assembly in 1948 (UN General Assembly, 1948). This implies that communities need viable institutions that have a right to organise themselves, represent their interests and have confidence and authority, as well as being supported by regional government without undue interference (Sharp, 1992).

Sustainable communities have governance systems that are strategic, visionary representative and accountable. They "…*enable inclusive, active and effective participation by individuals and organisations*" and have "*strong, informed and effective leadership and partnerships that lead by example (e.g., government, business, community)*" (Egan, 2004, p20). Principles of equity, gender equality and justice are integral to decision-making (Baker, 2006, Table 2.1). The community takes action to improve its future through participatory envisioning, planning and decision-making. Power is decentralised to local communities to allow them to make decisions on local issues affecting them. Local community governance structures work in partnership with local councils (Baker, 2006, Roxburgh and Tuffs, 2006).

There is a fair distribution of property rights and power across the community and between the community and others (Harvey, 2005, Didham, 2007, McIntosh, 2008). Land is available to fulfil community resource and energy needs and the community has the power to utilise or manage these resources sustainably for the good of the community and environment (Didham, 2007).

2.1.4.3 Transport and connectivity

Sustainable transport enables equitable access to basic goods and services, achieves the necessary connectivity of people to services, education and employment and has minimum impact to the environment (Durney and Desai, 2004). For the latter, the fairshare of biocapacity provides a metric for impact of total consumption (WWF, 2010, GFN, 2012) and so transport should only consume a minor portion of the fairshare to be sustainable. Ideally, sustainable transport should be one which is made by bicycle or on foot, as the EF of both is negligible (note that the Scottish Government aim to have 10% of all journeys made by bicycle by 2020, Scottish Government 2013, see page 102). However, given the geography of rural Scotland, this is impractical for longer journeys and accessing goods and services.

For longer journeys, the lowest impact sustainable transport solutions may be well-connected public transport, but this is more suited to urban areas (where there are higher numbers of people travelling to common destinations). To meet the needs of rural communities, public transport would have to be highly tailored to achieve the necessary connections to major transport links for onward travel. Alternatively, new forms of co-operative travel, such as liftshare (liftshare, n.d.), and community buses, together with co-operative enterprises to co-ordinate the distribution of goods and services, would achieve significant reductions in the impact of and need for travel if applied across the community.

Technology is an enabler to change, especially related to transport. Significantly more energy efficient forms of transport are essential for mobility beyond the local vicinity, even if the distance travelled is reduced. In 2012, Nissan placed new electric vehicles on the market for commercial sales. The vehicles are incentivised by the government through car tax exemption and with government grants to reduce the purchase costs. The Nissan Leaf has a range of 109 miles, a battery capacity of 24kWh and an eight hour charging time, although an 80% charge is possible in thirty minutes (Nissan, 2012). The 109 mile range means that most rural communities in Scotland would be able to access major conurbations without a re-charge (Scottish Government, 2010a). This together with the use of electricity generated with renewable energy and/ or micro-generated at home has the potential to significantly reduce the impact of vehicular travel (Alderson *et al.*, 2012, Nissan, 2012). By 2030, the Scottish

Government aim to decarbonise road and rail transport (Scottish Government, 2013a, see page 102).

Car share schemes, such as Edinburgh City Car Club (City Car Club, n.d.) and Moorcar, which has been implemented in Fintry, the Isle of Bute and Mallaig (Moorcar, n.d.), are a way of reducing the number of cars produced (and thus reducing the EF of production and maintenance). These schemes permit hourly rental of a community or co-operatively owned car to members of the community, who have joined the car share scheme. The schemes provide a service to those that find owning a car for low mileage expensive and, in rural areas, where public transport is often lacking, it fills a transport gap (Hodge and Haltrecht, 2009, Scottish Government, 2010a).

In addition, technology has the ability to reduce the need for travel. This is especially so with regard to business and working from home. If fast internet connections are available in rural communities, video-conferencing and synthetic environments will enable home-based (or community-based) working (SDC, 2010a).

Therefore, to achieve more sustainable transport and connectivity, a number of different approaches are required that need individuals to change their lifestyles and mobility significantly, as well as maximise opportunities for technology, and work together to provide community transport solutions. The extent of change required in transportation and mobility to achieve a sustainable transport EF (one which is only a minor part of the fairshare) is investigated in this study. Although transport is identified with its own aspect in the SCD, solutions to achieve its sustainability are interlinked with almost all the other aspects of the SCD (Figure 2.7).

2.1.4.4 Health, well-being and education

For this aspect of a sustainable community, members of the community need to be in generally good health and have high life expectancy. They are happy citizens and are satisfied with life and feel safe and secure in their community (Holmgren, 2002, Durney and Desai, 2004, Egan, 2004, OPL, n.d.). Achievement of these goals is highly dependent on other aspects of the SCD. For health and happiness, a fit and active lifestyle is required (increased use of bicycling and walking for transport solutions would make a significant contribution, Scottish Government, 2013a); decreases in materialism and "*retail therapy*" (McIntosh, 2001, p183) and being more ecologically aware, increase self-esteem (Kasser, 2008, Key and Kerr, 2012), as does meaningful work (Schumacher, 1999, Jackson, 2007) and being part of a healthy local economy.

Reaching full human potential requires harmony for both individuals and society living in balance with nature; this harmony can be rekindled through activities such as the Natural Change Project (Key and Kerr, 2011, 2012), but also requires replacement of the discourse that perceives humans as economic objects with a discourse that connects the practical elements of existence with spiritual, social and individual needs (McIntosh, 2008). In sustainable communities, healthy lifestyles and physical, mental and spiritual well-being are promoted through community structures, which achieve inclusivity through multiplicity and appropriate tailoring for the diverse needs of the whole community (OPL, n.d.).

Not only do sustainable communities have equitable access to schools and colleges and opportunities for educational achievement (Egan, 2004), but also have an education system that creates self-motivated learners, who are literate in sustainability, equipped for vocational opportunities and are critical citizens (Ledwith, 2005, Fagan, 2009, Priestly and Humes, 2010).

2.1.4.5 Environment and ecocentrism

Sustainable communities have local land managed for sustainability and biodiversity, and to benefit the community. Biodiversity is maximised, local habitats managed, degraded environments regenerated, and renewable resources are used only at the rate at which they can be replenished. People have positive attitudes to the environment and exhibit behaviour to protect and/or enhance biodiversity and take care that their local actions do not adversely affect the wider global environment. In sustainable communities, ecocentric attitudes and behaviour that protect and enhance natural resources and biodiversity (locally, globally and inter- and intra-generationally) prevail (Egan, 2004, OPL, n.d.).

Evidence for ecocentric attitudes comes in part from pro-environmental behaviour choices, although behaviour is moderated by many other influences (see section 2.1.1.1). However, considering human interaction with the environment solely as “attitude” or as the type of land management approach misses the spiritual connection with the land (see section 2.3.2.1). However, the measurement of the spiritual connection of communities with the environment (‘dualchas’) was beyond the scope of this study.

2.1.4.6 Economy

A sustainable community has extensive local employment with high levels of job satisfaction and businesses which operate within and make a significant positive contribution to a flourishing and diverse local economy, serve the needs of the local community, provide meaningful work, have a low impact on the environment and are socially just (Schumacher, 1999, Curtis, 2003, Durney and Desai, 2004, Egan, 2004, Ledwith, 2005). The strong local economy has links into the wider economy (Egan, 2004).

2.1.4.7 Built environment

Sustainable communities have low impact housing, which meets the needs of the population. There is good quality affordable housing (to buy or rent), in which the size of the dwelling matches the size and needs of the household. New buildings are eco-homes and eco-community buildings that meet their design purpose. Existing housing stock is retro-fitted to Passivhaus standards (Boardman, 2012, Passivhaus, 2012). Building is with sustainable and, as far as possible, local materials. Sustainable homes have energy efficient housing and heating systems, and have sustainable water use.

The Sustainable Development Commission (SDC, 2005) state that UK Domestic buildings are responsible for 25% of GHG emissions, over 50% of water consumption, 8% of waste and 24% of waste from construction and demolition of homes. The cost of upgrading homes to meet the 80 per cent reduction in GHG emissions by 2050 target is estimated to be a minimum of £210 billion and ill-health caused by sub-standard housing is estimated to be costing the NHS £2.5 billion per year (SDC, 2010b).

Creating sustainable communities with sustainable buildings will not arise from demolition and construction, even if legislation is changed to require developers to create carbon neutral homes. Less than 1% of current stock is new build each year and retrofitting sustainable solutions uses far less energy than demolition and new build. Policy will need to change to favour retrofitting and to encourage all house-owners, business property owners, landlords and housing associations to enhance their property (SDC, 2005).

Reductions in housing's carbon emissions by 2050 may be possible through houses becoming net exporters of energy, energy use reduction (rather than efficiency) and upgrading all housing to Passivhaus standard (Boardman, 2012, Passivhaus, 2012). All homes would need major investment, necessitating legislative control at national and local governmental levels, which would require property owners to make properties 'A' grade energy efficiency (i.e. Passivhaus standard,) and all property occupiers to receive personal carbon allowances to reduce energy use. Many new technological innovations should help achieve energy use reduction, especially at peak demand (for example, the installation of energy saving light bulbs reduced UK electricity used in residential lighting by 16% from 2008 to 2010 and light emitting diode technologies offer further reductions, Boardman, 2012). With all electricity from renewable resources, a transformation of the electricity generation industry from being one of supplier/retailer to one that is focussed on zero carbon energy service provision would be required. In areas with higher density housing, Boardman envisages district heating systems fed from CHP plants and implementation of micro-renewables (which with technological advances may include micro-CHP, Bristow *et al.*, 2004, see page 90) within homes. At present, UK building stock represents approximately 80% of non-financial assets (£5.3tn in 2009), but there is little linking this value with the energy-efficiency performance of the properties (Boardman, 2012).

2.1.4.8 Community, culture and social capital

The OECD defines social capital as "*networks together with shared norms, values and understandings that facilitate co-operation within or among groups*" (Keeley, 2007, p103). Therefore, not only do sustainable communities have community enterprises, organisations and governance committed to sustainable development, but they have a diversity of active social enterprises and clubs, which achieve inclusivity through diversity, creating opportunities for cultural, leisure, community and sporting activities. Together with high social capital, sustainable communities have motivated civil society actors, which create and catalyse change for better futures (Warburton, 1998, Bryden and Geisler, 2007, Dobson, 2010). This implies that the communities have the capability to change and adapt. Whether they have the power to change is considered under the aspect power to act.

There is a culture of co-operation, inclusivity, harmony, belonging, vibrancy, aspiration and self-worth. Within the community there is space and opportunity for spiritual growth and respect for and encouragement of diversity (Durney and

Desai, 2004, Egan, 2004, Ledwith, 2005). Cultural heritage, local identity and wisdom are valued (OPL, n.d.).

2.1.4.9 Energy to fuel life

Sustainable communities have access to energy to meet their needs at an affordable price (no household is in fuel poverty). Moreover, in rural communities with abundant renewable energy assets, these assets are fairly distributed and appropriately sited according to the wishes and needs of the local community. Income from these assets is used to progress the development of the sustainability of rural communities.

In sustainable communities, all energy consumed is from renewable resources (renewable electricity generation, biomass or pumped heat). This is especially significant for achieving a sustainable housing EF. The EF of the scenario of all UK electricity supply and demand generation by renewables has been estimated to be 10% of that of the current electricity generation method (4 million gha (+/- 5%) versus 41 million gha (+/- 4%), respectively, Alderson *et al.*, 2012). At a macro-generation level, offshore wind is likely to be a major component (Scottish Government, 2013a). Although Scotland has a large amount of tidal and wave energy, the technology is not sufficiently advanced for large scale exploitation.

Scotland has significant amounts of forestry (17% of rural land area), so forestry derived biomass is an additional option and can be implemented at micro to macro scales. Short rotation coppice (SRC) has yet to be fully exploited but, with yields four times that of conventional forestry, SRC has significant potential as a method for producing biofuel (Forestry Commission Scotland, 2009, Biomass, 2012).

Pumped heat uses electrically powered ground source or air source heat pumps (GSHPs or ASHPs, respectively) to move heat from either the ground or air outside a building to inside. The coefficient of performance is typically four for a GSHP and new ASHPs are achieving almost as good performance. GSHPs are better suited to rural (as opposed to urban) areas, where there is lower population density and greater land areas for harvesting heat energy, and to properties with low heat demand (MacKay, 2009). For a sustainable community, there must be both a change in energy consumed (to renewables) and reduction in energy used.

2.1.4.10 Power to act

The effects and nature of power are plural. Power relates to the control of knowledge, belonging and shaping of history. It runs through people and society in many shapes and forms (Sanne, 2002, Hobsbawm, 2011). A consideration of power is important for this study, because of the ability to achieve individual and community self-actualisation and empowerment is influenced by power, fair distribution of opportunities, recognition, and freedom to realise opportunities (Schlosberg and Carruthers, 2010). Disempowerment is found in the ‘lock-in’ articulated by Jackson (2005a), in the econocracy (Sanne, 2002) and in many communities. In communities, people rely on others (often external powers) to provide services and people assume that those in power will continue to do so (such as health, education and job opportunities). If an object or entity can do something, as people are inherently lazy, they will willingly disempower themselves and lose resilience (Didham, 2007). Passivity and apathy are human responses to oppression and injustice. Those suffering injustice lose their voice (Ledwith, 2005). Local production can be re-empowering (Didham, 2007), for example, the empowerment found with credit unions (Ledwith, 2005). Politically, power in Scotland has been centralised away from local communities and town councils, breaking down local democracy (Wightman, 2011).

There are a number of pre-requisites for enabling community action. Within their communities, communities need leaders of change (motivated actors), who can inspire and take communities forward (Jackson and Michaelis, 2003). Local governing bodies have to have the authority and power to act to implement change identified, envisioned and planned through inclusive community engagement and participation (Didham, 2007, Wightman, 2011). People need to be relatively safe and secure with good health (Maslow, 1954, Ledwith, 2005) and must be empowered within their communities for community action to be successful (Pye-Smith and Feyerabend, 1995, Ledwith, 2005, Roxburgh and Tuffs, 2006). Also, communities need material resources and financial support (Kaplan, 2000); the latter being achieved through community enterprises and in rural Scotland the greatest income opportunity currently comes from renewable energy. Together these pre-requisites build the capacity for a community to act.

2.1.5 Transition to sustainability and justice

Not only do communities have to have the capacity to act (Kaplan, 2000, Ledwith, 2005), but also the capacity to adapt to "*continually 'become' and to foster* *multiple emergent possibilities*" (Shucksmith and Rønningen, 2011, p277). Building capacity and transforming to sustainable states represent significant challenges for Scottish rural communities. In this section, first the concept of resilience, which has multiple definitions and interpretations, and why the concept of sustainable communities is used in preference to resilient communities are explored. Secondly, approaches to transition from unsustainable to sustainable states are presented. Lastly, justice is examined to identify an approach for analysing injustices that form barriers to transitions to sustainability in rural Scotland.

2.1.5.1 Resilience

Sustainable communities have to be resilient and have the capacity to adapt to economic, ecological and social crises (Cooper *et al.*, 2011). Similar to definitions of sustainability, there are many definitions of resilience and sustainability, and resilience and sustainability can be used inter-changeably especially if Handmer and Dovers (1996) definition of sustainability (see section 2.1.1) is compared with definitions of resilience. The concept of resilience is derived from ecological systems in their ability to respond and adapt to exogenous disturbances or shocks (Skerratt, 2013), but this definition implies a reactive approach to externalities, rather than a proactive approach to creating change and alternative futures. Resilience in human communities differs from resilience in ecological systems due to human agency. Skerratt (2013) defines human agency as "*the realm within which humans deliberately and consciously act, network, behave, imagine futures and make decisions between perceived options*" (p38).

Therefore, resilience can be "*defined as both a personal and a collective capacity to respond to change*" (Steiner and Markantoni, 2014, p410) and "*members of resilient communities intentionally develop personal and collective capacity that they engage to respond to and influence change, to sustain and renew the community and to develop new trajectories for the communities' future"* (Magis, 2010, p402).

This definition implies and assumes that the community has social capital, has the power to act, is self-organised and has the capacity to learn and adapt (Steiner and Markantoni, 2014). Each of these characteristics is incorporated within different aspects of the SCD, but not all the aspects of a sustainable community are incorporated within a definition of resilience, in particular the attributes of the sustainable consumption and environment and ecocentrism aspects. Therefore, a sustainable community is also a resilient community and for the purposes of this holistic study the concept of sustainable communities is used in preference to that of resilient communities.

2.1.5.2 Transition and scale of change

Communities are dynamic and creating sustainable communities implies change to alternative futures and consideration of approaches of transition. If the "*ideal model"* of sustainable development (which specifies fair opportunities and capabilities, Baker, 2006, p30-31) is the goal for sustainable communities, achieving the "*ideal model*" is likely to need transformation and radical cultural change (Curtis, 2003), given the gap between the present state of society and the "*ideal model*" (Baker, 2006, p30-31). Transformation is about "*fundamentally* *altering the nature of a system*", whereas adaptation is about changing a system or community without fundamentally altering it (Walker *et al.*, 2004, n.p.).

The "*three-class typology of resilience*" provides a useful framework for characterising different levels of change. The levels have been defined as follows: Type 1 – "*Resistance and maintenance*" (in essence do nothing); Type 2 – "*Change at the Margins*" (appeases the majority, but is insufficient to tackle the crises); and Type 3 – Transformation (fundamental change to society, Table 2.3, Handmer and Dovers, 1996, p497). Type 3 corresponds to the "*ideal model*" of sustainable development and requires changes to the power relationships and so is resisted by the powerful elites, who act as "…*a serious impediment to real progress toward a sustainable society*" (Handmer and Dovers, 1996, p486). This typology has been loosely applied in the methodology in this study in modelling the sustainability of different options (scales of change) for transport, housing and food.

However, the typology of resilience illustrates different scales of change, but not the characteristics of the desired end state. To be able to transition to a sustainable community (defined in this study as the SCD based on the concept of strong sustainability and Baker's "*ideal model"*) first and foremost is to define what the "*ideal model"* is in practice for each community. Goal-setting and futures envisioning are important for creating better futures and help develop future consciousness and wisdom (Lombardo, 2006). These techniques of forward projection (together with scenario analysis) help understand opportunities for creating desired future states. Scenario analysis is a means for defining different end-states when the future is uncertain or needs to be altered from the current path. Scenarios are "*imagined futures*", "*are a means to handle uncertainty*" and can demonstrate that different actions taken today can lead to dramatically different outcomes (Stout, 1999, p1). Societies need to be able to explore alternative trajectories to initiate transition (Hopkins, 2006).

Table 2.3 The "*three-class typology of resilience*" (adapted from Handmer and Dovers, 1996, p496)

Type	Implications	Approach	Impact on power	Emphasis
1– Resistance and Maintenance	• Not sustainable • System becomes strained to the point of total collapse	• Denial of need for change • Inflexible	• Maintains and enhances existing power structure and concentration	• Individual • Hazards managed by professional elites • Control of public agenda and information
2- Change at the Margins	• Acknowledge that present system is unsustainable • Minor changes which delay essential major change • Lulling people into false sense of security	• Treat symptoms • Some flexibility but overall largely inflexible • Reactive approach to change and hazards	• Maintains and enhances existing power structure, but environmental interests become part of power structure	• Largely individual • Rhetoric • Some distribution of hazard management • Control of public agenda and information with some participatory mechanisms
3- Transformation[1]	• Major change toward a sustainable trajectory • Ability to manage uncertainty • Chance of maladaptive change	• Treat causes • Flexible and adaptive • Able to cope with unexpected threats and hazards	• Significant changes in power distribution	• Collective • Humanity and the biosphere • Hazards managed by general population in a balance of freedom and responsibility • Information systems participatory and highly variable

[1]NB, in the original typology, "Openness and Adaptability" was the name for Type 3. However, given the ambiguity in meaning of 'adaptability' (Walker *et al*., 2004, see previous page), 'Transformation' has been used instead.

The use of forward projection to set long term vision (futures envisioning and then backward reasoning (back-casting) to determine the shorter term actions (Kemp *et al.*, 2007) are common to transition methods (the Transition Towns Movement, TTM, Hopkins, 2008) and community development practice. An example of the latter is the Loch Lomond and Trossachs National Park Community Futures Programme, which was developed by the Small Town and Rural Development Group (STAR) and is built upon sound principles of community development (Roxburgh and Tuffs, 2006, STAR, 2010). The Community Futures programme engages communities to create visions and action plans for change, but focuses on community development (societal change), as opposed to transformational change and holistic sustainability (incorporating all aspects of sustainability, as defined in the SCD). Therefore, the Community Futures programme could be said to be more often achieving level two, rather than level three, of the "*three-class typology of resilience*" (Handmer and Dovers, 1996, p496). However, the advantage of this approach is that it encompasses the unique needs of each community and permits development of bespoke solutions.

To create designs and plans for transformational (as opposed to type 1 or type 2 change), the Transition Towns Movement (TTM) uses participatory visioning and back-casting. The TTM explores the implications of peak oil, creates visions for more resilient carbon-free futures and back-casts to identify and implement the societal and infrastructure changes required to create their envisioned futures (Hopkins, 2008).

Both the TTM and the Community Futures programme incorporate a facilitator-led process, which enables community-specific development. Regardless of the level of change being facilitated, facilitators of change should be independent people who can help communities to achieve their objectives through envisioning, discovery, conflict resolution, engagement and encouragement. Facilitators can bring a process within which communities determine their own priorities and destiny. However, the facilitators need to be skilled in facilitation, both community development and sustainability literate, and aware that they can hold power over participants if participants *"…accept* [the facilitators'] *advice/opinions as a higher level of "truth" than their own opinions"* (Didham, 2007, p244).

The future of rural Scottish communities is uncertain and so approaches that facilitate better futures are important. One aim of this study is to outline possible futures, create scenarios and measure their potential sustainability. Participatory futures envisioning and modelling of scenarios of different levels of change are central to this study and have been incorporated within the methodology.

2.1.5.3 Justice

For successful transitions overarching impediments to change have to be resolved. Community-specific injustice is likely to be a fundamental impediment to sustainable development. Ethics are implicit in sustainable development (Ekins and Max-Neef, 1992, Moffat, 1996a) and power to enact decisions in relation to ethical considerations is critical to achieving a fairer future (Foucault, 1994, Harvey, 1996). Although the concept of a fair and just society underpins sustainable development, definitions of sustainable development rarely incorporate and articulate issues of justice (e.g., in relation to property rights, climate change or renewable energy) and power that are characteristic of critical assessments of post-modern society (also termed neoliberalism) and theories of community development (Harvey, 1996, 2005, Ledwith, 2005, Peck, 2010). Baker's framework (Table 2.1) does not elaborate how the normative principle of justice can be applied in resolution of injustice, nor how to resolve disempowerment, both of which are found in rural Scotland (see section 2.2). These gaps have led to the incorporation of power to act and land tenure within the sustainable community design framework (see section 2.1.4) and differs from previous sustainable community designs (e.g., The Egan Review's Components of a Sustainable Community, Egan, 2004, Figure 2.6). In the remainder of this section the major principles of justice and a relatively new framework for analysing injustice, which is applied in this study to analyse a potential barrier to sustainable development (objectives 3f and 7a, section 1.2), are outlined.

There is a vast multiplicity in definitions and interpretations of justice. Rawls has defined an ideal "*transcendental*" justice based on equal rights and fairness (Rawls, 1971, Sen 2010). However, whilst equal rights and fairness are essential and his works give a sound moral framework, Rawls's "*transcendental*" justice is likely to be unachievable, because we do not know *"… whether the plurality of reasons for justice would allow one unique set of principles to emerge*" (Sen, 2010, p11). Moreover, Rawls's work has focused on distributive justice, but capabilities and freedoms are also important (Sen, 2010). Poverty can thus be defined as the "*deprivation of basic capabilities*" (Sen, 1999, p20) and communities that are just and fair (from an anthropocentric viewpoint) can be said to contain people who are able to realise their capabilities (Sen, 1999), have meaningful work (Schumacher, 1999) and overall have a reasonable level of well-being. However, what this means practically depends on the context, collective identity, values and language of the society in which the justice is embedded (Harvey, 1996).

Considering injustice as a problem of distribution obscures the institutional, procedural and cultural practices that cause and/or further the injustice. A pluralistic justice discourse incorporates equity, recognition, participation and other capabilities (Young, 1990, Fraser, 1997, Schlosberg and Carruthers, 2010). These forms of injustice are not just individually experienced forms of distributional, recognition, participation and procedural injustice, but also collective capability and functioning. Therefore, justice discourses should be at a group level, rather than individual, and community-based capabilities are important (Schlosberg and Carruthers, 2010, Skerratt and Steinerowski, 2013).

Schlosberg (2004) deduced that social differences usually coincide with privilege and oppression. Lack of recognition affects both an individual, community or group directly and the perception of the individual, community or group by the rest of the world. The community or individual is perceived to be what they are not and this lack of recognition creates a "*foundation for distributive injustice*" (Schlosberg, 2004, p519) and results in communities and individuals being disempowered (Ledwith, 2005). Historically, Scottish rural communities have suffered injustice relating to social differences. Stories of the Clearances tell of the perception by the landed gentry and estate factors of the crofters as being the worth of "*savages*" (MacKenzie, 1946, p206). Although these extremes may have passed, the cultural legacy together with lack of opportunity and property rights for rural communities persists (McIntosh, 2001, Wightman, 2011). This has led to many communities becoming "*non-aspirational*" (Christina Noble, *pers. comm*., 2012).

Lack of recognition is also a way of interpreting the "*disembeddedness*" (Giddens 1991, p21) from nature in that humans fail to recognise the value of nature and the right of plants and animals to exist and fulfil their potential. A biocentric belief system could underpin the "*ideal model*" of sustainable development (Taylor, 1986, Moffatt, 1996a, Baker, 2006). Taylor's (1986) biocentric system of ethics provides a framework for resolving human conflicts with nature. This prevents the most manifest injustice (environmental harm) without requiring perfect justice (no environmental impact whatsoever), achieves the desired goal of humans impacting on nature causing minimal harm and requires restorative justice after the basic needs of wild animals and plants have been compromised (Taylor, 1986). However, implementation requires a switch to an ecocentric belief system, which requires '*dualchas'* (see section 2.3.2.1). Nevertheless, Taylor's biocentric justice system fits better with the "*ideal model"* of sustainable development (Baker, 2006).

Resolving energy injustice in rural communities in Scotland is likely to be a key factor in enabling rural communities to become more sustainable. Energy injustice (particularly fuel poverty) overlaps with other forms of injustice (e.g., climate injustice) and can be considered part of wider justice issues, such as lack of recognition and procedural injustice (Walker, 2011, n.p., Walker and Day, 2012). Thus, the causes of energy and climate injustice can be categorised within the distributive and procedural dimensions of justice, as has been done for climate justice (Table 2.4, Bulkeley and Fuller, 2011, 2012, Walker, 2011, McCauley *et al*., 2013). The importance of this analysis is that it teases out the underlying causes supporting and furthering the injustice. For example, Bulkeley and Fuller's (2011, 2012) analysis highlighted the issue of engagement with marginalised groups in low carbon community projects; if these groups are not included in decision-making, are not well supported financially and strategically,

Table 2.4 An analysis of the dimensions of climate justice (from Bulkeley and Fuller, 2011, 2012)

	Responsibility	**Rights**	**Recognition**
Definitions			
Distributive	Allocation of duties to mitigate	Share of benefits and costs of impacts of climate change and mitigating its effects	Structural conditions that create vulnerability and produce uneven landscapes of GHG emissions
Procedural	Imperatives for participation in climate decision-making	Provision of access to decision-making to relevant groups and individuals	The basis upon which exclusion and inclusion from decision-making is currently structured
Outcomes of an analysis of UK-wide low carbon community projects			
Distributive	Responsibility for taking action placed on communities, but often without support for community development/capacity building.[1] Moreover, there is a general lack of debate of "how responsibilities for cutting carbon" should be shared.	Share of benefits from low carbon community projects is often considered, but the share of costs of the projects and of mitigating the effects of climate change are not.	Fuel poverty projects only partially tackle inequality, and do not consider vulnerability.
Procedural	Community participation in decision-making is encouraged, but unfair burdens are being placed on some people (community volunteers), when other critical actors (e.g., government and private sector) should be taking a role.	Marginalised groups are often not included in decision-making	'Hard to reach' groups are recognised, but successful engagement is rarely achieved.

[1]Similar problems relating to lack of capacity building has been found in LEADER projects (Skerratt and Steinerowski, 2013).

and the cost to these groups of undertaking the project is not considered, then these groups are unlikely to engage.

One of the most manifest injustices in Scotland is ownership of the land (Wightman, 2011, see section 2.3.2.2). Remembering that justice is normative and plural, most important is correcting the most manifest injustices and creating a fair outcome. The inherent diversity in interpretation and impossibility of achieving Rawl's transcendental justice creates problems for resolving injustice, as restoring justice for one often means creating injustice for another (Harvey, 1996, Sen, 2010). Restoration of property rights in rural Scotland to local communities (Wightman, 2011) would cause an injustice to the current landowner. What is important is resolution of the most manifest injustice and restoring some form of comparative justice, which may be a partial solution but better than the current situation. Therefore, before embarking on any programme to address injustice, precise articulation of and public reasoning between competing injustices are essential to identify the most appropriate social choices (Sen, 2010). Precise articulation requires detailed analysis of the pluralistic nature and causes of any injustice.

In this study this means identifying issues of deprivation and injustice in rural communities (some of which are already described for rural Scotland) and identifying options for resolution. Frameworks such as Sen's, Schlosberg's, Taylor's and Bulkeley and Fuller's provide guidance for identifying injustices and act as a starting point for investigating the potential for a fairer outcome (Taylor, 1986, Schlosberg, 2004, Schlosberg and Carruthers, 2010, Sen, 2010, Walker, 2009, 2011, Bulkeley and Fuller, 2011, 2012, McCauley *et al*., 2013).

2.2 Global to local crises: possible scenarios of the future

Consideration of global and local crises are important for this study as realisation of ecological, socio-economic and resource crises form the scenario from which community visions were created in this study. There are multiple crises affecting the planet and societies. In the last 30 years world-wide natural ecosystems have declined by 33% whilst the ecological pressure exerted by humanity on the Earth has increased by 50% over the same period (Loh, 2000, Daly and Farley, 2004). Human-induced habitat destruction, pollution (excessive pesticide and fertiliser use, mining waste and urban and industrial effluents), over-exploitation of renewable resources (above regeneration rates), climate change and invasive species are causing biodiversity to be lost at between 50 and 500 times the natural extinction rate determined from the fossil record (Baillie *et al.*, 2004, WWF, 2010). The last decade is the warmest since records began and there has been a 0.7 degree Celsius temperature global surface temperature increase since 1906, due to large increases in anthropogenic emissions of GHGs (IPCC, 2007). Global warming and climate change represent one of the greatest threats to our planet. In 2012, the Eurozone crisis, credit crunch and economic crisis showed the frailty and failings of the economic system in Europe and the UK. During the last forty years, the rich have become richer, and the gap between rich and poor has widened (Meadows *et al.,* 2004, Harvey, 2005, UNDP, 2005, Peck, 2010).

The extent of over-consumption in Scotland as a whole is illustrated by the EF, where Scottish citizens are consuming over two and a half times their “fairshare” of the world’s biocapacity. In 2006, the Scottish EF was 4.8 global hectares per capita (gha/cap, SEI, 2011a), compared to the estimated per capita fairshare of available biocapacity of 1.8gha/cap (GFN, 2012, Table 2.5). The unsustainable nature of rural Scotland is created, experienced and enacted by socio-economic and ecological forces at scales from global to local and Scotland’s unsustainable consumption contributes to the global crises (SEI, 2011a).

Table 2.5 The world’s biocapacity compared to estimations of world-wide, UK’s and Scotland’s resource use (the EF measured in gha/cap by land-class) in 2008 (WWF, 2010, GFN, 2012)

Land-class	Footprint calculated from	World biocapacity	EF World	EF UK	EF Scotland
		(gha/cap)			
Cropland	Area used to produce food and fibre for human consumption, feed for livestock, oil crops and rubber	0.57	0.59	0.88	1.14
Pasture	Area used to raise livestock for meat, dairy, hide and wool products	0.23	0.21	0.45	0.26
Forests	Amount of lumber, pulp, timber products and fuel wood consumed by a country each year	0.76	0.26	0.53	0.20
Fisheries	Estimated primary production required to support the fish and seafood caught, based on catch data for 1,439 different marine species and more than 268 freshwater species	0.16	0.10	0.06	0.10
Built-up land	Area of land covered by human infrastructure, including transportation, housing, industrial structures, and reservoirs for hydropower	0.06	0.06	0.15	0.20
Carbon uptake (fossil fuel) land	Amount of forest required to absorb CO_2 emissions from burning fossil fuels, land-use change and chemical processes, other than the portion absorbed by oceans	N/A	1.47	2.65	2.86
Total		1.78	2.70	4.71	4.75

Over recent decades there has been unbridled expansion of the global economy and profligate use of resources despite obvious physical limits (Daly and Farley, 2004, Jackson, 2005a, Peck *et al.,* 2009, Peck, 2010). Increasing throughput in the economy leads to depletion of resources and increases pollution and depreciation of natural capital. Continually increasing growth is not feasible on a finite planet, because of the limits to the regeneration of renewable resources, the productivity of ecosystem services and the absorptive and assimilation capacity of waste. There are no substitutes for life support systems and once damaged their capacity will decline and cannot be replaced. The economy depends on the environment to provide the natural resources to fuel growth (Daly, 1995, Daly and Farley, 2004,), but there is no restraint within neoclassical economics to prevent consuming too much (Wackernagel and Rees, 1996, Gray and Bebbington, 2007). Demand is stimulated by the underlying neoclassical economic philosophy, the "*pursuit of self-interest*", and the ethic that consumption is perceived as a "*right*" (Daly, 1995).

The "*Tragedy of the Commons*" illustrates that the pursuit of self-interest where there is open (unmanaged) access to common property leads to collapse (Hardin, 1968, 1998, Ciriacy-Wantrup and Bishop, 1975). Pursuit of growth and unmanaged access to common resources has resulted in the assimilative capacity of the environment to absorb pollution (for example, GHGs, which have created climate change) and replenish renewable resources being surpassed and non-renewable resources extracted to the extent that they are much less abundant and increasingly difficult to extract, for example, peak oil (Campbell, 2003, Hopkins, 2006). Whilst new methods such as deep water drilling, Arctic exploration and tar sand extraction are being promoted, these methods have a higher carbon and energy intensity of production and environmental impact compared to the more easily accessible oil fields, whose production is declining or stopped, (Campbell and Laherrère, 1998, Kerr, 2011). North Sea oil and gas production peaked in 1999 and 2000, respectively (Scottish Government, 2012b), and, from 2005, the supply of oil from non-OPEC countries has not grown (Kerr, 2011). Although there is uncertainty with regard to the precise date of peak oil of conventional oil fields, it is likely that it will occur within the next twenty years and may have already happened (Campbell, 2002, 2003, Blunt 2009, UKERC, 2009). This, together with the uncertainty and energy intensity of new methods, means that it is likely there will be significant increases in the price of oil and its derivative products (Brecha, 2013).

These price increases will make new methods of extraction (with their far more damaging impact on the environment) more economically viable and so it is unlikely that the peaking of conventional oil will do much to avert climate change (Brecha, 2013). To counteract the impact from a climate change perspective, van den Bergh (2012) recommends effective and strict global climate change legislation (through taxation and carbon credits) to restrict these especially environmentally damaging oil extraction methods. Nevertheless, absence of cheap oil in the next decade has the potential to fundamentally change society (Hopkins, 2006, Holmgren, 2009) and may lead to many different outcomes depending on the extent of adaptation and mitigation (Hopkins, 2006).

Peak oil and policy to reduce fossil fuel use (climate change legislation, Scottish Parliament, 2009) is particularly important for rural communities as they are currently dependent on fossil fuels to overcome the challenges presented by geographical isolation, poor climate and soils and energy inefficient housing stock (Scottish Government, 2010a). There is a probability with resource shortages and without credible alternatives, rural communities could fail to thrive due to their frail economic nature and their dependence on fossil fuels (Hopkins, 2006, Holmgren, 2009, Scottish Government, 2010a).

2.3 Rural Scotland: an overview

The rural landscape of Scotland is iconic and, although it appears wild, the landscape is largely a result of human impact over millennia (Smout and Wood, 1991, Habron, 1998). Rural areas and the wild landscape dominate Scotland, although the majority of people live within urban areas (Scottish Government, 2010a). Rural communities have been shaped by history, human interaction with the landscape, by the landscape and its owners, and by the forces of oppression and injustice, industrialisation and neoliberalism (MacKenzie, 1946, Smout and Wood, 1991, Shucksmith and Rønningen, 2011, Wightman, 2011). Communities' culture and social capital are products of these and are inter-woven with the nature of land-ownership and the ability for self-determination (McIntosh, 2001, Wightman, 2011). In this section, the characteristics of rural Scotland are presented, together with the Scottish Government's definition of rurality (adopted for this research), an interpretation of the significance of the land to well-being, an examination of the distribution of power and property rights (especially with regard to renewable energy), and the Scottish Government's policy for sustainable development and climate change.

2.3.1 Scotland: facts and figures

The total land mass of Scotland is approximately 7.8 million hectares. Rural Scotland accounts for 19% of the total population and 94% of the land mass (Table 2.6). Using the Scottish Government's (2010a) definition of rural for this study, less than 20% of the population can be said to live in rural areas and just over a quarter of the rural population is more than 30 minutes from an urban area (Figure 2.8). The distinction between rural and urban and implications for rural policy and sustainable development can be significant. For example, the socio-economic nature of an accessible rural community with commuter links to and access to the service provision of large towns can be quite different to that of a remote rural community.

A small proportion of the population presently reside in the Highlands (the remote areas north of the major conurbations, Figure 2.8) and Islands, but, in the 18th century, over 50% of the population lived there. The population dropped initially during the 19th century Clearances (whereby many crofters were forcibly removed from the land to make way for large scale sheep farming) and then more rapidly following the Crofters' Holding Act of 1886, which made clearances illegal, as crofters migrated to the Lowlands or overseas "*in search of a more rewarding way of life*" (Smout and Wood, 1991, p303). Hill farms continue to dwindle and less than 10% of the population make their living from the land or the sea and many previously populated glens are deserted (McCarthy, 1999).

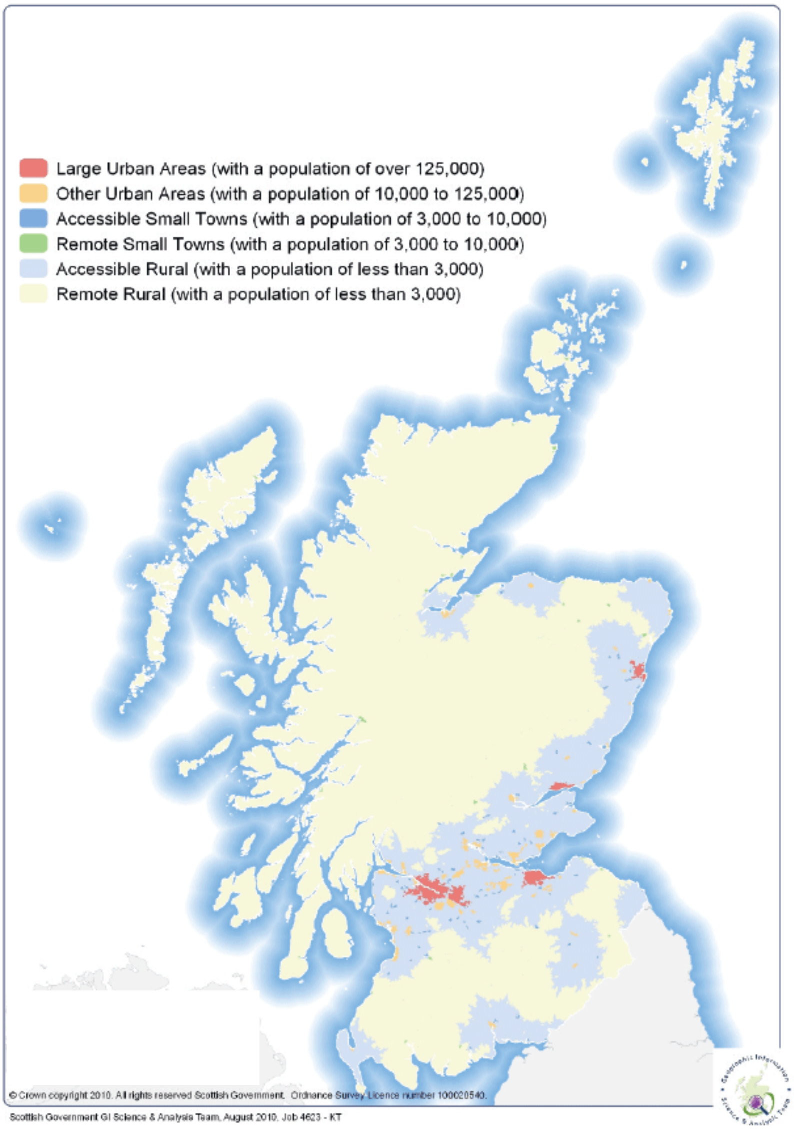


Figure 2.8 Scottish Government 2009-2010 urban/rural six fold classification (from Scottish Government, 2010a, p4). 'Rural' areas are areas outside settlements of more than 3,000 residents, 'remote rural' are settlements more than a 30 minute drive to the nearest settlement with a population of more than 10,000, and 'accessible rural' are areas within a 30 minute or less drive to the nearest settlement with a population of more than 10,000

Rural areas have a much lower percentage of the population in the age range 16-34 compared to urban areas, but a higher proportion in the older age bands, especially at pension age (Figure 2.9). Similarly, single adult households make up a much lower proportion of households in rural areas compared to urban, whereas households with one or more adults at pensionable age are higher in rural areas (Scottish Government 2010a). These facts reflect the difficulty in accessing employment and social networks in rural areas, and, in turn, community, social and economic enterprises are impeded by the unavailability of young, capable and motivated adults.

Table 2.6 Population distribution in urban and rural areas: 2008 mid-year estimate (from Scottish Government, 2010a, p5)

	Population			
Geographic area	2001	2008	% of total 2008	% change 2001-2008
Remote Rural	319,043	336,056	6.5%	5.3%
Accessible Rural	561,234	617,953	12.0%	10.1%
Rest of Scotland	4,183,923	4,214,491	81.5%	0.7%
Total	5,064,200	5,168,500	100%	2.1%

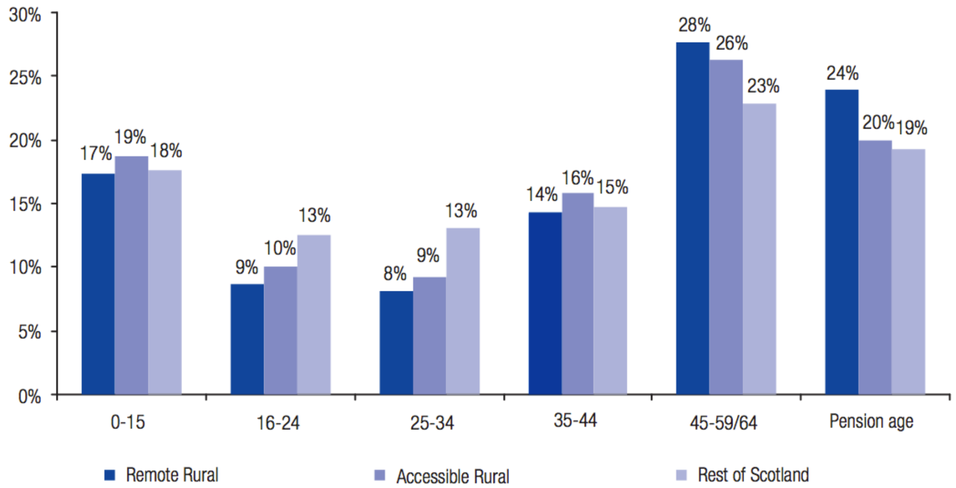


Figure 2.9 Age distribution of population by geographic area, 2008 (from Scottish Government, 2010a, p6)

Overall, Scotland's population is rising, but the increase in households is rising at a greater rate (Figure 2.10). The total population was 5.22 million in 2010 and is forecast to increase by 7% by 2033. The number of households increased by 15%

between 1991 and 2009, in 2011 was 2.4 million, and is forecast to be 2.8 million by 2033. This rise has been attributed to both population growth and changes in household structures (Scottish Government, 2011a). The latter means lower occupancy housing, which has implications for sustainability. Less than 8% of dwellings in rural Scotland are flats compared to 35% in urban areas and 12% in remote rural areas are either vacant or second homes, compared to 5% in accessible rural and 4% in urban areas. Only 13% of houses in remote rural areas have a 'good' energy efficiency rating compared to 31% in accessible rural and 55% in urban areas (Scottish Government 2010a). This is reflected in the fuel poverty statistics with the number of households in extreme fuel poverty in remote rural areas being three times that of urban areas and 50% of remote rural households are fuel poor (Figure 2.11, Scottish Government, 2011a). The Scottish Government has pledged to ensure that by 2016 people are not living in fuel poverty in Scotland (Scottish Government, 2011b).

Rural areas have been estimated to contain 15% of deprived households in Scotland (Carley, 2002). Deprivation in rural areas may be under-estimated in national statistics because post-code level aggregated data may have a high degree of variation in levels of deprivation (Higgs and White, 2000). Accessible rural areas tend to have higher house prices and adults with higher rates of pay (20% of households have an adult earning over £40,000, compared to 16% in remote rural and 12% in urban areas) and higher numbers educated to degree level than all other areas, suggesting they tend to be an enclave for those with higher salaries and high achievers (Scottish Government, 2010a).

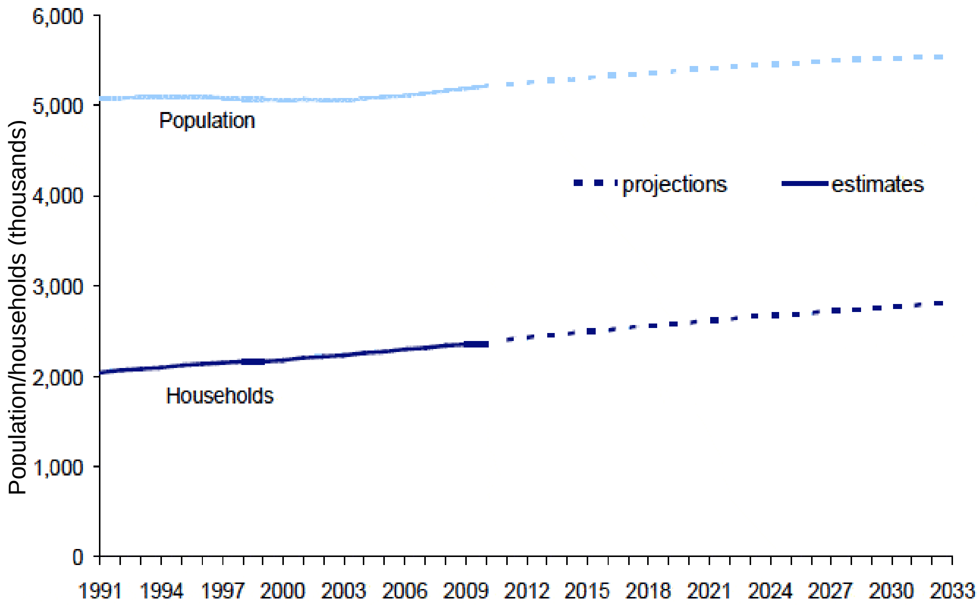


Figure 2.10 Population of and households in Scotland 1991-2033 (from Scottish Government, 2011a, p6)

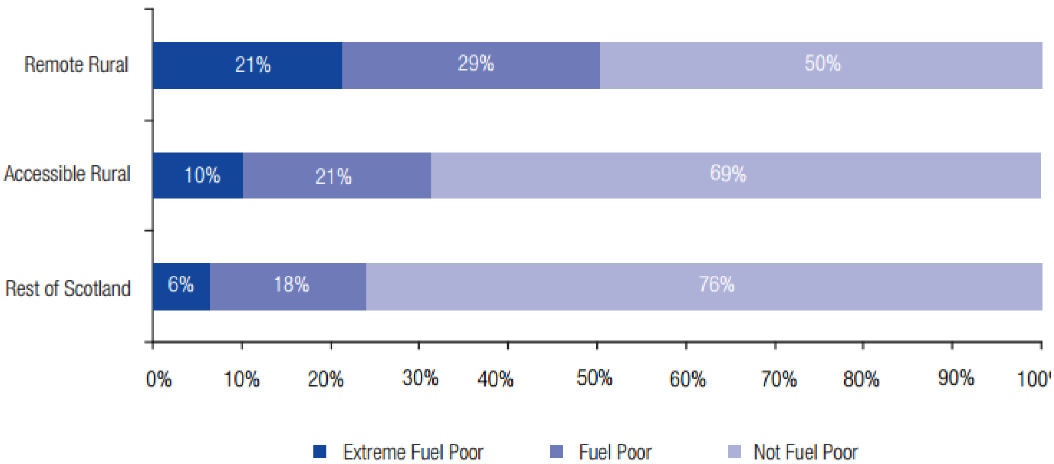


Figure 2.11 Proportion of households in fuel poverty by geographic area, 2008 (from Scottish Government, 2010a, p35). A household in fuel poverty has to spend more than 10% of its income to maintain satisfactory heating; extreme fuel poverty is when more than 20% has to be spent (Scottish Government, 2012b)

In Scotland, the breakdown in family structures is reflected in the rising demand for households above population growth (Scottish Government, 2011a, Figure

2.10). In rural communities, people can easily become very isolated, especially those that are more vulnerable, deepening their deprivation (Carley, 2002, Shucksmith, 2004). Isolation has been identified as a contributory factor to the higher suicide rates in remote rural areas (Levin and Leyland, 2005). Social structures are essential in not only alleviating depression and anxiety but also for social capital, a pre-requisite for behavioural change and sustainable communities (Jackson, 2005b, 2007, Wolf *et al.*, 2009, Dobson, 2010).

Rural communities are dependent on cars to access services and retail centres, especially as 11% of the remote rural and 4% of the accessible rural population have no access to bus services (Scottish Government, 2010a). Compared to urban areas, car use is 20% higher in rural areas with over 86% of the rural population having access to a car and over 76% travelling to work by car. However, for access to school there is little difference in the use of the car between urban and rural, but fewer children walk or cycle in rural areas and use public transport instead (51% of school children in remote rural and 40% in accessible rural areas travel by bus compared to 16% in urban areas).

Scotland's rate of premature deaths (e.g., heart disease, stroke and cancer) is twice that of most of Europe and this has been attributed to the largely unhealthy diet of Scots (Scottish Executive, 1993). Whilst there have been significant improvements in food provision in schools and healthy eating campaigns, the 2011 Scottish Health Survey revealed that still less than 25% of the population eat five portions or more of fruit and vegetables a day (Scottish Government, 2011d). The unhealthy diet has been attributed to the decline in local agricultural production, a reliance on imported foods, availability of processed foods, the climate and the (historic) lack of availability of fresh fruit and vegetables (Scottish Executive, 1993, Frey and Barrett, 2007). Rural communities tend to be less polluted and have higher life expectancy than urban areas, despite the higher suicide rates of remote rural areas (Levin and Leyland, 2005).

However, social capital is likely to be higher in rural areas as almost double the amount of people in remote rural areas give up time to volunteer (48% in remote rural, 34% in accessible rural and 26% in urban areas). Crime rates and neighbourhood anti-social behaviour are much less in remote rural areas than accessible areas and urban areas (Scottish Government, 2010a).

Lack of access to participatory democracy, economic wealth and social opportunities have been identified as the main bases for rural poverty (Shucksmith and Philip, 2000, Shucksmith, 2004), but "*poor access to services*" (e.g., "*lack of transport and / or disability*"), "*lack of productive activity*" (ability to engage in paid work or voluntary activity, which reduces social contacts and self-esteem) and "*attitudes and aspirations, which can influence both networking and productive activity through generations*" are also significant factors in deprivation in rural Scotland (Carley, 2002, p4). Frequently, rural jobs are casual, flexible, seasonal, part-time and low-paid or involve self-employment, resulting in flexibility but job insecurity (Mauthner *et al.*, 2001). Also, individuals with no access to transport in rural areas (in particular, lack of access to a car, as public transport may be poor or absent) can become totally isolated being unable to access services, employment or social networks (Shucksmith, 2000, Scottish Government, 2010a).

Social exclusion in rural Scotland has been attributed to a lack of social housing, car dependency and inadequate public transport, small workplaces associated with low pay and restricted careers, lack of unionisation or collective action of excluded groups, lack of strong personal networks (which may be important both in finding a job or in labelling people as undesirable), and the neglect of social exclusion in rural areas by policy makers and the public (Shucksmith and Philip, 2000). Young people are particularly at risk of deprivation through lack of education opportunities, leisure facilities, employment, career progression and social space and the visibility of living in a small community (Shucksmith, 2004). Moreover, they may not have access to a car and therefore cannot pursue job prospects (Shucksmith and Philip, 2000). The latter point is reflected in the population statistics where working age young people are notably under-represented particularly in remote rural communities (Scottish Government, 2010a).

Although education is used by young people to extricate themselves from rural life (McIntosh, 2001), Scottish education has been criticised for not creating citizens literate in sustainable development (Fagan, 2009). However, the new Scottish Curriculum for Excellence (CfE), which was fully implemented in 2012 (Education Scotland, n.d.), offers an opportunity for increasing sustainability literacy through the requirement to develop "*responsible citizens*" (Martin *et al*., 2013, p1530) and experiential learning. The concept of "*One Planet Schools*"

(Scottish Government, 2012k) was investigated by the Scottish Government and the resultant recommendations (detailed in the report "*Learning for Sustainability*", One Planet Schools Working Group, 2012) have been mostly accepted. In addition, the General Teaching Council for Scotland now requires "*all teachers to address "*learning for sustainability*" (defined as for One Planet Schools) in their teaching*" (Martin *et al*., 2013, p1530).

However, continuing this epistemological change into a life-long experiential learning process (thus creating capable and critical citizens who are sustainability literate) may be difficult to achieve especially as it has yet to be fully integrated into the epistemology of the secondary school curriculum (Priestley and Humes, 2010). At the moment CfE is in its infancy and whether it offers an opportunity for enlightened educators to create the responsible and capable citizens, which a sustainable community requires, has yet to be determined (Education Scotland, n.d., Fagan, 2009, Priestley and Humes, 2010).

Rural economic development activities are delivered through Highlands and Islands Enterprise and Scottish Enterprise, who have networks of Local Enterprise Companies. Rural business development and home-working is dependent on the drive for the upgrade of telecommunications. The Scottish Government has made a commitment for and set a plan to achieve the following for digital technology, saying: "*that next generation broadband will be available to all by 2020, with significant progress being made by 2015*" (Scottish Government, 2011c, p31). Digital technology is viewed as essential for economic recovery and to achieving its plans for a low carbon economy, by "*replacing goods and services* *with virtual equivalents, allowing more efficient use of energy* [and] *offering virtual technologies that allow online shopping, teleworking and access to online public services*" (Scottish Government, 2011c, p15).

Broadband and the internet are becoming a means to deliver public services (e.g., "telehealthcare" (virtual health care) and agricultural subsidy payment, Scottish Government, 2011c). However, lack of broadband or slow broadband speeds may limit the accessibility of these public services in rural areas. Approximately 20 percent of Scotland's residential and business premises are located more than 2km from the nearest exchange and so cannot achieve fast broadband using the existing copper cables. The challenge is to provide alternative technological solutions with new fibre optic cables or mobile services. The latter is often not possible in remote areas, where network coverage is poor, and so may "*create a society of unequal opportunity*" (Thomson *et al*., 2010, p45).

There is a broad diversity of land management and use, including historical, geological, climatic and cultural distinctions between different areas of Scotland. Highland rural society has the background of the clans and kinship, of cattle and sheep rearing, traditionally practising seasonal transhumance pastoral agriculture (the shieling system, Holl and Smith, 2007), of safe-guarding rather than commercially exploiting the land, the Gaelic language, the prevalence of the Free Church, which broke from the Church of Scotland in 1843, and the notorious Clearances when land owners realised the value in rearing sheep and game on their land at a time of great famine and poverty (MacKenzie, 1946, McCarthy, 1999, Smout and Wood, 1991). Even today Highland land is greatly inflated by the sporting values of estates compared to agricultural value (Wightman, 2011). Lowland society, on the other hand, has its roots in the Scots language, agriculture is largely cereal production and many areas have the commercial benefit of being closer to urban areas (Scottish Government, 2012a). Orkney and Shetland have different cultures again, based largely on Nordic culture.

Agriculture remains central to the rural economy, as demonstrated by the Foot and Mouth epidemic (Donaldson *et al.*, 2002, Levin and Leyland, 2005, Scottish Government, 2012a). Scottish agricultural productivity varies significantly as a result of extensive geographical variations in climate, geology, landscape and soil quality. For agricultural subsidy allocations, 72% of Scotland has been designated as 'Less Favoured Areas' (LFAs, Figure 2.12, Scottish Government, 2012a), but in some areas poor quality land may be a result of inappropriate land management (e.g., deforestation, industrial forestry, management for shooting and game, or over-grazing by sheep and / or deer) rather than inherently poor soil quality.

Agriculture is challenged by rising costs and is heavily reliant on European Union (EU) subsidies (Scottish Government, 2012a). Over the last thirty years, rural development programmes, many enacted through EU legislation, have tried to address the economic and social decline and marginalisation of rural areas (Bryden and Geisler, 2007). Nevertheless, income from agriculture peaked in 1995 followed by a major decline and slow recovery to 60% of the peak (Scottish Government, 2012a). Continual fuel price rises have a significant impact on rural communities, as well as agriculture, where transport is a necessity. There has

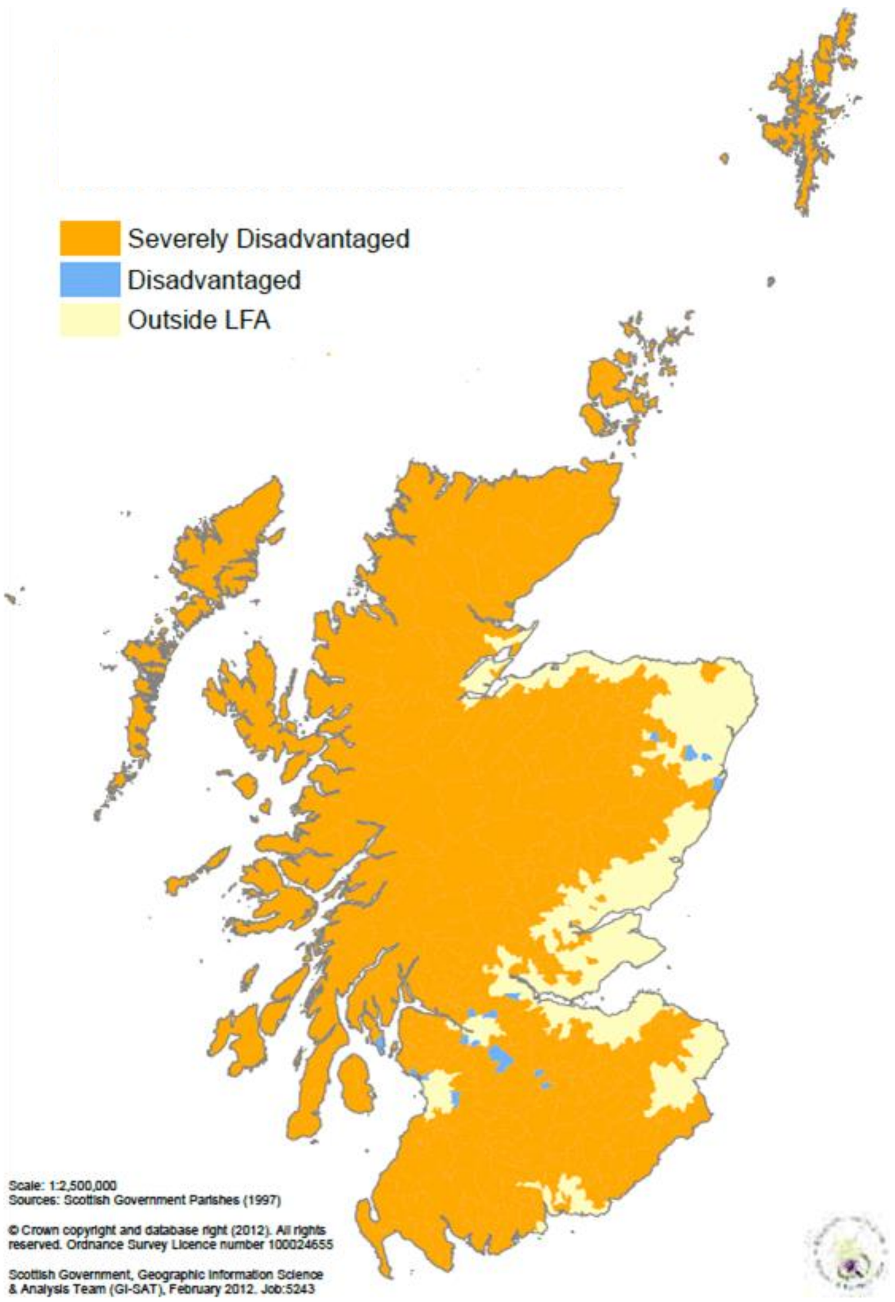


Figure 2.12 'Less Favoured Areas' and 'Non-Less Favoured Areas' in Scotland (from Scottish Government, 2012a, Map 3, p74)

been a change from a predominantly production economy (agriculture, forestry and fisheries) to a service economy (outdoor pursuits, wildlife tourism and general tourism). This has been driven by farm diversification (Bryden and Bollman 2000), causing a decline in the importance of agriculture. Management of the land as sporting estates or as windfarm developments or other renewable technologies provide alternative land-uses to agriculture. Growth areas in the rural economy are new technology and services and there is continual demand for second homes in scenic areas as holiday homes (Bryden and Bollman, 2000). These trends combined have socio-economic consequences for rural communities, weakening the link between communities and the land, reducing the working population and increasing reliance on tourism.

2.3.2 Scottish land: 'dualchas', property rights and renewable energy

Land is important in many ways. "…*Economically* [land ownership] *determines investment patterns, employment opportunities and local economic development. Culturally, land continues to inspire writers, poets, playwrights and singers.* [Spiritually land is a]… *powerful icon and influence of people's beliefs*." (Wightman, 1996, p14). This section explores the concept of '*dualchas*' (the Gaelic word to express spiritual and cultural ties with the land) and examines the distribution of power and property rights in Scotland.

2.3.2.1 '*Dualchas*'

The combination of consumerism, industrialisation of food production and the depopulation of rural areas in Scotland has resulted in most of the population losing its link with the land ('*dualchas'* in Gaelic, McCarthy, 1999). Historically, (before the Clearances) Scots had an intimate relationship with the land (McCarthy, 1999), especially in the Highlands where transhumance was practised (the sheiling system; at lower altitudes woodland was used to protect crops in summer and animals in winter and in summer animals were led up to higher ground where they grazed freely, Holl and Smith, 2007). Unusual places were named after single trees, small bogs or small tinchels (trapping areas). Personal identity (‘*dualchas*’) was rooted in place, where the environment was intrinsically linked with culture and identity (language, art, music and literature, McCarthy, 1999). The shieling system declined during the Clearances and disappeared by the end of the 19th century being replaced by sporting estates and large scale upland sheep grazing (Holl and Smith, 2007).

Many present-day Scots do not act as if humans are a part of nature, nor behave as if they have an inherent respect for the protection of ecosystem life support services. Even the few who have worked the land for generations often see agriculture as agribusiness rather than stewardship and ecosystem service provision. Although crofting is more resilient (perhaps because most crofters derive their income from off-farm activities), neoliberalism has invaded many areas of farming, and the policies and approach are utilitarian (Shucksmith and Rønningen, 2011). Attempts to exploit the land for developments, which have high environmental costs, continue; examples are the quashed Harris Superquarry (Figure 2.13, McIntosh, 2001), large scale commercial windfarms (Mountaineering Council of Scotland, MCofS, 2012) and Donald Trump’s golf course (Trump, 2013). Much of the heritage of harvesting renewably has been lost (for example, the practice of coppicing and pollarding as opposed to clear-felling).

Figure 2.13 Photo montage of Harris Superquarry: what it might have looked like (prepared by Envision for SNH for 1994-95 Public Inquiry, from McIntosh, n.d.)

Therefore, Scottish society, like most in the “western” world, has become “*disembedded from nature*” (Giddens 1991, p21, in Borgström *et al.*, 1999), as a result of our materially consumptive, industrialised and largely urban society. Material goods have replaced the rewards gained from human interaction with nature, so people lose their bond with their local context and the environment, ecosystem services and the value of natural capital, and become less and less inclined to protect it (Borgström *et al.*, 1999, Kasser, 2002, Key and Kerr, 2011, 2012). Increasingly nomadic existences within society further weaken ‘*dualchas*’ as a highly mobile individual fails to develop strong ties to place (McCarthy, 1999, Beck, 2000).

The cruel dilemma of protecting what is ‘sacred’ (the land) over the material need of increasing personal income and gaining self-worth through employment

(Schumacher, 1999) is articulated in Rev. Prof. McLeod's witness to the Harris Superquarry inquiry, which was investigating the possibility of a Superquarry on a hill on the Isle of Harris (Figure 2.13). In his testimony, Rev. Prof. McLeod emphasised the psychological and theological links with the land: (1) that "*rape of the environment* [can be considered] *rape of the community itself*"; [(2) that the indefensible, but] *perfectly legal*, [dichotomy of] *the idea that agrarian rights may belong to the people, while mineral rights belong to someone else*; [and, (3) that] *the people of Harris*, [who are the] *guardians and servants* [of the land, being] *torn between their love for the land and their need for jobs, …face a cruel dilemma. Capitalism offers to help them in characteristic fashion: it will relieve unemployment provided the people surrender guardianship of the land (thus violating their own deepest instincts)."* (McIntosh, 2001, p234).

This testimony provides an apt description of the respect we as humans should be attributing to the environment around us and within which we find ourselves. The philosophy of the Mi'Kmaq First Nation in North America (who also provided a testimony at the Superquarry inquiry) is "*one where man* [is] *not dominant over the creation or other life forms, which we share… this territory with*" (McIntosh, 2001, p235). This is similar to the Bolivian Bill for Mother Earth (UNITAS, 2010) and echoes ecological ethics and justice (Taylor, 1986, Curry, 2011, see section 2.1.5.3). In the case of the Harris Superquarry, the planning application was quashed.

The conflict between denigration of the landscape and the need for jobs was highlighted in the 1940's. Then, the main objectors to hydroelectricity developments opposed the loss of scenic amenity. However, industrialisation and construction provided job opportunities that were seen to give "*a greater share of the comforts of life and a release from the slavery and isolation of the croft. If they do not get it they will leave the Highlands, as many have already done….*" (Gregor and Crichton, 1946, p130-131).

The challenge for rural communities, is reconciling socio-economic sustainability with environmental sustainability, which means re-embedding people's lives and values with the land. These emotional links have been connected in McIntosh's "*Triune Basis of Community*" ("*Community with the Earth*" is one of the three aspects of community, the others being "*Community with Spirit/Self/God*" and "*Community with one another*", McIntosh, 2008, p48, see section 2.1.3). Perhaps this reconciliation would remove some of the contradictions present in society, address the 'value-action' gap (Stoll-Kleemann *et al*., 2001, Scottish Executive, 2005b, Key and Kerr, 2011, 2012, see section 2.1.1.1) and protect the environment at global and local scales, by creating alternative value structures for the determination of behaviour (Figure 2.1). In Scotland, a fundamental challenge is rebuilding communities around a protective or sacred view of our landscape and environment or '*dualchas'* (McCarthy, 1999). A key factor in this is having access to the land.

2.3.2.2 Ownership, property rights and governance

Ownership of the rural landscape is polarised with a small minority owning most of the land-mass, as a result land ownership is a theme in Scottish politics (McIntosh, 2001, Scottish Parliament, 2003, Macleod and Braunholtz-Speight, 2010, Wightman, 2011, Scottish Government 2012c, 2012d). Scottish land ownership has a difficult history. For almost a millennium the land has been subject to Scottish Feudal Law, but in the Highlands the principle for many years was kinship rights, which changed to feudal land tenure in the 19th century. With feudal land tenure landlords allocated large areas of land to sport hunting at the expense of crop production and livestock rearing, prevented access to foreshores (an important source of green manure) and often failed to protect the environment. The landowners influenced the size and distribution of the local population, access to employment and the link with and access of local people to the land (Wightman, 2011). Perhaps the worst abuse of the feudal tenure system by landlords was the Clearances of the 19th century (MacKenzie, 1946). They were largely a result of expansion of sheep farming and sporting estates (although occurred at a time when there was desperate poverty within Highland communities and the opportunity for emigration). Whilst some clearances were undertaken to alleviate the poverty and destitution of some communities, in other instances crofters were driven out by rack rents and evictions. The evictions and clearances led to the Crofters Holdings (Scotland) Act of 1886 (Wightman, 2011).

Some improvement occurred after World War I as communities were promised land in return for enlistment in the British army. Indeed, this benefited communities on Harris who moved to Skye. At the same time Lord Leverhulme gifted his estate creating the Stornoway Trust on the Isle of Lewis (Wightman, 2011). After World War II, significant areas of land passed into public ownership, such as the Forestry Commission, the National Coal Board and the Ministry of Defence. In 1974, the Land Tenure Reform (Scotland) Act prohibited new feu duties to feudal superiors and redemption of other feu duties, but did not go so far as to repeal feudal land law, as called for in a White Paper in 1969. The continued action of crofting communities and the Crofters Commission kept land reform on the political agenda and land reform became a fundamental objective of the new Scottish Parliament, which was created in 1999. As a result, Scottish Feudal Law was repealed in 2000 (Scottish Parliament, 2000, Wightman, 2011).

The Land Reform (Scotland) Act 2003 (Scottish Parliament, 2003) granted crofting communities the right to buy their croftlands and rural communities the right of "*first refusal*" when land is for sale. The "*community right to buy*" is central to this Act, helping communities and crofters take ownership of the land from absentee or distant landlords and creating opportunities for community development, especially with regard to renewable energy generation (Shucksmith, 2010). Between 2000 and 2006, the Scottish Land Fund assisted communities in community buy-outs and was restarted in 2012 with a budget of £6m (Scottish Government, 2012c).

However, the 2003 Act has not made a significant impact on the pattern of land ownership (Macleod and Braunholtz-Speight, 2010, Wightman, 2011). Many community acquisitions were instigated before the 2003 Act, such as those on Harris and Gigha. In the first nine years of the 2003 Act, only 11 purchases, totalling 21,000 hectares, have been successful with only three of these over 402 hectares (Scottish Government, 2012d). The low success rate in community purchases has been attributed to the bureaucratic and convoluted process combined with land not being available for communities to purchase, tight timescales for applications, rejections of community applications for technical reasons and communities being reluctant to approach locally-based landowners as this might provoke conflict (Macleod and Braunholtz-Speight, 2010, Scottish Government, 2012d). The right of community purchase can be prevented by exemptions (e.g., for offshore owners and inheritance transfers, Bryden and Geisler, 2007). Also, the 2003 Act does little to prevent bad management of Scottish natural heritage and social capital (Bryden and Geisler, 2007, Scottish Government, 2012d).

Wightman advocates a transfer of power from the few to the many, in order "*to introduce a broader sense of accountability to the wider public*" (Wightman, 1996, p16). However, land prices are too high for most of the public and he berates inheritance whereby the land ownership goes to a "lucky few". In 2010, 60% of the land in private ownership (i.e. 83.1% of the total rural land) was owned by 969 people (Wightman, 2011, Table 2.7).

The feudal history, the Clearances and the pattern of land ownership has led to a history where many communities have been relatively powerless. This has been exacerbated by the centralisation of governance and service provision, reducing local governance to tokenistic and powerless Community Councils (Wightman, 2011, Riddoch, 2014). This has created non-aspirational cultures (Assist Social Capital, 2008), from which communities have lost their voice (i.e. become disempowered and unrecognised, Daniels, 2001, Schlosberg, 2004, Ledwith, 2005, Pugh, 2012). For many aspiring young people, cultural and economic malaise creates an impetus to work hard to escape the confines of a remote Scottish rural community (McIntosh, 2001), rather than work hard for the common good.

Table 2.7 Land ownership in Scotland: key facts (Wightman, 1996, 2011). Land ownership data is from Wightman, 2011, p105-123.

Owners backgrounds • Aristocracy (11.5% of Scotland) • Old Money • New Money • Not for profit organisation • State • Overseas interests • Investment owners and corporations • Working farmers	Land use • Mixed estate • Forestry • Farms • Highland sporting estate • Lowland sporting estate • Crofting estate	Land owner status • Companies • Trusts • Individuals • Partnerships
Total land area = 19,470,000 acres Urban 2.6% Rural 97.4% Ownership: Public sector 12.1% Heritage sector: 2.5% Private sector 83.1% Community sector: 2.2%	11.8% of rural land is managed by the Forestry Commission on behalf of the Scottish Ministers. Rio Tinto (formerly British Alcan Aluminium Ltd) owns 117,249 acres (0.6% of the rural land) and is the fourth largest landowner Approximately 905,000 acres are owned by overseas individuals and offshore trusts (4.8% of rural land).	Forestry Approximately, 15% of Scotland is forest. Of this 55.9% is privately owned and the rest by the Forestry Commission Co-operatives are very few and there is little community forestry. The goal of forestry has been largely commercial benefits with many remote investors in the last century. Latterly, the Forestry Commission has changed its strategy to create a sustainable forestry strategy embracing local communities and biodiversity, but this is not necessarily the case in the private sector.

Land ownership is a key part of neoliberalism. Neoliberalism (and capital accumulation) is dependent *"…on the right to individual private property and the right to profit from it."* (Harvey, 2006a, p66). Those in power have control over land management decisions and the environmental management or mismanagement of the land is dependent upon landowner motivation. In some areas, landowners are in effect the rural planners and they have crucial roles in local development (Wightman, 1996). Polarisation of land ownership can cause harm for communities by preventing the community accessing and maximising the benefits of investment in local employment and economic development opportunities, by permitting developments that may be culturally inappropriate for the community and by breaking the cultural links with the local landscape (Wightman, 1996). In contrast, community land ownership can catalyse "*collective action, stewardship, and creative, forward-looking development*" (Skerratt, 2011, p5). Knowledge that control over the land is permanent enables communities to undertake futures envisioning, investments and long term planning (Skerratt, 2011).

A solution to neoliberal land management would be to have society hold the right to "*collective control of common property resources*" (Harvey, 2006a, p66). This collective control has been successful on the Isle of Gigha (described more fully as an example of a community developing sustainably in section 2.1.3). The community has been reinvigorated and ownership has been a catalyst for planning sustainable development (Didham, 2007).

Land management decisions need to enable "*democracy, opportunity, accountability, access to capital, freedom and public interest.*" (Wightman, 1996, p197). Community land ownership has to go hand in hand with appropriate democratic community structures and management and be interwoven with regional spatial planning decisions and environmental objectives. This is especially important when deciding on new or irreversible developments, such as the multitudinous renewable energy developments in Scotland (MCofS, 2012).

To be successful, land reform needs to ensure that conservation objectives are enacted upon, as much of Scotland's biodiversity and many environmentally sensitive areas lie in unprotected areas, and that the conservation objectives are culturally acceptable and socially sensitive (Bryden and Geisler, 2007).

2.3.2.3 Energy: resources and access

Energy is essential for life and its abundance is essential for the provision of food, assimilation of waste, and our basic needs. There are three aspects to energy relating to communities: the first is being able to generate it sustainably, the second is having access to it at an affordable price and the third is having control over the property rights attaining to the renewable resources. All three issues affect rural communities in Scotland in the form of abundance of renewable resources, fuel poverty (see section 2.3.1, Figure 2.11) and community energy either as community owned projects or a guaranteed share in the property rights of a commercial or private development.

2.3.2.3.1 Renewable energy generation installation and potential

Scotland is one of the energy richest nations in Europe (Boehme *et al.*, 2006). Scotland's natural resources are sufficient to enable Scotland to meet the Government's target of generating 100% of its demand equivalent from renewable resources by 2020 (whilst relying on existing fossil fuel generation for peak load demand, Scottish Government, 2011e) and help towards meeting the GHG emission reduction target of 80% by 2050 (Scottish Parliament, 2009, Scottish Government, 2013a). Offshore wind will make a significant contribution together with a combination of onshore-wind, hydroelectricity, biomass, wave and tidal-current generating technologies and micro-generation (Scottish Government, 2011e).

In January 2006, Scotland's installed capacity for renewable energy was 1.9 gigawatts (GW). In 2012, it was more than 4.2GW and is continuing to expand with another 3.3GW (mainly offshore windfarms), either under construction or having received consent (Scottish Renewables, 2012a). To meet the target of 100% renewable electricity generation by 2020, a further 9GW to 10GW of generating capacity is estimated to be required, which is small compared to the offshore wind capacity, estimated to be over 200GW (Scottish Government, 2011e).

Micro-grids (photovoltaics, PV, and micro-combined heat and power, micro-CHP) also have potential for making a major contribution to reducing GHG emissions, but would require universal implementation and battery storage (Bristow *et al.*, 2004). However, in Scotland, there is the problem of light incidence and angle to the sun for photovoltaic arrays and micro-CHP technology is not fully developed. Therefore, both a switch to renewable energy generation and upgrading of properties to Passivhaus standard (where the energy efficiency of the building is increased to the extent that traditional heating systems are not needed, Passivhaus, 2012) is important to eradicate fuel poverty (Figure 2.11) and meet the 2050 carbon emission target (Scottish Parliament, 2009, Scottish Government, 2013a). However, renewable energy solutions are most effective in addressing fuel poverty if implemented at a community or micro level (Boardman, 2012). This is very significant for the 21% of households in remote rural communities in extreme fuel poverty (Scottish Government, 2010a). On the Isles of Gigha and Eigg, community renewable energy has reinvigorated communities and been a means of transformation (Didham, 2007, Isle of Eigg, n.d., Isle of Gigha, n.d.). However, community-owned renewable energy assets form only a small minority of the owners of renewable energy developments in Scotland, as illustrated in the next section.

2.3.2.3.2 Community ownership and community benefits from renewables

Analysis of all the renewable energy sites listed in the Department of Energy and Climate Change's (DECC's) "*Planning System for Renewables*" in 2011 shows that 99% of capacity and 93% of DECC listed sites were wholly commercially or privately owned (Community Energy Scotland (CES), 2011, DECC, 2011a, Table 2.8). In 2011, the majority of community owned renewable capacity was onshore wind, but the only tidal renewable sites were exclusively community owned, whilst, for all types of ownership, onshore windfarms made up at least 80% of the capacity. There is a significant difference in the scale of community and commercial developments (Table 2.9).

Table 2.8 Summary of ownership of renewable energy sites in August 2011 based on an analysis of the "*Planning System for Renewables*" and sites listed by Community Energy Scotland (CES, 2011, DECC, 2011a)

Development owner	No. of sites approved, in construction or operational	Percentage of sites	Installed capacity (MW)	Percentage of installed capacity
Private	64	18%	212	3%
Commercial	255	74%	6,360	96%
Community	25	7%	73	1%
Total	344	100%	6,644	100%

Table 2.9 Detailed ownership of Scottish renewable energy sites in August 2011 (CES, 2011, DECC, 2011a)

A. Number of sites by ownership				
	Number of sites approved / operational			
Technology	Private	Community	Commercial	Total
Biomass - Dedicated	3	1	21	25
Hydro	13	6	70	89
Photovoltaics	0	1	0	1
Tidal Barrage and Tidal Stream	0	2	0	2
Wave	0	0	3	3
Wind Offshore	0	0	3	3
Wind Onshore	48	15	158	221
Total	64	25	255	344
B. Installed capacity by ownership				
	Installed capacity approved / operational (MW)			
Biomass - Dedicated	1	0	260	261
Hydro	10	1	503	514
Photovoltaics	0	0	0	0
Tidal Barrage and Tidal Stream	0	14	0	14
Wave	0	0	8	8
Wind Offshore	0	0	190	190
Wind Onshore	200	57	5,400	5,657
Total	212	73	6,360	6,644
C. Average size of site by ownership				
	Average size of site (MW/site)			
Biomass - Dedicated	0.5	0.0	12.4	10.4
Hydro	0.8	0.2	7.2	5.8
Photovoltaics	n/a	0.1	n/a	0.1
Tidal Barrage and Tidal Stream	n/a	7.0	n/a	7.0
Wave	n/a	n/a	2.5	2.5
Wind Offshore	n/a	n/a	63.3	63.3
Wind Onshore	4.2	3.8	34.2	25.6
Total	3.3	2.9	24.9	19.3
D. Technology as a percentage of installed capacity by ownership				
	Percentage of total installed capacity			
Biomass - Dedicated	1%	0%	4%	4%
Hydro	5%	2%	8%	8%
Photovoltaics	0%	0%	0%	0%
Tidal Barrage and Tidal Stream	0%	19%	0%	0%
Wave	0%	0%	0%	0%
Wind Offshore	0%	0%	3%	3%
Wind Onshore	95%	79%	85%	85%
Total	100%	100%	100%	100%

A conclusion from examining these figures is that the large majority of income from development of the Scottish landscape accrues to corporate entities. For commercial windfarms, some form of community compensation ("community benefit") has become standard practice. However, the Scottish Government (2010c) reported that community benefits in the preceding three years amounted to approximately £1,700 per megawatt of installed capacity per annum (£/MW/annum) for onshore windfarms. Whilst this is an average figure, this is very small compared to the income generating potential of over £100,000/MW/annum.

In a report by the Centre for Sustainable Energy (CSE) for the Department of Trade and Industry (DTI, as it was then), the authors concluded that the provision of community benefits by windfarm developers is "*justified*" on the basis that: (a) "*wind energy as an example of a development which typically leaves little benefit specifically for the locality in which it is based. This contrasts with housing or commercial building developments which are likely to bring some continuing benefits of employment and services*"; (b) many developers see community benefits as "*good neighbour*" gestures that align with the developers' corporate social responsibility statements and (c) community benefit can be seen to be a "*compensation*" for the visual and noise impacts, the loss of recreational spaces and inconveniences of the construction process (CSE, 2007, p10).

Of the 145 hydroelectricity generation developments in Scotland (HI Energy, n.d.), very few of the commercial developments have incorporated community benefits. Only five are listed on the Scottish Government's Register of

Community Benefits from Renewables (CES, 2013a). Hydroelectric power has been developed across Scotland in places close to communities such as Breadalbane (adjacent to Killin) and Kinlochleven (for the aluminium smelter) without a community benefit. On the other hand, a community benefit package has become more of a standard practice for onshore windfarms.

The Scottish Government recognises that the average community benefit is poor and they require a minimum of £5,000 per MW of installed capacity per annum (/MW/annum) from development on public estates and are continuing "*to push industry to offer these rates*." (Scottish Government, 2011e, p111). Some developers may be working towards this, for example the Scottish and Southern Energy (SSE) community benefit package is to invest £2,500/MW/annum in community projects and £2,500/MW/annum into a regional fund for onshore windfarms (SSE, n.d.). However, the average of the RWE npower community benefit payments, of those which are listed on the Register of Community Benefits from Renewables (CES, 2013a), is less than £1,700/MW/annum and one older windfarm is receiving less than £500/MW/annum.

Once land has been developed and the renewable resources secured by external third parties, development of the site by anyone else, most notably the community, is precluded. Therefore, there is an inter-generational issue for future sustainability: when fossil fuels are no longer abundant and communities need to develop their local resources for their own energy generation, all the best resources are likely to have been exploited and further development nearby could cause significant ecosystem impact. Therefore, "*community benefit*" as used by the Scottish Government (2011e, p111) and industry should perhaps be called "community compensation for opportunity foregone".

Community windfarms, such as those on the Isles of Eigg and Gigha, embody the issues of the community's rights to the land and resistance to the current and historical legacy of the polarisation of land ownership (Didham, 2007, Isle of Eigg, n.d., Isle of Gigha, n.d.). Community windfarms create a new and '*very radical model of place-shaping'* (Shucksmith, 2010, p9), which challenge both neoliberalism and the current distribution of power and property rights.

The disparities between commercial accrual of profits and receipt of community compensation (benefits), the very low level of community developments compared with commercial, and the fact that commercial exploitation of the land precludes community development suggest that the current situation is unfair. When a community lacks access to local energy resources and there is excessive profiteering by a small minority or distant global corporations, injustice is created. This is magnified when the community has a significant amount of fuel poverty, low incomes and lack of capital for essential community development. Here the concept of energy (in)justice is formed. In the future, in a peak oil society, this polarisation of energy assets may magnify this injustice. The importance of energy developments for building community capacity has been suggested (Didham, 2007, Maitland Mackie in Duncan, 2010, Skerratt, 2011). Lack of access to the benefits of renewable energy may prevent opportunities for community development. Evidence for this was gathered from case study communities and the causes of energy injustice were analysed and examined in this study.

2.3.3 Scottish policy

Politicians in the UK have not embraced a transition from neoliberalism and continue to ignore the physical limits of the planet by implementing policies and signing up to treaties that further promote and deregulate trade and consumption (Peck, 2010), despite the recognition of climate change at the level of government (Scottish Government, 2013a). Although neoliberalism has failed to restrain consumption and create a sustainable economy, it continues in policy circles, financial markets and regulation with the poor and middle classes continuing to be impoverished (Peck, 2010). Representative democracy requires a politicised society and national politics, but individualism depoliticises society and politicians fail to represent the heterogeneous society. Transformation to a more sustainable society requires politicians to enact radical decisions made by consensus, but consensus is difficult to achieve with the pluralistic and heterogeneous society created by individualism and globalism (Beck, 2000). In addition, long term decision-making for policy-makers is difficult when the risks and impacts of environmental issues are uncertain, when governments have short-term electoral cycles and with neoliberalism constraining the development of potential alternatives (Peck, 2010).

In Scotland, there are policy disconnects as a result of the different objectives of the administrations in the UK and Scottish governments, examples being the opposing views to Scottish independence and economic austerity measures and policy for decarbonisation of Scottish industry (Scottish Government, 2013a) versus UK promotion of the shale gas industry (HM Treasury, 2013). At the scale of local governance, parish councils and Burghs in Scotland were abolished in the 1970's with many powers being transferred to Local Authorities. Today's Community Councils are relatively powerless, leaving a vacuum for community governance (Wightman, 2011). Representative democracy in Scotland has been criticised for failing to engage its citizens and failing to promote and deliver transformational changes needed for sustainable development (Sustainable Development Commission (SDC), 2004, Didham, 2007).

2.3.3.1 Sustainable development and climate change policy

At the start of this research in 2005, the Scottish Executive (under the Labour Party administration) published a sustainable development strategy (Scottish Executive, 2005a). "*Supporting thriving communities*" was one of the four key aspects of the framework. At the time, the record of achievement of sustainable development policy was poor. Ekins and Max-Neef (1992) criticised UK policy as being focused on economic issues and not balancing ethical, economic, social and environmental concerns. The SDC (2004) report entitled "*Shows promise. But must try harder*" concluded more fundamental policy changes and a reaffirmation of commitment to sustainable development were required. Policy was and continues to be focused on the economy and not fundamental policy changes for sustainable development (Moffatt *et al.,* 2001, SDC, 2004), especially as the Labour administration's sustainable development policy was never fully enacted.

The current Scottish Government (SNP administration) has no comparable sustainable development strategy, but does state that "*The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations. The Scottish Government has as its overall purpose to focus government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth*." (Scottish Government, 2012e).

Given this policy statement, within Scotland, economic goals appear to take precedence over sustainable development. Nevertheless, the SNP Government has led the way with significant progress over climate change, meeting their objective to "*provide leadership to support Scotland's transformation to a low carbon economy*" (Scottish Government, 2012e) and "*transition to a low carbon economy*" is one of the six strategic priorities of the economic policy (Scottish Government, 2011f). The Scottish climate change policy is described below.

2.3.3.1.1 Climate Change (Scotland) Act 2009 and climate change targets

Since the start of this research, some ground-breaking climate change legislation has been enacted. Whilst reduction of GHG emissions to a sustainable level has not yet been achieved, the Climate Change (Scotland) Act 2009 (Scottish Parliament, 2009) has made a significant start by setting challenging targets for GHG emissions reduction. The emissions reduction targets are framed within economic policy, taking justification from the Stern Review (Stern, 2007, Scottish Government, 2013a). The Act set a target of 80% reduction GHG emissions by

2050 from baseline (for carbon dioxide, methane and nitrous oxide 1990 levels; for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride 1995 levels) and an interim target of 42% by 2020 and required the Government to set annual Scottish emission targets (Scottish Parliament, 2009), of which the most recent (2013) draft targets are outlined below (Scottish Government, 2013a).

In their most recent draft report, "*Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027 - The Draft Second Report on Proposals and Policies (RPP2)*" (Scottish Government, 2013a), the Scottish Government has taken a comprehensive approach and has developed policy targets for six different sectors: energy (electricity generation); homes and communities; business, industry and public sector; transport; waste and resource efficiency; and rural land use (Scottish Government, 2013a). Apart from rural land use, the proposed actions and targets in RPP2 and in previous policy statements are described below. Rural land use is considered in section 2.3.3.2. The Scottish Government have identified "*ten key behaviours*", to meet their targets (Table 2.10, Scottish Government, 2013a, p58).

2.3.3.1.1.1 Electricity generation

The targets for electricity generation are to "*decarbonise electricity generation by 2030*", and have the equivalent of "*100% of Scotland's demand for electricity to be met by renewables by 2020*" (Scottish Government, 2011f). Despite the scale of the challenge, the Scottish Government is making significant progress. The 2011 target for renewable generation being 31% of demand was exceeded with renewable electricity generation being 35% of demand. The latest target of achieving the equivalent of 50% of electricity demand being met by renewables by 2015 was set in October 2012. This target is to be achieved largely with hydro and onshore wind, whilst the remainder of the 2020 target (100% of demand being met by renewables by 2020) is to be achieved by offshore wind (Scottish Government, 2012f). However, renewables are not expected to fulfil the total electricity demand at peak times even by 2020. Although the plan is to phase out coal and operate carbon capture and storage (CCS) for gas, gas will continue to be a key resource for peak demand (Scottish Government, 2013a). CCS is still a nascent technology and has yet to become fully operational.

Table 2.10 Ten Key Household Behaviours (from Scottish Government, 2013a, p58, Table 3.1)

Home Energy	Installing a more efficient energy system
	Keeping the heat in (draught proofing & insulation)
	Better heating management
	Saving electricity
Travel	Walking, cycling, using public transport and/or car sharing instead of (solo) driving
	Using a low carbon vehicle, fuel efficient driving
	Using alternatives to flying where practical
Food	Avoiding food waste
	Eating a healthy diet high in fruit and vegetables, in season where we live
Consumption	Reducing and reusing, in addition to the efforts we already make on recycling

2.3.3.1.1.2 Homes and communities

The Scottish Government target is to reduce "*end use energy consumption to … 12% by 2020, …11% of heat demand to be met by renewables by 2020* [and] "*largely decarbonise the heat sector by 2050*" (Scottish Government, 2011f, Scottish Government, 2013a, p45). In order to achieve these targets the Scottish Government recognises that there is a need to change behaviour and to upgrade home energy efficiency and are using a range of different UK-wide and Scottish policies to achieve their energy consumption goals (Scottish Government, 2013a). Home efficiency improvements are being driven through the UK wide programme "*The Green Deal*", which is funded by private capital and enables installation of energy efficiency improvements paid subsequently through a charge on electricity bills (Scottish Government, 2013a). The behavioural change of reducing energy use is being encouraged with the implementation of smart meters. The new "*Warm Homes Fund*" is already giving grants to social and council housing for renewable energy schemes (Scottish Government, 2013a). Installation of renewable heat is incentivised by the UK Government's "*Renewable Heat Premium Payment scheme*".

However, the government has a long way to go tackling fuel poverty (as described in 2.3.1). Additional proposed policies include a new "*National Retrofit Programme*", which is to encourage refurbishment and may set minimum standards for household energy efficiency, changes to planning policy and a domestic "*low carbon heat*" policy (Scottish Government, 2013a, p102).

Community-led emissions reduction is encouraged through the Climate Challenge Fund (CCF). Since 2008, CCF made over £40m of awards to 390 communities to help them reduce GHG emissions (CCF, 2013). In some instances, CCF has been helpful in creating behaviour change by providing the necessary support to make change; for example, "*hand-holding participants through the process*" and "*intensive personal support*" overcame barriers "*related to fear of hassle and effort*" and "*inertia*", respectively (Brook Lyndhurst and Econometrica, 2011, p2). Moreover, CCF projects have been helpful in engaging communities and increasing social capital. CCF is perceived to be successful and so further funding (£10.3m) is available until 2015 (CCF, 2013).

The Scottish Government has a target for local and community ownership of 500MW of energy (heat and electricity) by 2020 (Scottish Government, 2013a). At present, the policy instrument aiding community energy projects is the Community and Renewable Energy Scheme (CARES), which is administered by CES. CARES offers start-up and infrastructure grants and pre- and post-planning loans for community or local renewable energy projects (CES, 2013b). If planning permission is unsuccessful, then the loan need not be repaid (CES, 2011). The initial first stage is the most risky for community groups and local land-owners to develop their own renewable energy companies and the CARES loan fund removes this barrier. By 2012, 42 projects (56MW installed capacity) had been offered loans (Scottish Government, 2012f).

2.3.3.1.1.3   Business, industry and public sector

By 2050, the Scottish Government expects business, industry and the public sector to be completely decarbonised (Scottish Government, 2013a), but the majority of policy instruments are UK based and may contradict or impede achievement of Scottish policy objectives (HM Treasury, 2013).

2.3.3.1.1.4   Transport

The Scottish Government aim to have "*almost complete decarbonisation of road transport by 2050* [and] *significant decarbonisation of rail by 2050*" (Scottish Government, 2011f), by "*decarbonising vehicles, road network efficiencies,* *sustainable communities including modal shift to walking, cycling and public transport, and business engagement around sustainable transport*" (RPP2, Scottish Government, 2013a, p4). By 2020, the Scottish Government specifically aim to have:

- *"A mature market for low carbon cars resulting in achievement of an average efficiency for new cars of less than 95 gCO_2e/km;*
- *an* [electric vehicle] *EV charging infrastructure in place in Scottish cities* [this is being funded in partnership with the Office of Low Emission Vehicles]*;*
- *Personalised travel planning advice provided to all households;*
- *Effective travel plans in workplaces with more than 30 employees; and*
- *At least 10% of all journeys made by bicycle."*

(Scottish Government, 2013a, p121).

By 2030, the Government expect "…*wholesale adoption of electric cars and vans, and conversion to hybrid or alternatively-fuelled HGVs and buses* [(i.e. decarbonised road traffic)]*, as well as significant steps to decarbonise rail and maritime transport.* [They] *are also aiming for significant modal shift towards public transport and active travel*." (Scottish Government, 2013a, p121). However, decarbonisation of aviation is more problematic and governed by the European Union.

2.3.3.1.1.5 Waste and resource efficiency

The framework for waste management was detailed in the "*Scotland's Zero Waste Plan*" (Scottish Government, 2010d), which aims to design waste "*out of our economy and way of life*… [The targets for recycling, re-use or composting household waste] are 40*% by 2010, 50% by 2013, 60% by 2020 and 70% by 2025 respectively; recycling 70% of all waste (including commercial and industrial waste) by 2025; and reducing the proportion of total waste sent to landfill to a maximum of 5% of all waste by 2025*" (Scottish Government, 2013a, p137).

2.3.3.1.2 Climate change legislation: opportunity for sustainable development

In summary, these climate change targets and plans are progressive and, if implemented, may contribute significantly towards achieving sustainable communities, which are defined in section 1.5.3.

2.3.3.2 Rural development and land use policy

The Scottish Government estimates that 19% of GHG emissions come from agriculture (Scottish Government, 2013a). The main agricultural policy "Farming for a Better Climate" is a voluntary programme, encouraging best practice in areas such as nitrogen efficiency and electricity consumption. In RPP2, the Government proposes a target of 90% uptake for nitrogen efficiency measures. Peatland restoration and increased forestry (target afforestation rate of 10,000 hectares (ha) per annum) are additional goals. Management of Scottish peatlands is essential for climate change, as 50% of UK carbon reserves are stored in peatland. In Scotland, there is estimated to be approximately 17,800 km^2 of peatland, which is estimated to store 1,620 mega tonnes of carbon (Billett *et al.*, 2010). There is potential for Scottish uplands to provide carbon stores, ecosystem services and woodland expansion in the future (Reed *et al.*, 2009). Details of peatland targets have yet to be agreed.

The EU Common Agricultural Policy (CAP) and subsidy reform is gradually moving towards protecting the environment, culture and heritage through delinking productivity and subsidy, subsidising pro-environmental actions and encouraging diversification to protect rural incomes. The Rural Development Regulation (1698/2005) set out the framework for supporting rural development between 2007 and 2013 (Scottish Executive, 2006). The key themes focused on improving the competitiveness of agriculture and forestry, environment and the countryside and quality of life and encouraging diversification and growth of economic activity in rural areas (EC, 2007). Currently 85% of Scottish agricultural land is within the category of Less Favoured Areas (LFAs, Figure 2.12) and fall under Pillar II of the Regulation (environment and countryside), attracting subsidy payments as a result. These are to be reformed within the new Scotland Rural Development Programme 2014-2020, which is currently under consultation (Scottish Government, 2012g). In 2006, £61 million per year was paid to approximately 13,000 Scottish farmers and crofters (Scottish Executive, 2006). Payments are distributed to farmers or crofters according to area, with 18% going to farmers or crofters in "very fragile" areas (namely islands), 25% in "fragile" areas (mainland areas of disadvantage and high transport costs) and 57% in "standard" areas (areas with lower transport costs).

Under the Scottish Rural Development Programme, farmers have a choice of subsidy payments (Land Management Options, LMOs) for economic, environmental and social developments. They are aimed at decoupling production from subsidy for environmental and archaeological protection, farm modernisation and diversification, and/or community benefit (Scottish Government, 2008). In addition to the LMOs, the LEADER ("Liaison Entre Actions de Développement de l'Économie Rurale" or "*Links between actions of rural development*") programme funds rural community development, providing significant opportunities for local sustainable development (ELARD, 2013). Reform of the CAP and new subsidies mean that high input and production agriculture is being replaced with initiatives to protect the environment, culture and heritage and diversify into other areas. Renewable energy and the development of low input agricultural systems have a big impact on agricultural practices that can be beneficial for the environment. Moreover, the carbon cost of high energy input agriculture may make it economically unfeasible in the future.

Shucksmith (2010) has considered these integrated EU rural development approaches, in the context of neoliberalism and power structures in society. Rural development has changed from a central government applied policy to one where the government acts as an enabler, but delivery is by others. LEADER and the Rural Development Programme are examples of this. They rely on local actors to act as catalysts of change. The approach does create co-operative social relations and appears to be different to the individualistic agenda of neoliberalism. However, these rural development approaches enable the state to withdraw from governing rural development, allowing private and voluntary sector partners to take the lead. With this, there has been a change in power emphasis, from "*power over*" rural communities to "*power to act*" (i.e. from social control to social production, Shucksmith, 2010, p4). However, this empowerment agenda, enacted through LEADER, may only engage those communities with sufficient social capital and community capacity to make the grant applications. More deprived communities (or sub-groups within communities) may be less likely to engage with, and therefore benefit from, programmes such as LEADER. To achieve inclusive community development through programmes like LEADER, disengaged communities need specific help, facilitation, targeting and engagement to build capacity before they can benefit from LEADER (Shucksmith, 2000, 2010), and even then additional interventions may not be successful, due to the realities of community life that characterises a variety of personalities and allegiances (Skerratt and Steinerowski, 2013).

2.4 Gaps in the literature requiring further research

Given the multiple interpretations of sustainable development and sustainability, it was important to define "sustainable community" and other key terms, and understand the existing frameworks illustrating the nature and aspects of a sustainable community. The existing frameworks fail to capture all aspects of community, especially relating to governance and land tenure, power to act and renewable energy. As a result a holistic and detailed framework for a sustainable community (the SCD) was developed to measure the sustainability of a rural community, thus completing the first objective of this study.

The literature review has identified the major environmental, social, economic and justice issues in rural Scotland. There is also a body of evidence relating to the failure of individuals and the state to create sustainable and pro-environmental behaviour. Evidence suggests that community action is more effective than individual (Wolf *et al.,* 2009, Dobson, 2010), yet what is lacking is evidence regarding how sustainability can be achieved at the community (*meso*-) level. The starting point of an investigation into this is to understand the current (baseline) sustainability of rural communities in Scotland. Two studies cited in this literature review (the EF of the Findhorn Foundation, Tinsley and George, 2006, and an ethnographic study of the Isle of Gigha, Didham, 2007) are limited in their holistic measurement of quantitative and qualitative sustainability. There is no holistic study measuring the sustainability of Scottish rural communities; this combined with the lack of a holistic model of a sustainable community represent gaps in knowledge, which were addressed in this study.

Measuring baseline sustainability is only the starting point of creating a sustainable community. The next step in transition to sustainability is to define the desired end point (as described in section 2.1.5.2). Community planning using visioning has been done in rural communities, but has focused on short term change without including the contexts of ecological, climate change and economic crises. Existing rural Scottish community visions developed through community development programmes tend to address the lowest level of change (as defined by Handmer and Dovers, 1996); the TTM, which focuses on more radical change (Hopkins, 2008), had not penetrated rural Scotland at the time of this study. Therefore, participatory visioning of sustainable community futures in this study not only fills a gap in knowledge, but also helped inform scenarios for modelling options for sustainable transport and housing, and identified the vision, priorities and enablers for three case study communities.

The benefit of renewable energy for rural communities has been recognised by the Scottish Government during the timeframe of this study (Scottish Government, 2011e), but at the start of this study there was a gap in knowledge of an individual's perception of its importance. This gap was not addressed intentionally; instead the importance of renewable energy to communities (the individual's perception of and community benefits arising from) and energy injustice was identified as part of a participatory research process in the envisioning focus groups. Distributional injustice in rural Scotland arising from unfair allocation of property rights and its impact on social capital is well documented in the literature (for example Isle of Eigg and Isle of Gigha, McIntosh, 2001, Didham, 2007, Wightman, 2011), as are historical and cultural legacies of injustice (Assist Social Capital, 2008), but injustice arising from rights to renewable energy (energy injustice) is not. As a result, the gap in knowledge in relation to the extent of renewable energy injustice across Scotland was identified and was addressed in this chapter. Identification of this injustice led to the realisation of a gap in knowledge relating to the causes and impact of renewable energy injustice in rural communities. Therefore, this latter point has also been formed into an objective for this study and is examined in detail in Chapter Six.

As noted earlier (page three), this study has seven objectives; the first two objectives (first, to define a sustainable community and develop a holistic framework to encapsulate the multiple dimensions of a sustainable community and, secondly, understand the opportunities and challenges for and gaps in knowledge with regard to the sustainability of rural Scottish communities) have now been addressed. In the next chapter the multiple research methods, which have been used to address the gaps in knowledge and fulfil the remaining research objectives, are defined.

Chapter 3 Methodology

To answer the open and pluralistic research questions required to investigate the potential for sustainable Scottish rural communities, an interdisciplinary and holistic approach and mixed methods were needed and applied in this study (Table 3.1). The research approach is considered in the first section of this chapter, and the case study selection process is outlined in the second section. The following section describes the baseline sustainability assessment, including indicator selection (established measures are needed for ensuring this study is methodologically robust and comparable) and baseline data collection. The remainder of the chapter outlines the approaches to envisioning focus groups, scenario modelling and issue analysis.

3.1 Research approach

The overarching research approach is interdisciplinary and integrative, using mixed methods. The advantage of this approach is that it allows broad and exploratory enquiry at multiple scales, that the research questions can be tailored to the needs of the research rather than the constraints of the experimental design, and that it enables the research to be deliberative and participatory (O'Riordan, 2000), permitting researcher interaction with the subject (Table 3.2).

Mixed methods (Figure 3.1) are used for developing an understanding of and options for the sustainability of three Scottish rural communities. The methods

Table 3.1 A list of the mixed methods applied to achieve this study's objectives

Objective	Chapter/ Section	Method	Data source	Comments
1. Define a sustainable community and develop a holistic framework to encapsulate the multiple dimensions of a sustainable community				
a. Define key terms such as strong sustainable development, sustainable communities, resilience, social capital, power, '*dualchas'* and justice	Chapter 2	Literature review	Literature	
b. Drawing on these definitions, models and practical examples of sustainable communities, and observations from this study, identify the integral aspects of community to create a Sustainable Community Design (SCD) framework and define sustainability for each aspect of the SCD (sustainability goals)	Chapter 2 Chapter 6	Literature review Critical analysis of research findings	Literature Case studies	Presented in Chapter Two is the final version of the SCD which was developed from existing frameworks and theories of sustainable communities, and refined from this study's findings, as a result of the analysis of energy to fuel life, power to act and energy injustice.
2. Understand the opportunities and challenges for and gaps in knowledge with regard to the sustainability of rural Scottish communities				
a. Research the status, history and geography of rural Scotland	Chapter 2	Literature review (influenced by field observation and focus groups)	Literature	
b. Identify and assess the impact of and opportunities and challenges arising from global and national forces, including: socio-economic paradigms, ecological crises, government policies and property rights	Chapter 2	Literature review (influenced by field observation and focus groups)	Literature	
c. Identify gaps in knowledge in the sustainability of rural Scottish communities	Chapter 2	Literature review	Literature	
3. Measure the extent of sustainability in a range of case study communities in rural Scotland				
a. Define criteria for case studies and select appropriate examples, based on their history and geography	Chapter 3	Literature review Secondary data analysis Continuous evaluation	Literature Secondary data Case studies	Case study selection is outlined in section 3.2. The results of earlier case studies influenced subsequent case study selection.

Continued overleaf

Objective	Chapter/ Section	Method	Data source	Comments
b. Design a methodology that is sufficiently sensitive to identify the degree of sustainability of and permit discriminatory analysis between case study communities	Chapter 3	Literature review Self-design	Literature	
c. Establish a robust set of indicators for measuring the sustainability of each aspect of the SCD and identify appropriate data collection methods (questionnaire, observation (field work) or secondary data sources)	Chapter 3	Literature review Secondary data analysis Self-design	Literature	
d. Create a mechanism for scoring and illustrating the degree of sustainability across multiple non-commensurate indicators and aspects of community	Chapter 3	Literature review Self-design	Literature	
e. Collect and analyse data for each case study community and measure the degree of sustainability for each aspect of the SCD	Chapter 4	Case study survey Participatory focus groups Secondary data analysis EF analysis	Questionnaire s Literature	For secondary data sources see section 3.3.1
f. Analyse the degree of freedom and capability which communities have to develop sustainably (identify and analyse injustice, including rights to renewable energy)	Chapter 2, Chapter 4	Literature review Participatory focus groups Field observation Justice analysis	Literature Case studies Secondary data	Distributional injustice arising from unfair allocation of property rights and its impact on social capital is well documented in the literature (Chapter 2). Comparative distribution of renewable energy assets and their associated benefits in the case studies (documented in Chapter 2 and 4) is used to inform the analysis of the impact of renewable energy injustice in rural communities (section 4.11), thus filling a gap in knowledge in relation to causes of energy injustice.

Continued overleaf

Objective	Chapter/ Section	Method	Data source	Comments
4. Envision future states to identify the community's view of sustainability and options for sustainable development				
a. Design a method for obtaining community visions of community sustainability in a resource-constrained future	Chapter 3	Literature review Self-design		Socio-economic crisis based on a scenario of strong and enforced carbon legislation and realisation of price increases as a result of peak oil in the absence of wage increases was used for the scenario for focus groups. The crises were defined in the literature review: see objective 2b. Focus group designs were based on literature on futures envisioning and author's own experience of facilitation and visioning in outdoor education and business
b. Using participatory focus groups, identify community visions for a thriving community in a resource-constrained world in 2030	Chapter 5	Envisioning exercises	Participatory focus groups	
5. Model different future states to identify the extent of change required				
a. Where possible, develop a modelling methodology to create scenarios of different futures states to measure the sustainability of consumption (EF) of these scenarios	Chapter 3	Self-design tailored by functionality of REAP	REAP (SEI,2011a)	Extent of modelling limited by functionality of REAP
b. Using insights from the community visions and current technological innovations, construct scenarios to detail different scales of change to create three levels of change (marginal, significant and transformation, Handmer and Dovers, 1996)	Chapter 3	Self-design	Participatory focus groups Observation Questionnaire data	Extent of modelling limited by functionality of REAP

Continued overleaf

Objective	Chapter/ Section	Method	Data source	Comments
c. Populate the scenarios with community data and estimate the EF of the different scenarios for transport, food and energy consumption	Chapter 5	Self-design and reasoned estimates EF analysis	Questionnaire data Secondary data primarily REAP with support from other sources	Secondary data sources are cited in text where appropriate
d. Estimate the impact of a switch to 100% renewable energy generation of the EF	Chapter 5	EF analysis	Secondary data primarily REAP with support from other sources	Secondary data sources are cited in text where appropriate Extent of modelling limited by functionality of REAP
6. Evaluate the methodology				
a. Assess whether the results are reasonable and robust and evaluate the effectiveness of the methodology	Chapter 6	Statistical analysis (where appropriate)	n/a	
b. Identify limitations of the methods used to assess sustainability (baseline assessment, focus group design and modelling design)	Chapter 6		n/a	
c. Evaluate the benefits of using an interdisciplinary approach	Chapter 6		n/a	
7. Drawing on lessons from all three communities, explore the opportunities, constraints and options for achieving sustainable communities				
a. Recommend options for creating sustainable communities	Chapter 6		n/a	
b. Identify opportunities for resolving overarching issues, in particular, energy (in)justice, but also, the inter-linked issues of governance, property rights, capability, power, well-being and sustainability literacy	Chapter 6		n/a	
c. Propose means to enacting change and assess the potential for the SCD to be used as a tool for creating sustainable communities	Chapter 6		n/a	
d. Identify recommendations for policy and future research	Chapter 6		n/a	

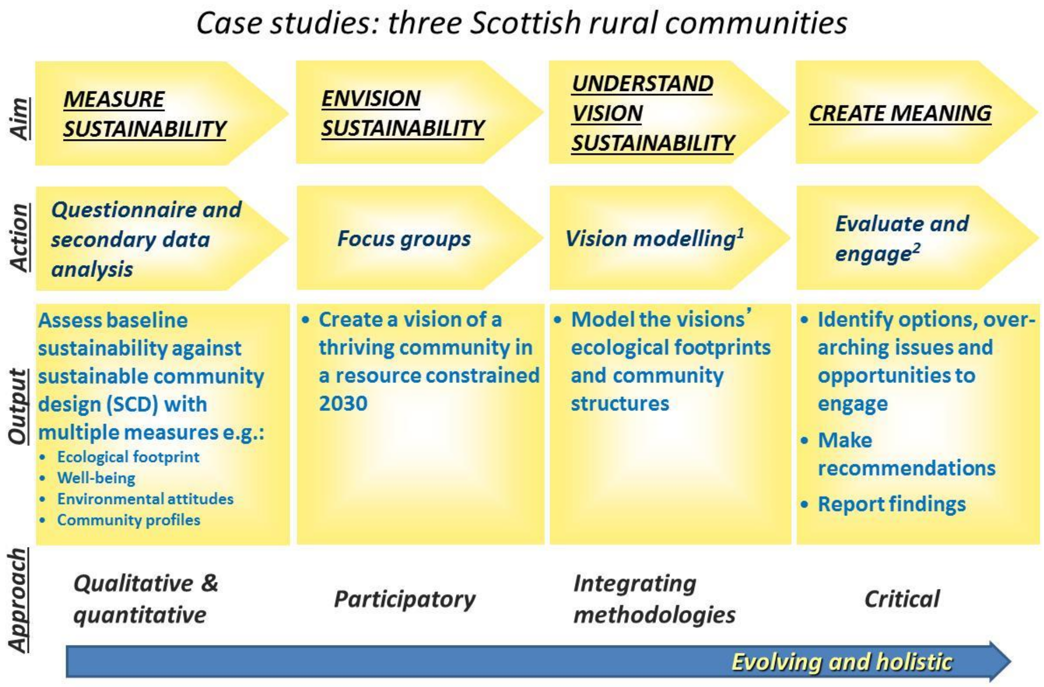
differ in epistemology, drawing from positivism, participatory theory and critical theory (Hoffmann, 1987, Jacob, 1997, O'Riordan, 2000, Ledwith, 2005, Ramos, 2006a, 2006b, Didham, 2007). Critical theory was chosen, as it *"seeks not simply to reproduce society via description, but to understand society and change it"* (Hoffman, 1987, p232-3). Sustainable development as a critical theory provides a mechanism to assess the current situation of rural communities today (Jacob, 1997, Didham, 2007). Therefore, "*critical theory provides the analytical lens for investigating the factors in our contemporary ideologies and worldviews that led to unsustainable practices and to consider what are those factors that remain beneficial in regards to the principles of social development*" (Didham, 2007, p9). Using the concept of strong sustainability (the "*ideal model"*, Baker 2006, p30-31, presented as the SCD in the previous section) as a critical theory, the goal of the research is finding options to create sustainable communities (Moffatt, 1996a, Jacob, 1997, Didham, 2007).

Approaches to creating desired future states generally use common approaches, of which the key steps are (a) assessment of the current situation; (b) envisioning future goals; (c) develop scenarios; (d) assess scenarios and compare to the vision; (e) make recommendations; and (f) act on recommendations and evaluate outcomes to initiate the next cycle of scenario building (Stout, 1999, Anderson, 2001, OST, 2002, Dutton *et al.,* 2005, Ledwith, 2005, Hopkins, 2006, 2008, Roxburgh and Tuffs, 2006, Kemp *et al.*, 2007). These steps loosely formed the core of this study's methodology (Figure 3.1). Community development reflective practice (praxis) and community engagement (action research) are essential for achieving the desired future states (Ledwith, 2005, Ramos, 2006a, 2006b). However, action research and facilitation of community transition were outside the scope of this study, because the focus was to identify reasonable options for a sustainable rural community, rather than the implementation of those options. The mixed methods approach was designed and started as compartmentalised steps (Figure 3.1). In practice, as the methodology evolved and issues emerged, data and analysis from each method did not remain exclusive to its aim (column in Figure 3.1); for example, the analysis of the issue of energy injustice (originated in column 4, Figure 3.1) and focus group data became inputs to the baseline sustainability assessment (as outlined in Table 3.1).

Table 3.2 A comparison of analytical and integrative research (Holling, 1998, Potschin and Haines-Young, 2006, Harvey, 2006b)

Attribute	Analytical Methods	Integrative Methods
Philosophy	Narrow and targeted Disproof by experiment Parsimony the rule	Broad and exploratory Multiple lines of converging evidence Requisite simplicity the goal
Scale	Single	Multiple with cross scale interactions
Causation	Single and separable	Multiple and only partially separable
Hypotheses	Singular with null	Multiple and competing
Uncertainty	Eliminate	Incorporate
Statistics	Standard Concern with Type I error	Non-standard Concern with Type II error
Evaluation	Academic peer assessment	Stakeholder (academic peer, participant and possibly others) assessment
Outcome risk	Exactly the right answer for the wrong question	Exactly the right question but useless answer

The first of the mixed methods was baseline sustainability assessment (Figure 3.1), using the SCD as a framework and its definitions as a gauge of sustainability. Community questionnaires provided baseline quantitative and qualitative data for calculating EFs (the sustainability of which was evaluated using the per capita share of the available biocapacity (fairshare), GFN, 2012) and socio-economic well-being, demographic and environmental attitude assessment. Questionnaire data was supported by secondary data (e.g., Scottish Index of Multiple Deprivation (SIMD), Scottish Neighbourhood Statistics (SNS) and Killin's local survey) and observation. Composite and single indicators were used to measure sustainability. The rationale for indicator selection is described in section 3.3.1. The fairshare is important for this study as it is used as a gauge for measuring the sustainability of baseline and future scenarios' consumption.



[1]It was not possible to model all aspects of the visions. Therefore, selected aspects were used as a basis for forming scenarios for the modelling of different scales of change

[2]Engagement of stakeholders is outside the scope of this study, but is the essential next step for creating meaning from the research and change in communities.

Figure 3.1 An illustration of the original compartmentalised approach to the methodology; in practice some data informed the analysis and outputs across the breadth of the study

The second method was participatory with futures envisioning focus groups (Figure 3.1). In the focus groups, community members were asked to attempt to define how the community can thrive and flourish in 2030. In two case studies, the focus groups were further qualified by follow-up surveys.

The third method (modelling, Figure 3.1) pooled together the earlier results and was complemented by the literature in identifying technological innovations and enterprises being pioneered by other communities, to create scenarios. The scenario modelling involved understanding what changes in transport, food production and consumption, and energy sources and consumption would significantly reduce the EF. The sustainability of these changes was assessed by comparing modelled EFs with the fairshare (GFN, 2012), using the 2008 value as a measure (GFN, 2012).

In the final (fourth) stage of the method, overarching issues were identified as well as options for creating thriving and sustainable communities, which are presented in chapter six. The results of the research were explored using sustainable development and concepts of justice as a critical theory and "*analytical lens*" (Didham, 2007, p9, Hoffmann, 1987, Jacob, 1997, Sen, 1999, 2010, Schlosberg, 2004, Walker, 2009, Schlosberg and Carruthers, 2010, Bulkeley and Fuller, 2011). As a result, the overarching issue of energy injustice has been identified and explored by this study.

This research approach was repeated in three case study communities, whose selection is described in the next section.

All field research followed the University of Stirling's Biological and Environmental Sciences ethical guidance and methods were reviewed by the ethics committee before being undertaken. Survey responses remained anonymous. Personal data was handled in accordance with the Data Protection Act 1998. Written consent, where appropriate, was obtained.

3.2 Case study selection

As outlined at the end of the last chapter, although rural communities make up 19% of the population (Scottish Government, 2010a), there is a gap in the literature with regard to sustainability of communities in rural Scotland. Three case studies were selected to provide a range of socio-economic and geographical examples of rural communities with an adult population of less than 1000. Criteria for selection related to levels of wealth (ranging from fourth to eighth in the deciles of the Scottish Index of Multiple Deprivation), history (ranging from prehistoric to relatively new settlements with different traditions of employment), services, and proximity to major conurbations. In each community, the level and success (outcomes) of community development interventions and actions were different. The purpose of selecting a diversity in case studies was to enable (a) testing of the sensitivity of using the SCD and its indicators and scoring mechanisms as a measure of sustainability; (b) identifying enablers and barriers for sustainable community development that are likely to be experienced in a significant proportion of rural Scotland; (c) obtain a diversity of opinion as to the potential for creating sustainable communities (i.e. community-members visions of sustainability) and (d) endeavouring to obtain as broad a range of inputs as the scope would permit of the nature and sustainability of rural communities in Scotland today.

The three communities selected were Fintry and Killin in Stirlingshire and Kinlochleven in Argyll (Figure 3.2). Fintry is close to the “central belt” (“Lowland” or low lying) and main urban areas of Scotland (is defined as an accessible rural

Figure 3.2 Map of central Scotland and southern Highlands showing the case study locations (from Ordnance Survey, 2013a, 2013b)

community by the Scottish Government, 2010a, 2010b) and was the first case study chosen in 2008, following discussions with members of Frost-FREE and Fintry Development Trust. In 2010, Kinlochleven (as a "Highland" (upland) community and remote rural community with relatively high levels of deprivation, Scottish Government, 2010a, 2010b) was chosen as a contrast to the relatively wealthy and accessible Fintry. However, detailed study of the relatively new and post-industrial village of Kinlochleven resulted in concerns that Kinlochleven may be atypical of Highland communities. Therefore, in 2011, Killin was selected as another remote rural community, but one with a long history of settlement and being a thriving agricultural and tourist centre.

Fintry and Killin are in the jurisdiction of Stirling Council (Stirling LA) and Kinlochleven is under Highland Council (Highland LA). For Killin and Kinlochleven, the LA and historical geographic boundaries differ. Killin is on the border of the historic districts of Stirlingshire and Perthshire and was historically within Perthshire and lies at the heart of the historical estate of Breadalbane (uplands of Albane, which extended across Argyll). Kinlochleven, although in Highland LA, is in the district of Argyll and Kinlochleven once straddled the border between Argyll and Invernesshire (Gregor and Crichton, 1946). Each community is described in more detail in turn in the following sections.

3.2.1 Fintry

Fintry is within a 30 minute driving time to its nearest conurbation, Stirling (16.6 miles away, Scottish Government, 2010a, 2010b). Glasgow and Falkirk are also within 20 miles (18.3 miles and 19.4 miles, respectively, from Fintry, Google

Maps, 2012, Figure 3.2). However, Fintry is geographically isolated and historically, in winter, the community was often cut-off and a trip to Glasgow or Stirling was a major journey (Figure 3.4). Fintry lies in a depression between the Gargunnock Hills (Figure 3.3) and the Kilsyth and Campsie Fells (to the south-east and south-west), which are unique volcanic formations (lava flows, SNH, 2010a), in the valley of the River Endrick (Endrick Water, which is a Site of Special Scientific Interest (SSSI) and has Special Area of Conservation status, SNH, 2005, 2010b). To the east, is the Loup of Fintry waterfall (marked as waterfall in Figure 3.3). The waterfall water levels are much lower than they were originally, as much of the water is diverted into the upstream Carron Valley Reservoir. The lowland and upland grassland is used for livestock (predominantly sheep) grazing.

There have been significant changes in settlement patterns, employment and population in the last 500 years. Geographically Fintry is dispersed with one main centre (located around the westerly B818/B822 road junction), two peripheral centres (one is the historic centre located to the east by the church and Bogside, and the other is at Balgair, at the Balgair Castle Holiday Park (caravan park), where there are permanent residents in mobile homes), and many dispersed dwellings predominantly based around farms or former farm buildings. The current centre ("Main Street", Figure 3.5) was originally a hamlet called Culcreuch and arose from a late 18th century water-powered cotton mill, which closed around 1890. New housing estates have been and continue to be built around the mill site.

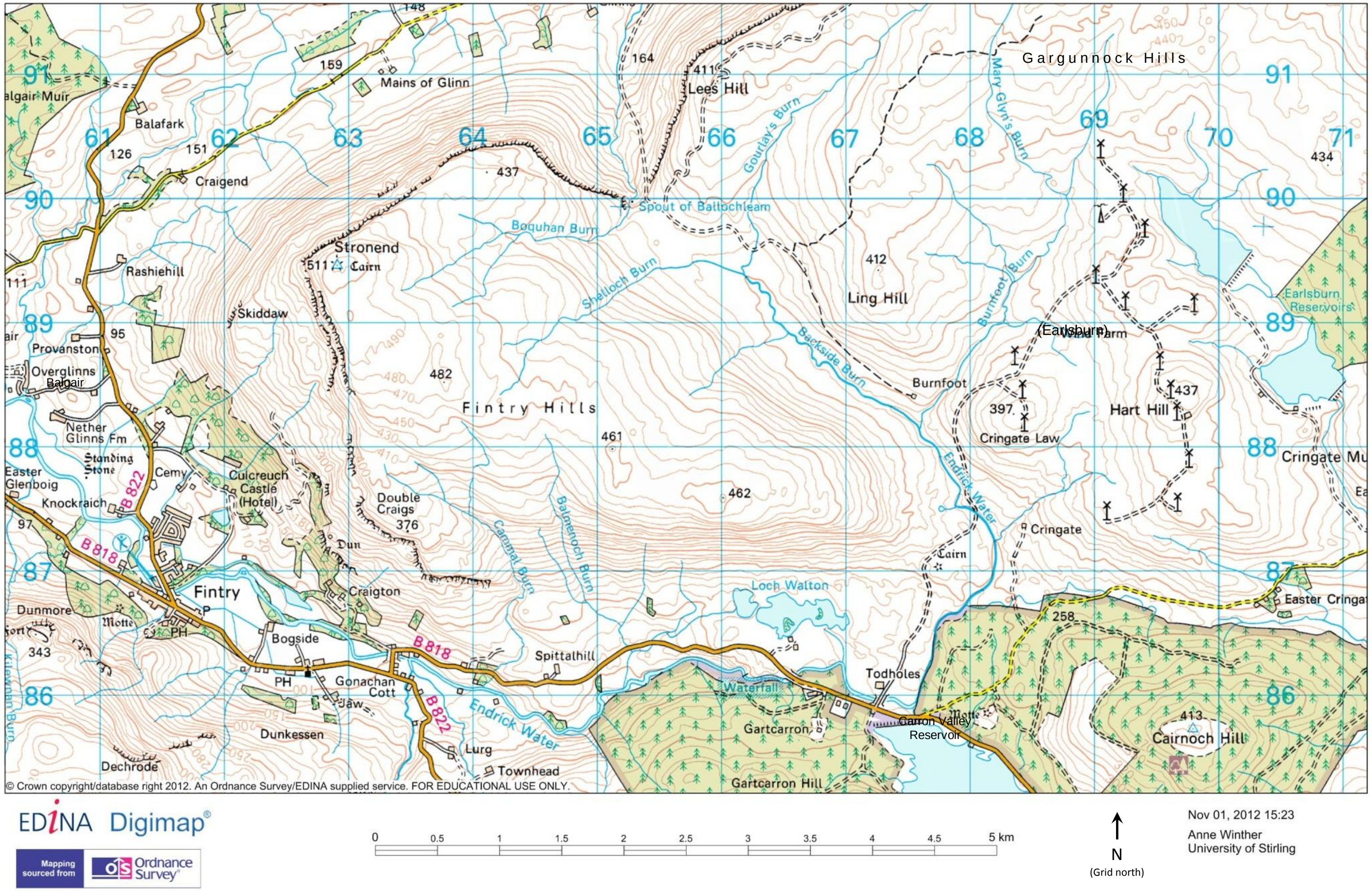


Figure 3.3 Map showing the geographic location of Fintry and the Earlsburn windfarm

Figure 3.4 "Off to Shop in Glasgow or Stirling" (from Wilson, n.d.).

The 2001 Census of Fintry indicates a population of 583 adults (aged 16 and over) and 178 children, SCROL, n.d.); Fintry had 308 domestic addresses in 2008 (Royal Mail, n.d.) with very little social or council housing (6% of dwellings, Table 3.3, Stirling Council, 2004a). Statistics suggest it is an affluent community being in the eighth decile of the Scottish Index of Multiple Deprivation (SIMD, Scottish Government, 2010b). For health, education, skills and training, the community is in the tenth decile, and for employment, income and crime the community is in the ninth decile, but for geographic access the community is in the lowest decile (Table 3.4), which reduces its overall rating compared to other areas.

The main businesses are one hotel (the 15th century Culcreuch Castle), one caravan site, two pubs, one coffee shop and soft furnishings maker and agriculture (cattle, sheep, lamb and intensive egg production, although the latter has recently closed). Despite the geology, landscape, waterfall, the Knochraich standing stone, Dunmore ancient fort and beautiful scenery (Figure 3.3, Figure 3.5), tourist facilities are only the caravan site and Culcreuch Castle Hotel and the village is not marketed as a tourist attraction (for example, it is difficult to find

Table 3.3 Summary of Fintry accommodation (Stirling Council, 2004a)

Accommodation			
House Type:	**Fintry Community Council No.**	**%**	**Stirling Council Area %**
House or Bungalow (Households living in:)			
Detached	178	66.4%	31.1%
Semi-Detached	51	19.0%	25.4%
Terrace	15	5.6%	16.8%
Flat, Maisonette or Apartment			
Purpose built flat/tenement	9	3.4%	22.1%
Part of converted or shared house	4	1.5%	3.1%
In commercial building	1	0.4%	1.1%
Other	10	3.7%	0.4%
Total	**268**	100%	100%
(Occupied houses only, excludes shared dwellings)			
Tenure:	**Fintry Community Council No.**	**%**	**Stirling Council Area %**
Owner Occupied	222	82.8%	66.6%
Rented from Council	16	6.0%	20.0%
Other social rented*	1	0.4%	2.6%
Private rented unfurnished	12	4.5%	3.0%
Private rented furnished	2	0.7%	4.4%
Living rent free	14	5.2%	3.4%
Total	**268**	100%	100%
* Housing Associations, Housing Co-operatives, Charitable Trusts etc.			

Table 3.4 Study communities' SIMD results (Scottish Government, 2010b)

Aspect	Fintry	Kinlochleven	Killin
Principle SIMD Datazone[1]	S01006074[2]	S01003722	S01006176[2]
Reference post-code	G63 0XN	PH50 4QG	FK20 8QT
SIMD 2009 V2 Decile	8	4	6
SIMD 2009 V2 Rank	4865	2001	3515
% Children 2008	21	15.7	15.1
% Working Age 2008	56.6	59	62.4
% Pensionable age 2008	22.5	25.3	22.5
Urban Rural Class 2008	5	6	6
% Income Deprived 2008	4	19	9
% Employment Deprived 2008	4	13	6
Current Income Domain 2009 Rank	9	4	7
Employment Domain 2009 Rank	9	4	8
Health Domain 2009 Rank	10	4	8
Education, Skills and Training 2009 Rank	10	5	5
Geographic Access Domain 2009 Rank	1	3	1
Crime Domain 2009 Rank	9	2	8
Housing Domain 2009 Rank	8	4	6

[1]There are 6,505 SIMD Datazones. Each is ranked from the most deprived (1) to the least deprived (6,505).
[2]The SIMD data zones for Fintry and Killin do not exactly match the area of each case study community, so the Datazone representing the "best-fit" has been used for each community. See Chapter Two.

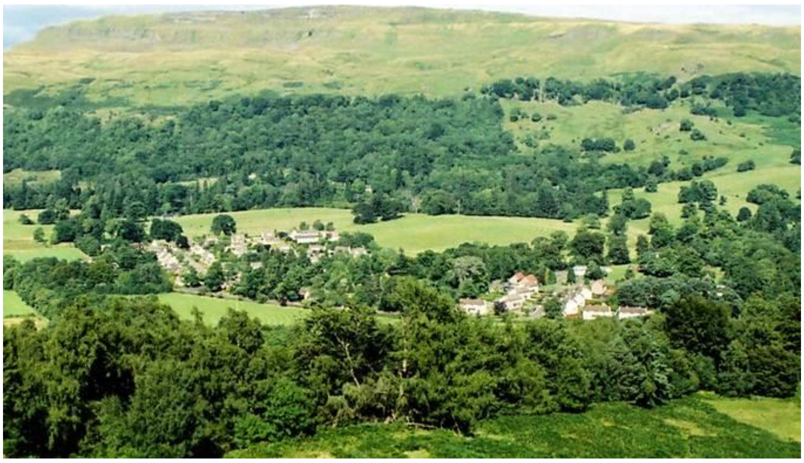
the waterfall and there is no visitor interpretation for points of interest (such as the local geology, monuments, conservation sites) and no advertised local walks.

Households contain predominantly either families with the main earner commuting to local conurbations for work, or retired couples or singles, and all are dependent on car travel to provide basic needs. There has been a gradual decline in services over the last 20 years with closure of the health-care facility, petrol station and shops. Public transport is very limited, with the main bus service transporting high school children to school. However, there is a primary school, with nursery and after-school club, car repair workshop and a limited post-office service. Since the refurbishment of the Sports Club in 2011, the club sells a selection of groceries (such as fresh milk and sugar) and has substantially expanded. A mobile van selling "local" meat supplies brought from a farm shop approximately 12 miles away and a mobile fish-monger visit the village once a week. At the time of the survey there was no community supported agriculture nor organic food production. The only food produced and consumed locally was the eggs from an intensive farm producer, which has since closed. Residents and visitors had to travel to a neighbouring village to purchase any other provisions.

The mobile home park at Balgair creates a third centre for the community, but with little in the way of services, other than the park's club house. There is no shop and the infrequent public transport is approximately one mile away from the centre of the site. There is no pavement linking the park to the centre of the village.

There is evidence of strong social capital within the community: the village hall has been newly refurbished; the sports club is very active and draws in players to the rugby club (Strathendrick Rugby Club) and indoor bowling alley from a large area; there is a very active arts and dramatic society (Fintry Amateur Dramatic Society); the sports club allows young people to use the facilities; and the community has a wind turbine (Figure 3.6), which provides income to the Fintry Development Trust (FDT). The community is almost unique in that it managed to negotiate the building of the turbine from a wind energy development company, instead of receiving a community benefit package (compensation) for the development. This has enabled Fintry to be in the enviable position of having a secure income to fund community activities, identified by the FDT. The primary goal of FDT is to make the community carbon neutral.

The success of FDT has been achieved through the motivation of members of the community to act on the opportunity of the Earlsburn wind farm and the resultant proceeds from the wind farm investment. The achievements have been summarised in a short documentary film "*Wind of Change*" (Reetz, 2011). Within the timeframe of the research, FDT has insulated homes for all those home owners, who wished to have it installed (Fintry Energy Project). 50% of homes in 2006 were in fuel poverty and the insulation project has saved £90,000 in fuel bills, thus reducing fuel poverty by a quarter. FDT has planted a community orchard, created a community woodland, supported the creation of a children's outdoor classroom, set-up a community car share scheme (Fintry Energy Efficient Transport), created an advice, bulk purchase and installation

A. 

B. 

Figure 3.5 Pictures of Fintry. A: Showing the village of Fintry with the Fintry Hills / Gargunnock Hills (lava flows) behind. Photograph taken from the south-west, below Dunmore hill fort. B: Looking east down Main Street on a rainy winter's day. Photograph taken from the westerly B818/B822 junction.

Figure 3.6 Two pictures of Fintry's wind turbine at Earlsburn taken at the open day in 2009 (from FDT, n.d.)

scheme for renewable energy heating systems, has employed two people to manage and implement their projects and activities (an Energy Advisor and an Enterprise Project Manager) and is developing a community market garden (Reetz, 2011).

Residents of Fintry have found having the local Energy Advisor invaluable for choosing and installing renewable energy systems, given the diverse range of systems, inexperience of the general population and novelty of the systems. The Energy Advisor is able to identify grants and loans available and potential savings, and understand and make appropriate choices for the type of dwelling and the energy demand of the household. Moreover, local renewable energy developments provide opportunities for local people to do the installations of renewable heating systems (Reetz, 2011). There are plans to develop wood chip heating systems, with sustainably managed forestry to supply wood chips and chipping plants, and an energy supply company.

The four motivated agents in Fintry that set up and negotiated the Fintry "wind-turbine", have set up a consultancy, frost-free Ltd (n.d.), which in partnership with West Coast Energy, is helping other communities develop their own renewable energy schemes. FDT continues to receive and be nominated for awards (the most recent was the Scottish Green Energy Award *"Best Community"*, Scottish Renewables, 2012b) and has been used repeatedly as a case study in policy circles (e.g., Julian and Dobson, 2012).

3.2.2 Kinlochleven

Kinlochleven (in Gaelic, *head of Loch Leven*) is a remote community on the west coast of Scotland and is set at the head of the sea loch, Scottish Government, 2010a, 2010b). The nearest towns are Fort William and Oban (22.6 and 40.1 miles away, respectively, Google Maps, 2012). Stirling (to the south east) and Inverness (to the north east) are equidistant being 87 miles away and Glasgow is 92 miles away (Figure 3.2).

The community is bounded by hills and lochs (the Mamores to the north, to the south Garbh Bheinn and the Aonoch Eagach ridge, which forms the northern side of Glen Coe, to the east Meall an Doire Dharaich and Loch Eilde Mor and the Blackwater Reservoir, both of which are at an elevation of over 300m, and to the west Loch Leven, Figure 3.7, Figure 3.8). The community is divided by the River Leven, which is part of the Leven Valley SSSI (designated for Dalradian geology and ancient semi-natural upper birch woodland). The SSSI covers 585 hectares, rises from sea level to 300m and is owned by Rio Tinto Alcan Ltd (RT-Alcan, SNH, 2008, Wightman, 2011).

Expansion or development of the community or land around it is limited by the geography and almost all of the flat land has been built upon during the last 100 years (Gregor and Crichton, 1946). Even in 1946, residents complained of the "…*close proximity of the hills and consequent restriction of the view* [having] *a very depressing effect psychologically*…. [and] *the houses on the south side lie completely in the shadow of the hills during the winter, and for three or four months of the year receive no ray of sunshine*" *(Gregor and Crichton,* 1946, p2).

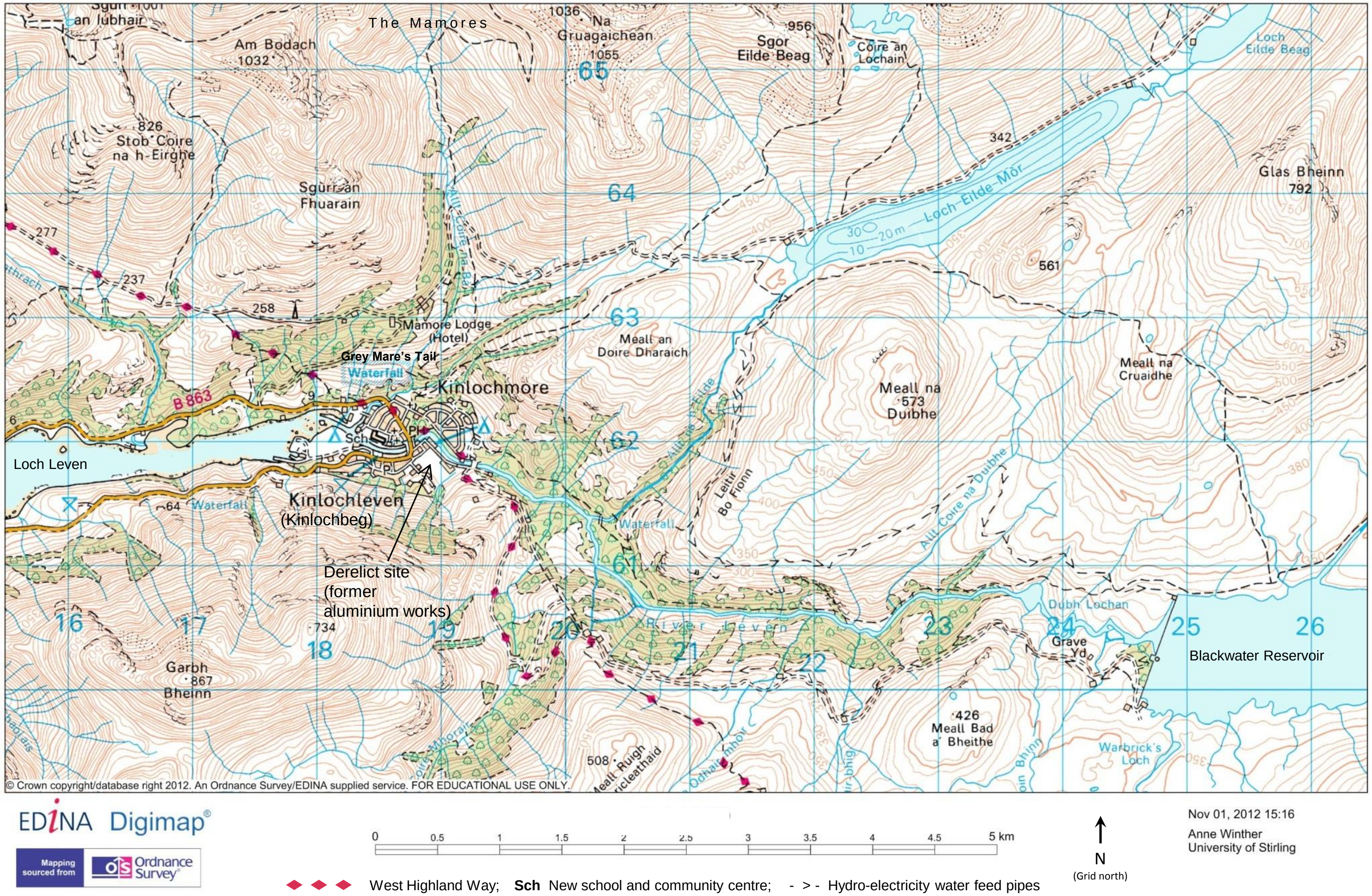


Figure 3.7 Map showing Kinlochleven, Kinlochbeg, Kinlochmore, British Alcan's developments and the West Highland Way

Moreover, Kinlochleven has high levels of precipitation with over 200mm of rainfall per annum (Gregor and Crichton, 1946).

Originally, Kinlochleven was two communities, Kinlochbeg and Kinlochmore, on either side of the River Leven; both boasted two cottages and a shooting lodge. Access was mainly by sea with a rough track connecting Kinlochbeg to a small pier on Loch Leven. Kinlochbeg and Kinlochmore were connected via a footbridge. Access to Kinlochmore by land was by a rough "road" along the north shore of Loch Leven, or by the military roads, which are now the West Highland Way (Gregor and Crichton, 1946, Figure 3.7). The West Highland Way runs through the village, which provides accommodation for the majority of walkers completing the 96 mile long distance walking route. To the south-east, the West Highland Way goes over the "Devil's Staircase" to the Kingshouse Hotel at the east end of Glen Coe. Fort William is 16 miles north-west on the West Highland Way. On the outskirts of the village is the Grey Mare's Waterfall which is spectacular. There is an indoor rock and ice climbing centre (The Ice Factor), which attracts many outdoor enthusiasts.

Kinlochleven was created with the founding of the now demolished aluminium smelter (Figure 3.8) just over 100 years ago. In 1904 the British Aluminium Company (now RT-Alcan and formerly British Alcan) applied and received consent for the hydroelectric power scheme and aluminium factory. They compensated the Kinlochmore land-owner, whose shooting lodge was subsumed by building Mamore Lodge (Figure 3.7). The loch was dredged to allow boat traffic, and a new pier and railway from the pier to the factory were constructed.

During the building of the aluminium works and hydroelectricity scheme over 3000 men were employed. Many of the jobs in the smelter were unpleasant, dirty and carried significant health risks, but the smelter provided opportunities for employment (Gregor and Crichton, 1946).

British Alcan designed the community and was the economic and social life blood of Kinlochleven with much of the day-to-day running of the community in the control of the company. This led to a culture of dependency and disempowerment and the "*paternalistic*" role of the company (Booth, 2000, n.p., KCT, 2010) continued until the smelter's closure. RT-Alcan is the fourth largest land-owner in Scotland, owning 117,249 acres (Wightman, 2011), around Kinlochleven and the Fort William smelter (adjacent to the Ben Nevis Estate, which is owned by the John Muir Trust, JMT, 2010).

Kinlochleven faces the challenges of being both a remote Highland and a post-industrial community, following the closure of the smelter ten years ago. *"A multi-agency and community forum* [Kinlochleven Land Development Trust (KLDT), now known as Kinlochleven Community Trust (KCT)] *was established to address the regeneration of the area."* 31.5 hectares of land within the village was transferred to KLDT and 1.5 hectares, including several buildings, was leased to KLDT (KCT, 2010, n.p.).

The 2001 Census population was reported as 750 adults and, in total, 897 (SCROL, n.d.). In 2008, SIMD estimated it as 849 with 13% unemployed, ranking it on the fourth decile for employment across Scotland. The crime ranking was very low

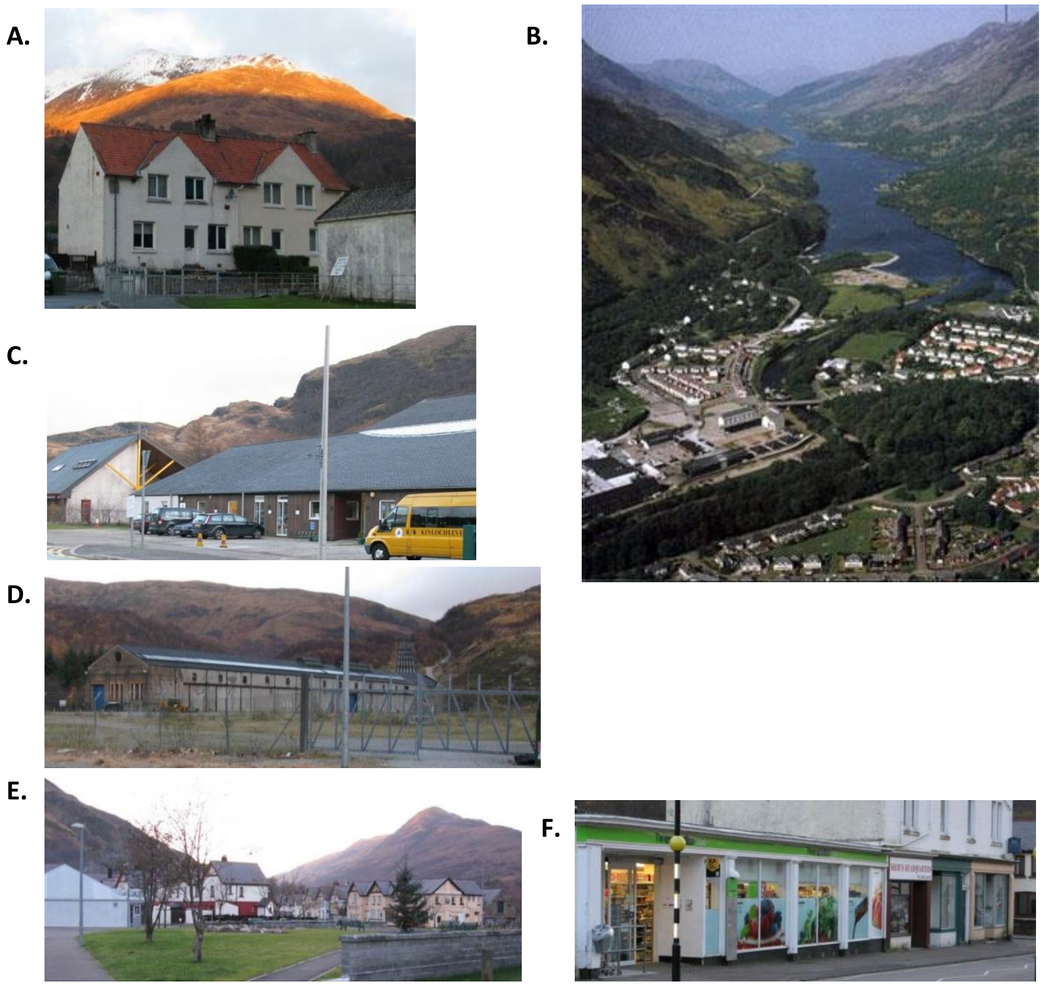


Figure 3.8 Pictures of Kinlochleven: A. British Alcan built housing with the Mamores behind; B. aerial view of Kinlochleven prior to closure and demolition of the smelter (KCT, 2010); C. the new community centre (right) and fire station (left); D. the village centre looking east showing the site of the former smelter, RT-Alcan hydroelectricity building, and Blackwater Reservoir water feed pipelines; E. the village centre looking west showing the Aluminium Centre (left) and original British Alcan built housing and shops (background) and the newly developed gardens (foreground); F. the Co-operative mini-market and hairdressers (two of the five remaining shops - the others, not shown, are the fish and chip shop, the Post office and an outdoor shop within the Ice Factor).

for a rural community being in the second decile (Table 3.4, Scottish Government, 2010b).

Highland Council perceives the work of KCT to be part of a "*long-term regeneration programme to revitalise and transform Kinlochleven*" (Highland Council, 2006). Achievements have been made in upgrading visitor accommodation, and developing key areas and facilities (Figure 3.9). However, more work needs to be done to create further community recreation facilities and: "*Further to ERDF funding and extensive remediation, the footprint of the former Smelter – presently retained by Alcan and originally earmarked as a Mountain Garden/parking – might present a wider range of economic development and environmental opportunities… The planned form and industrial heritage could merit Conservation Area status, whilst further cleaning-up of land could be targeted at land in the vicinity of the quays* [(Landfill site, Figure 3.9)]." (Highland Council, 2006, p1). The site of the former smelter remains derelict (Figure 3.8D, Site 2 in Figure 3.9).

In 1946, Gregor and Crichton, unable to obtain Kinlochleven birth and death rates, reported: "*The children are quite up to average height and weight for country areas, and show little or no ill-effects from the much-abused climate…. Slight rheumatism and chest troubles such as bronchitis and asthma are perhaps a little more common than usual in children, but no more so than in other parts of the west Highlands. The school medical officer drew our attention to the fact that in Kinlochleven the children's teeth are quite exceptionally good. The chief dental officer of the Department of Health for Scotland visited the school in 1944 and* *confirmed this. It is well known that the fumes from the factory chimneys contain traces of fluorine – hence the bluish film on the windows near the works – and it is suggested that the absorption of very minute quantities of the gas might harden the teeth.*" (Gregor and Crichton, 1946, p69-70). However, a study investigating the effects on smelter furnacemen, found "*no evidence of any adverse effect either from alumina dust or from traces of fluorine in the fumes*." (MRC, 1936, cited in Gregor and Crichton, p70). There are no more recent studies, but there is a higher than average incidence of cancer, comparative

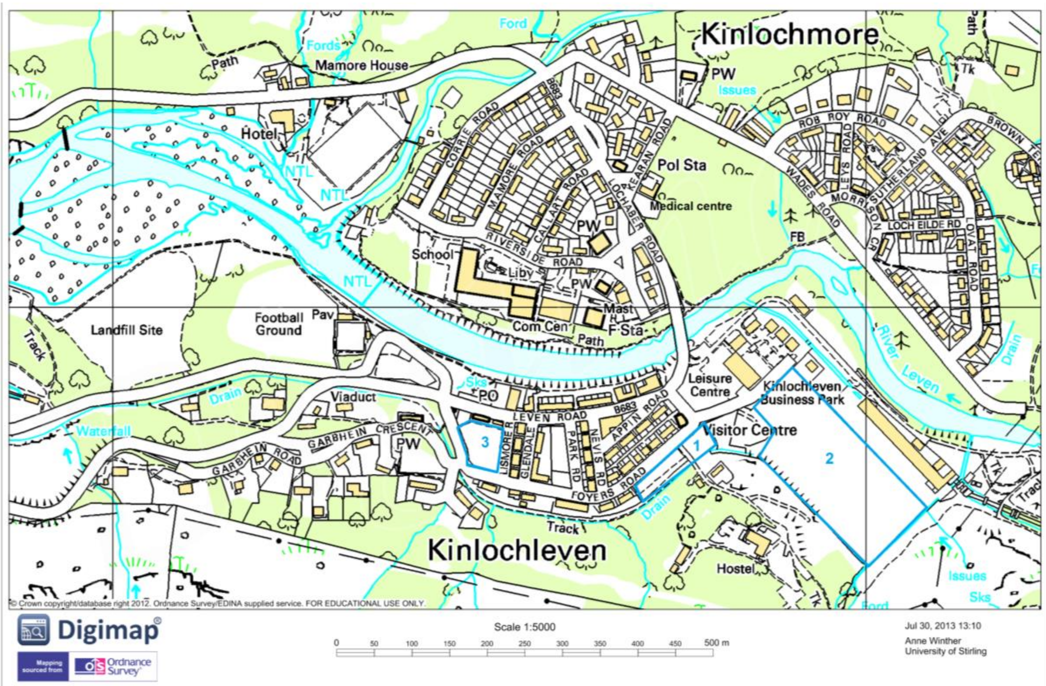


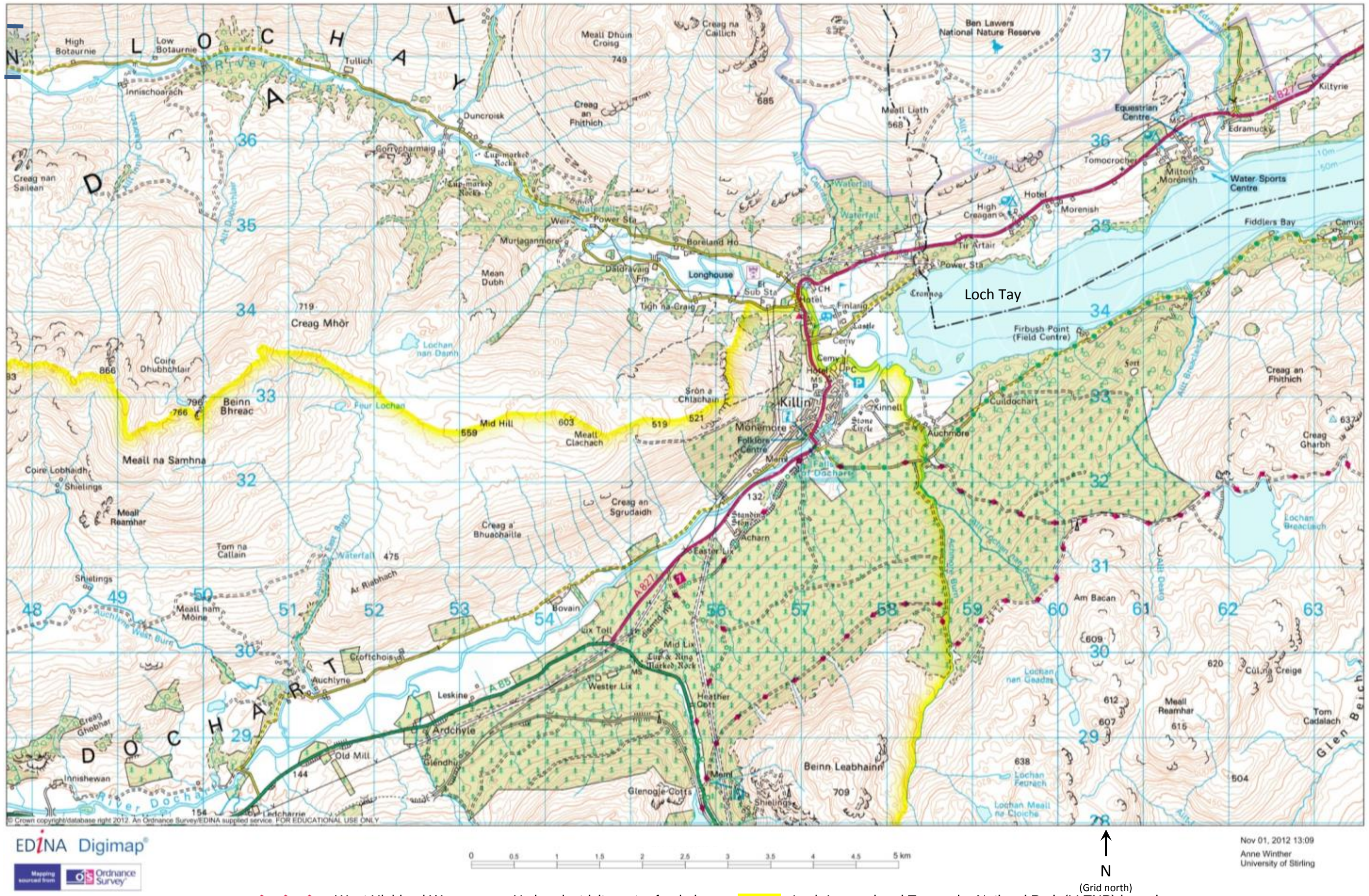
Figure 3.9 Kinlochleven's development areas. The school, The Ice Factor (Leisure Centre), community centre (Com Cen), library (Liby), medical centre, Aluminium story and post office (Visitor Centre), fire station (F Sta) and Kinlochleven Business Park (shown on map) have all been developed since 2001. Areas marked 1-3 (in blue) were identified as development areas in 2006 and remain vacant. Area 2 is shown in Figure 3.8D.

illnesses and families with less than 60% of the median income, when compared to the other case study communities and Stirling and Highland LAs (SNS, 2012).

3.2.3 Killin

As a remote rural community, (Scottish Government, 2010a, 2010b), Killin is situated in the centre of Scotland (Figure 3.2) at the head of Loch Tay (Walker, n.d.). The village is formed on the peninsula between the Rivers Lochay and Dochart (Figure 3.10) and lies on the border of the Loch Lomond and Trossachs National Park (LLTNP, shown in yellow in Figure 3.10), Stirling LA and the western end of Perth and Kinross LA. Killin is 2.5 miles off the main road (A85) that runs from Stirling to Crianlarich, Fort William, Oban and the Isles. Perth and Stirling are 44 miles and 37 miles away, respectively. Glasgow is 64 miles and Edinburgh is 76 miles (Killin and Ardeonaig Trust, KAT, 2012a). Very few, if any, complete a daily commute to these major conurbations. Note that the hamlet of Ardeonaig and the communities on the north shore of Loch Tay (including Tombreck) were excluded from the Killin study for practical reasons due to the distance from the main centre of Killin, even though residents consider themselves part of the community.

Killin is a historic community dating back millennia with evidence of bronze and stone age inhabitation (Figure 3.10). Unlike the two other communities, Killin has a clan history (Walker, n.d.) with four major clans associated with the area (Campbells of Glenorchy, later Earls of Breadalbane, Clan Macnab, Clan Alpine, and the Macgregors, the most famous being Rob Roy Macgregor). In the 18th



◆ ◆ ◆ West Highland Way; - > - Hydro-electricity water feed pipes; Loch Lomond and Trossachs National Park (LLTNP) boundary

Figure 3.10 Map of Killin case study area (excluding Glen Lochay)

century, the Earl of Breadalbane developed flax and wool spinning and weaving, built roads and bridges and established and encouraged new methods of farming. However, in the 19th century, they cleared forcibly their tenant farmers to create large sheep farms and sporting estates. Many of the cleared farmers were forced to emigrate oversees. People were literally driven out of their homes (MacKenzie, 1946, Walker, n.d.).

Until recently, Killin remained an agricultural centre for Breadalbane. Historically, the main form of agriculture was black cattle and with little lower land suitable for cultivation, cereals had to be grown on higher, harder to cultivate, land. Existence for the majority must have been hard and people resorted to bleeding their cattle to provide nourishment in harsh winters. There was a livestock market and dairy in Killin until the end of the 20th century. Since the 1960s (after the sale of much of the Breadalbane Estate) great swathes of land were planted with exotic conifers (Walker, n.d.), which has created no sustained employment. Killin was a formerly prosperous town that produced food and clothes and had five mills, one of which was a sawmill. In the 1950's the Breadalbane hydroelectric scheme was built and harnessed all the small burns from the hills, directing them into tunnels and dams. This has left insufficient water in many watercourses for local hydroelectricity generation by the local community, although the former Mill on the Dochart remains a possible site (KAT, 2012a, Willie Angus, *pers. comm.*, April, 2012).

In 1888, a branch line to the Callander and Oban Line railway (funded by local subscription) was opened and brought a new industry to Killin, tourism. People used to travel by rail to Killin, then on by steamer across Loch Tay, to return via Aberfeldy back to their original destination. A daily return trip to Glasgow could be made by train. In 1965 the line was closed with a substantial loss of tourism.

The landscape around Killin is spectacular. The Ben Lawers and Meall nan Tamarchan area is "*amongst the richest montane botanical sites in Britain*" (SNH, 2011), which is owned largely by the National Trust for Scotland (NTS). The stunning scenery, Ben Lawers conservation area, outdoor pursuits and clan history make Killin a tourist destination. The village is dependent on tourism and this is reflected in the number of restaurants, shops, caravan sites, hotels and bed and breakfasts (see Appendix B.2). However, the majority of tourists do not stay longer than to admire the view (Willie Angus, *pers. comm.,* November, 2010). Many of the large 19th century buildings on Main Street are bed and breakfast accommodation. Most of the shop buildings date from this era and have at least two storeys of flats above or behind. The north shore of the River Dochart was developed in the latter half of the 20th century with detached private dwellings. A substantial amount of social housing was built on the south east side of Main Street at this time. Further expansion of the village has occurred to the west of Breadalbane Park and Fingal's stone. Social housing was reported as being 18% of households in 2004 (Table 3.5). Killin's adult population is estimated to be 631 (see section 3.3.1.2).

Since 1997, the nearby Tombreck Farm on the north shore of Loch Tay has been transformed with the aim of creating a farm-based sustainable community. The newly completed Big Shed, which was winner of Low Carbon Building Award

2013, is a large community eco-building, providing a venue for classes and events and workspace for individuals and businesses (The Big Shed, n.d., Tombreck, n.d., Figure 3.11F).

Table 3.5 Summary of Killin accommodation 2004 (from Stirling Council, 2004b)

Accommodation			
House Type:	**Killin Community Council No.**	**%**	**Stirling Council Area %**
House or Bungalow (Households living in:)			
Detached	200	49.1%	31.1%
Semi-Detached	97	23.8%	25.4%
Terrace	46	11.3%	16.8%
Flat, Maisonette or Apartment			
Purpose built flat/tenement	36	8.8%	22.1%
Part of converted or shared house	6	1.5%	3.1%
In commercial building	16	3.9%	1.1%
Other	5	1.2%	0.4%
Total	**407**	100%	100%
(Occupied houses only, excludes shared dwellings)			
Tenure:	**Killin Community Council No.**	**%**	**Stirling Council Area %**
Owner Occupied	268	65.8%	66.6%
Rented from Council	50	12.3%	20.0%
Other social rented*	22	5.4%	2.6%
Private rented unfurnished	24	5.9%	3.0%
Private rented furnished	11	2.7%	4.4%
Living rent free	32	7.9%	3.4%
Total	**407**	100%	100%
* Housing Associations, Housing Co-operatives, Charitable Trusts etc.			

Killin was a member of Stirling Council's "*Community futures*" programme, which involved the setting up of a community development trust, ("Killin and Ardeonaig Trust", KAT), creating a community profile, detailed consultation and five year community action plan. This "*community futures*" approach (Roxburgh and Tuffs, 2006) continues to be promoted within LLTNP. The plan was revisited with a community consultation, review and re-write in 2011-2012, at which Tombreck residents were leading participants (KAT, 2012a, 2012b, *pers. obs.)*. The community has a history of social capital with the development of the railway branch line, the erection of the McLaren Hall, the production of the Killin News, and now KAT and many other community organisations.

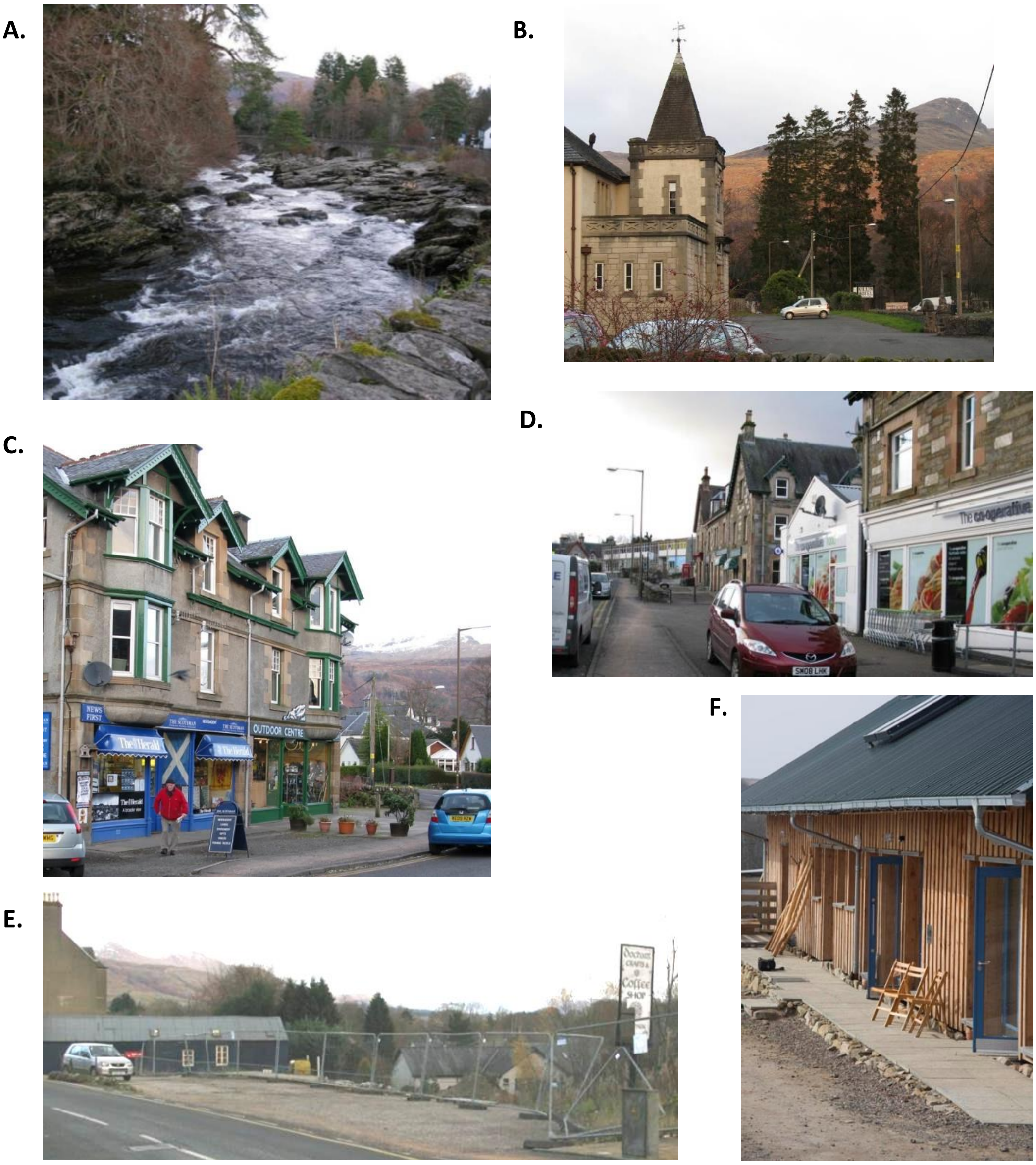


Figure 3.11 Pictures of Killin: (A) Falls of Dochart; (B) McLaren (village) Hall; (C) newsagent and outdoor shop with Meall Tarmachan in the background; (D) Killin Main Street with shops (Co-operative, antiques and café) and Primary School; (E) derelict site in village centre; (F) The Big Shed at Tombreck (from The Big Shed, n.d.)

3.3 Baseline sustainability measurement using the SCD

This section outlines the indicators selected for measuring baseline sustainability and a scoring mechanism for the sustainability of each aspect of the SCD. EF analysis, using REAPv2.17 (SEI, 2011a), formed a core part of baseline sustainability measurement and was used as the measure for modelling. The EF methodology specific to REAP is explored in more detail in this section. Baseline data collection and secondary data are described followed by an assessment of the primary data.

3.3.1 Indicator selection for sustainability assessment

To measure sustainability with a single composite indicator, the indicator would need to incorporate the ten aspects of the SCD, have an objective mechanism for determining limits to consumption, be able to link ecological and economic goals (which is always a challenge due to incommensurate units and placing monetary values on environmental goods), accommodate the small spatial scale of rural communities, and permit modelling of future states with changing consumption. However, there is no single indicator that can do this. Existing composite indicators are often not commensurate, are frequently flawed, use different assumptions and data, and yield contradictory results (Giaoutzi and Nijkamp, 1993, Moffatt *et al.* 2001, Moffatt, 2006, 2007). In addition, for informing policy, indicators need to have the ability to model interventions and predict outcomes over time and incorporate value judgements (normative concepts, Giaoutzi and Nijkamp, 1993). Nevertheless, existing composite indicators (Gross Domestic Product, GDP, Environmental Space, the EF and The Index of Sustainable

Economic Welfare, ISEW, Moffatt, 1996b, Jackson and Marks, 1999) were appraised for their ability to measure the sustainability of some SCD aspects.

GDP was eliminated because it measures the throughput of goods in the economy, encourages depletion of natural capital and is based on money exchange, rather than underlying, values (Wackernagel and Rees, 1996, Jackson and Michaelis, 2003, Daly and Farley, 2004, Jackson, 2005a). Environmental Space was discounted due to the methodological flaw that it has no objective mechanism for determining limits to consumption (Moffatt, 1996b). The EF was selected in preference to ISEW, because the EF is easier to use to compare results to biophysical limits, can be applied at the local level and enables the investigation of the impact of specific consumption activities (Wackernagel and Rees, 1996, George and Dias, 2005).

The advantage of EF analysis is that it uses productive land (land and sea) area as a proxy measure for consumption (land appropriation measured in global hectares, gha), so that EFs can be compared to the actual amount of productive land (biocapacity) available on the planet and so there is a finite limit (Wackernagel and Rees, 1996, Rees, 2000). In this study, for an individual, a sustainable EF is defined as one which is similar to the per capita available biocapacity (fairshare). However, with increasing global populations, the biocapacity has been predicted to decline over time. This means that in the future the fairshare will be a moving target. By 2050, it has been estimated to reduce to 1.0gha/cap (Moffatt, 2005). For the purposes of this study, the 2008 fairshare (1.8gha/cap, GFN, 2012) is used as a gauge to assess the sustainability of the baseline EF and for all scenario modelling. (Note that in 2012 GFN defined 2008 as the reference year for gha, removing a major criticism of EF and biocapacity accounting that EF accounts were not comparable as a time series (Borucke *et al.,* 2012). However, this improvement post-dates this study.)

In this study, the EF formed the core for assessing the sustainability of consumption choices and modelling the sustainability of future options, and Stockholm Environment Institute (SEI)'s Resources and Energy Analysis Programme, REAP was used for the EF analysis. Although the EF indicator addresses the economic valuation and finite limit problems by measuring resource use in land units, it does not measure all aspects of sustainability (Costanza, 2000, van den Bergh and Vergruggen, 1999, Moffatt, 2000, Senbel *et al.,* 2003). The use of the EF was combined with numerous individual indicators to measure each aspect of the SCD (Table 3.6). For each SCD aspect, goals for sustainability were defined based on the aspect descriptions presented in Chapter Two. For each goal the best (most relevant / appropriate) indicators were selected given the constraints of secondary data availability and collecting primary data. Primary data was collected mainly by questionnaire (see section 3.3.2) and supplemented by focus group data and field work observations. Evidence from secondary data sources is explicitly referenced with the results and includes national statistics consisting of the Scottish Census 2001 (SCROL, n.d.), SNS (2012) and the SIMD (Scottish Government, 2010b).

Table 3.6 Indicators of sustainable communities: indicators used to measure the sustainability of the SCD aspects

Aspect	Goal	Definition	Measure	Source
Sustainable consumption	Low impact consumption	Goods that are consumed have low impact on the environment and use minimal resources (the majority of which are renewable) in their production and consumption. Consumption is reduced significantly. Eliminate waste flows to landfill and for incineration. All "waste" reused, recycled or composted (zero waste).	• Total EF compared to the fairshare.[1] • Consumables and private services EF (purchase behaviour).	Questionnaire with gaps in EF data supplemented with secondary data from REAP (SEI, 2011a, e.g., food, public services, capital investment and some FDCs in all other categories of the EF).[1]
			• Waste arising and percentage recycling.	Questionnaire: QFintry 34-40, 42
			• Ethical purchases (EFBS[2], EFPS[2] and take-up of green electricity tariffs).	Questionnaire: QFintry 14, 19, 56-59, 112-115
			• Water use.	Questionnaire: QFintry 43-50
	Taking action to reduce consumption and resource use	Community enterprises to create more sustainable consumption and community resilience. Taking steps to transform food production and supply to the point where it has a net positive impact on the environment, local economy and peoples' well-being (i.e. organic, fair-trade, local and fossil fuel independent). Support local and low impact food production.	Presence of community enterprises e.g., • Local food production enterprises. • Co-operative and ethical purchasing (to reduce transport and costs). • Community car schemes. • Composting. • Promotion and support of local produce and consumer items. • Support of local production (e.g., facilities, funding, market creation).	Observation

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Governance and land tenure	Inclusiveness and representative leadership	The leaders of local government represent the needs of the local community and their actions are informed by their constituents.	• Satisfaction with and ability to influence local decision-making.	Questionnaire: QFintry 102-103
			• May 2012 local election turn-out.	Secondary data: General Register Office for Scotland, GROS, 2011, Highland Council, 2012, Stirling Council, 2012a
			• Percentage of population as members of community trusts.	Observation and secondary data: FDT, 2011a, SCROL, n.d.
	Effective governance structures	Appropriate governance structures (Community Councils and community trusts) exist and are effective in achieving community sustainable development.	• Community governance structures for sustainable development.	Secondary data: FDT, 2011b, KCT, n.d, KAT, 2007, 2012b
			• Presence of Community Councils.	Observation and secondary data: Fintry Community Council, 2009, Highland Council, 2011
	Fair distribution of power and property rights	The distribution of property rights are fairly apportioned across the community. There is land to fulfil community resource and energy needs and the community has the power to utilise or manage these resources sustainably for the good of the community and environment.	• Presence and type of community enterprises and co-operative schemes. • Type of land-owner service provision for and relationship with local community. • Ability to manage or utilise local resources for the benefit of the community and environment.	Observation, focus groups and secondary data, where appropriate, e.g., SNH, 2008, Highland Council, 2010, FDT, 2011a, 2011b, Wightman, 2011, KCT, 2013
Transport and connectivity	Public transport and connectivity to services	Frequent and affordable public or community transport to services and employment to fulfil basic needs. Infrastructure to cycle or walk to reach local services.	• Nature and frequency of public and community transport services. • Location of resources and services. • Presence of safe walk-ways and cycle routes.	Observation and secondary data: Google Maps, 2012, Stirling Council, 2012b, Traveline Scotland, 2012
			• SIMD geographic access ranking. •	Secondary data: Scottish Government, 2010b
	An equitable transport EF	A transport EF, which is approximately 20% of an individual's fairshare of the total available biocapacity.	• Transport EF.	Questionnaire supplemented by secondary data from REAP (SEI, 2011a), e.g., train, aeroplane and bus occupancy
			• Number of flights taken. • Type of car used for travel.	Questionnaire: QFintry48, 73-75

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Health, well-being and education	Happy citizens / satisfied with life	High self-reported happiness and life satisfaction.	• SIMD - % income deprived.	Secondary data: Scottish Government, 2010b, SNS, 2012
			• Responses to self-reported happiness and satisfaction with life questions.	Questionnaire: QFintry 104,112-115
	Healthy citizens	People in good health and living long.	• Cancer rates. • SIMD for health. • Comparative illness frequency.	Secondary data: Scottish Government, 2010b, SNS, 2012
			• Access to medical services and personal comments on events affecting health.	Observation
	Secure and safe citizens	People are safe and secure in their community.	• SIMD crime ranking. • Low income families.	Secondary data: Scottish Government 2010b
	Educating to create literate and critical citizens	Communities have access to schools and colleges and opportunities for educational achievement. Systems of education create critical citizens, who are literate in sustainability and equipped for vocational opportunities (Ledwith, 2005).	• SIMD education ranking.	Secondary data: Scottish Government, 2010b
			• School curricula with a core focus of sustainability. • Access to education. • Critical actors (Ledwith, 2005) inferred from degrees of passivism and activism in the community.	Observation and secondary data (e.g., Martin *et al.*, 2013, Education Scotland, n.d.)

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Environment and ecocentrism	Local land management for sustainability and biodiversity	Land management that maximises biodiversity and habitats in local environment, regenerates degraded environments, utilises renewable resources only and at the rate that they can be replenished and benefits the community.	• Land management for community benefit (e.g., education, employment, local food production, health (i.e. non-polluting), recreation, renewable energy generation, etc.). • Regeneration of degraded environments. • Community involvement in and responsibility for land management decisions and planning.	Observation
			• Use of organic and animal friendly agricultural practices.	Not measured
	Ecocentric attitudes and behaviour that protect and enhance natural resources and biodiversity (locally, globally and inter- and intra-generationally)	People have positive attitudes to the environment and behaviour to protect and/or enhance biodiversity and take care that their local actions do not adversely affect the wider global environment.	• Environmental, sustainability and climate change attitude questions.	Questionnaire: QFintry 117-119, 121
			• Frequency of pro-environmental behaviour and amount of organic food purchased.	Questionnaire: QFintry 19, 56-59, 61, 63-65, 112-115
Economy	Local employment, resources and production	Extensive local employment with high levels of job satisfaction.	• % employment deprived. • SIMD employment ranking. • Type of employment.	Secondary data: Scottish Government, 2010b, SNS, 2012, SCROL, n.d.
			• % in employment. • Distance to employment. • Job satisfaction.	Questionnaire: QFintry 107
	Flourishing, diverse and resilient businesses serving the needs of the local population	Businesses operate within a flourishing local economy to serve the needs of the local community and provide meaningful work.	• Number and diversity of businesses.	Observation and secondary data: FAME, 2012, 192.com, KAT, 2012a
	Sustainable businesses	Local businesses have a low impact on the environment, make a significant positive contribution to the local economy and are socially just.	• Corporate social responsibility policies, EF of production, protection of biodiversity and ethics.	Not measured

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Built environment	Sustainable homes	Energy efficient housing and heating systems. Sustainable and local building materials. Sustainable water use.	• Housing EF.	Questionnaire with gaps in EF data supplemented with secondary data from REAP (SEI, 2011a)
			• Water use (proxy measures – toilet water saving devices and collecting rainwater).	Questionnaire: QFintry 50, 61
			• Installation of renewable energy systems and use of renewable fuels.	Questionnaire: QFintry 11, 12, 15, 22
			• Use of sustainable and local building materials.	Not measured
	Taking action towards achieving low impact housing	Initiatives to reduce impact of the built environment (e.g., implementing water efficiency measures, energy efficient housing and heating, building with sustainable and local materials)	• Community initiatives. • Examples of sustainable buildings.	Observation
			• Use of sustainable and local building materials.	Not measured
	Housing to meet needs of population	Good quality affordable housing (to buy or rent), in which the size of the dwelling matches the size of the household.	• Dwellings (size, multiple occupancy, ownership).	Secondary data: Stirling Council, 2004a, KAT, 2012a, SNS, 2012
			• Occupancy.	Questionnaire: QFintry 1-2
			• Cost of heating the home.	Questionnaire: QFintry 7-13
			• Fuel poverty.	Indirectly measured as a community average heating cost and compared to average income from secondary data (for Killin, KAT, 2012a and SIMD ranking, Scottish Government, 2010b) as primary individual / household income data was not collected
	Sustainable community buildings	Eco-community buildings that meet their design purpose.	• Availability of and facilities provided by community buildings. • Sustainable construction and use of resources by community buildings.	Observation

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Community, culture and social capital	Community endeavour committed to sustainable development	Community enterprises committed to sustainable development.	• Presence and realisation of community-wide sustainable development and consumption objectives.	Observation
			• Satisfaction with the area as a place to live.	Questionnaire: QFintry 109
	High levels of social capital	A diversity of active social enterprises and clubs (achieves inclusivity through diversity) for recreation and development Opportunities for cultural, leisure, community and sporting activities.	• The number and nature of clubs and social enterprises.	Observation
			• Response to: "I feel close to people in my community".	Questionnaire: QFintry 113
	Motivated civil society actors	Actors within the community leading change for a better future. Culture of aspiration and self-worth and a community with voice.	• Evidence of voluntary endeavour.	Observation
	Space and opportunity for spiritual growth	Outwith the scope of the study.	Not defined	Not measured
	Respect for and encouragement of diversity	Outwith the scope of the study.	Not defined	Not measured
Sustainable energy to fuel life	Renewable energy systems in the built environment	Energy needs are met with carbon neutral renewable energy systems	• Renewable energy in the built environment.	Results of the previously assessed aspect, Built environment: sustainable homes
	Community renewable energy	Abundant renewable energy is sustainably and fairly utilised for community benefit	• Community renewables projects providing income. • Community renewables providing the community with energy.	Observation

Continued overleaf

Aspect	Goal	Definition	Measure	Source
Power to act	Authority to act	The community has the appropriate governance structures with the authority to make and enact decisions.	Inclusive governance structures giving authority.	Results of the previously assessed aspect, Governance and land tenure: inclusiveness and representative leadership and effective governance structures.
	Motivated and empowered actors and social capital	The community has motivated and empowered actors and high levels of social capital.	• Evidence of motivated and empowered actors and high social capital.	Results of the previously assessed aspects, Community, culture and social capital: High levels of social capital and Motivated civil society actors.
	Well-being and citizenship	The community has safe and secure and healthy citizens with self-worth.	• Levels of crime and ill-health.	Results of the previously assessed aspects, Health, well-being and education: Happy citizens / satisfied with life, Healthy citizens, Secure and safe citizens and Educating to create literate and critical citizens.
	Resources to act	The community has property rights; access to income and be addressing injustice.	• Means to act: fair distribution of renewable energy, property rights, or access to income.	Results of the previously assessed aspects, Governance and land tenure: Fair distribution of power and property rights and Sustainable energy to fuel life: Renewable energy systems in the built environment and Community renewable energy.

[1]As defined in the text this section.
[2]For definition and description of EFBS (Environmentally Friendly Behaviour Scale) and EFPS (Environmentally Friendly Purchasing Scale) see section 3.3.2.1.

Data is reported at the level of SIMD Datazones, which are made up of multiple Census Output Areas (COAs). However, some COAs straddle SIMD Datazones and the SIMD Datazones do not always match settlement boundaries (Scottish Government, 2010b, SCROL, n.d.). A description of the exact Datazones used is given in section 3.3.1.2.

A traffic light scoring system was used to link the disaggregated measures of sustainability (listed in Table 3.6) with the holistic SCD framework in a clear visual form. Traffic light scoring systems, such as those used in Environmental Impact Assessment (within Leopold matrices to assess and compare qualitative impacts, Glasson *et al.*, 1999) and for measuring progress in sustainable development (DEFRA, 2006, 2010), offer the opportunity of scoring sustainability across multiple aspects. DEFRA (2010) used a traffic light scoring system to measure positive or negative progress, but this study goes further than just measuring progress by using gauges to assess sustainability (strong sustainability goals and the fairshare).

Each community's level of achievement against each sustainability goal (measured by the indicators listed in Table 3.6) was scored by the traffic light scoring system. Attainment of each goal was scored as to whether individual behaviour and community activities: (a) were sustainable, just and effective at present; (b) required some action or taking action to achieve sustainability and justice; or, (c) were unsustainable and / or unjust (Figure 3.12). For some aspects of the SCD, there is an even number of goals, which means there is potential for scores to be tied. If the scores were tied, for example two "green" (meaning "sustainable/effective at present") and two "amber" (meaning "some action required or taking action to achieve sustainability and justice"), then the less sustainable score (amber, in this example) has been taken, to illustrate, in this case, that some action is still required, which a green score would miss.

Sustainable/ effective at present	Some action required or taking action to achieve sustainability and justice	Unsustainable and/or unjust

Figure 3.12 Sustainability "*traffic light*" scoring key

The EF analysis method is reviewed next, followed by a summary of the Datazones used for secondary data.

3.3.1.1 Ecological footprint (EF) methodology and REAP

EFs measure the total area required (hectares of water and land per person) to maintain a given population at an average resource per capita consumption and waste production rate. The EF is a measure of "*ecological sustainability*" (Wackernagel *et al.,* 2005, p28), rather than economic or social sustainability, and acts as a proxy for natural capital and life support systems (Moffatt, 2005). There are many different methodologies for calculating EFs (Monfreda *et al.,* 2004, Wackernagel *et al.,* 2005). This study utilises REAP, which uses the EF accounts generated using a compound method by the Global Footprint Network (GFN). In REAP, GFN's EF accounts are combined with other national statistics, to generate two region input-output tables for the UK. The most recent version of REAP (v2.17) uses input-output tables to allocate GFN's 2006 National Footprint Accounts to final demand categories (FDCs) and regions (SEI, 2011a, Borucke *et al.,* 2012).

The advantages of using a compound method over the original Fraser Valley survey method developed by Wackernagel and Rees (1996, the component approach) are that the EF of the whole economy can be calculated in the absence of knowing every single end use of every product consumed and risks of double counting are reduced. Although the component approach is suited to the community scale, it has highly variable methodologies (the EF's calculated using different methodologies are not comparable), is a resource intensive procedure, is reliant on the honesty of individuals and is particularly at risk of double counting (Monfreda *et al.*, 2004, Wiedmann *et al.*, 2006).

REAP incorporates GFN's EF accounts and two region input-output tables to allocate EF data to FDCs and regions, based on the EF calculated for socio-economic groups (Barrett *et al.*, 2005, Wiedmann *et al.*, 2006, SEI, 2007a, Paul *et al.*, 2010, Figure 3.13). REAPv2.17, which was used in this study, uses GFN's 2006 National Footprint Accounts (SEI, 2011a, Borucke *et al.,* 2012). The accounts are disaggregated categories of production and consumption; the 123 Standard Industrial Classifications are used for the production side of the economy and Classification of Individual Consumption According to Purpose (COICOP) categories are used to allocate consumption, so that FDCs are analysed rather than specific products (Figure 3.13).

The average EF for each local authority (LA) area is calculated with REAP according to the demographic profiles of each area, based on "A Classification Of Residential Neighbourhoods" (ACORN) classification system (Figure 3.13). There is a variation in EF across ACORN types across the UK. The greatest EF is

6.61gha/cap for *"ACORN Type 21 (Prosperous Enclaves, Highly Qualified Executives*)" in comparison to 4.09gha/cap for *"ACORN Type 50 (Council Areas, High Unemployment, Lone Parents"*, SEI, 2011a, np). REAPv2.17 contains the EF and carbon footprint (CF) at national and LA levels for the UK for the years 1992 to 2006. REAP has the functionality to allow scenarios of changing consumption variables and energy production to be modelled (SEI, 2011a).

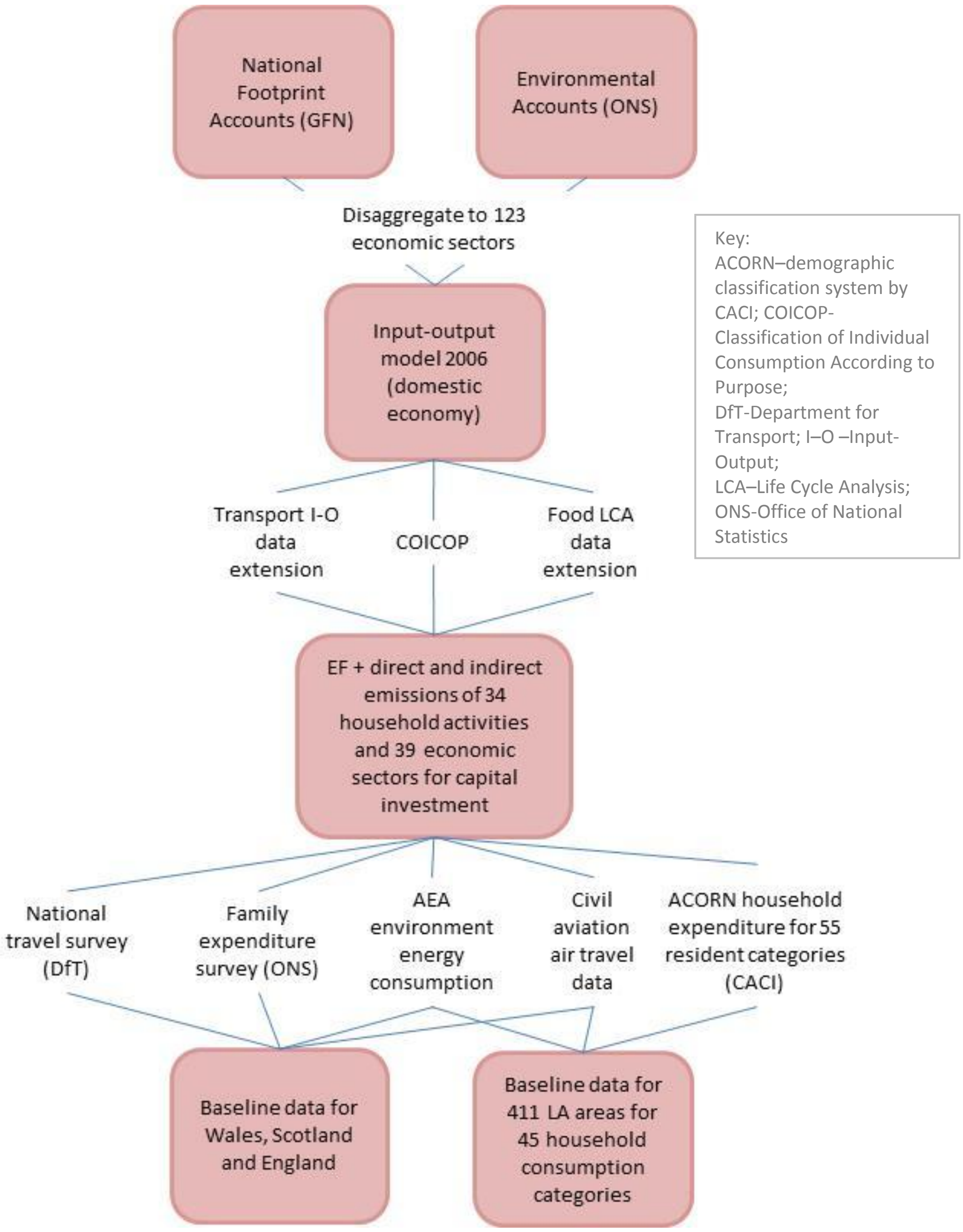


Figure 3.13 REAP data sources (adapted from SEI 2007a, p2)

3.3.1.1.1.1 Methodological concerns and errors

The margin of error for REAP EF analysis has not been calculated, but would be dependent on the accuracy of national statistics (Monfreda *et al.*, 2004). Nevertheless, the margin of error for the UK MRIO CF (embedded emissions indicator) has been quantified. The relative standard error for the aggregated results of carbon dioxide consumer emissions was found to be 5.5% for 2004 (the most recent year analysed), leading to the conclusion that the estimate of the total embedded carbon dioxide emissions from the UK MRIO is "*robust and reliable*" (Wiedmann *et al.*, 2008, p28). However, the error for the disaggregated individual sector level emission estimates was found to be significantly higher, because of problems with data classification within sectors (heterogeneous production methods and products) and across national boundaries. Very large errors (>100%) were found in 14 out of 123 sectors (coal and metal ore mining, fossil fuel extraction, textiles, tanning and luggage manufacture, basic chemicals, fertilisers, man-made fibres, bricks and tiles, iron and steel manufacture, other special purpose machinery, railway transport and real estate) and significant (>50%) for another 39 sectors (relating to forestry, clothing and footwear, animal feeds, paper, refined fuels, plastics, pharmaceuticals, ceramics, metal production, appliances, machinery, aircraft, jewellery, sporting goods, retailing (excluding cars) and telecommunications, Wiedmann *et al.*, 2008), meaning that care needs to be taken when analysing disaggregated data for these sectors.

Although REAP has the functionality for scenario analysis, it assumes that the relationship between productive output (in financial amounts) and areas of production land is fixed. This assumption is valid if there is a reasonably linear relationship between production and EF (e.g., increasing air travel and increasing emissions), but this is not the case for investment infrastructure (e.g., when increases in air travel necessitate the construction of new airports, Ferng, 2009).

The EF has been criticised for methodological limitations and for only partially measuring ecological sustainability (van den Bergh and Vergruggen, 1999, Costanza, 2000, Moffatt, 2000, van Kooten and Bulte, 2000, Senbel *et al.,* 2003, George and Dias, 2005, Moffatt *et al.*, 2005). The different methodological variations and applications mean that it is difficult to compare footprints calculated by different people (Moffatt *et al.*, 2005). Assumptions made about the assimilative capacity of the environment for wastes and the great diversity in timber productivity yields can influence the estimates of the land required (van Kooten and Bulte, 2000). The EF assumes that current industrial harvest practices are sustainable (e.g., agriculture and forestry), whereas in reality North America high-input agricultural production depletes cropland soils 10 to 20 times faster than they can regenerate, and so the EF is an under-estimate (Wackernagel and Rees, 1996).

Double counting of land use is also a problem, for example, where an area of land can provide more than one service, such as a forest which provides water collection, carbon dioxide assimilation and timber for development. To count the forest for water collection and timber would be double counting (Wackernagel and Rees, 1996). For each resource, assumptions are made in the life cycle analysis which can have significant impact on the resulting footprint for each resource (George and Dias, 2005). A substantial part of the EF calculation is based on the calculation of productive land required for assimilating and absorbing the carbon dioxide produced from burning fossil fuels (Ayres, 2000, Ferng, 2002), which does not allow for technological innovation (such as carbon sequestration) and may mean that, if all goods are produced using renewable energy, the EF may be reduced to almost nothing even though production and consumption activities would be in no way sustainable (Ayres, 2000, Ferng, 2002, George and Dias, 2005). Moreover, land substitutions cannot easily be modelled, for example, when forestry is converted to cropland (van Kooten and Bulte, 2000).

Some life-support services (e.g., global heat distribution, biodiversity, soil depletion and climate stability) have not been incorporated into the EF, because there is no easy way of characterising the relationship between them and per capita demand (Wackernagel and Rees, 1996), even though the EF claims to be a measure of "*ecological sustainability*" (Wackernagel *et al.,* 2005, p28). The EF does not adequately incorporate all forms of pollution associated with production and consumption (for example, polychlorinated biphenyls, dioxins and excess nitrogen), fresh water withdrawal and soil contamination (Wackernagel and Rees, 1996).

Each year, GFN continues to review and update their calculation methods and conversion factors, although the REAP methodology stays the same. This means that EF calculations produced using the same methodology but different data sets (e.g., REAPv1 and REAPv2.17) are not directly comparable (Dawkins *et al.*, 2010).

REAP uses monetary input-output tables (MIOTs) rather than physical input-output tables (PIOTs) to allow for calculation of the EF across categories with incommensurate units. The weaknesses in using MIOTs are that monetary prices have to be put on environmental goods and the MIOT is susceptible to changes in unit prices, which the PIOT is not (Weisz and Duchin, 2006, Moffatt, 2006).

Nevertheless, MRIOs have been argued to be better at calculating the EF of secondary products and accounting for international trade in services and goods than the GFN EF accounts and they have high sector disaggregation and can be used for scenario analysis (Wiedmann, 2009). Therefore, MRIO EF accounting may be one of the best aggregate indicators and is able to measure the sustainability of consumption, if compared against the fairshare. However, EF accounting is not able to measure the sustainability of all aspects of the SCD. Other disaggregated measures are required to supplement the EF, which are specific to each aspect of the SCD.

3.3.1.1.2 Calculations and assumptions for REAP

EF calculation was done using SEI's REAPv2.17 obtained in November 2012, using community data collected in the household questionnaire (Figure 3.14). The RP on-line community calculator (SEI, n.d.) was not used because the data requirements were significantly different to that collected from Fintry and because REAP has more flexibility for scenario modelling and allows interpretation of EF results in FDCs. For each case study, average per capita values for the measured variables (for example, per capita electricity, oil and LPG consumption in kWh/cap) were calculated in bespoke community calculators (adapted from the RP prototype, SEI, 2007c), the assumptions for which are outlined in Appendices A.3 and A.4.

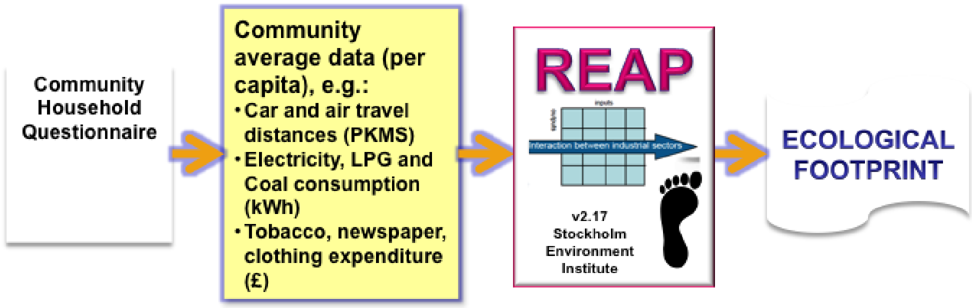


Figure 3.14 Ecological footprint calculation steps (adapted from SEI, 2007a, 2007b, 2011a)

REAP has scenario functionality, which enables amendment of physical or monetary average consumption values for transport, domestic energy, consumables and durables, services, demographics and food (for example, public road transport distance in kilometres per capita (km/cap), expenditure on tobacco in pounds sterling per capita (£/cap), electricity consumed in kilowatt hours per capita (kWh/cap), Figure 3.15) to create a user-defined EF, for a specific scenario or community. Multiple variables can be changed simultaneously.

For consumption variables related to public service provision and infrastructure and where detailed data was missing (for example, taxi mileage per capita), the REAP-defined LA averages were used. Stirling LA data was used for Fintry and Killin, and Highland LA data was used for Kinlochleven. The REAP consumption variables and the data sources and values used are given in Appendix B.1. Modelling of car efficiency was not possible in REAP and so appropriate manual adjustments were made to car distances outside REAP. The REAP FDCs were consolidated for transport, housing, private services, food, consumables, public services and capital investment.

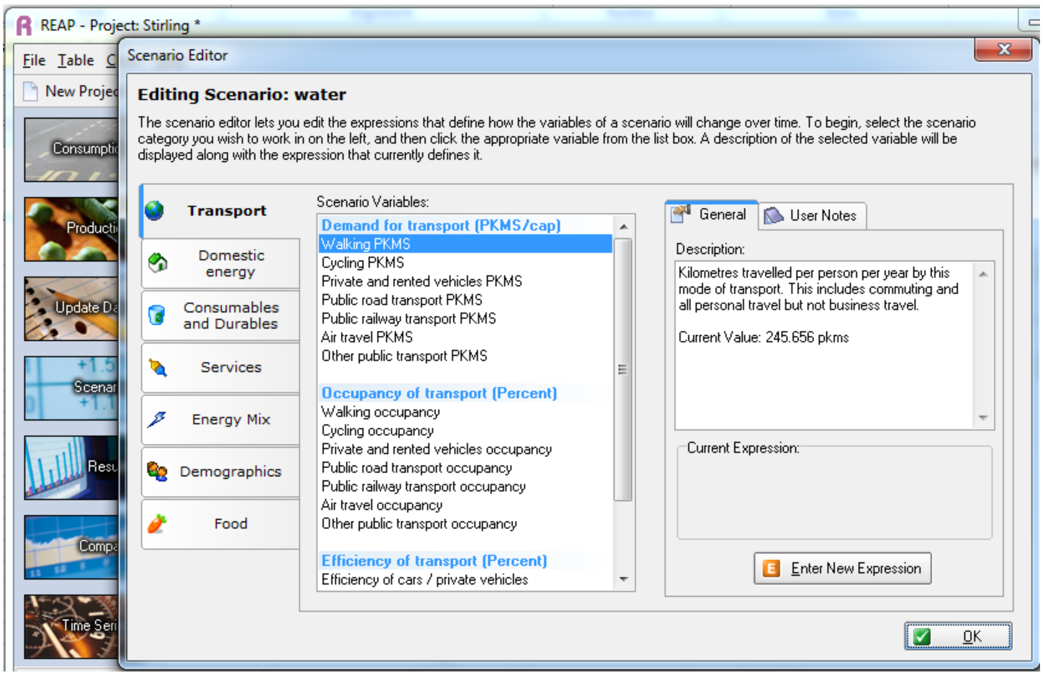


Figure 3.15 A snapshot of the REAPv2.17 scenario editor (from SEI, 2011a) showing the transport variables that can be modified in the editor to calculate a custom EF for a community

3.3.1.2 Case study area boundary definitions for secondary data

This section defines the SIMD Datazones and COAs used for secondary data analysis, as some COAs overlap SIMD Datazone boundaries (Scottish Government, 2010b, SCROL, n.d.). For Kinlochleven, the 2001 Census defines the whole of Kinlochleven as a settlement, which matches the case study boundary, comprising ten COAs, which all form the SIMD Datazone S01003722 (Table 3.7).

Table 3.7 Scottish Index of Multiple Deprivation (SIMD) Datazone and Census Output Area (COA) reference areas and population (SCROL, n.d., Scottish Government, 2010b, KAT, 2012a) showing SIMD Datazones used (highlighted in bold) for each case study

Community	COAs	Reference Postcode	Principle SIMD Datazone for each COA[1]	Adult population
Fintry[2]	60RG000052	G63 0YA	**S01006074**	583
	60RG000053	G63 0YL	"	
	60RG000054	G63 0LP	"	
	60RG000586	G63 0XA	"	
	60RG000587	G63 0XQ	"	
	60RG000049	G63 0YH	S01006072	
Kinlochleven	60QT000391	PH50 4	**S01003722**	750
	60QT000390	PH50 4	"	
	60QT001365	PH50 4	"	
	60QT000392	PH50 4	"	
	60QT000394	PH50 4	"	
	60QT000395	PH50 4	"	
	60QT000393	PH50 4	"	
	60QT001364	PH50 4	"	
	60QT000389	PH50 4	"	
	60QT001363	PH50 4	"	
Killin[3]	60RG000039	FK21 8UA	**S01006176**[3]	631
	60RG000489	FK21 8TE	"	
	60RG000490	FK21 8TN	"	
	60RG000683	FK21 8UN	"	
	60RG000684	FK21 8UT	"	
	60RG000038	FK21 8RE	S01006175	
	60RG000681	FK21 8SH	"	
	60RG000682	FK21 8UY	"	

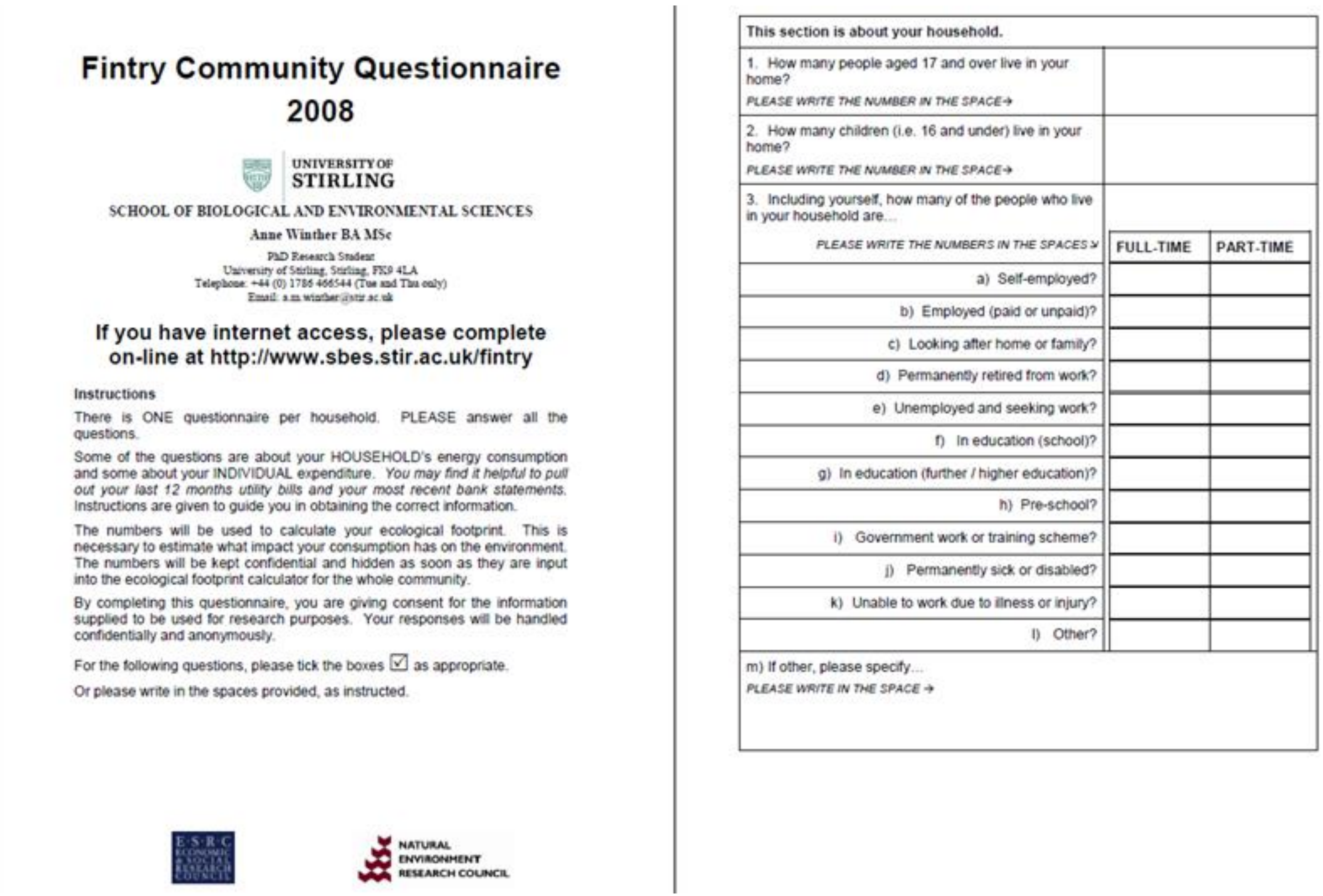
[1]The principle SIMD Datazone for each COA is quoted as some COAs straddle more than one Datazone. The SIMD Datazone used for sourcing secondary data for each case study is highlighted in bold.
[2]The population estimate includes all listed COAs, but SIMD data reported for Fintry is for S01006074, as the majority of S01006072 is outside the sample area.
[3] The Datazone S01006176 was not exclusive to Killin. COA 60RG000494 (postcode reference FK21 8SU) lies within this Datazone but was excluded from the population estimate, leading to an under-estimate of approximately 30. The majority of the population of this COA are distant to Killin.

For Fintry, the main (selected) SIMD Datazone (S01006074) does not cover the whole community case study area (Table 3.7). S01006074 excludes the COA 60RG000049, which was included in the sample area. For Killin, the area boundaries and sample boundary are inconsistent, meaning that the population of Killin has to be estimated due to differences in the COA, SIMD Datazone

S01006176 boundary, the natural physical boundary of the community and the electoral ward boundary. Moreover, the Stirling LA boundary lies on the eastern edge of the village, so that there are some residents of Killin living in Perth and Kinross LA. Reconciliation of the population figures suggests that the population should be 660 (KAT, 2012a) and both the 2001 Census and the SIMD population figures are under-estimates (SCROL, n.d., Scottish Government, 2010b, KAT, 2012a). However, the 2001 Census population was used to be consistent with the other case studies (SCROL, n.d., Table 3.7). The COAs used for population statistics are listed in Table 3.7 with the SIMD Datazones used to reference secondary data statistics highlighted in bold.

3.3.2 Household questionnaire design

The questionnaire (Figure 3.16) was made up of questions to obtain primary data to fulfil the data requirements specified in Table 3.6. The majority of questions fulfilled the data needs for calculating and modelling the community's EF (Table 3.8) and were based upon a 2007 prototype version of SEI's REAP Petite spreadsheets (RP, SEI, 2007b, 2007c). Only 10 of the 18 REAP "Consumables" FDCs and two of the 13 "Private Services" FDCs were measured in the household questionnaire (Table 3.9), because of the difficulty in quantifying individual contributions to the remaining FDCs. For these unmeasured FDCs the appropriate LA averages were used. The remaining questions collected demographic, well-being, environmental attitude and socio-economic data and were adapted from established national and international surveys (Table 3.8). Demographic data (age and gender) was collected to enable assessment of



Fintry Community Questionnaire 2008

UNIVERSITY OF STIRLING

SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

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If you have internet access, please complete on-line at http://www.sbes.stir.ac.uk/fintry

Instructions

There is ONE questionnaire per household. PLEASE answer all the questions.

Some of the questions are about your HOUSEHOLD's energy consumption and some about your INDIVIDUAL expenditure. *You may find it helpful to pull out your last 12 months utility bills and your most recent bank statements.* Instructions are given to guide you in obtaining the correct information.

The numbers will be used to calculate your ecological footprint. This is necessary to estimate what impact your consumption has on the environment. The numbers will be kept confidential and hidden as soon as they are input into the ecological footprint calculator for the whole community.

By completing this questionnaire, you are giving consent for the information supplied to be used for research purposes. Your responses will be handled confidentially and anonymously.

For the following questions, please tick the boxes ☑ as appropriate.

Or please write in the spaces provided, as instructed.

ESRC ECONOMIC & SOCIAL RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

This section is about your household.

1. How many people aged 17 and over live in your home? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
2. How many children (i.e. 16 and under) live in your home? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
3. Including yourself, how many of the people who live in your household are... *PLEASE WRITE THE NUMBERS IN THE SPACES↘*	FULL-TIME	PART-TIME
a) Self-employed?		
b) Employed (paid or unpaid)?		
c) Looking after home or family?		
d) Permanently retired from work?		
e) Unemployed and seeking work?		
f) In education (school)?		
g) In education (further / higher education)?		
h) Pre-school?		
i) Government work or training scheme?		
j) Permanently sick or disabled?		
k) Unable to work due to illness or injury?		
l) Other?		
m) If other, please specify... *PLEASE WRITE IN THE SPACE →*		

Figure 3.16 Fintry household questionnaire

4. What type of house do you live in? *PLEASE TICK ONE BOX ONLY*	Terraced house	☐
	Detached house	☐
	Semi-detached house	☐
	Flat / apartment / tenement	☐
	Mobile home	☐
5. How long have you lived in Fintry? *PLEASE TICK ONE BOX ONLY*	Less than a year	☐
	1-5 years	☐
	5-15 years	☐
	Over 15 years	☐
6. How old is your house? *PLEASE TICK ONE BOX ONLY*	Pre 1930	☐
	1930-1995	☐
	Post 1995	☐
Now some questions about your home… **First there are some questions about your heating and electricity usage.**		
7. How do you heat your home and hot water? *SELECT AS MANY THAT APPLY*	Electricity	☐
	Gas or LPG	☐
	Oil	☐
	Wood or biomass	☐
	Coal	☐
	Heat pump	☐
	Peat	☐
	Other – please specify below	☐
a) Other – please specify:		

From your bills for the last YEAR, please enter your total:		
8. Cost or litres used in the last 12 months of LPG or gas *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£	
		litres per year
9. Cost or litres used in the last 12 months of oil *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£	
		litres per year
10. Cost or kWh used in the last 12 months of electricity *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£	
		kWh per year
11. Total amount of wood consumed in tonnes in the last 12 months *PLEASE ENTER DETAILS IN THE BOX*		Tonnes
12. Number of bags or amount in tonnes of coal that you used in the last 12 months *PLEASE ENTER DETAILS FOR ONE BOX ONLY*		Bags
		Tonnes
13. The amount in tonnes or cost of peat that you used in the last 12 months *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£	
		Tonnes
14. Does your electricity come from 'Green' sources (i.e. do you buy your electricity from a renewables company or as a "green tariff". If you have not heard of this or are unsure, then please answer, "No".)? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐

Figure 3.16 Fintry household questionnaire (continued)

15. Do you generate your own electricity? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐
16. If yes, please give details…		
17. How many light bulbs do you have in total? *You may find it useful to think of each room in your house and outside and count the total light bulbs (including energy saving) in each room. If you make a note of the number of energy-saving bulbs at the same time, this will help answer Question 18.* *PLEASE WRITE THE NUMBER IN THE SPACE→*		
18. How many of your light bulbs are energy-saving? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
19. How often you turn off lights and appliances when not in use? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Some of the time	☐
	Most of the time	☐
	Always	☐

20. Do you have any of the following insulation installed…	None	Some	Full
a) Loft insulation	☐	☐	☐
b) Cavity or other wall insulation	☐	☐	☐
c) Underfloor insulation	☐	☐	☐
d) Double glazing	☐	☐	☐
e) Draught exclusion	☐	☐	☐

21. At what temperature do you typically run your heating? If you are unsure please check your thermostat setting if you have one. *PLEASE TICK ONE BOX ONLY*	25°C (77°F) and above	☐
	21-24°C (71-76°F)	☐
	19-21°C (65-70°F)	☐
	15-18°C (59-64°F)	☐
	Less than 14°C (58°F)	☐
	No temperature / thermostat control	☐
	Don't know	☐
22. Do you have any of the following renewable technologies installed? *SELECT AS MANY THAT APPLY*	Hydro	☐
	Wood stove or boiler or biomass heating (NOT coal or peat)	☐
	Ground source heat pump	☐
	Solar hot water	☐
	Passive solar heating	☐
	Solar photovoltaic panels	☐
	Wind turbine	☐
Now some questions about your appliances…		
23. How old is your washing machine? *PLEASE TICK ONE BOX ONLY*	Less than 1 year old	☐
	1-12 years old	☐
	Over 12 years old	☐
	Don't know	☐

Figure 3.16 Fintry household questionnaire (continued)

24. At what temperature do you typically wash your clothes? i.e. the temperature that you select for the majority of your washing. *PLEASE TICK ONE BOX ONLY*	30°C 40°C 50°C 60°C 70°C 80°C 90°C	☐ ☐ ☐ ☐ ☐ ☐ ☐
25. How many times each WEEK does the washing machine run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
26. How many times each week is the tumble dryer run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
27. How many times each WEEK does the dishwasher run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
27A Which of your appliances have a high energy rating (A or above)?		

	Yes	No	Not applicable	Don't know
Washing machine	☐	☐	☐	☐
Dishwasher	☐	☐	☐	☐
Fridge	☐	☐	☐	☐
Freezer	☐	☐	☐	☐

28. How big is your garden? Please select the best description of its size. *PLEASE TICK ONE BOX ONLY*	Don't have one Balcony / terrace / patio No more than 20 feet by 20 feet Quarter of an acre Half an acre Greater than half an acre	☐ ☐ ☐ ☐ ☐ ☐
29. Do you own or rent any other land (allotment, agricultural or wild areas?) *PLEASE TICK ONE BOX ONLY*	Yes No	☐ ☐
30. Do you grow any food for your own consumption? *PLEASE TICK ONE BOX ONLY*	Yes No	☐ ☐
IF YOU SELECTED "No" TO QUESTION 30 PLEASE GO TO QUESTION 33.		
31. If yes, what proportion of your fruit and vegetables you eat are home grown? a) In summer… *PLEASE TICK ONE BOX ONLY*	None Less than a quarter A quarter Half Three-quarters All	☐ ☐ ☐ ☐ ☐ ☐

Figure 3.16 Fintry household questionnaire (continued)

b) In winter… *PLEASE TICK ONE BOX ONLY*	None	☐
	Less than a quarter	☐
	A quarter	☐
	Half	☐
	Three-quarters	☐
	All	☐
32. Do you ever produce more than you need? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐
33. How much of the food you buy is produced locally (i.e. within 100 miles of your home)? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most (more than half)	☐
	All	☐
	Don't know	☐
Now some questions about your household waste…		
34. How many GREY (general waste) buckets (wheelie bins) does your household fill in a typical fortnight? INCLUDE any general waste that you take to the local waste collection site in this calculation. DO NOT INCLUDE any waste that is recycled or composted. *PLEASE TICK ONE BOX ONLY*	The bucket is half full or less	☐
	A three-quarter full bucket	☐
	One full bucket	☐
	Two buckets	☐
	Three buckets	☐
	Four buckets	☐
	Greater than four buckets	☐

35. How much of your glass waste do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
36. How much of your paper waste do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
37. How much of your cardboard waste do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
38. How much of your plastic waste do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
39. How much of your aluminium waste (cans and foil) do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐

Figure 3.16 Fintry household questionnaire (continued)

40. How much of your steel waste (tin cans) do you recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
41. What else do you recycle? (printer cartridges, appliances, textiles) *PLEASE TICK AS MANY AS APPLY*	Printer cartridges	☐
	Appliances	☐
	Textiles	☐
	Stamps	☐
	Plastic bottle tops	☐
	Tetrapak	☐
	Mobile phones and other electronics	☐
	Other (please specify below)	☐
a) Please specify other goods you recycle….		
42. How much of your food waste do you compost? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐
42A. How much of your garden waste do you compost or recycle? *PLEASE TICK ONE BOX ONLY*	None	☐
	Some (less than half)	☐
	Most	☐
	All	☐

Here are some questions about your household's water use…		
43A Does your water come from the main water supply?	Yes	☐
	No	☐
	Don't know	☐
43B. Do you have a private water supply, a well or spring at your property?	Yes – in use	☐
	Yes – not in use	☐
	No	☐
	Don't know	☐
43. How many bathrooms does your house have? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
44. How many times a week does your shower get used? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
45. How many times a week does your bath get used? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
46. How many times a week does your toilet get flushed? *PLEASE WRITE THE NUMBER IN THE SPACE→*		
47. In a **typical summer**, do you or anyone in your household use mains water (sprinkler, hose or watering can) to water your garden or wash your car? If so, how often in a week? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Occasionally	☐
	Once a week	☐
	Twice a week	☐
	Three times a week	☐
	Four times a week	☐
	Five times a week	☐
	Daily	☐

Figure 3.16 Fintry household questionnaire (continued)

48. In **winter**, do you or anyone in your household use mains water (sprinkler, hose or watering can) to water your garden or wash your car? If so, how often in a week? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Occasionally	☐
	Once a week	☐
	Twice a week	☐
	Three times a week	☐
	Four times a week	☐
	Five times a week	☐
	Daily	☐
49. Do you have any other use of mains water that takes a lot of water? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐
a) If yes, please explain and note how often…		
50. Have you implemented a water saving device to reduce the amount of water used in flushing your toilet(s)? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐
Now some questions about your household expenditure *Please write "ZERO" or "0" if you have spent nothing.* *Please try and answer the question as best you can. If you do not know the answer, please write in your best guess for the amount. If you cannot or do not wish to answer the question, please write "don't know" in the response box.*		
51. How much does your household spend on pets and pet food in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	£	
52. How much does your household spend on telephone bills (mobile, landline and broadband) in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	£	

53. How much does your household spend on electronics (e.g. TV, computers, cameras, MP3 players and mobile phones) in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	£	
54. How much does your household spend on furniture and household furnishings in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	£	
55. How much does your household spend on power tools, DIY materials and equipment for house and garden in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	£	
The next section is about what you do personally as an individual, not your whole household. Please answer the questions about you as an individual only.		
How often do you…		
56. Buy or use second-hand clothing *PLEASE TICK ONE BOX ONLY*	Never	☐
	Sometimes	☐
	Often	☐
	Always	☐
57. Do you reuse envelopes and jiffy bags, when posting items? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Sometimes	☐
	Often	☐
	Always	☐
58. When shopping, how often do you take your own carrier bags instead of accepting new bags from a sales assistant? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Sometimes	☐
	Often	☐
	Always	☐

Figure 3.16 Fintry household questionnaire (continued)

59. How often do you share tools (e.g. power tools, vacuum cleaners, blenders, lawn-mowers) with friends and neighbours? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Sometimes	☐
	Often	☐
	Always	☐
60. How often do you take a packed lunch to work? *PLEASE TICK ONE BOX ONLY*	Never	☐
	Sometimes	☐
	Often	☐
	Always	☐
61. Do you do any of the following activities? *PLEASE TICK AS MANY AS APPLY*	Take showers instead of baths	☐
	Recycle bath water e.g. for watering plants	☐
	Wait until the washing machine is full before running the wash-cycle	☐
	Wait until the dish-washer is full before running the wash-cycle	☐
	Collect rain water for watering plants in the garden	☐
	None of these	☐

Now for some questions about your food… about what you eat personally each week		
62. Thinking of all the meals you have in a week, please can you count how often you eat meat or fish at each meal in a week? Please enter the number of times you have meat and fish in a week… *PLEASE WRITE THE NUMBER IN THE SPACE↘*		
a) AT BREAKFAST…		
b) AT LUNCH-TIME…		
c) AT TEA / EVENING MEAL…		
63. What proportion of your fruit and vegetables are organic? *PLEASE TICK ONE BOX ONLY*	None	☐
	A quarter	☐
	Half	☐
	Three-quarters	☐
	All	☐
64. What proportion of the dairy products you consume is organic? *PLEASE TICK ONE BOX ONLY*	None	☐
	A quarter	☐
	Half	☐
	Three-quarters	☐
	All	☐
65. Now consider all the other food you eat, what proportion of this is organic? *PLEASE TICK ONE BOX ONLY*	None	☐
	A quarter	☐
	Half	☐
	Three-quarters	☐
	All	☐

Figure 3.16 Fintry household questionnaire (continued)

66. In a typical week, how many meals do you eat out in one week? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
Now some questions about your transport. Remember this is for your yourself	
67. For most of the journeys which you travel by car, how many people are in the car? *Please include yourself in this number.* *E.g. if you travel alone please write 1 in the box. If you travel alone half the time and half the time with someone, please write 1.5 in the box.* *DO NOT INCLUDE CHILDREN.* *PLEASE WRITE THE NUMBER IN THE SPACE→*	
68. What type of car do you travel in most often? *PLEASE TICK ONE BOX ONLY*	Small diesel ☐ Small petrol ☐ Medium diesel ☐ Medium petrol ☐ Large diesel ☐ Large petrol ☐ Other – (please specify) ☐
a) If other type of car: *PLEASE SPECIFY*	
69. How many miles do you travel by car each YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
70. In a typical WEEK, how many miles do you travel by bus? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
71. In a typical WEEK, how many miles do you travel by train? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
71B. In a typical WEEK, how many miles do you walk? *PLEASE WRITE THE NUMBER IN THE SPACE→*	

71C. In a typical WEEK, how many miles do you travel by cycle? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
72. How many miles IN THE YEAR that you travel by car could feasibly be done by public transport, bicycle or walking? *PLEASE WRITE THE NUMBER IN THE SPACES BELOW↘*	
a) Public transport	
b) Bicycle	
c) Walking	
73. How many return flights have you taken in 2007 that are to destinations in the UK? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
74. How many return flights have you taken in 2007 that are to destinations in Europe? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
75. How many return flights have you taken in 2007 that are to destinations elsewhere in the world? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
This next section is about what you have bought recently. Thinking over the last year, how much have you spent on consumer goods in a typical month…Remember this is for you not your household. *Please write "ZERO" or "0" if you have spent nothing.* *Please try and answer the question as best you can. If you do not know the answer, please write in your best guess for the amount. If you cannot or do not wish to answer the question, please write "don't know" in the response box.*	
76. How much do you spend on cigarettes and tobacco in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
77. How much do you spend on cultural activities in a MONTH? (e.g. theatre, museums, cinema, etc.) *PLEASE WRITE THE NUMBER IN THE SPACE→*	
78. How much do you spend on sporting events in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	

Figure 3.16 Fintry household questionnaire (continued)

79. How much do you spend on betting and the lottery in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
80. How much do you spend on soaps, shampoo, make-up, shaving products, toothpaste, etc. in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
81. How much do you spend on newspapers, books and stationery in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
The next few questions relate to your annual spend. Again, this if for you as an individual.	
82. How much do you spend on clothing in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
83. How much do you spend on footwear in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
84. How much do you spend on equipment for sports, games and hobbies in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
85. How much do you spend on jewellery, clocks and watches in a YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
About your interests and activities…	
How often would you do each of the following? At least…	
86. Actively take part in sports or games *PLEASE TICK ONE BOX ONLY*	Most days ☐ Twice a week ☐ Once a week ☐ Once every 2 weeks ☐ Once every month ☐ Less often ☐ Never ☐

87. Go to a keep fit class or the gym *PLEASE TICK ONE BOX ONLY*	Most days ☐ Twice a week ☐ Once a week ☐ Once every 2 weeks ☐ Once every month ☐ Less often ☐ Never ☐
88. Go out walking in the countryside *PLEASE TICK ONE BOX ONLY*	Most days ☐ Twice a week ☐ Once a week ☐ Once every 2 weeks ☐ Once every month ☐ Less often ☐ Never ☐
89. Do active outdoor pursuits such as hiking, horse riding or cycling *PLEASE TICK ONE BOX ONLY*	Most days ☐ Twice a week ☐ Once a week ☐ Once every 2 weeks ☐ Once every month ☐ Less often ☐ Never ☐

Figure 3.16 Fintry household questionnaire (continued)

90. Go hunting, shooting or fishing *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
91. Do gardening *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
92. Do voluntary, charity or community work	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐

93. Go to a film, concert or theatre or visit a museum or something similar *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
94. Socialise with friends *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
95. Drive in the countryside for pleasure *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐

Figure 3.16 Fintry household questionnaire (continued)

96. Go to a community event or local club, or participate in community activities *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
97. Shop on-line or surf the web *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
98. Go shopping for clothes or other goods *other than* food *PLEASE TICK ONE BOX ONLY*	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐

99. Go to a sporting event	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
100. Do environmental conservation work	Most days	☐
	Twice a week	☐
	Once a week	☐
	Once every 2 weeks	☐
	Once every month	☐
	Less often	☐
	Never	☐
101. In a typical week, how many hours per week do you watch TV? *PLEASE WRITE THE NUMBER OF HOURS IN THE SPACE→*		

Figure 3.16 Fintry household questionnaire (continued)

Now some questions about you and your community…		
102. Overall how satisfied are you with how local decisions are made in your community? *PLEASE TICK ONE BOX ONLY*	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐
	Don't know	☐
103. Do you agree or disagree that you can influence decisions affecting your local community? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
104. Taking all things into consideration, how satisfied do you feel with your life? Please rate your happiness on a scale of 1 to 10 with 10 being "very happy" and 1 being "very unhappy". *PLEASE TICK ONE BOX ONLY*	Very happy 10	☐
	9	☐
	8	☐
	7	☐
	6	☐
	5	☐
	4	☐
	3	☐
	2	☐
	Very unhappy 1	☐

105. What is the highest qualification you have obtained, either while at school or gained after you left school? *PLEASE TICK ONE BOX ONLY*	None	☐
	School Leaving Certificate	☐
	O Grade, Standard Grade, GCSE, CSE, Senior Certificate or equivalent	☐
	GCE 'A' level/'S' level / Higher School Certificate / CSYS / Advanced Senior Certificate or equivalent	☐
	GSVQ Foundation or Intermediate, City and Guilds Matriculation, SVQ Level 1 or 2, SCOTVEC Module or equivalent	☐
	Scottish SCE/SLC/SUPE Higher	☐
	GSVQ Advanced, SVQ Level 3, ONC, OND, SCOTVEC National Diploma, City & Guilds Advanced/Final level/Part II or III or equivalent	☐
	HNC, HND, City & Guilds Full Technological Certificate, VQ Levels 4 or 5 or equivalent	☐
	RSA/Other clerical and commercial	☐
	Nursing qualification	☐
	Professional qualification (membership awarded by professional institute)	☐
	Degree, including higher degree	☐
	Other technical or business qualification/certificate	☐

Figure 3.16 Fintry household questionnaire (continued)

106. Are you in paid or unpaid employment? *PLEASE TICK ONE BOX ONLY*	Yes	☐
	No	☐
If your answer to the previous question was "No" please go to question 108…		
107. Overall, thinking about your working life, how satisfied are you with your job? *PLEASE TICK ONE BOX ONLY*	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐
107A On a typical day, how far do you travel to reach your place of work? (ie one way)? *PLEASE WRITE THE NUMBER OF MILES IN THE SPACE→*	miles	
107B In a typical week, whilst you are at work, how many miles do you travel by motor vehicle or plane to carry out your job? *PLEASE WRITE THE NUMBER OF MILES IN THE SPACE→*	miles	
107C Please describe the nature of your work and your job…		
108. How long have you lived in Fintry? *PLEASE WRITE THE NUMBER IN THE SPACE→*	Years	
109. Overall, how satisfied or dissatisfied are you with this area as a place to live in? *PLEASE TICK ONE BOX ONLY*	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐

110. Taking everything into account, would you say that during the last two years this area has got a better place to live in, got worse or remained about the same? *PLEASE TICK ONE BOX ONLY*	Better	☐
	Worse	☐
	About the same	☐
	Don't know	☐
111. Over the next few years, would you expect this area to get better as a place to live in, get worse or remain about the same? *PLEASE TICK ONE BOX ONLY*	Better	☐
	Worse	☐
	About the same	☐
	Don't know	☐
Please say whether you disagree or agree with the following statements: *PLEASE TICK ONE BOX ONLY FOR EACH STATEMENT*		
112. "On the whole my life is close to how I would like it to be"	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
113. "I feel close to the people in my local area"	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐

Figure 3.16 Fintry household questionnaire (continued)

114. "There are people in my life who really care about me"	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
115. "Most days I feel a sense of accomplishment from what I do"	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
116. Do you buy any of the following 'environmentally friendly' products rather than alternatives which are not environmentally friendly? *PLEASE TICK AS MANY BOXES AS APPLY*	Recycled paper or envelopes	☐
	Recycled toilet roll, kitchen paper, aluminium foil, etc.	☐
	Environmentally friendly washing powders/liquids and household cleaners that are kinder to the environment	☐
	Environmentally friendly paints, glues and varnishes	☐
	Other - specify	☐
	None of these	☐

a) If *other*, please specify		
117. Do you agree or disagree that most people in Scotland today need to change their way of life so that future generations can continue to enjoy a good quality of life and environment? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
118. Do you agree or disagree that you personally need to change your way of life over the next few years, so that future generations can continue to enjoy a good quality of life and environment? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
119. As far as you know, do you personally think the climate is changing and, if so, are human actions responsible? *PLEASE TICK ONE BOX ONLY*	Yes, I think the climate is changing but humans are not responsible	☐
	Yes, I think the climate is changing and humans are partly responsible	☐
	No, I do not think the climate is changing	☐
	Don't know	☐

Figure 3.16 Fintry household questionnaire (continued)

120. Overall, how do you feel about climate change? *PLEASE TICK ONE BOX ONLY*	Very good thing	☐
	Fairly good thing	☐
	Neither good/nor bad thing	☐
	Fairly bad thing	☐
	Very bad thing	☐
	Don't Know	☐
121. Which, if any, of the following statements most closely describes your own opinion about taking action against climate change? *PLEASE TICK ONE BOX ONLY*	Every possible action should be taken against climate change	☐
	Some action should be taken against climate change	☐
	No action should be taken against climate change	☐
	None of these	☐
	Don't know	☐
122. To help us plan better in future, please tell us about how long it took you to complete this questionnaire.	Minutes	
123. And just a few details about yourself. Are you: *PLEASE TICK ONE BOX ONLY*	Female	☐
	Male	☐
124. What was your age last birthday? *PLEASE WRITE THE NUMBER IN THE SPACE→*		

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

IF YOU HAVE ANY FURTHER COMMENTS, QUERIES OR SUGGESTIONS, PLEASE DO NOT HESITATE TO CONTACT THE AUTHOR, THE CONTACT DETAILS OF WHOM ARE SHOWN ON THE FRONT PAGE

UNIVERSITY OF STIRLING

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

Figure 3.16 Fintry household questionnaire (continued)

Table 3.8 Question sources for the questionnaire

Fintry question number (QFintry)	Adapted from	Source
1, 2, 6-55, 62-85	Prototype questionnaire developed for RP	SEI, 2007a, 2007b, 2007c
3, 61, 86-100, 116-118	A Survey of Knowledge and Attitudes to the Environment in Scotland (QH7C, QG14, QH5, QG16, QSD3 and QSD4)	Barber *et al.*, 2005
4, 67, 109-111	Quality of Life Survey	Stirling Council, 2007
5, 101-102, 106-107, 123-124	Self-design	N/A
56-60	Self-design for EFBS scale	N/A
103	People, Families and Communities Survey 2005	ESDS, 2005a
104, 112-115	European Social Survey (ESS), 2006 (QC1, QE7, QHS12, QHS11 and QHS8 The statement '*I love learning new things*' was not used based on advice from Nic Marks (*pers. comm.*) as it showed no variance in his surveys.	ESS, 2006a, 2006b
105	Health and Lifestyle Survey 1991	ESDS, 2005b
108	Community Attitudes Survey 1992/93 (Q2-5)	ESDS, 2005c
119-121	Climate change survey	Spence, 2008
122	British Social Attitude Survey 2005	ESDS, 2005d

Table 3.9 Measured REAP FDCs for consumables and private services (SEI, 2011a)

FDCs measured in questionnaire	FDCs not measured and populated with REAPv2.17 data (SEI, 2011a)
Consumables	
Tobacco	Textiles
Clothing	Household appliances
Footwear	Glassware and household utensils
Furniture and furnishings	Medical products, appliances & equipment
Garden equipment and household tools	Telephone & telefax equipment
Audio-visual & photo processing equipment	Items for recreation and culture (major durables)
Other recreational equipment	Non-residents expenditure in the UK[1]
Newspapers, books & stationery	UK residents spending abroad (on holiday or business)[2]
Personal care.	
Jewellery and personal items.	
Private Services	
Telephone & telefax services	Water (utilities)
Recreational & cultural services	Out-patient services
	Hospital services
	Postal services
	Education
	Accommodation services
	Social protection
	Insurance
	Financial Services
	Other business services
	Other voluntary organisations serving UK households

[1]This value was deducted from the total EF
[2]This was value was zero as the values were not stored within REAPv2.17

whether the age and gender profile of the respondents matched that of the population, as defined in the 2001 Census (SCROL, n.d.). The author decided not to collect income data to encourage participants to respond more openly to the other questions.

The Fintry questionnaire (Figure 3.16) underwent minor revisions for Kinlochleven and Killin (Appendix A.1). Questions were: deleted due to poor variance (Q87-Q100Fintry) or duplication (Q5Fintry); amended for grammar or clarity, without compromising integrity and comparability; or added due to enhancements in REAP (e.g., ferry usage, Q67Kinlochleven).

3.3.2.1 Scales

Three scales were used within the questionnaire: one for life satisfaction and two for pro-environmental behaviour (EFBS and EFPS). Statements from the European Social Survey (ESS), Round 3, 2006 were used to create a life satisfaction scale (ESS, 2006a, 2006b). Respondents were asked to state their level of agreement with the statements specified in questions Q112-Q115Fintry (Figure 3.16) on a scale of strongly disagree to strongly agree. The responses were coded on a scale of 1 to 5 and were consolidated to produce a life satisfaction scale (1-5, 1 being the least satisfied and 5 the most satisfied).

An environmentally friendly behaviour scale (EFBS) was made from combining responses to the Likert-style questions Q19Fintry and Q56-Q59Fintry (Figure 3.16). The maximum score was 10 (for answering "*always*" to all five questions) and minimum 0 (for answering "*never*" to all five questions).

An environmentally friendly purchasing scale (EFPS) was made from combining responses to the Likert-style question Q116Fintry (Figure 3.16). For each “yes” response, a score of one was added to the composite scale. The maximum was 5. This was adjusted to give a scale 1-10 to allow comparison with the EFBS scale.

3.3.3 Household questionnaire data gathering

Appropriate geographical boundaries, relevant postcodes and households were identified using Edina’s Digimap (EDINA, 2008, 2010), COAs (SCROL, n.d., Scottish Government, 2010b) and the Post-office postcode finder (Royal Mail, n.d.). This was supplemented by the electoral roll for Kinlochleven (The UK Electoral Roll, 2010). For Killin, a list of addresses, used by Killin Cutting Carbon for their community insulation project, was provided by Willie Angus (2011). Households were selected by allocating a random number. The sample size and the dates of data collection are shown in Table 3.10. An individual respondent was selected randomly from within each household using a method similar to that of the Scottish Centre for Social Research for the Family Resources Survey (Sue Harley, *pers. comm*., July, 2007). The initials of all members (aged 17 and over) of a household were requested, placed in order and then one selected using a random number list. The selected respondent was offered a choice of completing the questionnaire on-line or by self-completion and return in a pre-paid envelope. In a small number of cases the response was obtained by structured interview, on the request of the respondent. The internet questionnaire was a replica of the hard-copy.

For Fintry, 156 households were selected randomly from 308 domestic addresses identified. For Kinlochleven, the sample was 187 out of the 533 households identified. 123 of the 187 selected households had respondents selected in advance of visiting the community using the electoral register (not all residents were on the electoral roll). The selected respondents were contacted by letter containing the questionnaire with the aim of improving the efficiency of questionnaire distribution. However, the response rate was poor and not repeated in Killin. The remaining 64 households were approached in person, using the same method as Fintry. In Killin, households were selected from the 426 households identified (Angus, 2011). The hamlet of Ardeonaig and farms along the north shore of Loch Tay (e.g., Tombreck) were excluded from this analysis, due to the distance from the centre of Killin.

An introductory letter was sent to each community to introduce the researcher and advise them of an impending visit. This was followed within a fortnight by a house call. This enabled the researcher to revisit properties from where no response had been received. Address details and the answer sheet responses were stored separately, so the responses remained anonymous.

Table 3.10 Community household data collection dates and sample sizes

Community	Dates data collected	Number of households	Initial sample size	Sample as percentage of total
Fintry	Apr–Jul 2008	306	156	51%
Kinlochleven	May–Aug 2010	533	187	35%
Killin	Jun–July 2011	426	149	35%

All selected and found (a very small number of properties could not be located) houses were approached at least twice, in order to maximise the opportunity for the occupier to be in residence. Most of the properties where no response was obtained were approached at least four times.

3.3.4 Questionnaire and data evaluation

In this section, the validity of the sample data as representing the case study communities is assessed. The assessment of the representativeness of the sample data showed bias in gender and age, so sample data was weighted to reflect better the demographic profile of the populations (discussed in section 3.3.4.3).

3.3.4.1 Data assessment methodology

The demographic data (gender, age and level of education achievement) collected in the household questionnaire was used to test whether the data collected represented the community. Results of selected responses to both household and individual questions were analysed in MS-Excel 2010, IBM SPSS Statistics version 19.0.0 and MINITAB Release 14 Statistical Software. The non-parametric Kruskal-Wallis test (Rogerson, 2001) and Chi-square (χ^2) test (for ordinal data with unequal categories, Siegel, 1956) were used to test for differences between responses according to demographic grouping. All χ^2 results quoted have a minimum expected cell count of greater than 1 and less than 20% of cells, which have an expected frequency of less than 5 (Siegel, 1956). For scales, such as the well-being and life satisfaction variables, Spearman's rho was used to identify correlations (Rogerson, 2001, Howell, 2012).

The probability of less than a 5% chance of the results occurring by chance (*$p<0.05$*) was assumed to be significant (Rogerson, 2001). In these instances, the null hypothesis of no significant difference or no correlation (as appropriate) was rejected. Where a value of *$p<0.05$* is quoted, the results are assumed to be significant. Adjustments to data to allow for unequal sample sizes (for example, where the gender and age profile of the experimental data differs from that in the general population) are described in section 3.3.4.3.

3.3.4.2 Household questionnaire response analysis

An analysis of the household questionnaire responses is presented in this section to investigate whether the data is a representative sample.

3.3.4.2.1 Fintry

Out of the 156 households approached, 20 (13%) were vacant, holiday homes or not found. This reduced the sample size to 136 (Table 3.11) and represented 44% of the households in the community. 19 residents refused to participate (14% of the revised sample). 79 responses were received, which equates to 26% of households in the community and which gives a 59% response rate for the sample. This response rate is good, suggesting that the responses should be a reasonable representation of the population (Gillham, 2000).

3.3.4.2.2 Kinlochleven

The survey process was slightly different for Kinlochleven. The aim of this was to improve the efficiency of questionnaire distribution. Due to the remoteness of the location, the electoral roll was used to reduce time in the field. 123

individuals selected from the electoral roll were contacted by letter with the questionnaire. The remaining 64 households were approached in person, as the residents of these households were not on the electoral roll. The response from selected individuals that returned posted questionnaires was slow and so the researcher followed-up missing questionnaires as part of the door-to-door survey of the remaining 64 households. Talking to residents, 17 (14%) of the selected individuals that should have received the questionnaires claimed that they never did (i.e. that the questionnaire was not delivered the post) and 14 questionnaires (11%) were either returned to the researcher with the wrong name (i.e. not at this address) or marked deceased, or were identified by the resident on calling at the property to have the wrong name.

Table 3.11 Summary of the response analysis

	Fintry	Kinlochleven[1]	Killin
Total number of households in case study	308	533	426
Sample size	156	187	149
Number of vacant homes / not found	20	53	54
Revised sample size	136	134	95
Number respondents too infirm to respond / unsafe	0	14	2
Number of refusals	19	20	6
Number of responses received	79	50	44
Percentage of responses received using the internet	29%	8%	0%
Responses as a percentage of the whole community	26%	9%	10%
Responses as a percentage of the revised sample	59%	37%	46%

[1]One respondent within Kinlochleven left all the responses relating to the calculation of the EF blank but did complete the attitudinal questions. This response was included in the response analysis, as deleting it also gave a response rate of 37% as a percentage of the revised sample.

Out of the 187 selected households identified, 53 (28% of the original sample) were vacant, holiday homes or not found. This reduced the sample size to 134. A further 12 residents were considered unable to participate due to infirmity or illness and a further two properties were not approached due to concerns over the researcher's safety (Table 3.11). The revised sample size represented 25% of the households in the community. In total 20 residents refused to participate (15% of the revised sample) and 50 responses were received, giving a 37% response rate for the sample, which is not ideal but not totally unsatisfactory (Gillham, 2000, states that response rates of less than 30% as unsatisfactory). This equates to 9% of the total number of domestic households in the community. This figure is much lower than in Fintry, because a larger proportion of households are vacant or holiday properties (28% of the sample were vacant, unsafe or not found compared to 12% in Fintry, Table 3.11).

3.3.4.2.3 Killin

Out of the 149 households approached, 54 (36%) were vacant, holiday homes or not found (Table 3.11). Six residents refused to participate. 44 responses were received, giving a 46% response rate, which is satisfactory (Gillham, 2000). This equates to 10% of households in the community. This figure is much lower than in Fintry, because a larger proportion of households are vacant or holiday properties (36% of the sample households were vacant or not found compared to 12% in Fintry, Table 3.11). No respondent used the internet to make a response.

3.3.4.2.4 Implications for the representativeness of the data

The response rate from Fintry was exceptionally good (59%), but the response rates of Kinlochleven (37%) and Killin (46%) were disappointing, especially given the number of questionnaires handed out being similar to Fintry. For Kinlochleven, there could be a number of factors affecting this, such as suspicion of outsiders, which might relate to the higher crime rates, low social capital, increased deprivation, high levels of serious illnesses, some properties acting as refuges for victims of domestic abuse (*anon. pers. comm*., July 2010) and a significant proportion of empty homes. The large number of vacant properties was not anticipated in both Kinlochleven and Killin. This reduced the number of properties that could be included in the sample substantially. Moreover, 11% of Kinlochleven questionnaire letters sent to named selected respondents were returned to sender, suggesting that there is a significant turnover of residents (wrong address or deceased) and a failure to update the electoral roll.

Killin's relatively low response rate was unexpected given its higher social capital and may have been a result of survey fatigue. In the previous six months residents had experienced two other door-to-door surveys and the Killin Action Plan community-wide consultation.

Almost a third (29%) of Fintry respondents used the internet web survey in preference to the paper survey response. In Kinlochleven only 8% of responses used the internet and none in Killin. The increased reluctance to use the internet may be a result of a number of factors, for example, poor internet connectivity, (especially, in more remote areas of Killin), poor access to computers, and lower internet use and capability.

As the responses to the questionnaire form only a sample of each community, the response rates give an indication of likely representativeness, which was good for Fintry and satisfactory for Killin. However, Killin had a low number of total responses, which means that the chances of capturing a fully representative sample are less. Kinlochleven had a bigger sample size, but much lower response rate. The respondent size was large enough to enable EF calculations and undertake sustainability assessments for each case study, but to ensure the samples were demographically representative the demographic profiles of these samples were compared to those of the 2001 Census.

3.3.4.3 Household questionnaire demographic analysis

On comparison of the sample age and gender profiles with the 2001 Census (SCROL, n.d.) some significant differences were found and this has led to weighting of the experimental data to remove bias (SCROL, n.d., Table 3.12). Four key demographic groups were identified: working age females (16-64f), working age males (16-64m), retired females (65+f) and retired males (65+m). In all three communities, 16-64m is under-represented and 65+f is over-represented compared to the 2001 Census (Table 3.13). In Fintry, 65+m is also over-represented compared to the 2001 Census (SCROL, n.d.).

Using the χ^2 test (Siegel, 1956), a significant difference (p<0.01) was found between the age/gender profile of the combined sample and the combined 2001 Census populations (SCROL, n.d.), and, the age/gender profile of the Fintry sample compared to the Fintry 2001 Census data (p<0.01, Table 3.14). For Kinlochleven and Killin, no significant difference may have been a result of the smaller sample sizes having less power to reject the null hypothesis (Type II error, Howell, 2012).

Table 3.12 Comparison of gender and age with 2001 Census (SCROL, n.d.)

	Questionnaire survey			2001 Census		
Gender	*Male*	*Female*	*N*	*Male*	*Female*	*N*
Fintry	44%	56%	79	49%	51%	583
Kinlochleven	35%	65%	49	47%	53%	750
Killin	30%	70%	43	47%	53%	651
Age	*16-64*	*65+*	*N*	*16-64*	*65+*	*N*
Fintry	61%	39%	79	77%	23%	583
Kinlochleven	65%	35%	49	73%	27%	750
Killin	62%	38%	42	71%	29%	651

Table 3.13 Comparison of sample and 2001 Census population by age/gender categories (SCROL, n.d.)

Case study	Age/gender category	Sample frequency	Census frequency	Percentage of sample	Percentage of Census
Fintry	16-64f	30	227	38%	39%
	16-64m	18	219	23%	38%
	65+f	14	73	18%	13%
	65+m	17	64	22%	11%
	Total	79	583	100%	100%
Kinlochleven	16-64f	20	263	41%	35%
	16-64m	12	286	24%	38%
	65+f	12	132	24%	18%
	65+m	5	69	10%	9%
	Total	49	750	100%	100%
Killin[1]	16-64f	16	231	38%	35%
	16-64m	10	228	24%	35%
	65+f	13	113	31%	17%
	65+m	3	79	7%	12%
	Total	42	651	100%	100%

[1] Two respondents failed to specify their age.

Table 3.14 Results of χ^2 tests comparing sample age/gender category distributions with the 2001 Census (SCROL, n.d.)

Sample	Pearson χ^2	df	*p*	N (Sample)	N (2001 Census)
Fintry	12.011	3	0.007*	79	583
Kinlochleven	3.986	3	0.263	49	750
Killin	6.361	3	0.095	42	651
All	14.933	3	0.002*	170	1,984

*Significant at the 99% confidence level (Siegel, 1956, Rogerson, 2001).

An analysis of responses to key variables in the questionnaire by these age/gender categories found some significant differences (for example, working age males had on average higher car mileage than retirement age females), implying that weighting of the variable responses is required to adjust for this bias. Bias for responses by the level of educational achievement was inconclusive as educational achievement varied by age and gender (e.g., over 65 females generally had no qualifications) and adjustment of the data (i.e. weighting) was discounted.

Quantitative variables were weighted by age and gender to adjust for bias in the demographic profile of respondents, using the working age/retirement age and gender ratios of the 2001 Census population to create weighting factors for each age/gender category (WF^{cat}, Table 3.15). To account for missing data and zero values, WF^{cat} was adjusted for each individual variable (Table 3.16).

Table 3.15 Weighting factor calculation for gender and age categories using 2001 Census gender and age profiles (SCROL, n.d.)

	Percentage of population				Weighting factor (WF^{cat})	
	Sample		2001 Census			
Age Range	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Fintry						
16-64	38%	23%	39%	38%	1.03	1.65
65 and over	18%	22%	13%	11%	0.71	0.51
Kinlochleven						
16-64	41%	24%	35%	38%	0.86	1.56
65 and over	24%	10%	18%	9%	0.72	0.90
Killin						
16-64	38%	24%	35%	35%	0.93	1.47
65 and over	31%	7%	17%	12%	0.56	1.70

The increase in total EF on weighting is 6% for Fintry and 4% for Kinlochleven and Killin (section 3.2.1), which is within the margins of error. Apart from the total EF, all results in Chapter Four report weighted values for quantitative variables.

Explanations for changes in value of more than 25% on weighting (Table 3.16) are given in the following three sections.

Table 3.16 The effect of age/gender weighting on key variables

	Percentage change in mean value on weighting		
Variable	**Fintry**	**Kinlochleven**	**Killin**
Transport			
Baseline Car PKMS	11%	7%	8%
Local bus PKMS	-5%	-19%	-17%
Train PKMS	-17%	N/A[1]	N/A[1]
Walk PKMS	15%	1%	-2%
Cycle PKMS	24%	15%	23%
Domestic air PKMS	51%	6%	49%
International air PKMS	22%	19%	21%
Car occupancy	-5%	2%	1%
Car efficiency	1%	-5%	-2%
Ferry PKMS	N/A[2]	-22%	N/A[1]
Household energy consumption			
Electricity	0%	5%	-7%
LPG	4%	21%	-28%
Oil	-10%	1%	33%
Coal	3%	15%	2%
Consumables			
Tobacco	6%	-6%	5%
Clothing	11%	1%	8%
Footwear	8%	2%	7%
Furniture, furnishings, carpets	20%	-3%	18%
Tools and equipment for house and garden	13%	13%	22%
Audio visual, photo and information processing equipment	8%	13%	33%
Other recreational items and equipment	44%	12%	33%
Newspapers books and stationery	3%	1%	-2%
Personal care	10%	-3%	0%
Personal effects	32%	11%	62%
Private services			
Telephone and telefax services	0%	-4%	4%
Recreational and cultural services	11%	53%	63%

PKMS = Passenger kilometres
[1]The transport PKMS was zero.
[2]Not measured.
The number of respondents in each age/gender group for each variable is in Appendix B.1

Categorical variables could not be weighted across the four groups due to low responses in certain categories. Weighting by gender was not done because there was little variation by gender and weighting would have required Likert-style response categories for attitudinal questions to be combined, which would not have yielded meaningful results for certain question responses (e.g., QFintry119-121).

3.3.4.3.1 *Fintry*

Although the response rate was good, the 65+m age/gender group is significantly over-represented in the Fintry sample. The percentage of respondents in this age group is double that found in the 2001 Census (Table 3.15, SCROL, n.d.). This has made a significant impact on the average values of the variables when the variables are weighted. For Fintry, domestic air travel, other recreational items and equipment and personal effects all have a change greater than 25%.

Domestic air travel increased by 51% on weighting. Three respondents made more than 10 domestic flights per year. These were all in the working age male category and therefore incurred the greatest weighting. Many white collar jobs require domestic air travel and this is reflected in the amount of air travel for male working respondents in this largely commuter community. Only three respondents aged 65 and over made domestic flights and the maximum in the year was three flights. Given the time available to pensioners to use alternative means of transport, reduced need to travel for work and the greater expense of flying, this is not surprising. However, only one respondent in this age group reported travelling by train. This may be a facet of the question and is discussed in Chapter Five, or due to lack of trains, as none of the communities are connected by rail. However, the amount of flying may be an over-estimate for those in employment, because the questionnaire did not differentiate between flying on business and flying for commuting or personal travel. If any respondent included business travel by air in their response for the number of flights they made, then the EF would be an over-estimate.

The FDC "*other recreational items and equipment*" is classified by SEI as expenditure on "*pets and pet food*" and "*equipment for sports, games and hobbies*" (SEI, 2011a). Of the eleven respondents that stated that they spent £400 or over per year on equipment for sports, games and hobbies, nine of them were of working age, which attracted the highest weighting factors. Similarly, four out of five respondents, who stated they spent £400 or over on pets and pet food in a year, were of working age. SEI classifies "*personal effects*" as expenditure on "*jewellery, clocks and watches*". Fifty respondents stated they had no expenditure on these items. All three respondents with expenditure of over £400 were of working age. No respondent of retirement age stated they spent more than £50 per year on personal effects. Higher expenditure in these consumption categories is expected for working age people as they likely to be more active and have greater disposable income. Having both weighted and unweighted EF results gives an idea of the likely range between which the true EF lies.

3.3.4.3.2 Kinlochleven

Despite a greater disparity between the number of respondents of working age and those retired, there were less significant changes in the mean values of the quantitative data variables. For Kinlochleven, ferry travel had a change of 22%. Only two respondents stated they travelled by ferry and one made regular long distance trips by ferry. Both respondents were retirement age females. A weighting factor of 0.79 was applied to both responses, significantly reducing the value of each response. The amount of ferry travel is likely to be under-estimated for the whole community because of the question wording as discussed in Chapter Five.

The FDC "*recreational and cultural services*" increased by 53% on weighting. SEI (2011a) defined "*recreational and cultural services*" as expenditure on "*cultural activities*", "*sporting events*" and "*betting and the lottery*". The six respondents, who stated they spent more than £400 per annum in any one of these areas, were all of working age. The weighting factor towards these working males (three of the six respondents) was particularly high at 1.5 and still increased the mean for the three variables despite the female weighting factor being 0.85. However, the majority of respondents were retired females (WF^{cat}=0.74), all of whom had zero expenditure for cultural activities and sporting events.

3.3.4.3.3 Killin

Numerous variables had changes greater than 25%. This is not unexpected given the smaller sample size and increased disproportionality in gender and age categories compared to the 2001 Census. 65+males were particularly badly under-represented in this sample with only three respondents and for some variables one of the three failed to make a response. This means that of the three communities, Killin's results are likely to be the least reliable, as a representative sample of the total population.

The FDCs "*domestic air PKMS*", "aud*io visual, photo and information processing equipment*", "*other recreational items and equipment*", "*personal effects*" and "*recreational and cultural services*" all have a change greater than 25% (Table

3.16). Six respondents undertook domestic air travel; two were in the 16-64f group (WF^{cat}=0.89) and four in 16-64m (WF^{cat}=1.56).

All retirement age females (65+f, WF^{cat}=0.69) stated they had zero expenditure on electrical appliances (TVs, computers, mp3 players and mobile phones), whilst of the ten 16-64m respondents (WF^{cat}=1.25) only one had no expenditure, one did not disclose his expenditure and the remainder spent between £100 and £2000 per annum. The significant change in "*personal effects*" expenditure (62%) can simply be attributed to the low value of the unweighted mean (£6 per annum) and that only six respondents stated they spent money on personal effects. The significant change in "*recreational and cultural services*" can be attributed to the zero expenditure on "*cultural activities and sporting events*" by the largest group, 65+females, and only one 65+female had any spending on betting and the lottery (a small £12 per annum compared to the average of £69 per annum).

Only eleven respondents stated they consumed LPG; ten of these specified the amount they consumed; two of these stated they consumed both LPG and oil (LPG consumption was small compared to oil which was the primary fuel). Twelve respondents stated they consumed oil. The significant changes in the average LPG and oil consumption must be a result of the exclusivity of the consumption of these fuels in the majority of cases.

3.3.4.3.4 Summary of demographic analysis and impact on sustainability assessment

Despite the use of a random selection process for respondents in households, (to capture the activities of those not at home rather than the home-worker), there was a bias in that males of working age (the 16-64m group) are under-represented. This may have been a result of lack of personal contact with the respondent when questionnaires were left. In Kinlochleven, two specific properties (with working age males as the sole occupier) were avoided for safety reasons, based on advice from respondents and members of the community, further reducing the responses from the 16-64m group.

The demographic bias in the samples did not make a material difference to the overall assessment of sustainability, namely whether the community on any aspect is scored red, amber or green. If the research was to be repeated in the future when the EF is much lower, data bias is likely to be more important as the variation in response by demographic group may have a greater bearing on the overall assessment of sustainability.

3.3.4.4 Scale assessments

The validity of the three scales used in the questionnaire (life satisfaction, EFBS and EFPS, see section 3.3.2.1) was analysed. The life satisfaction scale was assessed for validity by comparing responses to the scale with responses to the question on self-reported happiness (Q104Fintry: "*Taking all things into consideration, how satisfied do you feel with your life? Please rate your happiness on a scale of 1 to 10 with 10 being "very happy" and 1 being "very unhappy*").

The life satisfaction scale was found to correlate with self-reported happiness (1-10, 1 being the most unhappy and 10 the most happy), using Spearman's rho (Spearman r_s=0.531, p<0.001 (2-tailed) and N=170), confirming that the responses forming the life satisfaction scale and the responses to the self-reported happiness question are valid (Marks, N., *pers. comm*., Kline, 1986). This strongly suggests that responses to the life satisfaction scale and self-reported happiness were not a reflection of how the respondents were feeling on the day, but on the whole reflects their general happiness and life satisfaction.

The two scales (EFBS and EFPS) were found to correlate with one another, using Spearman's rho (r_s=0.437, p<0.001 (2-tailed) and N=173), suggesting that they are valid measures of environmentally friendly consumption behaviour.

3.4 Envisioning sustainability

The fourth objective of this study was participatory envisioning of future states to identify the community's vision of sustainability (Table 3.1). This participatory method filled a gap in knowledge (what are community visions of sustainable rural communities in the scenario of a resource-constrained future). In addition, where possible and appropriate, the focus group discussion was used: to inform qualitative aspects of the baseline sustainability assessment (Table 3.6); identify community priorities for change; in theory represent the first step in the process towards transition to more sustainable communities (see section 2.1.5.2); inform the development of options for sustainable rural communities; and contribute to the development of policy recommendations. Nine community focus groups were held: two in Fintry; four in Kinlochleven; and three in Killin. Volunteers were recruited by letter, local advertisements and by approaching local community groups (the latter for Killin only). In Kinlochleven secondary school pupils also participated (this was confined to Kinlochleven as the only village with a secondary school).

Each focus group had three core parts within the agenda (Table 3.17). The first session sought to understand the priorities of the present, where participants were asked to identify the key challenges for the community and what needed to be done to address these issues. The second part was an envisioning exercise. The participants were asked to identify what the community would need to thrive and flourish in 2030, given the scenarios of "tough" climate change legislation and peak oil. 2030 was chosen as the scenario year as it is within most people's comprehension and within the timescale that climate change legislation and peak oil could have dramatic effects on society.

The facilitator (the author) outlined examples of potential price changes and resource shortages for basic goods that could occur by 2030, assuming that the Government works to a target of reducing GHG emissions by 40% by 2030 (half way to the 80% by 2050 target) and that fossil fuel resources are in short supply because of peak oil. 40% by 2030 was chosen for the focus groups before the Scottish Government made its commitment to reducing GHGs by 42% by 2020 (Scottish Parliament, 2009). A 10 fold price rise of basic commodities was given as an example alongside an inflation increase of wages of 3% per annum, which equates approximately to doubling existing wages in 20 years. In the final part of the focus group, participants were asked to identify actions and priorities for the community today, so that this could be fed back to local community groups.

Table 3.17 An outline agenda for the focus groups

Activity	By whom / comments
Welcome, registration and introduction	AW
Identify challenges today	All in breakout groups - not done in all focus groups
What is a thriving community	All in breakout groups - not done in all focus groups
Outline of scenarios for envisioning 2030	AW
Envision 2030	All in breakout groups
Next steps: **Identify actions that can be done today to help achieve the vision** **Prioritise most important vision ideas**	All in breakout groups - not done in all focus groups
Close	AW

AW=Anne Winther

In Kinlochleven and Killin, participants were asked: to identify actions for today to help achieve the 2030 vision; write their ideas on post-it notes and attach it to the relevant idea on their vision; and then prioritise the ideas on the visions using three stickers to highlight the most important ideas.

Follow-up questionnaire surveys (Appendix A.2) of Kinlochleven and Killin residents were carried out to ask residents for their priorities for a sustainable community. In Kinlochleven, the questionnaires were handed out on the street with a pre-paid stamped addressed envelope for return. In Killin, the survey was carried out in conjunction with a community survey and distributed to all householders through the Killin News. In Kinlochleven, 60 questionnaires (Appendix A.2) were handed out and 18 responses received (30% response rate). In Killin, approximately 400 questionnaires were handed out (distributed with the Killin news) and 47 responses received (approximately 10% response rate). The demographic profile of respondents is given in Appendix A.5.

3.5 Modelling: assessing the sustainability of the visions

In this section, the methodology developed to measure the sustainability of consumption (using the EF as a measure) of different futures states is described (fulfilling objectives 5a and 5b). For three levels of change (marginal, significant and transformational), scenarios were developed for transport, food and energy. Scenarios were limited to these consumption categories due to availability of data and that the EF was the only aggregated indicator used to measure sustainability. The three levels of change were based on degrees of sustainability defined in the "*Ladder of Sustainable Development*" (Baker, 2006, p30-31) and levels in the "*typology of resilience*" (Handmer and Dovers, 1996, p496). Step 1 focused on small scale incremental improvements in resource consumption requiring only marginal or minor lifestyle changes; Step 2 centred on medium scale improvements in resource consumption achievable with significant but not radical lifestyle change; Step 3 involved structural change and transformation, characterised by large scale incremental improvements in resource consumption and radical lifestyle changes (Table 2.3, Handmer and Dovers, 1996, Baker, 2006).

Where appropriate, narratives were used to inform the detailed scenarios for transport, food and energy (sections 3.5.1 to 3.5.3). Section 3.5.4 explores the possibility of reduction in the EF across all consumption categories to achieve an EF equivalent to the fairshare. Modelling of the impact of 100% renewable energy across Scotland was done as renewable energy was flagged as important in focus groups and to evaluate Alderson *et al.*'s (2012) estimate of EF reduction. Key variables were assigned new values in each scenario. If there was no case study baseline value, then the relevant the REAP LA average value was used. Each scenario's EF was calculated using REAP's scenario function (REAPv2.17, Figure 3.17). Time was not included in the scenarios because (a) projecting forward the EF is unreliable (George and Dias, 2005, Borucke *et al.*, 2012) and (b) the scenarios are snapshots of the future based in the timeframe of today (i.e. using the national accounts data embedded within REAP (SEI, 2011a) and data from this study). The scenario results were compared with the fairshare (GFN, 2012) as a gauge of sustainability.

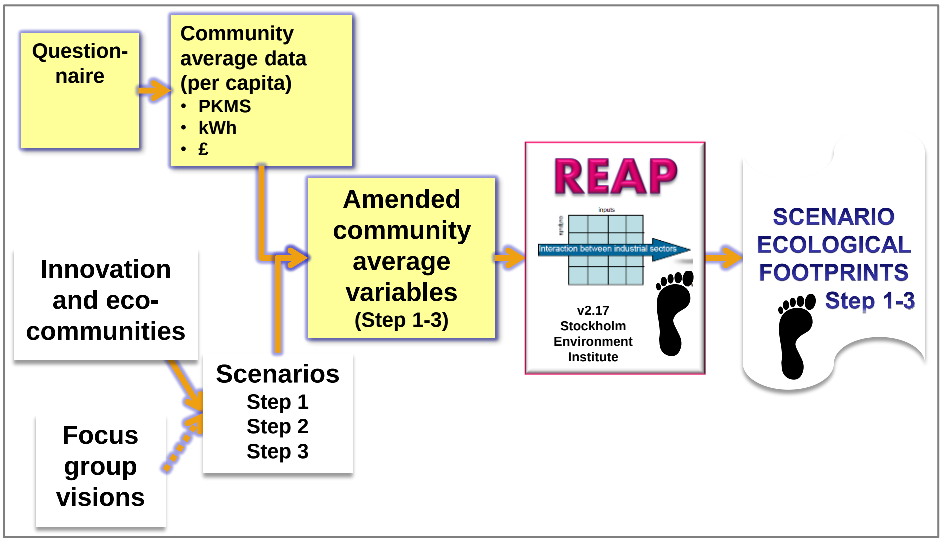


Figure 3.17 Ecological footprint calculation for the narrative sustainable future scenarios (adapted from SEI, 2007a, 2007b, 2011a)

3.5.1 Transport

The exploration of possible transport futures related to changes in car use only (CAR), long distance travel only (LDT), car and long distance travel combined (PT), and technology (electric and hybrid cars and renewable energy). For CAR, LDT and PT modelling, narratives were used to create scenarios for three levels of change from the baseline (CAR1, CAR2 and CAR3; LDT1, LDT2 and LDT3; and PT1, PT2 and PT3, respectively). The narratives were based on ideas from the community visions, the SCD, and the literature on technological innovations and sustainability. For example, lift sharing, use of bicycles and co-operative food purchasing were ideas to reduce travel by car identified in focus groups (see section 5.1). The narratives were used to estimate likely changes in key variables, from which scenario values were calculated (Table 3.18, Appendix C.1 and, for Fintry only, Figure 3.18-Figure 3.21). PT1-PT3 scenarios used the combined values for CAR1-CAR3 and LDT1-LDT3 (Table 3.18 and Figure 3.20).

Note that a 40% efficiency improvement in a car is roughly equivalent to replacing an average car with a medium petrol hybrid when comparing the GHG emissions (AEA, 2012, Table 3.19). International and domestic travel by train were assumed to have the same EF. Air travel occupancy was not changed in scenario modelling, because high levels of occupancy are maintained by the air transport industry. Travelling on business was not included as this is accounted for separately under the appropriate FDC, for example (a) consumption of postal services (distance travelled by a postal worker delivering the post by van) or (b) indirect domestic fuel consumption (distance travelled by lorry driver, driving the fuel tanker to deliver domestic heating oil to the consumer).

Table 3.18 Narratives and transport variables for transport modelling scenarios

Scenario	Description	Narrative	Variables changes from baseline
CAR1	Personal car use (excludes business travel) – *Step change 1*	The bus service has improved with links to train travel for long distance commuters. There is a car lift share scheme, which some people have joined. New technology enabling the building of more efficient cars and drivers driving more efficiently have caused car efficiency to increase on average by 20%. More people cycle for journeys of less than five miles. There is a community car scheme (car pool), which has reduced the need for as many new cars being purchased. The distance travelled by car is reduced by 20%, car occupancy is increased to 40%, car efficiency is increased by 20% and the expenditure on new vehicles is decreased by 20%. Whilst car use has decreased there is only a small change in the distances travelled (a mode change rather than a change in the need for travel). There is an increase in bus travel by the equivalent of 10% of the distance travelled by car. The distance travelled by cycling is increased by 1% of that travelled by car. The increase in walking is by 0.5 miles per weekday (46*.5*5), assuming forty-six working weeks in a year. Train travel is increased by 5% of car travel. There is an increase in bus and train occupancy to 50%. Car purchases have reduced by 20% per annum.	Car PKMS = 80% of baseline Car occupancy increased to 40% Car efficiency increased by 20% Expenditure of new vehicles = 80% of baseline Bus PKMS increased by 10% of car PKMS Cycling PKMS increased by 1% of car PKMS Walking PKMS increased by 0.5 miles per weekday (46*.5*5) Train PKMS increased by 5% of car PKMS Bus occupancy and train occupancy increased to 50%
CAR2	Personal car use (excludes business travel) – *Step change 2*	Again, the bus service has improved and is increasingly utilised and integrated. The car lift share scheme is well used and even more people cycle. The community car scheme (car pool) has further reduced the need for new cars. Car purchases amount to 50% of baseline expenditure. The amount of home-working and local employment has increased and there are tele-working facilities provided locally through community enterprises. The distance travelled by car is reduced by 40%, car occupancy is increased to 50% and car efficiency by 30%. The increase in distance travelled by bus is equivalent to 25% of the baseline car travel distance and, for cycling, the increase in distance cycled is equivalent to 2% of the distance travelled by car. The distance walked is increased by 1 mile per weekday (46*5 per annum). Train travel is increased by the equivalent of 10% of the distance travelled by car. There is an increase in bus and train occupancy to 70%.	Car PKMS = 60% of baseline Car occupancy increased to 60% Car efficiency increased by 40% from baseline Expenditure on new vehicles = 50% of baseline Bus PKMS increased from baseline by 20% of car PKMS Cycling PKMS increased from baseline by 5% of car PKMS Walking PKMS increased from baseline by 1 miles per weekday (46*5) Train PKMS increased by 10% of car PKMS[1] Bus occupancy and train occupancy increased to 70%

Continued overleaf

Scenario	Description	Narrative	Variables changes from baseline
CAR3	Personal car use (excludes business travel) – *Step change 3*	All commuting and personal transport is done by public transport or bicycle. No personal car use except through community enterprises, or for service provision (e.g., doctor) and for emergencies. Car mileage is equivalent to 1 return trip to Stirling per day for the whole community using the community pool car, which is 100% more efficient and has 100% occupancy. Bus use represents 30% of former car use and has an occupancy of 80%. The additional distance travelled by train represents 20% of former car use and train occupancy is 80%. 10% of the distance originally travelled by car is now done by bicycle. There is a reduction on the expenditure on new cars by 98%. There is an increase in walking on average per person by two miles per week day (46*2*5).	Car PKMS = 1 return trip to Stirling per day for whole community using the community pool car Car occupancy = 100% Car efficiency increased by 80% Bus PKMS = 30% of baseline car use Bus occupancy = 80% Train PKMS increased by 20% of baseline car PKMS[1] Train occupancy = 80% Bicycle PKMS = 10% of baseline car PKMS Expenditure on new vehicles = 2% of baseline Walking PKMS increased by 2 miles per week day (46*2*5)
LDT1	Long distance travel (flying) – *Step change 1*	Instead of taking European holidays flying, many choose to travel by train to Europe or to closer destinations. Some families choose to drive to Europe or south coast of England for holidays (car mileage increased by 0.125 trips for each household to the south coast). All domestic flights are now taken by train, as well as 25% of European flights. As a result, train occupancy has risen to 50%. 25% of European flights are not taken. There is no change in ferry usage. Long haul flying is reduced by 20%.	Train PKMS increased by 100% of domestic air PKMS and 25% of European air PKMS[1] Domestic air PKMS = 0 European air PKMS = 50% of baseline Long haul air PKMS = 80% of baseline Train occupancy increased to 50% Car ferry constant Passenger ferry constant Car PKMS increased by per capita proportion of 0.125 trips for each household to south coast
LDT2	Long distance travel (flying) – *Step change 2*	All domestic flights are taken by train. European flights are reduced by 50% and long haul (beyond Europe) by 75%. Of the remainder, 10% of all international flights are now taken by boat or train and for the rest, the journeys are not made. Train occupancy is 70%. Passenger ferry usage is increased by the equivalent of twenty cross-channel trips per year for whole community and car ferry usage by the equivalent to five cross-channel trips per year for whole community.	Train PKMS increased by 100% of baseline domestic air PKMS, 25% of baseline European air PKMS and 7% of baseline long haul air PKMS[1] Domestic air PKMS = 0 European air PKMS = 25% of baseline Long haul air PKMS = 25% of baseline Train occupancy increased to 70% Ferry PKMS increased by 3% of baseline long haul air PKMS, plus per capita proportion of 20 cross-channel passenger trips per year for whole community and per capita proportion of 5 cross-channel car ferry trips per year for whole community Car PKMS increased by per capita proportion of 0.125 trips for each household to south coast

Continued overleaf

Scenario	Description	Narrative	Variables changes from baseline
LDT3	Long distance travel (flying) – *Step change 3*	There is little international travel. International travel represents 10% of baseline and this is done 30% by ferry and 70% by train. There is no flying, apart from on essential government, medical or military purposes. Domestic train travel has increased as the alternative to flying. Total train travel has increased from the baseline by 20% of domestic flights baseline (domestic train travel) and 70% of 10% of the baseline of international travel (international train travel). Train occupancy is 90% of the baseline.	Air PKMS = 0 Ferry PKMS = 0.1 * 0.3 * baseline (European air PKMS + long haul air PKMS) Train PKMS = (0.1 * 0.7 * baseline (European air PKMS + long haul air PKMS)) + 20% domestic air PKMS[1] Train occupancy increased to 80%
PT1	Personal car use and long distance travel) – *Step change 1*	A combination of CAR1 and LDT1	Car PKMS = 80% of baseline + per capita proportion of 0.125 trips for each household to south coast Car occupancy increased to 40% Car efficiency increased by 20% Expenditure of new vehicles = 80% of baseline Bus PKMS increased by 10% of car PKMS Cycling PKMS increased by 1% of car PKMS Walking PKMS increased by 0.5 miles per weekday (46*.5*5) Train PKMS increased by 5% of car PKMS + 100% of domestic air PKMS + 25% of European air PKMS[1] Bus occupancy and train occupancy increased to 50% Domestic air PKMS = 0 European air PKMS = 50% of baseline Long haul air PKMS = 80% of baseline Car ferry and passenger ferry constant

Continued overleaf

Scenario	Description	Narrative	Variables changes from baseline
PT2	Personal car use and long distance travel) – *Step change 2*	A combination of PT2 and LDT2	Car PKMS = 60% of baseline + per capita proportion of 0.125 trips for each household to south coast Car occupancy increased to 60% Car efficiency increased by 40% from baseline Expenditure on new vehicles = 50% of baseline Bus PKMS increased from baseline by 20% of car PKMS Cycling PKMS increased from baseline by 5% of car PKMS Walking PKMS increased from baseline by 1 miles per weekday (46*5) Train PKMS increased by 10% of baseline car PKMS + 100% of baseline domestic air PKMS + 25% of baseline European air PKMS + 7% of baseline long haul air PKMS[1] Bus occupancy and train occupancy increased to 70% Domestic air PKMS = 0 European air PKMS = 25% of baseline Long haul air PKMS = 25% of baseline Ferry PKMS increased by 3% of baseline long haul air PKMS, plus per capita proportion of 20 cross-channel passenger trips and 5 cross-channel car ferry trips per year for whole community

Continued overleaf

Scenario	Description	Narrative	Variables changes from baseline
PT3	Personal car use and long distance travel) – *Step change 3*	A combination of PT3 and LDT3	Car PKMS = 1 return trip to Stirling per day for whole community using the community pool car Car occupancy = 100% Car efficiency increased by 80% Bus PKMS = 30% of baseline car use Bus occupancy = 80% Train PKMS increased by 20% of baseline car PKMS + (0.1 * 0.7 * baseline (European air PKMS + long haul air PKMS)) + 20% domestic air PKMS [1] Train occupancy = 80% Bicycle PKMS = 10% of baseline car PKMS Expenditure on new vehicles = 2% of baseline Walking PKMS increased by 2 miles per week day (46*2*5) Air PKMS = 0 Ferry PKMS = 0.1 * 0.3 * baseline (European air PKMS + long haul air PKMS)
ECCE	Technological innovation: electric cars and conventional electricity	Scenarios listed above were combined with a technological innovation scenario whereby existing fossil fuelled cars are replaced by electric cars of the efficiency of the Nissan Leaf and powered using the current electricity generation mix.	EF of direct emissions from Car PKMS = 0 EF of indirect emissions from Car PKMS = that of scenario + EF of fossil fuel generated electricity consumed for Car PKMS for Nissan Leaf (Nissan, 2012)
ECPR	Technological innovation: electric cars and renewable electricity	Scenarios listed above were combined with a technological innovation scenario whereby existing fossil fuelled cars are replaced by electric cars of the efficiency of the Nissan Leaf and powered using electricity generated solely by renewables.	EF of direct emissions from Car PKMS = 0 EF of indirect emissions from Car PKMS = that of scenario + EF of renewables generated electricity consumed for Car PKMS for Nissan Leaf (Nissan, 2012)
Hybrid	Technological innovation: hybrid cars	Baseline scenario combined with a technological innovation scenario whereby existing fossil fuelled cars are replaced by hybrid cars with the efficiency of a medium hybrid petrol car (AEA, 2012, Table 3.19).	Car efficiency = medium petrol hybrid = 0.57

[1] International and domestic train travel are assumed to have the same EF.

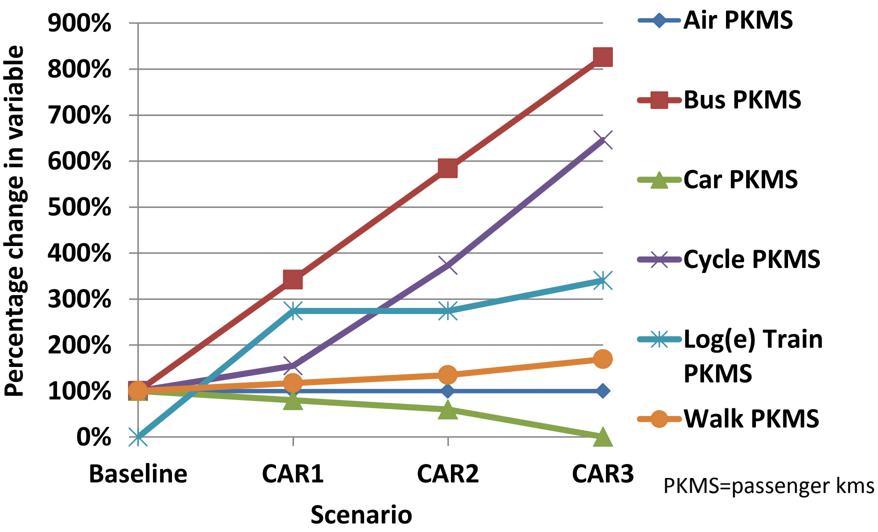


Figure 3.18. Percentage changes of transport variables (average distances per annum) from baseline for CAR scenarios' steps 1-3 for Fintry. This figure is based on the variable changes detailed in Table 3.18

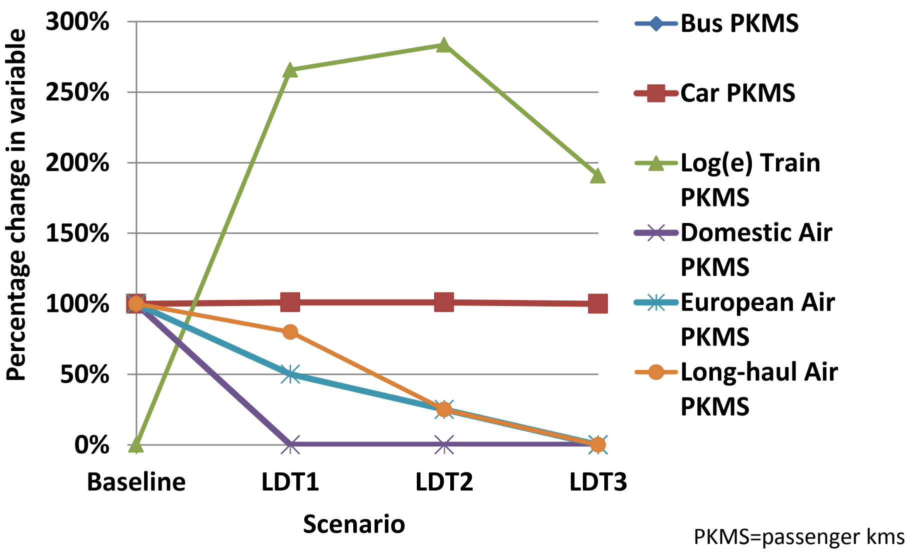


Figure 3.19. Percentage changes of transport variables (average distances per annum) from baseline for LDT scenarios' steps 1-3 for Fintry. This figure is based on the variable changes detailed in Table 3.18

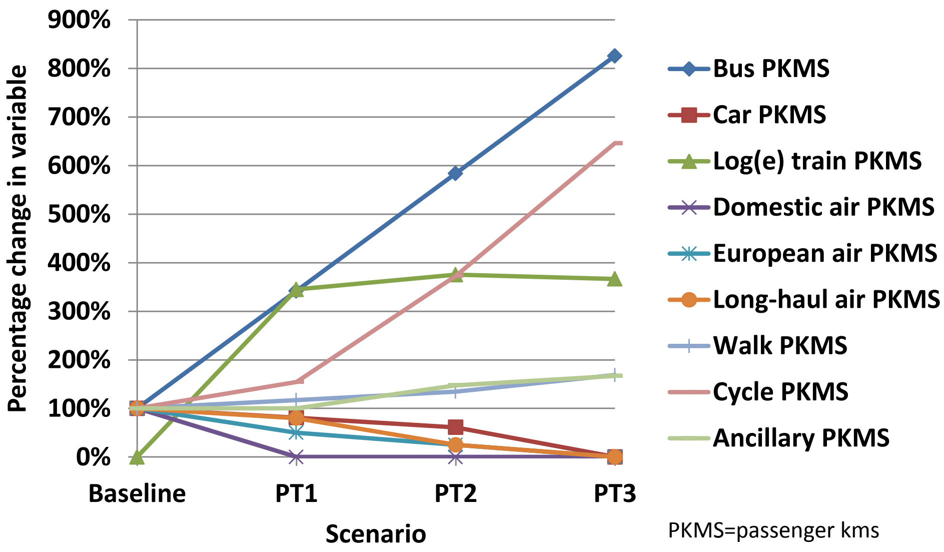


Figure 3.20. Percentage changes of transport variables (average distances per annum) from baseline for PT scenarios' steps 1-3 for Fintry. This figure is based on the variable changes detailed in Table 3.18. In this figure, ancillary PKMS includes ferry travel and the baseline uses the Stirling LA average value for ferry PKMS

Table 3.19 Calculation of relative efficiency of a medium petrol hybrid car (data from SEI, 2011a, AEA, 2012)

Emissions (kg CO_2e /km)		
Average car (2012, unknown fuel)	Medium petrol hybrid (2012)	Relative efficiency[1] of medium petrol hybrid
0.25	0.14	0.57

[1]Efficiency is defined in REAP relative to the 2006 average car and in this survey using data from AEA, 2012. As cars become more efficient in REAP the value decreases. This definition and calculation has been retained to maintain consistency with REAP

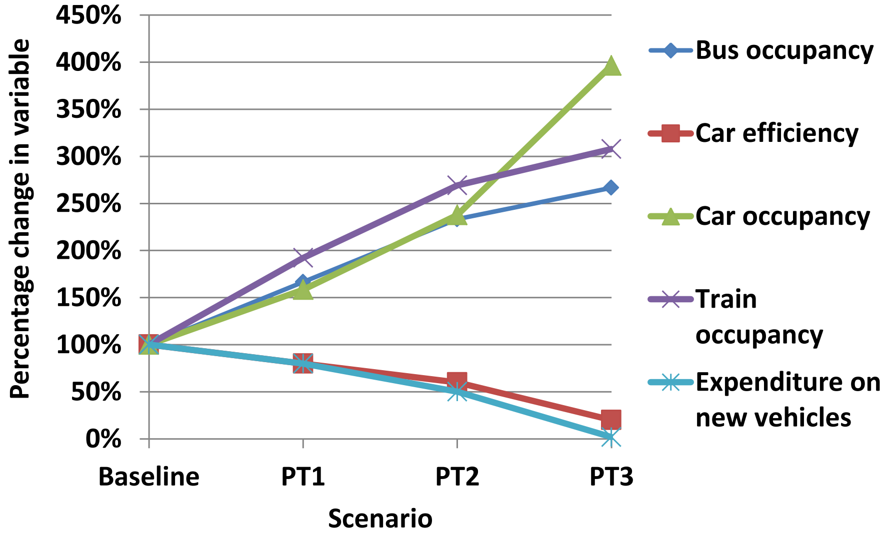


Figure 3.21 Percentage changes in occupancy, expenditure and efficiency transport variables from baseline for PT scenarios' steps 1-3 for Fintry. This figure is based on the variable changes detailed in Table 3.18. Whilst the variable changes shown are for PT scenarios, the same changes were applied for each of the CAR scenarios, and, where appropriate, LDT scenarios. Efficiency is defined in REAP relative to the 2006 average car and in this survey using data from AEA (2012). As cars become more efficient, the efficiency value decreases (SEI, 2011a). This definition has been used to maintain consistency with REAP

3.5.1.1 Impact of technological innovation on baseline and step 2 transport EF

First, the impact of technological innovation on the baseline transport EF was investigated. This was the impact of switching the current car mix to hybrid and electric cars and the differential effects of using electricity from conventional

(ECCE) and renewable sources (ECPR). Then, the impact of these technological innovations on scenario step 2 (PT2) was investigated.

The impact of technological innovation on the car EF was investigated in scenarios where all cars were replaced by: 50% electric cars and 50% hybrid cars with current electricity generation methods; 100% electric cars with current electricity generation methods (ECCE); 50% electric cars and 50% hybrid cars with 100% renewables electricity generation; and 100% electric cars with 100% renewables electricity generation (ECPR). Also, the ECPR and PT/LDT scenarios were combined to investigate the effect on each community's transport EF of combining universal electric car (ECPR) implementation with reduced mobility and different modes of travel. The following paragraphs explain the assumptions used in these scenarios. Hydrogen fuelled cars were excluded from the analysis due to lack of operational cars for modelling and the variance in ecological resource use, GHG emissions and energy loss in hydrogen production (the variance is dependent on the production method, Helmers and Marx, 2012).

The hybrid car efficiency that was used in the modelling was that of a medium hybrid petrol car. AEA (2012) reported the miles to GHG (CO_2e) conversion factor for a medium petrol hybrid car to be 0.225kg CO_2e per mile, which equates to an efficiency of 56.9% relative to the efficiency of the average car used in this study (Table 3.19).

Electric cars have no direct emissions, as their energy is sourced from electricity, so the EF of the indirect emissions from the electricity consumed to power the car battery was calculated separately. The Nissan Leaf, which has a maximum range of 109 miles and a battery capacity of 24kWh (Nissan, 2012) was estimated to have a minimum energy consumption of 0.14kWh/km. As the range is likely to be an overestimate, the more realistic figure of 0.20kWh/km (Helmers and Marx, 2012) was used. The UK electricity consumption EF of 0.171gha/cap (SEI, 2011b) and average UK electricity consumption of 2,081kwh/cap (SEI, 2011a) gave a conversion factor of 0.0000822gha/kWh. In the absence of EF data for the production, repair and maintenance of electric cars, the EF of these FDCs was assumed to be the same as conventional cars. The EF of electricity generated by 100% renewables was assumed to be 10% of that generated by the current method (Alderson *et al.*, 2012).

3.5.2 Food

Food modelling was undertaken to understand the effect of increasing domestic production and dietary changes would have on the EF. The focus group discussions identified the importance of "growing your own" and relocalising production (see section 5.1) and so have been incorporated into the scenarios for increasing domestic production and sustainable community agriculture. Although eating more healthily was not identified within the focus groups, the benefits of healthy eating and eating less meat on the EF have already been identified (Frey and Barrett, 2007, Berners-Lee *et al.*, 2012, Chapter Two) and so were incorporated into the scenarios of changing food consumption. Case study food expenditure and volume data was not collected, so for the modelling Stirling LA data was used; REAP holds expenditure values and EFs for each of the COICOP food categories. Scenarios were developed for three levels of change for:

domestic food production (scenarios FDP1-FDP3); for decreasing meat and less healthy food consumption (scenarios FC1-FC3); and for combining FC1-FC3 with sustainable community agriculture (SCA). FC and FDP scenarios were independent.

The amount of domestic production for each food type for FDP1-FDP3 were incrementally changed by 10% for each scenario up to 100% domestic production (Table 3.20), apart from alcoholic beverages (which increased 20%, 40% and 60% above baseline for FDP1-FDP3, respectively, as baseline domestic production was only 30%) and cocoa, chocolate and sugar confectionery (which were not modelled due to cocoa not being grown in the UK).

Table 3.20 Values used for the amount of domestic production of food (percentage of domestic production) for each food FDC for modelling scenarios FDP1-FDP3 (baseline values for Stirling LA from REAPv2.17, SEI, 2011a)

	Percentage of domestic production			
FDC	**Baseline**	**FDP1**	**FDP2**	**FDP3**
Meat and meat products (excl. poultry)	75%	82%	90%	100%
Poultry meat and poultry meat products	73%	80%	87%	100%
Fish	71%	78%	85%	100%
Fruit and vegetables	76%	83%	91%	100%
Vegetable and animal oils and fats	72%	80%	87%	100%
Dairy products	75%	83%	91%	100%
Grain mill products, starches and starch products	87%	96%	100%	100%
Bread, rusks and biscuits; pastry goods and cakes	93%	100%	100%	100%
Other food products (incl. sugar)	73%	81%	88%	100%
Non-alcoholic beverages	76%	84%	91%	100%
Alcoholic beverages	30%	36%	42%	48%

The FC1 scenario assumed a change in diet and consumption, brought about by: better use of food (i.e. less food waste); a reduction in meat and fish expenditure by 20%; and an increase in expenditure on dairy products by 10%, and fruit and vegetables by 40% (Table 3.21). The FC1 diet is healthier with additional vegetable and fruit consumption (although the increase in dairy expenditure is due to increases in vegetarianism) and decreases in less healthy foods (confectionery, chocolate and beverages by 20% and oils and fats and bakery items by 10%). The decrease in total food expenditure was £170/cap/annum.

Table 3.21 Food expenditure values used and percentage changes from baseline for each FDC in the modelling of the food consumption scenarios FC1-FC3 (baseline values for Stirling LA from REAPv2.17, SEI, 2011a)

Scenario / Food FDC	Baseline Expenditure (£/cap /annum)	FC1 Percent change	FC1 Expenditure (£/cap /annum)	FC2 Percent change	FC2 Expenditure (£/cap /annum)	FC3 Percent change	FC3 Expenditure (£/cap /annum)
Produce[1]	**696**		**684**		**592**		**364**
Meat (excl. poultry)	277	-20%	222	-60%	111	-100%	0
Poultry meat	93	-20%	75	-60%	37	-100%	0
Fish	46	-20%	37	-60%	19	-100%	0
Fruit and vegetables[2]	146	+40%	204	+100%	291	+150%	364
Dairy products	134	+10%	147	+0%	134	-100%	0
Essentials							
Grains and starch products	42	+0%	42	+0%	42	+0%	42
Less healthy foods	**866**		**708**		**546**		**294**
Oils and fats	10	-10%	9	-10%	9	-10%	9
Bread, biscuits and pastry	141	-10%	127	-20%	113	-30%	99
Chocolate and confectionery	78	-20%	62	-60%	31	-80%	16
Other (incl. sugar)	107	-20%	86	-30%	75	-40%	64
Non-alcoholic beverages	362	-20%	289	-40%	217	-80%	72
Alcoholic beverages	168	-20%	134	-40%	101	-80%	34
Total	**1,604**		**1,434**		**1,179**		**700**

[1]Proteins and more healthy foods
[2]Protein rich vegetables (e.g., lentils) are included within "fruit and vegetables" FDC.

In FC2, the changes were more pronounced than in FC1 with the expenditure on less healthy foods and meat and fish fruit decreasing further (Table 3.21) and vegetable expenditure increasing by 100%. Expenditure on grain and dairy products was unchanged (although vegetarianism is likely to increase dairy expenditure, this is offset by increases in veganism). The decrease in total food expenditure from the baseline was £424/cap/annum.

In FC3, a vegan diet with healthy eating was modelled with meat, fish and dairy consumption as zero and fruit and vegetable expenditure increasing by 150% (Table 3.21). FC1-FC3 scenarios assumed no change in the amount of domestic production or the method of production (it is not possible to investigate different production methods, such as organic agriculture, grow-your-own, community supported agriculture and use of GM crops within REAP). In a sustainable future, this is unlikely to be the case, so SCA scenarios were created to investigate the effect of increased demand for fruit and vegetables (above baseline) coming from community market gardens and "growing your own". This assumed additional land requisitioned for food production would come from the "built land" category and, that production methods would use very few resources (for example, permaculture production methods), so that the EF of fruit and vegetable production above baseline was assumed to be zero (i.e. in scenarios FC1+SCA, FC2+SCA and FC3+SCA). In FC1+SCA+25%, FC2+SCA+25%, FC3+SCA+25% scenarios an additional 25% of the baseline fruit and vegetable production was converted to SCA or grow-your-own.

3.5.3 Energy

Two different aspects of energy consumption were investigated. First, the effect of switching from the current electricity generation mix to wholly renewable energy generation was investigated. This was in order to understand the impact of this on the total EF of Scotland's production and consumption accounts and to identify which FDCs are most affected by the switch. Secondly, the impact of reducing household electricity and fossil fuel consumption and switching to GSHPs and renewable electricity generation was investigated.

3.5.3.1 100% renewable energy generation scenarios for Scotland

Electricity is generated in the UK in many different ways. REAP holds the national accounting data relating to the amount of electricity generated by each method (measured in megatonnes of oil equivalent, Mtoe). REAP scenarios have the functionality to investigate the effect of altering the amount of electricity generated by each method (SEI, 2011a). The scenario of a switch to 100% renewable electricity generation for Scotland had the total electricity consumption unchanged and fossil fuel consumption replaced by hydro and wind power (Table 3.22). As there was no functionality to model tidal and off-shore wind electricity generation, the hydroelectricity values were increased instead (Scenarios A and B, Table 3.22).

Table 3.22 Energy sources for electricity generation in modelling 100% renewable electricity generation (values from REAPv2.17, SEI, 2011a)

Electricity generation method	Energy consumed (Mtoe)[1]		
	Scotland's baseline	Scenario A	Scenario B
Gas	2,740	0	0
Coal	2,750	0	0
Nuclear	2,720	0	0
Oil	340	0	0
Hydro	330	3,000	500
Wind	130	5,510	8,400
Solar	0.24	500	110
Biofuels	2,010	2,010	2,010
Other	1,840	1,840	1,840
Total	12,860	12,860	12,860

[1]REAP input variable units

3.5.3.2 Household renewable energy, conservation and efficiency scenarios

Three scenarios (E1-E3) were developed to investigate switching to renewable energy provision and reducing energy consumption (due to implementation of energy efficiency improvements in the home and, where appropriate switches to GSHPs and/or ASHPs, Table 3.23, Figure 3.22). The narratives and scenarios were informed by Fintry's (FDT's) plans for implementation of renewable heating systems (identified through ongoing community engagement after the focus groups were held), the literature (see section 2.1.4.7) and the results of the focus groups.

In the absence of more detailed data, the EF of electricity generated by micro-renewables (i.e. photovoltaic panel or CHP) was assumed to be the same as for grid renewables. The consumption of oil, coal and LPG reduced in each scenario (E1-E3) to zero in E3. ASHPs and GSHPs were assumed to have a coefficient of performance of four, thus consuming only one quarter of current energy used for heating (MacKay, 2009). The electricity consumed for heating (as opposed to lighting, cooking and appliances) was estimated from questionnaire data for principle heating sources. Additional woodfuel consumed in E1-E3 was assumed to be a mixture of short rotation coppice (SRC) and log wood (an average of the yield of the two types of fuel (8 tonnes/ha/year, Appendix A.4) was used).

Table 3.23 Description of the E1-E3 energy scenario narratives

Scenario	Narrative	Variable changes
E1	Some steps towards energy conservation and implementation of renewables.	Energy consumption is reduced by 20%. 20% of remaining fossil fuel consumption is replaced with renewable energy. Wood consumption increases by 10% of LPG and oil and 80% of 20% of coal. GSHP increases by 10% of LPG and oil and 20% of 20% of coal. Of this GSHP electricity requirement, 80% is renewables and 20% conventional electricity. Oil and LPG consumption is reduced by 20% 20% of electricity that was conventional electricity generation is renewables. All GSHP heating that was conventional electricity generation is renewables. 20% of heating by electricity is by GSHP.
E2	Significant changes in energy consumption and implementation of renewables.	Energy consumption reduced by 40% from baseline. 50% of remaining Oil and LPG consumption is replaced with 25% wood and 25% GSHP. No coal. 80% of 60% of baseline coal energy is provided by wood fuel; the remaining 20% of 60% of baseline coal by GSHP. Wood replaces coal (as previous) and 25% of LPG and oil 50% of reduced conventional electricity demand is now from renewable sources All GSHP electricity is renewables. 50% of heating by electricity is by GSHP.
E3	All fossil fuel heating is replaced by renewables; all electric heating by GSHP/ASHP and all electricity consumed is generated from renewables.	Energy consumption is reduced by 60% from current. All electricity is from renewable resources. All fossil fuel heating is replaced by renewables. Remaining coal energy requirement is replaced by 20% GSHP and 80% wood. Remaining LPG and oil energy requirement are replaced by 50% GSHP and 50%wood. All heating by electricity is now by GSHP.

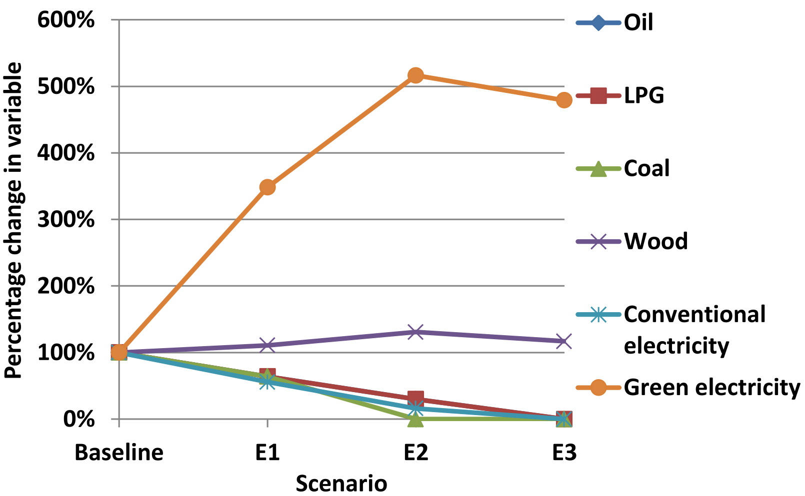


Figure 3.22 Percentage changes from baseline for E1-E3 scenarios for Fintry

3.5.4 Step1-Step3 modelling on the total EF

The Step1-Step3 scenarios, the results for transport, energy and food were combined to investigate the reduction in the total EF for each scenario, which scenario achieved a total EF less or equal to the fairshare (GFN, 2012), and which components become dominant in the EF. Detailed modelling was not done for consumables, private services, government and capital investment, so a reduction in the baseline EF was applied (20%, 40% and 60% reduction from the baseline EF was applied for Step1-Step3 respectively, for the FDCs for consumables, private services and government and a 10%, 20% and 30% reduction for Step1-Step3, respectively, for capital investment). These reductions assumed that implementation of renewable energy generation was incorporated within the reductions, rather than being modelled separately (i.e. the renewable energy production scenario modelling within REAP was not utilised).

3.6 Overarching issues and energy injustice

The fourth stage of the research (Figure 3.1) was to create meaning and fulfil the seventh objective (explore the opportunities, constraints and options for achieving sustainable communities), for which most of the detailed discussion is presented in Chapter Six. Justice (ethical and fair distribution and access to resources) was not given its own aspect in the SCD as justice underlies all the SCD aspects and is essential for sustainability (the "*ethical and equitable distribution of resources and opportunities*", Baker, 2006, p30-31, see section 2.1.1.1). Just distribution and access to energy resources is a prerequisite for achieving sustainability for the SCD aspect “sustainable energy to fuel life”. Given the importance of energy injustice identified during the course of the study, it was analysed in more detail. The Scottish distributional analysis of energy resources was presented in Chapter Two. The community renewable energy sustainability assessments (presented in Section 4.9) were analysed using a responsibility, rights and recognition framework (adapted from Bulkeley and Fuller, 2011, see section 2.1.5.3). The results of the analysis are in section 4.11 and the resultant recommendations and implications are discussed together with other overarching issues in Chapter Six.

3.7 Reflections on the methodology

In this chapter multiple research methods have been expounded. Although all approaches were based on underlying established methods, tools and techniques, the methods (baseline measurement, visioning and modelling) were novel. In addition, the integration of these diverse methods in one study, together with an analysis of energy injustice, was unique and enabled an interdisciplinary and holistic enquiry.

At the start of the study, the search for an appropriate composite indicator to measure the sustainability of rural communities and have a ‘*Plimsoll line’* (Plimsoll, 1873) or gauge of sustainability was difficult. Although the EF was the best at measuring consumption, it could not be used for all aspects of the SCD. Therefore, a basket of indicators were used with incommensurate units, so a traffic light system was invented for scoring. Given the breadth of the SCD, the data requirements were considerable and this was reflected in the size of the questionnaire and the length of time required to collect and analyse data. The strength of this methodology (using the SCD, a wide but specific list of disaggregated indicators and the EF, and a traffic light scoring system) is that it enabled holistic measurement of a rural community against a strong definition of sustainability. Comparison of the results across three case studies enabled the SCD scoring methodology to be tested for sensitivity in determining differences between rural communities.

Conditions that motivate people are often unique and there is a risk that they are misidentified (Slay, 2011). Therefore, a challenge for creating sustainable communities is that the unique needs of each and every community must be respected and integrated into community-specific change and, in order to understand this potential diversity, three very different communities were selected for this study. These case study communities provided a diversity of evidence to test the sensitivity of the SCD framework. Primary data was collected by household questionnaire, which was designed based on multiple established national surveys. Doorstep data collection over three separate years was time-consuming, difficult and required doorstep courage and a thick skin. In Kinlochleven, I had regular encounters with widows, addicts, carers, hopelessness and those in poverty. The Scotcen doorstep approach of being apologetic for intrusion and rapidly retreating if the householder looked busy (before he or she could say no) worked well. In addition, a five minute chat on the doorstep sometimes supplemented focus group data. A vast array of secondary data from national statistics (Scottish Government, 2010b, SNS, 2012, SCROL, n.d.) and REAPv2.17 (SEI, 2011a) accompanied the primary data.

The remaining methods were designed to identify the challenges, opportunities, options and policy recommendations for the future of rural communities. The creation of future visions of a resource-constrained future in 2030 in participatory focus groups was the second novel method. Focus group visions represent the views of self-selecting groups in Fintry and two of the four in Kinlochleven. Recruiting participants through the school in Kinlochleven, and in Killin EAK and the WRI engaged participants that would not normally volunteer time for this type of research exercise. Recruiting members was difficult; in Kinlochleven signs were vandalised in such a way as to imply substantial physical anger (robust wooden signs were broken and cast into the river). Therefore, the recruitment method was changed for Killin, using local groups as recruitment mechanisms, and follow-up questionnaires were used to canvas opinion from those that did not attend.

The third novel method was consumption modelling to understand the potential for behaviour change and technological innovation in reducing the EF to a sustainable level (using the fairshare as a gauge of sustainability). Finally, energy injustice was analysed to complete this holistic enquiry. The methodology evolved during the course of the study because data from one method informed another. For example, focus group observations were used for baseline sustainability assessment, to inform narratives for the modelling and contributed to the analysis of energy injustice. Although the original intention of the modelling was to test the sustainability of the community visions, the visions were insufficiently detailed to permit such direct modelling, so appropriate ideas from the visions (section 5.1) were incorporated indirectly into the narratives written to populate scenarios for three levels of change for transport, food and energy. Insufficient data prevented modelling other aspects of consumption.

Another example of methodological evolution related to energy injustice and the importance of community renewables for catalysing and enabling change and of having power to act, all of which were only fully identified five years into the study. Therefore, energy to fuel life and power to act were not included in the initial methodology or the design of the SCD. In addition, the methodology of the critical enquiry into energy injustice does not easily fit into the empiricist approach of "method", "result" and "discussion", so making the critical analysis of energy injustice "fit" within the overall presentation of this study has been awkward. This unavoidable awkwardness is the nature of mixed methods and interdisciplinary research, and, as it is critical to making holistic recommendations for the future of rural communities, incorporation of these mixed methods has been embraced rather than avoided.

In summary, this study uses mixed methods (Figure 3.1) to investigate the interdisciplinary study of the options for the future rural communities, as there is no single method or indicator that can combine empirical and normative enquiry to an entity that has the complexity and multiple interdisciplinary dimensions of a community. Also, the purpose of the enquiry is to identify options for rural communities in order to inform policy of opportunities for sustainable communities and how to facilitate their development. This methodology provides a framework for understanding the current sustainability of rural communities (described next in Chapter Four), envision and test future possibilities and make recommendations for change. The value and strength of this approach is that it enables breadth and depth of enquiry, affording the most holistic approach to analysing communities and identifying options for creating sustainable communities in their fullest and truest definition.

Chapter 4 The sustainability of three Scottish rural communities

This chapter presents the results of the baseline assessment of the sustainability of the three case study communities, completing the third objective of this study. Case study selection and background overviews for each community (objective 3a) were presented in Chapter Three, section 3.2. Each case study's baseline sustainability was evaluated using the Sustainable Community Design (SCD) as a framework with a basket of indicators used to measure the case study's sustainability across the ten aspects of the SCD (as described in detail in Chapter Three). Scoring for each aspect of the SCD used a "traffic-light" sustainability assessment method (creating a scorecard for each aspect). Detailed results are given in the following sections (4.1 to 4.10). EF analysis forms part (but not all) of this. The overall EF results are assessed as part of sustainable consumption (section 4.1). The EF components (e.g., transport and housing EFs) have been used to inform the assessment of their relevant aspects of the SCD (transport and connectivity, and built environment, respectively). The overall sustainability for each community is presented in the final section (section 4.11) of this chapter together with an analysis of energy injustice.

4.1 Sustainable consumption

Consumption is measured against two goals: low impact consumption and taking action to reduce consumption and resource use (Figure 4.1). All three communities achieve low scores (“unsustainable”, Figure 4.1), except that Fintry scores “amber” for taking action to reduce consumption and resource use.

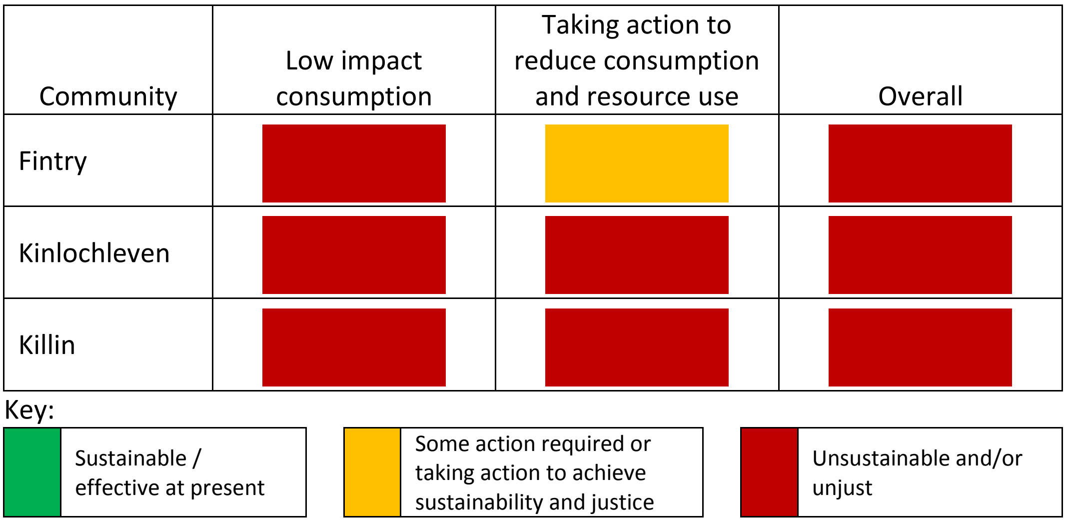


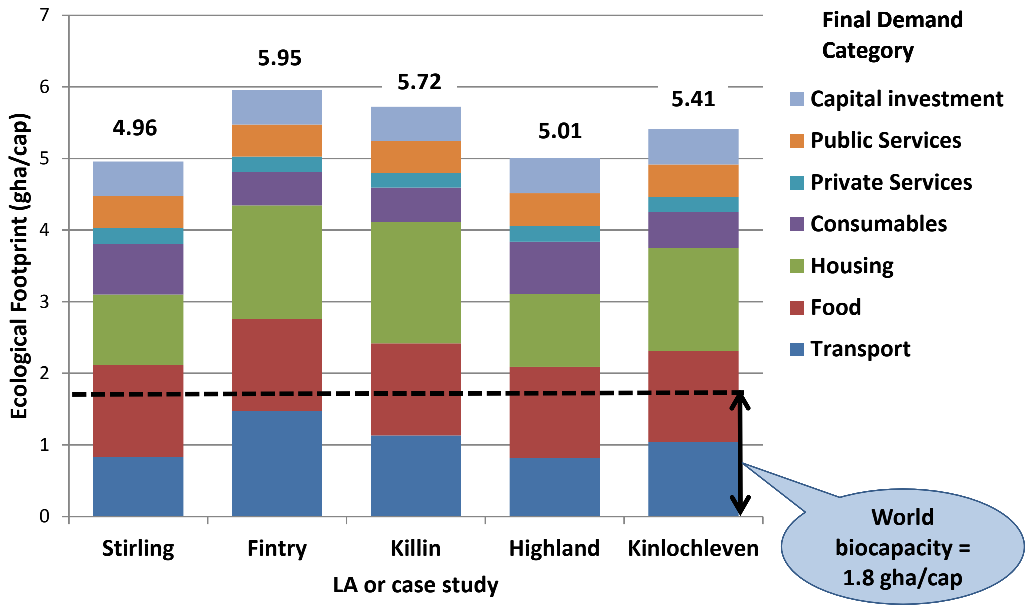
Figure 4.1 Sustainable consumption community scorecard

4.1.1 Low impact consumption

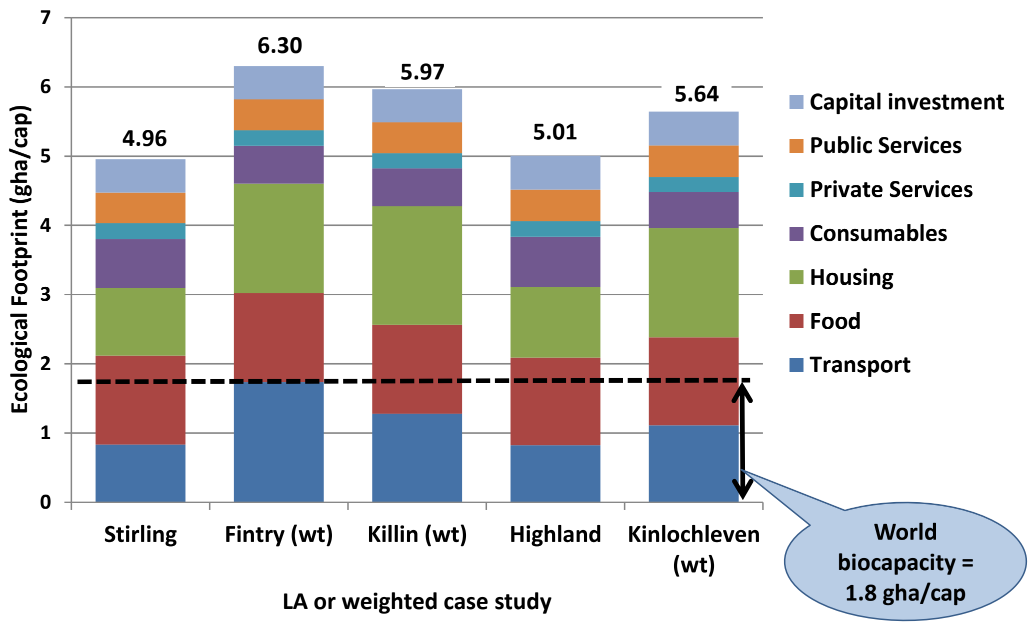
Each community’s total EF is a measure for low impact consumption. The overall EF results are shown in and are compared to the relevant LA area (Stirling, expressed as Stirling LA on the charts to avoid confusion with Stirling city, for Fintry and Killin, and Highland for Kinlochleven) and the Earth’s available biocapacity. All three communities are using more than three times their fairshare of biocapacity (GFN, 2012), whether unweighted or weighted results[1] are used (Figure 4.2, Table 4.1), which is unsustainable.

The EF of the consumables and private services FDCs reflects the sustainability (resource intensity, rather than biodiversity impact) of purchase choices. Twelve consumables and private services FDCs had data collected. The consumables EF for Fintry, Kinlochleven and Killin was 0.55gha/cap, 0.55gha/cap and 0.52gha/cap,

[1]In all other results, demographically weighted results are only reported.



A. Unweighted



B. Weighted

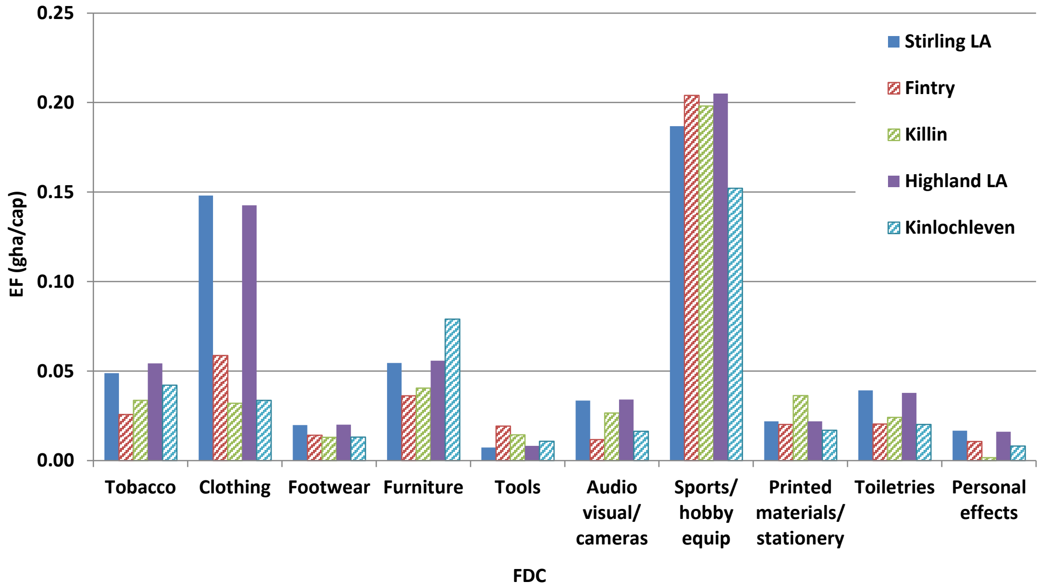
Figure 4.2 Case study total EFs showing: (A) the EF results for unweighted data; and (B) the EF results for data weighted by Census 2001 demographic profiles (section 3.3.4.3). The black dashed line represents the fairshare (GFN, 2012). The EFs of Stirling and Highland LAs are shown for comparison. The total EF is broken down into seven FDCs, as shown (modelled in REAPv2.17, SEI, 2011a)

respectively, and much lower than the LA consumables EF of 0.73gha/cap and 0.70gha/cap for Stirling and Highland, respectively (Table 4.2, Figure 4.3, Appendix B.1). The EF for consumables represents approximately 25% of the fairshare of the Earth's biocapacity (fairshare, 1.8gha/cap, GFN, 2012, Table 4.2) and equipment for sports and hobbies (other recreational equipment) has the greatest EF. The private services EF was made up of predominantly unmeasured categories (Table 3.9) and so the resultant EF was similar to the LA values (less than 10% difference) and largely unaffected by weighting. The resultant private services EF was 0.22gha/cap, 0.21gha/cap and 0.22gha/cap for Fintry, Kinlochleven and Killin, respectively and represented over 10% of the fairshare (GFN, 2012, Table 4.3, Figure 4.4).

Zero waste is the goal of a sustainable community, but, despite relatively high recycling rates for Fintry and Killin (Figure 4.5), all three communities have a substantial amount of waste going to landfill (on average approximately half a Council-provided waste bin per household per week, Table 4.4). All recyclables should have 100% recycling rates.

Table 4.1 Total EF as a percentage of the fairshare (GFN, 2012) comparing unweighted and weighted data (modelled in REAPv2.17, SEI, 2011a)

	Unweighted		Weighted	
Community	**EF (gha/cap)**	**Percent of fairshare**	**EF (gha/cap)**	**Percent of fairshare**
Stirling LA	4.96	275%		
Fintry	5.95	331%	6.30	350%
Killin	5.72	318%	5.97	332%
Highland LA	5.01	278%		
Kinlochleven	5.41	300%	5.64	314%



Key to final demand category abbreviations: Tools = Garden equipment and household tools; Audio visual/ cameras = Audio-visual & photo processing equipment; Sports/ hobby equip = Other recreational equipment; Printed materials/ stationery = Newspapers, books & stationery; Toiletries = Personal care; Personal effects = Jewellery and personal items.

Figure 4.3 Detailed comparison of the EF of measured "Consumables" FDCs (modelled in REAPv2.17, SEI, 2011a)

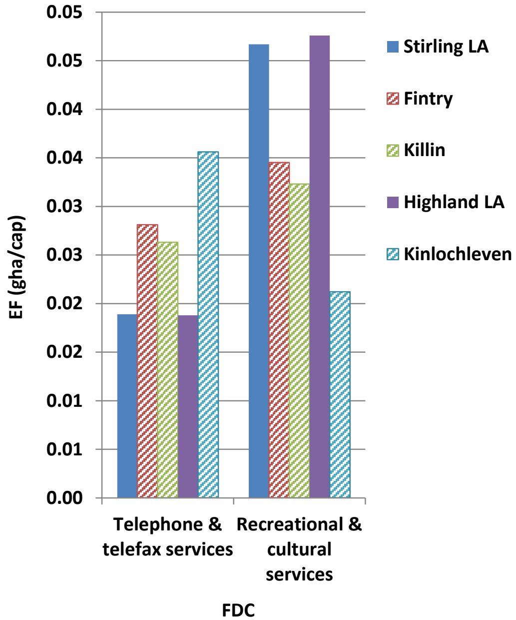


Figure 4.4 Detailed comparison of the EF of measured "Private Services" FDCs (modelled in REAPv2.17, SEI, 2011a)

Table 4.2 Consumables EF results (modelled in REAPv2.17, SEI, 2011a)

Community	EF (gha/cap)		
	Measured categories[1]	Unmeasured categories[2]	Total
Stirling LA	0.58	0.13	0.70
Fintry	0.42	0.13	0.55
Killin	0.42	0.13	0.55
Highland LA	0.60	0.13	0.73
Kinlochleven	0.39	0.13	0.52

1-Tobacco, Clothing, Footwear, Furniture and furnishings (incl. carpets), Garden equipment and household tools, Audio-visual & photo processing equipment, Other recreational equipment, Newspapers, books & stationery, Personal care and Jewellery and personal items

2-Textiles, Household appliances, Glassware and household utensils, Medical products; appliances & equipment, Telephone & telefax equipment, Items for recreation and culture (major durables), UK residents' spending abroad (on holiday or business), Other: Non-residents' expenditure in the UK

Table 4.3 Private Services EF results (modelled in REAPv2.17, SEI, 2011a)

Community	EF (gha/cap)		
	Measured categories[1]	Unmeasured categories[2]	Total
Stirling LA	0.02	0.21	0.23
Fintry	0.03	0.20	0.22
Killin	0.03	0.19	0.22
Highland LA	0.02	0.21	0.22
Kinlochleven	0.04	0.18	0.21

1- Telephone & telefax services and Recreational & cultural services

2- Water (utilities), Out-patient services, Hospital services, Postal services, Education, Accommodation services, Social protection, Insurance, Financial services, Other business services and Other: voluntary organisations serving UK households

Table 4.4 Approximate amounts of landfill waste generated weekly by each community

Community	Mean number of wheelie bins (bins/household/week)[1]	N
Fintry	0.4	79
Kinlochleven	0.5	46
Killin	0.5	44

[1] The figures are approximate, as the data was a self-reported assessment of how full the wheelie bin was each week (less than a quarter, a quarter, a half, one full, two full or more than two).

Similarly, all food and garden waste should be composted, but the data suggests this is not the case (Figure 4.6). Fintry and Killin's food composting is likely to be higher now, as in 2012 Stirling Council implemented kerbside food waste collection, in addition to garden waste collection (*pers. obs.*).

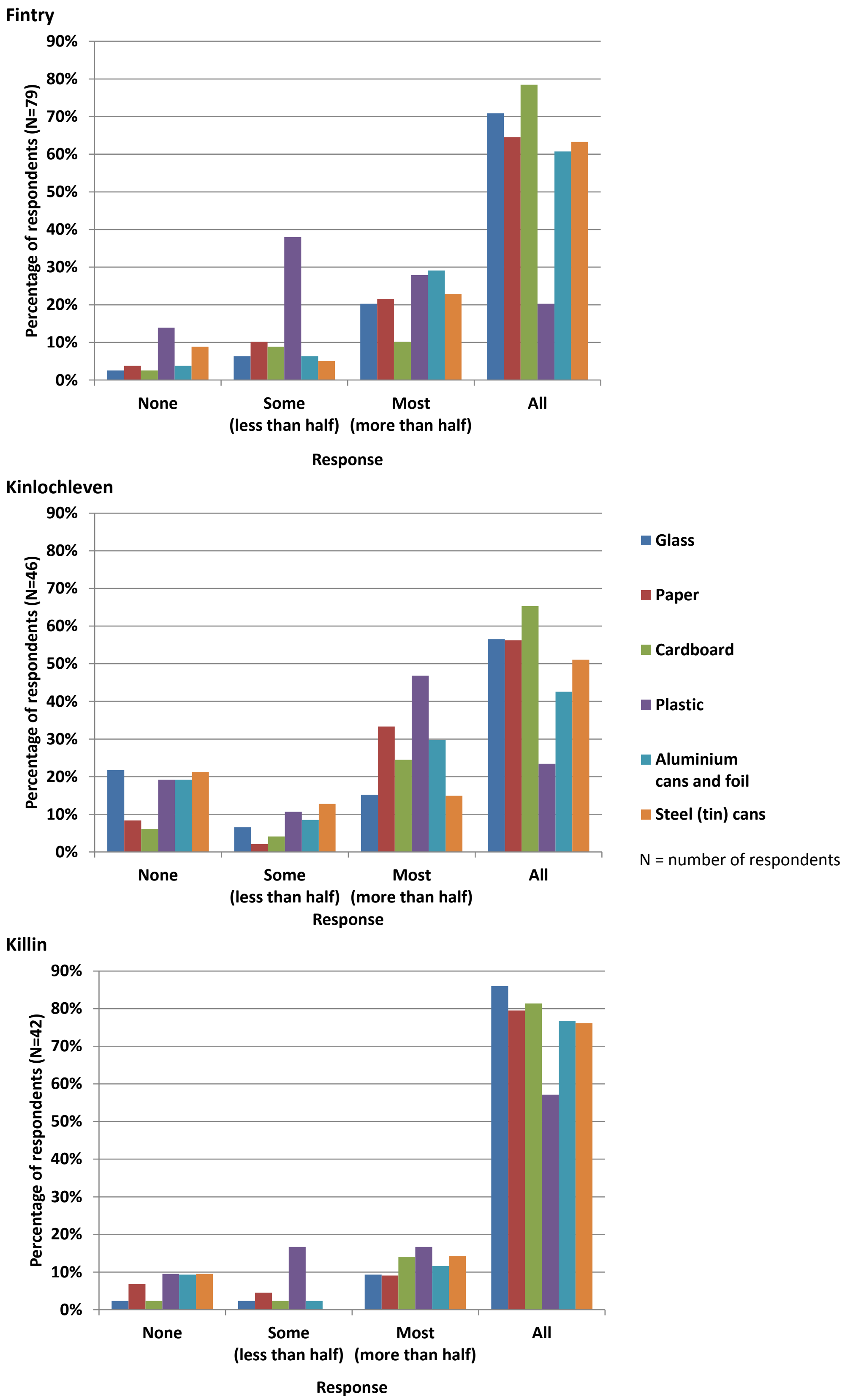
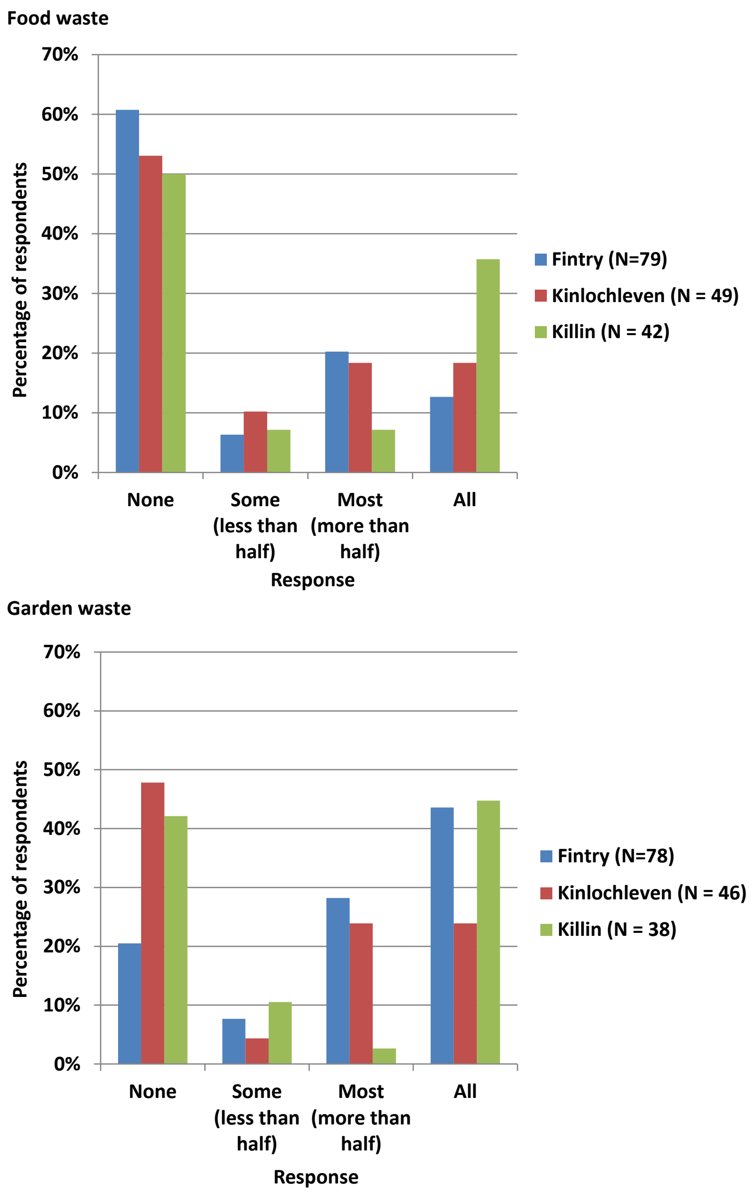


Figure 4.5 Stated amounts of waste recycled in response to the Likert-style questions “How much waste do you recycle?” (Fintry Questionnaire no. 35-40)



N = number of respondents

Figure 4.6 Stated amounts of food and garden waste composted in response to the Likert-style questions "How much do you compost?" (Fintry Questionnaire no. 42-42A)

For the two environmentally friendly consumption behaviour scales (EFBS and EFPS, Chapter Two), the scores for all three communities were relatively low (all being less than four out of a maximum score of 10, Table 4.5). For the EFPS, the only activity undertaken regularly was "take your own carrier bags shopping" with over 50% of respondents doing this "often" or "always".

Table 4.5 EFBS and EFPS scores for each community

Community	EFBS score	N	EFPS	N
Fintry	3.5	79	3.8	79
Kinlochleven	3.9	49	3.5	48
Killin	3.5	44	3.7	41

Out of a maximum score of 10.
N = number of respondents

The low level of environmental awareness in purchase decision-making is further suggested by the low take-up of green electricity tariffs. In Fintry, only eight (10%) of respondents had green electricity tariffs in their home. Kinlochleven and Killin had two respondents each which corresponded to 4% and 5% of the sample population. Lower acceptance levels of green tariffs may be reflected in the increased poverty in the latter two communities which in turn causes lower uptake, as green tariffs tend to be more expensive.

The EF of water consumption could not be estimated using REAP and there were no water meters to provide data for water consumption. However, with data on use of appliances and bathrooms collected in the questionnaire and assumptions developed for RP (SEI, 2007b, 2007c), a rough estimate of water consumption was made of being over 30,000l/annum (Table 4.6). The water consumption EF of Stirling and Highland LAs are 0.0133gha/cap and 0.0132gha/cap, respectively (SEI, 2011a), representing just under 1% of the fairshare (GFN, 2012). Drinking and cooking water only represents approximately 5% of the total consumption, which suggests that over 90% of water purified to drinking water standard is not used as such (SEI, 2007b, 2007c). This is not a sustainable use of water, especially as some of the heaviest users of water (toilets, and garden hoses) do not need purified water.

Table 4.6 Estimated water consumption

Community	Estimated water consumption by device (l/capita/annum)[1]						
	Shower	Bath	Toilet	Appliances[2]	Hose	Cooking	Total
Fintry	2,100	4,600	8,400	10,400	11,200	1,800	38,700
Kinlochleven	2,300	5,000	10,600	8,200	6,400	1,800	34,300
Killin[3]	2,100	4,900	N/A	9,000	6,800	1,800	24,700[3]
	N						
Fintry	77	77	73	77	77		
Kinlochleven	49	43	35	49	46		
Killin	43	44	0	43	41		

[1]Estimated water consumption per device per use is from RPv0.91 (SEI, 2007b, 2007c). The volumes (in litres) are: shower, 10l, bath, 80l, toilet, 6l, appliances, 65l, and hose, 500l. Cooking and drinking water is estimated at 5l/cap/day. For houses with toilets with water saving devices fitted, a volume of 3l per toilet flush was used.
[2]Appliances = washing machine and dishwasher.
[3]Excludes toilet flush volumes; the question was removed for Killin, due to poor responses and a complaint.

4.1.2 Activities to reduce impact of consumption

Since the questionnaire, there are now community enterprises in Fintry, funded by the FDT, to reduce consumption and its impact, for local food production and community car sharing. In Kinlochleven, the only enterprise is a volunteer run compost scheme and the thrift shop has closed. In Killin, at the time of the survey there were no schemes to reduce consumption or its impact, but plans were being enacted for Tombreck to take-over and run the former grocery store, operating an outlet for locally produced goods and thrift items. In all three communities recycling is likely to increase with LA enhancements to kerb-side recycling.

4.2 Governance and land tenure

The goals of this aspect are: inclusiveness and representative leadership; effective governance structures; and fair distribution of power and property rights (Figure 4.7).

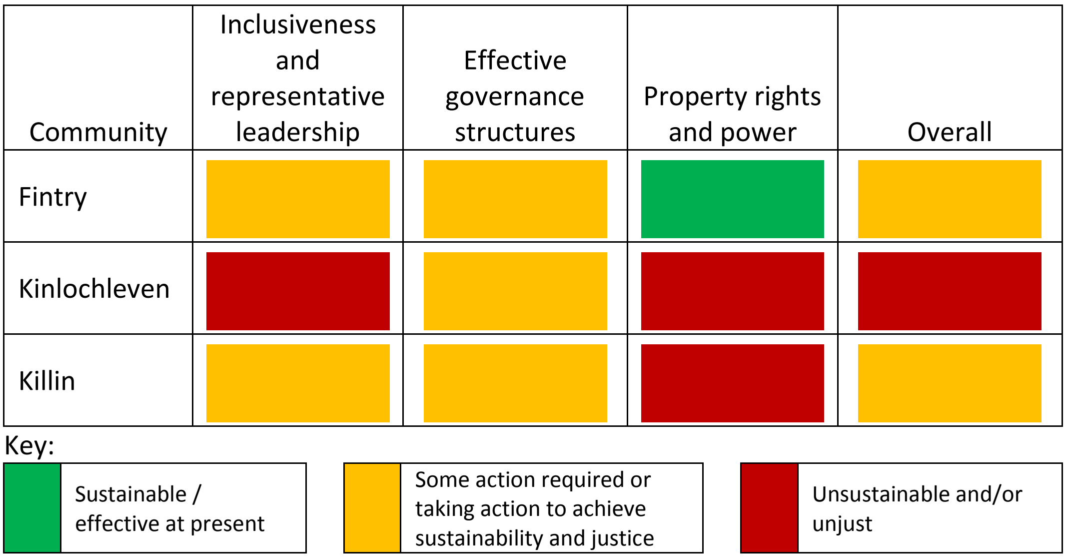


Figure 4.7 Governance and land tenure community scorecard

Kinlochleven scored the lowest out of the three communities with this aspect being unsustainable, as it failed in the areas of inclusiveness and representative leadership and fair distribution of power and property rights (Figure 4.7). Fintry scored highest of the three communities, but only received “amber” scores in inclusiveness and representative leadership and effective governance structures. Fintry achieves “green” status for property rights and power. Although Killin has more democratically formed community structures than Fintry, Killin lacks community property rights and resources, and so scored lower than Fintry (Figure 4.7).

4.2.1 Inclusiveness and representative leadership

Election turn-out is a means of assessing this goal (Figure 4.7). Fintry lies within the Ward of Forth and Endrick and, although the local election turn-out is not available for Fintry specifically, the overall Ward turn-out at the 2012 local election is available and was estimated to be approximately 49% (Table 4.7, GROS, 2011, Stirling Council, 2012a). As this is less than half the electorate, it suggests that the electorate is not motivated to vote for the LA. This may be for a number of reasons, for example apathy, contentment or futility. The risk is that the LA elected representatives do not represent the views of the majority of the local population and they lack voice in decisions made at LA level.

Table 4.7 Local council election turn-out May 2012 (GROS, 2011, Highland Council, 2012, Stirling Council, 2012a)

Community	Ward	Electorate 2011	Number of ballot papers May 2012	Percentage turn-out
Fintry	Forth and Endrick	9,684	4,708	49%
Kinlochleven	Fort William and Ardnamurchan	8,500	3,530	41%[1]
Killin	Trossachs and Teith	8,552	4,315	50%

[1]Turn-out quoted by Highland Council (2012) based on electorate of 8,593 in May 2012. The May 2012 election turn-out for the two Stirling Council wards was unavailable.

FDT membership requires that a member subscribes to the objectives of FDT (FDT, 2011b). This may exclude some members of the community, although the membership of FDT was almost 200 in 2011 (34% of adult population, FDT, 2011a, SCROL, n.d.). Although 56% of questionnaire respondents reported that they were at least fairly satisfied with how local decisions are made in Fintry, only 41% of survey respondents agreed that they could influence decisions (Figure 4.8). This together with the low election turn out and membership of FDT has led to an “amber” score.

Kinlochleven lies within the Ward of Fort William and Ardnamurchan and the turn-out of this Ward at the 2012 local election was 41% (Highland Council, 2012, Table 4.7), suggesting that the LA does not represent the views of the majority of the local population. Only 37% of respondents reported they were at least fairly satisfied with how local decisions are made and only 34% of survey respondents agreed that they could influence decisions (Figure 4.8). The current membership of KCT is 163 (Jayne Wilkinson, KCT, *pers. comm.,* April 2013), which represents less than 25% of the adult population. When KCT was set up no long term strategy was implemented and until 2010, there was little community involvement in KCT (*anon. pers. comm*., June 2010). For example, the decision to demolish the village hall *"was imposed on the community".* This has created "*apathy, because of inability to participate"* in decision-making. There is a perception of a *"small clique"* managing things and *"there are power struggles within the community. I heard there is no money left."* (Kinlochleven focus group participant, May 2010). Some residents fear KCT has been mismanaged, creating bad sentiments and mistrust within the community (Kinlochleven residents, *anon. pers. comm.*, May-July 2010). These results have led to a "red" score.

Killin lies within the Ward of Trossachs and Teith and the turn-out of this Ward at the 2012 local election was estimated to be 50% (Table 4.7). Although the Killin and Ardeonaig Trust (KAT) is progressive in terms of its approach to community development, in 2010, KAT had 10 trustees and 91 members (Angus, *pers. comm*.) and an AGM of approximately 100 (less than 25% of the adult population). 57% of questionnaire respondents were either fairly or very satisfied with local decision-making and 53% agreed that they could influence decisions (Figure 4.8). Despite this level of satisfaction, there is some frustration with the LA and LLTNP, which was voiced in focus groups. Planning permission was described as "*tricky*" needing consents from both LLTNP and Stirling LA. *"The village is being treated like a child that is constrained. Small communities have been over-looked. The Park is focused on being a tourist and conservation area and not industry. Ideas* *are thwarted by the LLTNP. We would like Killin to leave the* [jurisdiction of LLTNP].” (Killin focus group participants, November, 2010). These results have led to an “amber” score.

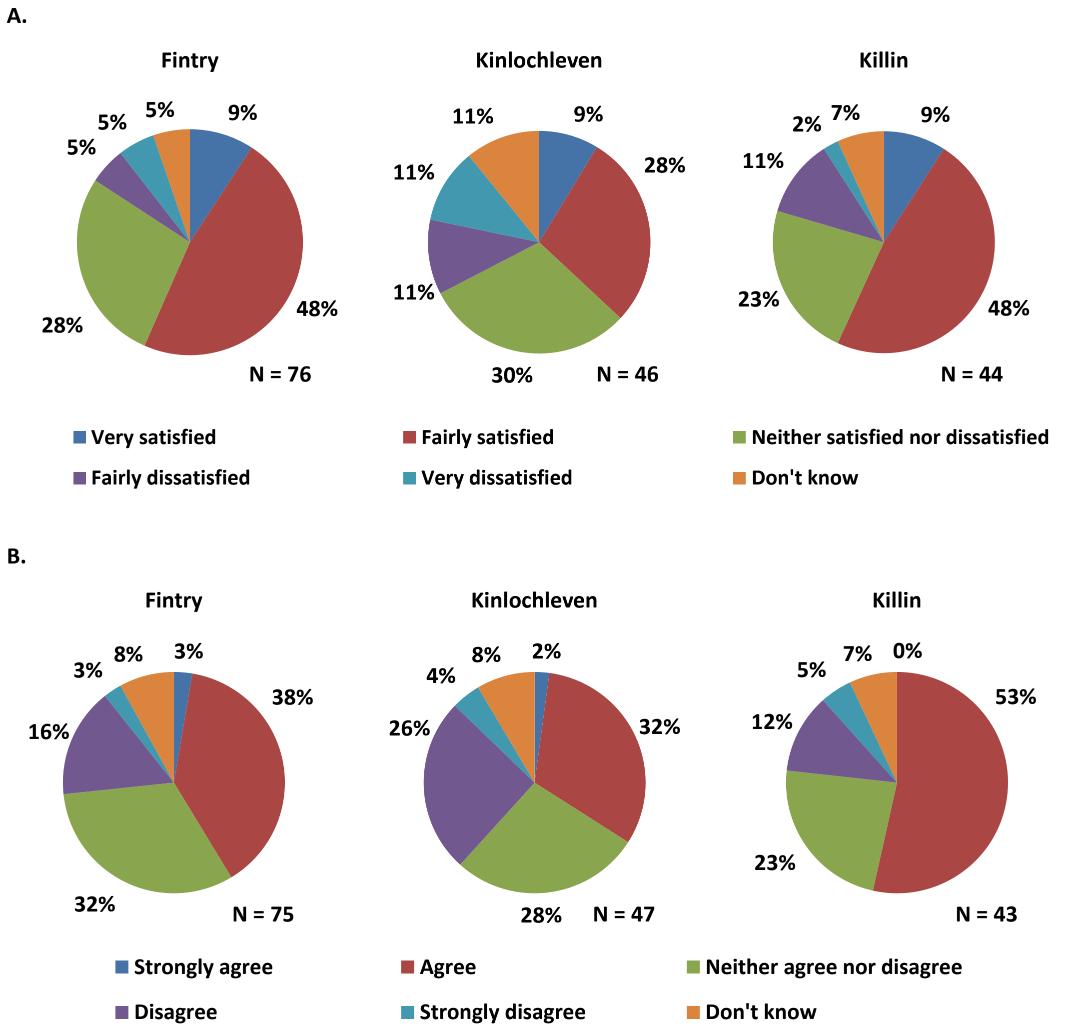


Figure 4.8 Satisfaction with and ability to influence local decisions in response to the Likert-style questions (A) “Overall how satisfied are you with how local decisions are made in your community?” and (B) “Do you agree or disagree that you can influence decisions affecting your local community?” (Fintry question no. 102-103)

4.2.2 Effective governance structures

The Fintry Community Council meets monthly and its objectives (defined in its constitution) are to represent the community, voice opinions and "*take such action in the interests of the community as appears to it to be desirable and practicable*" (Fintry Community Council, 2009, p1). Through this constitution, Fintry Community Council has the right to represent the community, but the constitution does not give it authority to take decisions on major issues within the community (such as planning and medical and education service provision, local fiscal duties, etc.). Fintry Community Council's role is to petition to higher authorities, rather than make decisions. However, no membership is required (voting of representatives is open to all the electorate, unlike FDT) and the Community Council is inclusive in that it represents the whole community.

Each community has a development trust; the purpose of each development trust (FDT, KCT and KAT) is different. FDT was set up under the Companies Act 2006 as a company limited by guarantee and its objectives are to:

> *"4.1 To advance environmental protection by promoting the adoption of measures to encourage the more efficient use of the world's resources, and in particular more efficient use of non-renewable energy sources so as (i) to minimise the proliferation of mines, wells and other extraction facilities which degrade the natural environment and (ii) to reduce greenhouse gas emissions and thus avoid the damage to the natural environment caused by global warming;*

4.2 To prevent and/or relieve poverty, and to relieve those in need by reason of age, ill-health, disability, financial hardship or other disadvantage, through providing them (either free of cost, or at reduced cost) with a range of energy conservation measures;

4.3 To advance education in the fields of renewable energy, energy conservation and similar areas; and

4.4 To promote the voluntary sector and the effectiveness and/or efficiency of charities, and in particular, through providing them (either free of cost, or at reduced cost) with a range of energy conservation measures…"

within Fintry Community Council boundaries. (FDT, 2011b, p3).

Membership of FDT is open to the whole adult community provided that they agree to the objectives of the company. Individuals are required to apply to the Directors for membership.

An "amber" score was given as FDT is not a true democratic organisation, as it requires membership, although it is currently well run and managed. FDT will have a very large income (estimated at £400,000/annum) within the next five years and democratically accountable management which listens (and can demonstrate it listens) to the voices of the whole community and acts fairly will be essential for managing and preventing conflict. Further work on the decision-making processes may be required to ensure all the community has adequate voice (Ledwith, 2005, Pugh, 2012).

Until November 2011, there was no community council in Kinlochleven and so there was no democratically accountable body representing the community at the local level. An election was held in 2011 and the Community Council is now in existence if still in infancy (Highland Council, 2011). However, the KCT holds land on behalf of the community and uses the income from its investments to the benefit of the community. KCT employs three part-time staff. KCT has sustainable development, regeneration and training defined in its constitution, the purposes of which are "3.*1 To manage community land and associated assets for the benefit of the Community and the public in general following principles of sustainable development… and by such management relieve poverty in the Community area, and to encourage economic regeneration; 3.2 To provide, or assist in providing, recreational facilities, and/or organising recreational activities, which will be available to members of the public at large with the object of improving the conditions of life of the Community and following principles of sustainable development…; 3.3 To advance community development, including urban or rural regeneration, following principles of sustainable development… and to encourage and promote training and the provision of educational facilities and courses, skills development and employment training; 3.4 To advance the education of the Community about its environment, culture, heritage and/or history; 3.5 To advance environmental protection or improvement including preservation, and conservation of the natural environment, the promotion of sustainable development, the maintenance, improvement or provision of environmental amenities for the community and/or the preservation of buildings* *or sites of architectural, historic or other importance to the community*." (KCT, n.d.).

Although KCT continues to manage its commercial buildings and has renovated a derelict park area adjacent to the Aluminium Story visitor centre, evidence of KCT delivering sustainable development activities, which have created significant community development, employment opportunities, educational achievements and environmental improvements, as articulated in the constitution, is lacking. Kinlochleven respondents scored lowest of all three communities in terms of their satisfaction with how decisions are made and the extent to which they felt they could influence decisions (Figure 4.8). Although KCT may be acting in good faith, some perceive that it is tainted by vested interests and are unhappy with the current management (Kinlochleven residents, July 2010, *anon. pers. comm.*).

The principles of sustainable development are enshrined in the objectives of KAT (KAT, 2007). KAT has an annually reviewed five year community plan (KAT, 2012b), which in 2012 was redeveloped with extensive participatory community planning and consultation. Through the development of the KAT action plan, a number of activities have been agreed to help alleviate current issues within the community and further develop the community sustainably (KAT, 2012b). However, KAT requires membership, which risks exclusivity. Nevertheless, whilst not all the community are members of KAT, they have been invited to participate in questionnaires and consultation events and membership of KAT has increased and community meetings and development planning meetings are well supported.

Whilst 53% of questionnaire respondents agreed that they can influence decision-making (Figure 4.8), a number of focus group participants articulated their frustration with the lack of local control and ability to influence planning decisions. Therefore, an "amber" score was given.

4.2.3 Fair distribution of power and property rights

The majority of land around Fintry is held by a multitude of farmers as mainly sheep and cattle farms with some arable on the flatter ground. The nature of the land tenure was not investigated in detail, but the fact that there are many landlords means that the land is more evenly distributed than in Kinlochleven, for example. The land surrounding Fintry Sports Club has been planted as a community orchard and the school has an outdoor classroom / woodland area (FDT, 2011b).

Despite the lack of large areas of community owned land (unlike the Isles of Eigg and Gigha), the community has substantial property rights with the community owned share of the Earlsburn wind farm. Other community property or developments include the Fintry Sports and Social Club, the Menzies Hall, the woodland classroom, the community orchard and the community car share scheme (Fintry Energy Efficient Transport, FDT, 2011a). The community has demonstrated its power to enact these enterprises historically and in the last decade.

In Kinlochleven, all surrounding upland is owned by the corporate entity, RT-Alcan (Wightman, 2011). RT-Alcan is a remote entity, with which the community has difficulty engaging: there is no resident landlord or corporate office within the community with which the community can interact (*anon. pers. comm*., July 2010). Without land rights the community is precluded from developing or enhancing these areas, for example for social amenity or hydroelectricity. Kinlochleven is effectively land-locked by RT-Alcan and Loch Leven. The former smelter site at the centre of the village remains derelict and in the ownership of RT-Alcan. Further renewable energy development by RT-Alcan (hydroelectricity) has had planning approval since the field research for this case study. However, Kinlochleven Community Council objected to this new 5MW generating scheme at Loch Eilde Mor (Highland Council, 2010), because RT-Alcan's "*current facility is at present running at half power,* [(there are] *concerns that* [the water] *source has been cut to qualify for government funding), no benefits* [from the development will accrue to the community of] *Kinlochleven…* [and] *construction will disrupt* [the] *annual event and walkers on the West Highland Way*" (Highland Council, 2010, 5.19). The lack of property rights and access to resources is in stark contrast to the situation in Fintry and the Isle of Gigha (Didham, 2007). However, in the last six months, KCT have been successful in negotiating permission to investigate the feasibility of constructing a 100kW hydroelectric scheme on RT-Alcan land on Allt nan Slatan burn above Kinlochleven (KCT, 2013).

Almost all the hydroelectricity opportunities have been exploited in Killin with the Scottish and Southern Hydroelectricity commercial developments of last century, and what remains would be challenged by the Scottish Environment Protection Agency (SEPA) due to the high conservation status of the remaining waterways in the Tay catchment. This has prompted one Killin resident to describe the development of all the major waterways for hydroelectricity in the area as "*We have been robbed of our resources.*" (Killin resident, *anon*. *pers. comm*., November 2010). At present, the community receives no direct benefit from the existing hydroelectricity installations. The community has struggled to purchase the former Breadalbane Folklore Centre (the Old Mill) in the village (*anon., pers. comm.*, April 2011). Although KAT are progressing this, they have yet to be successful at owning this building for the community. There is an opportunity to utilise the warm air outflow from a biomass power station, which is currently under construction, but the cost of developing the site to utilise the outflow may be too high to enable the community to take action (*anon., pers. comm.*, April 2012). The lack of success in obtaining benefits from renewable energy developments and the on-going struggle to acquire community assets demonstrate that the current balance of land ownership and power is unsustainable in Killin.

4.3 Transport and connectivity

The goals for transport and connectivity are having good public transport and connectivity to services and an equitable transport EF. Fintry and Killin both had red scores for public transport connectivity, whereas Kinlochleven had amber, as the public transport to Fort William is reasonable and many services are present in the village, such as medical services, high school and library. All three communities had an unsustainable transport EF, making their overall transport score for this aspect "unsustainable" (Figure 4.9).

4.3.1 Public transport and connectivity to services

Fintry has no regular (i.e. hourly) bus service connecting Fintry to Glasgow, Falkirk or Stirling. During school term time, there is a bus service to Balfron. In 2012, Fintry set up an operating hub (Fintry Energy Efficient Transport) for Moorcar Club (Moorcar, n.d.) to provide cars and electric bicycles through a sharing scheme. This is a start to addressing the poor connectivity of Fintry to other destinations other than by personal cars.

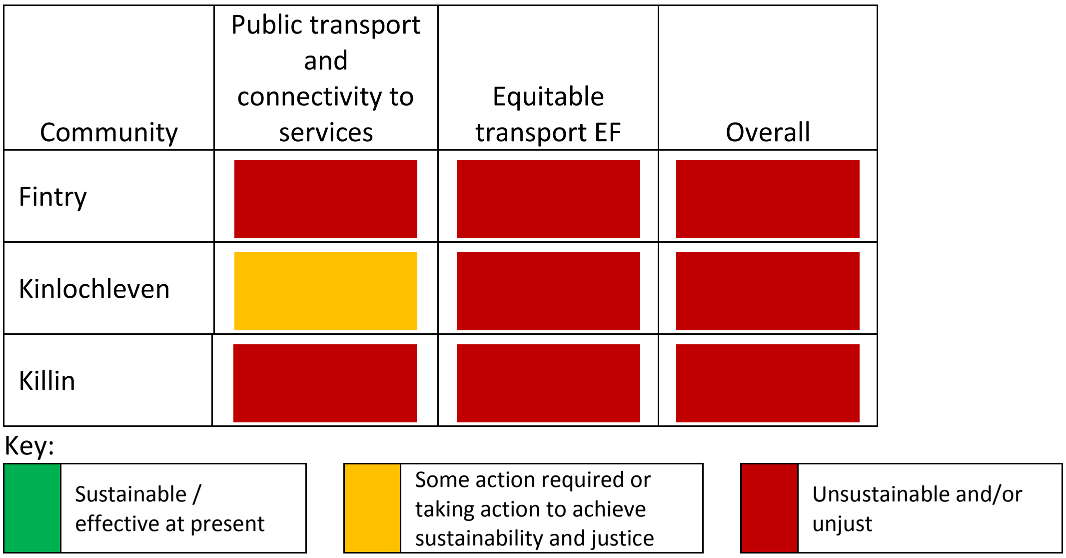


Figure 4.9 Transport and connectivity community scorecard

Kinlochleven has an hourly bus service to the town of Fort William, but not to Oban, which is the transport link to the Isles. The bus services to Inverness and Glasgow are fairly regular during the day, but take approximately three and a half hours (Traveline Scotland, 2012). The driving time is approximately two hours to Stirling and slightly longer to Glasgow (Google Maps, 2012). There are no cycle routes along Loch Leven, and the roads to Glencoe and Fort William are not considered safe for cycling (focus group participant, May 2010).

Killin has a less frequent bus service and no commuter bus (arriving before 9am) to Stirling. The service takes at least one and a half hours, depending on connections. The driving time is approximately one hour (Google Maps, 2012). There is a taxi-run Stirling Council funded Demand Responsive Transport service that connects people with other villages or transport services, such as Crianlarich (Stirling Council, 2012b). However, this service does not extend to parts of the Killin locale that reside within Perth and Kinross LA area. There is a less regular bus service to Aberfeldy (approximately five per day) with connections on to Perth but again there is no commuter bus for Aberfeldy. In Killin, KAT has estimated that 82% of households own and run a car and they have reported that fuel purchased in Killin costs 5p/litre more than that bought in Stirling (KAT, 2012a). This is likely to create distributional injustice for those on low income levels. For geographic access, Fintry and Killin is placed in the SIMD's first (worst) decile and Kinlochleven in the third decile (Scottish Government, 2010b). These results reflect the distances to essential services (Table 4.8).

4.3.2 Equitable transport EF

The transport EF for Fintry, Kinlochleven and Killin is 1.73, 1.11 and 1.28 gha/cap (Figure 4.10), which is 98%, 62% and 71%, respectively, of the fairshare (GFN, 2012), which is unsustainable. Kinlochleven has the lowest average distance travelled by air (and, as a result, EF for air travel), which is much less than the average for Highland LA and less than 50% of that of Fintry or Killin (Table 4.9). All respondents travel by car except for five seniors and one respondent of unknown age. The reasons for this are unclear but are likely to be related to age and personal mobility. In Kinlochleven, three 65+f and one 65+m stated that they did not travel by car on a regular basis. One 65+f respondent and one respondent with unspecified age/gender in Killin stated that they did not travel by car. Over 45% of Killin respondents travel in smaller cars (Figure 4.11). There is a general lack of hybrid and electric vehicles, with only one respondent stating they travelled in a hybrid, and electric cars were difficult to obtain at the time of the survey (the survey pre-dates the launch of electric cars by major motor manufacturers).

Table 4.8 Distances to destinations for essential services (return trips) from each community (Google Maps, 2012)

	Distance of return trip (miles)		
Destination	**Fintry**	**Kinlochleven**	**Killin**
Secondary school	12.6	0	43.2
Doctor	12.6	0	0
Dentist	21.6	13.4	43.2
Small supermarket	12.6	0	0
Large supermarket in small town/city	33.2	43.4	74.2
Hospital Accident and Emergency	34.8	43.4	88.2

Table 4.9 Average annual number of flights taken and corresponding estimates of distances flown by respondents in each community

Community	**Fintry**	**Kinlochleven**	**Killin**
Average number of flights (flights/cap/annum)			
Domestic	1.7	0.2	0.7
Europe	1.3	0.3	0.7
Long haul	0.5	0.3	0.6
All destinations	3.5	0.8	2.0
Average distance (km/cap/annum)[1]			
Domestic	2,200	300	900
Europe	3,400	900	1,900
Long haul	7,300	3,700	8,400
All destinations	12,800	4,800	11,200
N	79	48	42

[1]For calculation and weighting for emissions of average flight distances see Chapter Two (AEA, 2010, Google Earth, 2011).

Figure 4.10 Transport EF results for each FDC based on distances travelled collected in the household questionnaires. The car travel EF is broken down into direct emissions, purchase of vehicles and running a vehicle. Vehicle purchase data and, for Fintry only, the distance travelled by ferry were not collected, so the Stirling LA average (SEI, 2011a) was used for these categories (modelled in REAPv2.17, SEI, 2011a)

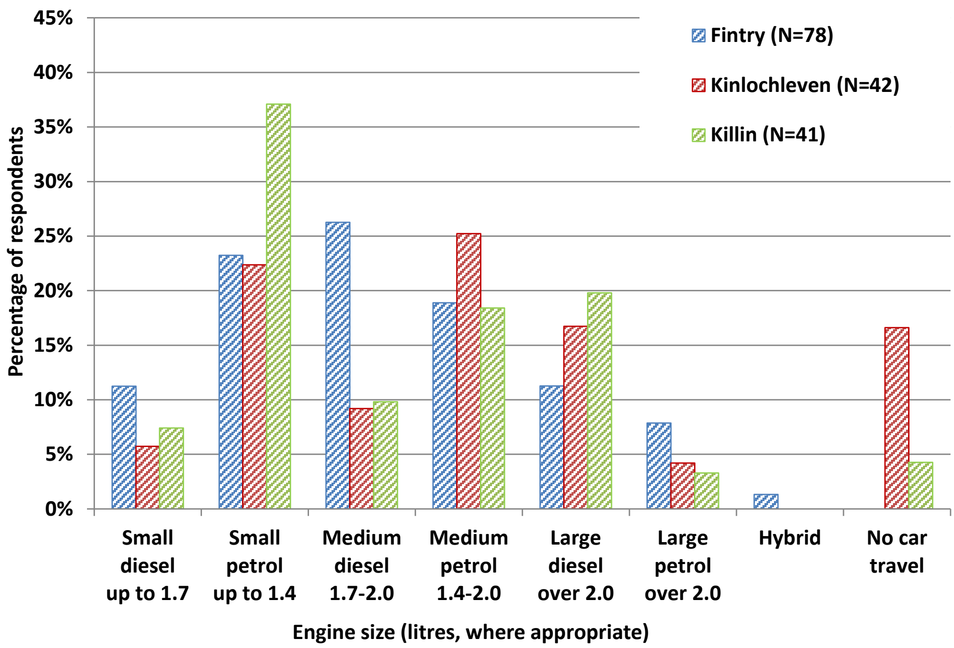


Figure 4.11 Responses to the question "What type of car do you travel in most often?" (Fintry question no. 68)

4.4 Health, well-being and education

The four goals for this aspect of the SCD are: happy citizens that are satisfied with life; healthy citizens; secure and safe citizens; and education that endeavours to create literate and critical citizens (Ledwith, 2005, Fagan, 2009, Figure 4.12). Fintry scores highest with an “amber”. The lower scoring goals for Fintry are education, over which all three communities have little direct control, and health and well-being due to lack of a medical centre. Kinlochleven scores “red” with its relatively high incidences of illnesses, higher crime rates and less satisfied questionnaire respondents. Killin is a safe place to live and has high life satisfaction scores, but has higher than average incidence of illnesses (SNS, 2012) and so scores “amber”.

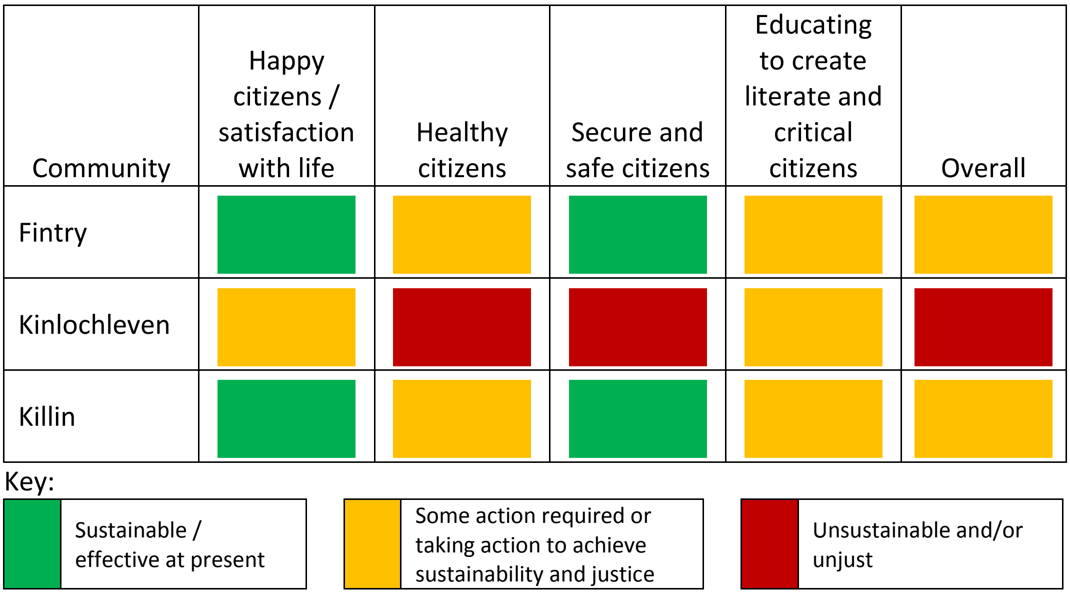


Figure 4.12 Health, well-being and education community scorecard

4.4.1 Happy citizens / satisfaction with life

Residents of Fintry and Killin have the highest self-reported happiness (mean scores out of a maximum score of 10 are $\bar{x}$=8.3 and $\bar{x}$=8.0, respectively) and

Kinlochleven has the lowest ($\bar{x}$=7.8). Only a small proportion of residents reported themselves as unhappy (a score of less than five: 1%, 8% and 5% of respondents in Fintry, Kinlochleven and Killin, respectively). On the life satisfaction scale, Killin has a higher percentage of respondents reporting agreement to the life satisfaction statements than both Fintry and Kinlochleven (Figure 4.13).

There is no statistically significant difference between case studies for self-reported happiness (Kruskal-Wallis H=3.60, df=2, *p*=0.166, N=170), but there is for the life satisfaction scale (Kruskal-Wallis H=11.35, df=2, *p*=0.003, N=169), suggesting that the lower average life satisfaction score for Kinlochleven is significantly different ($\bar{x}$=4.0, 3.6 and 4.1, for Fintry, Kinlochleven and Killin, respectively). Nevertheless, when these life satisfaction scores were compared with that of the Scottish respondents to the ESS 2006 (ESS, 2011), all three case study communities reported higher scores than the Scottish ESS 2006 respondents. The difference with ESS respondents was statistically significant (Kruskal-Wallis H=205.98, df=3, *p*=<0.001, N=77 (Fintry), N=49 (Kinlochleven), N=43 (Killin) and N=235 (ESS, 2011)). Based on these results, Fintry and Killin were given a “green” score and Kinlochleven “amber”.

In 2008, 4% of the population was income deprived in Fintry, compared to 9% in Killin and 14% in Kinlochleven (Scottish Government, 2010b) and 24% of families receive less than 60% of median income (Table 4.10, SNS, 2012). This is reflected in SIMD’s 2009 income domain ranking (deciles) as ninth, seventh and fourth, respectively (Scottish Government, 2010b). This illustrates the contrast in wealth of the three communities and, where there is significant poverty in Kinlochleven, this is likely to reflect on the well-being of the population.

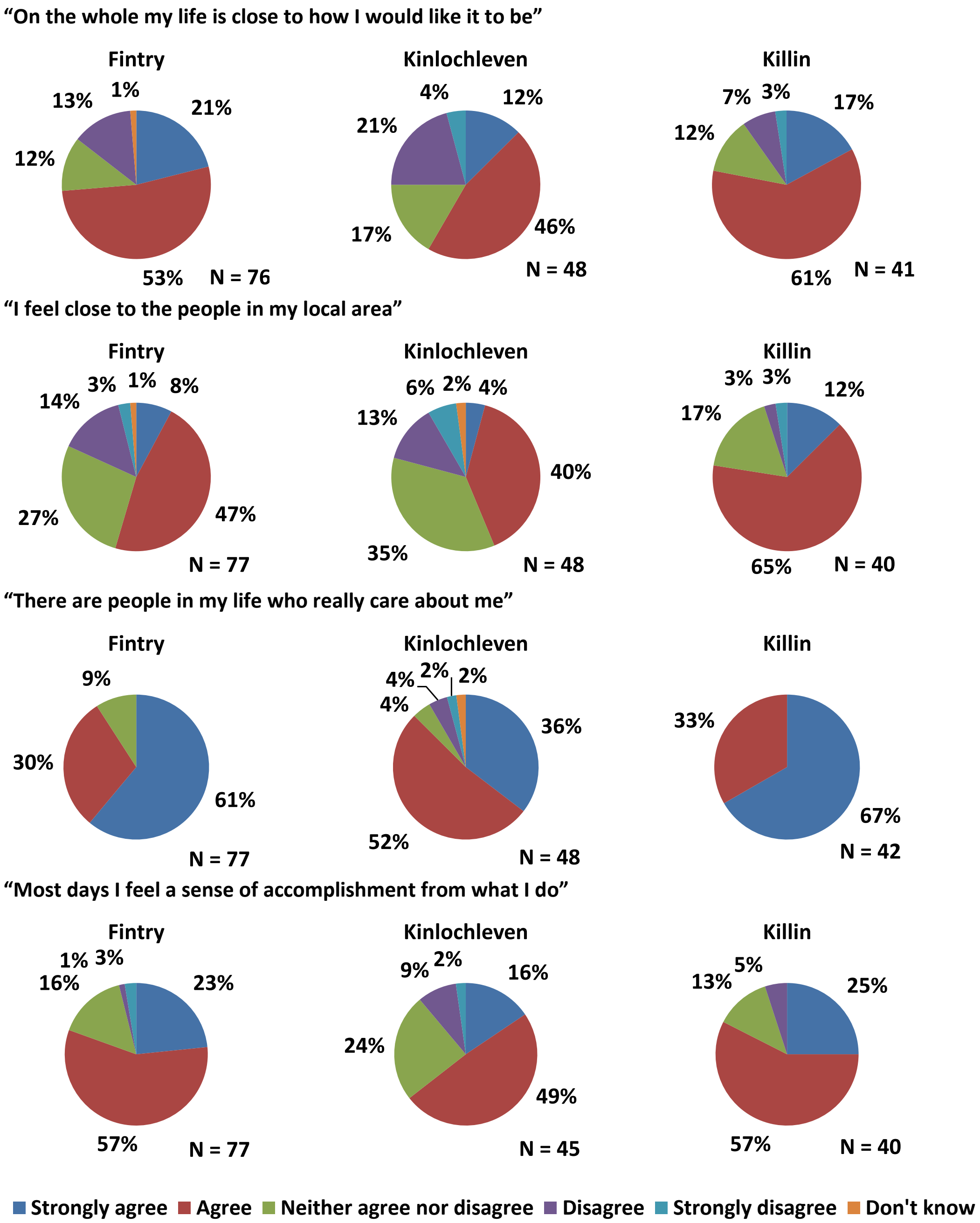


Figure 4.13 Responses to questions on life satisfaction. Respondents were asked the extent to which they agreed with these Likert-style questions (Fintry questionnaire no. 112-115) and the results were combined to create the life satisfaction scale

4.4.2 Healthy citizens

The SIMD reports that Fintry was in the tenth (top) decile for health, Kinlochleven in the fourth decile and Killin in the eighth decile (Scottish Government, 2010b). The low score for Kinlochleven corresponds with the high cancer and comparative illness counts, which are much higher than expected for a rural community (Table 4.10). Although the health of Fintry residents appears to be better than average (Table 4.10), Fintry has no local community health facilities (as illustrated in Table 4.8) and this is compounded by no regular public transport to these facilities, dentist or hospital.

Table 4.10 Health and income statistics for each community showing cancer rates, comparative illness counts and low income families (SNS, 2012)

Case study	Datazone[1]	Percentage cancer registration, 2000-2009 (%/cap/annum)	Comparative illness count as a percentage of population	Percentage of families receiving less than 60% of median income
Fintry	S01006074	0.4%	5%	N/A
Kinlochleven	S01003722	0.9%	16%	24%
Killin	S01006176	0.7%	9%	5%
Stirling LA	-	0.5%	11%	16%
Highland LA	-	0.6%	10%	14%

[1]SNS data is available for Datazones (not communities), which are described in Chapter Two.

Pollution from the smelter is described in the 1946 study (see section 3.1, Gregor and Crichton, 1946). Five different residents indicated that there are some residents who are suffering ill health with, or have relatives that have passed away following, potentially pollution-related illnesses. The "*company*" was said to "*take care of*" sick and/or dying "*factory workers*" by activities such as maintaining gardens or providing cash in "*brown envelopes*" (Kinlochleven residents, May-July 2010 and Kinlochleven focus group participants, May 2010).

However, in this research, those suffering or who had received support remained silent. One resident reported that "*there is no hope*" for Kinlochleven and said that many the people he/she had loved and cared for were either sick, dead or had left, saying "*heavy metals landed on this village. The factory killed many of my family and friends. I go to a funeral every week*." (*anon. pers. comm*., June 2010). Another focus group participant said "*We have lost a generation*" (Kinlochleven focus group participant, May 2010). Also, there is concern about the lack of psychiatric care in the community and the social housing policy; "*We are a dumping ground for the worst cases from Glasgow and Fort William*" (*anon. pers. comm*., June 2010).

4.4.3 Secure and safe citizens

The SIMD in 2009 placed Fintry in the ninth decile, Killin in the eighth decile and Kinlochleven in the second decile in terms of crime (Scottish Government, 2010b). The crime ranking for Kinlochleven is low for a rural community (i.e. there are high levels of reported crime) and is opposite to the perception of school pupils, who, in one of the envisioning focus groups, reported that they felt safe at night in the village. The higher levels of crime are in line with the unemployment and income deprivation in the community (19% of the population of Kinlochleven are income deprived and 13% employment deprived, Scottish Government, 2010b, SNS, 2012).

4.4.4 Educating to create literate and critical citizens

Fintry is in the tenth (top) decile and Kinlochleven and Killin both in the fifth decile for the SIMD ranking of Education, Skills and Training (Scottish Government, 2010b). Fintry's senior school education is in Balfron, approximately five miles away and is accessed by bus. The primary school has an outdoor classroom, in part designed by the pupils (Reetz, 2011). There is an outdoor village playground. After school activities, such as dance, football, athletics and music lessons are located in other nearby villages, but there is no public transport to connect to these activities.

Kinlochleven High School was opened in 2008. In 2012, Kinlochleven High School had approximately 140 pupils and there are approximately 60 children in the primary school (Jill Mills, Deputy Head Teacher, Kinlochleven High School, *pers. comm.*, June 2012).

Killin has a primary school and secondary school education is at McLaren High School in Callander, which is approximately forty minutes by bus from Killin. KAT has the objective "*to advance education… and raise awareness and interest in the local environment and heritage,… following the principles of sustainable development*" (KAT, 2007, p1-2). The work of EAK (Environmental Action Killin), KCC (Killin Cutting Carbon) and KAT suggest that in Killin there are some citizens at least partially literate in sustainability (KAT, 2012b, Tombreck, n.d.). Given that these organisations have yet to engage the whole population, further work may be required to enable all citizens in Killin to become literate in sustainability.

Although, in 2013, significant progress was made in the requirement for educations for sustainable development in the curriculum, as yet there is no evidence to suggest that the Scottish education system, as described in Chapter One, is enabling the majority of citizens to be literate in sustainability (Ledwith, 2005, Fagan, 2009). Therefore, an amber score was given to all communities.

4.5 Environment and ecocentrism

The two goals for this SCD aspect were local land management for sustainability and biodiversity and ecocentric attitudes and behaviour that protect and enhance natural resources and biodiversity (locally, globally and inter- and intra-generationally, Figure 4.14). Fintry and Killin scored “amber” for both of these. Kinlochleven had a lower score for the land management goal, despite the naturally regenerating upland woodland surrounding the community (SNH, 2008), because of the extent of land in Kinlochleven that lies unremediated (Figure 3.8).

Community	Local land management for sustainability and biodiversity	Ecocentric attitudes and behaviour (local action – global impact)	Overall
Fintry			
Kinlochleven			
Killin			

Key:

Sustainable / effective at present	Some action required or taking action to achieve sustainability and justice	Unsustainable and/or unjust

Figure 4.14 Environment and ecocentrism community scorecard

4.5.1 Local land management for sustainability and biodiversity

In Kinlochleven, the land beyond the immediate village boundary is owned solely by RT-Alcan, whilst the land around Fintry and Killin is owned largely by smaller farming estates. The Ben Lawers estate adjacent to Killin is owned and managed by NTS. The idealistic goal of land management for the environment and community, such as that found in the Findhorn community (Findhorn, n.d.) or on the Isle of Gigha (Didham, 2007), is not realised in any of the case study communities. Nevertheless, each community has some examples of community land.

In Fintry, a new community orchard has been planted and a market garden planned. However, whilst this is better than many communities, this is the extent of land management for sustainability and biodiversity identified.

In Kinlochleven the land is managed largely to support the RT-Alcan hydroelectric scheme. There is neither agricultural production nor energy generation for the local community. Whilst recreational activities take place on the RT-Alcan Estate, they do not form the principle management purpose. RT-Alcan appear to be permitting the natural regeneration of the woodland and have undertaken some tree planting (*anon. pers. comm*., July 2010). Over the last ten years, KCT has been involved with improving the appearance of two community spaces. Neither has had a biodiversity goal, but one is now the village green. There is a lack of play areas and gardens in Kinlochbeg, where many flats have no gardens (Kinlochleven focus group participants, May 2010).

Killin does not have any community owned land or projects at present and KAT are trying to progress a community purchase of the Old Mill at Dochart Bridge.

All land depleted of resources due to over-grazing or over-cropping can be considered to be degraded. In Fintry and Killin, extensive grazing over many years and the general absence of native woodland suggests that the land is likely to be degraded. In Killin, the land owned by NTS is being managed with sustainable development goals and with the aim to protect the unique biodiversity of the land.

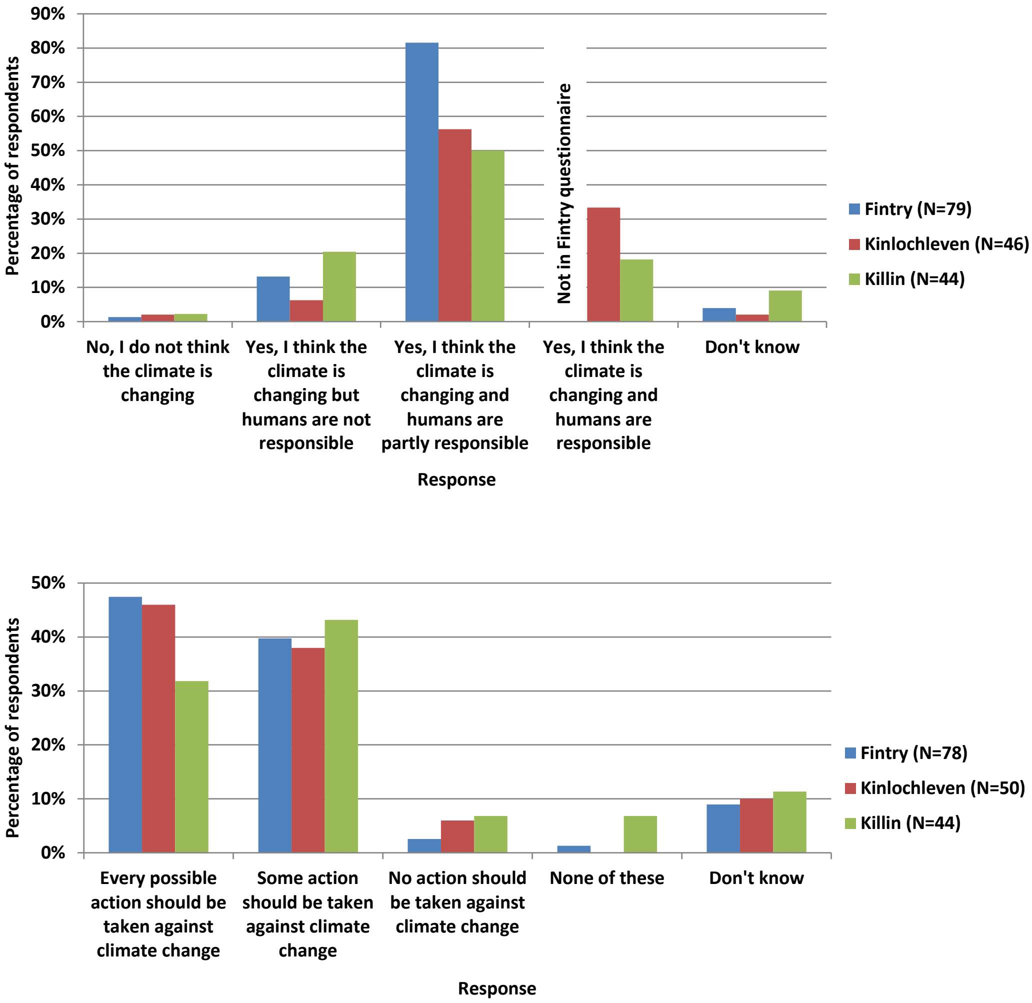
Kinlochleven is unique in having industrially degraded land (see section 3.1.2). At present, despite its large size and central location within the community, the site has not undergone regeneration. It continues to be an eyesore, and a location of pollution, but it could be an opportunity if properly remediated.

Community involvement in and responsibility for land management decisions and planning is very limited in all three communities. The planning process in Scotland does not permit community-led decision-making or authority. This grievance was articulated many times in focus groups in both Fintry and Killin. In Kinlochleven, this is illustrated by the newly approved RT-Alcan hydroelectricity development scheme. The community was not involved and indeed the community council actively objected to the further development of the hydroelectricity, as described in section 4.2 (Highland Council, 2010).

The author has not measured the extent of organic farming, the extent of animal friendly agricultural practices, nor the employment of agri-environmental or other schemes for biodiversity (Scottish Government, 2012h) in the three case study communities. Nevertheless, the majority of agricultural practice in Fintry and Killin is likely to be conventional rather than organic. In Fintry, Townhead Farm has participated in a lapwing experimental study (Heather McCallum, *pers. comm.*, April 2012) and, near Killin, Tombreck Farm has the goal of sustainable agricultural and living practices (Tombreck, n.d.). In Kinlochleven, the land management practice is native forest regeneration and there has been significant tree planting and removal of sheep (*anon*. *pers. comm*., July 2011). On consideration of the evidence in this section, Fintry and Killin have been given "amber" and Kinlochleven a "red" score. The latter is because of the lack of community involvement in land management and the derelict smelter site.

4.5.2 Environmental attitudes

Over half of respondents agreed that climate change is being at least partly caused by humans (Figure 4.15A) and approximately 80% of residents in all three communities agreed that at least some action should be taken against climate change (Figure 4.15B). Although the majority of respondents agreed that people in Scotland need to change behaviour (Figure 4.16A), only approximately half of the respondents agreed to the statement that they personally need to change their lifestyles so that future generations can continue to enjoy a good quality of life and environment (Figure 4.16B, 48%, 57%, and 43% for Fintry, Kinlochleven and Killin respectively). When only working age respondents were considered, the percentage was much higher (Figure 4.16C, 65%, 78% and 50% in agreement, respectively). Although Killin has highest levels of organic food consumption compared to the other communities (Figure 4.17), despite lack of access to organic retailers, the EFBS and EFPS scores (section 4.1) suggested that behaviour was not particularly environmentally friendly in any community.



A.

B.

Figure 4.15 Respondents' attitudes to climate change. Each figure shows the responses to the Likert-style questions: (A) As far as you know, do you personally think the climate is changing and, if so, are human actions responsible? (Fintry questionnaire no. 119), and, (B) How much action should be taken against climate change? (Fintry questionnaire no. 121)

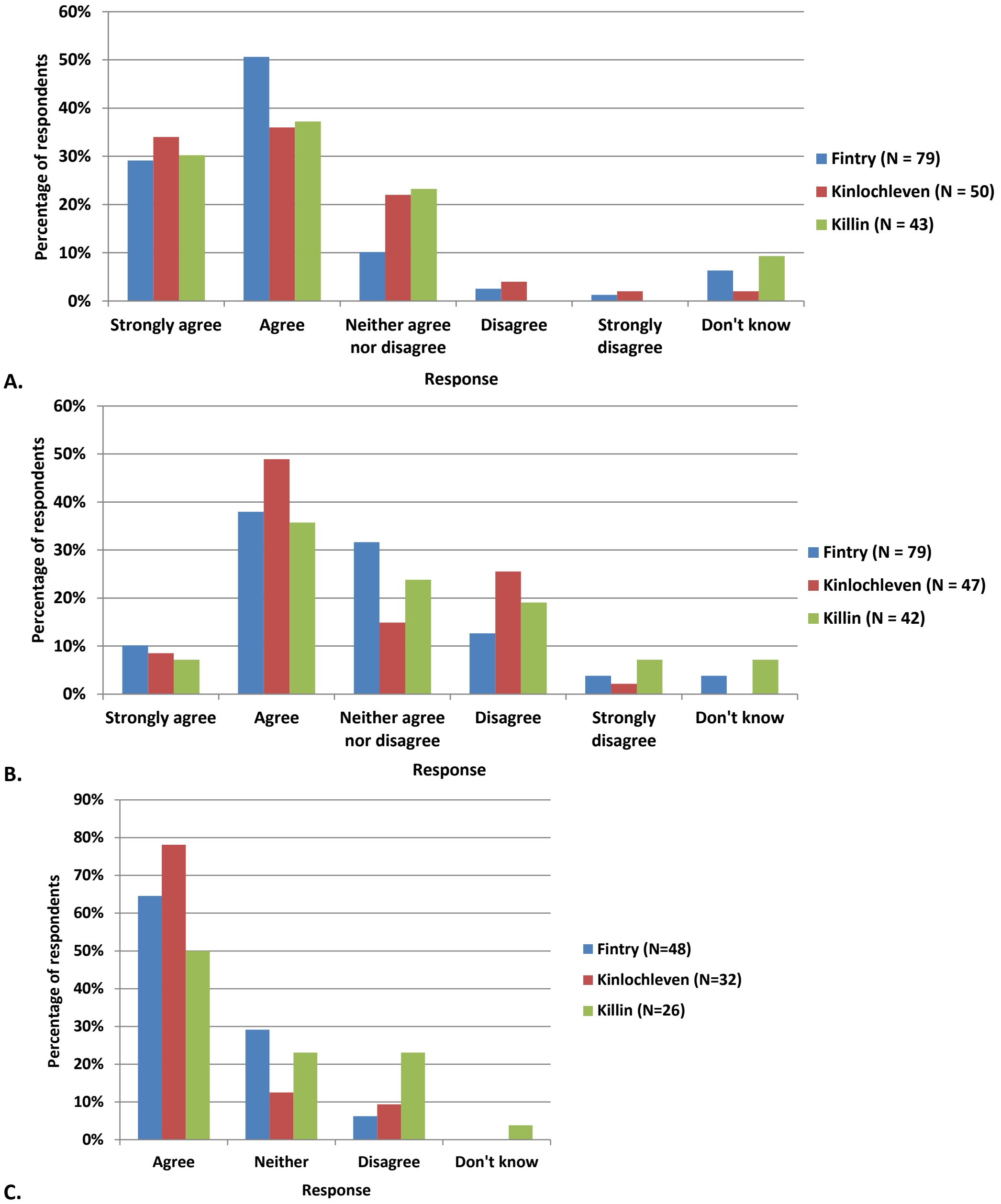


Figure 4.16 Respondents' attitudes: the responses to the Likert-style questions relating to whether people need to change behaviour (Fintry questionnaire no. 117-118): (A) Do you agree or disagree that most people in Scotland today need to change their way of life so that future generations can continue to enjoy a good quality of life and environment? (B) Do you agree or disagree that you personally need to change your way of life over the next few years, so that future generations can continue to enjoy a good quality of life and environment? (C) shows the attitudes to (B) for those under age 65

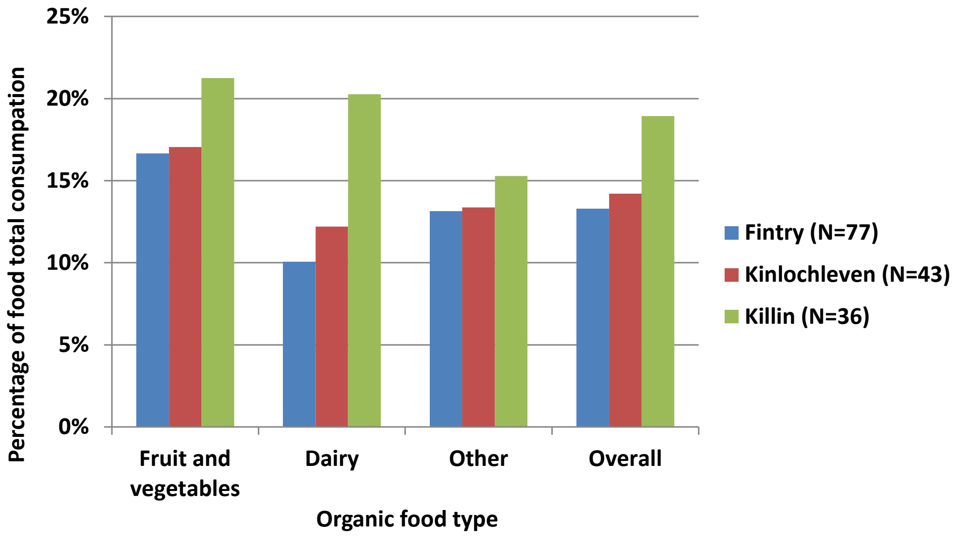


Figure 4.17 Proportion of stated organic food consumed by respondents, based on responses to Likert-style questions asking respondents to estimate their organic consumption (Fintry questionnaire no. 63-65)

Using implementation of rainwater saving devices as a proxy measure of environmentally friendly gardening practice for those with gardens, only 28%, 18% and 34% of respondents (weighted by gender, N=78, N=47 and N=41, Fintry, Kinlochleven and Killin, respectively) stated that they had installed them. Based on the evidence presented in this section and in the absence of more detailed evidence, an "amber" score has been given to all three communities.

4.6 Economy

The case study communities were only assessed on two of the three goals for this aspect of the SCD, namely local employment, resources and production and flourishing, diverse and resilient businesses serving the needs of the local population. All three communities had "red" scores (Figure 4.18) because of the lack of local employment and businesses, although Killin has a greater number of businesses than the other two communities.

4.6.1 Local employment, resources and production

The distribution of the length of commuter journeys reflects the variations in locations of employment and geography for each community (Figure 4.19). As expected, commuters in Fintry have the lowest proportion of local journeys with 48% of journeys being in the 15-30 mile distance category, which corresponds to the distances to the major conurbations. Kinlochleven is very varied, whilst Killin respondents are mainly employed locally (72%), with the rest largely with employment more than 30 miles from Killin. The maximum distance for employment is 60 miles for Fintry and Kinlochleven, and 120 miles for Killin. The results suggest a lack of local employment in Fintry and Kinlochleven.

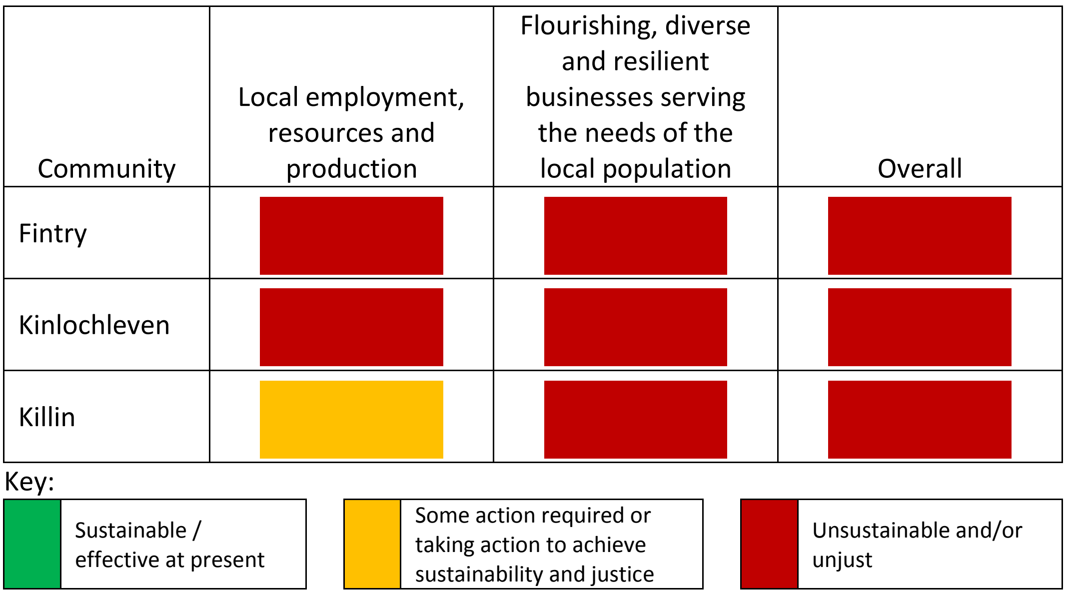


Figure 4.18 Economy community scorecard

Four percent of the population of Fintry was employment deprived in 2008, in contrast with 13% of Kinlochleven and 6% of Killin, placing Fintry on the ninth decile of the SIMD for employment, Kinlochleven the fourth and Killin the eighth (Scottish Government, 2010b). This corresponds with the social grades of

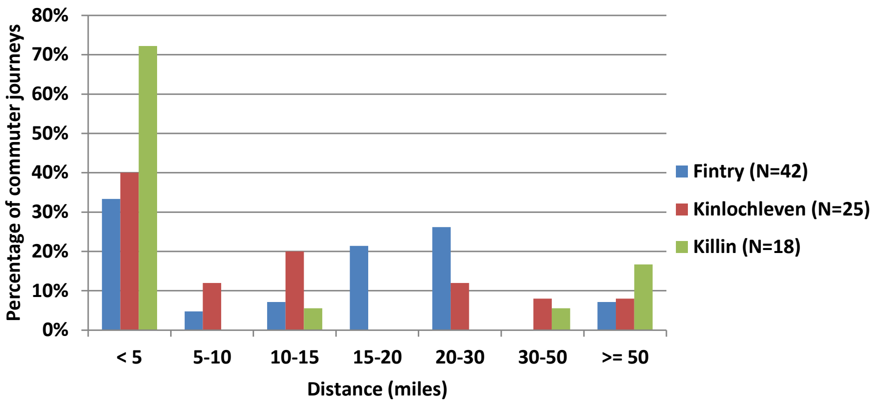


Figure 4.19 Commuter journeys of respondents by distance travelled

household reference persons (Table 4.11). The proportion of people in the community with lower social grades could be higher than the figures quoted in Table 4.11, as the household reference person completing the survey may in many instances be the most senior figure in the household. In Fintry 92% of those in employment in the survey were at least fairly satisfied with their jobs, compared with 90% in Killin and 77% in Kinlochleven (Figure 4.20). Although Kinlochleven had the highest proportion of dissatisfied respondents, 39% (the highest of the three communities) were very satisfied with their jobs. In Kinlochleven and Killin, focus groups highlighted the lack of meaningful and fairly paid employment for young people and the lack of local employment was identified in Fintry.

In Killin, several focus group participants articulated the need for local apprenticeships to improve opportunities for young people. In Kinlochleven there is *"…nothing here for the 20 something."* (Kinlochleven focus group participant, May, 2010). In Kinlochleven, the demise of virtually all the shops was identified as an issue and a priority for change: "*we need to start up new* *businesses in the empty shops (e.g., a tea room). The Grameen Bank – we need it here*" (*anon. pers.comm.,* June 2010).

Table 4.11 Census 2001 results of approximated social grade of all people aged 16 and over in households (SCROL, n.d.)

		Social grade				
Community	**N**	**AB**	**C1**	**C2**	**D**	**E**
Fintry	583	28%	36%	15%	7%	14%
Kinlochleven	750	9%	24%	16%	25%	27%
Killin[1]	731	16%	31%	19%	17%	17%

Key of Social grade of household reference person:
AB-Higher and intermediate managerial/administrative/professional
C1-Supervisory, clerical, junior managerial/administrative/professional
C2-Skilled manual workers
D-Semi-skilled and unskilled manual workers
E-On state benefit, unemployed, lowest grade workers
[1]This is the sample size used for the Census 2001, which differs in extent to this study's sample size (see section 3.3.1.2).

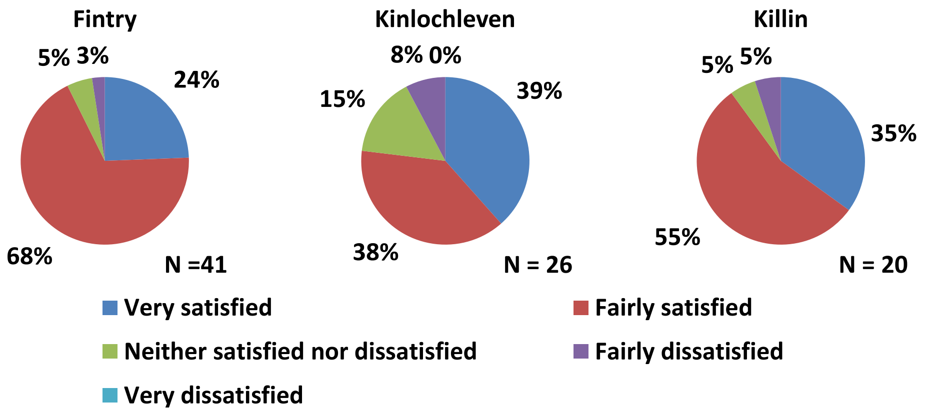


Figure 4.20 Percentage of employed respondents satisfied with their jobs

In Killin, the "*economy is focused on tourism and it's not thriving. There is no business investment, no "round table" and no business community*." (Killin focus group participant, November, 2010). "*Keeping young people in with jobs is another issue. There is no [direct] public transport to Stirling for training, apprenticeships, etc. Young people cannot afford cars and fuel."* (Killin focus group participant, November, 2010). Of those under age 65 surveyed 79%, 78%

and 69% were in employment in Fintry, Kinlochleven and Killin (N=48, 32 and 26), respectively.

In summary, whilst there is high employment in Fintry, few are employed within the village. In Kinlochleven, employment deprivation and the proportion dissatisfied with their jobs are higher. Killin has the greatest local employment, but for some employment means commuting significantly longer distances.

4.6.2 Flourishing, diverse and resilient businesses serving the needs of the local population

Fintry is a combination of a retirement and commuter village. 53 businesses have been identified[2] (Appendix B.2, FAME, 2012, 192.com). Two are community companies and one is a consultancy service for communities. The main businesses are related to tourism (a hotel and a caravan site), catering with two pubs and two cafes, and agriculture (not all farms may be listed in Appendix B.2). The rest are small businesses and trades, such as soft furnishings, plumbing, carpentry, and software developing. Four IT companies are based in Fintry and may use technology to enable home-working. 64% of adults in Fintry are in the managerial/professional/supervisory social grades of A, B and C1 (Table 4.11, SCROL, n.d.).

Despite the larger population, small supermarket and hairdressers, only 37 businesses have been identified[3] in Kinlochleven (Appendix B.2, FAME, 2012,

[2] The list of businesses is an estimate as many people work as self-employed persons without being listed as a business or in the telephone directory. Some of the businesses listed may be a duplicate, trading under more than one name.
[3] See footnote 2.

192.com). Kinlochleven has a post office, which was relocated in 2011 to the redeveloped visitor centre, The Aluminium Story. The tourism trade is boosted by the West Highland Way running through the village and the Ice Factor, which boasts an indoor climbing wall, an outdoor high ropes course, an outdoor equipment retail outlet and was Scotland's only indoor ice climbing wall. The Ice Factor has been successful and has led to its owner expanding the business in Scotland and internationally. 40% of Kinlochleven's businesses are tourism related (laundry, accommodation, restaurants and pubs). Kinlochleven has the highest proportion of unemployed / lowest grade workers (social grade E) and fewest in the AB grade (Table 4.11). There is an opportunity to exploit the landscape for tourism, other than for the transient West Highland Way walkers. *"The old paths are overgrown but there are great pools and walks that could be redeveloped. There is a lack of people using the local hillsides – it's strange."* (Kinlochleven focus group participants, May 2010). A footpath development scheme that began a decade ago (Booth, 2000) has ceased; the footpaths are under-developed and over-grown; and there is a lack of visitor interpretation and marketing (for both the local landscape and industrial heritage), which would otherwise maximise tourist opportunities. In addition, there are individuals in the community who are unemployed, have low incomes and are desperate for work, who would very much like to undertake work on the paths again (resident, *anon. pers. comm.,* July, 2010).

In Killin, 122 businesses were identified[4] (Appendix B.2, FAME, 2012, 192.com). This corresponds with the higher level of local employment (Figure 4.19); of these businesses 15% are farms and approximately 30% are reliant on tourism. However, in 2011 businesses were complaining of poor visitor numbers (Killin residents, *anon. pers. comm*.) and tourists have switched from using catered to self-catering accommodation. Local employment is not used for care provision and carers drive from Stirling to carry out daily duties for sick and/or elderly persons within the community, rather than using carers local to the community (Killin focus group participants, November 2010). There is a lack of suitable premises for businesses (industrial units), so expansion of a successful business is not possible and new businesses cannot find premises (Killin focus group participants, November 2010). This gives the impression that Killin is not thriving economically (Killin focus group participant, November, 2010).

All three communities have been given an unsustainable ranking as in all three communities local employment has been raised as a key concern in the focus groups. Fintry is unsustainable due to the lack of local businesses and employment, Killin because it is reliant on tourism and is not self-sufficient for basic services (e.g., care provision is provided by distant workers) and Kinlochleven because of the lack of local employment and businesses within the community.

[4] See footnote 2.

4.6.3 Sustainable businesses

This goal was not measured. For economies to be sustainable, the businesses operating within the economy have to operate sustainably. Moreover, in EF terms, the EF of a business forms part of the life cycle assessment of the final product or FDC.

4.7 Built environment

This aspect of the SCD has four goals: sustainable homes, taking action towards achieving low impact housing, housing that meets needs of population and sustainable community buildings (Figure 4.21). Fintry scored the highest with an “amber” score, due to its activities to improve the efficiency of community buildings and housing by insulating homes and installing renewable energy systems. However, Fintry lacks affordable social housing, unlike Kinlochleven and Killin, both of which have social housing. Kinlochleven has had no energy efficiency project and Killin’s only focused on insulation. Kinlochleven has a new more energy efficient community building. All communities had “red” scores for the sustainable homes goal, because of their housing EFs. Business buildings were excluded from the assessment of this aspect.

4.7.1 Sustainable homes

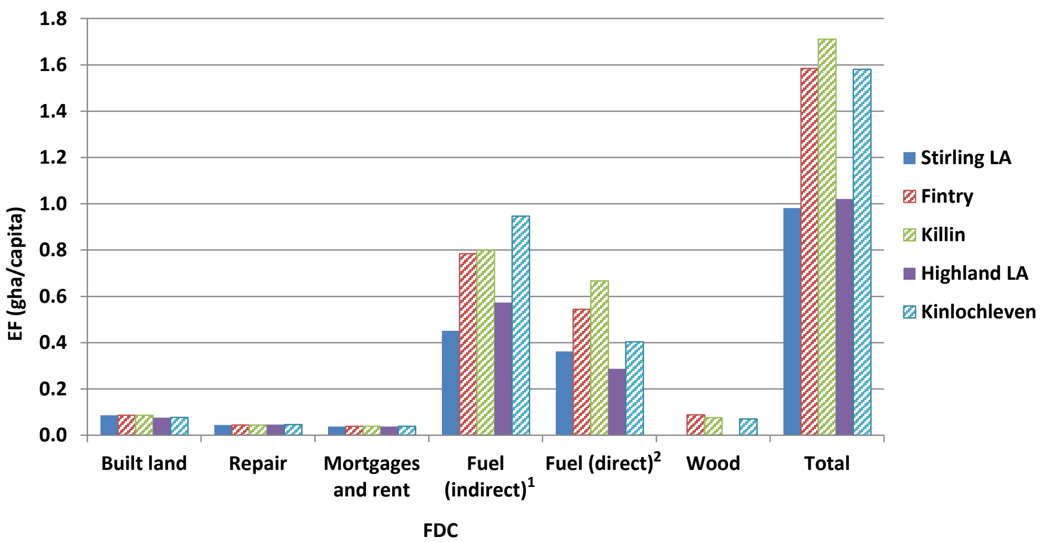
The principal measure for this goal is the housing EF, which is significantly higher than LA averages for all three communities (Figure 4.22), making this measure unsustainable. Fintry, Kinlochleven and Killin’s housing EF is 89%, 85% and 92%, of the fairshare, respectively. The number of households with green tariff

Community	Sustainable homes	Taking action towards achieving low impact housing	Housing to meet needs of population	Sustainable community buildings	Overall
Fintry					
Kinlochleven					
Killin					

Key:

	Sustainable / effective at present		Some action required or taking action to achieve sustainability and justice		Unsustainable and/or unjust

Figure 4.21 Built environment community scorecard



[1]Fuel (indirect) is the EF of the production and transportation.
[2]Fuel (direct) is the EF (fossil fuel land) of the emissions of fossil fuels.

Figure 4.22 Housing EF. The measured categories were fuel and wood. LA averages were used for the EF of built land, repair (and maintenance), and mortgages and rent (modelled in REAPv2.17, SEI, 2011a)

electricity in Fintry reduced its housing EF to a value close to Kinlochleven (Figure 4.22), despite Fintry having higher total energy consumption (average total energy consumption, excluding energy sourced from the ground or air by

GSHPs/ASHPs, was 16,600, 13,200 and 18,100 kWh/cap/year for Fintry, Kinlochleven and Killin, respectively (Appendix C.1).

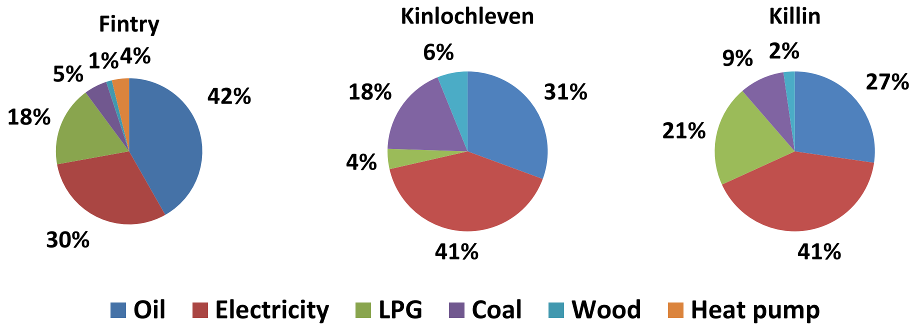
Fuel consumption dominates the housing EF at 89-90% (Table 4.12). Domestic woodfuel is not accounted for in the national EF and so is not reported for LAs (Figure 4.22). Only 18% of houses using woodfuel in Kinlochleven reflects the poor availability of local woodfuel (Table 4.12, Table 4.13).

Four respondents use wood as a primary heating source (one each in Fintry and Killin and two in Kinlochleven, Figure 4.23). Four respondents in Killin and Kinlochleven stated that they had biomass boilers of unknown fuel type (the question was excluded from the Fintry questionnaire). Therefore, the remainder of wood consumption must be as a secondary heating source. 57% of Kinlochleven respondents burn coal; and 18% rely on coal for their primary heating fuel (Table 4.12, Table 4.13). In Killin, more households consume wood than coal, but only 2% have wood as the primary fuel.

In the absence of water meters, the amount of water consumed per household is difficult to estimate. Proxy measures of activities to reduce water consumption suggest a general lack of awareness of the importance of water conservation with less than 15% with toilet water saving devices (Table 4.14) and less than 35% collecting rainwater (section 4.5.2).

The penetration of renewable energy systems into domestic properties was low. Four Fintry respondents stated they had GSHPs installed, but this represents a small proportion of homes (5% of respondents, N=79, Figure 4.23). One Fintry respondent had a wind-turbine and one a solar thermal panel. Other than wood stoves and boilers, no respondents in Killin and Kinlochleven stated they had renewable energy installations (Table 4.15).

Although Fintry is taking some action towards implementing renewable energy systems, the housing was scored as unsustainable (together with the other communities) because, despite the renewable energy systems and green tariff, the EF was on a par with Kinlochleven and only slightly less than Killin (Figure 4.22).



Fintry N=79, Kinlochleven N=49, Killin N=44.

Figure 4.23 Primary household heating fuel type for each community

Table 4.12 FDC EF as percentage of housing EF

LA or case study	Built land	Repair	Mortgages and rent	FDC Fuel (indirect)	Fuel (direct)	Wood	Total
Stirling LA	9%	5%	4%	46%	37%	0%	100%
Fintry	5%	3%	2%	49%	34%	6%	100%
Killin	5%	3%	2%	47%	39%	4%	100%
Highland LA	7%	4%	4%	56%	28%	0%	100%
Kinlochleven	5%	3%	2%	60%	26%	4%	100%

Excludes water EF.

Table 4.13 Household wood and coal consumption

Community	Percentage of households consuming	Percentage of households as primary fuel	Average (tonnes/cap)[1]	N
Wood				
Fintry	30%	1%	0.70	74
Kinlochleven	18%	6%	0.56	44
Killin	34%	2%	0.60	41
Coal				
Fintry	39%	5%	0.3	76
Kinlochleven	57%	18%	0.4	47
Killin	29%	9%	0.3	41

[1]The calorific value of coal is approximately three times the value of wood (gross), AEA, 2010, 2012.

Table 4.14 Percentage of respondents with toilet water saving devices

Community	Implemented toilet water saving device Percentage of respondents	N
Fintry	12%	76
Kinlochleven	9%	44
Killin	14%	43

Table 4.15 Renewable energy installations

	Number of respondents with renewable energy system installed[1,2]				
Community	Wood stove or boiler	GSHP	Solar hot water	Photo-voltaic panels	Wind turbine
Fintry	14	4	1	1	2
Kinlochleven	2	0	0	0	0
Killin	11	0	0	0	0

[1]These results were from "yes"/ "no" style questions. N and the percentage of installations cannot be accurately estimated as many respondents left the question blank instead of responding "no".
[2]Hydro is not reported as some respondents may have confused technology with electricity provider (Scottish Hydro).

4.7.2 Taking action towards achieving low impact housing

Other than Council provided services, at the time of the research there were no activities within Kinlochleven for reducing the EF of housing. In Killin at the time of the research, Killin Cutting Carbon (a Climate Challenge Fund (CCF) initiative) was completing a project to insulate homes. However, this activity has ceased. At Tombreck, near Killin, sustainable homes have been built using local and sustainable materials. The author is unaware of any such construction underway in Fintry or Kinlochleven.

Fintry has made considerable progress with activities and projects to reduce carbon emissions. Example projects include insulation and the appointment of a community Energy Officer, who not only advised on insulation but also advised and co-ordinated the purchase and installation of home renewable energy solutions. Fintry is making progress to improve the sustainability of homes within the community and has undertaken an insulation project, insulating many homes in the village, as well as progressing further work with insulating single layer stone built properties and reducing the carbon impact of homes is an objective of FDT. The extent of implementation of renewable technologies and toilet water-saving devices are evidence for action with the aim of minimising the impact of housing. However, the questionnaire survey predates the FDT projects and so many more households have and are expected to implement renewables in Fintry, as a result of the activities of FDT.

Although KCT has an objective of sustainable development, Kinlochleven has no co-ordinated activities or projects to reduce carbon emissions specifically within the community.

4.7.3 Housing meets the needs of the population

For Killin respondents the occupancy is 1:1.25 (occupants:bedrooms) and for Kinlochleven it is 1:1. This data was not collected for Fintry. Both Killin and Fintry focus group participants highlighted the importance and current shortage of affordable housing in their communities. This is particularly acute in Fintry, where over 80% of homes are owner-occupied (Table 3.3, Stirling Council, 2004a, 2004b). In Kinlochleven houses are more affordable and there is a greater proportion of social housing. Several residents said that they had purchased in Kinlochleven as the prices were cheaper than other Highland villages (*anon. pers. comm*., July 2010) and this is reflected in national statistics (Table 4.16).

Some homes fail to provide accommodation that is affordable to heat in the winter. Although fuel poverty was not measured directly, the average household expenditure on energy was considerable (Table 4.17). In Killin, the KCC commissioned survey (KAT, 2012a) identified that 51% of households had an income of less than £15,000/annum, so the average expenditure of over £2,000/annum (Table 4.17) would place many of the 51% of households in Killin in fuel poverty (fuel expenditure more than 10% of income, DECC, n.d.).

The poorer quality of housing in Killin and especially so in Kinlochleven is reflected in the SIMD housing domain rankings (sixth and fourth deciles, respectively, Scottish Government, 2010b), whereas Fintry is in the eight decile. Although Kinlochleven has plenty of affordable housing, the housing, especially in Kinlochbeg, is generally of poor quality; many people live in households with no central heating (SNS, 2012, Figure 4.8) and rely on a coal fire and back boiler for heating (18% have coal as a primary heating source, Table 4.13).

Table 4.16 Housing prices, tenure and heating (SNS, 2012)

Area	Datazone	2010 mean house price (£)	Percentage of households (%)			Persons in households without central heating (%)
			Owned	Private rented	Social rented	
Stirling LA	LA average	181,523	67	9	24	3
Fintry	S01006074	175,975	82	11	7	3
Kinlochleven	S01003722	88,222	43	8	49	11
Highland LA	LA average	158,355	66	11	22	6
Killin	S01006176	136,667	64	21	15	8

Table 4.17 Cost of heating the home

Community	Electricity (£/annum)	N	LPG (£/annum)	N	Oil (£/annum)	N	Average total (£/annum)	Date of survey
Fintry	917	67	199	71	417	70	1,533	2008
Kinlochleven	974	37	54	49	238	47	1,266	2010
Killin	997	33	204	42	837	39	2,039	2011

These figures have not been indexed for inflation and they exclude the cost of wood and coal (Table 4.13).

4.7.4 Sustainable community buildings

In Fintry, FDT has funded the implementation of energy saving lighting and water heaters and a biomass heating system (in January 2012) in the Sports and Social Club (FDT, n.d.). The Menzies Hall continues to rely on radiant heaters due to the problems with upgrading an old building and requirement for intermittent heating (FDT, n.d.). Whilst neither building is carbon neutral, both have had enhancements.

In Kinlochleven, the Leven Centre is the only community building. Additional space is available at the High School and Salvation Army hall. The Leven Centre is a relative new building (built in the last ten years), and so the energy efficiency is likely to meet current building standards, but the building does not have a renewable heating system.

In Killin, there are two community buildings (McLaren Hall and the Sports and Social Club). Neither of these is fitted with renewable heating systems. In addition, the Church, Doctor's surgery, Primary School, and NTS provide additional buildings. However, The Big Shed at Tombreck is an eco-building built with sustainable materials (The Big Shed, n.d.).

4.8 Community, culture and social capital

The goals for this aspect of the SCD are community endeavour committed to sustainable development, opportunities for cultural, leisure, community and sporting activities, motivated civil society actors, space and opportunity for spiritual growth, and, respect for and encouragement of diversity. Both Fintry and Killin have sustainable "green" scores, whereas Kinlochleven has been scored unsustainable "red", (Figure 4.24), due to its lower social capital, inclusivity issues with multiple community sub-groups and fewer social enterprises.

4.8.1 Community endeavour committed to sustainable development

The purpose of each development trust (FDT, KCT and KAT, described in section 4.2.2) is different. FDT is committed to creating a low impact carbon neutral community (FDT, 2011b). Although the objective of FDT is not explicitly sustainable development, FDT's approach to development could be argued to be sustainable as the actions to reduce the community's CF have far wider benefits. KCT has a stated aim of sustainable development (KCT, n.d.), but progress has been slow. The KCT's main focus has been securing and managing its property assets. Since 2010 there has been a project to develop renewable energy assets for the community. Although KCT has a poverty alleviation goal in its objectives (section 4.2.2), evidence of progress against this objective is lacking. Moreover, one resident believes that there is a "*lack of foresight in the village*" (focus group participant, May 2010, *anon. pers. comm*.). In Killin, KAT has an objective of sustainable development within its constitution and is continuing with an inclusive, participatory and reflective approach to community planning (see section 4.2.2).

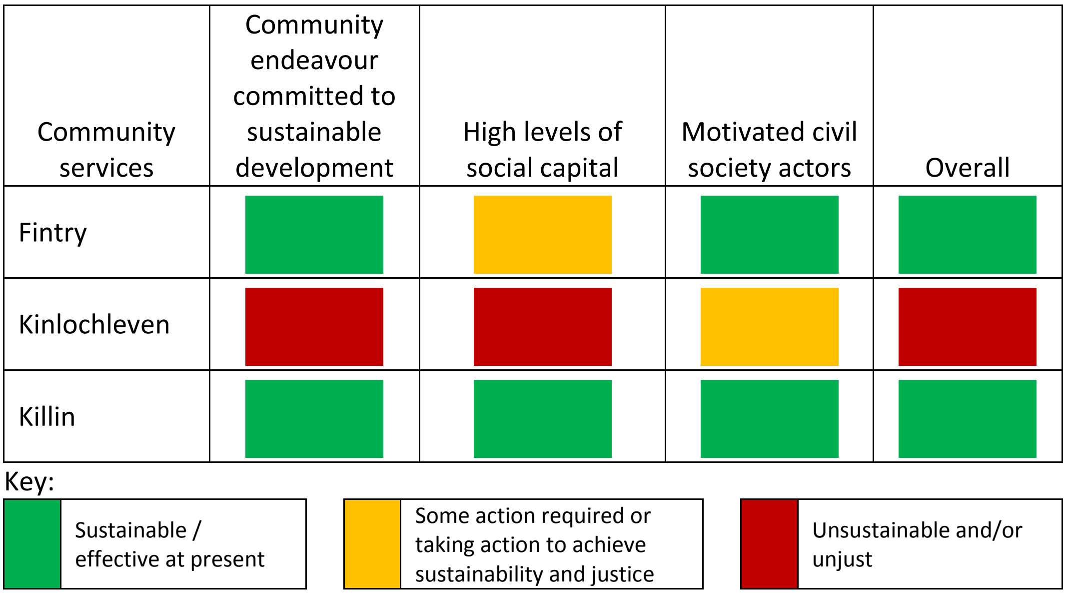


Figure 4.24 Community, culture and social capital community scorecard

4.8.2 High levels of social capital

Clubs and community groups are listed in Appendix B.2. For rural communities, the opportunities for cultural, leisure and sporting activities in Fintry and Killin are abundant. This abundance was not as evident in Kinlochleven, although there were active community groups and initiatives. Facilities exist at The Leven Centre, which is a venue for Lochaber College courses, a toddler group and a youth club. It has a gymnasium, theatre and cinema facilities and a large hall and has meeting rooms for hire. The library hosts book clubs for children. Since the data collection in Kinlochleven, there have been some improvements in social projects; notably, a new drama enterprise, Dramafish Studios, and Nether Lochaber Amateur Boxing Club are both tenants of KCT. These more recent developments may have increased social capital, together with the reinstatement of the Community Council and the completion of a new public green space in the centre of the village. Overall the Kinlochleven community may lack cohesion with different community sub-groups with *"little communication"* (Kinlochleven focus group participant, May 2010) between them. In Kinlochbeg, there are significant amounts of social housing with deprived households (the area has been described by more than one resident as a social "*dumping zone*", Kinlochleven focus group participant, May 2010); in Kinlochmore, there are new home owners (some of whom are public sector workers and holiday home owners) and old villagers who once had a connection with the factory. Nevertheless, the community's new school, library and Highland service point have attracted skilled professionals to the community. Relatively cheap housing (SNS, 2012, Table 4.16) has also encouraged younger people to purchase property in the village (*anon. pers. comm.*, July 2010), but also this has encouraged second homes, due to their affordability as weekend houses (*anon. pers. comm*., July 2010), which fail to help the social capital of the community during the week. In 2010, there were some in the community that harboured ill feelings about the demolition of the village hall and the controversial changes involved in the relocation of the post office. At the time the latter created division and depleted goodwill and social capital within the community.

Killin has the highest number of community groups and perhaps the highest level of social capital. "*The hall is a fantastic social venue with visiting bands, opera* *and panto.* [Killin is] *thriving socially….* [e.g.,] *people work together (…everybody looks out for everyone else…); coffee mornings are well supported; there are numerous evening functions; and people are very generous in terms of charitable donations (approximately £30,000 - £40,000 is raised per year)*". (Killin focus group participants, November, 2010).

The extent of informal social networks is illustrated by the responses to the question "I feel close to people in my local area" (Figure 4.13, page 256). Only 40% and 47% of respondents in Kinlochleven and Fintry, respectively, strongly agreed with this statement in contrast with 65% in Killin. This suggests that Killin has strong informal networks, which are less abundant in Fintry and even less so in Kinlochleven. In terms of satisfaction with the local community as a place to live, Fintry and Killin are the highest with over 90% at least fairly satisfied, and Kinlochleven has 84% at least fairly satisfied. The latter is also the only community with residents (two in number) stating they are very dissatisfied with the area as a place to live (Figure 4.25).

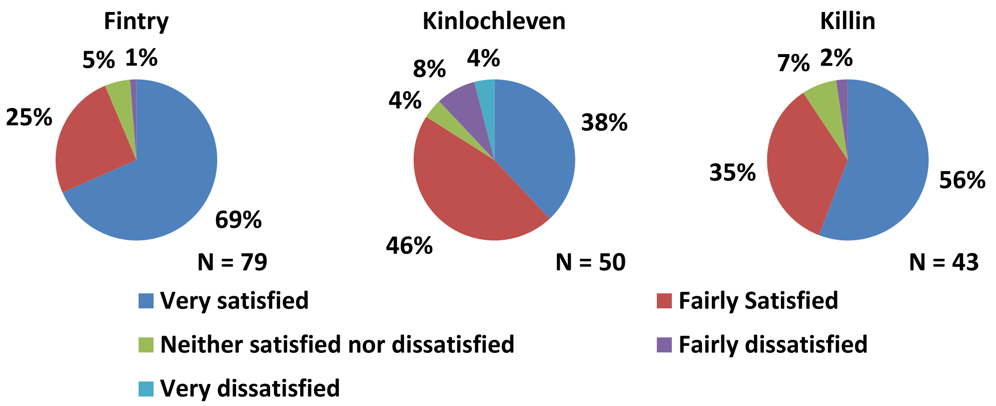


Figure 4.25 Responses to satisfaction with local community as a place to live (for the Likert style Fintry question no. 109)

4.8.3 Motivated civil society actors

Critical citizens are those who are not happy with the status quo, but it can be argued that they are more likely to be active citizens, who enact change. Active citizens are not only motivated to take action but, to be successful in creating change for the better, they should also be competent (i.e. have the skills) to take on active roles in shaping and enhancing the community (Ledwith, 2005). Examples of these critical citizens / motivated actors ("citizen actors") are present in Fintry and would include the founding members of FDT. In Killin, these citizen actors are present in leading the Killin Action Plan and initiating activities to reduce carbon emissions (albeit, at present, unsuccessful). In Kinlochleven, there are citizen actors, but in 2010 they had little in the way of achievements. Since then, some progress towards a community renewable energy development (KCT, 2012a) has been hard won, for which community endeavour deserves recognition, but the project is still in its infancy. In 2000 when the development enterprise preceding KCT was set up, there was a lack of motivated and willing volunteers to take on Kinlochleven community development enterprise (Booth, 2000). The author found people in Killin to be the most community orientated with many participating in community clubs and organisations and many examples of volunteer effort. In Fintry, again there were many volunteers involved in and around the activities of the Sports and Social Club and its associated clubs, Fintry Amateur Dramatic Society, FDT, Fintry Focus newsletter and the village hall. In Kinlochleven, there were fewer volunteers working on the compost site, the toddler group and the Salvation Army.

The Killin News and Fintry Focus are both compiled entirely from voluntary effort (except printing), unlike that of the Kinlochleven Community Trust newsletter, which is written by part-time employees of KCT. The latter takes a significant amount of time away from other activities that could be done by the paid workers for KCT. However, within Kinlochleven in the areas of the most deprived social housing, the author found informal community spirit and action. One example of this was a survey respondent who was helping her neighbour, who was an alcoholic and had exhibited unacceptable behaviour that had led him to be banned from the only food shop in the village, The Co-operative. The neighbour had kindly agreed to do all the food shopping for this person. In another instance, the author witnessed many of the residents of one of the social housing block of flats helping one family move into their new accommodation.

In Kinlochleven, the levels of deprivation are higher than the other communities. This is a community that needs higher social capital to overcome the deprivation, but too often the lack of social capital, lack of (or lack of engagement of) citizen actors, mis-directed community activities or the exclusion of many of the population from community activities amplifies it.

4.9 Sustainable energy to fuel life

The two goals for this aspect of the SCD are renewable energy systems in the built environment and community renewable energy (Figure 4.26). All three communities have excellent natural resources for renewable energy, although in the cases of Killin and Kinlochleven this is in the form of hydroelectric power rather than on-shore wind.

Community	Renewable energy systems in the built environment	Community renewable energy	Overall
Fintry			
Kinlochleven			
Killin			

Key:

Sustainable / effective at present	Some action required or taking action to achieve sustainability and justice	Unsustainable and/or unjust

Figure 4.26 Sustainable energy to fuel life community scorecard

Fintry owns the output of one of the fifteen turbines (total installed capacity of the site is 37.5MW), which has been estimated to achieve between £50,000 - £100,000 of income (after costs) per annum (FROST-FREE, *pers. comm.*), and substantially over £100,000 per annum after the loans for initial investment costs are repaid. Fintry's turbine was added onto the Earlsburn windfarm development as an additional turbine at the community's request. Fintry is a good example of a fair and just community benefit scheme, where the community assumes financial risks but also the returns similar to the developer. The community now has a platform to become sustainable with a significant income after loan repayment. However, this has required exceptional skills and determination of the four founding members of Fintry Renewable Enterprise and exemplary and fair use of the Development Trust framework to create a new set of aims for the community "*to promote the use of renewable energy and energy* *efficiency within the community to reduce CO_2 emissions and the effects of global warming*" (FDT, n.d.).

The Blackwater Reservoir, the largest in Scotland, and the extensive pipework and plans for further hydroelectricity generation, places Kinlochleven in a very favourable locale for community benefits from such a large hydroelectricity scheme. However, currently the author is led to believe that no such community benefit is received. During the course of the research Kinlochleven Community Council was reconstituted in opposition to the further development of the hydroelectricity generation due to the lack of benefit to the community. The community had no property rights to any land with renewable energy potential and indeed the community is "land-locked' by Loch Leven to the west and the upland areas all owned by RT-Alcan. Nevertheless, at the time of writing some progress is being made with RT-Alcan in acquiring community rights to develop a local watercourse for hydroelectricity, but this is most unlikely to be on a similar scale to the Blackwater Dam scheme.

In the case of Killin, the extensive hydroelectricity development schemes built by North of Scotland Hydro-Electric Board in the 1950's are on almost all the upland watercourses in the vicinity. Only the River Dochart remains without development, although historically, the Falls of Dochart served as an energy source for a watermill. The community would like to reinstate this, but are struggling with the requirements of the SEPA for protecting biological ecosystems, protecting the amenity of the Falls and the ownership of the mill, before even considering the funding requirements of any development.

Currently, Killin receives no community benefit from SSE plc.'s Breadalbane hydroelectricity schemes.

Kinlochleven and Killin have not made significant progress in either renewable energy systems in the built environment (domestic or commercial premises) or community renewable energy. The lack of ability to utilise the electricity generated in Kinlochleven was highlighted on numerous occasions, especially as Kinlochleven was one of the first villages in Britain to have electricity (Kinlochleven focus group participants, May 2010). However, at the time of writing, KCT started negotiation with RT-Alcan to develop a community (KCT-owned) hydroelectric scheme with the aim of generating £70,000-£80,000 of annual income (KCT, 2012a). This requires transfer of property rights from RT-Alcan to KCT, which can only be a positive step for the community.

Without realisation of Kinlochleven's plans as yet, it is only possible to conclude that the lack of community benefit for Kinlochleven and Killin from existing renewable energy developments is unjust and "red" scores have been given. Fintry is making progress with renewable energy systems in the built environment, but evidence of radical transformation of energy consumption is lacking. Fintry's community energy project does not provide energy for the community. Therefore, for Fintry "amber" scores were given.

4.10Power to act

This is an overarching aspect of the SCD and its goal is having the capacity, capability and authority to act. Evidence to justify the scores for this aspect consolidates what has already been presented (Figure 4.27, Ledwith, 2005). Fintry's and Killin's scores for community, culture and social capital, in particular have elevated the score for this aspect to "amber" (Figure 4.27). In Kinlochleven the lack of power to act was emphasised in the focus groups. The *"factory was a nanny state, full employment, safety net".* When the smelter was closed, there was *"no easy transition and it took the wind out of the sails of the community. The community used to be reliant on the factory to provide everything. People aren't used to doing things for themselves. The village is fragile – lots we don't own and areas we can't get in. There are still landlord and serf attitudes and mentality."* (note that the italicised quotes on this page are from Kinlochleven focus group participants and are unattributed to maintain anonymity, May 2010).

Community	Authority to act	Motivated and empowered actors and social capital	Well-being and citizenship	Resources to act	Overall
Fintry					
Kinlochleven					
Killin					

Key:

Sustainable / effective at present	Some action required or taking action to achieve sustainability and justice	Unsustainable and/or unjust

Figure 4.27 Power to act scorecard showing this aspect of the SCD's definition and the communities' "traffic-light" sustainability assessment

An example of the lack of resources inhibiting the ability of a community to undertake sustainable development was found in Killin. Funding for KCC's insulation project, which employed two people part-time for a year to act as energy officers and co-ordinate the project, was from the CCF. Unfortunately, a follow-up CCF application to extend the project to promote carbon reduction behaviour and activities was unsuccessful (Willie Angus and Bernard Mallett-Griffiths, *pers. comm.*) and this lack of funding has curtailed Killin's activities to reduce carbon emissions within the community. With little other income Killin is struggling to make progress with sustainable development activities.

4.11 Overall sustainability and issue analysis

In the first part of this section energy injustice is analysed, followed by the presentation of the case studies holistic sustainability.

4.11.1 Overarching issue: energy injustice

Sustainable energy to fuel life for each community was assessed in section 4.9. The detailed analysis of the ownership of renewable energy sites in Scotland in 2011 (Chapter Two, section 2.3.2.3) showed that the distribution of renewable energy resources in Scotland is unjust and henceforth has been termed "energy injustice". Using Bulkeley and Fuller's (2011, 2012) categorisations previously used for analysing climate justice (Table 2.4), the causes of this injustice have been analysed (Table 4.18).

Fintry being the most wealthy of the communities has been able to capitalise on this with its ability to secure the community renewable development opportunity. Kinlochleven, with highest levels of deprivation and lowest social capital, is least likely to be able to capitalise on such opportunities.

Table 4.18 Energy injustice: an analysis of responsibility, rights and recognition (framework adapted from Bulkeley and Fuller, 2011)

	Responsibility	Rights	Recognition
Distributive	• No legal requirement for developers or land-owners to consider distribution of benefit from new or legacy renewables to the community. • The developer or land-owner has no duty or responsibility to act in the interest of the community, rather than for private or shareholder interests.	• Unfair share of benefits from renewable energy developments to commercial enterprises. • Lack of opportunity to develop sites for the community either because sites are already developed or because no property rights or environmental protection legislation (SEPA). • Unequal access to funds for renewable energy developments (despite CARES, funding is still difficult to obtain). • Further commercial development of sites precludes development by communities in the future (inter-generational). • Unfair distribution of property rights.	• Whilst there is recognition of the need for renewable energy to act as catalysts for creating more sustainable communities, this recognition has not pertained to dramatic changes in policy. The scale of need is not recognised. • Communities that are non-aspirational and have low self-worth struggle to voice their need. This perpetuates the lack of recognition of need.[1] • Lack of specialist support for communities for these difficult technical projects.
Procedural[4]	• Lack of democratic community governance structures to force change. • Lack of legal planning requirements for community involvement in commercial developments. • Lack of requirement to have community governance structures and development organisations.	• Lack of effective legislation on community property rights. • Insufficient funding (government or commercial support) for community developments. • Lack of legislation for provision of community benefits for heritage renewable energy developments. • Lack of legislation enabling rebalance of property rights. • Lack of inclusion of communities in decision-making.	• Rural communities are excluded from decision-making • Lack of procedures for resolving injustices (social choice theory).[2] • Lack of involvement of community development trusts in renewable energy developments at outset and with developments on public lands (e.g., Forestry Commission).[3]

[1]In this study, specific to Kinlochleven.
[2]Creating renewable energy developments involves injustice to someone or something. For example, taking away property rights from a private land-lord for community benefit does involve an injustice for the private land-lord but overall may create a more just outcome. There are no procedures for this. Moreover, the rights of nature need to be incorporated within this justice system.
[3]Although the sale of leases of renewable energy developments on public land does not affect the case study communities directly, the lack of opportunity for community involvement has been identified as a gross oversight by both Andy Wightman and Maitland Mackie (*pers. comm*., Fintry, 9th March 2012).
[4]The effectiveness of Environmental Impact Assessment (EIA) in the planning process for renewable energy developments is not included in this analysis. EIA considers the impact on flora, fauna and landscape amenity. No attempt is made in this analysis to evaluate whether EIA is successful in considering the intrinsic value and worth of the environment and whether EIA is successful in considering the rights of nature (Taylor, 1986).

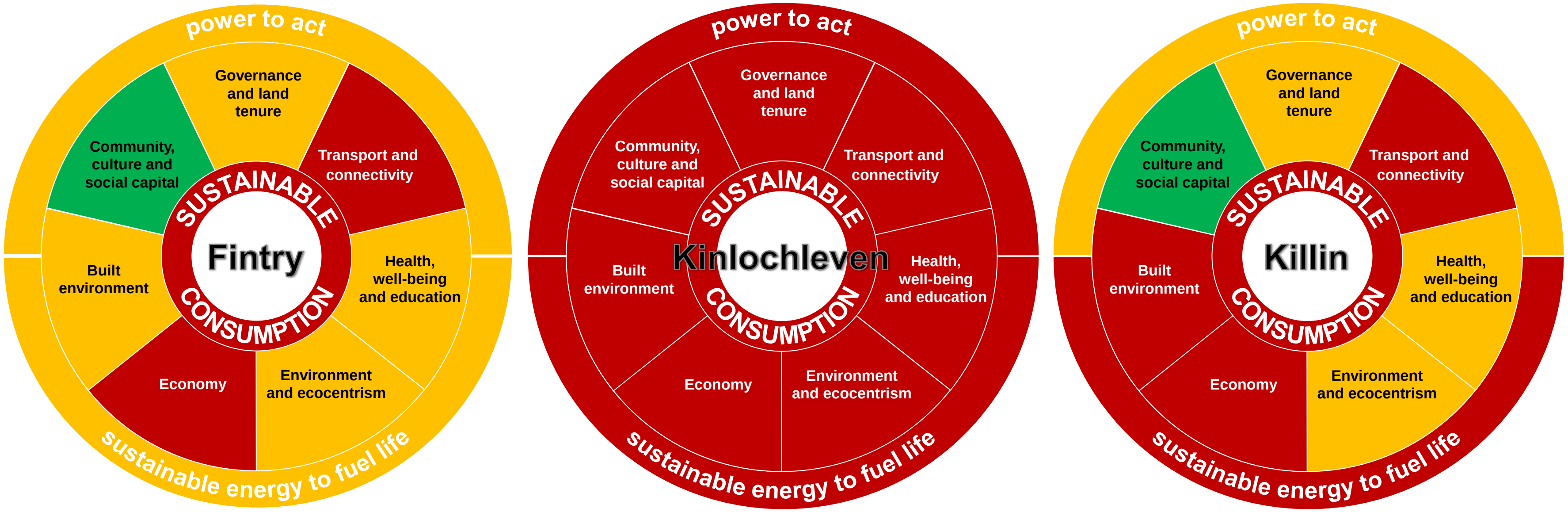
Analysis of the nature of injustice (Table 4.18) reveals that, although the manifest injustice is distributional (receipt of income from commercial renewable energy developments), the causes of injustice relate to responsibility, rights and recognition (Bulkeley and Fuller, 2011, 2012, McCauley *et al*., 2013). As land rights are required for renewable energy developments, the polarisation of land ownership is a significant factor in energy injustice. Therefore, the lack of recognition of the rights of the community to local resources is likely to have caused the unfairness of the lack of community property rights to renewable energy. Community renewable energy has not been recognised for its potency to catalyse community development (for example, Fintry) and lack of income and assets have not been tackled as problems that impede rural community development. Adequate procedures (for local government and corporate developers) to manage assets for local communities are lacking and there is a deficiency in the powers of democratically elected community governance structures to participate in the associated decision-making and land development processes. The full energy injustice analysis (Table 4.18) has been used to generate recommendations for addressing this injustice and these recommendations are presented in Chapter Six.

4.11.2Summary of the case studies' baseline sustainability

Each community's sustainability "scores" have been consolidated and mapped to the aspects of the SCD (Figure 4.28). Fintry is the most sustainable with only three aspects scored "unsustainable", namely consumption, economy and transport and connectivity. However, only one category scored "sustainable", community, culture and social capital. At the opposite extreme, Kinlochleven scored “unsustainable” in all aspects. Like Fintry, Killin had “sustainable” community, culture and social capital. However, in addition to consumption, economy and transport and connectivity, Killin also had built environment and energy to fuel life ranked as “unsustainable”.

The effort involved to consolidate both primary and secondary data should not be underestimated and it required interdisciplinary research skills. The focus groups (the results of which are described in the next section) and field observation notes provided additional and essential primary data, which supported the results of the questionnaire and enabled a more holistic assessment of each case study community. The questionnaire itself was extremely lengthy for both participants and subsequent data analysis, which required robust and careful management.

The baseline sustainability assessment completes the third objective of this study. Understanding the geographical, historical and cultural context of rural communities combined with an evaluation of their baseline sustainability, provides a platform for building visions for the future. The baseline sustainability assessment has identified the extent of the sustainability of these rural



Sustainability scoring key:

(green)	Sustainable / effective at present
(amber)	Some action required or taking action to achieve sustainability and justice
(red)	Unsustainable and/or unjust

Figure 4.28 Baseline sustainability assessment scores

communities. For example, Fintry, which has been used in policy circles as an example of a community developing sustainably, especially with regard to renewable energy, is only sustainable in the aspect relating to community, culture and social capital. Kinlochleven, on the other hand, is the most deprived community and has scored unsustainable in all aspects.

In summary, the results illustrate that this method is sensitive to tease out the differences between rural communities and highlights the heterogeneous nature of rural Scotland. All three communities are not yet developing sustainably and the sustainability assessment presented in this chapter reveals the vulnerability of these communities, given our understanding of pending crises, making the exploration of alternative future trajectories imperative. In the next chapter, communities' visions of sustainable futures and models of sustainable consumption are explored.

Chapter 5 Future sustainability: visions and modelling

In this chapter, the results of the mixed methods approach to investigating options for the future sustainability of rural communities are presented. In the first section the results of the participatory research to understand the communities' visions of a resource-constrained future are described. The results of the community visions of the future, together with learning from best practice in sustainability (as described in the literature review) and new technologies, enabled the creation of narrative scenarios describing different levels of change towards sustainability (described in Chapter Three). These narratives were used to create quantitative scenarios for modelling within REAP (SEI, 2011a). The sustainability of future consumption scenarios for transport, food and energy were evaluated using EF analysis and the fairshare as a gauge of sustainability. The results of the modelling for these aspects of consumption were combined with the remaining consumption categories to explore the possibility of each community's EF achieving the fairshare with different levels of change.

5.1 Community visions of sustainability in a resource-constrained 2030

The following three sections give a summary of each case study community's visions for the future. There were two focus groups in Fintry, four in Kinlochleven, and three in Killin (Table 5.1). In all focus groups participants were asked to describe their vision of how their community could thrive and flourish in

2030 in a resource-constrained future. The format of the focus groups differed according to the number of participants (larger focus groups had break-out groups), type of focus group, and location (Table 5.1). Fintry focus groups (recruited by invitation to all householders for volunteers) had a short discussion on what are the challenges for the community today; this was omitted in the later focus groups as this discussion was repetitive when participants moved on to discuss their visions. Note that the italicised quotes in this section are from focus group participants and are unattributed to maintain anonymity

5.1.1 Fintry focus group results

In 2008, the Earlsburn windfarm and FDT had just been established. The results of the discussion on the state of and priorities for Fintry in 2008 (summarised in Appendix B.3) assumed that the activities of FDT were progressed and identified the following opportunities, as short-term priorities: a youth club, reducing energy consumption, better transport (public transport, community car/bus and car sharing notice board), affordable housing, changes to planning policy (increased planning consultation and a more open and adventurous planning set up), and food (co-operative, community garden, allotments, orchard and woodland).

The key themes of the participants' visions of Fintry thriving in a resource-constrained 2030 (Table 5.2 and Table 5.3) were distilled into a cloud (Figure 5.1), which is based on the author's analysis of the focus group results. One overarching goal identified was relocalisation with local production of energy and food. Local production was justified by its ability to create local employment

Table 5.1 Focus groups descriptions, participants and activities

Community	Location	Type / Comments	Date	Number of participants	Focus group activity: Identify challenges for today	What are the features of a thriving community	2030 vision: features of your community	How to achieve 2030 vision	Priorities for 2030 vision
Fintry	Menzies Hall	General public	06/09/2008	8	F	-	F	-	-
Fintry	Menzies Hall	General public	13/09/2008	3	D	-	D and F	-	-
Kinlochleven	Kinlochleven High School	School pupils (S3)	13/05/2010	4	-	D	D	D	S
Kinlochleven	Kinlochleven High School	General public	20/05/2010	6	-	F	F	F	S
Kinlochleven	Community Centre	General public	22/05/2010	3	OD	D	D	D	S
Kinlochleven	Kinlochleven High School	School pupils (S3)	24/11/2010	15	-	F	F	F	S
Killin	Private dwelling	Killin's Scottish Women's Rural Institute (WRI)	28/10/2010	5	OD	D	D	D	-
Killin	Killin Sports Club	Environmental Action Killin (EAK)	04/11/2010	7	-	F	F	F	S
Killin	Killin Sports Club	General public	23/11/2010	3	-	D	D	D	S

Key: D = open small group discussion with facilitator; OD = open small group discussion that arose naturally during the focus group although it was not part of the agenda; F = break-out groups with flip charts; and S = each participant given three stickers to prioritise the actions of how to achieve 2030 in open forum.

Table 5.2 Fintry focus group vision ideas for 2030: flip chart responses from 06/09/2008

• Less reliant on bio fuels
• Go organic
• Local production of food and energy
• More:
  o Tele-commuting – less commuting to work
  o local employment opportunities and businesses
  o mixed housing and affordable housing
  o locally sourced food for schools in Balfron and Fintry
  o use of hybrid cars and provisions made for charging or re-fueling
  o home cooking = reducing food miles
  o awareness of origin of food
• Reduction in wasted food
• Encouraging a more active lifestyle (e.g., cycling)
• Sustainable tourism – due to possible change in climate
• More use of air source and ground source heating
	• Each house to generate own energy so that we limit our use of oil
	• Less cars per household / more efficient use of cars
	• At least as thriving as now – school, sports centre, etc.
	• More self-sufficient – better use of local produce and therefore reduction of food miles
	• Use technological advances to enable more people to be employed in the village / able to work from home
	• Use technological advances to enable improved transport system for people who can't drive
	• Facilities for older people
	• Facilities for younger people to maintain the population – youth clubs
	• More involvement in community groups

(which would require more affordable housing). Existing social facilities and positive community attributes were assumed to persist. Fintry has "*proven in the past that the area can sustain local employment and livelihoods. Historically, … employment has been the flax mill, farming, the distillery and a sweet business.*" There was awareness of environmental needs, for example: *"Residents own gardens should be organic as well as local farms. Education is required to encourage residents not to use chemical lawn feed and other chemicals in the garden and peat should be banned."* and *"We should make better use of the water available e.g., using grey / untreated water for non-drinking purposes."*

The structural barriers to achieving the visions were highlighted: *"Lots of infrastructure investment is needed – a massive challenge for government". "The same people usually volunteer or co-ordinate most things in the village. We need to extend beyond these people to involve different people. How do we do this?"*

Table 5.3 Fintry focus group vision ideas for 2030: flip chart responses and discussion from 13/09/2008 (this focus group had only three participants and so the discussion was documented by the facilitator and is reported here together with the participants' flip chart summary)

• Poor does not mean a health decline. Need to keep the population healthy without material things. • With shortages of oil, food and climate change, war is the most likely scenario for a world of scarce resources. • Now looking at accelerated change for the next 20 years. Something has to give. There has to be relocalisation and a barter scheme if the money supply fails. • We now have the highest consumption of prepared meals. Public health improved during WWII with the scarce food supply and increasing reliance on local food. But today people with less and less get caught in the trap of having more pre-processed foods in their diet and so are less healthy. They cannot afford the fresh foods and energy use to cook them. It becomes a vicious circle. Affordable local provision of food has to happen. • Central Government influence is likely to decline by 2030. Because of Globalisation and EU decisions and voters' mandate (disenchanted and disenfranchised) • More community jobs if relocalisation. More people will use bikes or public transport to commute to Glasgow / Stirling and more people will work from home. • People will have to be producers and be more self-sufficient. • The community shop and co-operative food supply we can do now. • Why not use waste to generate electricity? • Historically there was the cotton mill – no reason why we can't do something similar with the water supply now to create energy. • If isolated we need to be able to grow and make our own bread (Paris in the 1800's used to be 80% self-sufficient). • The need to relocalise goes hand in hand with planning – the planners need to be more open to development in the countryside allowing people to be self-sufficient. A fear of the planners is that the infrastructure today can't cope (e.g., septic tanks, etc.) but building regulations have to catch up with the real world [i.e. don't need septic tanks and there are other ways to put human waste to beneficial use]. • The community needs to define its own needs [in a proactive way] e.g., low density development and building in greenfield sites [after all agriculture adjacent to housing is more productive than open fields]. There is no opportunity for this sort of dialogue e.g., productivity of small holdings vs. open fields. • Farming is now nearly all pasture versus small crops • Need to relearn the ability to use resources and reuse. • Community Development Partnerships – should set these up with developing country communities and learn from them (not necessarily the other way round) – see International Action for Community Development. • Everyone working together – then everyone has a purpose to contribute to something. People have a role in their work but not in the place where they live. • More foraging! • Need changes to health and safety legislation e.g., with regard to cheese and milk production.
Flip chart summary • Transport changes • Grow food locally • Wind-power and heating – renewable energy supply • Planning changes required – changes to the built environment – requires institutional change • More local employment, where there are local producers and purchasers e.g., crafts, clothing, school uniforms! • Re-education, re-learning and re-skilling • Enhancements in community spirit should be the reason for relocalisation – not just global warming

RELOCALISE the community with more LOCAL PRODUCERS and consumers by RE-EDUCATION, RELEARNING AND RE-SKILLING, because these enhancements create COMMUNITY SPIRIT. This should be a reason for relocalisation – not just global warming. People need to be more SELF-SUFFICIENT, but WORKING CO-OPERATIVELY, so that everyone has a purpose and opportunity to contribute. In 2030, the community is at least as thriving as now and ENERGY SELF-SUFFICIENT.

Figure 5.1 A cloud based on the author's analysis of the main themes of Fintry's vision identified in the focus groups (keywords are highlighted in capitals)

If we do more ourselves then we *"need changes to health and safety legislation e.g., with regard to cheese and milk production." "People have a role in their work but not in the place where they live."*

Local and co-operative food production was seen to be something that could be achieved in the short term rather than left to 2030. Energy self-sufficiency was seen as essential and other forms of community electricity generation such as waste and hydroelectric were suggested.

5.1.2 Kinlochleven focus group results

In Kinlochleven the demography of the focus groups varied substantially with two of the groups having participants recruited by written invitation to all households and two of the groups being made up of secondary school pupils (S3), which differed substantially in size (Table 5.1). In all four focus groups, the participants were asked for their views on what makes a thriving community: the economy (jobs), community spirit, cohesion and endeavour and retail, leisure and health services were all key features (Table 5.4). In the first general public focus group (20/05/2010) renewable energy was not ranked highly as a priority (Table 5.5): instead the energy efficiency and type of heating in the home and self-sufficiency became priorities. Community renewable energy only received one star and yet community renewable energy was highlighted as the most important priority in the second focus group (22/05/2010, Table 5.6), in which the local economy was a key feature (through tourism, connected transport (e.g., boats for tourists) and creative arts). In the last focus group at Kinlochleven High School, the lack of animals and farming were highlighted and horses were identified as a transport alternative (Table 5.7). Community renewable energy was ranked as the highest priority for 2030 in the follow-up questionnaires (Table 5.8). The participants' vision ideas are summarised in Figure 5.2.

Table 5.4 Kinlochleven focus group participants' views of "what is a thriving community?"

Focus group	Comments	
Kinlochleven High School: 13/05/2010	A busy community One that works – makes money and has jobs Something that happens everyday	Happy Everyone gets on and that
General public: 20/05/2010	Jobs for every member who requires one Self help groups formed and running Community spirit Being able to live and let live Range of ages with replenishment Focal centre with community spirit Everybody makes an effort	More supportive community members Once a month newsletter to all villagers More facilities for adults Welcome to village pack for newcomers
General public: 22/05/2010	Reasonable population Income possibilities Tolerance Housing	Focal point Level of autonomy Health Sustainable
Kinlochleven High School: 24/11/2010 with year S3	Tourism – jobs / income Own opinion respected Leisure centre Everybody contributes Shops Health service Youth clubs	People who care – help out e.g., litter pick Everyone knows each other Lots of things happening Education systems Plenty of jobs

Table 5.5 Kinlochleven focus group 20/05/2010 vision ideas for 2030: participant flip chart responses (ordered as on the flip charts) prioritised with star stickers

Group 1	Group 2
***Eco-friendly houses – double glazing, insulated, solar panels **Community heating systems – woodchips / hydroelectric for all three areas of the village Solar energy for street lighting *Allotments / community gardens.. have more self-sufficient food sources… hens… animals *Education – schools need to inform children about being self sufficient Community compost Hydroelectric power generated locally – channel it to Kinloch Buses used but needs to be better service and connect with other services and be user friendly Car share Employment - Mass employment? Eden Project? Quality of environment needs to be more than one person keeping the village clean and tidy Pride in the community Free pick up of household items to reduce fly tipping Community shop with regular changes of sellers	Self-sufficient – electricity, nuclear power, solar power Better transport – horses, etc Balanced population Waste reduction **Modern building – insulation Rationing geothermal heating ****Community involvement at the local level
Group 3 *Community owned power *Micro CHP systems Passive homes *Older houses – heated glass, triple glazed, air exchange system Recycle better recycle own? Petrol cars – community use Buses on compressed natural gas ***More self-sufficient Pull together for more facilities in the community More employment and training for villagers Cleanse the land and grow your own	

* The number of star stickers allocated by participants to each idea to prioritise vision ideas

Table 5.6 Kinlochleven focus group 22/05/2010 vision ideas for 2030: summary of participants' discussion scribed by facilitator onto flip chart and agreed and prioritised with star stickers by participants

****Renewable energy – turbines (wind), hydro, tidal and solar Free electricity **Self-sufficient food production – allotments and hens Tourism Seaweed Composting *Retail outlets	**Tourism – employment, landmark attraction (industrial heritage), build on existing events e.g., have a dance at trial bike, Mamore Lodge, Build an IT Centre on the factory **Creativity – pottery courses, tours, business and tourism and facility for local community Internet business – retail Art centre *Transport – boat for tourists

* The number of star stickers allocated by participants to each idea to prioritise vision ideas

Table 5.7 Kinlochleven High School 13/05/2010 and 24/11/2010 focus groups' vision ideas for 2030: consolidated participant flip chart responses prioritised with star stickers

13/05/2010 (not prioritised due to time constraints)	24/11/2010
More buses to reduce travel by car Community garden? To grow food, etc. More renewables Children – safe, lots to do, good small school	*****************Horses ***********Grow own foods *******More eco-houses ******Wind mills for energy **More animals and farming **Energy capping **Improve public transport – buses *Car sharing *Insulate housing *More recycling Use bicycles / walking Use manure Use energy – hydroelectric power and trade for resources (e.g., oil) More housing – create jobs and income for shops

* The number of star stickers allocated by participants to each idea to prioritise vision ideas

This community is more SELF-SUFFICIENT. There is COMMUNITY RENEWABLE ENERGY providing "FREE" ENERGY for all and funding employment and opportunity. All new HOUSES are ECO-FRIENDLY and existing are RETRO-FITTED. Everyone is EDUCATED IN SUSTAINABILITY AND SELF-SUFFICIENCY. All the LAND has been REMEDIATED with new BUSINESSES in the centre making use of the renewable energy. HEALTH concerns have been recognised and addressed. We GROW MOST OF OUR OWN FOOD in the allotments and COMMUNITY GARDENS. Everyone, who can, GETS INVOLVED IN THE COMMUNITY. The TRANSPORT LINKS ARE EXCELLENT. This is a TOURISM DESTINATION.

Figure 5.2 A cloud based on the author's analysis of the main themes of Kinlochleven's vision identified in the focus groups (keywords are highlighted in capitals)

Table 5.8 Results of Kinlochleven focus groups' follow-up questionnaire vision prioritisation

Rank	Variable	Mean score (N=18)
1	Community renewable energy	2.3
2	Eco-friendly housing	3.3
3	Major tourist destination	4.1
4	Community engagement	4.9
5	Low carbon connected transport	5.1
6	Busy shops	5.4
7	Community fruit and vegetables	6.2
8	District heating	6.6
9	New industry	7.0
10	Self-sufficiency education	7.3
11	Outsiders' help[1]	8.3

[1]This was not identified in the focus group but arose as an idea with residents, who did not attend the focus groups, in a discussion in the local pub in November 2010.

Priorities that were identified for today (in the two adult focus groups) were *c*ommunication and cohesiveness, a welcoming pack for new people moving to the village, a new sign for Kinlochleven and a Community Council with strong leaders. However, this output (and in part the summary vision, Figure 5.2) glosses over and obscures the deep-seated problems within the community. The focus group on 22nd May 2010 had an in-depth discussion relating to injustice and deprivation within the community. One participant described the community as a "*wild-west*" town, divided by the "*social dumping zone*" of Kinlochbeg and the largely RT-Alcan built houses of Kinlochmore. All participants highlighted the unfairness of: people with serious social or addiction problems being relocated to Kinlochleven (due to the lack of access to services, the quality of housing and the lack of sunlight in Kinlochbeg, in particular, in the winter); the lack of support for the continuing legacy of direct or indirect suffering related to health problems or bereavement, which the participants attributed to the pollution from or working within the former aluminium smelter; and having rich hydroelectric resources in the community, but no share of or access to them.

5.1.3 Killin focus group results

The discussion in Killin's focus groups (Table 5.9 to Table 5.13) tended to be detailed and lengthy, especially in the WRI focus group, 28/10/2010. The village was said to be thriving socially, but not economically: "*There are lots of clubs; people work together; coffee mornings are well supported; there are numerous evening functions;* [and]*… people are very generous in terms of charitable donations (approximately £30,000 - £40,000 is raised per year)*." Changes in the retail economy over the last twenty years were highlighted: "*Twenty years ago people did not go to Stirling to shop. There was a shoe shop here and a pharmacy. Now there is a dispensary at the doctors. The supermarket and butcher are gone. Local shops are dying, but we have everything we need in the village,* [as] *the butchers van visits twice weekly and the fish van visits weekly*." "*There are almost 50 holiday homes (self-catering). Most tourists do not stay in the village during the day but use the village as a base for touring. Many shop before they arrive, so often the benefit of the visitor to Killin's food shops is limited. The stays are longer here than Callander (there are a lot of one night B&B's in Callander). Many visitors are walkers. There are five caravan sites within five miles.*"

Concern was voiced that agriculture is central to the local economy, but goods produced in the area are not available to purchase, there is neither an abattoir nor dairy, and cattle and sheep production are not exclusive to the area, in that production is divided between highland pastures in the local area and are “finished” (fattened) in the lowlands. Most farms are farmed by families going back two to three generations. “[A National Park employee (name withheld for anonymity)] *tried to start a farmers' co-operative within the National Park for sharing resources. Farmers could combine deliveries, for example, fertilisers...* [The National Park employee’s project] …*didn’t work because of the presentation and the fact it came down from the park and not from the farmers*.” One solution offered was, “*Bring in locals and young people to agriculture and recreate the link with the land*.” However, one participant highlighted his concern that, “*The village is being treated* [by the National Park] *like a child that is constrained. Small communities have been over-looked.*” (focus group participant, 4/11/2010).

The continuity of community life in 2030 was highlighted: “*The choir will still be going in 2030.*” Other features for 2030 included: “*Trading, self-sufficient, slow travel and car sharing much more; “Slower lifestyles not rushing about”*; “*Different ways to do tourism: cycling and horses - people will stay for a week not a weekend”*; “*The dentist needs to come here and we should have a tele-link to*

Table 5.9 Killin: What is a thriving community? Results of discussion on 4/11/2010

Group 1		Group 2	
Most important	**Also**	**Most important**	**Also**
• Primary school • Local shops • Demographic spread – employment opportunities	• Lots of community events • Trades people • Public transport links • Affordable housing • Sport facilities • Pubs • Environment	• Adaptability • Self-sufficient as far as possible in energy, trades and food • Co-operative attitude – people are involved	• High employment • Making best use of resources – people

Table 5.10 Killin focus group 28/10/2010 vision ideas for 2030: summary of participants' discussion scribed by facilitator

Idea	Comments
Local food, growing your own and home-cooking	• We would need: a local slaughter house, changes to health and safety legislation and a local dairy - there used to be a dairy in the village • Difficulty in overcoming the"no time because commuting" problem • Big shed – Tombreck are trying to do this • Bad weather is not good for growing • Increase growing by allotments and garden share – invite keen gardeners to work unused gardens and green spaces • Buy less food and so waste less: "*We are forced to buy more than we need because of the packaging and buy-one-get-one free offers*" • Make soup, but people need to be motivated and have the time to do this • Serve smaller portions • Eat seasonal food – Spanish strawberries are tasteless • Use freezers and fridges to minimise effort cooking and trips to the shops
Transport	• People are going to Stirling "for nothing better to do" • We need to make the most of every trip because of the distance • The community bus £10 to Braehead is a great idea and taken up. But it is not comfortable and is noisy. • Car pool – sharing car journeys. We would need a focal point in the library or the Co-operative supermarket with a car share board. • Pony-express - travel to Callander by car and then pick up the bus from there • Bring the train back! Still increasing ticket prices is a disincentive • Need a bus to Ben Lawers and other tourist destinations to ferry visitors • Fewer gas guzzling cars • In the past there was a steamer on the loch that linked all the villages to the train. The 7.40am train went straight to Buchanan Street. It was wonderful and the return was 8pm. The train used to be wonderful for tourism. People would come from Glasgow for an evening sail on the steamer. We need to learn from the past
Waste	• Killin used to have its own dump and no lorry collection • In the past, we didn't produce as much rubbish • Commercial recycling needs to be much better • In Canada, there are deposits on bottles – an incentive for recycling • Take your own bowl for fish and chips or use one sheet of greaseproof with newspaper for insulation, instead of the foam boxes
Employment	• There is nothing for young people - young people need apprenticeships • Children go away to school (Callander) and do not come back • A great many in the village are retired and do not need jobs • The quality of life is good here and people have to choose between that and being well paid • There is increasing home-working. Business can be done like that without or with only few extended road trips to distant clients
Housing	• Why do builders get away with low specification housing? All houses should have solar panels, high insulation and renewable heating systems
Trading systems	• Co-operatives • Barter systems instead of using money
Killin society	• The village will become even more sociable with increased trading in food and services and the set-up of co-operatives. Working together, people will get to know each other better • Barter systems mean that you need to know your neighbour and vice versa • Entertainment has to be local

Table 5.11 Killin vision ideas for 2030 and their prioritisation for 4/11/2010 and 23/11/2010 focus groups

04/11/2010 Focus Group 1	04/11/2010 Focus Group 2	23/11/2010 Focus Group
• ***Community hydro scheme and other small scale renewables – wood fuel • **Sustainable tourism • **Development of local food supply • **Thrift shop / community compost / furniture swapping • **More effective community council • *Local abattoir • Locally based employment (food and energy production) • Secondary education in village • Affordable housing • Lots of community events • Higher environmental quality	• ***Local energy sources – wood, wind and solar • **Transport – horses/bikes/car sharing and reducing trips • *Employment – local to serve local needs e.g., food and energy • *Education and health – telecommunication – more local services • *Environment – some land for food and timber • *Fewer cows – more vegetables • Better waste management – sewage • Decision-making – probably more local as ignored! • Social culture stays local! More co-operative • Horse breeding • House sharing to reduce costs	Priorities identified in discussion rather than star ranking: • Encourage small business • Community services need to provide all year round employment not just tourism • Community owned assets generating income and controlled and run by local people. • Keep a community atmosphere • Need to prevent house prices being so high and houses being sold as second homes. There is no / little social housing. Almost 80% of the social housing has gone. No house = no job

* The number of star stickers allocated by participants to each idea to prioritise vision ideas

Table 5.12 Killin focus group 4/11/2010 ideas of how to achieve vision priorities for action

Vision idea	How to achieve the idea
Local energy sources and renewable energy	• Local hydro scheme • Awareness raising e.g., KCC • Encourage micro-renewable energy • Explore local woodland / fuel supply and create a community supply company • Sewage recycling as a source of energy
Transport – horses, bikes, car sharing, fewer trips	• Car sharing system • Asking others to collect messages • Yellow lines and traffic wardens on main street • Reinstate railway • Community video-conferencing suite to reduce travel • Promote greater use of community bus • Promote use of buses
Local food supply	• Support Loch Tay food chain • Polytunnels and allotments find ground for these • Diversification of agriculture • Talk to co-op to stock local food once resource and demand is there • Pigs in areas of bracken • Find land for arable farming e.g., tatties, oats and barley • Local abattoir • Promote venison and rabbits and make available locally • Education so folk see the benefit of local food purchasing
Community council	• Challenge Stirling Council regarding carbon use and environmental impact of decisions e.g., local officer "carbon impact assessment" • Big debate about community priorities to inform KCC • Encourage more community involvement to improve representation

Table 5.13 Killin focus group 28/10/2014 priorities for action as stated by the participants and recorded by the facilitator

- Prosperity is dependent on tourism (as it was in the past) so we need public transport, car sharing, etc.
- Self-sufficient
- Community transport
- The most important thing for me is to keep the community spirit going
- Encourage people to produce own food, grow own vegetables etc. Cut down trips to the supermarket. Car share to go to the supermarket for basic food stuffs

the Forth Valley hospital for consultant follow-up meetings"; and, "*We need to take more control of decisions locally*."

One of the overarching goals identified in focus groups was addressing the lack of community energy and self-sufficiency in renewable energy was given the highest priority in the follow-up questionnaire (Table 5.14). The vision ideas are summarised in Figure 5.3.

Table 5.14 Results of Killin focus groups' follow-up questionnaire vision prioritisation (N=47)

Rank	Variable	Mean score
1	Self-sufficient in renewable energy & a community hydroelectric scheme	3.8
2	Well-connected public transport & car sharing	4.1
3	Growing, producing & eating local food	4.2
4	Maintaining community spirit & adaptability	5.3
5	Local provision of services (building work, home helps, catering, road clearing, public areas)	5.3
6	Small business facilities (buildings, apprenticeship support, resource centre, high speed broadband)	5.6
7	Local control of planning decisions & more empowered & effective community council	6.2
8	Everyone buys less, travels less, uses less energy & "makes do"	6.3
9	Local ownership & management of community assets	6.8
9	Affordable eco-friendly housing	6.8

Killin is much more SELF-SUFFICIENT with a COMMUNITY RENEWABLE ENERGY supply funding enterprise and supplying energy. COMMUNITY OWNED ASSETS, which are CONTROLLED AND RUN BY LOCAL PEOPLE, generate income. Everyone makes much FEWER TRIPS. LOCAL TRIPS are by BIKE, WALKING and in some cases by HORSE. COMMUNITY TRANSPORT links Killin with other villages and the regular buses / trains to Glasgow and Stirling. No one makes single car journeys to shop anymore – trips like that are done on the community bus or co-ordinated with others. Large areas of land have been turned over to LOCAL FOOD PRODUCTION (local farmers or growing your own), which is consumed locally. ALL HOUSES HAVE HIGH INSULATION AND RENEWABLES. Housing matches the need for it. SMALL BUSINESSES are flourishing and there is YEAR-ROUND EMPLOYMENT. HEALTH SERVICES are delivered LOCALLY. The most important thing is to KEEP THE COMMUNITY SPIRIT GOING.

Figure 5.3 A cloud based on the author's analysis of the main themes of Killin's vision identified in the focus groups (keywords are highlighted in capitals)

5.1.4 Common themes for the visions of rural communities in 2030

Whilst all three communities have very different histories, challenges and competencies, common themes were identified across all three communities. With prioritisation of vision statements for Kinlochleven and Killin, the comparison of the results for these two communities is easier.

Comparing the Killin and Kinlochleven priorities (Table 5.8 and Table 5.14), most important was self-sufficiency in energy and renewable energy generation.

Renewable energy generation was not vocalised as much in Fintry, most probably because Fintry had already secured its own wind turbine to generate income for the local community. Nevertheless, "*continue FDT priorities*" including "*self-sufficiency in energy*" was identified. The lack of ability to secure community renewable energy in Kinlochleven and Killin highlighted the problem of energy injustice in these communities, which is likely to be common across Scotland.

The importance of community was highlighted in the focus groups. Community engagement (Kinlochleven) and maintaining community spirit (Killin) were ranked fourth by both communities in the vision questionnaires (Table 5.8, Table 5.14). In Fintry the opportunity for enhancing community spirit through relocalisation was identified (Figure 5.1).

Well-connected eco-friendly transport was identified as a key aspect of the vision in all three communities. The sustainability of different transport options was investigated by modelling changes in personal mobility, modes of transport and less polluting (hybrid and electric) cars and is outlined in the next section.

There is recognition of the need to support young people (with youth clubs) and that there is little opportunity for young people within the communities today. The majority of those under the age of 30 leave the communities to seek training and employment within the large conurbations, although many return. In one focus group this was articulated as a "*rite of passage*". There was concern about the lack of opportunity for this age group and apprenticeships were identified as a necessity in Killin to retain young people within the community.

The need to retrofit the built environment to eco-friendly standards and to have new buildings built to exemplar standards in energy efficiency and with sustainable materials was identified. As one focus group participant commented "*Why do builders get away with low specification housing*?"

Relocalisation of food production was articulated in all three communities and local food was seen as a core part of the local economy in a sustainable community. The impact of consumer food choices on the EF are explored in section 5.2. Participants recognised the importance of relocalisation of the economy and its dependence not only on food relocalisation, but also the relocalisation of services, trades, small businesses, retail outlets and employment. One Killin participant's comment was "*We need to learn from the past*".

5.2 Sustainability choices: modelling transport, food and energy options

For transport, food and household energy consumption, narratives were created based on the visions and examples of best practice and innovation to provide scenarios to input into REAPv2.17 (SEI, 2011a, see section 3.5). The resultant scenario EFs were compared to the fairshare, as defined in section 3.3.1, as a gauge of sustainability to provide evidence to identify options and recommendations for sustainable alternatives to current lifestyles. In addition, the effect of switching to 100% renewable electricity generation on Scotland's EF was investigated.

5.2.1 Transport modelling

The three scenarios related to different levels of change (Step 1, Step 2 and Step 3) and explored changes in: car use (CAR), long distance travel (LDT), personal travel (PT, car and long distance travel combined); and technology (a medium sized petrol hybrid car (AEA, 2012), and an electric car (modelled on the Nissan LEAF, Nissan, 2012) powered by electricity generated using the conventional generation mix (ECCE) and powered by electricity generated from renewables (ECPR)). The potential electricity demand to fuel electric cars was compared to the respondents' reported household electricity consumption.

5.2.1.1 Transport scenarios (CAR, LDT and PT) modelling results

For scenarios CAR1-CAR3, the reduction in transport EF was greatest in Kinlochleven (the EF is 60%, 40% and 26% of baseline for CAR1-CAR3 respectively), and least in Fintry (the EF was 66%, 50% and 39% of baseline for CAR1-CAR3). Killin's reduced EF was 67%, 51% and 40% of baseline (Figure 5.4, Appendix C.2). Fintry had the greatest reduction in EF for the LDT scenarios (LDT1-LDT3, the EF representing 92%, 83% and 76% of baseline, respectively, Figure 5.5, Appendix C.2). In Kinlochleven, the LDT1-LDT3 EFs were 98%, 92%, and 87% of baseline and for Killin they were 93%, 81% and 72% respectively. The low reduction in Kinlochleven for LDT1 reflected the low amount of air travel in the sample. In Fintry, the baseline average number of return domestic flights taken was 1.7 flights/cap, whilst in Kinlochleven and Killin the number was 0.2 and 0.7 flights/cap respectively (Table 4.9).

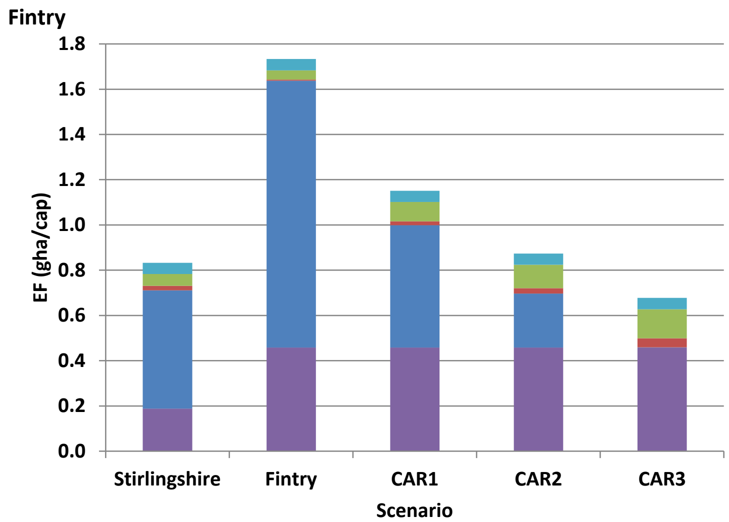
For the scenarios PT1-PT3, the percentage reduction in EF for each community was similar (Figure 5.6). The percentage reductions in baseline transport EF for PT1 were between 41% and 43%, for PT2 between 67% and 68% and for PT3 between 85% and 88% of baseline (Figure 5.6, Figure 5.7, Appendix C.2). Fintry had the highest baseline EF; application of PT3 reduced the transport EF to 15% of the fairshare, whereas Killin's and Kinlocheven's were both 8% (Figure 5.8, Appendix C.2).

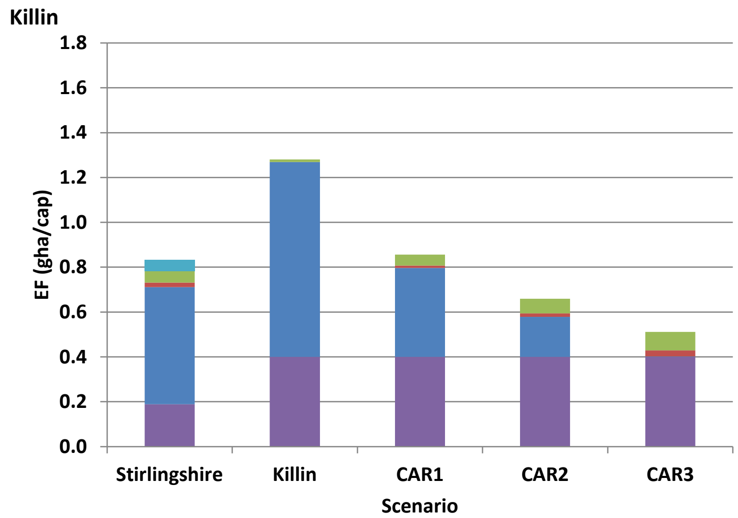
5.2.1.2 Modelling technology: hybrid, ECCE and ECPR results

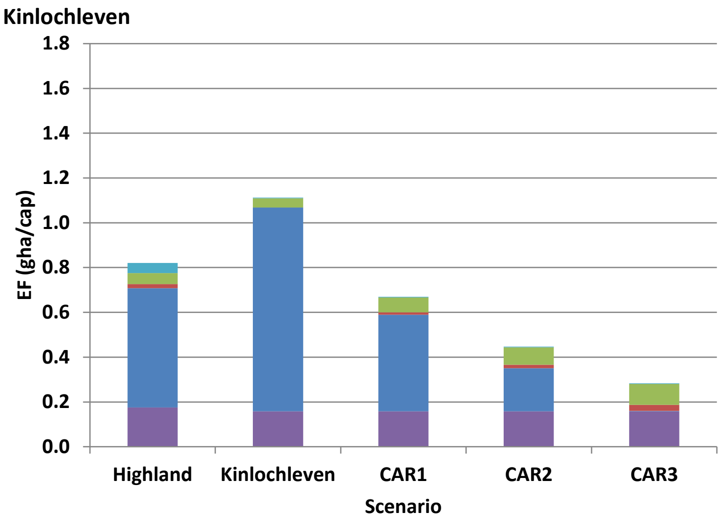
Replacement of all cars with hybrids (hybrid scenario) and electric cars powered by conventional electricity (ECCE) reduced Fintry's car EF from 1.19gha/cap to 0.86gha/cap (27% reduction) and 0.72gha/cap (40% reduction). The latter result was significantly improved when renewable electricity replaced conventional electricity (ECPR): as the car EF was reduced by 63% (assuming the EF of renewable electricity was 10% of conventional electricity, Alderson *et al.,* 2012, Figure 5.9). Fintry's total transport EF was reduced by 27% for ECCE and by 43% for ECPR. The percentage reduction in car EF from baseline was equivalent in all three communities. The transport EF in the ECPR scenario equated to 55% of the fairshare for Fintry, 30% for Kinlochleven and 41% for Killin (Table 5.15).

5.2.1.3 The effect on the transport EF of combining ECPR with LDT3, PT1 and PT2 scenarios

For all three communities, the changes required to achieve mobility of the level of PT3 (Appendix C.2) would be punitive with very little travel and mobility, no flying, no individual car ownership, no commuting by car and the majority of



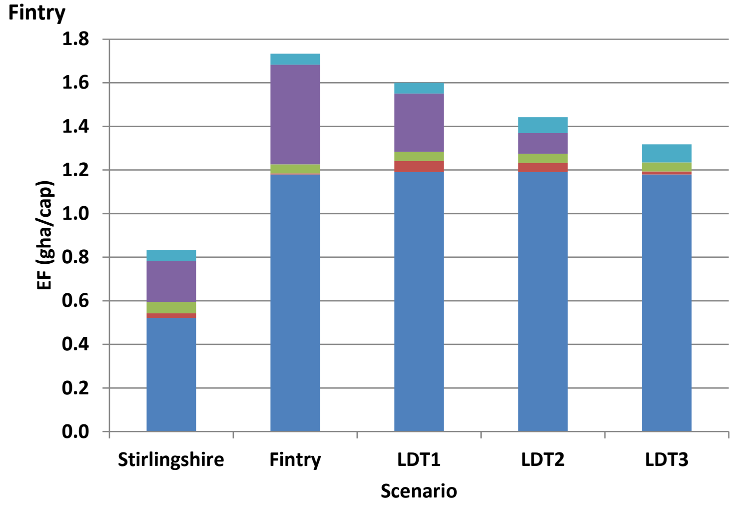


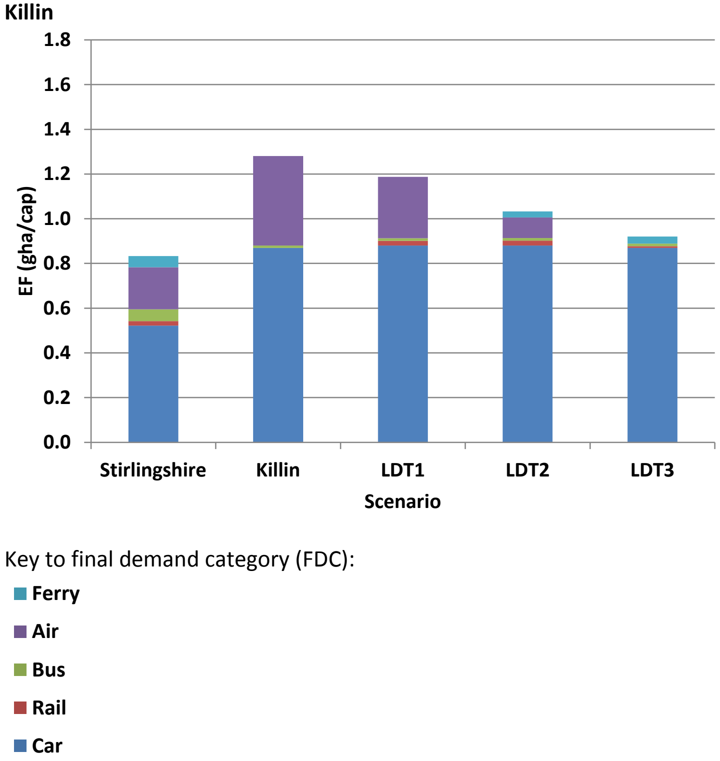


Key to final demand category (FDC):

- **Ferry**
- **Air**
- **Bus**
- **Rail**
- **Car**

Figure 5.4 Transport modelling EF results for scenarios CAR1-CAR3 compared to baseline and LA for each community (modelled in REAPv2.17, SEI 2011a)





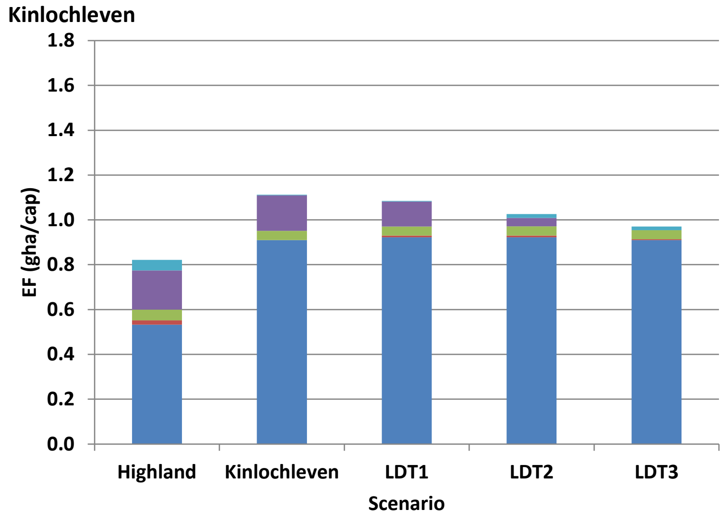
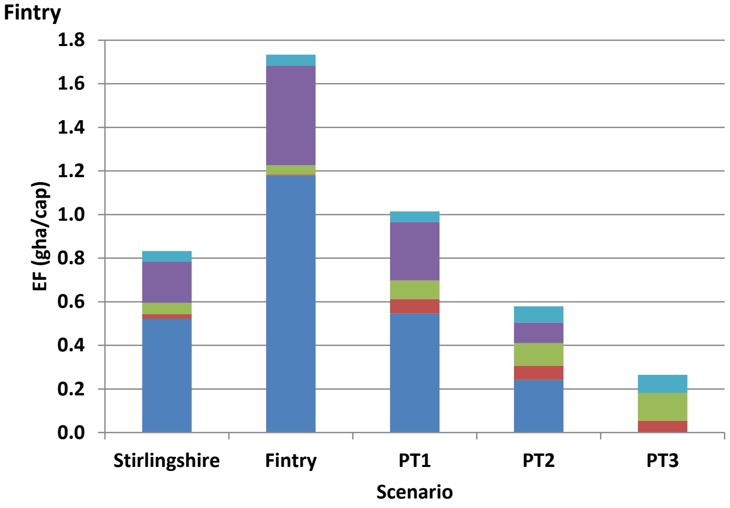
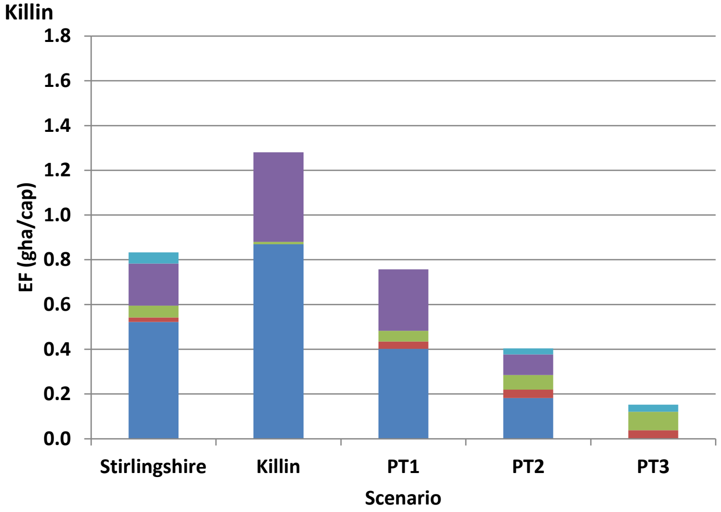
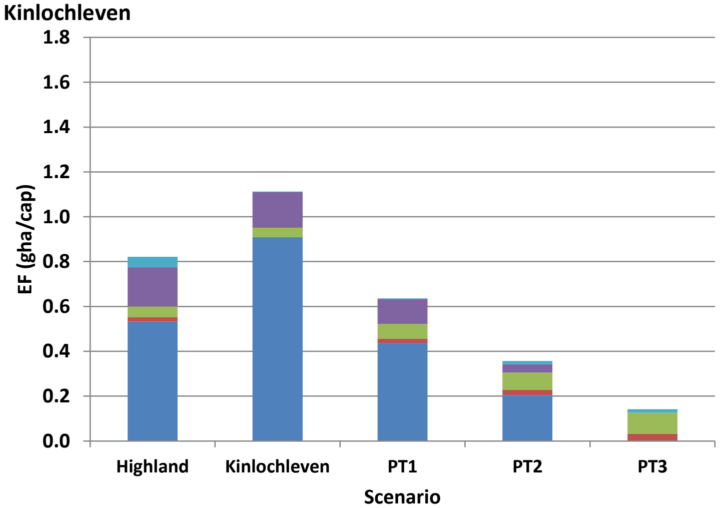


Figure 5.5 Transport modelling EF results for scenarios LDT1-LDT3 compared to baseline and LA for each community (modelled in REAPv2.17, SEI 2011a)







Key to final demand category (FDC):

- **Ferry**
- **Air**
- **Bus**
- **Rail**
- **Car**

Figure 5.6 Transport modelling EF results for scenarios PT1-PT3 compared to baseline and LA for each community (modelled in REAPv2.17, SEI 2011a)

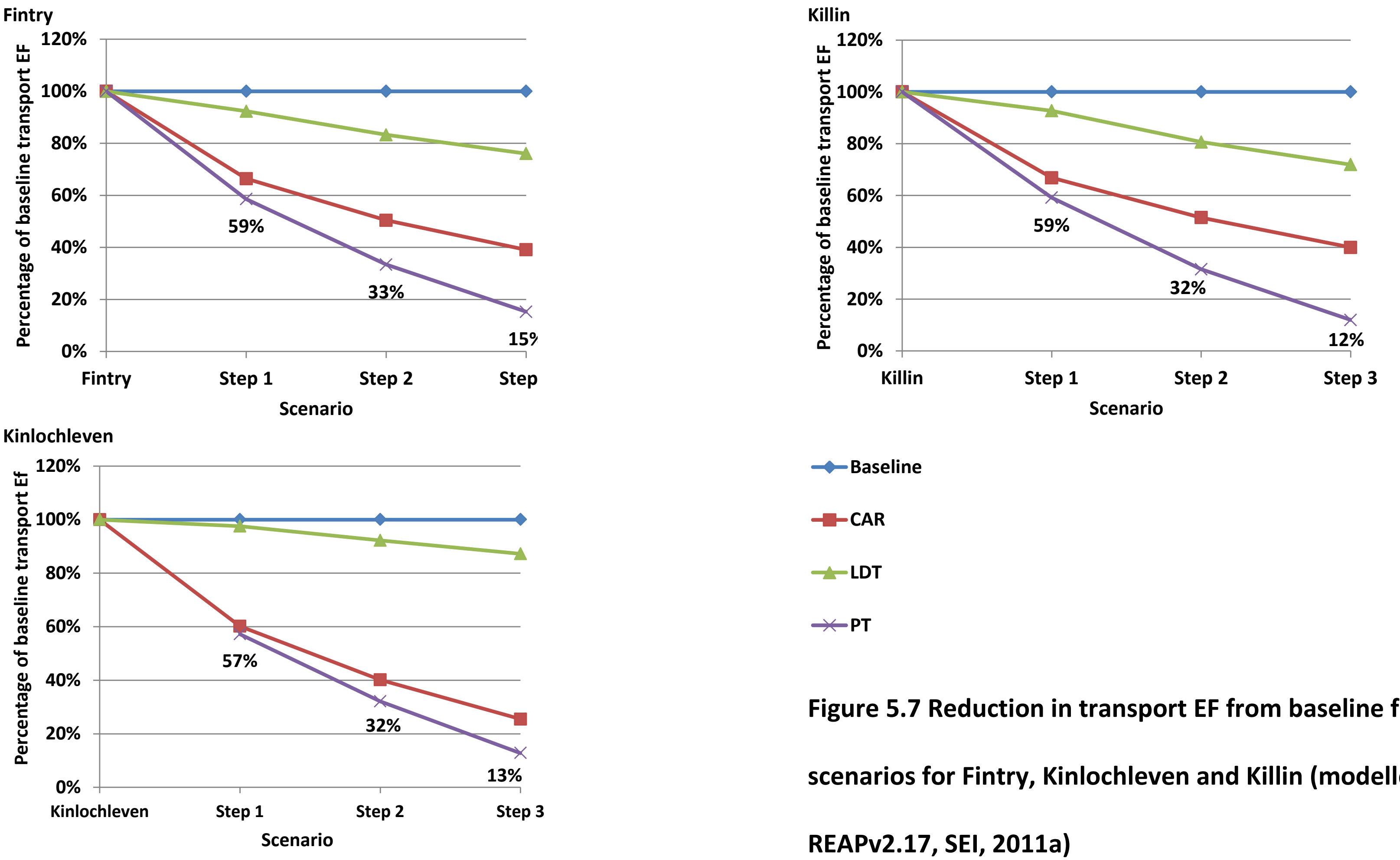


Figure 5.7 Reduction in transport EF from baseline for all scenarios for Fintry, Kinlochleven and Killin (modelled in REAPv2.17, SEI, 2011a)

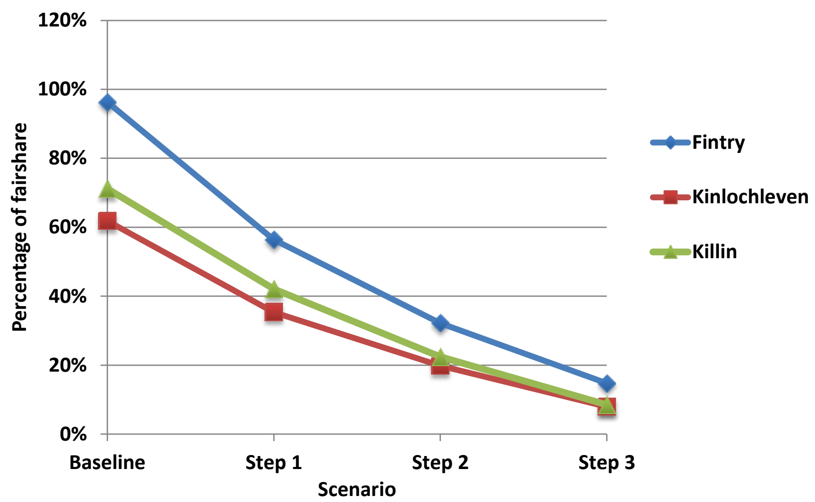


Figure 5.8 Transport modelling EF results for scenarios PT1-PT3 shown as a percentage of the fairshare (modelled in REAPv2.17, SEI, 2011a, GFN, 2012)

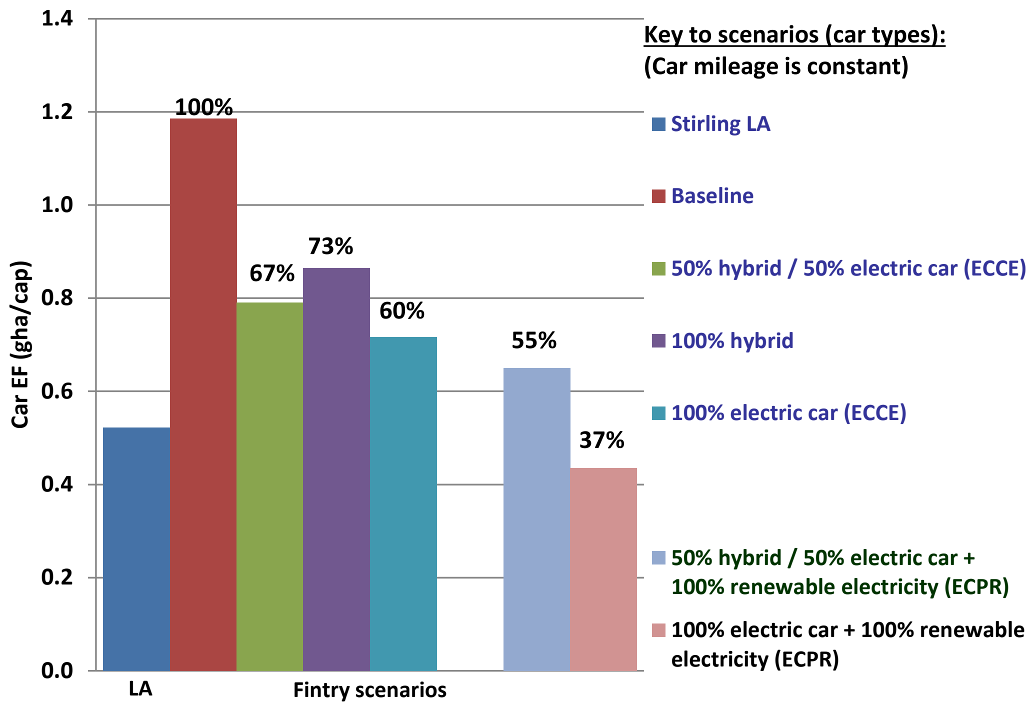


Figure 5.9 The effect of technology on Fintry's baseline car EF (modelled in REAPv2.17, SEI, 2011a). The percentage reduction in car EF from baseline was equivalent in all three communities, so only Fintry's results are shown

working population work at home or in local employment. Therefore, the further investigation of the potential of ECCEs and ECPRs was undertaken in order to identify whether current technological advances in electric vehicles could achieve a sustainable transport EF even in a highly unsustainable and highly mobile community, such as Fintry.

When the LDT3 and ECPR scenarios were combined (i.e. 100% ECPR implementation with no flying and all remaining long distance travel is over land or by sea), then both Kinlochleven's and Killin's transport EF were reduced to almost 20% of the fairshare (22% and 21% respectively), whereas Fintry remained at 32% of fairshare (Table 5.15).

The efficiency of the PT2 car and that of a hybrid car are very similar, hence the EF of replacing the car efficiency of PT2 with that of a hybrid are almost identical. The PT2+ECPR scenario achieves EF reductions to less than 20% of fairshare for Kinlochleven and Killin and 27% of fairshare for Fintry (Table 5.15).

5.2.1.4 Electricity generation requirements of ECPR scenarios

The electricity consumption of electric cars deployed in place of baseline and scenario PT1-PT3 cars was compared to baseline household electricity consumption. Deployment of electric cars increased baseline household electricity consumption by 51% for Kinlochleven and Killin and 71% for Fintry. In the PT2 scenario, electricity consumption increased by 43%, 32% and 31% for Fintry, Kinlochleven and Killin respectively, and in PT3 the increase was negligible for all three communities (Table 5.16).

Table 5.15 Comparison of the effect of ECCE and ECPR implementation on the transport EF for baseline, PT1, PT2 and LDT3 scenarios

Scenarios[1]	EF (gha/cap) Car	Rail	Bus	Air	Ferry	Total	% of baseline	% of fairshare
Fintry - Baseline	1.18	0.00	0.04	0.46	0.05	1.73	100%	96%
PT2	0.24	0.06	0.10	0.09	0.07	0.58	33%	32%
Baseline + ECCE	0.72	0.00	0.04	0.46	0.05	1.27	73%	71%
Baseline + ECPR	0.44	0.00	0.04	0.46	0.05	0.99	57%	55%
PT1 + ECPR	0.25	0.07	0.09	0.27	0.05	0.72	42%	40%
PT2 + ECPR	0.14	0.06	0.10	0.09	0.07	0.48	28%	27%
LDT3 + ECPR	0.44	0.01	0.04	0.00	0.08	0.57	33%	32%
Kinlochleven - Baseline	0.91	0.00	0.04	0.16	0.00	1.11	100%	62%
PT2	0.20	0.02	0.08	0.04	0.01	0.36	32%	20%
Baseline + ECCE	0.55	0.00	0.04	0.16	0.00	0.76	68%	42%
Baseline + ECPR	0.34	0.00	0.04	0.16	0.00	0.55	49%	30%
PT1 + ECPR	0.21	0.02	0.07	0.11	0.00	0.41	37%	23%
PT2 + ECPR	0.12	0.02	0.08	0.04	0.01	0.27	24%	15%
LDT3 + ECPR	0.34	0.00	0.04	0.00	0.02	0.40	36%	22%
Killin - Baseline	0.87	0.00	0.01	0.40	0.00	1.28	100%	71%
PT2	0.18	0.04	0.06	0.09	0.03	0.40	32%	22%
Baseline + ECCE	0.52	0.00	0.01	0.40	0.00	0.94	73%	52%
Baseline + ECPR	0.33	0.00	0.01	0.40	0.00	0.74	58%	41%
PT1 + ECPR	0.20	0.03	0.05	0.27	0.00	0.55	43%	31%
PT2 + ECPR	0.11	0.04	0.06	0.09	0.03	0.33	26%	19%
LDT3 + ECPR	0.33	0.01	0.01	0.00	0.03	0.38	30%	21%

[1]ECPR and ECCE assume 100% replacement of cars with ECPR and ECCE respectively.

Table 5.16 Electricity consumption requirements of electric car options compared to household baseline electricity consumption

Community	Electricity consumption (kwh/cap) Household baseline[1]	ECPR + baseline transport mobility[2]	ECPR + PT2 transport mobility[2]	Percentage of household baseline electricity consumption ECPR + baseline transport mobility	ECPR + PT2 transport mobility
Fintry	5,360	3,800	2,310	71%	43%
Kinlochleven	5,560	2,850	1,750	51%	32%
Killin	5,230	2,640	1,620	51%	31%

[1]The baseline is for all electricity tariffs and does not distinguish generation method. Green tariff electricity made up less than 10% of electricity consumption in Fintry and less than 5% in Kinlochleven and Killin.
[2]This does not include household baseline electricity consumption.

5.2.2 Food modelling

As food consumption data was not collected, food domestic production scenarios (FDP1-FDP3) were created for Stirling LA food consumption to investigate the effect of increased domestic production. Food consumption scenarios (FC1-FC3) were created to investigate the effect of changes in diet (increasing vegetarian and vegan diets and less unhealthy foods).

5.2.2.1 Increasing domestic food production (FDP1-FDP3)

Overall, there was little change in the food EF on increasing domestically produced food (1% change for scenarios FDP1-FDP3, Figure 5.10, Table 5.17). For most food types (FDCs), in scenario FDP3 (where there was 100% domestic production except for alcoholic beverages (48% domestic production) and cocoa, chocolate and sugar confectionery, where there was no change from baseline), the EF decreased, except for fruit and vegetables, vegetable and animal oils and fats, and grain mill products, starches and starch products where there was an increase of 13%, 14% and 4% respectively, Table 5.17) and dairy, where there was no change in EF. An increase in domestic production from 30% to 48% (FDP3) for alcoholic beverages produced a significant decrease in EF of this FDC to 85% of baseline.

Table 5.17 Domestic food production modelling EF results for scenarios FDP1-FDP3 using Stirling LA baseline data (modelled in REAPv2.17, SEI, 2011a)

Scenario	Baseline		FDP1		FDP2		FDP3	
	Input variable	Result	Input variable	Result	Input variable	Result	Input variable	Result
FDC[1]	Percentage domestic	EF (gha/cap)	Percentage domestic	Percentage of baseline EF	Percentage domestic	Percentage of baseline EF	Percentage domestic	Percentage of baseline EF
Meat and meat products (excl. poultry)	75%	0.21	82%	99%	90%	98%	100%	96%
Poultry meat and poultry meat products	73%	0.06	80%	97%	87%	94%	100%	89%
Fish	71%	0.04	78%	96%	85%	91%	100%	82%
Fruit and vegetables	76%	0.27	83%	**104%**	91%	**108%**	100%	**113%**
Vegetable and animal oils and fats	72%	0.02	80%	**104%**	87%	**108%**	100%	**114**%
Dairy products	75%	0.09	83%	100%	91%	100%	100%	100%
Grain mill, starches and starch products	87%	0.06	96%	**103%**	100%	**104%**	100%	**104%**
Bread, rusks, biscuits, pastry goods, cakes	93%	0.04	100%	82%	100%	82%	100%	82%
Other food products (incl. sugar)	73%	0.04	81%	91%	88%	83%	100%	69%
Non-alcoholic beverages	76%	0.07	84%	92%	91%	85%	100%	76%
Alcoholic beverages[2]	30%	0.05	36%	95%	42%	90%	48%	85%
Total		0.98		99%		99%		99%

[1]Cocoa, chocolate and sugar confectionery were not modelled.
[2]The input variables for alcoholic beverages had an increase of 20%, 40% and 60% above baseline for scenarios FDP1-FDP3, as the baseline domestic production was much lower at 30%.

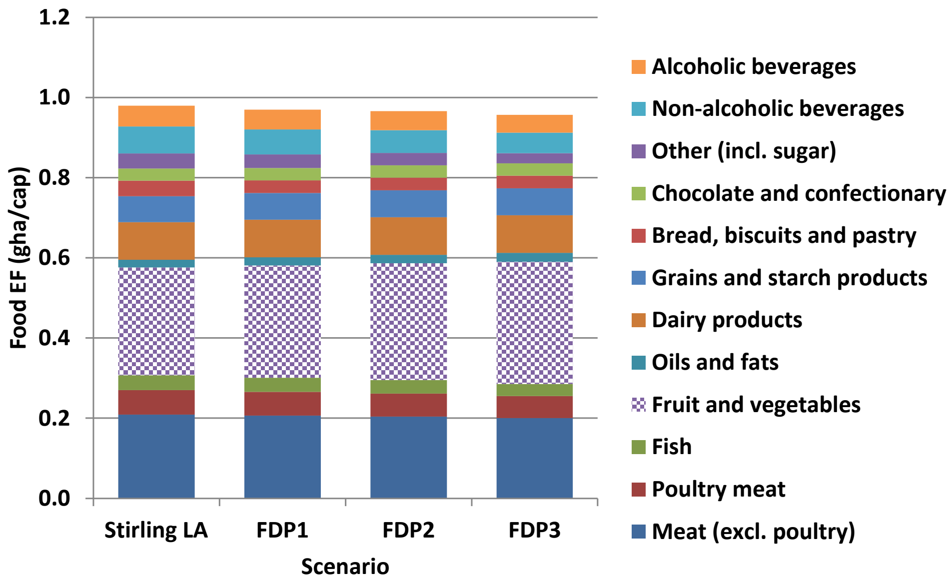


Figure 5.10 Domestic food production modelling EF results for scenarios FDP1-FDP3 using Stirling LA baseline data (modelled in REAPv2.17, SEI, 2011a)

5.2.2.2 Changes in diet (FC1-FC3)

In FC1-FC3 the effects of changing consumption were investigated independent of changing proportions of domestic production. The scenario FC3 enabled modelling reduction in consumption of less healthy foods and a vegan diet. Taking a vegan diet on its own, elimination of meat, fish and diary FDCs resulted in no net reduction in the EF of food consumption. It caused the EF of dairy and meat FDCs to drop to zero, but the EF of fruit and vegetables substantially increased to match that of the baseline (0.67gha/cap, Figure 5.11). However, in this scenario the household expenditure on produce (protein-rich foods and fruit and vegetables) was reduced significantly (by £332/cap/annum, or 48% of baseline, Table 3.21).

The 15% reduction in the total food EF in FC3 (Table 5.19) was due to a 66% reduction in the consumption of “less healthy foods” (the FDCs of oils and fats,

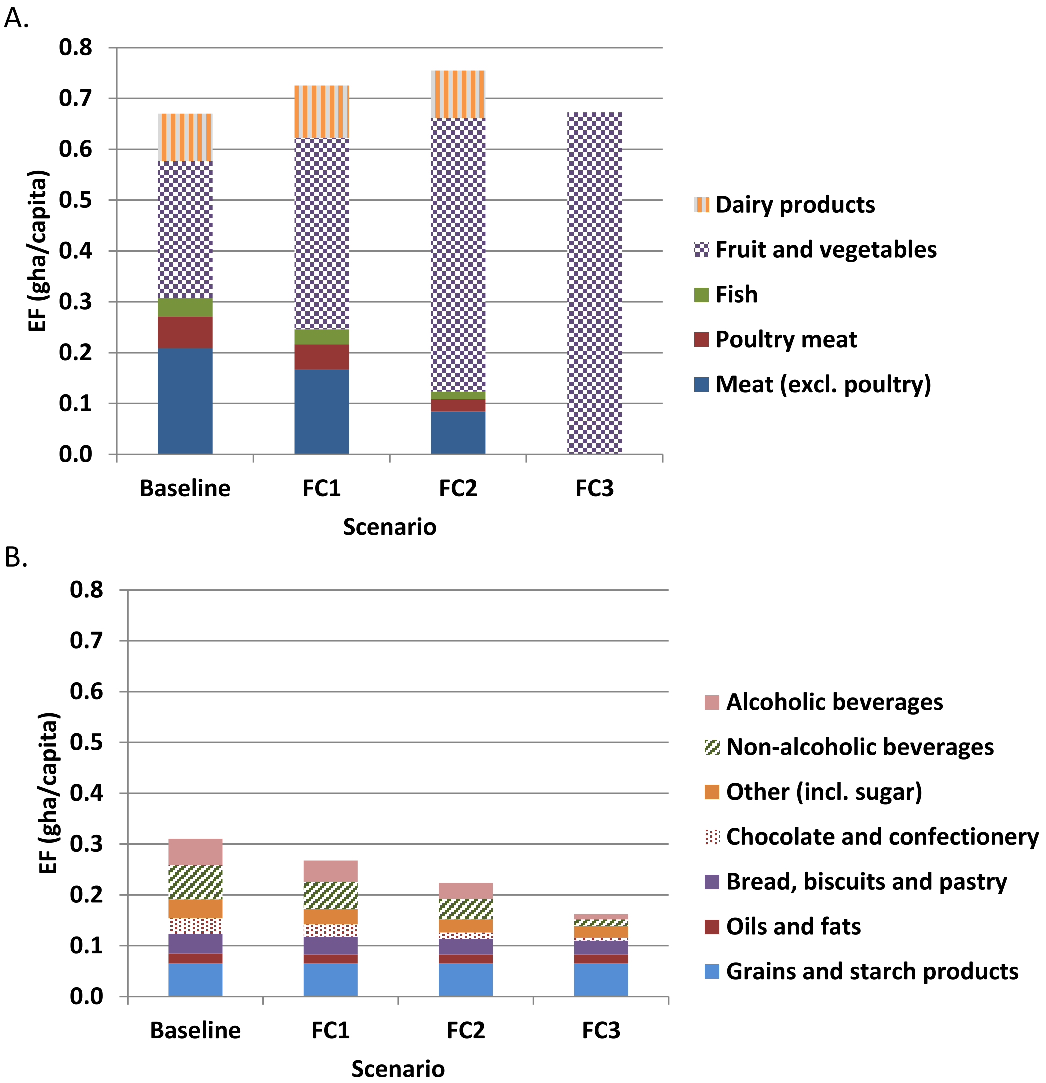


Figure 5.11 EF results for Stirling LA food consumption scenarios FC1-FC3. (A) for meat, diary, fish, fruit and vegetable FDCs; and (B) less healthy foods and essentials (grains) FDCs (modelled in REAPv2.17, SEI, 2011a)

bread, biscuits and pastry, chocolate and confectionery, other (incl. sugar), non-alcoholic beverages and alcoholic beverages), the EF of which was reduced 60% from baseline. The food EF for FC3 represented 46% of the fairshare (85% of baseline food EF). As this did not reduce the food EF to a sustainable level, the EF of fruit and vegetables produced using a sustainable community agriculture scenario (SCA) was investigated. In the SCA scenario, the increased demand for fruit and vegetables (above baseline) for FC1-FC3 was assumed to come from community market gardens and "growing your own" (i.e. the land for additional food production was converted from the "built land" category) and the production methods were assumed to be those using very few resources (e.g., permaculture production). In the SCA scenario, the EF of additional (above baseline) fruit and vegetable production was assumed to be zero. This reduced the food EF for FC3+SCA to 0.43gha/cap, which was a 56% reduction from baseline and equivalent to 24% of the fairshare (Table 5.18 and Table 5.19).

Table 5.18 EF results for Stirling LA food consumption scenarios FC1-FC3 (modelled in REAPv2.17, SEI, 2011a)

Food FDC	Scenario EF (gha/cap)			
	Baseline	**FC1**	**FC2**	**FC3**
Produce	**0.67**	**0.73**	**0.75**	**0.67**
Meat (excl. poultry)	0.21	0.17	0.08	0.00
Poultry meat	0.06	0.05	0.02	0.00
Fish	0.04	0.03	0.01	0.00
Fruit and vegetables[1]	0.27	0.38	0.54	0.67
Dairy products	0.09	0.10	0.09	0.00
Essentials	**0.06**	**0.06**	**0.06**	**0.06**
Grains and starch products	0.06	0.06	0.06	0.06
Less healthy foods	**0.25**	**0.20**	**0.16**	**0.10**
Oils and fats	0.02	0.02	0.02	0.02
Bread, biscuits and pastry	0.04	0.03	0.03	0.03
Chocolate and confectionery	0.03	0.02	0.01	0.01
Other (incl. sugar)	0.04	0.03	0.03	0.02
Non-alcoholic beverages	0.07	0.05	0.04	0.01
Alcoholic beverages	0.05	0.04	0.03	0.01
Total	**0.98**	**0.99**	**0.98**	**0.83**
Total as percentage of fairshare	54%	55%	54%	46%
Total+SCA		0.88	0.71	0.43
Total+SCA as percentage of fairshare		49%	39%	24%
Total+SCA+25%		0.82	0.64	0.36
Total+SCA+25% as percentage of fairshare		45%	36%	20%

[1]NB: Protein rich vegetables are included within "fruit and vegetables" FDC.

Table 5.19 Stirling LA FC1-FC3 results as a percentage of baseline (modelled in REAPv2.17, SEI, 2011a)

	Scenario as percentage of baseline EF			
Food FDC	**Baseline**	**FC1**	**FC2**	**FC3**
Produce[1]	100%	108%	113%	100%
Essentials	100%	100%	100%	100%
Less healthy foods	100%	82%	65%	40%
Total	100%	101%	100%	85%
Total+SCA	100%	90%	72%	44%
Total+SCA+25%	100%	83%	65%	37%

[1]NB: Protein rich vegetables are included within "fruit and vegetables" FDC.

The scenarios FC1-3+SCA were further adjusted, whereby 25% of the baseline fruit and vegetable production was converted to SCA (scenarios FC1+SCA+25%, etc.). The resultant EF for FC1+SCA+25%, FC2+SCA+25% and FC3+SCA+25% was 0.82, 0.64 and 0.36gha/cap, respectively (Table 5.18), giving a significant reduction from the baseline (17%, 35% and 63%, respectively, Table 5.19). The resultant EF for FC3+SCA+25% represented only 20% of the fairshare.

5.2.3 Energy modelling

Two aspects of modelling were undertaken. First, the effect on the national (Scottish) footprint of replacing the current electricity generation with 100% renewable energy generation was investigated to enable a comparison with Alderson *et al.*'s (2012) estimate of the relative EF of renewable electricity generation. Secondly, the effect of energy conservation and renewable technologies on the communities' footprints was modelled using step scenarios.

5.2.3.1 The EF of 100% renewable energy generation for Scotland

Although two different scenarios were explored for renewable energy generation, scenarios A and B (Table 3.22), their results differed by only 1%, so the results for scenario A only are reported. Converting Scotland from its conventional energy generation mix to one that is 100% renewables reduced the Scottish EF by 14% (0.66gha/cap from 4.75gha/cap, Table 5.20). The 57% reduction in EF was in housing FDCs (reducing the housing EF by 40% from the baseline) and was exclusively in the "fossil fuel land" category (Table 5.21, SEI, 2011a).

The conventional (baseline) household electricity EF was estimated at 0.36gha/cap and the Scenario A and B household electricity EFs both at 0.04gha/cap (12% of baseline). When electricity generation by other carbon based sources ('other' in Table 3.22) was replaced by renewables, the Scenario A and B electricity EF reduced to 0.03gha/cap (8% of baseline).

Table 5.20 The EF modelling results for 100% renewable electricity generation in Scotland (Scenario A) by amalgamated FDC

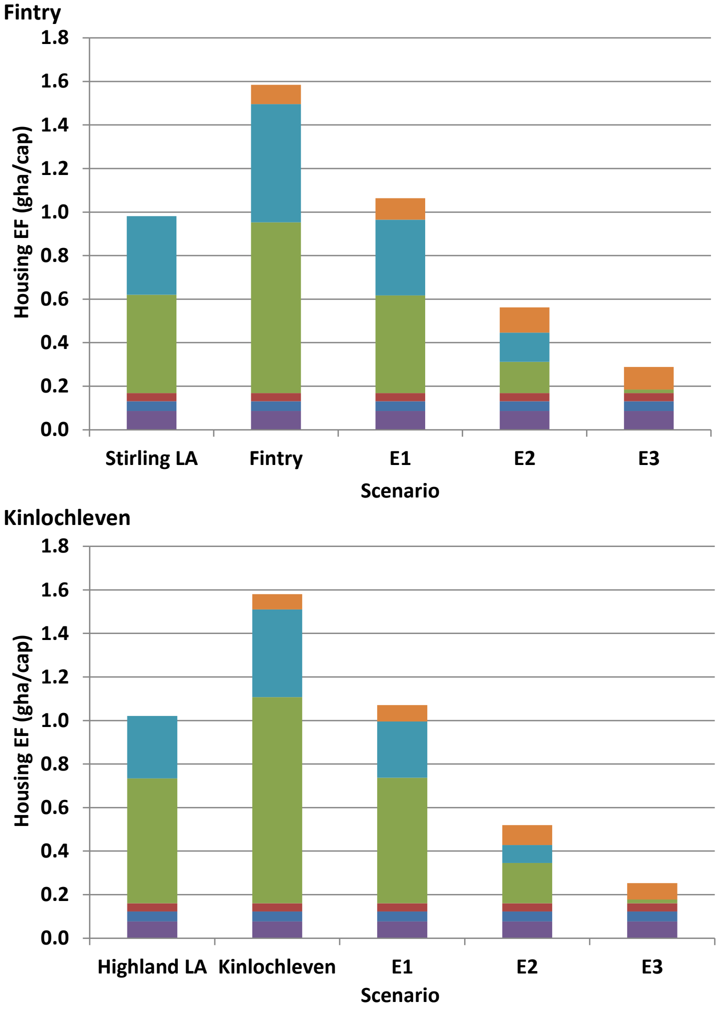
	EF by FDC (gha/cap)							
	Total	**Transport**	**Food**	**Housing**	**Consum-ables**	**Private Services**	**Public Services**	**Capital investment and adjustments**
Scotland baseline	4.75	0.78	1.22	0.94	0.73	0.22	0.45	0.43
Scenario A	4.09	0.75	1.17	0.56	0.67	0.18	0.37	0.39
Reduction (baseline-A)	0.66	0.03	0.05	0.37	0.05	0.04	0.08	0.04
Reduction as percentage of baseline	14%	4%	4%	40%	7%	16%	17%	10%
Reduction as percentage of total reduction	100%	4%	8%	57%	8%	5%	12%	6%

Table 5.21 The EF modelling results for 100% renewable electricity generation for Scotland (Scenario A) by land category

	EF by land category (gha/cap)						
	Total	**Fossil fuel**	**Forest**	**Sea**	**Built land**	**Pasture**	**Cropland**
Scotland	4.75	2.86	0.20	0.10	0.20	0.25	1.14
100% renewables	4.09	2.20	0.20	0.10	0.20	0.25	1.14
Reduction in EF	0.66	0.66	0.00	0.00	0.00	0.00	0.00

5.2.3.2 Household renewable energy, conservation and efficiency scenarios

Energy consumption scenarios (E1-E3, Table 3.23, Figure 3.22) were created for each community to investigate the effect of energy saving and technological innovations on the housing EF. Application of the E1 scenario gave a reduction in the housing EF of between 31% and 33% for all three communities; E2 gave a reduction of between 62% and 67%; and E3 gave a reduction of between 82% and 84% (Figure 5.12, Table 5.22 and Table 5.23). In E3, fuel (other than wood-fuel) was reduced to 2% of the baseline and this was the EF for renewable electricity. The EF of built land remained constant. Housing repair and mortgages remained constant in these scenarios, due to the limitation of being unable to model these aspects in REAP (SEI, 2011a). In a more sustainable future, the use of sustainable building products and "green" financial institutions, could substantially reduce the 0.08gha/cap current attributed to them; this could reduce the E3 EF at the most by 25%. The use of wood as fuel is the most significant aspect of the E3 housing EF for Killin and Fintry (Table 5.22). E3 could be sustainable with the resultant EF being between 13% and 17% of the fairshare.



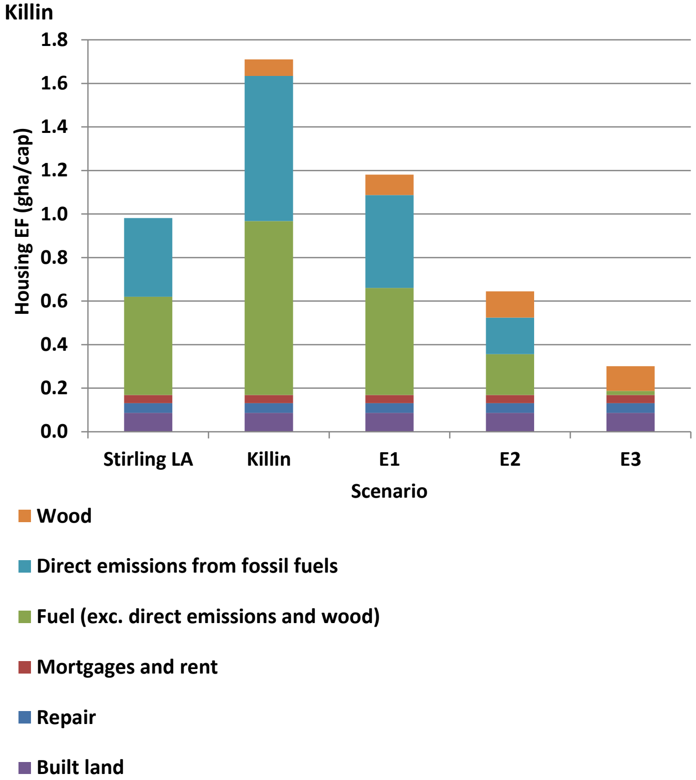


Figure 5.12 Housing EF modelling results for energy scenarios E1-E3 for Fintry, Kinlochleven and Killin (modelled in REAPv2.17)

Table 5.22 Housing EF modelling results for energy scenarios E1-E3 for Fintry, Kinlochleven and Killin (modelled in REAPv2.17)

FDC	Baseline EF (gha/cap)	E1 EF (gha/cap)	E1 % of baseline	E2 EF (gha/cap)	E2 % of baseline	E3 EF (gha/cap)	E3 % of baseline	Percentage of total housing EF for each scenario: Baseline	E1	E2	E3
FINTRY											
Built land	0.09	0.09	100%	0.09	100%	0.09	100%	5%	8%	15%	30%
Repair	0.04	0.04	100%	0.04	100%	0.04	100%	3%	4%	8%	15%
Mortgages & rent	0.04	0.04	100%	0.04	100%	0.04	100%	2%	4%	7%	13%
Fuel (indirect)[1]	0.78	0.45	57%	0.14	18%	0.02	2%	49%	42%	25%	6%
Fuel (direct)[2]	0.54	0.35	64%	0.13	25%	0.00	0%	34%	33%	24%	0%
Wood	0.09	0.10	111%	0.12	131%	0.10	117%	6%	9%	21%	36%
Total	1.58	1.06	67%	0.56	35%	0.29	18%	100%	100%	100%	100%
KINLOCHLEVEN											
Built land	0.08	0.08	100%	0.08	100%	0.08	100%	5%	7%	15%	30%
Repair	0.05	0.05	100%	0.05	100%	0.05	100%	3%	4%	9%	18%
Mortgages & rent	0.04	0.04	100%	0.04	100%	0.04	100%	2%	4%	7%	15%
Fuel (indirect)[1]	0.95	0.58	61%	0.19	20%	0.02	2%	60%	54%	36%	7%
Fuel (direct)[2]	0.40	0.26	64%	0.08	20%	0.00	0%	26%	24%	16%	0%
Wood	0.07	0.07	107%	0.09	130%	0.08	107%	4%	7%	18%	30%
Total	1.58	1.07	68%	0.52	33%	0.25	16%	100%	100%	100%	100%
KILLIN											
Built land	0.09	0.09	100%	0.09	100%	0.09	100%	5%	7%	13%	29%
Repair	0.04	0.04	100%	0.04	100%	0.04	100%	3%	4%	7%	15%
Mortgages & rent	0.04	0.04	100%	0.04	100%	0.04	100%	2%	3%	6%	13%
Fuel (indirect)[1]	0.80	0.49	62%	0.19	23%	0.02	2%	47%	42%	29%	6%
Fuel (direct)[2]	0.67	0.43	64%	0.17	25%	0.00	0%	39%	36%	26%	0%
Wood	0.08	0.09	124%	0.12	159%	0.11	149%	4%	8%	19%	38%
Total	1.71	1.18	69%	0.64	38%	0.30	18%	100%	100%	100%	100%

[1]Production and transportation of fossil fuels and electricity (excludes direct emissions).

[2]Direct emissions from fossil fuels.

Table 5.23 Energy scenario results as a percentage of baseline and fairshare

Community	Variable	Unit	Baseline	E1	E2	E3
Fintry	EF	gha/cap	1.58	1.06	0.56	0.29
	Percentage of baseline	%	100%	67%	35%	18%
	Percentage of fairshare	%	88%	59%	31%	16%
Kinlochleven	EF	gha/cap	1.58	1.07	0.52	0.25
	Percentage of baseline	%	100%	68%	33%	16%
	Percentage of fairshare	%	88%	59%	29%	14%
Killin	EF	gha/cap	1.71	1.18	0.64	0.30
	Percentage of baseline	%	100%	69%	38%	18%
	Percentage of fairshare	%	95%	66%	36%	17%

5.2.4 Consolidating scenario results across final demand categories

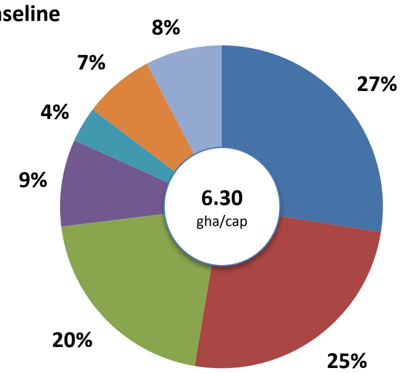
In this section the scenario results were combined across sectors and FDCs to illustrate the reduction in the total EF for each scenario (Steps 1, 2 and 3), to investigate which combinations of scenarios achieve a total EF less or equal to the fairshare and to identify which components become dominant in the EF.

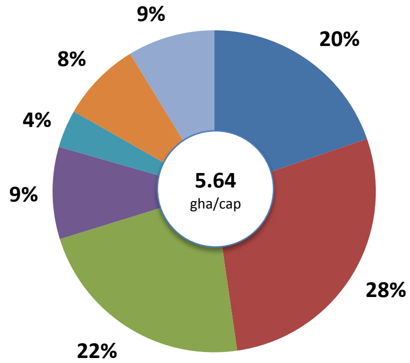
Detailed modelling was not done for consumables, private services, government and capital investment, so a reduction in the baseline EF was applied at each level (20%, 40% and 60% reductions from the baseline were applied for Step 1 – Step 3, respectively, for consumables, private services and government, and 10%, 20% and 30% reductions for Step 1 - Step 3, respectively, for capital investment). Although capital investment would be required for transformational change, the assumption was made that more sustainable forms of investment and building were undertaken, thus reducing the overall capital investment EF, but at a rate less than the other sectors. Renewable energy was incorporated within these reductions, rather than being modelled separately.

At the outset (baseline), transport and housing make the most contribution to the EF for Fintry (between 25% and 27%, respectively, of Fintry's total EF); for Kinlochleven and Killin, housing dominates (28% and 29%, respectively, of their total EFs) with food and transport both being between 20**%** and 22% (Figure 5.14, Figure 5.13, Table 5.24). In Step 1, housing and food predominant in Kinlochleven and Killin, but in Fintry, which has the highest transport EF, transport has approximately an equal share of the footprint. In Step 2, capital investment exceeds transport for Kinlochleven and Killin, but not Fintry. In Step 3, the rank order changes again with food being predominant, followed by capital investment and then housing for all three communities (Figure 5.14, Table 5.24). Only when the modelling reaches Step 3, does the EF of all three communities achieve the fairshare. Fintry's EF is still slightly over the fairshare with 1.86gha/cap. Kinlochleven has the lowest EF, in line with its lower baseline EF, with 1.69gha/cap, respectively (Figure 5.14, Table 5.24). In summary, the scenario modelling suggests that reduction in community EFs to the level of the fairshare is possible, but only with transformational change that is applied in the Step 3 scenarios.

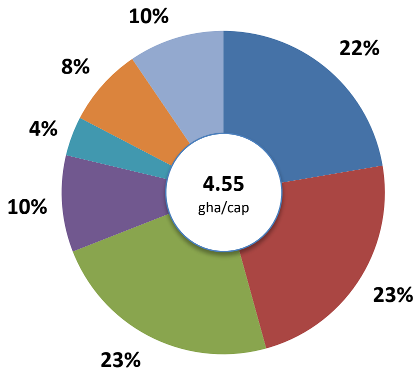
Fintry | **Kinlochleven**

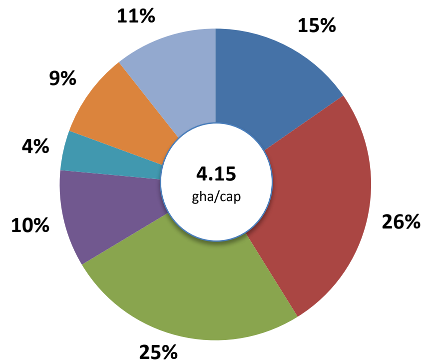
Baseline



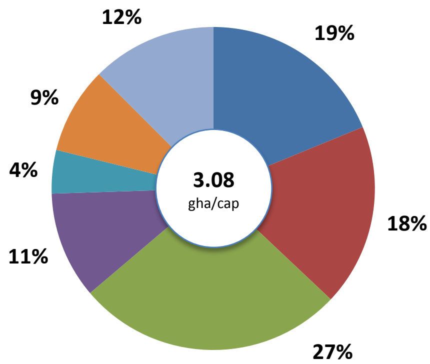


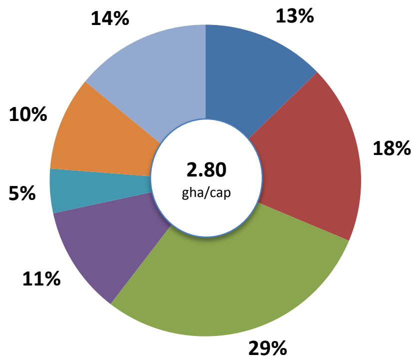
Step 1



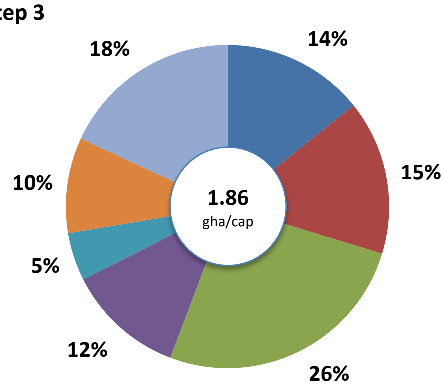


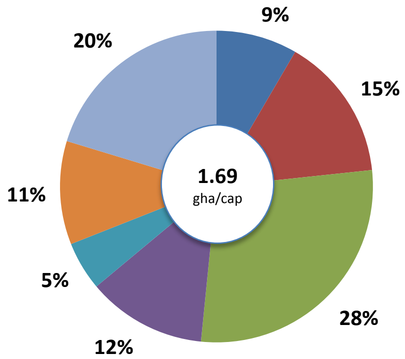
Step 2





Step 3





Killin

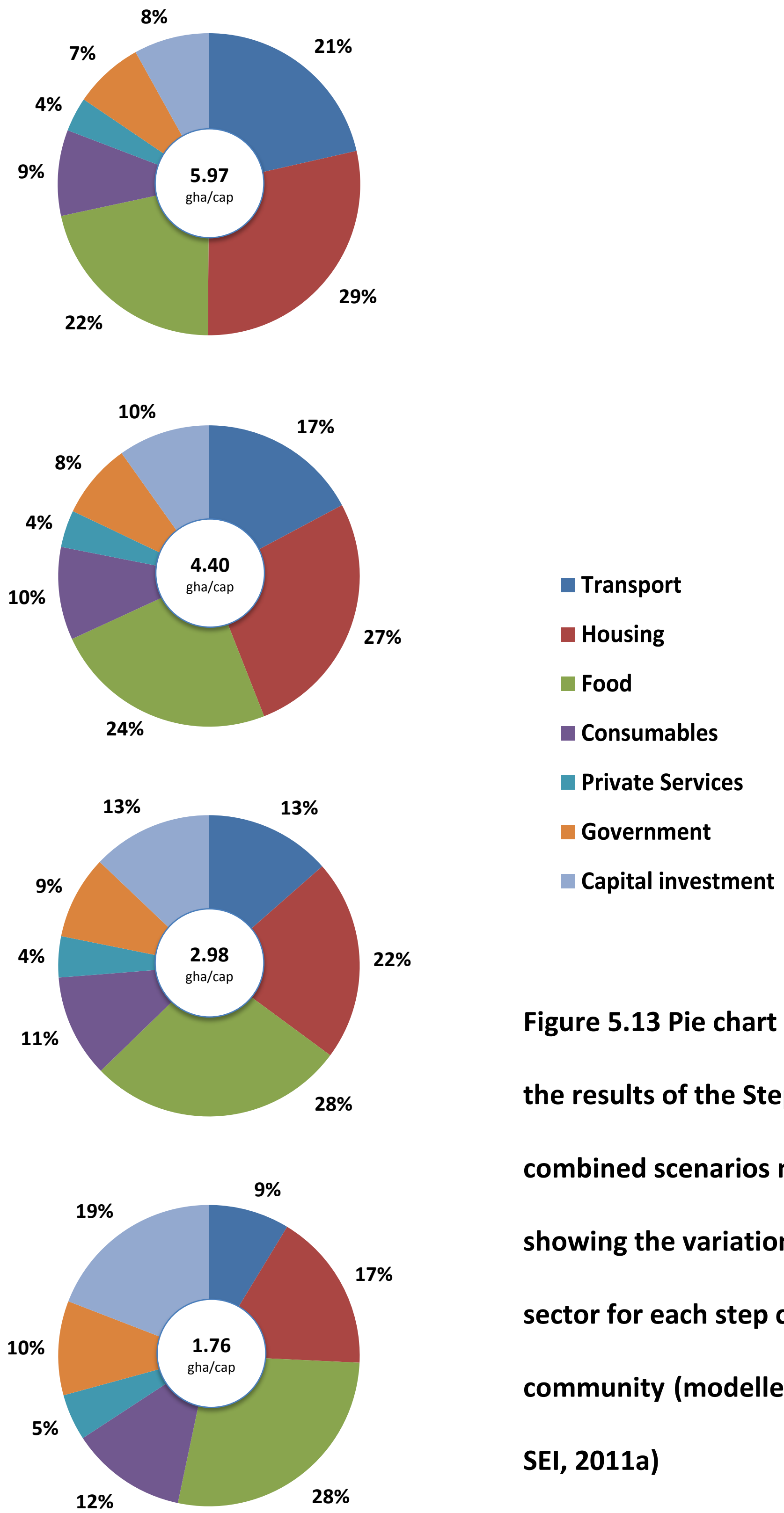


Figure 5.13 Pie chart summary of the results of the Step 1 – Step 3 combined scenarios modelling showing the variation in EF by sector for each step change for each community (modelled in REAPv2.17, SEI, 2011a)

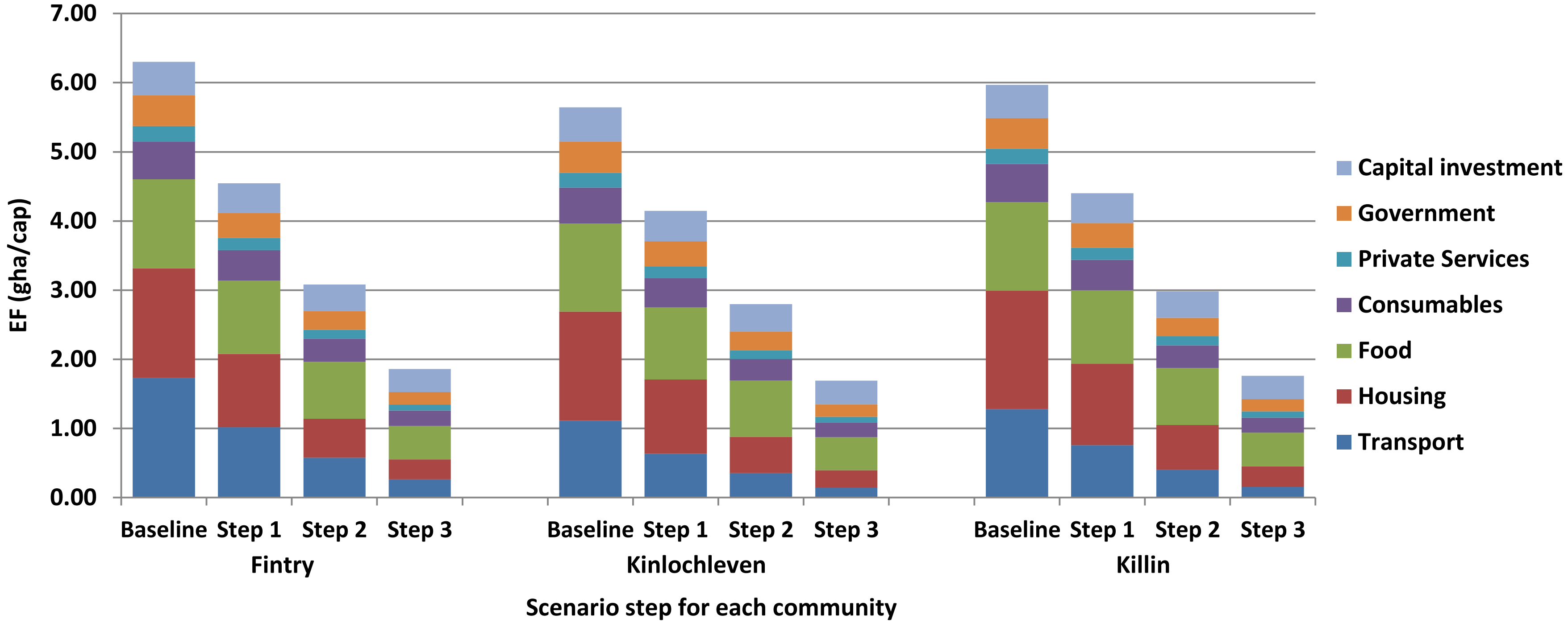


Figure 5.14 The summary EF results of the Step 1 – Step 3 combined scenarios modelling by sector for each community (modelled in REAPv2.17, SEI, 2011a)

Table 5.24 The summary EF results of the Step 1 - Step 3 combined scenarios modelling for each community (modelled in REAPv2.17, SEI, 2011a) compared to the fairshare (GFN, 2012)

	Fintry EF (gha/cap)				Kinlochleven EF (gha/cap)				Killin EF (gha/cap)			
FDC	Baseline	Step1	Step2	Step3	Baseline	Step1	Step2	Step3	Baseline	Step1	Step2	Step3
Transport[1]	**1.73**	**1.02**	**0.58**	**0.26**	**1.11**	**0.64**	**0.36**	**0.14**	**1.28**	**0.76**	**0.40**	**0.15**
Cars	1.18	0.55	0.24	0.00	0.91	0.44	0.20	0.00	0.87	0.40	0.18	0.00
Rail	0.00	0.07	0.06	0.05	0.00	0.02	0.02	0.03	0.00	0.03	0.04	0.04
Buses	0.04	0.09	0.10	0.13	0.04	0.07	0.08	0.09	0.01	0.05	0.06	0.08
Air	0.46	0.27	0.09	0.00	0.16	0.11	0.04	0.00	0.40	0.27	0.09	0.00
Ancillary	0.05	0.05	0.07	0.08	0.00	0.00	0.01	0.02	0.00	0.00	0.03	0.03
Housing	**1.58**	**1.06**	**0.56**	**0.29**	**1.58**	**1.07**	**0.52**	**0.25**	**1.71**	**1.18**	**0.64**	**0.30**
Built land[2]	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09
Repair[3]	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04
Mortgages & rent[3]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Fuel (indirect)	0.78	0.45	0.14	0.02	0.95	0.58	0.19	0.02	0.80	0.49	0.19	0.02
Fuel (direct)	0.54	0.35	0.13	0.00	0.40	0.26	0.08	0.00	0.67	0.43	0.17	0.00
Wood	0.09	0.10	0.12	0.10	0.07	0.07	0.09	0.08	0.08	0.09	0.12	0.11
Food	**1.28**	**1.06**	**0.82**	**0.49**	**1.27**	**1.05**	**0.81**	**0.48**	**1.28**	**1.06**	**0.82**	**0.49**
Food products[4]	0.98	0.82	0.64	0.36	0.98	0.82	0.64	0.36	0.98	0.82	0.64	0.36
Catering services[5]	0.30	0.24	0.18	0.12	0.29	0.23	0.17	0.12	0.30	0.24	0.18	0.12
Consumables[5]	**0.55**	**0.44**	**0.33**	**0.22**	**0.52**	**0.42**	**0.31**	**0.21**	**0.55**	**0.44**	**0.33**	**0.22**
Private Services[5]	**0.22**	**0.18**	**0.13**	**0.09**	**0.21**	**0.17**	**0.13**	**0.09**	**0.22**	**0.18**	**0.13**	**0.09**
Government[5]	**0.45**	**0.36**	**0.27**	**0.18**	**0.45**	**0.36**	**0.27**	**0.18**	**0.45**	**0.36**	**0.27**	**0.18**
Capital investment[6]	**0.48**	**0.43**	**0.38**	**0.34**	**0.49**	**0.44**	**0.39**	**0.34**	**0.48**	**0.43**	**0.38**	**0.34**
Total	**6.30**	**4.55**	**3.08**	**1.86**	**5.64**	**4.15**	**2.80**	**1.69**	**5.97**	**4.40**	**2.98**	**1.76**
Percentage of fairshare	**350%**	**253%**	**171%**	**103%**	**313%**	**230%**	**155%**	**94%**	**332%**	**245%**	**166%**	**98%**

[1]Excludes ECPR/ECCE scenarios
[2]Assumed built land constant.
[3]Reduction not modelled.
[4]Scenarios FC1-3+SCA+25%.
[5]Includes reduction of 20%, 40% and 60% from baseline for Step 1 – Step 3, respectively.
[6]Includes reduction from baseline of 10%, 20% and 30% for Step 1- Step 3, respectively.

5.3 Summary of the visions and modelling

Participants from three communities were able to explore their visions for their communities to thrive in a resource-constrained future in 2030. The common themes are highlighted in Figure 5.1-Figure 5.3 and section 5.1.4 and related to relocalisation, local food production, renewable energy self-sufficiency, co-operation, thriving small businesses, community owned assets, community spirit and less travel but better transport links. The participatory focus groups were also useful for identifying and exploring overarching issues (e.g., community spirit, governance and energy injustice) and providing further evidence for the baseline sustainability assessment.

The EF is a quantitative measure of sustainable consumption and so cannot be used to measure other, non-consumption, aspects of the SCD. Therefore, the scope of this study was practically limited to modelling the effect of different consumption on the EF and that was limited by data availability to transport, food and energy. Nevertheless, the benefit of using the EF is having an objective measure of sustainability in the fairshare. The results of the modelling have demonstrated the importance of transformational change to travel, both in terms of mode and amount of travel and the importance of low carbon technological solutions (ECPR) for sustainability. The modelling of food was more difficult and this is discussed further in the next chapter, but highlighted the importance of home-grown food for reducing the EF. Modelling the EF of 100% renewable energy for Scotland demonstrated that renewables have the potential for reducing the electricity EF by 90%. Finally, modelling changes to the built environment demonstrated the potential for significant EF reductions. To create a community EF comparable to the fairshare, the modelling suggests at least significant and some transformational lifestyle changes are required.

Chapter 6 Evaluation and creating meaning

The first part of this chapter presents a detailed evaluation of the methodology (addressing the sixth research objective). This is followed by a discussion of the options for creating sustainable communities and the overarching issues. Combined, the options and issues identified form the basis for recommendations for sustainable community development, policy and further research, which are outlined in the last section of this chapter, completing the objectives of this study.

6.1 Methodological evaluation

This section presents a detailed evaluation of each of the mixed methods and an appraisal of the overall interdisciplinary research approach and design.

6.1.1 Measuring baseline sustainability

Based on the evidence presented in this study, it will be argued that the SCD, its basket of indicators and the scorecard approach can be used to measure the sustainability of communities, bringing together normative and empirical measurements of sustainability. In the following sections the suitability of the sustainability assessment methods are considered. The use of the SCD, selection of indicators, the traffic-light scoring mechanism, design of the household questionnaire, potential errors, the use of the EF and the validity and appropriateness of the fairshare are appraised, and where appropriate recommendations are made.

6.1.1.1 Baseline sustainability data assessment

This section considers whether the questionnaire distribution and collection of data was effective and appraises the questionnaire design. Two ways of evaluating the usefulness of the design of the household questionnaire are: first, did the questionnaire provide all the data requirements for the analysis; and secondly, did the questions provide responses that were meaningful, show variation between respondents and prevent ambiguity.

The questionnaire was based on the data requirements of the first MS-Excel version of RP (SEI, 2007b, 2007c) and the data needs of measuring sustainability against an early version of the SCD. The questionnaire design was reasonably robust as the questions were based on proven discriminatory questions used in other studies (Table 3.8) and the needs of RP. However, not all the REAP FDCs had questions relating to them, as this study's questionnaire mirrored that of RP (SEI, 2007b, 2007c) rather than REAPv2.17 (SEI, 2011a). With hindsight, further questioning could have been done for certain categories, such as, expenditure on holidays abroad and eating out. However, services such as water usage and medical and education services could not be modelled, as the consumer did not have the expenditure and cost information. Further recommendations for questionnaire improvements are noted in the text below.

During the course of the research, the SCD developed and new versions of REAP and RP with modified data requirements were published. Between communities, the questionnaire underwent changes to correct minor errors, improve the quality of data collection and remove superfluous questions (those that had poor discriminatory power (e.g., Q86-100Fintry) were deleted (Figure 3.16, Appendix A.1). However, Q86-100 included the question relating to hours of voluntary work (Q92Fintry), which was deleted in error for Kinlochleven and reinstated for Killin (Q71). Ferry travel was added for Kinlochleven (Q67) and Killin (Q66), as it became an input variable in the new version of REAPv2.17 (SEI, 2011a).

Overall, the questionnaire provided sufficient data for community-specific EF calculation in REAP and sustainability assessment. Specific data gaps were filled by proxy data (e.g., the Stirling LA average replaced experimental data for Fintry ferry travel). The use of proxy data enabled both calculation of the EF and evaluation of sustainability and did not affect the classification of consumption as being unsustainable.

One of the goals for the environment and ecocentrism aspect was "ecocentric attitudes and behaviour that protect and enhance natural resources and biodiversity (locally, globally and inter-and intra-generationally)". The intention of this goal was to measure both attitudes and behaviour, as pro-environmental behaviour is not just defined by attitude, but also numerous and often conflicting determinants (Dunlap *et al*. 2000, Stern, 2000, Nordlund and Garvill, 2002, Joireman *et al*., 2003, Nordlund *et al*., 2010, Figure 2.1). Therefore, a combination of attitudinal and behavioural questions were used to assess this SCD aspect's goal (EFPS and EFBS scales (Q19, Q56-59, Q116Fintry), attitudes to climate change (Q119-121Fintry), opinion on whether activities are detrimental for future generations (Q117-118Fintry) and the extent of organic food consumption (Q63-65Fintry)). The climate change questions, which had been designed for a climate change survey prior to this study (Spence, 2008), were of low power because they did not show sensitivity to differences in attitude significantly (Figure 4.15). Q119Fintry was corrected for Kinlochleven and Killin, because the Fintry questionnaire was missing the response "yes I think the climate is changing and humans are responsible". Questions relating to personal commitment would be needed to further investigate differences in attitude. This was done in part by the question, "Do you agree or disagree that you personally need to change your way of life over the next few years, so that future generations can continue to enjoy a good quality of life and environment?"

The results were sufficient to assess the sustainability of this aspect, but not causality of the behaviour or degree of ecocentrism (Figure 2.1). Given the gap between behaviour (EFPS and EFBS) and this understanding of climate change, additional environmental attitude questions to determine degrees of anthropocentrism or ecocentrism (e.g., NEP, Dunlap *et al.*, 2000) could have been included. However, given the 'value-action gap' (Figure 2.1, Stern, 2000, Nordlund and Garvill, 2002, Joireman *et al*., 2003, Nordlund *et al*., 2010), additional questions would need to be combined with more detailed assessment of the causes of environmentally unfriendly behaviour and the understanding of the links between behaviour and its impact on the planet (e.g., using participatory focus groups) to identify interventions to facilitate pro-environmental behaviour.

The number of hours of voluntary effort (Q92Fintry) and involvement in community activities is useful for providing evidence for social capital and should, together with questions to investigate type of voluntary or community activity, be included in future questionnaires. In future, tick-box or "yes/no" questions (e.g., Q22Fintry) require a "none of these" option to ensure that the respondent made a response, rather than leaving the question blank. For Q22Fintry, the results for "hydro" may be an over-estimate, as some respondents were confused by the name of their electricity provider being "Scottish Hydro", and no distinction between biomass primary heating systems and secondary heating by stoves was made.

Secondary data and observation were used to provide additional evidence for the sustainability assessment to support experimental data (for example, the SIMD (Scottish Government, 2010b) provided information on crime rates and SNS (2012) on health, supporting observational data in Kinlochleven) and the presence of relevant community enterprises was used as evidence for scoring taking action to reduce consumption, which is a goal of the SCD aspect sustainable consumption.

The SCD goals that were not measured related to the sustainability of businesses, space and opportunity for spiritual growth and respect and encouragement of diversity. For the former, this was because satisfactory analysis would have required an in-depth study of the individual businesses and their practices within each community. This is beyond the scope of this study of household and personal behaviour choices. Nevertheless, businesses and the economy, and spiritual growth and diversity, are integral to sustainable communities, as defined in the SCD, and analysis of these goals should form part of further research agendas. The latter would provide evidence for the role of McIntosh's (2001) triune in the context of the SCD.

From the response analysis (section 3.3.4), it is possible to conclude that the number of responses to Fintry's questionnaire was exceptionally good. For the reasons described in Chapter Three, the response rates in Killin and Kinlochleven were less satisfactory, but not unsatisfactory (Gillham, 2000), suggesting the results are likely to be a reasonable representation of the current state of the sustainability of the three rural communities studied. If this questionnaire is repeated in subsequent studies, the use of local researchers and an action research approach to collect survey data may benefit the response analysis by encouraging survey completion.

Demographic analysis of the quantitative questions in Chapter Three demonstrated variation in responses and that there was bias where the 16-64m demographic group was under-represented. Although weighting of quantitative data in the analysis compensates for this bias, it is unlikely to have made a material difference to the overall assessment of the EF (Figure 4.28 illustrates the impact of weighting on the EF). Detailed evaluation of the EF and its assessment are presented in the next two sections.

Overall it is possible to conclude that the household questionnaire design (with the exception of the climate change questions, which should be redesigned in future questionnaires) was effective in that, together with secondary data, it provided sufficient information to assess the sustainability of the case study communities, showed variation between respondents and prevented ambiguity.

6.1.1.2 Detailed EF error evaluation

The accuracy of the EF calculation is affected by the quality of the data collected, the assumptions used in this study and the assumptions and data used in the REAP application. Although data was not collected for all FDC categories, the use of REAP's LA data enabled a total EF to be calculated for the communities to allow comparison with the fairshare. This section contains a detailed discussion of possible data analysis errors and considers the accuracy of experimental data arising from the questionnaire design, errors due to assumptions made on data consolidation into REAP consumption categories and errors arising from the MIOT design of REAP.

6.1.1.2.1 Transport

In the questionnaires, there was no specific request to separate business mileage from personal car travel in the car travel question. Although an improvement in future would be to make this distinction clear in the instructions, the assumption was made that respondents did not include business travel in their personal annual car mileage. This may have caused the distance travelled by car, aeroplane and public transport to be an over-estimate for those in employment, in effect double counting if these distances travelled are incorporated within the EF of production of goods and services.

Car occupancy was calculated by dividing the number of adult passengers reported to be in the car by five. This assumes most cars have five seats, but many have more or less. The questionnaire asked for respondents to state their average car occupancy, but to exclude children in their estimation. However, EF calculations assume the inclusion of all children despite their age. Therefore, the occupancy for the case studies is an under-estimate, and, in the specific cases where children have been excluded, the transport EF will be an over-estimate. This impact may not be as great as might be expected as transport to and from school in Fintry and Killin is provided by Stirling Council for journeys over two miles. In all three communities, the primary school is within walking distance from the village centre and for Kinlochleven, so is the High School. Only after-school, at weekends and during holiday time, is the occupancy likely to be an under-estimate and only for those respondents with families. The car occupancy in all three communities was found to be less than the LA average (Appendix B.1). Fintry, Kinlochleven and Killin's car occupancies were 25%, 26% and 25% weighted respectively. These compare with a LA average of 32% (SEI, 2011a). If the LA car occupancy average value is used in place of the experimental value for Fintry, then the transport EF reduces by 10% (0.14gha/cap to 1.33gha/cap). Offsetting this is the likely underestimate of the EF for car purchases as the LA values for the average cost of car purchases, which were provided in REAP, were used. Given the substantially higher distance travelled by car in the case studies compared to the average for the LAs (distance travelled by car was 81%, 41% and 30% higher than the LA average for Fintry, Kinlochleven and Killin respectively, Appendix B.1), the expenditure on cars is likely to be proportionally higher. This is even if cheaper cars compared to average are bought in the communities of Killin and Kinlochleven, where educational achievement and average incomes are lower compared to Fintry (Scottish Government, 2010b).

Moreover, distances travelled by public transport (bus, train and ferry) were requested as, “In a typical week, how far do you travel by…”. This may have led to an under-estimate of these three modes of transport as atypical long distance journeys may have been discounted. Associated with the lack of measurement of children’s travel, is the fact that bus usage is likely to be an under-estimate, as school travel has not been included in the analysis. This under-estimate is greatest for Killin, as teenagers in Killin travel over 50 miles a day to the High School in Callander.

In summary, the data limitations may have caused errors in the region of 10-20%, but many of the errors cancel each other out and do not materially affect the result that the baseline transport EF is unsustainable and significant reductions (in the order of 70% or more) are required to reduce the EF to a level which is sustainable (equating to less than 20% of the fairshare). The purpose of this research is not a highly accurate EF, but accuracy only to a level which provides sufficient indication whether the mode and need of travel and distance travelled is sustainable. In the future when the transport EF is closer to the fairshare, accuracy is likely to be more important and detailed travel analysis of mode of transport, purpose of travel (personal or business) and car occupancy for both regular and infrequent (e.g., holidays) may be required. Children’s travel would also need to be analysed separately. Moreover, the EF of production and maintenance of electric cars were assumed to be the same as conventional cars. Evaluation of this assumption is recommended if used in further research, as is an investigation of the potential of low emission community and public transport and hydrogen powered vehicles. Participatory focus groups and structured interviews would be useful for investigating both barriers to and opportunities for using, and developing plans to increase the use of, public, community and shared transport. This would aid the more detailed development of options for transport.

6.1.1.2.2 Food

Due to a change in the data requirements in REAP, food data was collected only in terms of the number of meat or fish meals per week with the aim of converting this into mass consumed (based on the method used by RP v0.91, SEI, 2007c). However, the functionality to model the EF using units of mass was removed in REAPv2.17 and replaced with expenditure units, preventing estimating community-specific food EFs within REAP. Expenditure by food type would have been difficult to obtain without asking respondents to keep a detailed shopping diary, which was not done. Even if a diary approach had been used, the scenario modelling function would have provided only estimates, as the REAP consumption categories group together foods with very different production methods and place. For example, fruit and vegetables include both fresh and processed fruit and vegetables and can range from potatoes grown in Scotland to canned lentils grown in Turkey. Given this diversity in the EF of production, any scenario modelling with this method is likely to be imprecise and makes calculating community-specific food EFs within REAPv2.17 inadvisable. Community-specific food EF calculation would require component-based EF calculation (Chapter Two, Wackernagel and Rees, 1996, Monfreda *et al.*, 2004, Wiedmann *et al.*, 2006), which is beyond the scope of this research**.**

The questionnaires collected data on organic food consumption. Whilst this is an indicator of environmental attitudes and behaviour (as organic production methods have a positive impact on biodiversity, Fuller *et al.*, 2005, Hole *et al.* 2005), the effect of organic versus conventional food production on the EF is unclear and was excluded in REAPv2.17 (Frey and Barrett, 2007, SEI, 2011a); the first version of REAP had the functionality to model organic production.

The error in the baseline food EF is very unlikely to be so high as to invalidate the assertion that the food EF is unsustainable on comparison with the fairshare. However, the size of the errors in modelling the scales of change for scenarios FDP1-FDP3 and FC1-FC3 is uncertain. Nevertheless, even with this weakness, the results do suggest that a total switch to domestic production for all food types or a switch to an entirely vegan diet are unlikely to achieve sustainability without alternative food production methods (such as sustainable community agriculture practices). Further research into the EF and biodiversity impacts of specific food production choices, including a comparison of both the EF of domestic and industrial preparation and the EF of food stuffs domestically produced and those produced overseas (where the transportation of the food stuffs is off-set by a lower EF of production), is required to understand the sustainable production method for each food type to enable informed decision-making on behalf of consumers and policy-makers.

6.1.1.2.3 Energy

Collecting data with different temporal (monthly or yearly) and unit scales (household or individual) could have given opportunity for confusion and erroneous responses, but this was discounted as no obvious errors were found in the data, questions were grouped (e.g., household expenditure was in the first half and individual in the second half, see text separating Q55-Q56Fintry) and clear headings stating explicitly the required response was used (e.g., Q78-Q81Fintry and Q82-85Fintry).

Peat consumption for fuel was included in the questionnaire as it makes a contribution to the housing EF, although peat is not included as a consumption category in REAPv2.17 scenario modelling (SEI, 2011a). A total of six respondents noted that peat was used as a fuel in their household. Two of these did not specify quantities used. Of the remaining four, two respondents stated they spent £12 and £8 per year on peat and another two stated they burnt 20kg and 10kg per year. These quantities are relatively small once taken as a community average. As there are no guidelines on the calorific values of peat and the actual calorific value is likely to be variable dependent on the source of extraction and the modest amount consumed, the consumption of peat for heating fuel was excluded from the baseline sustainability assessment and associated modelling. Therefore, the baseline housing EF may be a slight under-estimate as a result, but the addition of peat consumption is most unlikely to make a significant difference to the total housing EF.

The EF analysis of domestic renewable fuel use was hampered by the inability to model the EF of the communities' wood fuel consumption in REAP. The EF varies widely according to site of production and type of wood product consumed. For example, willow short rotation coppice has a yield three times that of traditional forestry (Biomass, 2012), from which wood fuel is more often a by-product rather than the object of the forest management (the main object being sawn timber).

The estimates of wood fuel yields used to estimate the wood fuel EF are average figures and may differ to the actual productivity in the areas of the case study communities. Moreover, with lack of information on the relative values for the gha to ha conversion, the estimates for the wood fuel EF are less robust. Nevertheless, wood fuel yield from a small woodland in Stirlingshire is between one and five tonnes/ha/annum (*pers. obs.*), which is comparative to Biomass's (2012) estimate of 2.9 tonnes/ha/annum.

In rural areas, communities may have unmanaged woodlands or large gardens, which provide wood fuel. Some gardens, which are accounted for as built land, may be providing wood fuel and so, in these instances, for accounting purposes, there should be a re-allocation of land in the EF accounts, if wood can be sourced from land counted as built land. This has not been done in the calculation of the EF in this research and so may represent an over-estimate of the EF.

Respondents had a choice of units for specifying quantities of household energy consumption (Q8-Q13). Specifying consumption in prices for LPG, electricity and oil was almost universally preferred, but prices varied over the timeframe of data collection (Figure 6.1). Adjustments for price fluctuations were incorporated into the calculation of calorific amounts of consumption (Appendix A.4). However, the price fluctuation for heating oils was significant and highly variable within in short time periods (Figure 6.1), making the likelihood of respondents paying different prices and an overall estimate of the average amount of oil consumed per capita (based on one price for the whole sample) difficult. UK average oil prices were used, so the amount of oil consumed may be an over–estimate, because the price paid in remote areas such as Killin and Kinlochleven is likely to be higher than the UK average due to the additional delivery cost to remote areas. However, analysis of the few responses where respondents have quoted both price and volume for oil, the prices used were generally similar (for Fintry, the price used (41.0p/l, DECC, 2011b) was within 8% of that quoted by a respondent, for Kinlochleven the price was the same and for Killin, there was a

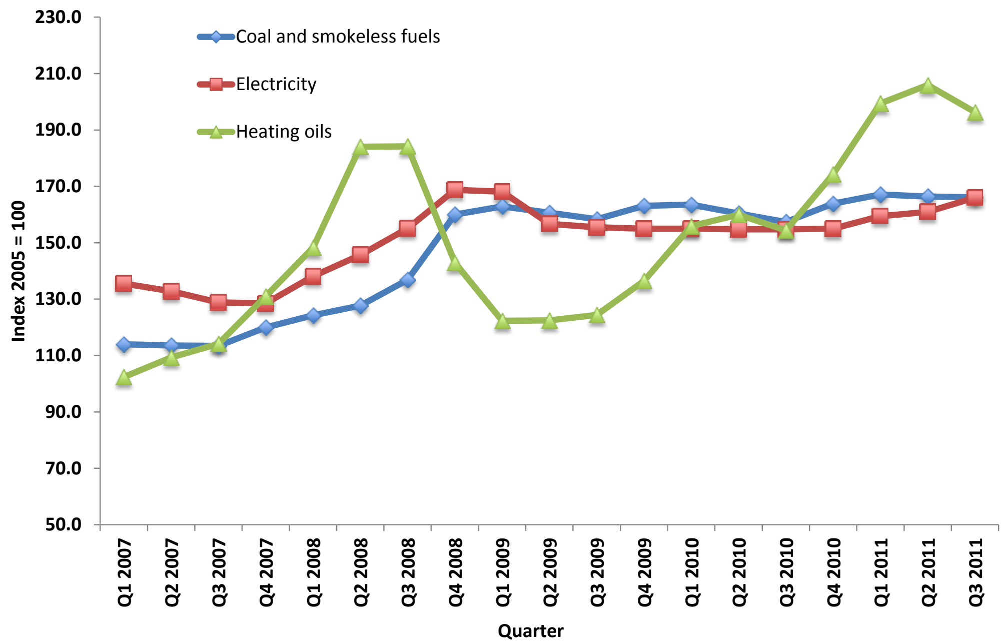


Figure 6.1: Fuel price indices from Q1 2007 to Q3 2011. The Retail Prices Index (RPI) excludes LPG, so LPG is not shown (DECC, 2011a)

greater difference (24%) but the one response was a rough estimate with questionable accuracy). Moreover, respondents' errors in their own estimates of fuel consumption have not been investigated, but a 10% error or more could be possible.

A 10% increase in price per unit of 10% for electricity created a 5% reduction in Fintry's housing EF (reduced by 0.07gha/cap) and a 1% change in the total EF. A 20% price increase created a 9% reduction in the housing EF (0.14gha/cap). When oil, LPG and electricity prices were all increased by 10%, then Fintry's housing EF reduced by 0.11gha/cap (7% reduction in housing EF; 2% in total EF). When prices for all three fuels were increased by 20%, Fintry's housing EF was reduced by 13% (0.21gha/cap) and Fintry's total EF by 4%. All of these price fluctuations were insufficient to change the scoring for the housing EF from being unsustainable.

Whilst the electricity price did not vary as much as heating oil (Figure 6.1), electricity tariffs vary greatly depending on (a) the supplier and (b) the type of payment plan selected (for example, there are great variations between pre-paid meter, direct debit, on-line or economy 7 and when consumers choose to have a standing charge) and the amount of electricity consumed (tariff varies with consumption). For example, in November 2010, Scottish and Southern's direct debit with no standing charge tariff was 15.70p/kWh for the first 364kWh in a quarter, and then 11.64p/kWh thereafter (Scottish and Southern, 2010) and Scottish Power's domestic tariff was for 16.32p/kWh for the first 225kWh and 11.20p/kWh thereafter (Scottish Power, 2010). Typically, pre-paid meters are more expensive than a direct debit tariff. The respondents were asked neither for the name of their utility provider nor to which tariff they subscribed, so a single tariff was selected for the purposes of this study. Therefore, the actual consumption by respondents on tariffs other than the one that was used would create a slightly lower or higher EF than that portrayed in the results. For those respondents on pre-paid meters, the electricity EF would be significantly higher than in practice. Due to the multiple tariffs and providers and fluctuations in prices over time and regional price variations, in future, the questionnaire would be better designed to collect actual (kWh) figures instead of price data, or collect price data and the specific tariff and provider to which the consumer subscribes. In retrospect, respondents could have been requested to input the physical amounts consumed only; this would have led to less people responding to the question, but more accurate answers.

If household income data had been collected, estimates of fuel poverty could have been made. However, income data was excluded as many people find this question intrusive.

In terms of assessing sustainability, an EF reduction of at least 60% is required to achieve sustainability, and a reduction of approximately 30% would be reasonable for the "amber" score. Although there may be a 20% error in estimation of consumption, these results suggest that the impact on the housing EF by errors in price estimation was not significant enough to change the level of sustainability for each community.

6.1.1.2.4 Consumables and private services

The accuracy of the questionnaire data collected for all the measured consumables' FDCs and the private services' FDC "*Recreational and cultural services*" may be weaker than other questionnaire data collected for EF calculations. There were some significant differences between LA EF values (from REAP, SEI, 2011a) and community EF values (calculated in REAP from primary questionnaire data, Appendix B.1). For example, for Fintry, Kinlochleven and Killin, the clothing EF was 40%, 24% and 22% that of the LA average, respectively, and the tools EF was 264%, 132% and 197% that of the LA average, respectively. The majority of consumables FDC EFs were much less than the LA average. Although rural residents may well spend much less than their urban counterparts (as they have less access to retail outlets for material goods), participants may have under-estimated their expenditure, either because they wish to remain modest, have forgotten and/or not kept a tally of expenditure. Asking for monthly expenditure rather than annual (as was done for cigarettes and tobacco, cultural activities, sporting events, betting and the lottery, toiletries and personal care, and newspapers, books and stationery) may improve accuracy, but risks seasonal or atypical purchases being missed. In future, questions relating to the number and type of items purchased over a set period, together with total expenditure would help rectify this. However, significant numbers of additional questions could risk reducing response rates.

The question for eating out (estimating catering services QFintry66, RP v0.91, SEI, 2007c) was weak as it did not collect expenditure data nor type of food consumed. Therefore, LA average figures were used for catering services, but this may be an overestimate as the opportunities for eating out are less than in urban areas. Moreover, REAP uses the consolidated FDC “catering services” (SEI, 2011a), so REAP’s estimation of the EF is likely to be error-prone due to the heterogeneous nature and production of foods and beverages consumed within catering services (Wiedmann *et al.*, 2008).

The EF for consumables and private services is likely to represent the minimum EF and the true value is likely to lie between the experimental and LA values. The minimum value is still unsustainable, as the consumables EF represents 25%, and, combined with private services, 35% of the fairshare.

6.1.1.2.5 Limitations of monetary input-output tables (MIOTs) and impact of EF experimental errors

REAPv2.17 uses monetary input values for food and consumables scenarios for populating the MIOT (except for energy which uses calorific values, SEI, 2011a). This is works well for allocating goods consumed across consumption categories only if prices are constant or move steadily with inflation, but in the British economy that is not always the case. Fortunately, price volatility for energy consumption did not affect the modelling in REAP as input variables had the units of kWh/cap/annum. Price changes in consumables or private services may affect the accuracy of the EF results, if they have changed from the 2006 price value (REAP assumes a 2006 price, Dawkins *et al.*, 2010). No adjustment for inflation was made to values input in price units. This represents an inherent weakness for valuing goods in monetary terms (Klauer, 2000, Moffatt, 2005).

Whilst there are likely to be significant errors (greater than 50% in some FDC's EF estimation for each community), the aggregated FDCs are likely to be more accurate (Wiedmann *et al*., 2008). With regard to errors in the EF calculation in this assessment many of the errors identified in this and previous sections are likely to cancel each other out, leading to a reasonable approximation of the EF. It is possible to conclude that any bias or error in the data is unlikely to have made a material difference to the assessment of sustainability, namely whether the community on any aspect was scored red, amber or green. Also, with the large difference between the experimental EF results and the fairshare, it is possible to have a high degree of confidence in the accuracy of the assessment of whether a community is sustainable, moving towards sustainability or unsustainable. In future, consumption is likely to decrease, leading to the EF being much smaller and closer to the fairshare, so that errors in the calculation of the EF would be likely to affect the results adversely, which would necessitate better accuracy for discriminatory results.

6.1.1.3 The fairshare's suitability as a gauge

The fairshare is a normative concept, which has been applied in this study to gauge the sustainability of consumption obtained by empirical measures, but its use has issues, relating to equity and validity (Moffatt, 2000, Moffatt *et al.,* 2001). First, using a per capita measure of planetary biocapacity risks confusing equity with equality (Moffatt, 2005). For a just society, not all resources need to be distributed equally (Sen, 2010). In this study, an average figure was used to calculate a per capita EF for the whole community, so within each community diversity of EF was permitted, but overall if the community was sustainable the average would need to be comparable to the fairshare. When aiming for a sustainable EF for the whole of Scotland, it might be reasonable to assume that rural communities could have, for example, a transport EF slightly higher than their urban counterparts, but this would imply that urban dwellers consume less than the fairshare to compensate. To create a just future, community participation in debates regarding distribution of resource consumption impacts may be needed to facilitate just outcomes.

The second issue with the fairshare is whether the selection of the fairshare as a measure of sustainability today can be argued to be valid. For this study it represents a level of resource use which is in line with planetary capability today. Moreover, the scale of the reduction in resource use required (approximately 75% for rural communities) is in line with the reduction in GHG emissions set as a target by the Scottish Government (Scottish Parliament, 2009, Scottish Government, 2013a). However, the weakness of using the fairshare is that as population increases, biocapacity decreases. Repetition of this study in the future using the future's actual (and most likely substantially reduced) biocapacity as a fairshare would mean that the target for sustainable living at the time in the future would be much more difficult to achieve. Therefore, it may be useful to borrow the idea of reference years from climate change targets and have the fairshare as an index with reference years used to ensure the goal-posts do not move with time (Scottish Parliament, 2009). Therefore, a recommendation is to use the 2008 biocapacity as a reference year for the fairshare in repeat studies. For this study, the advantage of using the fairshare is that it permitted investigation of whether Scottish society is living, or in the future could live, sustainably.

6.1.1.4 The SCD scorecard approach and framework

This section considers whether the SCD scorecard approach is a valid tool for measuring sustainable communities. A review of the literature and existing indicators led to the conclusion that no single indicator could achieve a holistic sustainability assessment of a community (Section 3.3.1), so a basket of indicators was used with the SCD scorecard assessment. This early conclusion was further justified and illustrated by the diversity in sustainability across different aspects of community (intra-community): for example, Fintry had the highest (most sustainable) traffic-light SCD score (Figure 4.28), but had the least sustainable (highest) EF (Figure 4.2). A single indicator, such as the EF, which measures only certain aspects of sustainability (Wackernagel *et al.*, 2005, Moffatt, 2005), is insufficient to measure community sustainability.

The traffic light scorecard mechanism has been demonstrated in this study to be an effective way of comparing multi-dimensional and non-commensurate normative aspects of community capability (i.e. in terms of sustainability). Most importantly, the comparison of the three communities highlight that the SCD and sustainability scorecards are sensitive to differences in levels of sustainability between not only different communities but also different aspects of communities. The SCD was helpful in teasing out and visually illustrating what is sustainable and what is not, helping to explain why communities, such as Fintry, are sustainable in some aspects but not all.

In its current format the SCD scorecard approach is best suited to smaller rural communities as the results (use of averages) might struggle to capture the diversity of issues and range of sustainability in large and highly heterogeneous and dynamic communities, for example, within an urban setting. In addition, the use of a scorecard approach may not be without some bias, as aspects of the research have been participatory and the researcher's judgement has been used to score normative aspects of sustainability to one of three possible levels (red, amber, green). A recommendation for future use of the SCD approach would be to review the classification of these scores. Interrogation of the results with the communities themselves (i.e. stakeholders, Table 3.2, Holling, 1998, Potschin and Haines-Young, 2006, Harvey, 2006b) would be mechanisms to validate the scoring and this is a recommendation of this study. The latter would require participatory engagement and could provide opportunities to develop sustainability literacy and integrate sustainability with the communities' existing community development plans and processes.

Comparing the SCD measurement approach with DEFRA's (2010) progress on sustainable development, the latter may be criticised for measurement of progress with reference to the past without actually creating a vision of the future. Without a clear vision of the future, identification of actions and prioritisation of tasks is difficult and risks inappropriate or unsuccessful outcomes (Stout, 1999, Anderson, 2001, OST, 2002, Dutton *et al.,* 2005, Ledwith, 2005, Hopkins, 2006, 2008, Roxburgh and Tuffs, 2006, Kemp *et al.* 2007). Clear vision and targets need to be set, (e.g., to reduce our EF to our fair share of biocapacity, to reduce our carbon emissions (Scottish Parliament, 2009) to a point where carbon is assimilated rather than emitted), otherwise society is a rudderless ship and may be busy with self-congratulation on making progress but in reality is only taking one small step, which makes little impact on the extent of their long journey to sustainability.

Therefore, it is possible to conclude that the approach used in this study makes a robust attempt at being able to assess holistically sustainability against a wide range of dimensions. The evidence of the SCD's validity comes from its ability to tease out differences in sustainability between and within different aspects of community (inter- and intra-dimensions of sustainable communities). Also, the original SCD design was drawn from a multitude of sources and sound principles of community design and development (Holmgren, 2002, Durney and Desai, 2004, Egan, 2004, Didham, 2007, McIntosh, 2008, BioRegional, 2013, OPL, n.d.) Therefore, it is possible to conclude that the SCD is a valid representation of a sustainable community.

6.1.2 Focus group design

The focus groups suffered from representing only a small proportion of the community (Fintry and Killin 2% and Kinlochleven 4%). This is the difficulty with focus groups for participatory research as opposed to focus groups for community development (e.g., the KAT action plan workshop and AGM had approximately 100 attendees, April 2012, *pers. obs.*). With such small samples bias is likely towards people who are more altruistic and concerned about sustainability. In Killin, specialist groups were targeted rather than open meetings to help address this. The Killin WRI focus group achieved participation from people who were unlikely to have participated in an open forum. The results were validated by using a follow-up questionnaire with 18 respondents in Kinlochleven and 47 in Killin.

A limitation of the envisioning focus groups was the participants' level of sustainability literacy, climate change awareness and knowledge of appropriate and possible technological innovations. It is unrealistic to expect someone to recommend transformative and technologically innovative solutions without understanding the problem and options for change (note the TTM emphasises education, in the transition process, Hopkins, 2008). Nevertheless, the focus groups achieved the research aim of creating visions for each community and provided useful background and input for the baseline sustainability assessment and issue analysis. In future, the study would benefit from using an approach combining sustainability literacy with envisioning focus groups.

6.1.3 Modelling design

The advantage of using the EF for the modelling was that it does not just investigate GHG emission potential (the reduction of which is the goal of climate change policy, Scottish Parliament, 2009) or fossil fuel dependence (the reduction of which is the goal of the TTM, Hopkins, 2008), but also measures ecological sustainability using the fairshare as a gauge. However, the modelling was limited in using the EF in that it only measures the sustainability of some aspects of consumption (pollution and biodiversity impacts are omitted, Wackernagel *et al.*, 2005, Moffatt, 2005) and does not measure the non-consumption aspects of the SCD. Therefore, the modelling was limited to only that of the ecological sustainability of consumption (measured by the EF) and not the wider aspects of sustainable communities (such as impact on employment, health and social capital) and so did not permit changes to land use, economy (e.g., impact of increased local production and consumption, a key part of the visions, on the economy), retrofitting housing (i.e. specific measures such as double glazing), poverty alleviation, and normative aspects such as social capital.

The use of narratives enabled investigation of the EF of specific scenarios, framed different levels of change and allowed better interpretation than a linear model. The disadvantage of using narratives is that some of the choices made for the variables are highly subjective depending on the narrative used. The advantage is that the interpretation of the results is clear because the input variables are based on a defined scenario. The narratives can be changed, with new input values, to reflect changing ideas, so should not be seen as static, and have been used in this research as a means of framing multiple complexities in a human-centred discourse. The intention is to create something more real, at the risk of making it less objective (Holling, 1998, Potschin and Haines-Young, 2006).

A weakness in the REAP modelling was the inability to change methods of production and investigate EF changes when consumers choose more environmentally friendly products (e.g., recycled paper and organic rather than conventionally produced food). Percentage reductions in input values, rather than absolute values, were used in the scenarios to model changes from current consumption, as consumption is unlikely to be equal across each community. Nevertheless, the modelling did provide sufficient insight to investigate the sustainability of transport, energy and food options.

Limiting the modelling to food, energy and transport (which was a result of data availability) restricted the extent of the investigation of the sustainability of future options. However, given the interconnectedness of the SCD aspects, the modelling permitted identification of options that benefitted other aspects (e.g., some transportation ideas require building social capital in implementing co-operative solutions). Modelling of the sustainability of non-consumption aspects, together with an action research approach to measuring the holistic impact on implementation of the options, could form the basis of future research.

6.1.3.1 Renewable electricity generation modelling

This modelling was done to test Alderson *et al.*'s (2012) EF estimates for electricity generated by renewable energy as opposed to the current electricity generation mix. As the input variables (production side of the economy) were only available for the whole economy, Scotland was used as the basis for modelling electricity generation, rather than the community case studies. Fossil fuel based electricity generation is accounted for entirely in the fossil fuel land category (Table 5.21). This corresponds to the GFN accounting methodology (Kitzes *et al.*, 2008). Switching Scotland to 100% renewable electricity reduced the total EF of consumption by 14%, regardless of the type of renewable energy (hydroelectricity, biomass or wind, which have different land requirements for electricity generation) used to replace the fossil fuel and nuclear forms of electricity generation. Moreover, REAP does not have the accounts for tidal, wave and offshore wind methods of electricity generation, so the impact on the EF for generating electricity from these methods could not be modelled. Taking this into consideration, the accuracy of the REAP estimates of renewable electricity generation is uncertain. Further work is required to investigate the effects of differing renewables generation methods on the EF. This is beyond the scope of this research as the intention of investigating the effect of switching to 100% renewable electricity generation was to understand the scale of reduction in the footprint electricity generation. Nevertheless, modelling the effect of switching to 100% renewables on the EF can still be used to give a general impression of the scale of EF reduction. In this study, the EF of the electricity FDC was found to be 12% of baseline when the electricity was generated by 100% renewables in place of the baseline conventional electricity generation. This is comparable to the assertion made by Alderson *et al.* (2012) that renewable electricity generation has an EF of approximately 10% of that of conventional electricity generation. This is important for this study as this assumption was used to model the impact of using electricity generated by renewables in calculating the transport EF of electric cars (ECPR scenarios).

Despite the weaknesses in modelling changes to electricity production methods, the results have been included to illustrate the following points; namely that (a) converting to 100% renewable electricity generation is very unlikely to be sufficient to create sustainability on its own, (b) the results support the assumption that electricity generated by 100% renewables is 10% of the current generation method, and (c) more detailed research into the effect of different types of renewable energy generation on the EF is required. The latter will require detailed life cycle analysis and incorporation in the national footprint accounts.

6.1.4 The interdisciplinary approach and mixed method research design

In this study, the strong sustainability (Pearce, 1989, Daly, 1995, Neumayer, 2003, Daly and Farley, 2004) concept of Baker's (2006) *"ideal model"* of sustainable development has been used as a critical theory of society, because, at this level underlying truths of society are revealed. This has been demonstrated in this study in the identification of issues of energy injustice and local government (sections 4.11 and 6.2.2). The SCD formed the basis for the measurement and modelling of sustainability as well as the envisioning focus groups. The mixed methods used in this study are based on the underlying principles of sustainable development (Moffatt, 1996b) and sustainable consumption (Jackson, 2009) and incorporate models of pro-environmental behaviour (Stern, 2000, Nordlund and Garvill, 2002, Joireman *et al*., 2003, Nordlund *et al*., 2010), justice (Bulkeley and Fuller, 2011, 2012, McCauley *et al*., 2013) and community development (Ledwith, 2005, Roxburgh and Tuffs, 2006). Although profligate sustainable consumption is a central factor of unsustainability and was a significant aspect of this research (assessed by analysing EFs and purchasing behaviour), the study of consumption alone is insufficient to investigate the holistic nature of sustainable communities, as has been demonstrated in this study (see section 6.1.1.4). Also, the existing models of sustainable communities (presented in 2.1.3), the definition of sustainable development in its original form (WCED, 1987) and Baker's "*Ladder*" (2006) are insufficient to analyse the full complexity of the factors that lead to unsustainable communities, as concepts of justice, power to act (community development) and energy to fuel life need to be incorporated. By using mixed methods and participatory approaches, this study challenges the reductionist approach to science and knowledge acquisition, which is a characteristic of industrial cultures, as opposed to sustainable cultures. As holistic thinking is an underlying philosophy of sustainable cultures (Table 2.2, Holmgren, 2002), the aim was to create a holistic understanding of rural communities that, combined with models of narrative visions, could illustrate today's challenges and options for sustainable futures. Dependencies, narratives, desires, stakeholders, temporal and spatial scales, actors, structures and institutions are all relevant in determining and creating futures. The participatory nature and reflexive approach has enabled the broad and exploratory research approach (Holling, 1998, O'Riordan, 2000, Potschin and Haines-Young, 2006, Harvey, 2006b) to evolve and adapt to new issues (e.g., energy injustice, aspiration) discovered during the study. The risk of this approach is that the answers are incomplete and unrepeatable (Table 3.2) and the risk of incompleteness is magnified by the absence of stakeholder review of the results and conclusions (a feature of integrative methods, Table 3.2, Holling, 1998, Potschin and Haines-Young, 2006, Harvey, 2006b), but application of the SCD has permitted framing of sustainability, capturing its holism, enabling measurement, creating a tool for future studies and revealing inter-connected options for sustainability.

Until now, the complexity of assessing sustainability (as illustrated in this study) and lack of simple indicators have weakened the ability of policy makers to do something about sustainable development (Moffatt *et al.,* 2001). Community SCD scores amalgamated at LA level could be one way of reducing this complexity. However, models used for informing policy must be robust, repeatable with other communities, rigorous, reasonable, internally consistent and give unambiguous results (Moffatt *et al.* 2001).

The combination of using this experimental approach with the SCD scorecard assessment and EF modelling of future scenarios can be argued to have many of the features necessary for informing policy, namely: it enables incorporation of value judgements; it has the ability to model options for changing consumption and to predict outcomes in terms of ecological resource impact (Moffatt *et al.* 2001). This study helps to explain why different interventions are appropriate for different communities (why some communities need much more support than others to achieve sustainability).

6.2 Creating meaning: options, issues and limitations for sustainable communities

This section contributes to the seventh objective of this study to create meaning from the research by: reviewing the options for achieving sustainable communities; discussing the benefits associated with and opportunities for resolving energy injustice and overarching issues; and identifying limitations and enablers of change.

6.2.1 Options for sustainable consumption: insights from modelling

The concomitant crises affecting society, highlighted in Chapter Two, raise the fundamental question underlying this research: how rural communities might thrive and live sustainably in a resource-constrained future with realisation of concomitant socio-economic and ecological global and local crises. To answer this question, options for sustainable communities are discussed in this section based on the results of the modelling of food, energy and transport visions. Relocalisation and self-sufficiency were two priorities identified in the visions. These overarching goals underlie the definition of the options modelled in this study.

The purpose of the modelling was to investigate whether community visions of thriving communities in resource-constrained futures can have sustainable consumption. Sustainable consumption is placed centrally in the SCD, as it encompasses all other aspects and is dependent on the ability to act (power, Foucault, 1994, Harvey, 1996, Kaplan, 2000, Ledwith, 2005, Didham, 2007) and the energy to produce and consume (thermodynamics, Moffatt, 1996a). The EF was used as a measure of sustainable consumption for the modelling, whereby sustainability was defined as having a total EF below the level of the fairshare. For the individual sectors, transport, food and energy, a level of 20% of the fairshare was defined as ecologically sustainable for each sector. Comparison of the EF of the three case study communities (Figure 4.2) with the fairshare (GFN,

2012) and the EF of Findhorn (Tinsley and George, 2006, section 2.1.3) shows the extent of unsustainable consumption and the level of transformation required to become sustainable. This is also demonstrated in the modelling of transport, food and energy (section 6.2.1). The following sections discuss the options and interconnected impacts and benefits arising from the modelling.

6.2.1.1 Transport and connectivity options

The results of the baseline sustainability assessment show that the transport EF is unsustainable and requires a significant reduction to be sustainable (for instance, 80% for Fintry, Figure 4.10, Appendix C.2), and that there is a lack of eco-friendly forms of transport (Figure 4.11) and use of public transport (Figure 4.10). The mobility of residents of Kinlochleven is much less than that of Killin and Fintry (Figure 4.10**,** Table 4.9). It is important to understand whether this might be due to more sustainable transport in Kinlochleven or a result of deprivation. Despite the lower EF, Kinlochleven residents travel more by car than Killin residents (Kinlochleven's car travel makes a greater contribution to the EF). However, the SIMD geographic access results (where Kinlochleven has the highest score of the three communities being in the third decile, Scottish Government, 2010b) should indicate that people may need to travel less to access services. However, the lack of shops and a quality supermarket, with a reasonable choice of products, indicates otherwise and Kinlochleven residents have to travel to the conurbations of Fort William, Oban, Inverness or Glasgow for a reasonable selection of quality retail services. At least in Killin, there was a greater selection of shops, but since the survey the greengrocers with its wide variety of foodstuffs has closed. However, there is public transport in Kinlochleven with an hourly bus to Fort William, unlike Killin where the bus service is more sporadic. Similarly, the lack of local employment opportunities in Kinlochleven necessitate more car travel than Killin, although in Killin employment opportunities are still limited (section 4.6). Kinlochleven's lower transport EF is largely due to lower amounts of air travel (Table 4.9). Although the underlying cause is uncertain, this may reflect the lower levels of affluence, educational achievement (Scottish Government, 2010b, SNS, 2012, Table 3.4, Table 4.10), and/or lack of aspiration to travel. With regard to educational achievement, when all three samples were combined, personal mobility (car and air travel) was found to be significantly higher for those with higher educational achievement (Appendix A.7), suggesting that mobility is related to achievement. Moreover, all the communities' EFBS and EFPS scores were less than four out of a maximum score of ten, which do not suggest that high levels of environmental awareness persist within Kinlochleven. As income data is not available, it is not possible to investigate the correlation of this with distances travelled by car and aeroplane. However, educational achievement should be a reasonable proxy for income and so Kinlochleven's transport EF is likely to be due to deprivation rather than sustainability literacy. This raises an issue with development in that if deprivation is relieved, then there is a risk of increasing mobility and the transport EF in Kinlochleven, unless the transport solutions are sustainable.

Kinlochleven's transport EF is likely to be reduced by those in the community that do not travel by car (17%, Figure 4.11), all of whom were retired and did not travel by air, suggesting restricted mobility, which might be due to age and/or deprivation.

The communities' visions of sustainable transport (Figures 4.1-4.3) are ones in which everyone makes fewer trips, businesses, employment and services (especially health) are relocalised (thus reducing the need for travel) "*local trips are by bike, walking and in some cases by horse*", transport links are excellent with community transport providing additional links to other villages and major public transport routes and "*no one makes single car journeys to shop anymore*" (*anon*. focus group participants). The modelling of different options (three levels of change with the third level being the most radical and punitive in restrictions in mobility) enabled further exploration of the feasibility and extent of change to transport and mobility to be sustainable.

The options for reducing long distance travel (LDT, i.e. to England or international destinations) are different to local journeys. LDT choices are whether to travel or not (can the need be satisfied locally) and method of travel (car, bus, rail, boat or aeroplane). These options apply to reducing the EF for local journeys, but local journeys have a greater range of alternatives from people-power, shared travel, and changes to community structures to eliminate the need for travel. The LDT1-LDT3 scenarios modelled had reductions in the amount of LDT within each scenario and, for some of the remaining LDT, the mode of travel was changed. In LDT1 there was no domestic flying, and instead all domestic LDT journeys were taken by train, a 50% reduction in European flying and 25% of European flights taken by train and a reduction in long haul flying by 20%. In LDT2, there was a

75% reduction in European and long haul flights and in LDT3 there was no flying. To achieve even the level of change in flying in LDT1 requires both significant improvements in the speed, connectivity and efficiency of rail and ferry travel and active policy disincentivisation of air travel. At present, with the continued development of airports across the UK, lack of aviation in the Scottish Government's policy on emissions reductions (RPP2, note that decarbonisation of air travel is under the remit of the European Union, Scottish Government, 2013a), a change in policy to restrict and regulate air travel to the levels required even at LDT1 is unlikely. Although significant reductions in the amount of air travel are necessary, further work is also required in quantifying the benefits of taking the train as opposed to flying, as Wiedmann *et al*.'s (2008) error analysis of the rail CF suggested significant inaccuracies and detailed life cycle assessment of different types of public transport to identify the most sustainable.

Fintry is the most affluent community and has the highest transport EF and so the changes in mobility for this community to achieve sustainability are likely to be the most radical. The results of the modelling suggest that for Fintry Step 2 change (i.e. scenario PT2, which was estimated to have a transport EF of 32% of the fairshare) is insufficient as a solution for sustainable transport. However, for Kinlochleven and Killin, as their baseline transport EF is lower, then a change at the Step 2 level may be sufficient (PT2 transport EF was estimated to be 20% and 22% of baseline for Kinlochleven and Killin respectively). PT2 assumes the average car efficiency to be improved to the level of at least a medium hybrid, implying that almost all solely fossil fuel cars are phased out and drivers drive more efficiently (with better tyre pressures, less acceleration and lower speeds). This implies that some hybrid vehicles could be used as a means of overcoming the problems of range associated with electric cars in these remote communities.

The PT2 scenario would require: a reduction in car use (increasing journey occupancy to 60% and reducing distance travelled by car by 40%) and car ownership; and significantly improved local public or community transport, enabling commuters to access their jobs and residents to access goods and services, and making connections to train, bus and ferry services for long distance travel. More people would need to walk or cycle for journeys of less than 5 miles, so safe cycle routes and electric-assisted bicycles are needed. However, the provision of a safe cycle route from Kinlochleven to its nearest village, Glencoe, with bus connections to Glasgow and Fort William, and similarly (but to a slightly lesser extent), Killin along the north shore of Loch Tay to Tombreck and onto Kenmore, would be difficult given the steep mountainous terrain. Therefore, an asset for these communities with dangerous cycle routes would be the simple solution of installing cycle racks on the buses.

In PT2, as per the visions, people would need to make fewer trips, which could be facilitated by increases in home-working, local employment, tele-working facilities provided locally through community enterprises, local service provision and co-operative purchasing schemes whereby journeys for essential goods are reduced by bulk orders and deliveries. Therefore, shopping for provisions and accessing services would require co-ordinated travel, using lift-share schemes, and co-ordinated goods distribution. In addition, increases in local food production and its co-ordinated distribution might reduce transportation of food and people to shops. However, this also requires a means of distributing local food so that additional journeys are not made by car to purchase single items (e.g., a box of eggs) from a local farm. New retail outlets for local produce would also reduce the need for travel. With reductions in car travel, owning a car with low user mileage becomes less economic and car share schemes bridge this gap. This meets the need in scenario PT2 to reduce the EF of car purchases so schemes such as the Moorcar community car share scheme (Moorcar, n.d.) should be implemented and utilised in all three communities.

As an alternative or complimentary to PT2 implementation, the potential for achieving a sustainable transport EF by wholesale switching to electric cars was investigated. Significant reductions in EF can be achieved with implementation of electric cars and renewable energy, as implementation of ECPRs reduced the baseline car EF by 63% (Figure 5.9). In Kinlochleven, where air travel is less, implementation of ECPRs reduced the baseline transport EF to 30% of the fairshare, suggesting that mobility reduction to the level of the PT2 scenario is not necessary if there is wholesale adoption of ECPRs and travel is reduced to at least the level of PT1 (the transport EF for the combined PT1+ECPR scenario for Kinlochleven was 23% of the fairshare, Table 5.15). However, in Killin more significant changes to travel than PT1 would be needed to achieve a sustainable transport EF even with wholesale ECPR implementation as the transport EF for the combined PT1+ECPR scenario was 31% of the fairshare. For Fintry, in the PT2+ECPR scenario the transport EF is only reduced to 27% of baseline (Table

5.15). Fintry's baseline ferry EF is equivalent to 3% of the fairshare (0.05gha/cap). This is much higher than that for the other two communities and may be a significant overestimate, as the LA average figure was used in place of baseline sample data as the latter was not collected in Fintry. If baseline ferry travel is excluded then the transport EF for PT2+ECPR is reduced to 0.43gha/cap, which equates to 24% of the fairshare, suggesting that significant transformation is still required in Fintry, at least to the level of PT2+ECPR. An alternative way of achieving a sustainable transport EF in Kinlochleven and Killin is to keep all travel the same except for eliminating all air travel and wholesale implementation of ECPRs, as the LDT3+ECPR scenario was 22% and 21% of the fairshare respectively (Table 5.15).

Therefore, the modelling suggests that there needs to be transformation in transport to be sustainable and that this may be accomplished by different levels of adoption of multiple options. Nevertheless, ECPRs are likely to be essential for transformation, but the additional cost and problems of range for electric cars (Nissan, 2012, Next Green Car, 2013) are significant barriers to their uptake in rural communities. Also, the additional requirement for electricity generated by renewables to power ECPRs is substantial and needs adequate consideration.

The additional annual electricity consumption from ECPRs deployed without mobility changes was found to be between 51% (Kinlochleven and Killin) and 71% (Fintry) of baseline household electricity consumption (Table 5.16). Currently, the minimum off-peak demand (between 01:00 and 06:00) has been estimated to be between 40% and 60% less than the maximum peak evening demand (17:00-20:00) of electricity consumption (Hesmondhalgh and Sustainability First, 2012). Therefore, there may be a possibility, which needs further investigation, that charging of electric cars could be accommodated by conventional electricity generation, if they are charged at lowest off-peak demand times (which is an assumption of the Scottish Government's current climate change policy for transport, as charging of ECPRs at night would flatten the electricity demand curve, Boehme *et al.*, 2006, Scottish Government, 2011e, 2012i, 2013). However, achieving sufficient renewables capacity to support both baseline household and electric vehicle charging would be a significant challenge with renewable energy production contributing only 6% to the total electricity produced in the UK in 2008 (DECC, 2012). Given the scale of the challenge of installing renewable energy capacity and meeting increased demand from transport, reduced mobility and community renewable energy generation and micro-renewables in rural communities are all likely to be essential for sustainability. Moreover, community renewable energy developments to fuel transport present economic opportunities for those communities with abundant renewable energy assets and should be a priority for LAs, who wish to alleviate deprivation and encourage business development in rural areas.

In summary, the results suggest significant reduction in car use and/or reduction in air travel of at least the level of PT2 for Fintry and PT1 for Killin and Kinlochleven are required, together with implementation of ECPRs, as renewable energy powered transport is likely to be an essential component of transformation. The reduction in both car use and local journeys would be dependent on a new culture of co-operation and community enterprise, supported by legislation and incentives to favour the implementation of environmentally friendly transport, car and car lift sharing (requiring increased co-operation and co-ordination), community transport and relocalisation of jobs and services. The affordability of electric cars especially and the practicalities of their recharging (i.e. a network of rural recharging points) need to be addressed. The success of Fintry's efforts to reduce their transport EF through community enterprises will provide useful insights for other communities to reduce their transport EF.

6.2.1.2 Food options

In the food modelling, the scenarios investigated were: increasing domestic production without changing production methods (FDP1-FDP3); changing to a more healthy and increasingly vegetarian diet (FC1-FC2) and vegan diet (FC3); and switching some fruit and vegetable production to SCA (using existing built land) were investigated for Stirling LA area. Primary expenditure data was not collected as collating sufficient primary data for modelling was not feasible using the questionnaire format, and this approach would have been unlikely to yield more insight as modelling food data in REAPv2.17 was limited.

The food modelling results should be taken with caution, as the COICOP food categories represent a gross combination of food stuffs, especially in the fruit and vegetable category, which includes pulses and fresh and processed fruit and vegetables. Given the heterogeneity of production methods of food types within each COICOP category (e.g., pulses, and fresh and processed fruit and vegetables) and the inability of the UK to produce some of the protein rich pulses (e.g., lentils and soya beans, which are some of the main alternatives to meat and dairy), the scenario results may be unreliable (Wiedmann *et al.,* 2008). Also, REAP models food using monetary values rather than mass and volume units. The errors associated with this have not been quantified, but the use of mass and volume units would have been unlikely to substantially improve the analysis due to the consolidation of food types into the FDCs. Meat and meat products (excluding poultry) and fruit and vegetables had the highest baseline food EFs (over 0.2gha/cap; all other FDCs were less than 0.1gha/cap, Table 5.17), suggesting that a significant reduction in both FDCs (without a rise in an alternative category) would have significant benefits.

The EF results of FC1-FC3 and SCA scenarios suggested that the benefit of switching to vegetarian or vegan diets may be negligible if fruit and vegetable production is unchanged (Table 5.18 and Table 5.19). The results of the FDP1-FDP3 scenarios (Table 5.17) suggested that there may be advantages in increasing domestic production of poultry, fish, bakery items, other (e.g., spices and sugar) and beverages, as the decrease in EF for FDP3 varied between 11% and 31% (Figure 5.10, Table 5.17). Chocolate and confectionery was not modelled in terms of domestic production, because cocoa beans are difficult to produce in the UK. Switching to domestically produced meat had little effect on the EF (4% reduction for FDP3), even though emissions from transport would be reduced. Increasing consumption of domestically produced (as opposed to imported) meat may not be more sustainable, if more resource intensive or biodiversity-harming production methods are used (FAO, 2006). Reducing overall meat consumption and increasing locally produced meat from less harmful production methods (e.g., wild venison) are likely to be most effective in reducing the meat EF. However, if more 'wild' foods are used, then the impact of poaching, hunting and foraging needs to be evaluated from a biodiversity perspective and management of common hunting and foraging grounds is necessary, in case unmanaged access degrades the common resources (Hardin, 1968, 1998, Ciriacy-Wantrup and Bishop, 1975).

Further investigation of the benefits of increasing domestic production of healthy foods (especially those present in a vegan diet) and the impact of transportation from different countries and regions, which needs to be off-set by any additional resource utilisation of production in Scotland (due to lower productivity in some areas, Chapter Two, Scottish Government, 2012a) is required. These investigations should inform what food importation should be reduced, so only those foods that cannot be grown with low resource intensity in the UK are imported and diets changed to favour domestically produced food with low resource intensity. Also, investigation of the EF and nutrient quality of food preparation within the home versus in industrial settings and that of different types of storage is a requirement for developing detailed and informed options for the cook in every household. Research into the cost and EF productivity ratios of different production methods across the geographic diversity of Scotland (e.g., small scale intensive polyculture versus industrial agriculture) is required.

This research suggests that one way of increasing food production without increasing the EF is the use of “derelict” land and low input methods of agriculture (such as permaculture). To reduce the food EF to anywhere near sustainable levels, substantial changes are likely to be required in the production methods of fruit and vegetables and seasonality and locality of production and consumption, especially if fruit and vegetable consumption is to increase to compensate for reductions in consumption of meat, fish and less healthy foods. Relocalisation of food production using low input agriculture, such as permaculture, reduction in food waste to near zero and significant reduction in less healthy foods and beverages are likely to be sensible options for reducing the EF (Holmgren, 2006, Hopkins, 2008, Levidow and Psarikidou, 2011). Projects supporting local production and SCA must reduce the estimated 16% wasted in transportation, storage and production to be sustainable. To be sustainable consumers need to change their habits to reduce the 19% of food wasted in the home, requiring education in home economic skills and in what are sustainably produced foods, and changes to production (Berners-Lee *et al.*, 2012) to reduce the food EF. This research is limited in that it only tested the EF of food production; for ecological sustainability (in which pollution and biodiversity impacts are accounted) changes to environmentally friendly and preferably organic production methods, which accumulate rather than erode soil, are required (Holmgren, 2002, Audsley *et al.* 2009).

To create more sustainable production and consumption of food in the case study communities there should be a multi-stranded approach to develop sustainability literacy, community agriculture and market transformation to locally produced foods. First, CSA projects would need substantial commitment from residents (i.e. financial and/or volunteer effort) at the start of the growing season in exchange for food produced, but if successful might have the additional benefits of creating local employment and skill development. The current lack of suitable community land in all three communities and financial capital in Kinlochleven and Killin would be significant constraints.

Secondly, with the CfE, food sustainability literacy has a vehicle to be developed within formal education, but there is nothing similar for life-long learning (Martin *et al*., 2013). As stated by focus group participants, there is an opportunity to utilise existing community groups, such as the WRI, for developing food sustainability literacy. In addition, further research is required to inform producers and consumers of the most beneficial means of producing and preparing food (i.e. temporally and spatially) for each food type. This food sustainability literacy should permit informed choices and include the health and ecological impacts of wasting food, of eating "less healthy foods", and of the methods of production which chemically pollute foods and the environment and leach soil nutrients, thus improving human and ecological health and well-being.

For market transformation to locally produced food, new local intermediaries (local abattoirs, transporters and wholesalers, which have largely disappeared in Killin and across rural Stirlingshire, as highlighted in focus groups) are needed to replace supermarkets, or the supermarkets have to take on this role in a regional rather than national capacity. For local food to be sustainable, the producers need to localise their raw materials, otherwise local producers are just small scale global food factories. Community intermediaries would be required to aid co-operative purchasing to reduce the transportation costs of foods that cannot be produced locally. These actions would need to be supported by government policy (e.g., fiscal and policy incentives for local food production, processing and markets). Therefore, tackling market transformation has regional, corporate and government implications.

In summary, in a sustainable future, diets will change to favour those foods that can be produced with lower resource inputs in Scotland and food production, which has good yields, low resource intensity, the majority of foodstuffs produced locally, low EF and is beneficial to biodiversity (Holmgren, 2002). Options to achieve this include: switching to agricultural practices, such as CSA and grow-your-own using preferably organic practices; local producers supplying AFNs; co-operative purchasing to reduce transportation to rural communities; changes in diet to more healthy foods, local foods and increasingly vegetarian and vegan; and changes in agricultural production to those of organic and environmentally friendly methods with low resource intensity (Robinson and Sutherland, 2002, Fuller *et al.*, 2005, Green *et al.*, 2005, Hole *et al.* 2005, Holloway *et al.*, 2007, Audsley *et al.*, 2009, Frey and Barrett, 2007, Berners-Lee *et al.*, 2012). A major benefit of SCA and sustainable food consumption is the potential that they can break the cycle of the econocracy (Sanne, 2002), bridge the value-action gap (Stoll-Kleemann *et al.*, 2001), create social capital

(Warburton, 1998, Keeley, 2007) and recreate '*dualchas*' (McCarthy, 1999, Key and Kerr, 2011, 2012).

6.2.1.3 Energy options for the built environment

Given that the housing EF is at least 85% of the fairshare (Figure 4.22) and there is a lack of eco-friendly housing in all three communities, there are significant opportunities to reduce the impact from housing. Fuel consumption represents over 89% of the housing EF for all three communities (Figure 4.22), so reducing consumption has to be the core focus for sustainability. FDT's insulation and renewable energy projects illustrate the potential of community-led initiatives for driving change within the home (section 4.7). However, much more needs to be done to make housing sustainable to the level of Passivhaus (SDC, 2010b, Boardman, 2012). Another option for reducing the housing EF is increasing dwelling occupancy (ratio of number of occupants to bedrooms), as switching from single to double occupancy dwellings would, in effect, halve the housing EF for these properties. However, this is not easily implemented, especially as rising levels of lower dwelling occupancy (Figure 2.10) may be related to individualism and breakdown of family structures (Beck, 2000, Scottish Government, 2011a). Historically, families tended to share dwellings to a greater extent, when individual values were less important.

In the energy modelling, the scenarios (E1-E3) were created for each community to investigate the effect of energy saving and technological innovations on the housing EF. The E3 modelling did not reduce the fuel consumption to Passivhaus levels (only to 40% of baseline energy demand, although this included total energy (heat, cooking and appliances), Table 5.22, Figure 5.12). Nevertheless, in E3, a sustainable housing EF was achieved. All heating in E3 is from renewable resources (biomass or GSHPs with renewable electricity).

In the E2 and E3 scenarios, the EF of wood, repair, built land, and mortgages and rent become significant in terms of the housing EF (Table 5.22, Figure 5.12). At present levels in rural communities, wood fuel (logs) is sourced mainly from timber surgeons' waste and storm damage (where there is local forestry); local forest management for provision of logs for home heating in the communities is likely to be minimal. However, in the future, as coal consumption decreases, forests may become wholly or partially managed for fuel, although in E3, the increase in woodfuel consumption is only between 7% and 49% of current levels (Table 5.22, Figure 5.12), due to improvements in house energy efficiency. The models assume that log wood is used for heating rather than manufactured wood pellets, as the latter has a CF three times higher than wood chips as a result of indirect emissions from production (AEA, 2012). In the future, woodland resources should be a priority for Kinlochleven, replacing coal as a fuel for heating homes and as a resource for building sustainable homes. However, the timeframes for growing viable woodlands will make this very much a long term goal, but may be an important action to instigate now in order to maintain sustainability of the community in the future.

The EF of building maintenance and repair can be improved by using sustainable materials and production practices which have lower EFs. To reduce the EF of mortgages and rent, the contribution of the financial services sector to the production side of the EF needs to be reduced in line with Step 3 scenario. To reduce the built land EF (5% of baseline housing EF, but 30% of E3 housing EF, Table 5.22), developed land should be used to its full capacity before requisitioning more land for building purposes.

The success of Fintry's insulation and renewable energy project was much greater than that of Killin. Based on feedback from both communities, the key difference appears to be that FDT employed energy officers, who engaged with the community and took a holistic approach to energy management (e.g., used infra-red sensing to identify weaknesses in a house's thermal fabric and promoted renewable heating systems as well as insulation, Gordon Cowtan, *pers. comm.*, 2010). In contrast, Killin's insulation project employed external (to the community) contractors to carry out energy audits and home assessments. The lack of knowledge of and distance from the community may have reduced the success of engaging with Killin residents (Willie Angus, *pers. comm.*, November, 2010). With the complexity of domestic renewable energy technology and retro-fitting older properties and with Government incentive schemes changing on a frequent basis, community energy officers are essential to identifying and sourcing successful and appropriate technology solutions (Reetz, 2011). The need to undertake widespread retro-fitting and renewable heating installations presents an economic opportunity for rural communities to employ local energy officers to co-ordinate improvement programmes, optimise bulk purchasing and identify bespoke housing improvement strategies, skilled installers and service specialists for renewable heating systems, and builders to undertake bespoke retro-fitting to improve energy efficiency of all buildings to near Passivhaus standards. Strong policy is needed to support and enable retro-fitting and change construction to sustainable standards.

In summary, unsustainable fuel consumption is the major factor in the housing EF. Increasing dwelling occupancy would have a significant effect on the housing EF and should be a consideration included in policy-making. The scenarios investigated changes to heating systems, heat demand, energy consumption and fuel. In E3 a sustainable housing EF was achieved even though this did not assume that heat demand was at the level of Passivhaus (i.e. negligible). This assumption reflected the impossibility of all existing housing stock achieving Passivhaus standard. Switching from fossil fuels to renewable heating systems requires investment in (preferably local and community) renewable electricity generation and wood fuel. The latter requires investment now to ensure woods are managed productively for the future. Local energy advisors are essential to aid householders (illiterate in renewable energy systems, government incentives and new insulation technologies) in choosing the most appropriate choice for their property. Community-led programmes with bulk purchasing, locally trained installers and advisors have the opportunity to boost local employment and skills and minimise costs to the consumers.

6.2.1.4 Implications of reducing the total EF

Sustainable consumption requires the total EF to reduce to the level of the fairshare (a reduction in EF of 71%, 68% and 70% for Fintry, Kinlochleven and Killin, respectively is required, Figure 4.2). Therefore, for the areas not modelled in detail (i.e. consumables, private services, government and capital investment, as opposed to transport, food and energy) this scale of reduction in EF is required. In terms of the overall modelling, this requires a reduction at the level of Step 3 (apart from capital investment) to achieve sustainability. Capital investment EF reduction was assumed to be less, as continued investment in innovative technologies is essential for achieving sustainability, but the assumption was made that there would be some improvement due to more sustainable methods of development. To consume differently, the consumer is dependent on the selection of sustainable goods and services to be available and marketed preferentially, in other words without coercion to consume unsustainably or with coercion to consume sustainably (McIntosh, 2001, Hobsbawm, 2011).

A sustainable community has zero waste, a low water footprint, CF and EF and only consumes products that are produced using minimal sustainable resources, in an environmentally-friendly way and with only positive social impacts. EFPS and EFBS and the amount of waste arising in each community illustrate the gap between what is required and current consumer behaviour (Table 4.2, Table 4.4 and Table 4.5). Individuals cannot be expected to change their behaviour without the local community and society and the economy at large moving towards sustainability in conjunction with the individual (Nordland and Garvill, 2002, Sanne, 2002, Joireman *et al.*, 2003, Jackson, 2005b, 2007, Wolf *et al.*, 2009). For example, the infrastructure for local sustainable food production has to be in place to enable local food purchasing. Similarly, the relevant infrastructure has to be developed for car sharing, car lifts, utilising community transport and co-operative purchasing. Moreover, goods offered by retailers need to be the ones that are most sustainable and affordable. Without the community infrastructure in place and changes to the economy, attempts to force or encourage individual behaviour change might appear punitive and likely be futile. The role of regional service delivery to avoid duplication of effort (e.g., car share schemes, energy officer employment, care provision, local governance structures, local food initiatives) requires further investigation.

Moreover, consumption choices have a social equity dimension, which is also not captured by the EF. For example, ecologically sustainable choices (e.g., electric cars and organic food) are exclusive and unobtainable for a significant minority (or even majority), due to the higher costs of environmentally friendly or ecologically sustainable choices (Next Green Car, 2012). With the high levels of deprivation in Kinlochleven and those suggested in Killin (by KAT's income survey, KAT, 2012a), community-enacted solutions are necessary to overcome the financial barriers to implementing and/or purchasing more sustainable solutions (e.g., renewable heating systems, electric cars and organic food).

The options identified in the modelling form the threads that create a tapestry of a sustainable community. For example, local food production, home-working, relocalised services (e.g., carers), community transport, local housing retrofitting and renewables installation all have economic benefits. The transport solutions and local food may create opportunities to improve health and well-being. Car and lift sharing, community supported agriculture, bulk or cooperative purchasing groups, renewable energy developments and community transport are likely to beneficial in terms of social capital, community capability and power to act. As materialism and individualism are detrimental to well-being (Kasser, 2002, 2008), less material, more sustainable, co-operative and community-focused lifestyles (as identified in the visions) are likely to have a positive impact on well-being. Communities who undertake development projects and create visions for sustainability are likely to have higher levels of aspiration and sustainability literacy. The SCD thus becomes a tapestry of interconnected and interdependent solutions for creating thriving and flourishing communities.

One aspect of these interconnections is the level of individuals' power to act in making consumption choices. At the governmental level, recycling and waste management is being tackled in the Zero Waste Plan (Scottish Government, 2010d), but consumer goods, purchase choices and the drivers of (un)sustainable consumption are not (i.e. the government is not redesigning the econocracy, Sanne, 2002). One key part of improving the level of individual's power to act is making choices of sustainable consumer goods viable for individuals in rural communities (Stoll-Kleemann *et al.*, 2001), but this requires a change in the structure and motivation of the economy away from the promotion of materialism in favour of sustainability and society (Sanne, 2002, Ledwith, 2005). The coercive power of marketing and profferance of material goods is pervasive in multiple dimensions of physical and virtual space (Foucault, 1994, Hobsbawm, 2011), making it difficult for an individual to change behaviour (Figure 2.1). In addition, satisfaction of material welfare creates apathy towards unsatisfactory socio-economic policies of government at all levels (McIntosh, 2001, Hobsbawm, 2011).

The best options for creating significant changes to mobility and transportation, food production and distribution and energy consumption and the infrastructure changes are likely to be unique to each community. This implies a need for community engagement in the development of community-specific solutions. Local government not only needs to recognise the importance of this and support it, but also be able to assess the sustainability of individual communities and act accordingly. Changing lifestyles to adapt to these new ways of living is likely to require sustainability literacy, infrastructure development and community capacity to develop, support and implement appropriate solutions. These solutions need to be affordable and achievable, even in more highly deprived communities, and also available to deprived households within more affluent communities. The need for significant local investment to generate income to deliver community projects and the need for renewable energy to power both vehicles and the home increases the importance of community-owned renewable energy installations.

In summary, the options for creating sustainable communities are a range of interconnected and interdependent solutions, which are applicable to varying degrees in all communities, but the starting point, design, application, process and outcome is unique to each community.

6.2.2 Overarching issues: energy injustice, community property rights, power, well-being and sustainability literacy

Exploration of the overarching issues are important for creating meaning from this research and identify what challenges have to be overcome to create sustainable communities. The analysis of these challenges in this section informs the recommendations outlined in section 6.3. Developing and then enacting the options for sustainability requires consideration of their multi-faceted benefits and resolution of the problems of injustice, deprivation, and lack of power and property rights, as well as developing sustainability literacy. In the previous section, options for creating sustainable consumption and the benefits of community action for well-being and reducing materialism have been reviewed. This section considers the aspects of the SCD that relate to sustainable energy to fuel life, power to act, governance and land tenure, and health, well-being and education (Figure 2.7). All four are highly interconnected and also relate to other SCD aspects, which encompass community social capital, aspiration, the economy and '*dualchas*'. First, the issue of energy injustice, using the case studies as comparative examples, is analysed, then the inter-relationship between governance structures and the power to act in each of the communities is considered, and, finally, opportunities to enhance well-being and increase sustainability literacy are examined.

6.2.2.1 Energy to fuel life: energy injustice

Fuel poverty is particularly acute in remote rural communities (as highlighted in Chapter Two) and, even though income data was not collected, given the estimates of household income and levels of deprivation in secondary data, it is highly likely to be prevalent in Kinlochleven and Killin (Scottish Government, 2010a, 2010b, 2011a, KAT 2012a). This injustice has occurred when society can rely on fossil fuels and these resources are still relatively abundant and affordable, compared to possibilities in the future (Campbell, 1998, 2002, 2003, Campbell and Laherrère, 1998, Hopkins, 2006, Holmgren, 2009, Kerr, 2011, Brecha, 2013). The scenario modelling (Chapter Five) highlighted the increased importance of renewable energy to fuel rural communities in a peak oil and low carbon “2030” world. Therefore, fuel poverty and energy injustice can be argued to have even more importance than perhaps most people in society, corporations or government currently realise. The case study of Fintry has highlighted the opportunities and community benefits from a renewable energy development. The benefits are not just financial but are also in terms of community cohesion, governance (requiring a development trust structure), community enterprise and social capital. The financial benefits have enabled, for example, the investment in community enterprises to reduce household carbon emissions and fuel poverty (part funded by CCF) and provide the specialist expertise necessary for their achievement, the appointment of a community development officer, refurbishment of community property, the set-up of a car club, and creation of an orchard. Whilst the community has always had a degree of social capital and scores highly on the SIMD, the community can now be described as further advanced in the construction of community structures that break individual “lock-in” to unsustainable patterns of consumption (Sanne, 2002, Jackson, 2005a, Ledwith, 2005).

Energy injustice occurs when large corporations develop swathes of the rural landscape resources, and preclude local communities from becoming energy self-sufficient and creating directly or indirectly meaningful employment from the benefits of the local resource as demonstrated in this study. Energy injustice has been revealed on comparison of Fintry with Killin and, in particular, Kinlochleven. Both Killin and Kinlochleven suffer significant deprivation, although this is more acute and obvious in Kinlochleven (Scottish Government, 2010b, KAT, 2012a, SNS, 2012). Social capital is much higher in Killin than Kinlochleven and following closure of the aluminium smelter, many sub-groups in Kinlochleven may lack aspiration and voice.

Both the experience of the case study communities and the analysis of renewable energy developments in Scotland (2.3.2.3) have highlighted the scale of energy injustice in Scotland. Principles for the restoration of justice should be built on fair, rather than equal, distribution (Sen, 2010). All rural communities do not have to achieve either the scale of benefits that corporate developers realise from renewable energy developments, or even the scale of benefits that Fintry realises, but all communities should have a fair and reasonable opportunity to develop energy solutions from their local resources to sustain the communities in the future. If a community receives a community benefit from a corporate enterprise and has no financial risk, then the Scottish Government's recommendation of £5,000/MW/annum appears fair. However, given the large amount of money to be made from wind farm and hydroelectric developments, perhaps more substantial benefits should accrue to local communities.

Resolving injustice and creating opportunities require sound reasoning, as resolving injustice is problematic and infringes on the liberties of another (Harvey, 1996). Whilst deliberation of what is fair and unfair is subjective, a sound principle is resolving the most manifest injustice (Sen, 2010) and it is the manifest injustice of renewable energy that is addressed in this section.

The SCD aspect, energy to fuel life, is especially important, not only because energy fuels life, but, as in the case of Fintry, the benefits of renewable energy projects have the potential to transform rural communities. The justice literature (section 2.1.5.3) has facilitated the analysis of energy injustice in this study (section 4.11.1). From this analysis (Table 4.18), recommendations for resolving the injustice can be made (Table 6.1).

Given the pending and socio-economic crises (outlined in section 2.2), the ability of rural communities to be self-sufficient in terms of energy generation and derive income from community energy developments, creating meaningful employment, sustaining the local community and its services, funding infrastructure enhancements and acting as a catalyst for social change, is essential for the sustainability of rural communities in the future. While the energy demand from housing is likely to decrease, this may be offset by the demand for electricity for transport (section 6.2.1.1).

Although there is an abundance of renewable energy resources in rural Scotland (Boehme *et al*., 2006) and renewable energy developments have the potential to be catalysts of sustainable development, the majority of renewable energy opportunities in Scotland are being developed by commercial and private

Table 6.1 Recommendations for resolving energy injustice (framework adapted from Bulkeley and Fuller, 2011)

	Recommendations
Responsibility	• Community "benefit" or share in any renewable energy scheme should be compulsory for all commercial renewable energy developments over a certain size and phased in at smaller scales to prevent preferential development of smaller scale renewable developments to circumvent community shares. • Sustainability and community development capabilities are pre-requisites: education and training programmes targeted at mobilising new individuals (rather than the "usual suspects") would be essential. • Financial support (similar to "green jobs") from public sector required to fund community development and leadership posts. • Land-owners required to share energy developments with rural communities, if suitable energy resources exist in a locality. • Local community governance with power to plan and enact community renewable energy.
Rights	• Planning should always go in favour of community over commercial developments. • Legislation is required to force heritage renewable energy developments to provide just levels of community benefits at the Government's recommended rate of £5,000/MW per annum and opportunities to share in any expansion of existing developments. • Supplement the CARES scheme (CES, 2013b) with significant additional funding and expertise to build necessary capacity within communities to initiate enterprises to maximise and develop opportunities arising. • Local community governance structures (Wightman, 2011) with power to enact local decisions and planning. • Changes to legislation and taxation to favour community assets. • Approaches such as social choice theory, stakeholder engagement, consensus decision-making and "*stirring*" committees should be used to address conflict and minimise any adverse impact of creating a more just solution (Costanza 2002, Didham 2007, Sen, 2010, van Gelder, 2011).
Recognition	• All commercial developments include a community development project scoped as part of the commercial development, so that the opportunity for community involvement can be properly articulated and, in the absence of community development, appropriate levels of community compensation can be made. • Intrinsic value of place should be a core part of environmental impact assessment (EIA, this is greater than landscape amenity and includes spiritual attachment and history, McCarthy, 1999, Dobson, 2010). • Community renewable energy experts are required to guide communities through the complex nature and opportunities for community renewable energy. • Communities that have higher levels of deprivation or who are perceived to lack aspirational community projects should be the focus for local government support. • Community energy projects must resolve issues of fuel poverty and have socio-economic benefits for "hard-to-reach" groups. • Skilled facilitators are engaged to build community capacity to manage community enterprises and develop the community sustainably.

enterprises, and rural communities are excluded from a fair share of the benefits (section 2.3.2.3). The benefits of the development of rural resources are being accrued by the international organisations of global capitalism, frequently to the loss of opportunity for rural communities (Scottish Government, 2011e). Commercial development also precludes communities from developing the natural assets in the future. Yet, community renewable energy is not just a way of meeting rural energy needs but also for creating sustainable communities. Injustice arises when communities are not receiving the appropriate level of benefits or are not being sufficiently engaged in the development of local opportunities. Energy injustice in rural Scottish communities reflects existing inequalities in social structures and in the distribution and control of natural resources (Wightman, 2011) and renewable energy developments. Polarisation of property rights relating to renewable energy developments has contributed to the creation of energy injustice (Table 4.18). This polarisation of renewable resources with distant entities is an issue that needs to be addressed for the future sustainability of rural communities.

The recommendations made in Table 6.1 are based on the detailed analysis at the level of community (rather than individual, Schlosberg and Carruthers, 2010, Skerratt and Steinerowski, 2013), because the injustice is not just individually experienced forms of distributional, recognition, participation and procedural injustice, but are also of collective capability and functioning, thus affecting the community and social capital (Warburton, 1998, Keeley, 2007). The recommendations for change though are aimed at policy-makers and national government as both individuals and the community lack power to make the changes.

As noted in the literature review, not only do policy-makers need to recognise the unjust distribution of assets and procedures that further the injustice, but also the needs of "*vulnerable and marginalised social groups*" (i.e. rural communities). Policy-makers then need to pursue "*procedural justice through opening up involvement and influence in decision-making processes at different levels*" (Walker, 2011, n.p.) and enact the necessary changes in governance and distribution of property rights. Nevertheless, the process of change is unlikely to be easy and the inescapable plurality of competing principles and individual and collective needs are likely to be crucial to tackling injustice (Harvey, 1996, Sen, 2010).

6.2.2.2 Property rights, governance and authority to act

The difference in levels of deprivation between the three communities has been described in Chapter Four and has been illustrated in the inequalities in property rights to renewable energy. In this section, the issue of property rights is further explored and how this and governance structures relate to power to act.

6.2.2.2.1 Property rights

Creating sustainable communities requires a rebalancing of property rights. Recommendations to changes in property rights for energy injustice (section 6.2.2.1) form only one aspect of the polarisation of control of land into the hands of the few. The Land Reform (Scotland) Act 2003 (Scottish Parliament, 2003) has made no impact on the study communities. Transfer of land to communities might create a sense of community accountability for the management of the land and the opportunity to manage the land for the benefit of the community and the environment (Wightman, 1996), although natural heritage, biodiversity and social capital objectives would have to be enshrined in the land transfer (Bryden and Geisler, 2007, Scottish Government, 2012d). In Kinlochleven and

Killin, there is a lack of community-owned land for community enterprises (e.g., business space and CSA) and so transfer of property rights would be essential for pursuing sustainable community development objectives. Community property rights are powerful in supporting most other aspects in the SCD.

Both Killin and Fintry have some land managed for sustainability, but the majority of land management is not under community management. If property rights are transferred to communities, then their land management practice must be environmentally and socially responsible. Safe-guarding (as opposed to exploiting) ecosystem services should be integral to agricultural practice. Community land management and cultivation offer an opportunity for creating a new form of '*dualchas*' (McCarthy, 1999, Dobson, 2010); this opportunity was highlighted in a Killin focus group (see section 5.1.3). The need for horses for overcoming transport problems was highlighted in one of the Kinlochleven focus groups, but, stating this, it also highlighted the lack of opportunity for young people to engage with land-based agriculture in this remote area of Scotland. Community land ownership may provide multiple benefits: creating environmentally-friendly community agriculture, rebuilding an identity, sense and link with place, building self-esteem, reducing the desire for material goods, developing protective environmental attitudes and developing a new culture around the local landscape (Giddens, 1991, Borgström *et al*. 1999, McIntosh, 2001, 2008, Kasser, 2008). However, the economic rewards of land management for sporting rights, versus landscape amenity, community food and energy developments, biodiversity enhancement and carbon storage are likely to be contested debates within communities in the future.

The collective arguments presented here, together with the analysis in Chapter Two and Chapter Four, for community land ownership are compelling. Community land ownership may be a powerful tool for creating sustainable communities, if through ownership the multitudinous cultural, economic, environmental and social objectives are enacted, and especially if the community receives fair opportunities and benefits from Scotland's abundant renewable energy resources. However, there needs to be appropriate governance structures at local and regional levels to manage these assets and build and manage sustainable rural communities.

6.2.2.2.2 Governance

The results of the modelling and variety of possible options highlight the need for greater community self-determination and involvement in planning and development. Although community councils are inclusive (because the whole electorate has the opportunity to elect members and attend meetings), they lack power, authority and responsibility (Wightman, 2011), as their role is to report community views rather than enact decisions and they are unable to manage community assets. On the other hand, development trusts have power and authority to develop community initiatives and enterprises (and have power to act), but can be exclusive in terms of membership and are not democratically accountable.

As community development trusts become more powerful and have a greater impact on the development of the community (e.g., FDT), inclusion is essential for creating a fully accountable and just governing body. A structure, which is democratically accountable to all, is transparent and has power to enact decisions and manage community assets, is essential (Egan, 2004, Baker, 2006). A strict mandate is required to prevent corruption and profiteering from vested interests. This is especially important if large sums of money are involved, as is and has been the case in FDT and KCT, and to ensure that there is fair and inclusive access to community enterprises, participation and decision-making (Harvey, 2005, Didham, 2007, McIntosh, 2008). This requires definition of inclusivity on decision-making processes, actions for encouraging participation of hard to reach groups, and encouragement of greater community involvement from all to make community development decisions representative. The situation in Kinlochleven, when it had no elected representatives (community council) but still had a development trust (the KCT with accountability only to its members), was unjust and risked prejudiced and discriminatory decision-making and dissent. This example suggests the triviality of the current role of a community council, as community development (e.g., planning) in Kinlochleven was able to continue without its existence.

The policy implication is that community governance structures need to be reviewed and revisions enacted to ensure justice, inclusion, sustainability, relocalisation and self-determination and resolve the inappropriate dichotomy of having elected community councils with little power and authority and the nonelected development trusts with little accountability, but, in some instances, significant power for community development. Also, Local Authorities need to be accountable to the elected community bodies, to ensure that each community has adequate service provision and voice. The benefit of decentralising power is that communities can make developments that focus on the needs of each community and that improve multiple aspects of the SCD (Shucksmith, 2010). However, development of capability and sustainable literacy are essential prerequisites, especially in those communities with low social capital (Shucksmith, 2000, 2010, Skerratt and Steinerowski, 2013, see section 2.3.3.2), and offer opportunities for alternative means to developing self-esteem instead of, and counteracting the power of, materialism (see section 6.2.1.4, McIntosh, 2001, Kasser, 2002, 2008, Hobsbawm, 2011). As one focus group participant described their community "*people have a role in their work but not in the place where they live*".

6.2.2.3 Well-being, sustainability literacy, environmental quality and deprivation

Kinlochleven's life satisfaction score is significantly lower than Killin and Fintry. Therefore, future sustainable community development in Kinlochleven needs to incorporate actions to improve life satisfaction and tackle the causes for dissatisfaction, which may be related to other issues already identified, for example, poor health, poverty, poor living accommodation, high crime levels, lack of social capital and poor employment prospects (Scottish Government, 2010b, SNS, 2012). Links of cause and effect between high numbers of long term illnesses and pollution in Kinlochleven is very difficult to prove. Illnesses diagnosed now may have been from pollution from the smelter in the past, or may be a result of poor nutrition and substance abuse (*anon. pers. comm.*, July 2010). Nevertheless, those who worked in the highly polluted areas of the smelter may be most at risk. Further work should be done to determine current cancer rates and to ascertain what chemical, radioactive or heavy metal pollution resides in the local community. This is especially important if more people are to grow their own food and former industrial areas are redeveloped. As already noted, options for increasing sustainability are likely to have a positive impact on well-being if implemented with inclusivity and engagement. Within Kinlochleven, options for improving well-being may be required in addition to and complimentary with, or be a central tenet to, options for improving sustainability. This again illustrates the importance of community-specific and community-led sustainable development.

Sustainability literacy underlies sustainable community development (for the latter, see section 6.2.3). However, as already noted, all the communities' EFBS and EFPS scores were less than four out of ten, and other proxy measures of environmentally-friendly behaviour suggest low levels of environmental behaviour within communities. Yet, over 60% of respondents agreed that that most people in Scotland need to change their way of life, so that future generations can continue to enjoy a good quality of life and environment and in the under 65 age group over 50% of respondents agreed they personally needed to change their way of life (section 4.5, Figure 4.16). This suggests a gap between the realisation of need to change, the ability to make changes and possibly the knowledge of potential alternatives. Moreover, there is little historical evidence that the Scottish education system is creating, in the majority of cases, critical citizens and/or motivated actors, who are literate in sustainability (Ledwith, 2005, Fagan, 2009). The Curriculum for Excellence (CfE) offers greater opportunity, but, as noted in Chapter Two, CfE is too new to be assessed and is reliant upon enlightened educators (Education Scotland, n.d., Fagan, 2009, Priestley and Humes, 2010), who may or may not be sustainability literate.

Community initiatives and policy strategies are needed to further life-long learning for sustainability and create citizens that can think and act reflexively for the benefit of the community rather than themselves. For Killin, this means that they need to enact further their KAT objective to "*advance education and to promote learning for the benefit of the general public… following principles of sustainable development*" (KAT, 2007, p1-2). For other communities, this needs to be enshrined in their community objectives and their LA's education system, and then acted upon. This requires integration of sustainability literacy objectives between departments at local government, for example, education services, community services, planning and countryside services, so that the local governing body's approach is consistent and more effective at delivering sustainability. The role in using existing community groups to promote more sustainable forms of living has already been noted with regard to food.

Integration of principles of sustainability into everyday habits is a prerequisite for developing sustainable communities.

A weakness in this study is the lack of environmental quality measurements for assessing sustainability of land management. DEFRA's (2006) natural environment measures included bird populations, fish stocks, air quality (ammonia, nitrogen oxides, sulphur dioxide and particulates), river quality (biological and chemical), population of 288 priority species, and status of 19 priority habitats. One way of enhancing environmental awareness (helping to achieve a goal of sustainability literacy) is for communities to take control of their own biodiversity goals and take action to monitor, measure and enhance local biodiversity. This is important because "*preservation of local natural capital relies upon the preservation of local social capital - the community - and vice versa. Nature cannot be preserved without the local community/economy that depends on its resources and services, labors to use it well, knows it intimately and passes on the knowledge and values of its sustainability over time. Hence, social capital is central to a functioning, sustainable local economy*" (Curtis, 2003, p87).

The continual and persistent economic decline in the communities is likely to be typical of rural communities across Scotland and needs to be reversed. Failure to reverse the economic decline will lead to further population loss and decline, as what is left of local economies disappears. The economy's relocalisation, which is one of the key priorities identified in the focus groups (Chapter Five), and is a feature of the *"ideal model"* (Baker, 2006), requires a change in attitudes away from jobs that provide individuals with high financial rewards, to lower paid and highly rewarding ones (Schumacher, 1999). However, this change in culture is only likely to happen when actions are taken concomitantly across all aspects of the SCD. Historically, other than tourism in the early 20th century, agriculture was the focus of rural economies, although Killin and Fintry have had mill-based industry and Kinlochleven has only had an industrial past. However, as there is no significant community agriculture, other than Tombreck, in any of the communities, the work required to relocalise food production and services, and create new industry and enterprises within the communities is significant and requires the support of the recipients of goods and services (changing what they consume) and social transformation. Fintry's orchard was achieved only through the action of its development officer and with the financial support of FDT. Many rural communities are much smaller than the ideal self-sufficiency size espoused by the TTM (e.g., Totnes, Devon, Hopkins, 2008). The extent to which rural communities can become sustainable will be dependent on the concomitant development of other local communities with whom services and employment can be shared.

6.2.2.4 Power and capability

Citizen actors are in part a product of their education and their life experiences (Ledwith, 2005). Their skills and competencies are essential to creating sustainable communities. Power is a handy convenience in the context of people relying on power to provide services, jobs and food (Foucault, 1994). People often accept these services uncritically (Sanne, 2002) and then become disempowered and loose resilience because they are reluctant to think for themselves (Booth, 2000, Ledwith, 2005). In this study, there was a contrast in the baseline power to act scores between communities showing that there are different levels of capability for empowerment. Fintry has the most power and capability, which has largely arisen as a direct result of its community renewable energy scheme and the motivated actors, who initiated the negotiations with the developer. The benefits of Fintry's renewable energy for developing the community have already been discussed (section 6.2.2.1) and so this section focuses on insights from the other two communities, whose power and capability contrast with that of Fintry.

The lack of aspiration and volunteer effort in parts of Kinlochleven are likely to be a result of the high levels of deprivation (Maslow, 1954, Ledwith, 2005), the perceived and actual levels of ill-health and/or the loss of the aluminium smelter (Booth, 2000). The smelter occupied the role of the "laird" or landowner as it provided a burgeoning local economy and the community's social infrastructure. The organisation setup to reinvigorate the community (KCT) has not achieved its aims. Using the approach of "*Here we are*" (Here We Are, n.d.), the pollution and "*grief*" (Booth, 2000, n.p.) at the loss of employment need to be recognised, as does the plight of those in deprivation, especially given the physical and mental health and addiction problems within the community. The experience of KCT provides an example of how financial investment without inclusive engagement, support to develop community capability and recognition of the community's injustices (especially relating to energy and land) is ineffective.

Given the lack of motivated and capable actors within Kinlochleven willing to take on the work of Kinlochleven's development, statutory (non-governmental and governmental) agencies had to fill the gap, leading to a non-participatory and paternalistic approach to the formation and development of KCT. A contributing factor might have been the cultural legacy of the historical disempowerment of the paternalistic "factory" and its absentee land-owner, RT-Alcan (Wightman, 2011). KCT may have made more progress in achieving its original objectives today, if it had engaged more of the population at the start (which may have required significant support and training to develop the necessary skills), "*so that they* [might have gained] *the agency and capacity to direct their own local development activities*" (Didham, 2007, p260, as occurred with the Isle of Gigha's community buy-out and to an extent in Fintry and Killin). "*Advocating cooperation, creating vision, and inspiring enthusiasm are held as primary features of establishing experiential learning cycles that support the formation of a culture of sustainability.*" (Didham, 2007, p287). However, at the start when KCT was formed, there was no communal goal, as Gigha had, and it would have been very difficult to gather together the community when it was bereft.

Power to act, comes from the emotional heart of the community. It is founded in McIntosh's triune (McIntosh, 2001), but requires the three dimensions of procedural and distributional justice, responsibilities, rights and recognition, to be enacted (Bulkeley and Fuller, 2011, 2012, McCauley *et al*., 2013). For Kinlochleven to have a healthy vibrant community, recognition of the health problems, deprivation and bleak economic situation, together with the beauty and isolation of their locale and the unique history of their people is necessary. Kinlochleven has many different groups and each group's voice needs recognition. A community engagement project combining praxis such as Community Futures (Roxburgh and Tuffs, 2006) with recognition of the need and creation of common goals and visions for the future is needed. The effort required to create this is not to be under-estimated and may struggle to succeed due to the many different social groups within the community (Skerratt and Steinerowski, 2013). Nevertheless, as the most manifest injustices (Sen, 2010) of the three case study communities are within Kinlochleven, it is important to take action towards resolution. Once goals and visions are agreed, the community has to be given the power to act on its goals in order to thrive. However, sustainable community development requires significant investment in clearly defined projects, restitution of injustices, transfer of property rights to appropriate community bodies where necessary, and new forms of strong and empowered local governance . Obtaining self-sufficiency in energy generation should be one of the goals for the community, but that in itself will not solve the problems in Kinlochleven. Community capacity and aspiration have to be developed alongside projects to develop energy resources within inclusive community development processes.

Killin has a more aspirational culture, many active community organisations and enterprises, but is constrained by a lack of power to act, despite its excellent community planning process. The use of a Community Futures programme approach (Roxburgh and Tuffs, 2006) for the development of their community action plan has created the co-operation, vision and enthusiasm, which are necessary for forming the "*culture of sustainability*" (Didham, 2007, p287). In community planning workshops, KAT has defined clear goals and through this iterative planning process, the community has gained confidence, widened its goals and learnt from the experience. However, in some aspects KAT is struggling to realise their goals; for example, loss of CCF funding for a bid to carry on carbon emission reductions in the village, ceased the operations of KCC (Willie Angus, *pers. comm*., April, 2012); the community would like to develop their own renewable energy, but are struggling with property rights, funding and environmental legislation. Recently, KAT has finally been successful with plans to upgrade Breadalbane Park so that it can be used as a community facility.

Killin has the aspiration and capacity to make changes towards a more sustainable future, but (unlike Fintry) lacks power to take the necessary action. Killin requires redistribution of property rights, such as benefits from the hydroelectricity scheme and proposed biomass scheme, and decision-making powers, such as planning within the community and greater voice and representation at both the local council and National Park Authority.

Fintry, Killin and the Isle of Gigha have built strategies for change with varying degrees of success (Didham, 2007, Chapter Two, Chapter Four, Figure 4.28). Although analysis of the successes and failures of these communities provides valuable lessons and insights for application in other communities, these strategies are not necessarily directly applicable in any other community (section

6.2.1.4). Each community has to frame their own destinies. Motivated actors and community capacity have been essential in developing these communities, but the presence and effectiveness of these attributes require power and voice. In addition, inclusive engagement of local people and bespoke and participatory community development strategies are essential (Ledwith, 2005), such as offered by the Development Pathway to Sustainable Communities (described in section 6.3). Power to enable self-determination, civic engagement, recognition and inclusion positively reinforces the other aspects of the SCD, creating a culture of aspiration and self-sufficiency (McIntosh, 2001).

6.2.3 Limitations of the options for strong sustainability

This study has attempted to take a holistic view of strong sustainability to build rural communities in the image of the "*ideal model"* (Baker, 2006, p30-31). However, the options described above if fully enacted may only achieve Baker's '*strong sustainable development model'* (the penultimate rung of the ladder, Table 2.1). This is because the "*ideal model*" (the top rung of the ladder) requires: the principles of normative sustainability to take "*precedence over pragmatic considerations*; *…decentralisation of political, legal, social and economic institutions; …equitable participation* [with] *…bottom up community structures* [in] *control;* and *…environmental policy integration* [with] *principled priority to the environment"* (Table 2.1, Baker, 2006, p30-31, i.e. a biocentric belief system, Taylor, 1986). Therefore, it is unlikely that the options presented here would achieve the "*ideal model"* unless there is a concomitant fundamental and radical transformation of society and its belief and value systems. Intrinsic valuation of nature is central to the *"ideal model"* of sustainable development (Baker, 2006), making one of the fundamental challenges of creating sustainable communities to be rebuilding a protective or sacred view of the environment ('*dualchas'*, McCarthy, 1999, McIntosh, 2001). Note that this was not assessed in this study and is identified as an opportunity for further research (see Chapter Seven). The intrinsic value of nature has to be central to the belief system, in order to build visions of sustainable futures, in which this is the central tenet (Key and Kerr, 2012) and, therefore, is an unpreventable weakness of this study (this lack of intrinsic valuation of nature may have limited this study's futures envisioning, in which only more environmentally friendly purchasing and gardening practices, and the need for horses to provide transport solutions were articulated) and a challenge for future sustainable community development. This illustrates the importance and need for environmental education and sustainability literacy, to create people who are ecologically aware and have their psyche embedded in their landscape (Key and Kerr, 2012), recreating '*dualchas'* (McCarthy, 1999). A key factor in this is having access to the land to enable the development of community responsibility and stewardship of it. In addition, people need to have the skills, confidence and power to be critical citizens to be able to build more sustainable futures.

Nevertheless, in the focus groups the participants highlighted the need for relocalisation, which is similar to Baker's (2006, p30-31) description of the "*ideal model*" as being spatially bioregional with "*extensive local self-sufficiency*". Increasing social capital is a central part to the achievement of sustainability and is inter-linked with aspiration, voice and empowerment (Warburton 1998, Baker, 2006, Bryden and Geisler, 2007, Dobson, 2010). The potential injustice of opportunities from national development programmes such as LEADER, whereby with communities with highest deprivation and lowest social capital benefit the least from opportunities (Shucksmith, 2000, 2010), was highlighted in Chapter Two. Building community social capital and facilitating development for less sustainable and more deprived communities, such as Kinlochleven, needs to be a policy priority not only to facilitate sustainable development, but also to address injustice.

A change to citizen-led local decision-making, production and social change (Dobson, 2010) appears to be an essential requirement for sustainability. Societal self-questioning may help to overcome our ingrained consumptive behaviour (Jackson and Michaelis, 2003, Ledwith, 2005) and challenge the econocracy and current economic policy (Sanne, 2002, Harvey, 2002, 2006a, Cooper *et al*., 2010). Sustainability literacy is essential for community development (Fagan, 2009). Although re-skilling and re-education were identified in community visions, they were not identified as priorities for the communities. Yet, sustainability literacy and education are essential elements of a sustainable future, and need to be addressed at all levels and ages of education (Martin *et al*., 2013). Changing the awareness and perceptions of those already educated in consumerism and act as uncritical consumers (Sanne, 2002) become significant challenges for achieving sustainability. However, the options present a start for valuing the environment as a highly regarded part of humanity.

Therefore, tackling the economic and societal problems of today requires taking action, not just in one dimension but in all dimensions of society, and using an approach that is built on consensus, grounded in preservation and enhancement of the environment and focused on managing rather than allowing unrestricted access to common resources (Hardin, 1968, 1998). This implies collectivism, consensus, humility, pursuing the common good in preference to the individual, pursuit of wisdom and citizenship, collective as opposed to individual property rights, spirituality and socialism instead of materialism and consumption.

6.3 Recommendations for enabling change

This section completes the objectives of this study by assessing the potential for the SCD to be used as a tool for creating sustainable communities within a process model for enacting change; and identifying policy implications and recommendations for future research.

6.3.1 The SCD as a tool for sustainable community development

The validity and usefulness of the SCD as an effective measure of the sustainability of rural communities has been demonstrated in this study. In this section, how the SCD could be used as an effective practical aid as part of a process for developing sustainable communities is presented. In Chapter Two the Community Futures Programme (Roxburgh and Tuffs, 2006) was presented as a sound framework for community development, but not for achieving sustainability (Handmer and Dovers, 1996, Baker, 2006) and was evidenced by KAT's work in Killin. Combining the Community Futures approach with the SCD framework could provide a mechanism or pathway for achieving community-specific sustainable community development, such as the Development Pathway to Sustainable Communities (DPSC, Figure 6.2).

The first step of the DPSC is baseline sustainability assessment. This study's baseline sustainability assessment results (Figure 4.28) illustrate concisely each community's "where we are" and diversity within rural Scotland. This is important for building a sense of self-worth and for recognising problems and achievements within communities. The SCD is also an aid for communities in understanding their own degree of sustainability. The SCD offers both a portrayal of the dimensions of a community and an opportunity to initiate discussion on those aspects of deepest concern to a community. Failure of one aspect may have ramifications across all other aspects, as a community can be considered to be a complex system (Schuler, 1996, Ledwith, 2005) and the SCD is a representation of that complexity.

As part of the DPSC, the baseline sustainability assessment can be considered as a foundation for change. Taking the time to understand where we are now is important on a number of levels. First, it informs the discussion on where to go from here, why there is a need to change and an appreciation of the wholeness of community in which an individual resides. Secondly, after implementing change projects, it enables an evaluation of progress from the baseline. Thirdly, it is important for the cultivation of a nascent determination and motivation to act, which is a step towards developing greater power within the community to act. Fourthly, it helps develop an individual's link to place, creating roots (counteracting the neo-liberal tendency of "*disembeddedness*", Giddens 1991, p21, Borgström *et al.*, 1999, McCarthy, 1999, Beck, 2000) and providing an opportunity for reflection, both on the state of the community and the individual within the community (encouraging critical thinking is a core aspect of community development and sustainability literacy, Ledwith, 2005, Fagan, 2009).

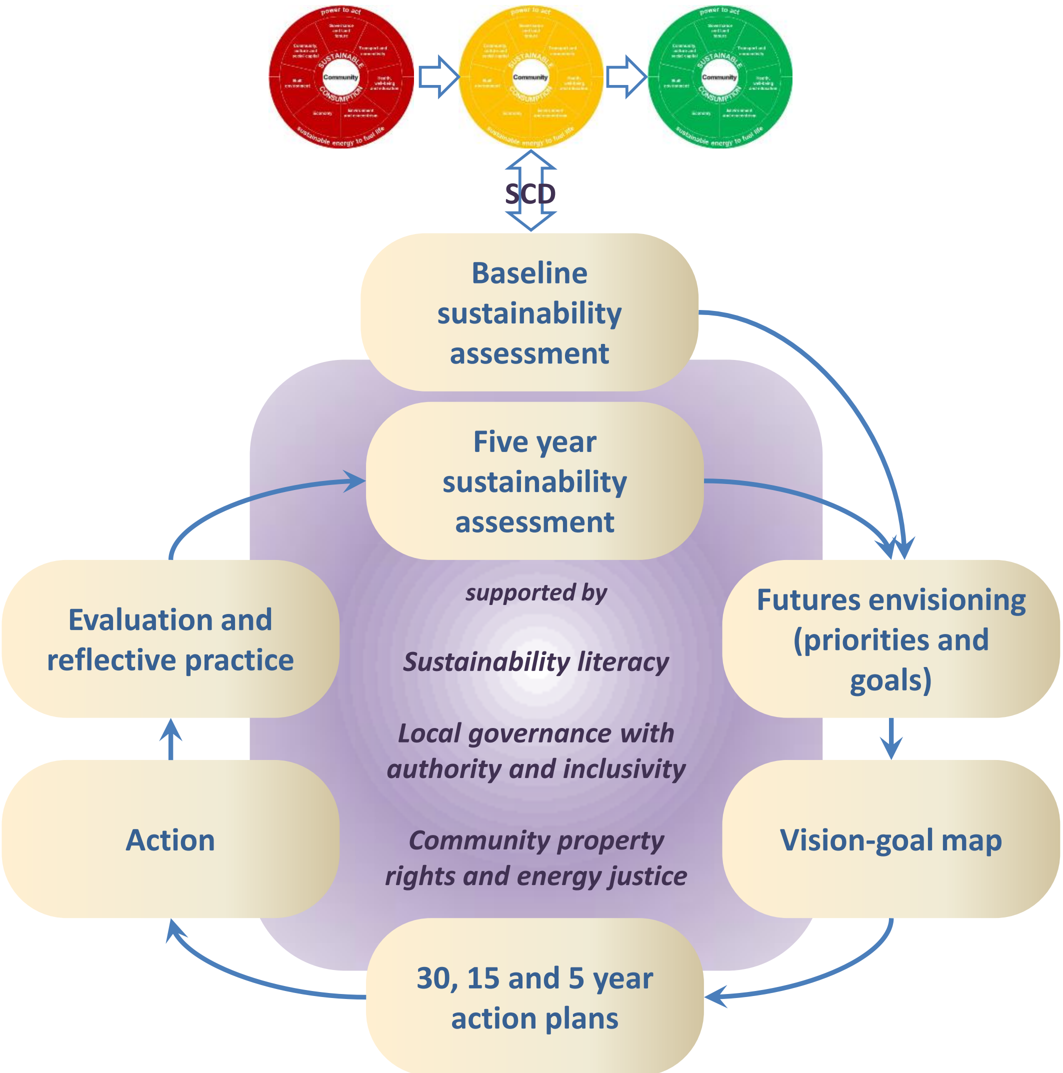


Figure 6.2 The Development Pathway to Sustainable Communities (DPSC, adapted from Stout, 1999, Anderson, 2001, OST, 2002, Dutton *et al.*, 2005, Harvey, 2005, Ledwith, 2005, Hopkins, 2006, 2008, Roxburgh and Tuffs, 2006, Kemp *et al.*, 2007, Fagan, 2009, Wightman, 2011, Bulkeley and Fuller, 2012)

The next step of the DPSC is futures envisioning, which with civic engagement is beneficial to society (Jackson, 2005b, 2007, Wolf *et al*., 2009, Dobson, 2010). Futures envisioning creates a belief that one can positively affect the future and is critical to optimistic thinking, which in itself is a self-fulfilling prophecy, thus increasing well-being. This is important in today's fast-paced society, where "*cultural amnesia*", lack of vision, hope and esteem has led to "*depression, negativity and nihilism*" (Lombardo, 2006, p49). However, to create sustainable visions, sustainability literate facilitators are essential and an understanding of possible options (for example what innovative solutions and technology have worked in other communities) needs to be explored with participants, so that the participants are more informed than in this study's focus groups. The importance of futures envisioning is to create an aspiration of sustainability and a thriving community, as well as identifying goals for development.

The third step is the vision-goal map. Extensive community consultation and engagement should precede the formation and prioritisation of the action plan. The next stage of the DPSC is then to enact the plan and deliver community projects and solutions. The last stage in the DPSC is evaluation, reflection and celebration before moving into the next phase by reassessing the new level of sustainability within the community.

Evaluation and reflective practice are not only essential for the DPSC, but also for creating critical citizens literate in sustainability (Ledwith, 2005). Moreover, local governance and inclusivity assumes competing and conflicting needs are resolved through pragmatic and fair systems of conflict resolution and inclusive debate and decision-making (Harvey, 1996, Sen, 2010, van Gelder, 2011). The DPSC is dependent on competent facilitators and requires LA support. Competent means that they are sustainability and DPSC literate, are able to undertake reflective practice, and are aware of their position of having power over their participants (Ledwith, 2005) and being perceived by participants as extolling a "*higher level of truth*" (Didham, 2007, p244). The DPSC is an opportunity for changing the culture of rural communities to those that are empowered, participatory and inclusive. However, the issues of sustainability literacy, local governance, inclusivity, property rights and energy injustice (outlined in section 6.2.2 and shown in the centre of Figure 6.2) need to be resolved. The skill and capacity development and governance procedural changes required to reach this level of wisdom, competency and empowerment should not be under-estimated.

The sustainable futures envisioning, the vision-goal map, actions plans, reflective practice and inclusive participation and governance were omitted from Kinlochleven's initial development planning process. This may well have contributed to the difficulties KCT has had in achieving its original objectives. Community participation in the DPSC offers opportunity for civic engagement, which is an essential element of creating transformation to sustainability, countering individualism and materialism and developing environmental citizens, who are concerned with public rather than self-interest (Jackson, 2007, Dobson, 2010). The DPSC provides a framework for community change, which is more effective than individual change (Jackson, 2005b, 2007, Wolf *et al*., 2009, Dobson, 2010).

In policy circles, Fintry is held as a model for development (e.g., Julian and Dobson, 2012), but inclusivity has been achieved through implementation of projects (e.g., home insulation), in the absence of participatory strategy, design and decision-making. Therefore, Fintry would be an ideal candidate for an inclusive community development, using a process such as the DPSC. The advantage of the DPSC is that it enables community-specific development. Rural Scottish communities are diverse. This diversity exemplifies the problem with centralised policy-making where "one size fits all" and suggests that to create sustainable communities, policy-making has to facilitate an approach that allows and builds upon diversity and difference. This is a key element driving the recommendations for rural policy and community development made in this chapter and is a foundation for building community-led and community-specific sustainable development processes.

6.3.2 Recommendations for further research

The next step for this research is to explore the opportunities for and effectiveness of using the DPSC and SCD scorecard approach both at community and regional levels. At regional levels, the SCD can be used as a tool for monitoring, evaluating and reflecting on progress, as well as for developing regional action plans to support the DPSC. The most effective method would be to use an action research approach, where members of the community are involved in developing the project and the research. Given the baseline sustainability assessment has been done and options identified from the focus groups and modelling, the most appropriate communities to take this on would be those in the case study themselves.

As discussed in section 6.2.1, the SCD scorecards have not been reviewed by the communities themselves and addressing this is a recommendation of this study. The options evaluated in the modelling also have not been reviewed by the communities for practicality, acceptability, benefits and interdependencies, indicating the need for engagement to further the development of the options.

The SCD scorecard has been successful in being sufficiently sensitive to measure differences in sustainability between three communities and demonstrating the extensive multiplicity and variance in sustainability within each community. Thus, the next stage of research should investigate the applicability of the SCD across rural communities in Scotland and the rest of Europe. This would be useful to tease out nuances in different cultural settings and would test its repeatability.

A limitation for future research using the SCD scorecard would be the availability of secondary data at the regional and community level in international contexts. The availability of GFN's (2012) EF accounts for the UK and the apportionment across FDCs within REAP (SEI, 2011a) have facilitated the assessment of sustainability consumption in this study. Alternative indicators and associated secondary data and alternative tools for EF calculation may have to be identified in other countries and a simplification of the range of data required to justify assessments in certain aspects (e.g., sustainable consumption) may be appropriate. As discussed in section 6.1.1.4, more detailed classification may be required to reduce the risk of subjectivity and bias in scoring of sustainability in future studies.

Further research is also necessary to understand, for example, the most sustainable food stuffs, best modes of transport (for long distance travel) and develop the most appropriate community indicators for biodiversity. The research results would then require integration into community sustainability education and assessments of sustainability.

Biodiversity enhancement should be a community objective and project, used to inform regional (LA) objectives and help recreate the community's link with the land. Valuation of nature is central to the "*ideal model*" of sustainable development (Baker, 2006), making one of the fundamental challenges of creating sustainable communities to be rebuilding a protective or sacred view of the environment ('*dualchas*', McCarthy, 1999, McIntosh, 2001). How communities can create visions and plans for a sustainable future when the majority in a community is sustainability illiterate is uncertain. The Natural Change project (Key and Kerr 2011, 2012) has demonstrated how nature can influence attitudes and value and belief systems. Further research is required into the interventions required to achieve this in practice and the degree of ecocentrism required to act pro-environmentally. Also further research is required into the success of the CfE for creating citizens literate in sustainability and the best strategies for life-long learning.

As a result of the holistic nature of this study, there are multiple opportunities for further research. The most important is to further the use of the SCD scorecard for the development of sustainable rural communities.

6.3.3 Policy implications

The key policy recommendations identified in this study can be summarised as follows:

- Deliver sustainable community development by making LAs responsible for overseeing and enabling regional sustainable community development. Sustainable communities (developed using approaches such as the DPSC and evaluated through the SCD scorecard) become a goal of LAs and community development officers are present in all communities.

- Transfer property rights to enable community renewable energy developments, community agriculture, sustainable housing, industrial space, and community ownership and access to the land. For existing and future commercial renewable energy developments, all developments deliver the minimum benefit (compensation) of £5,000/MW installed capacity per annum. Embedded within this are sound programmes for addressing injustice and creating fair decisions in situations of competing and conflicting needs. All new renewable energy developments have a community component. Community developments are prioritised ahead of commercial and private developments. The recommendations of the energy injustice analysis (Table 6.1) are taken forward.

- Relocalise the economy, consumption, production and service provision. The LA, with community councils and development officers, actively promote and develop comprehensive regional and local food chains and production/consumption networks.

- Ecocentric attitudes need to be enshrined within the legislative framework (UNITAS, 2010) to support attitude changes to ecocentrism and sustainability.

- This should be facilitated by incorporation of strong sustainability within the curriculum and new methods of engagement for life-long learning. Therefore, with urgency, sustainability literacy must be an integral and major part of children's and life-long education. This has to integrated not only with an appreciation and valuing of the local environment, but also the development of the competencies of critical citizens who take responsibility to engage.

- Change transport policy to deliver the switch to electric and hybrid transport, powered by renewable energy. Penalise individual car ownership, only after the implementation of incentivised community transport, car share and car lift share schemes. Place severe restrictions on air travel. Plan a co-ordinated transport system to meet the needs of rural communities with the aim of reducing the ecological impact of transport by 80%.

- Change community governance structures to enable democratically elected bodies to make decisions on planning, renewable energy and sustainable development activities and manage community assets. Community councillors form part of the LA council. The dichotomy between the powers of and inclusivity of the community development trusts and community councils is resolved. New ways of participatory democracy are explored to ensure inclusivity and resolution of competing needs and injustice (e.g., "*stirring*" committees, Didham, 2007, p19, consensual decision-making, van Gelder, 2011).

- Change building regulations for new properties such that all buildings must be built to Passivhaus standard with sustainable materials. Appoint community energy officers to deliver community-wide retrofitting of houses up to near-Passivhaus standard, using bulk purchasing and incentive schemes. All private-rented property has to be retrofitted by law.

- Change health and safety legislation appropriately to foster and support local production (e.g., abattoirs, dairy production).

- Enact changes to land management practices for biodiversity, local production and sustainability, which will require legislation to restrict pesticide use and promote environmentally friendly alternatives and prohibit the use of peat for horticulture and fuel.

Policies relating to transfer of property rights and changes to land management practices are complex in terms of restitutive justice (Sen, 2010), competing needs and reasons for change. Given that the current landscape is a result of human land management over millennia (Smout and Wood, 1991, Habron, 1998, Holl and Smith, 2007), the most appropriate land management for the combined goals of biodiversity and carbon storage (Reed *et al.*, 2009, Billett *et al.*, 2010) and cultural, economic, energy and justice needs, will require significant changes to current land management practices and to the landscape. These competing and conflicting needs (e.g., current landowner economic benefit versus sustainable community agriculture (local food production), renewable energy generation, landscape amenity and biodiversity enhancement) require not only careful deliberation in participatory decision-making processes, but also mechanisms for creating just solutions that are enshrined in the community governance structures (Didham, 2007, van Gelder, 2011). Moreover, the community governing bodies need the appropriate power and authority to make these decisions (Baker, 2006, Wightman, 2011) and also the mechanisms for evaluating and reflecting the fairness of decisions made and ensuring that they acted responsibly.

As already noted, the current community council and community development trust structures are inadequate. Further work is required to design and create better frameworks for local governance, based on the experience of the past (e.g., Burghs, Wightman, 2011), and innovation from stakeholder engagement (Costanza *et al.*, 2002) and alternatives to representative democracy (e.g., “*stirring*” committees, Didham, 2007, p19, and consensus decision-making, van Gelder, 2011). Inclusivity, participation and fairness should be the central tenets of any such structure. Underlying the need for relocalisation, identified in the focus groups, was a need to enhance community capacity and capability. Concomitant building of community capacity and individual capability at managing community assets should go hand in hand with increased local (community-level) authority to make and enact decisions (e.g., planning).

UK approaches to tackling climate change have been criticised for being “*ameliorative*” and “*tokenistic*” (Ledwith, 2005, p94), focusing on individual responsibility for behaviour change and for taking an approach that is anthropocentric and neoliberal, instead of tackling the root causes of injustice and GHG emissions. Although the Scottish Government has set high targets for addressing climate change (Scottish Parliament, 2009, Scottish Government, 2013a), the targets may not be achieved solely by individual behaviour change unless a different approach, focusing on community and incorporating the recommendations of this study, is promoted alongside macro-level policy for emissions’ reduction. Policies such as raising building standards are an opportunity for government to illustrate its commitment to both climate change and sustainability objectives and would prevent some of the frustration with policy articulated in focus groups. At LA level, using the SCD and DPSC as a tool would present an opportunity to move community development towards strong sustainable development. Significant skilled support would be required and reflective practice, local facilitator competency development and inclusivity would be essential (Shucksmith and Philip, 2000, Shucksmith, 2004, Ledwith, 2005).

The results of this study (especially with regard to energy (in)justice) can be argued to be compelling, convincing and robust as the stakeholders (communities) have been involved in the process of building future visions and identifying injustice (Costanza *et al.*, 2002). The overall scorecard results show that the three communities are largely unsustainable and this is universal for the aspects of sustainable consumption, transport and connectivity, and economy (Figure 4.28). This suggests that rural communities across Scotland are unlikely to thrive in the future unless action is taken now to transform society. Action is required at all levels (individual through to global policy) with interventions for all aspects, from socio-economic policy through to education (sustainable literacy) and infrastructure and the econocracy to transform individual behaviour choices into collective responsibility.

If the concepts of capability, justice and power are adjoined to sustainable development, then a fuller critique of society, the quality of that society and identification of means to improve the future of that society is possible. This has been demonstrated in this study. In addition definitions of sustainable development do not encompass reflectivity (Jacob, 1997), yet to enable societies to be sustainable, reflexivity is likely to be essential (Ledwith, 2005). Therefore, there is opportunity to build on the strengths of both and so strong sustainable community development should be both an extension to and integration of sustainable development and community development.

In this study the SCD has demonstrated that it can be used as a measure of sustainable community development. Tools such as sustainability assessments, visioning, back-casting and exploration of multiple options will need to involve all stakeholders in a society-wide transformation. The approach used in this study for envisioning futures is participatory (rather than action research). Action research is done by participants for themselves, rather than a third party researcher and aims to generate action for human betterment by building on existing experience (Ramos, 2006a, 2006b). Due to the novelty, uncertainty and complexity of technology and innovations (which were more acute in 2005 at the start of this study with less well-developed solutions, such as GSHPs, biomass boilers and electric cars) and this being interwoven with community sustainable development needs, a participatory approach was taken. The intention of this study was to identify options to reduce the uncertainty and complexity and make recommendations for the way forward for rural communities. The next step is to use these recommendations with action research and build community sustainability through praxis (Ledwith, 2005).

A total re-think is required to create a society able to cope with the concomitant crises we have created (Holmgren, 2009). Community (grassroots) action has been cited as a way of creating new ways to negate or challenge unsustainable behaviour (Shucksmith and Rønningen, 2011) and analysis of injustice at this level informs and exposes the greater whole of injustice in society – the scale problem, governance and political will problem (Scholsberg, 2004).

It is impossible to separate economics from the wider geography and socio-cultural and ecological dimensions of society. Economics is a necessary part of the change required, but to consider it alone is detrimental to society (Harvey, 2005, Hobsbawm, 2011). The policy interventions outlined in this section combined with a switch to community action could provide opportunities for a better future. Community initiatives have the potential to be powerful agents of change (Foucault, 1994). Integrating community sustainable development to changes in national and global society has the potential to create *"transformative change*" (Ledwith, 2005, p104), ameliorating the concomitant socio-economic and ecological crises, overthrowing the coercive and apathy-inducing power within society (McIntosh, 2001, Sanne, 2002, Hobsbawm, 2011) and creating thriving communities.

Chapter 7 Conclusion

Seven objectives were identified at the start of this study (Chapter One), in order to explore the options for creating sustainable communities in rural Scotland. The first objective was to define a sustainable community and develop a holistic framework, which encapsulated the multiple dimensions of a sustainable community. Although the WCED (1987) definition of sustainable development continues to be the accepted meaning of the term, in application both sustainable development and sustainability have multiple meanings in their current usage and frequently do not address the multi-dimensional or dynamic nature of community (Ledwith, 2005, Robinson, 2008, Shucksmith and Rønningen, 2011). Baker's (2006) "*Ladder of Sustainable Development*" tackles the ambiguities of weak and strong definitions of sustainable development (Pearce, 1989, Neumayer, 2003). However, on comparison with sustainable communities' philosophies (e.g., One Planet Living, BioRegional, 2013, permaculture, Holmgren, 2002, and the Egan Review's "*Components of sustainable communities*", Egan, 2004, p19), both Baker's (2006) "*Ladder*" and these philosophies were found to be inadequate in capturing the multi-dimensional nature of a sustainable community. Therefore, a new definition of sustainable community was enunciated and then explicated in the sustainable community design (SCD). The SCD framework was refined based on practice (experiences of community development in, for example, Findhorn, the Isle of Gigha, and BedZED) and issues of property rights, power, aspiration and energy injustice identified both in the literature review and in this study.

The literature review highlighted the opportunities and challenges for and gaps in knowledge with regard to the sustainability of rural Scottish communities (fulfilling the second objective). The review identified the global and local forces, policies, institutions and macro-level infrastructure, which are compelling societal change and are influencing the expression of unsustainable behaviour, even when attitudes may be pro-environmental. Energy injustice, rural deprivation, '*dualchas'* (McCarthy, 1999), the conflict between environmental stewardship and economic benefits, and the unfair distribution in the ownership of land were identified. Neither a holistic study measuring the sustainability of Scottish rural communities, nor a holistic model encompassing all aspects of sustainable communities could be found. In addition, there was a lack of knowledge of potential options for sustainable futures and the experience of energy justice (and its benefits) and injustice in rural Scotland.

In order to address these gaps a multi-scale, multi-method and interdisciplinary form of study was required. A four stage mixed method approach was designed and permitted open and exploratory scientific enquiry, challenging the reductionist approach to science and knowledge acquisition, which is characteristic of industrial cultures (Holmgren, 2002). The four stages were: quantitative and qualitative measurement of baseline sustainability (the third objective), participatory futures envisioning (the fourth objective), modelling scenarios of sustainability (the fifth objective) and creating meaning (including the analysis of overarching issues) from the enquiry (the seventh objective). The sixth objective was to evaluate this methodology. Three diverse case studies (which differed, for example, in deprivation, remoteness, history, structure, resources, social capital and land-use) were selected in order to test the sensitivity of the baseline sustainability assessment methodology and explore a range of options for future community sustainability. The case studies selected were Fintry and Killin in Stirlingshire and Kinlochleven in Argyll.

Measurement of case study baseline sustainability was done using the SCD framework. To address the multiple non-commensurate dimensions of the SCD and enable visual interpretation of the results, a scorecard approach was used to evaluate each community's sustainability. Evidence for the assessment came from household questionnaire surveys, observations and secondary data. Ecological sustainability of consumption was measured by ecological footprint (EF) analysis using Stockholm Environment Institute's Resources and Energy Analysis Programme (REAPv2.17). The combination of using EF analysis and the 2008 value of the Earth's available biocapacity (the fairshare) as an index enabled both the ecological sustainability of baseline consumption of each community to be estimated and future options to be modelled.

The SCD traffic light scorecard sustainability assessment of the three rural communities, Fintry, Kinlochleven and Killin, showed that none of the three communities were sustainable in all dimensions. Fintry was the most sustainable with only three dimensions being unsustainable (transport and connectivity, consumption and economy). Killin had five unsustainable dimensions (built environment and energy to fuel life in addition to those of Fintry). Fintry's, and to a lesser extent Killin's, SCD scorecard results contrast with those of

Kinlochleven, which was unsustainable in all dimensions. The SCD scorecard approach identified Kinlochleven's deprivation and lack of power, property rights, capability and social capital within the community (identified in the SCD aspects: energy to fuel life; power to act; governance and land tenure; and health, well-being and education). The results of the baseline sustainability assessment demonstrated the sensitivity of the SCD scorecard approach to assessment by identifying inter- and intra-community differences in levels of sustainability. Given the success of the SCD scorecard approach in identifying these nuances in rural communities' sustainability in Scotland, the SCD should be tested and applied in other countries where rural communities are struggling to thrive and flourish (e.g., across Europe).

The fourth objective of this study was to use futures' envisioning to identify community views of options for their community to thrive and be sustainable in a resource-constrained future. Community-specific visions of 2030 were created in participatory focus groups. Key features of the 2030 visions were relocalisation, vibrancy, community renewable energy, transformation in mobility and co-operative enterprises. These visions contributed to the development of narratives for the community-specific modelling of options for transport and energy, and regional modelling of food production and consumption, facilitating the achievement of the fifth objective of this study.

To identify the extent of change required to achieve sustainable consumption scenarios were created for three different levels of change from small changes to transformation. The sustainability of the scenarios was assessed using EF analysis with the fairshare as a gauge of strong sustainability. The modelling in REAPv2.17 (SEI, 2011a) of different levels of change for transport illustrated that, to achieve a sustainable transport EF (one which equated to 20% or less of the fairshare), the most significant changes to mobility and transport were needed in Fintry. Nevertheless, in all three communities, a switch to electric cars powered by renewable (as opposed to conventional) electricity, infrastructure developments, greatly reduced mobility (e.g., virtually no flying) and vehicle journeys with high occupancy were found to be essential to reduce the transport EF to a sustainable level. If all cars were switched to electric cars, the additional electricity consumption to power electric cars would be significant, but unlikely to be more than current household consumption, especially in the scenarios of reduced vehicle use. However, given that current electricity generation by renewables is such a small part of the current electricity generation mix (DECC, 2012), the challenge to meet the whole of society's demand for renewables is likely to be a very significant challenge. A switch to wholesale adoption of electric cars powered by renewables would be insufficient to achieve a sustainable transport EF. Therefore, transportation is likely to be reduced and changed to shared rather than individual transportation, requiring infrastructure development, changes to policy and changes in modes of transport from single car use to community transport, car sharing, using bicycles and walking and provision of local renewable energy supplies. Walking and cycling and more co-operative forms of travel are likely to increase both health and well-being and social capital. This combined with increasing awareness of the impact of travel, may increase ecological awareness, which increases self-esteem (Kasser, 2008, Key and Kerr, 2012).

In the absence of detailed community food data, different options for food production and consumption were modelled using LA data. The food modelling suggested that decreasing the amount of consumption of less healthy foods and switching to sustainable forms of community agriculture would have the greatest impact on reducing the unsustainable ecological footprint of food. The benefits arising from community agriculture would be multiple, providing opportunities for local employment, building social capital, improving health, well-being and "*recreating the link with the land*" (Killin focus group respondent, November, 2010), i.e. "*dualchas*", (McCarthy, 1999, Key and Kerr, 2012).

The modelling of energy futures identified the need for a widespread retro-fit of homes and installation of renewable heating solutions, providing economic opportunities for rural communities. However, reskilling of builders and engineers would be significant and require a strong legislative planning framework as well as substantial funds to pay for the significant infrastructure development. In addition, investigation of the impact of switching national electricity generation in REAPv2.17 (SEI, 2011a) to one which was based on renewables rather than the current electricity mix, supported Alderson *et al.*'s (2012) assumption that renewable electricity generation has an EF approximately 10% of that of the current electricity generation mix.

To summarise the modelling, it suggested that with technological change, relocalisation and a reversal of globalisation and its attributes to a more collective and responsible society, it is possible for Scottish society to live in the future within the current fairshare of the planet's available biocapacity. However, the significance and radical nature of the transformation required, and the actions needed to support it, should not be underestimated.

The fourth stage of the methods related to the identification of overarching issues. The major issue identified was energy injustice and, following its discovery in 2010 during field research in Kinlochleven and Killin, its significance required incorporation within the objectives and the SCD. Energy injustice arises when the abundant renewable energy opportunities are being developed mainly by commercial enterprises with no or small benefits (compensation for opportunity lost) accruing to communities. Fintry's experience owning its own turbine illustrated that community renewable energy is not just a way of meeting rural energy needs, but also for developing sustainable communities, by catalysing community action, building capacity and providing income for community initiatives. Comparison of Fintry's renewable energy development with those of Killin and Kinlochleven revealed injustice, which was manifested with the communities not receiving the appropriate level of benefits or being insufficiently engaged in the development of local opportunities. Bulkeley and Fuller's (2011, 2012) responsibility, rights and recognition framework of distributive and procedural justice enabled analysis and the detailing of recommendations for change. In the literature the model had only been applied for analysing climate justice (Bulkeley and Fuller, 2012). The analysis concluded that energy injustice is a reflection of the polarisation of land assets in Scotland, existing inequalities in social structures and in the distribution and control of natural resources and renewable energy developments. Therefore, it was recommended that transfer of renewable energy and property rights to communities should be a central part of government policy, but supported by strong and targeted capability and sustainability development, new community governance structures (with enhanced constitution and powers), and sound mechanisms to resolve injustice (Sen, 2010).

The options identified from this study are multiple and highly interconnected and interdependent, rather like threads that are woven in a tapestry. The development of options for sustainability is specific to the needs of each community and thus requires a sound process of community development to create, prioritise and implement community-specific options. In this study, the Development Pathway to Sustainable Communities (DPSC) has been presented as one such model to facilitate the overarching aim of this study to improve the sustainability of rural communities. The combination of the DPSC with the SCD scorecard approach to assess sustainability offers a tool for government organisations to facilitate, measure, monitor and target sustainable community development. The SCD provides the holistic framework to ensure that all aspects of a community are encompassed in envisioning, planning and taking action to achieve sustainability. Therefore, a key research and policy recommendation is to implement the DPSC model within local government and communities across rural Scotland.

The sixth objective was to evaluate the methodology. An assessment of the results suggested that the findings presented in this study are reasonable and robust. The benefit of this interdisciplinary approach was that the multi-dimensional nature of a sustainable rural community was revealed; for example without this holistic approach and mixed methods, in particular the use of focus groups, the overarching issue of energy injustice may not have been identified. The methodology permitted cross-fertilisation of ideas and data between different stages of the research. Two limitations of this approach are its repeatability, but that needs to be tested in future research, and, for the SCD scorecard, its dependency on secondary data for fulfilling many of the SCD indicators and REAPv2.17 (SEI, 2011a) for providing EF accounting and regional proxy data. The latter would provide a challenge for extending and testing the approach in other countries, and so the indicators used to populate the SCD scorecards would need to be revisited.

As part of the baseline sustainability measurement (SCD aspect: power to act), whether communities had the power and capability to enact change was assessed. The implications of a lack of power, property rights and capability were considered in the penultimate chapter and together with other insights and options identified in this study, fed into the recommendations for policy-makers. Understanding power and influence is a way to empowerment and influence is a key to re-empowering communities (McIntosh, 2008). Therefore, changing society is not just about changing economic theory and rebuilding community, but it is also about redistributing the power base and, transforming the powerful accumulators into facilitators of social and environmental justice and into creators of meaningful work (Schumacher, 1999), and they themselves living sustainably (Hamm, 2010, Peck, 2010).

To explore the options for creating sustainable communities in rural Scotland, this study has taken a holistic approach, which has necessitated a multi-scale, multi-method and interdisciplinary form of study, creating multiple threads of evidence, insight and understanding. These threads have been examined and then woven together, revealing a novel map of factors that create options for sustainable communities. The baseline sustainability assessment provides the foundation for the discussion, as its multiplicity informs 'where we are', 'where we need to go', the opportunities that can catalyse change and the constraints that have to be removed to move forward.

This study demonstrates that integration of quantitative and qualitative measurements of sustainable development, futures envisioning and critical theory is possible and that this both provides greater opportunity for broad and exploratory investigation and gives greater insight and meaning than any one of the approaches alone. Not only is this research providing insight to the nature of sustainable communities, but also is pioneering the use of integrated methods and geography as a holistic research approach for sustainability.

The pressures facing and challenges for rural communities in Scotland range from global to local issues. Continuing trends of decline and realisation of ecological crises may compromise the ability of rural communities to not just thrive but survive in the future. Given the diversity of communities, options for sustainable communities need to be defined by the communities themselves. This requires action to address sustainability literacy, engagement to create community sustainability visions and plans, and policy-makers' recognition of the need to support, promote, evaluate effectiveness and appraise regional sustainability and enact radical policy to address the most unsustainable forms of consumption. The SCD provides a mechanism and approach to create strategies to enhance critical aspects of each community's sustainability, thus tackling activities that worsen global warming and socio-economic and ecological decline. Essential to our future is the creation of sustainable societies, which are positive about their roles, can determine their future, can foster collective well-being, are founded on wisdom, consider their past and are reflexive in implementation. Success requires radical action by policy-makers to enact transformation, such as re-aligning property rights to communities and changing socio-economic theory to an ecocentric and socially just sustainable society.

In creating options for sustainable futures for rural communities and a framework for their evaluation and integration into the process of sustainable community development, this study is contributing to the reinvention of geography's role in society. This study articulated a strong definition of sustainability, to which all communities and governments should aspire. Although this definition may be more an ideal, the importance of envisioning and taking transformational actions aimed at achieving sustainable rural communities cannot be understated: thus, creating aspiration, resolving rural Scotland's most manifest injustices and achieving sustainable development in

Scotland. This study has taken a significant step forward in contributing to knowledge of creating options for rural sustainable communities and should be used as an opportunity to further the development of sustainable communities both in Scotland and abroad.

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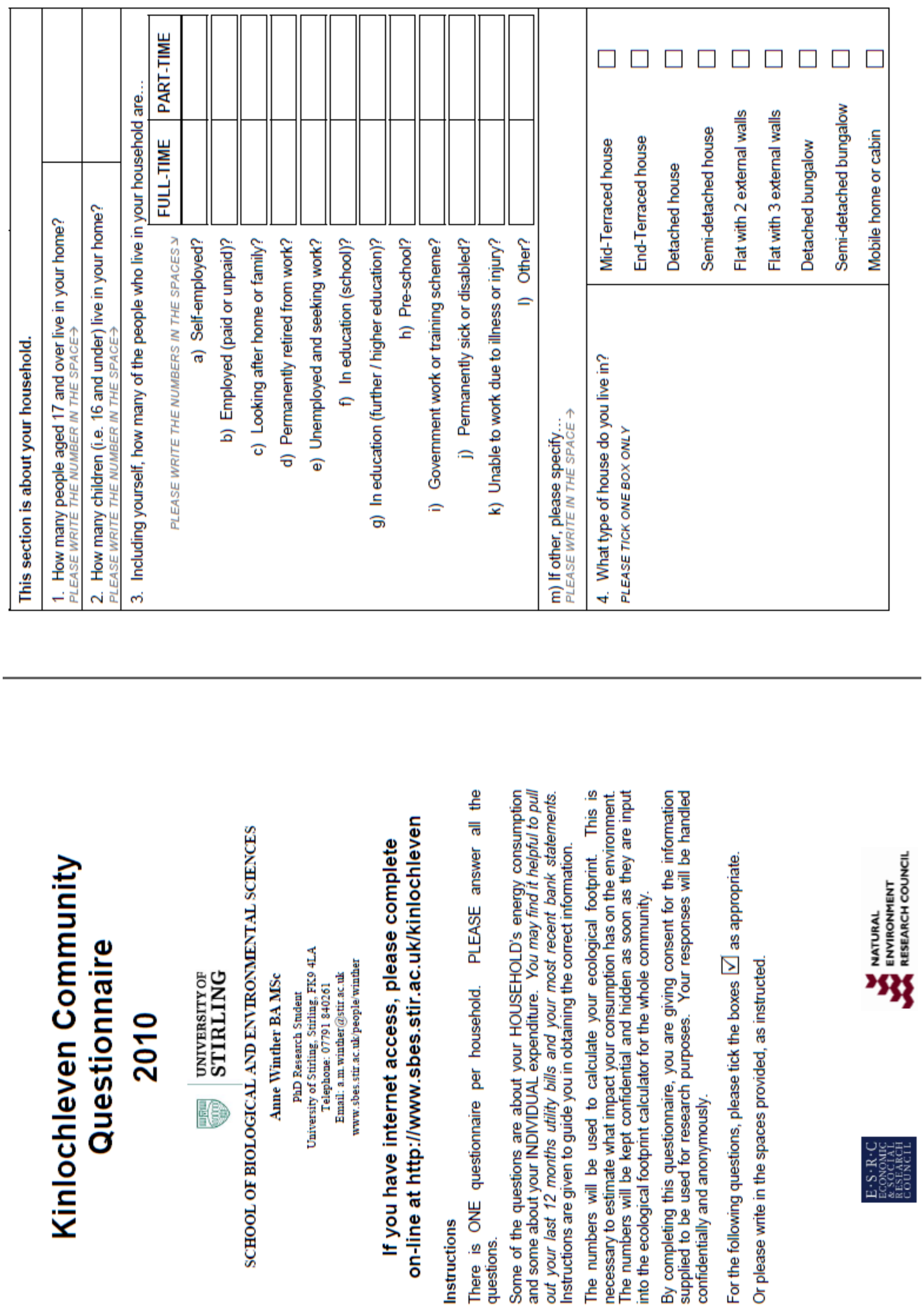
Appendices

Appendix A Methodology and data analysis

A.1 Household questionnaire documentation


This section is about your household.

1. How many people aged 17 and over live in your home?
PLEASE WRITE THE NUMBER IN THE SPACE→

2. How many children (i.e. 16 and under) live in your home?
PLEASE WRITE THE NUMBER IN THE SPACE→

3. Including yourself, how many of the people who live in your household are…
PLEASE WRITE THE NUMBERS IN THE SPACES↘

	FULL-TIME	PART-TIME
a) Self-employed?		
b) Employed (paid or unpaid)?		
c) Looking after home or family?		
d) Permanently retired from work?		
e) Unemployed and seeking work?		
f) In education (school)?		
g) In education (further / higher education)?		
h) Pre-school?		
i) Government work or training scheme?		
j) Permanently sick or disabled?		
k) Unable to work due to illness or injury?		
l) Other?		

m) If other, please specify…
PLEASE WRITE IN THE SPACE →

4. What type of house do you live in?
PLEASE TICK ONE BOX ONLY

- Mid-Terraced house ☐
- End-Terraced house ☐
- Detached house ☐
- Semi-detached house ☐
- Flat with 2 external walls ☐
- Flat with 3 external walls ☐
- Detached bungalow ☐
- Semi-detached bungalow ☐
- Mobile home or cabin ☐

Kinlochleven Community Questionnaire 2010

UNIVERSITY OF STIRLING

SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

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If you have internet access, please complete on-line at http://www.sbes.stir.ac.uk/kinlochleven

Instructions

There is ONE questionnaire per household. PLEASE answer all the questions.

Some of the questions are about your HOUSEHOLD's energy consumption and some about your INDIVIDUAL expenditure. *You may find it helpful to pull out your last 12 months utility bills and your most recent bank statements.* Instructions are given to guide you in obtaining the correct information.

The numbers will be used to calculate your ecological footprint. This is necessary to estimate what impact your consumption has on the environment. The numbers will be kept confidential and hidden as soon as they are input into the ecological footprint calculator for the whole community.

By completing this questionnaire, you are giving consent for the information supplied to be used for research purposes. Your responses will be handled confidentially and anonymously.

For the following questions, please tick the boxes ☑ as appropriate.

Or please write in the spaces provided, as instructed.

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

Figure A.1 Kinlochleven household questionnaire

5. How many bedrooms are in your house? PLEASE WRITE THE NUMBER IN THE SPACE→	
6. How long have you lived in Kinlochleven? PLEASE TICK ONE BOX ONLY	Less than a year ☐ 1-5 years ☐ 5-15 years ☐ Over 15 years ☐
7. How old is your house? PLEASE TICK ONE BOX ONLY	Pre 1930 ☐ 1930-1995 ☐ Post 1995 ☐
Now some questions about your home… **First there are some questions about your heating and electricity usage.**	
8. How do you heat your home and hot water? SELECT AS MANY THAT APPLY	Electricity ☐ Gas or LPG ☐ Oil ☐ Wood or biomass ☐ Coal ☐ Heat pump ☐ Peat ☐ Other – please specify below ☐
a) Other – please specify:	
From your bills for the last YEAR, please enter your total:	
9. Cost or litres used in the last 12 months of LPG or gas PLEASE ENTER DETAILS FOR ONE BOX ONLY	£ litres per year

10. Cost or litres used in the last 12 months of oil PLEASE ENTER DETAILS FOR ONE BOX ONLY	£ litres per year
11. Cost or kWh used in the last 12 months of electricity PLEASE ENTER DETAILS FOR ONE BOX ONLY	£ kWh per year
12. Total amount of wood consumed in tonnes in the last 12 months PLEASE ENTER DETAILS IN THE BOX	Tonnes
13. Number of bags or amount in tonnes of coal that you used in the last 12 months PLEASE ENTER DETAILS FOR ONE BOX ONLY	Bags Tonnes
14. The number of blocks or cost of peat that you used in the last 12 months PLEASE ENTER DETAILS FOR ONE BOX ONLY	£ Blocks
15. Does your electricity come from 'Green' sources (i.e. from a renewables company or as a "green tariff". If you are unsure, then please answer, "No".)? PLEASE TICK ONE BOX ONLY	Yes ☐ No ☐
16. Do you generate your own electricity? PLEASE TICK ONE BOX ONLY	Yes ☐ No ☐
17. If yes, please give details…	
Light bulbs *For Q18 and Q19, think of each room in your house and your outside lighting and count both the total number of light bulbs and the number of energy-saving in each location.*	
18. How many light bulbs do you have in total? PLEASE WRITE THE NUMBER IN THE SPACE→	

Figure A.1 Kinlochleven household questionnaire (continued)

19. How many of your light bulbs are energy-saving? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
20. How often do you turn off lights and appliances when not in use? *PLEASE TICK ONE BOX ONLY*	Never ☐ Some of the time ☐ Most of the time ☐ Always ☐

21. Do you have any of the following installed…	None	Some (5-15cm)	Full (15-30cm)
a) Loft insulation	☐	☐	☐
	None	Some	Full
b) Cavity or other wall insulation	☐	☐	☐
c) Underfloor insulation	☐	☐	☐
d) Double glazing	☐	☐	☐
e) Draught exclusion	☐	☐	☐
f) Condensing boiler	☐	☐	☐
g) Hot water tank insulation (foam jacket)	☐	☐	☐
h) External wall insulation	☐	☐	☐

22. At what temperature do you typically run your heating? Please check your thermostat setting if you have one. *PLEASE TICK ONE BOX ONLY*	25°C (77°F) and above ☐ 21-24°C (71-76°F) ☐ 19-21°C (65-70°F) ☐ 15-18°C (59-64°F) ☐ Less than 14°C (58°F) ☐ No temperature control ☐ Don't know ☐

23. Do you have any of the following renewable technologies installed? *SELECT AS MANY THAT APPLY*	Hydro ☐ Wood or biomass boiler (NOT coal or peat) ☐ Ground source heat pump ☐ Solar hot water ☐ Passive solar heating ☐ Photovoltaic panels ☐ Wind turbine ☐ Wood stove with back boiler ☐ Wood stove without back boiler ☐
Now some questions about your appliances…	
24. How old is your washing machine? *PLEASE TICK ONE BOX ONLY*	Less than 3 years old ☐ 3-12 years old ☐ Over 12 years old ☐ Don't know ☐
25. At what temperature do you typically wash your clothes? i.e. the temperature that you select for the majority of your washing. *PLEASE TICK ONE BOX ONLY*	30°C ☐ 40°C ☐ 50°C ☐ 60°C ☐ Over 60°C ☐
26. How many times each WEEK does the washing machine run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
27. How many times each week is the tumble dryer run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
28. How many times each WEEK does the dishwasher run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*	

Figure A.1 Kinlochleven household questionnaire (continued)

29. Which of your appliances have a high energy efficiency rating (A or above)?

	Yes	No	Not applicable	Don't know
Washing machine	☐	☐	☐	☐
Dishwasher	☐	☐	☐	☐
Fridge or fridge freezer	☐	☐	☐	☐
Freezer	☐	☐	☐	☐

30. How big is your garden? Please select the best description of its size.
PLEASE TICK ONE BOX ONLY

- Don't have one ☐
- Balcony / terrace / patio ☐
- No more than 20 feet by 20 feet ☐
- Quarter of an acre ☐
- Half an acre ☐
- More than half an acre ☐

31. Do you own or rent any other land (allotment, agricultural or wild areas?)
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

32. Do you grow any food for your own consumption?
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

IF YOU SELECTED "No" TO Question 32 PLEASE GO TO Question 35.

33. If yes, what proportion of your fruit and vegetables you eat are home grown?

	None	Less than a quarter	A quarter	Half	Three-quarters	All
In summer	☐	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐	☐

34. Do you ever produce more than you need?
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

35. How much of the food you buy is produced locally (i.e. within 100 miles of your home)?
PLEASE TICK ONE BOX ONLY

- None ☐
- Some (less than half) ☐
- Most (more than half) ☐
- All ☐
- Don't know ☐

Now some questions about your household waste…

36. How many GREY (general waste) buckets (wheelie bins) does your household fill in a typical week?
INCLUDE any general waste that you take to the local waste collection site in this calculation.
DO NOT INCLUDE any waste that is recycled or composted.
PLEASE TICK ONE BOX ONLY

- The bucket is quarter full or less ☐
- A half full bucket ☐
- One full bucket ☐
- Two buckets ☐
- Greater than two buckets ☐

37. How much of your waste do you recycle?

	None	Some (less than half)	Most	All
Glass	☐	☐	☐	☐
Paper	☐	☐	☐	☐
Cardboard	☐	☐	☐	☐
Plastic	☐	☐	☐	☐
Aluminium cans and foil	☐	☐	☐	☐
Steel (tin) cans	☐	☐	☐	☐

Figure A.1 Kinlochleven household questionnaire (continued)

38. What else do you recycle?
PLEASE TICK AS MANY AS APPLY

- ☐ Printer cartridges
- ☐ Appliances
- ☐ Textiles
- ☐ Stamps
- ☐ Plastic bottle tops
- ☐ Tetrapak
- ☐ Mobile phones and other electronics
- ☐ Clothes
- ☐ Other (please specify)

a) Please specify other goods you recycle….

44. How much of your food and garden waste do you compost?

	None	Some (less than half)	Most (more than half)	All
Food waste	☐	☐	☐	☐
Garden waste	☐	☐	☐	☐

Here are some questions about your household's water use…

45. Does your water come from the main water supply?

- ☐ Yes
- ☐ No
- ☐ Don't know

46. Do you have a private water supply, a well or spring at your property?

- ☐ Yes – in use
- ☐ Yes – not in use
- ☐ No
- ☐ Don't know

47. How many bathrooms does your house have?
PLEASE WRITE THE NUMBER IN THE SPACE→

48. How many times a week is your shower used?
PLEASE WRITE THE NUMBER IN THE SPACE→

49. How many times a week is your bath used?
PLEASE WRITE THE NUMBER IN THE SPACE→

50. How many times a week is your toilet flushed?
PLEASE WRITE THE NUMBER IN THE SPACE→

51. Do you or anyone in your household use mains water (sprinkler, hose or watering can) to water your garden or wash your car? If so, how often?

	Never	Occasionally	Once or twice a week	Three or four times a week	Daily
In a typical summer	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐

52. Do you have any other use of mains water that takes a lot of water?
PLEASE TICK ONE BOX ONLY

- ☐ Yes
- ☐ No

a) If yes, please explain.

53. Have you implemented a water saving device to reduce the amount of water used in flushing your toilet(s)?
PLEASE TICK ONE BOX ONLY

- ☐ Yes
- ☐ No

Now some questions about your household expenditure

Please write "ZERO" or "0" if you have spent nothing.

Please try and answer the question as best you can. If you are unsure, please enter your best guess. If you do not wish to answer the question, please enter "don't know".

54. How much does your household spend on pets and pet food in a MONTH?
PLEASE WRITE THE NUMBER IN THE SPACE→ £

55. How much does your household spend on telephone bills (mobile, landline and broadband) in a MONTH?
PLEASE WRITE THE NUMBER IN THE SPACE→ £

56. How much does your household spend on electronics (e.g. TV, computers, cameras, MP3 players and mobile phones) in the last YEAR?
PLEASE WRITE THE NUMBER IN THE SPACE→ £

57. How much does your household spend on furniture and household furnishings in the last YEAR (e.g. sofa, bed, bookcase, kettle, food-mixer,iron, fridge, washing machine, curtains, etc.)?
PLEASE WRITE THE NUMBER IN THE SPACE→ £

Figure A.1 Kinlochleven household questionnaire (continued)

58. How much does your household spend on power tools, DIY materials and equipment for house and garden in the last YEAR? £
PLEASE WRITE THE NUMBER IN THE SPACE→

The next section is about what you do personally as an individual, not your whole household. Please answer the questions about you as an individual only.

59. How often do you…

	Never	Sometimes	Often	Always
Buy or use second-hand clothing	☐	☐	☐	☐
Reuse envelopes and jiffy bags	☐	☐	☐	☐
Take your own carrier bags shopping	☐	☐	☐	☐
Share tools (e.g. appliances, power tools, lawn-mowers) with friends and neighbours	☐	☐	☐	☐
Take a packed lunch to work	☐	☐	☐	☐

60. Do you do any of the following activities?
PLEASE TICK AS MANY AS APPLY

- Take showers instead of baths ☐
- Recycle bath water e.g. for watering plants ☐
- Wait until the washing machine is full before running the wash-cycle ☐
- Wait until the dish-washer is full before running the wash-cycle ☐
- Collect rain water for watering plants in the garden ☐
- None of these ☐

Now for some questions about your food… about what you eat personally

61. Thinking of all the meals you have in a week, please can you count how often you eat meat or fish at each meal in a week? Please enter the number of times you have meat and fish in a week…

a) AT BREAKFAST…	
b) AT LUNCH-TIME…	
c) AT TEA / EVENING MEAL…	

62. What proportion of your food is organic?

	None	A quarter	Half	Three-quarters	All
Fruit and vegetables	☐	☐	☐	☐	☐
Dairy products	☐	☐	☐	☐	☐
All other food	☐	☐	☐	☐	☐

63. In a typical week, how many meals do you eat out in one week (please include fast food)?
PLEASE WRITE THE NUMBER IN THE SPACE→

Now some questions about your transport. Remember this is for your yourself

64. For most of the journeys which you travel by car, how many people are in the car?

Please include yourself in this number. E.g. if you travel alone please write 1 in the box. If you travel alone half the time and half the time with someone, please write 1.5 in the box. DO NOT INCLUDE CHILDREN.

PLEASE WRITE THE NUMBER IN THE SPACE→

65. What type of car do you travel in most often?
PLEASE TICK ONE BOX ONLY

- Small diesel up to 1.7litres ☐
- Small petrol up to 1.4 litres ☐
- Medium diesel 1.7-2.0 litres ☐
- Medium petrol 1.4-2.0 litres ☐
- Large diesel over 2.0 litres ☐
- Large petrol over 2.0 litres ☐
- Other – (please specify) ☐

a) If other type of car (e.g. hybrid, LPG):
PLEASE SPECIFY

66. How many miles do you travel by car each YEAR?
PLEASE WRITE THE NUMBER IN THE SPACE→

67. In a typical WEEK, how many miles do you travel by… ?

bus	
train	
ferry foot passenger	

Figure A.1 Kinlochleven household questionnaire (continued)

ferry with car	
walking	
cycling	
68. How many return flights did you take in 2009 that are to destinations in…	
the UK	
Europe	
Rest of the world	

This next section is about what you have bought recently. Thinking over the last year, how much have you spent on consumer goods in a typical month…Remember this is for you not your household.

Please write "ZERO" or "0" if you have spent nothing.

Please try and answer the question as best you can. If you are unsure, please enter your best guess. If you do not wish to answer the question, please enter "don't know".

69. In a **MONTH** how much do you spend on…?	
cigarettes and tobacco	
cultural activities (e.g. theatre, museums, cinema, etc.)	
sporting events	
betting and the lottery	
soaps, shampoo, make-up, shaving products, toothpaste, etc	
newspapers, books and stationery	

The next few questions relate to your annual spend. Again, this is for you as an individual.

70. In a **YEAR** how much do you spend on…?	
clothing	
footwear	
equipment for sports, games and hobbies	
jewellery, clocks and watches	
71. In a typical week, how many hours per week do you watch TV? PLEASE WRITE THE NUMBER OF HOURS IN THE SPACE→	

Now some questions about you and your community…

72. Overall how satisfied are you with how local decisions are made in your community? PLEASE TICK ONE BOX ONLY	Very satisfied		☐
	Fairly satisfied		☐
	Neither satisfied nor dissatisfied		☐
	Fairly dissatisfied		☐
	Very dissatisfied		☐
	Don't know		☐
73. Do you agree or disagree that you can influence decisions affecting your local community? PLEASE TICK ONE BOX ONLY	Strongly agree		☐
	Agree		☐
	Neither agree nor disagree		☐
	Disagree		☐
	Strongly disagree		☐
	Don't know		☐
74. Taking all things into consideration, how satisfied do you feel with your life? Please rate your happiness on a scale of 1 to 10 with 10 being "very happy" and 1 being "very unhappy". PLEASE TICK ONE BOX ONLY	Very happy	10	☐
		9	☐
		8	☐
		7	☐
		6	☐
		5	☐
		4	☐
		3	☐
		2	☐
	Very unhappy	1	☐
75. What is the highest qualification you have obtained, either while at school or gained after you left school? PLEASE TICK ONE BOX ONLY			

Figure A.1 Kinlochleven household questionnaire (continued)

None	☐
School Leaving Certificate	☐
Senior Certificate, Standard Grade, O Grade, GCSE, CSE or equivalent	☐
Higher School Certificate, CSYS, Advanced Senior Certificate, GCE 'A' level/'S' level or equivalent	☐
SVQ Level 1 or 2, SCOTVEC Module, GSVQ Foundation or Intermediate, City and Guilds Matriculation or equivalent	☐
Scottish SCE/SLC/SUPE Higher	☐
SVQ Level 3, SCOTVEC National Diploma, GSVQ Advanced, ONC, OND, City & Guilds Advanced/Final level/Part II or III or equivalent	☐
HNC, HND, City & Guilds Full Technological Certificate, VQ Levels 4 or 5 or equivalent	☐
RSA/Other clerical and commercial	☐
Nursing qualification	☐
Professional qualification (membership awarded by professional institute)	☐
Degree, including higher degree	☐
Other technical or business qualification/certificate	☐

76. Are you in paid or unpaid employment? PLEASE TICK ONE BOX ONLY	Yes	☐
	No	☐

If your answer to the previous question was "No" please go to question 76

77. Overall, thinking about your working life, how satisfied are you with your job? PLEASE TICK ONE BOX ONLY	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐
78. On a typical day, how far do you travel to reach your place of work? (ie one way)? PLEASE WRITE THE NUMBER OF MILES IN THE SPACE→	miles	
79. In a typical week, whilst you are at work, how many miles do you travel by motor vehicle or plane to carry out your job? PLEASE WRITE THE NUMBER OF MILES IN THE SPACE→	miles	
80. Please describe the nature of your work and your job…		
81. How long have you lived in Kinlochleven? PLEASE WRITE THE NUMBER IN THE SPACE→	Years	
82. Overall, how satisfied or dissatisfied are you with this area as a place to live in? PLEASE TICK ONE BOX ONLY	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐
83. Taking everything into account, would you say that during the last two years this area has got a better place to live in, got worse or remained about the same? PLEASE TICK ONE BOX ONLY	Better	☐
	Worse	☐
	About the same	☐
	Don't know	☐
84. Over the next few years, would you expect this area to get better as a place to live in, get worse or remain about the same? PLEASE TICK ONE BOX ONLY	Better	☐
	Worse	☐
	About the same	☐
	Don't know	☐
85. Please say whether you disagree or agree with the following statements: PLEASE TICK ONE BOX ONLY FOR EACH STATEMENT		

Figure A.1 Kinlochleven household questionnaire (continued)

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
"On the whole my life is close to how I would like it to be"	☐	☐	☐	☐	☐	☐
"I feel close to the people in my local area"	☐	☐	☐	☐	☐	☐
"There are people in my life who really care about me"	☐	☐	☐	☐	☐	☐
"Most days I feel a sense of accomplishment from what I do"	☐	☐	☐	☐	☐	☐

86. Do you buy any of the following 'environmentally friendly' products rather than alternatives which are not environmentally friendly?

PLEASE TICK AS MANY BOXES AS APPLY

- Recycled paper or envelopes ☐
- Recycled toilet roll, kitchen paper, aluminium foil, etc. ☐
- Environmentally friendly washing powders/liquids and household cleaners that are kinder to the environment ☐
- Environmentally friendly paints, glues and varnishes ☐
- Other - specify ☐
- None of these ☐

a) If *other*, please specify

87. Do you agree or disagree that most people in Scotland today need to change their way of life so that future generations can continue to enjoy a good quality of life and environment?

PLEASE TICK ONE BOX ONLY

- Strongly agree ☐
- Agree ☐
- Neither agree nor disagree ☐
- Disagree ☐
- Strongly disagree ☐
- Don't know ☐

88. Do you agree or disagree that you personally need to change your way of life over the next few years, so that future generations can continue to enjoy a good quality of life and environment?

PLEASE TICK ONE BOX ONLY

- Strongly agree ☐
- Agree ☐
- Neither agree nor disagree ☐
- Disagree ☐
- Strongly disagree ☐
- Don't know ☐

89. As far as you know, do you personally think the climate is changing and, if so, are human actions responsible?

PLEASE TICK ONE BOX ONLY

- Yes, I think the climate is changing but humans are not responsible ☐
- Yes, I think the climate is changing and humans are partly responsible ☐
- Yes, I think the climate is changing and humans are responsible ☐
- No, I do not think the climate is changing ☐
- Don't know ☐

90. Overall, how do you feel about climate change?

PLEASE TICK ONE BOX ONLY

- Very good thing ☐
- Fairly good thing ☐
- Neither good/nor bad thing ☐
- Fairly bad thing ☐
- Very bad thing ☐
- Don't Know ☐

91. Which, if any, of the following statements most closely describes your own opinion about taking action against climate change?

PLEASE TICK ONE BOX ONLY

- Every possible action should be taken against climate change ☐
- Some action should be taken against climate change ☐
- No action should be taken against climate change ☐
- None of these ☐
- Don't know ☐

Figure A.1 Kinlochleven household questionnaire (continued)

92. Please select one of the following statements to describe your future in Kinlochleven:

I want and fully intend to spend the rest of my life in Kinlochleven	☐
I would like to spend the rest of my life here but I have to move to find a job	☐
I have a job here but I do not want to stay	☐
I have no job, I want to move, but I feel stuck here	☐
I am not happy here. I shall be leaving soon	☐
I am settled here now but do not want to stay here forever	☐
Other please specify	☐

a) If *other*, please specify

93. Please state whether you are optimistic or pessimistic about the following:

	Very optimistic	Optimistic	Neither optimistic or pessimistic	Pessimistic	Very pessimistic
My personal future	☐	☐	☐	☐	☐
The future of Kinlochleven	☐	☐	☐	☐	☐
The future state of the local environment	☐	☐	☐	☐	☐
The future state of the environment worldwide	☐	☐	☐	☐	☐

94. If Kinlochleven were to thrive in 2030 what would it need?

95. To help us plan better in future, please tell us about how long it took you to complete this questionnaire.	Minutes
96. And just a few details about yourself. Are you: *PLEASE TICK ONE BOX ONLY*	Female ☐ Male ☐
97. What was your age last birthday? *PLEASE WRITE THE NUMBER IN THE SPACE→*	

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

IF YOU HAVE ANY FURTHER COMMENTS, QUERIES OR SUGGESTIONS, PLEASE DO NOT HESITATE TO CONTACT THE AUTHOR, THE CONTACT DETAILS OF WHOM ARE SHOWN ON THE FRONT PAGE

UNIVERSITY OF STIRLING

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

Figure A.1 Kinlochleven household questionnaire (continued)

Killin Community Questionnaire 2011

UNIVERSITY OF STIRLING

SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

Anne Winther BA MSc

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If you have internet access, please complete on-line at http://www.sbes.stir.ac.uk/people/winther

Instructions

Thank you for agreeing to complete this questionnaire. The quesionnaire responses will contribute to my PhD research investigating the development of sustainable communities in rural Scotland.

PLEASE answer all the questions. There is one questionnaire per household.

Some of the questions are about your HOUSEHOLD's energy consumption and some about yourself, attitudes and INDIVIDUAL expenditure. *You may find it helpful to pull out your last 12 months utility bills and your most recent bank statements.*

The numbers will be used to calculate your ecological footprint. This is necessary to estimate what impact your consumption has on the environment.

By completing this questionnaire, you are giving consent for the information supplied to be used for research purposes. Your responses will be handled anonymously.

For the following questions, please tick the boxes ☑ as appropriate, or please write in the spaces provided, as instructed

This first section is about your household and your home…	
1. How many people aged 17 and over live in your home? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
2. How many children (i.e. 16 and under) live in your home? *PLEASE WRITE THE NUMBER IN THE SPACE→*	

3. Including yourself, how many of the people who live in your household are…

PLEASE WRITE THE NUMBERS IN THE SPACES↘	FULL-TIME	PART-TIME
a) Self-employed?		
b) Employed (paid or unpaid)?		
c) Looking after home or family?		
d) Permanently retired from work?		
e) Unemployed and seeking work?		
f) In education (school)?		
g) In education (further / higher education)?		
h) Pre-school?		
i) Government work or training scheme?		
j) Permanently sick or disabled?		
k) Unable to work due to illness or injury?		
l) Other?		

m) If other, please specify… *PLEASE WRITE IN THE SPACE →*

4. What type of house do you live in? *PLEASE TICK ONE BOX ONLY*

- Mid-Terraced house ☐
- End-Terraced house ☐
- Detached house ☐
- Semi-detached house ☐
- Flat with 2 external walls ☐
- Flat with 3 external walls ☐
- Detached bungalow ☐
- Semi-detached bungalow ☐
- Mobile home or cabin ☐

5. How many bedrooms are in your house? *PLEASE WRITE THE NUMBER IN THE SPACE→*	
6. How long have you lived in Killin? *PLEASE WRITE THE ANSWER IN THE SPACE→*	

Figure A.2 Killin household questionnaire

7. How old is your house? PLEASE TICK ONE BOX ONLY	Pre 1930 ☐ 1930-1995 ☐ Post 1995 ☐
This section has some questions about your heating and energy usage.	
8. How do you heat your home and hot water? SELECT AS MANY THAT APPLY	Electricity ☐ Gas or LPG ☐ Oil ☐ Wood or biomass ☐ Coal ☐ Heat pump ☐ Peat ☐ Other – please specify below ☐
a) Other – please specify:	
From your bills for the last YEAR, please enter your total:	
9. Cost or litres used in the last 12 months of LPG or gas *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£ litres per year
10. Cost or litres used in the last 12 months of oil *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£ litres per year
11. Cost or kWh used in the last 12 months of electricity *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£ kWh per year
12. Total amount of wood consumed in tonnes in the last 12 months *PLEASE ENTER DETAILS IN THE BOX*	Tonnes

13. Number of bags or amount in tonnes of coal that you used in the last 12 months *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	Bags Tonnes
14. The number of blocks or cost of peat that you used in the last 12 months *PLEASE ENTER DETAILS FOR ONE BOX ONLY*	£ Blocks
15. Does your electricity come from 'Green' sources (i.e. from a renewables company or as a "green tariff". If you are unsure, then please answer, "No".)? *PLEASE TICK ONE BOX ONLY*	Yes ☐ No ☐
16. Do you generate your own electricity? *PLEASE TICK ONE BOX ONLY*	Yes ☐ No ☐
17. If yes, please give details…	
***Light bulbs** - think of each room in your house and your outside lighting and count both the total number of light bulbs and the number of energy-saving in each location.*	
18. How many light bulbs do you have? *PLEASE WRITE THE NUMBER IN THE SPACE→*	*In total* *Energy saving*
19. How often do you turn off lights and appliances when not in use? PLEASE TICK ONE BOX ONLY	Never ☐ Some of the time ☐ Most of the time ☐ Always ☐
20. At what temperature do you typically run your heating? Please check your thermostat setting if you have one. PLEASE TICK ONE BOX ONLY	25°C (77°F) and above ☐ 21-24°C (71-76°F) ☐ 19-21°C (65-70°F) ☐ 15-18°C (59-64°F) ☐ Less than 14°C (58°F) ☐ No temperature control ☐ Don't know ☐

Figure A.2 Killin household questionnaire (continued)

21. Do you have any of the following installed…	None	Some (5-15cm)	Full (15-30cm)
a) Loft insulation	☐	☐	☐
	None	Some	Full
b) Cavity or other wall insulation	☐	☐	☐
c) Underfloor insulation	☐	☐	☐
d) Double glazing	☐	☐	☐
e) Draught exclusion	☐	☐	☐
f) Condensing boiler	☐	☐	☐
g) Hot water tank insulation (foam jacket)	☐	☐	☐
h) External wall insulation	☐	☐	☐

22. Do you have any of the following renewable technologies installed?
SELECT AS MANY THAT APPLY

- Hydro ☐
- Wood or biomass boiler (NOT coal / peat) ☐
- Ground source heat pump ☐
- Solar hot water ☐
- Passive solar heating ☐
- Photovoltaic panels ☐
- Wind turbine ☐
- Wood stove with back boiler ☐
- Wood stove without back boiler ☐

Now some questions about your appliances…

23. How old is your washing machine?
PLEASE TICK ONE BOX ONLY

- Less than 3 years old ☐
- 3-12 years old ☐
- Over 12 years old ☐
- Don't know ☐

24. At what temperature do you typically wash your clothes?
i.e. the temperature that you select for the majority of your washing.
PLEASE TICK ONE BOX ONLY

- 30°C ☐
- 40°C ☐
- 50°C ☐
- 60°C ☐
- Over 60°C ☐

25. How many times each WEEK does the washing machine run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*

26. How many times each week is the tumble dryer run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*

27. How many times each WEEK does the dishwasher run in your household? *PLEASE WRITE THE NUMBER IN THE SPACE→*

28. Which of your appliances have a high energy efficiency rating (A or above)?

	Yes	No	Not applicable	Don't know
Washing machine	☐	☐	☐	☐
Dishwasher	☐	☐	☐	☐
Fridge or fridge freezer	☐	☐	☐	☐
Freezer	☐	☐	☐	☐

29. How big is your garden? Please select the best description of its size.
PLEASE TICK ONE BOX ONLY

- Don't have one ☐
- Balcony / terrace / patio ☐
- No more than 20 feet by 20 feet ☐
- Quarter of an acre ☐
- Half an acre ☐
- More than half an acre ☐

30. Do you own or rent any other land (allotment, agricultural or wild areas?)
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

31. Do you grow any food for your own consumption?
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

IF YOU SELECTED "No" TO Question 31 PLEASE GO TO Question 34.

Figure A.2 Killin household questionnaire (continued)

32. If yes, what proportion of your fruit and vegetables you eat are home grown?

	None	Less than a quarter	A quarter	Half	Three-quarters	All
In summer	☐	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐	☐

33. Do you ever produce more than you need?
PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

34. How much of the food you buy is produced locally (i.e. within 100 miles of your home)?
PLEASE TICK ONE BOX ONLY

- None ☐
- Some (less than half) ☐
- Most (more than half) ☐
- All ☐
- Don't know ☐

Now some questions about your household waste…

35. How many GREY (general waste) buckets (wheelie bins) does your household fill in a typical week?
INCLUDE any general waste that you take to the local waste collection site in this calculation.
DO NOT INCLUDE any waste that is recycled or composted.
PLEASE TICK ONE BOX ONLY

- The bucket is quarter full or less ☐
- A half full bucket ☐
- One full bucket ☐
- Two buckets ☐
- Greater than two buckets ☐

36. How much of your waste do you recycle?

	None	Some (less than half)	Most (more than half)	All
Glass	☐	☐	☐	☐
Paper	☐	☐	☐	☐
Cardboard	☐	☐	☐	☐
Plastic	☐	☐	☐	☐
Aluminium cans and foil	☐	☐	☐	☐
Steel (tin) cans	☐	☐	☐	☐

37. What else do you recycle?
PLEASE TICK AS MANY AS APPLY

Tetrapak	☐	Printer cartridges	☐
Mobile phones and other electronics	☐	Appliances	☐
Clothes	☐	Textiles	☐
Other (please specify)	☐	Stamps	☐
		Plastic bottle tops	☐

a) Please specify other goods you recycle….

44. How much of your food and garden waste do you compost?

	None	Some (less than half)	Most (more than half)	All
Food waste	☐	☐	☐	☐
Garden waste	☐	☐	☐	☐

Here are some questions about your household's water use…

45. Does your water come from the main water supply?

- Yes ☐
- No ☐
- Don't know ☐

46. Do you have a private water supply, a well or spring at your property?

- Yes – in use ☐
- Yes – not in use ☐
- No ☐
- Don't know ☐

47. Do you or anyone in your household use mains water (sprinkler, hose or watering can) to water your garden or wash your car? If so, how often?

	Never	Occasionally	Once or twice a week	Three or four times a week	Daily
In a typical summer	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐

48. Do you have any other use of mains water that takes a lot of water? *PLEASE TICK ONE BOX ONLY*

- Yes ☐
- No ☐

a) If yes, please explain:

Figure A.2 Killin household questionnaire (continued)

49. Have you implemented a water saving device to reduce the amount of water used in flushing your toilet(s)? *PLEASE TICK ONE BOX ONLY*

Yes ☐
No ☐

50. How many bathrooms does your house have? *PLEASE WRITE THE NUMBER IN THE SPACE→*

51. How many times a week is your shower used? *PLEASE WRITE THE NUMBER IN THE SPACE→*

52. How many times a week is your bath used? *PLEASE WRITE THE NUMBER IN THE SPACE→*

Now some questions about your household expenditure

Please write "ZERO" or "0" if you have spent nothing.

Please try and answer the question as best you can. If you are unsure, please enter your best guess, or WHAT you have bought. If you do not wish to answer the question, please enter "don't know".

53. How much does your household spend on pets and pet food in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→* £

54. How much does your household spend on telephone bills (mobile, landline and broadband) in a MONTH? *PLEASE WRITE THE NUMBER IN THE SPACE→* £

55. How much does your household spend on electronics (e.g. TV, computers, cameras, MP3 players and mobile phones) in the last YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→* £

56. How much does your household spend on furniture and household furnishings in the last YEAR (e.g. sofa, bed, bookcase, kettle, food-mixer,iron, fridge, washing machine, curtains, etc.)? *PLEASE WRITE THE NUMBER IN THE SPACE→* £

57. How much does your household spend on power tools, DIY materials and equipment for house and garden in the last YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→* £

The next section is about what you do personally as an individual, not your whole household. Please answer the questions about you as an individual only.

58. How often do you…

	Never	Sometimes	Often	Always
Buy or use second-hand clothing	☐	☐	☐	☐
Reuse envelopes and jiffy bags	☐	☐	☐	☐
Take your own carrier bags shopping	☐	☐	☐	☐
Share tools (e.g. appliances, power tools, lawn-mowers) with friends and neighbours	☐	☐	☐	☐
Take a packed lunch to work	☐	☐	☐	☐

59. Do you do any of the following activities? *PLEASE TICK AS MANY AS APPLY*

- Take showers instead of baths ☐
- Recycle bath water e.g. for watering plants ☐
- Wait until the washing machine is full before running the wash-cycle ☐
- Wait until the dish-washer is full before running the wash-cycle ☐
- Collect rain water for watering plants in the garden ☐
- None of these ☐

Now for some questions about your food… about what you eat personally

60. In a typical week, how many meals do you eat out in one week (please include fast food)? *PLEASE WRITE THE NUMBER IN THE SPACE→*

61. Thinking of all the meals you have in a week, please can you count how often you eat meat or fish at each meal in a week? Please enter the number of times you have meat and fish in a week…

a) AT BREAKFAST…
b) AT LUNCH-TIME…
c) AT TEA / EVENING MEAL…

62. What proportion of your food is organic?

	None	A quarter	Half	Three-quarters	All
Fruit and vegetables	☐	☐	☐	☐	☐
Dairy products	☐	☐	☐	☐	☐
All other food	☐	☐	☐	☐	☐

Now some questions about your transport. Remember this is for your yourself

63. For most of the journeys which you travel by car, how many people are in the car?

Please include yourself in this number. E.g. if you travel alone please write 1 in the box. If you travel alone half the time and half the time with someone, please write 1.5 in the box. DO NOT INCLUDE CHILDREN.

PLEASE WRITE THE NUMBER IN THE SPACE→

64. How many miles do you travel by car each YEAR? *PLEASE WRITE THE NUMBER IN THE SPACE→*

Figure A.2 Killin household questionnaire (continued)

65. What type of car do you travel in most often? *PLEASE TICK ONE BOX ONLY*	Small diesel up to 1.7litres	☐
	Small petrol up to 1.4 litres	☐
	Medium diesel 1.7-2.0 litres	☐
	Medium petrol 1.4-2.0 litres	☐
	Large diesel over 2.0 litres	☐
	Large petrol over 2.0 litres	☐
	Other – (please specify)	☐

If other type of car (e.g. hybrid, LPG), PLEASE SPECIFY:	
66. In a typical WEEK, how many miles do you travel by… ?	
bus	
train	
ferry foot passenger	
ferry with car	
walking	
cycling	
67. How many return flights did you take in 2009 that are to destinations in…	
The UK	
Europe	
Rest of the world	

This next section is about what you have bought recently. Thinking over the last year, how much have you spent on consumer goods in a typical month…Remember this is for you not your household.

Please write "ZERO" or "0" if you have spent nothing.

Please try and answer the question as best you can. If you are unsure, please enter your best guess. If you do not wish to answer the question, please enter "don't know".

68. In a **MONTH** how much do you spend on…?	
cigarettes and tobacco	
cultural activities (e.g. theatre, museums, cinema, etc.)	
sporting events	
betting and the lottery	
soaps, shampoo, make-up, shaving products, toothpaste, etc	
newspapers, books and stationery	

The next few questions relate to your annual spend. Again, this is for you as an individual. If you are unsure, please enter what you have bought.

69. In a **YEAR** how much do you spend on…?	
clothing	
footwear	
equipment for sports, games and hobbies	
jewellery, clocks and watches	
70. In a typical week, how many hours per week do you watch TV? *PLEASE WRITE THE NUMBER OF HOURS IN THE SPACE→*	

Now some questions about you and your community…

71. In a typical week, how many hours do you spend participating in community activities (e.g. clubs, societies, voluntary work, etc.)? *PLEASE WRITE THE NUMBER OF HOURS IN THE SPACE→*	

72. Overall how satisfied are you with how local decisions are made in your community? *PLEASE TICK ONE BOX ONLY*	Very satisfied	☐
	Fairly satisfied	☐
	Neither satisfied nor dissatisfied	☐
	Fairly dissatisfied	☐
	Very dissatisfied	☐
	Don't know	☐
73. Do you agree or disagree that you can influence decisions affecting your local community? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐

Figure A.2 Killin household questionnaire (continued)

74. Taking all things into consideration, how satisfied do you feel with your life? Please rate your happiness on a scale of 1 to 10 with 10 being "very happy" and 1 being "very unhappy".

PLEASE TICK ONE BOX ONLY

Very happy	10	☐
	9	☐
	8	☐
	7	☐
	6	☐
	5	☐
	4	☐
	3	☐
	2	☐
Very unhappy	1	☐

75. What is the highest qualification you have obtained, either while at school or gained after you left school?

PLEASE TICK ONE BOX ONLY

- None ☐
- School Leaving Certificate ☐
- Senior Certificate, Standard Grade, O Grade, GCSE, CSE or equivalent ☐
- Higher School Certificate, CSYS, Advanced Senior Certificate, GCE 'A' level/'S' level or equivalent ☐
- SVQ Level 1 or 2, SCOTVEC Module, GSVQ Foundation or Intermediate, City and Guilds Matriculation or equivalent ☐
- Scottish SCE/SLC/SUPE Higher ☐
- SVQ Level 3, SCOTVEC National Diploma, GSVQ Advanced, ONC, OND, City & Guilds Advanced/Final level/Part II or III or equivalent ☐
- HNC, HND, City & Guilds Full Technological Certificate, VQ Levels 4 or 5 or equivalent ☐
- RSA/Other clerical and commercial ☐
- Nursing qualification ☐
- Professional qualification (membership awarded by professional institute) ☐
- Degree, including higher degree ☐
- Other technical or business qualification/certificate ☐

76. Are you in paid or unpaid employment?

PLEASE TICK ONE BOX ONLY

- Yes ☐
- No ☐

If your answer to the previous question was "No" please go to question 80

77. Overall, thinking about your working life, how satisfied are you with your job?

PLEASE TICK ONE BOX ONLY

- Very satisfied ☐
- Fairly satisfied ☐
- Neither satisfied nor dissatisfied ☐
- Fairly dissatisfied ☐
- Very dissatisfied ☐

78. On a typical day, how far do you travel to reach your place of work (ie one way)? *PLEASE WRITE THE NUMBER OF MILES IN THE SPACE →* ______ miles

79. In a typical week, whilst you are at work, how many miles do you travel by motor vehicle or plane to carry out your job? *PLEASE WRITE THE NUMBER OF MILES IN THE SPACE →* ______ miles

80. Please describe the nature of your work and your job…

81. Overall, how satisfied or dissatisfied are you with this area as a place to live in?

PLEASE TICK ONE BOX ONLY

- Very satisfied ☐
- Fairly satisfied ☐
- Neither satisfied nor dissatisfied ☐
- Fairly dissatisfied ☐
- Very dissatisfied ☐

82. Taking everything into account, would you say that during the last two years this area has got a better place to live in, got worse or remained about the same?

PLEASE TICK ONE BOX ONLY

- Better ☐
- Worse ☐
- About the same ☐
- Don't know ☐

83. Over the next few years, would you expect this area to get better as a place to live in, get worse or remain about the same?

PLEASE TICK ONE BOX ONLY

- Better ☐
- Worse ☐
- About the same ☐
- Don't know ☐

84. Please say whether you disagree or agree with the following statements:

PLEASE TICK ONE BOX ONLY FOR EACH STATEMENT

Figure A.2 Killin household questionnaire (continued)

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
"On the whole my life is close to how I would like it to be"	☐	☐	☐	☐	☐	☐
"I feel close to the people in my local area"	☐	☐	☐	☐	☐	☐
"There are people in my life who really care about me"	☐	☐	☐	☐	☐	☐
"Most days I feel a sense of accomplishment from what I do"	☐	☐	☐	☐	☐	☐

85. Do you buy any of the following 'environmentally friendly' products rather than alternatives which are not environmentally friendly? *PLEASE TICK AS MANY BOXES AS APPLY*	Recycled paper or envelopes	☐
	Recycled toilet roll, kitchen paper, aluminium foil, etc.	☐
	Environmentally friendly washing detergent and household cleaners that are kinder to the environment	☐
	Environmentally friendly paints, glues and varnishes	☐
	Other - specify	☐
	None of these	☐
a) If *other*, please specify		
86. Do you agree or disagree that most people in Scotland today need to change their way of life so that future generations can continue to enjoy a good quality of life and environment? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐

87. Do you agree or disagree that you personally need to change your way of life over the next few years, so that future generations can continue to enjoy a good quality of life and environment? *PLEASE TICK ONE BOX ONLY*	Strongly agree	☐
	Agree	☐
	Neither agree nor disagree	☐
	Disagree	☐
	Strongly disagree	☐
	Don't know	☐
88. As far as you know, do you personally think the climate is changing and, if so, are human actions responsible? *PLEASE TICK ONE BOX ONLY*	Yes, I think the climate is changing but humans are not responsible	☐
	Yes, I think the climate is changing and humans are partly responsible	☐
	Yes, I think the climate is changing and humans are responsible	☐
	No, I do not think the climate is changing	☐
	Don't know	☐
89. Overall, how do you feel about climate change? *PLEASE TICK ONE BOX ONLY*	Very good thing	☐
	Fairly good thing	☐
	Neither good/nor bad thing	☐
	Fairly bad thing	☐
	Very bad thing	☐
	Don't Know	☐
90. Which, if any, of the following statements most closely describes your own opinion about taking action against climate change? *PLEASE TICK ONE BOX ONLY*	Every possible action should be taken against climate change	☐
	Some action should be taken against climate change	☐
	No action should be taken against climate change	☐
	None of these	☐
	Don't know	☐

Figure A.2 Killin household questionnaire (continued)

91. Please select one of the following statements to describe your future in Killin:

I want and fully intend to spend the rest of my life in Killin	☐
I would like to spend the rest of my life here but I have to move to find a job	☐
I have a job here but I do not want to stay	☐
I have no job, I want to move, but I feel stuck here	☐
I am not happy here. I shall be leaving soon	☐
I am settled here now but do not want to stay here forever	☐
Other please specify	☐

a) If *other*, please specify

92. Please state whether you are optimistic or pessimistic about the following:

	Very optimistic	Optimistic	Neither optimistic or pessimistic	Pessimistic	Very pessimistic
My personal future	☐	☐	☐	☐	☐
The future of Killin	☐	☐	☐	☐	☐
The future state of the local environment	☐	☐	☐	☐	☐
The future state of the environment worldwide	☐	☐	☐	☐	☐

93. If Killin were to thrive in 2030 what would it need?

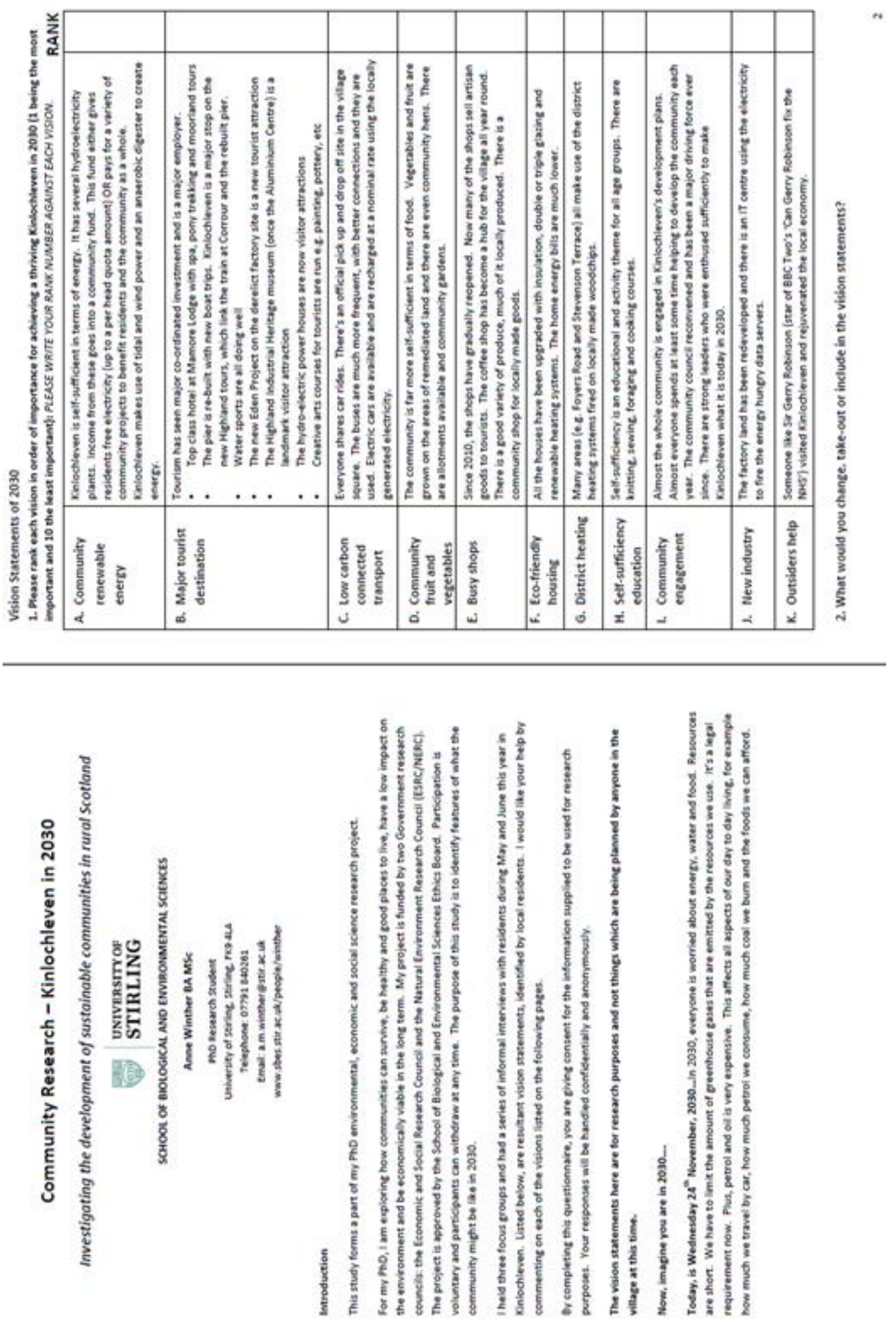
94. To help us plan better in future, please tell us about how long it took you to complete this questionnaire.	Minutes
95. And just a few details about yourself. Are you: *PLEASE TICK ONE BOX ONLY*	Female ☐ Male ☐
96. What was your age last birthday? *PLEASE WRITE THE NUMBER IN THE SPACE →*	

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

IF YOU HAVE ANY FURTHER COMMENTS, QUERIES OR SUGGESTIONS, PLEASE DO NOT HESITATE TO CONTACT THE AUTHOR, THE CONTACT DETAILS OF WHOM ARE SHOWN ON THE FRONT PAGE

Figure A.2 Killin household questionnaire (continued)

A.2 Kinlochleven and Killin vision follow-up questionnaires



Community Research – Kinlochleven in 2030

Investigating the development of sustainable communities in rural Scotland

UNIVERSITY OF STIRLING

SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

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Introduction

This study forms a part of my PhD environmental, economic and social science research project.

For my PhD, I am exploring how communities can survive, be healthy and good places to live, have a low impact on the environment and be economically viable in the long term. My project is funded by two Government research councils: the Economic and Social Research Council and the Natural Environment Research Council (ESRC/NERC). The project is approved by the School of Biological and Environmental Sciences Ethics Board. Participation is voluntary and participants can withdraw at any time. The purpose of this study is to identify features of what the community might be like in 2030.

I held three focus groups and had a series of informal interviews with residents during May and June this year in Kinlochleven. Listed below, are resultant vision statements, identified by local residents. I would like your help by commenting on each of the visions listed on the following pages.

By completing this questionnaire, you are giving consent for the information supplied to be used for research purposes. Your responses will be handled confidentially and anonymously.

The vision statements here are for research purposes and not things which are being planned by anyone in the village at this time.

Now, imagine you are in 2030....

Today, is Wednesday 24th November, 2030...In 2030, everyone is worried about energy, water and food. Resources are short. We have to limit the amount of greenhouse gases that are emitted by the resources we use. It's a legal requirement now. Plus, petrol and oil is very expensive. This affects all aspects of our day to day living, for example how much we travel by car, how much petrol we consume, how much coal we burn and the foods we can afford.

Vision Statements of 2030

1. Please rank each vision in order of importance for achieving a thriving Kinlochleven in 2030 (1 being the most important and 10 the least important): *PLEASE WRITE YOUR RANK NUMBER AGAINST EACH VISION.*

		RANK
A. Community renewable energy	Kinlochleven is self-sufficient in terms of energy. It has several hydroelectricity plants. Income from these goes into a community fund. This fund either gives residents free electricity (up to a per head quota amount) OR pays for a variety of community projects to benefit residents and the community as a whole. Kinlochleven makes use of tidal and wind power and an anaerobic digester to create energy.	
B. Major tourist destination	Tourism has seen major co-ordinated investment and is a major employer. • Top class hotel at Mamore Lodge with spa, pony trekking and moorland tours • The pier is re-built with new boat trips. Kinlochleven is a major stop on the new Highland tours, which link the train at Corrour and the rebuilt pier. • Water sports are all doing well • The new Eden Project on the derelict factory site is a new tourist attraction • The Highland Industrial Heritage museum (once the Aluminium Centre) is a landmark visitor attraction • The hydro-electric power houses are now visitor attractions • Creative arts courses for tourists are run e.g. painting, pottery, etc	
C. Low carbon connected transport	Everyone shares car rides. There's an official pick up and drop off site in the village square. The buses are much more frequent, with better connections and they are used. Electric cars are available and are recharged at a nominal rate using the locally generated electricity.	
D. Community fruit and vegetables	The community is far more self-sufficient in terms of food. Vegetables and fruit are grown on the areas of remediated land and there are even community hens. There are allotments available and community gardens.	
E. Busy shops	Since 2010, the shops have gradually reopened. Now many of the shops sell artisan goods to tourists. The coffee shop has become a hub for the village all year round. There is a good variety of produce, much of it locally produced. There is a community shop for locally made goods.	
F. Eco-friendly housing	All the houses have been upgraded with insulation, double or triple glazing and renewable heating systems. The home energy bills are much lower.	
G. District heating	Many areas (e.g. Foyers Road and Stevenson Terrace) all make use of the district heating systems fired on locally made woodchips.	
H. Self-sufficiency education	Self-sufficiency is an educational and activity theme for all age groups. There are knitting, sewing, foraging and cooking courses.	
I. Community engagement	Almost the whole community is engaged in Kinlochleven's development plans. Almost everyone spends at least some time helping to develop the community each year. The community council reconvened and has been a major driving force ever since. There are strong leaders who were enthused sufficiently to make Kinlochleven what it is today in 2030.	
J. New industry	The factory land has been redeveloped and there is an IT centre using the electricity to fire the energy hungry data servers.	
K. Outsiders help	Someone like Sir Gerry Robinson (star of BBC Two's 'Can Gerry Robinson fix the NHS') visited Kinlochleven and rejuvenated the local economy.	

2. What would you change, take-out or include in the vision statements?

2

Figure A.3 Kinlochleven vision follow-up community questionnaire

3. For your most important vision, how could it be achieved? What needs to be done now?

4. How many hours do you spend each month with Kinlochleven community groups or doing voluntary work in the village now?

5. For the most important vision that you chose, please state whether you agree or disagree with the following statements. *FOR EACH QUESTION, PLACE A TICK IN THE BOX TO INDICATE YOUR RESPONSE.*

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
If enacted now, this vision would contribute to the welfare of people in Kinlochleven today	☐	☐	☐	☐	☐
This vision will bring in skilled people of working age from outside the village which will boost the local economy	☐	☐	☐	☐	☐
I would be willing to help make this happen	☐	☐	☐	☐	☐
This vision will make the people in Kinlochleven more resilient to the affects of economic downturn and shortages of petroleum based fuels	☐	☐	☐	☐	☐

6. Now, in 2010, how much time would you be prepared to commit each month to make your most important vision a reality?

7. Are you: Male ☐ Female ☐

8. How many years have you lived in Kinlochleven?

9. What age group are you in?

Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70-79 ☐ 80+ ☐

10. How many years formal education have you had

7☐ 8☐ 9☐ 10☐ 11☐ 12☐ 13☐ 14☐ 15☐ 16☐ 17☐ 18☐ 18+☐

11. What is your occupation? If you have more than one job or undertake voluntary work, please describe them.

12. As far as you know, do you personally think the climate is changing and, if so, are human actions responsible?

PLEASE TICK ONE BOX ONLY

- Yes, I think the climate is changing but humans are not responsible ☐
- Yes, I think the climate is changing and humans are partly responsible ☐
- Yes, I think the climate is changing and humans are responsible ☐
- No, I do not think the climate is changing ☐
- Don't know ☐

3

13. Which, if any, of the following statements most closely describes your own opinion about taking action against climate change?

PLEASE TICK ONE BOX ONLY

- Every possible action should be taken against climate change ☐
- Some action should be taken against climate change ☐
- No action should be taken against climate change ☐
- None of these ☐
- Don't know ☐

14. To reduce their carbon emissions, some people are choosing to adopt a low carbon lifestyle. Which, if any, of the following statements most closely describes how you feel PERSONALLY about taking action to reduce your carbon emissions?

PLEASE TICK ONE BOX ONLY

- I do not understand what is meant by a low carbon lifestyle and reducing carbon emissions ☐
- I understand but do not wish to reduce my carbon emissions ☐
- I understand but I do not know what to do about it ☐
- I understand what I could do, but feel unable to do much in my circumstances ☐
- I have reduced my carbon emissions in the last year and would like to do more ☐
- I am committed to and live a low carbon lifestyle ☐

15. What have you done in the last TWO years to reduce the impact of your lifestyle on the environment and reduced your carbon emissions? *PLEASE LIST ALL WHAT YOU HAVE DONE*

16. Please could you state your priorities in the next 12 months for reducing your carbon emissions?

17. Do you grow any food for your own consumption?

PLEASE TICK ONE BOX ONLY

Yes ☐
No ☐

18. If you selected "No" would you like to grow your own food if suitable land was available to you?

Yes ☐
No ☐

19. If yes, what proportion of your fruit and vegetables you eat are home grown?

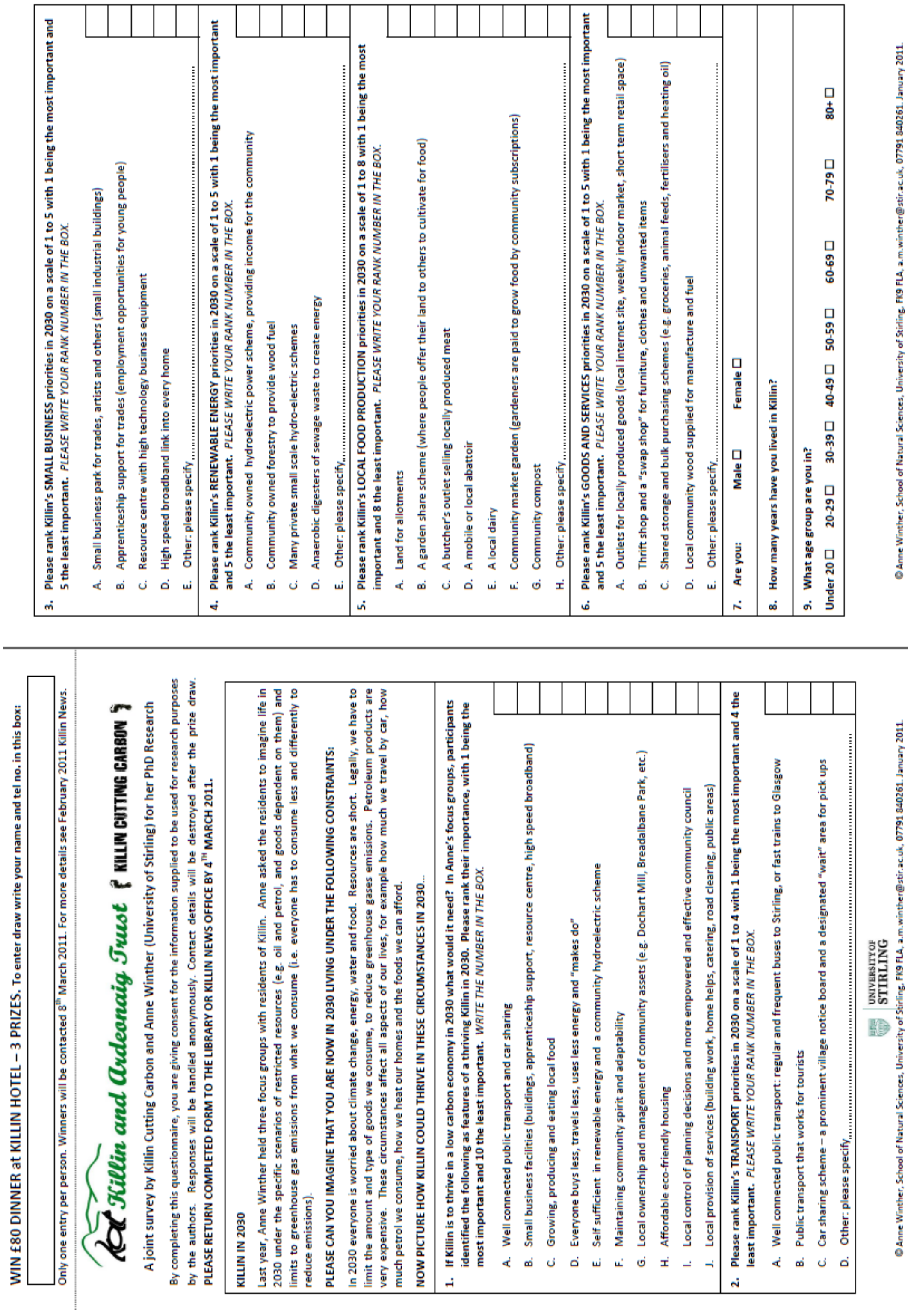
	None	Less than a quarter	A quarter	Half	Three-quarters	All
In summer	☐	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐	☐

20. Please state whether you are optimistic or pessimistic about the following:

	Very optimistic	Optimistic	Neither optimistic nor pessimistic	Pessimistic	Very pessimistic
My personal future	☐	☐	☐	☐	☐
The future of Kinlochleven	☐	☐	☐	☐	☐
The future state of the local environment	☐	☐	☐	☐	☐
The future state of the environment worldwide	☐	☐	☐	☐	☐

4

Figure A.3 Kinlochleven vision follow-up community questionnaire (continued)



WIN £80 DINNER at KILLIN HOTEL – 3 PRIZES. **To enter draw write your name and tel no. in this box:**

Only one entry per person. Winners will be contacted 8th March 2011. For more details see February 2011 Killin News.

Killin and Ardeonaig Trust — KILLIN CUTTING CARBON

A joint survey by Killin Cutting Carbon and Anne Winther (University of Stirling) for her PhD Research

By completing this questionnaire, you are giving consent for the information supplied to be used for research purposes by the authors. Responses will be handled anonymously. Contact details will be destroyed after the prize draw. **PLEASE RETURN COMPLETED FORM TO THE LIBRARY OR KILLIN NEWS OFFICE BY 4TH MARCH 2011.**

KILLIN IN 2030

Last year, Anne Winther held three focus groups with residents of Killin. Anne asked the residents to imagine life in 2030 under the specific scenarios of restricted resources (e.g. oil and petrol, and goods dependent on them) and limits to greenhouse gas emissions from what we consume (i.e. everyone has to consume less and differently to reduce emissions).

PLEASE CAN YOU IMAGINE THAT YOU ARE NOW IN 2030 LIVING UNDER THE FOLLOWING CONSTRAINTS:

In 2030 everyone is worried about climate change, energy, water and food. Resources are short. Legally, we have to limit the amount and type of goods we consume, to reduce greenhouse gases emissions. Petroleum products are very expensive. These circumstances affect all aspects of our lives, for example how much we travel by car, how much petrol we consume, how we heat our homes and the foods we can afford.

NOW PICTURE HOW KILLIN COULD THRIVE IN THESE CIRCUMSTANCES IN 2030…

1. **If Killin is to thrive in a low carbon economy in 2030 what would it need? In Anne's focus groups, participants identified the following as features of a thriving Killin in 2030. Please rank their importance, with 1 being the most important and 10 the least important.** *WRITE THE NUMBER IN THE BOX.*
   - A. Well connected public transport and car sharing
   - B. Small business facilities (buildings, apprenticeship support, resource centre, high speed broadband)
   - C. Growing, producing and eating local food
   - D. Everyone buys less, travels less, uses less energy and "makes do"
   - E. Self sufficient in renewable energy and a community hydroelectric scheme
   - F. Maintaining community spirit and adaptability
   - G. Local ownership and management of community assets (e.g. Dochart Mill, Breadalbane Park, etc.)
   - H. Affordable eco-friendly housing
   - I. Local control of planning decisions and more empowered and effective community council
   - J. Local provision of services (building work, home helps, catering, road clearing, public areas)

2. **Please rank Killin's TRANSPORT priorities in 2030 on a scale of 1 to 4 with 1 being the most important and 4 the least important.** *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*
   - A. Well connected public transport: regular and frequent buses to Stirling, or fast trains to Glasgow
   - B. Public transport that works for tourists
   - C. Car sharing scheme – a prominent village notice board and a designated "wait" area for pick ups
   - D. Other: please specify……………………………………………

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3. **Please rank Killin's SMALL BUSINESS priorities in 2030 on a scale of 1 to 5 with 1 being the most important and 5 the least important.** *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*
   - A. Small business park for trades, artists and others (small industrial buildings)
   - B. Apprenticeship support for trades (employment opportunities for young people)
   - C. Resource centre with high technology business equipment
   - D. High speed broadband link into every home
   - E. Other: please specify……………………………………………

4. **Please rank Killin's RENEWABLE ENERGY priorities in 2030 on a scale of 1 to 5 with 1 being the most important and 5 the least important.** *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*
   - A. Community owned hydroelectric power scheme, providing income for the community
   - B. Community owned forestry to provide wood fuel
   - C. Many private small scale hydro-electric schemes
   - D. Anaerobic digesters of sewage waste to create energy
   - E. Other: please specify……………………………………………

5. **Please rank Killin's LOCAL FOOD PRODUCTION priorities in 2030 on a scale of 1 to 8 with 1 being the most important and 8 the least important.** *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*
   - A. Land for allotments
   - B. A garden share scheme (where people offer their land to others to cultivate for food)
   - C. A butcher's outlet selling locally produced meat
   - D. A mobile or local abattoir
   - E. A local dairy
   - F. Community market garden (gardeners are paid to grow food by community subscriptions)
   - G. Community compost
   - H. Other: please specify……………………………………………

6. **Please rank Killin's GOODS AND SERVICES priorities in 2030 on a scale of 1 to 5 with 1 being the most important and 5 the least important.** *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*
   - A. Outlets for locally produced goods (local internet site, weekly indoor market, short term retail space)
   - B. Thrift shop and a "swap shop" for furniture, clothes and unwanted items
   - C. Shared storage and bulk purchasing schemes (e.g. groceries, animal feeds, fertilisers and heating oil)
   - D. Local community wood supplied for manufacture and fuel
   - E. Other: please specify……………………………………………

7. **Are you:** Male ☐ Female ☐

8. **How many years have you lived in Killin?**

9. **What age group are you in?**
   Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70-79 ☐ 80+ ☐

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Figure A.4 Killin vision follow-up community questionnaire

10. How many years of formal education have you had?

7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 18+ ☐

11. What is your occupation? If you have more than one job or undertake voluntary work, please describe them.

12. Do you grow any food for your own consumption? Yes ☐ No ☐

13. If you selected "No" would you like to grow your own food if suitable land was available to you? Yes ☐ No ☐

14. If yes, what proportion of your fruit and vegetables you eat are home grown?

	None	Less than a quarter	A quarter	Half	Three-quarters	All
In summer	☐	☐	☐	☐	☐	☐
In winter	☐	☐	☐	☐	☐	☐

15. As far as you know, do you personally think the climate is changing and, if so, are human actions responsible? *PLEASE TICK ONE BOX ☑ ONLY*

- Yes, I think the climate is changing but humans are not responsible ☐
- Yes, I think the climate is changing and humans are partly responsible ☐
- Yes, I think the climate is changing and humans are responsible ☐
- No, I do not think the climate is changing ☐
- Don't know ☐

16. Which, if any, of the following statements most closely describes your own opinion about taking action against climate change? *PLEASE TICK ONE BOX ☑ ONLY*

- Every possible action should be taken against climate change ☐
- Some action should be taken against climate change ☐
- No action should be taken against climate change ☐
- None of these ☐
- Don't know ☐

17. To reduce their carbon emissions, some people are choosing to adopt a low carbon lifestyle. Which, if any, of the following statements most closely describes how you feel PERSONALLY about taking action to reduce your carbon emissions? *PLEASE TICK ONE BOX ☑ ONLY*

- I do not understand what is meant by a low carbon lifestyle and reducing carbon emissions ☐
- I understand but do not wish to reduce my carbon emissions ☐
- I understand but I do not know what to do about it ☐
- I understand what I could do, but feel unable to do much in my circumstances ☐
- I understand what I could do and would like to start reducing my carbon emissions ☐
- I have reduced my carbon emissions in the last year and would like to do more ☐
- I am committed to and live a low carbon lifestyle ☐

18. What is the most interesting thing you have done to reduce your carbon emissions in the last two years? If nothing, please state nothing.

19. What are your priorities now for reducing your carbon emissions? If none, please state none.

20. Have you used Killin Cutting Carbon website or office resources or attended its events? Yes ☐ No ☐

21. If not, what do you know of Killin Cutting Carbon?

22. If yes, for what purpose?

23. If yes, please describe your experience. How satisfied were you?

24. What would you like Killin Cutting Carbon to do for Killin in the future?

25. ECONOMICALLY what is most important to Killin NOW? Please rank the following, 1 being the most important and 8 the least. *PLEASE WRITE YOUR RANK NUMBER IN THE BOX.*

A. Tourist industry and related tourist services	☐	B. Retailing	☐
C. Farming and related support businesses	☐	D. Construction, plumbing, electrical and joinery	☐
E. Stalking, fishing and shooting	☐	F. Technology enabled home-working	☐
G. Transport	☐	H. Other: please specify..	☐

26. Please state whether you are optimistic or pessimistic about the following:

	Very optimistic	Optimistic	Neither optimistic or pessimistic	Pessimistic	Very pessimistic
My personal future	☐	☐	☐	☐	☐
The future of Killin	☐	☐	☐	☐	☐
The future state of the local environment	☐	☐	☐	☐	☐
The future state of the environment worldwide	☐	☐	☐	☐	☐

27. Please state whether you agree or disagree with the following statements about Killin TODAY

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
SOCIALLY Killin is thriving today	☐	☐	☐	☐	☐
ECONOMICALLY Killin is thriving today	☐	☐	☐	☐	☐

PLEASE WRITE ANY COMMENTS HERE:

Figure A.4 Killin vision follow-up community questionnaire (continued)

A.3 Transport assumptions and conversion factors

A.3.1 Car efficiency and occupancy

The response to the type of vehicle driven was used to calculate the average efficiency of cars, measured in GHG emissions (AEA, 2010, Table A.1). Car occupancy assumed five seats. Average car efficiency and occupancy was weighted by the number of kilometres driven by each respondent to give the weighted average efficiency and weighted average occupancy, which were used to calculate the EF.

Table A.1 GHG conversion factors and relative efficiency factors for each car type (AEA, 2010)

Car Type	Miles to GHG conversion factor (kg CO_2e per mile)	Relative efficiency
Average car (unknown fuel)	0.396	1.000
Average petrol hybrid	0.314	0.794
Small petrol car (less than 1.4 litres)	0.330	0.834
Small diesel car (less than 1.7 litres)	0.281	0.711
Medium petrol car (1.4 to 2 litres)	0.409	1.035
Medium diesel car (1.7 to 2 litres)	0.350	0.884
Large petrol car (over 2 litres)	0.570	1.440
Large diesel car (over 2 litres)	0.474	1.197
Medium petrol hybrid car	0.228	0.576
Large petrol hybrid car	0.414	1.046
Medium LPG or CND car	0.353	0.892
Large LPG or CND car	0.490	1.240

A.3.2 Air travel assumptions

The REAP average for air travel occupancy (69%) was not changed for baseline and scenario modelling. Domestic, European and long haul flights have different GHG emissions (AEA, 2010), so the average number of passenger kilometres per year was weighted to the type of flight using AEA's (2010) average flight distances, adjusted by the typical difference in flight distance of (dis)embarking from Glasgow or Edinburgh instead of London (+/- 160km, Google Earth, 2011). The resultant distances were used to calculate the amount of kilometres travelled per respondent (Table A.2).

Table A.2 Average distances for domestic, European and long-haul flights weighted by GHG emissions (AEA, 2010, Google Earth, 2011)

Type of flight	Domestic	European	Long-haul
Return flight distance from Glasgow (km)	1,000	2,600	17,000
GHG emission conversion factor (kgCO_2e/km)	0.22	0.18	0.15
GHG emission as a percentage of the average	1.22	0.98	0.80
Weighted return flight distance (km)	1,200	2,600	14,000

A.4 Domestic energy: assumptions and conversion factors

Domestic energy was collected in physical and/or monetary units. Both required conversion to calorific values (kWh) to input into REAP. Energy prices were subject to price variations over the data collection timeframe, so monetary amounts consumed were adjusted using the Retail Prices Index (RPI, DECC, 2011b), for oil and electricity and consumer bills were used for LPG (Calor Scotland 2007-2011). The price per kWh came from Scottish Power's tariff in September 2010, adjusted by the RPI. (Table A.3, Scottish Power, 2010, DECC 2011b). For oil and LPG, the calorific value and volume (litres) per tonne vary according to the source and the refining process and the calorific value of a tonne of coal varies, giving different conversion factors for each year of the study (Table A.3, BERR, 2008). In the absence of a RPI for LPG, appropriate average prices were calculated from residential bills (Calor Scotland, 2007-2011). Coal consumption data was collected in bags or tonnes. One tonne of coal was assumed to contain 40 bags.

Table A.3. Energy conversion factors (monetary and physical to calorific unit conversion, BERR, 2008, DECC, 2010, 2011c)

Community	Fintry	Kinlochleven	Killin
Time period	May 07-Apr 08	May 09-Apr 10	Jul 10-Jun 11
Electricity			
Price index for time period (average)[1]	135.3	155.1	157.5
Indexed price first 255 kWh (p/kWh)[2]	14.03	16.37	16.62
Indexed price thereafter (p/kWh)[2]	9.63	11.24	11.41
Oil[3]			
Price (£/l)	0.410	0.405	0.540
Energy by weight (GJ/t)	41.0	40.8	40.7
Volume by weight (l/t)	1,014	1,024	1,015
Conversion factor (kWh/l)	11.23	11.07	11.14
LPG[3]			
Price (p/l)	0.32	0.41	0.49
Energy by weight (GJ/t)	45.9	46.0	46.0
Volume by weight (l/t)	1,937	1,931	1,924
Conversion factor (kWh/l)	6.58	6.62	6.64
Coal[3]			
Energy by weight (GJ/t)	29.0	28.2	28.3
Conversion factor (kWh/t)	8,056	7,833	7,861

[1]From RPI: Index year 2005 = 100 (DECC, 2011b)
[2]Reference price Sep 2010: 16.32p/kWh (First 255 kWh) and thereafter 11.20p/kWh (Scottish Power, 2010)
[3] Assumes 277.78 kWh/GJ. Conversion factors from BERR, 2008, DECC, 2010 and DECC, 2011c.

A.4.1 EF of green tariff and renewable energy generation

Switching production to using renewable electricity as opposed to conventional can be modelled in REAP, but household consumption of renewable electricity cannot. Therefore, Alderson *et al.*'s estimate that electricity generated from 100% renewables has an EF 10% of that of the current electricity generation mix (Alderson *et al.*, 2012) was used to estimate the EF of green tariff electricity.

A.4.2 EF of wood fuel

None of the communities were using short rotation coppice (SRC), so the yield for conventional forestry (2.9 tonnes per hectare per year (tonnes/ha/year) was used to calculate the baseline EF (Table A.4). As SRC may be used in future (because the yield is three times that of conventional forestry), the average of wood and SRC yield (Biomass, 2012) was used to calculate the EF in the household energy scenarios. In the absence of global hectare (gha) to Scotland's hectares (ha) conversion data, a 1:1 ratio was assumed.

Table A.4 Estimates of UK wood fuel yields (Biomass, 2012)

Fuel type	Yield (kWh/ha.year)[1]	Yield (tonnes/ha.year)[1]
Wood	10,300	2.9
SRC (willow)	46,000	12.9
Average	28,150	8

[1]In this instance 1gha was assumed to be equivalent to 1ha.

A.4.3 Peat and solid fuel

There was no question in the questionnaire relating to manufactured solid fuel and no respondent included this in the "other" option of heating sources. Therefore, manufactured solid fuel was set to zero in all scenarios and solid fuel was assumed to be wood, peat or coal, as indicated by the respondent.

A.4.4 Accounting for consumption of UK goods by foreigners

Within the results for each LA the EF of consumption of UK goods by foreigners is included. To ensure that the EF of each community was not over-inflated, the value for consumption of UK goods by foreigners was subtracted from the final demand category for spending on holidays abroad.

A.5 Demographic profiles of focus groups

The samples are too small to undertake a statistical comparison with the 2001 Census by age. In Fintry focus groups were predominantly male (64%), and so unlikely to represent the population in terms of gender, but most age ranges were represented apart from 20-29 and 80+ age groups (Table A.5, SCROL, n.d.). In Kinlochleven and Killin the gender ratio was more balanced and likely to be representative of the population (56% and 53% female respectively, compared with 53% female in the 2001 Census (Table A.5, SCROL, n.d.). In Kinlochleven the 70+ age group was not represented, but all others were. In Killin, focus group participants were all aged 40 and above and in one focus group (EAK) all participants had over 18 years of formal education. Therefore, in Killin the under-40 age groups were inadequately represented (Table A.5, SCROL, n.d.).

In the follow-up surveys, in Kinlochleven females were under-represented with only 44% of surveys completed by females (compared to 53% in the 2001 Census population, SCROL, n.d.), but in Killin the gender ratio for the surveys was similar to the 2001 Census (54% as opposed to 53% in the Census). In terms of age, under-30 age groups in both communities were under-represented and in Kinlochleven the 40-49 age group was over-represented with 41% of respondents in this group (Table A.6).

Table A.5 Demographic profiles of adult focus groups

	Fintry		Kinlochleven		Killin	
Age category	Number	Percent	Number	Percent	Number	Percent
By age						
Under 20	2	18%	0	0%	0	0%
20-29	0	0%	1	11%	0	0%
30-39	1	9%	1	11%	0	0%
40-49	4	36%	1	11%	4	0%
50-59	2	18%	2	22%	2	27%
60-69	1	9%	4	44%	6	13%
70-79	1	9%	0	0%	1	40%
80+	0	0%	0	0%	1	7%
Missing	-	-	-	-	1	7%
Total	11	100%	9	100%	15	100%
By gender						
Female	4	36%	5	56%	8	53%
Male	7	64%	4	44%	6	40%
Missing	-	-	-	-	1	7%
Total	11	100%	9	100%	15	100%
2001 Census percentage of population by gender						
Female		51%		53%		53%
Male		49%		47%		47%
Total		100%		100%		100%

Table A.6 Demographic profile of Kinlochleven follow-up questionnaire

By age

	Kinlochleven		Killin	
Age category	Number	Percent	Number	Percent
Under 20	0	0%	0	0%
20-29	0	0%	1	2%
30-39	4	24%	4	9%
40-49	7	41%	7	15%
50-59	2	12%	11	23%
60-69	3	18%	15	32%
70-79	0	0%	7	15%
80+	1	6%	2	4%
Total	17	100%	47	100%

By gender

Gender	Number	Percent	Number	Percent
Female	8	44%	25	54%
Male	10	56%	21	46%
Total	18	100%	46	100%

A.6 EF calculation methods

All approaches are dependent on how the amount of land appropriated by consuming resources or assimilating waste is measured. The amount of bioproductive land (biocapacity) is revised and published annually (WWF, 2010, Borucke *et al.,* 2012). As each country or geographic region has different land productivities, it is difficult to compare EFs (measured in hectares) between countries and over time (Monfreda *et al.*, 2004). Therefore, each land class (listed and defined in Table 2.5) in each year has its productivity calculated using yield factors, which *"…reflect the relative productivity of national and world average hectares of a given land use type*" (Kitzes *et al.*, 2008, p82, Figure A.5).

For both biocapacity and EF calculation, equivalence factors are used to compare between the different land classes to convert the land (measured in hectares, ha) in each class to a standardised (normalised) average productive hectare, global hectares (gha, Monfreda *et al.*, 2004, Kitzes *et al.*, 2008, Figure A.5, Figure A.6), so that the total number of global hectares are equal to the number of *actual* hectares of bioproductive land (11.9 billion gha, WWF, 2010).

The national footprint accounts generated annually by GFN use the compound method. They aggregate national and international data of production, trade (imports and exports), built land and carbon uptake (George and Dias, 2005, Wackernagel *et al.*, 2005, Kitzes *et al.*, 2008), mainly sourced from the UN Food and Agriculture Organization statistical database (FAOSTAT) and supplemented by data from other sources, for example, scientific studies, World Resources Institute (land cover classification), IPCC (GHG emissions) and British Petroleum (international hydroelectricity inventory, Kitzes *et al.*, 2008). The EF, calculated from national net consumption, is unique for each land class (Figure A.6).

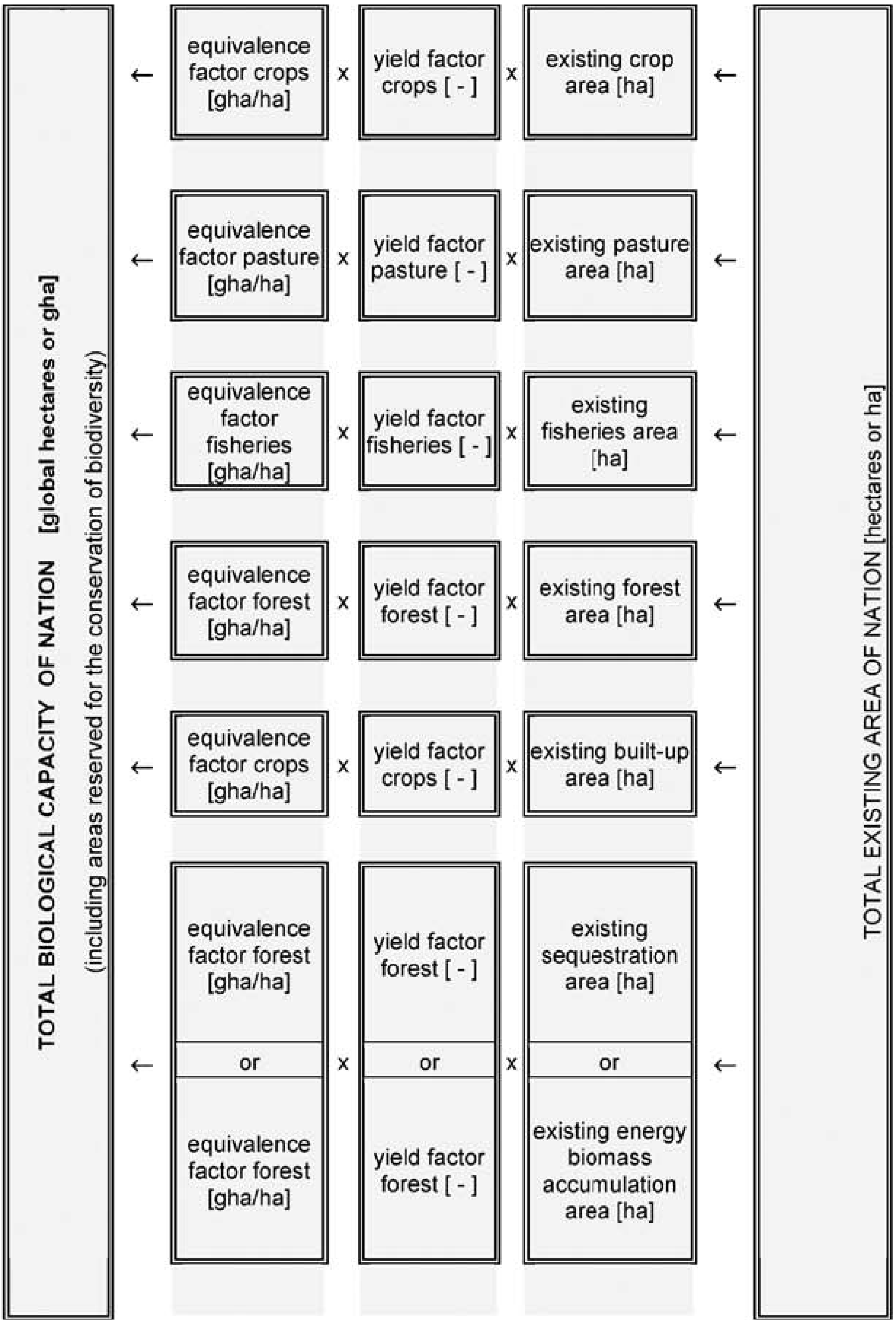

Figure A.5 Biocapacity (land appropriation) calculation method (from Monfreda *et al*., 2004)

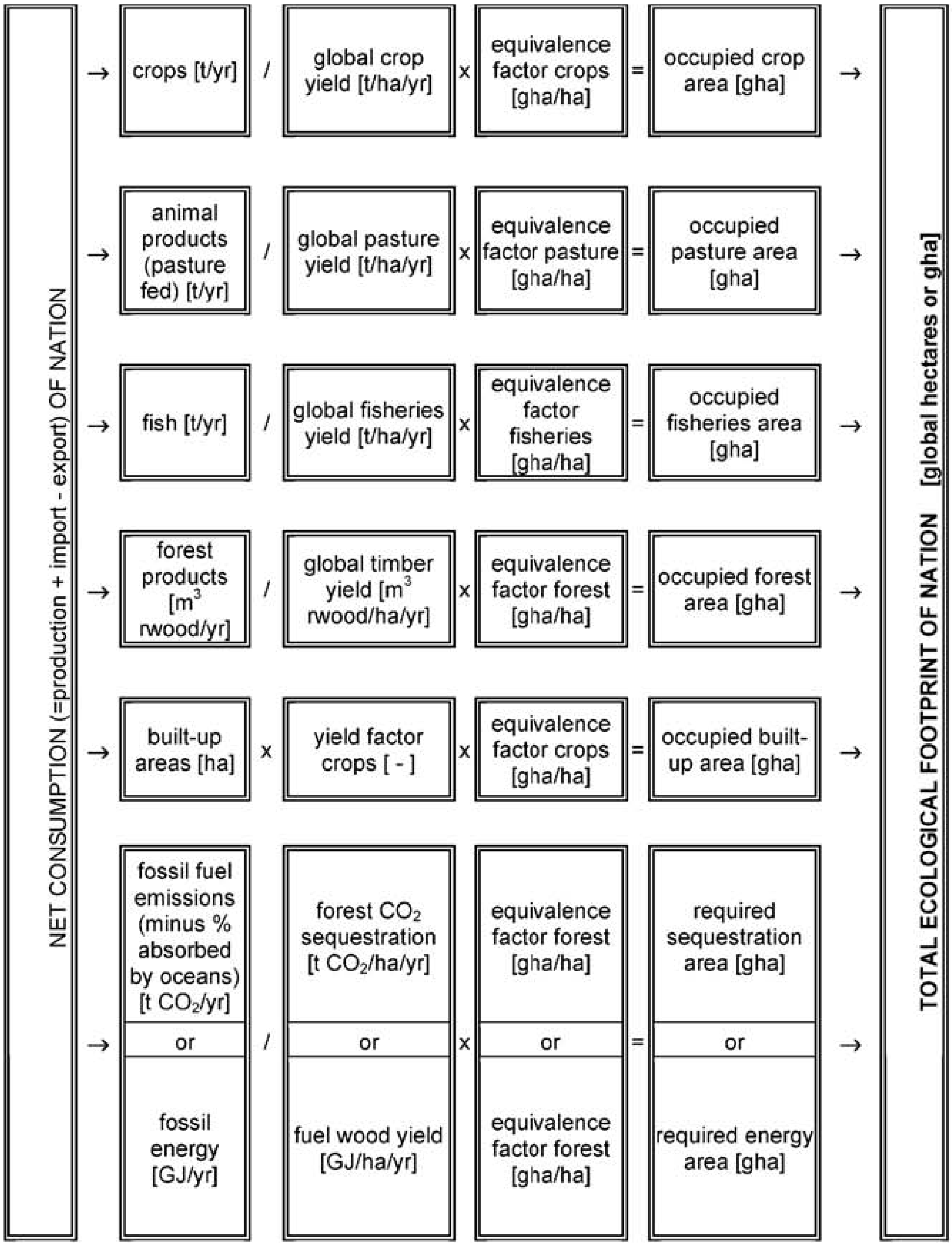

Figure A.6 EF compound calculation method (from Monfreda *et al.*, 2004)

The weakness of the compound approach is that it does not allow disaggregation to regions and consumption categories. Input-output modelling, using the EF accounts generated by the compound method, permits disaggregation of the accounts into FDCs and regions, making it more useful for scenario modelling and, therefore, informing policy (Monfreda *et al.*, 2004, George and Dias, 2005).

Input-output tables (the basis of structural economics, Duchin, 1998) contain the economic inputs and outputs of an economic system and their advantage is that they can incorporate ecological components (Leontief, 1966, Daly, 1968, Wiedmann *et al.*, 2006). They have been used to generate and integrate CFs (where total global production emissions are allocated to consumption categories), water footprints and EF analysis, providing a consistent basket of indicators for policymakers (Wiedmann, 2009, Ewing *et al.*, 2012). However, the integration of all three indicators post-dates both this study and REAPv2.17.

A.7 Variation of key variables by level of educational achievement and age

Table A.7 Variation of key variables by level of educational achievement and age

Level of educational achievement	Air PKMS[1]			Car PKMS impact[1,2]			Age		
	Mean	Median	N	Mean	Median	N	Mean	Median	N
0	2,394	0	31	6,241	4,872	20	66	66	31
1	6,658	0	24	7,285	5,463	22	60	66	24
2	8,125	0	32	12,938	11,766	28	53	53	32
3	8,630	2,600	23	16,721	13,747	20	54	54	23
4	11,670	5,200	53	15,383	12,630	47	54	55	53
Total			163			126			163
All levels (incl. missing levels)	1,229	0	169	12,641	9,998	142	58	58	170
Kruskal-Wallis test result*		H	P		H	p		H	p
		22.66	<0.001**		23.42	<0.001**		16.29	0.003**

Key to level of educational achievement:
Group 1: 'O' Grade, Standard Grade, Intermediate 1, Intermediate 2, City and Guilds Craft, SVQ level 1 or 2, or equivalent.
Group 2: Higher Grade, CSYS, ONC, OND, City and Guilds Advanced Craft, RSA Advanced Diploma, SVQ level 3 or equivalent.
Group 3: HND, HNC, RSA Higher Diploma, SVQ level 4 or 5, or equivalent.
Group 4: First degree, Higher degree, Professional Qualification.
*df=4 and the results are for adjustments for ties
**Significant at the 99% confidence level
[1]The Kruskal-Wallis test for these variables was still significant at the 99% level, if only working age respondents were included in the analysis.
[2]If outliers over 50,000km/year were excluded for Car PKMS, the variation in car travel by level of educational achievement was still significant (H=16.58, df=4 *p*=0.002).

Appendix B Baseline sustainability assessment

B.1 REAP input variables: values and data sources

The number of responses (N) for each variable and the weighting factor (WF^{cat}) applied to each case according to demographic group is shown in Table A.8. Table A.9 has the consumables FDC EF results. The values used to calculate the REAP baseline ecological footprint for each case study are given in Table A.10.

Table A.8 Variable responses (N) and the weighting factors (WFcat) by age group and gender for each case study community

A. Fintry

Variable	N				WF^{cat}			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
Household energy (kWh/capita/year)								
electricity	22	15	8	16	1.08	1.53	0.95	0.42
LPG	28	16	11	17	1.00	1.69	0.82	0.46
oil	28	17	13	17	1.04	1.66	0.72	0.48
coal	29	16	14	17	1.02	1.78	0.68	0.49
wood	26	16	12	16	1.05	1.64	0.73	0.48
Transport								
number in car (occupancy)	29	18	14	16	1.03	1.61	0.69	0.53
car type	30	18	14	16	1.01	1.63	0.70	0.54
car (km/capita/year)	30	18	12	16	0.99	1.59	0.79	0.52
bus (km/capita/year)	30	18	14	16	1.01	1.63	0.70	0.54
train (km/capita/year)	30	18	14	16	1.01	1.63	0.70	0.54
cycle (km/capita/year)	30	18	14	17	1.03	1.65	0.71	0.51
walk (km/capita/year)	28	18	12	14	1.00	1.50	0.75	0.56
passenger ferry (km/capita/year)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
car ferry (km/capita/year)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
air flights	30	18	14	17	1.03	1.65	0.71	0.51
Consumables and services (£ spent on… / capita/year)								
cigarettes and tobacco	30	18	14	17	1.03	1.65	0.71	0.51
Clothing	28	18	13	15	1.03	1.54	0.71	0.54
Footwear	28	18	13	15	1.03	1.54	0.71	0.54
equipment for sports, games and hobbies[1]	30	17	14	17	1.01	1.72	0.70	0.50
pets and pet food[1]	29	18	14	15	1.02	1.59	0.68	0.56

Variable	N				WF^{cat}			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
cultural activities[2]	30	18	13	17	1.01	1.63	0.75	0.50
sporting events[2]	30	18	14	17	1.03	1.65	0.71	0.51
betting and the lottery[2]	30	18	14	17	1.03	1.65	0.71	0.51
telephone services	28	17	12	12	0.96	1.52	0.72	0.63
soaps, shampoo, make up shaving stuff, toothpaste etc.	28	18	11	15	1.00	1.50	0.82	0.53
newspapers books and stationery	30	18	12	15	0.97	1.57	0.78	0.55
jewellery, clocks and watches	29	18	14	17	1.05	1.63	0.70	0.50
tv, computers, cameras, MP3 players, mobile phones	24	18	8	12	1.01	1.29	0.97	0.57
furniture and household furnishings	25	17	12	14	1.06	1.50	0.71	0.53
power tools and equipment for house and garden	27	18	11	13	1.00	1.44	0.79	0.58

[1]Other recreational items and equipment
[2]Recreational and cultural services

B. Kinlochleven

Variable	N				WF^{cat}			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
Household energy (kWh/capita/year)								
electricity	18	10	7	3	0.74	1.45	0.96	1.17
LPG	19	12	12	5	0.89	1.53	0.70	0.88
oil	19	12	12	5	0.89	1.53	0.70	0.88
coal	19	11	12	5	0.87	1.63	0.69	0.86
wood	19	12	12	4	0.87	1.49	0.69	1.08
Transport								
number in car (occupancy)	19	11	5	4	0.72	1.35	1.37	0.90
car type	19	12	3	4	0.70	1.21	2.23	0.87
car (km/capita/year)	16	12	9	5	0.92	1.33	0.82	0.77
bus (km/capita/year)	19	12	10	5	0.85	1.46	0.81	0.85
train (km/capita/year)	18	12	10	5	0.88	1.43	0.79	0.83
cycle (km/capita/year)	18	12	10	5	0.88	1.43	0.79	0.83
walk (km/capita/year)	18	12	10	5	0.88	1.43	0.79	0.83
passenger ferry (km/capita/year)	18	12	10	5	0.88	1.43	0.79	0.83
car ferry (km/capita/year)	18	12	10	5	0.88	1.43	0.79	0.83
air flights	20	12	11	5	0.84	1.53	0.77	0.88
Consumables and services (£ spent on… / year)								
cigarettes and tobacco	18	12	11	4	0.88	1.43	0.72	1.04
clothing	18	12	9	4	0.84	1.37	0.84	0.99
footwear	18	12	9	4	0.84	1.37	0.84	0.99
equipment for sports, games and hobbies[1]	17	12	11	4	0.91	1.40	0.70	1.01
pets and pet food[1]	20	12	12	5	0.86	1.56	0.72	0.90
cultural activities[2]	19	12	11	4	0.85	1.46	0.74	1.06
sporting events[2]	18	12	11	4	0.88	1.43	0.72	1.04
betting and the lottery[2]	19	12	10	4	0.83	1.43	0.79	1.04
telephone services	19	12	11	5	0.87	1.49	0.75	0.86

Variable	N				WF[cat]			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
soaps, shampoo, make up shaving stuff, toothpaste etc.	18	12	9	3	0.82	1.33	0.82	1.29
newspapers books and stationery	18	12	11	4	0.88	1.43	0.72	1.04
jewellery, clocks and watches	18	12	11	4	0.88	1.43	0.72	1.04
tv, computers, cameras, MP3 players, mobile phones	18	12	11	4	0.88	1.43	0.72	1.04
furniture and household furnishings	18	12	12	4	0.90	1.46	0.67	1.06
power tools and equipment for house and garden	17	12	11	4	0.91	1.40	0.70	1.01

[1]Other recreational items and equipment
[2]Recreational and cultural services

C. Killin

Variable	N				WF[cat]			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
Household energy (kWh/capita/year)								
electricity	12	8	12	3	1.03	1.53	0.51	1.42
LPG	14	10	13	3	1.01	1.40	0.53	1.62
oil	15	10	13	3	0.97	1.44	0.55	1.66
coal	14	10	12	3	0.99	1.37	0.56	1.58
wood	14	8	13	2	0.94	1.62	0.49	2.25
Transport								
number in car (occupancy)	14	10	10	3	0.94	1.30	0.64	1.50
car type	16	10	9	3	0.84	1.33	0.73	1.54
car (km/capita/year)	13	10	9	3	0.96	1.23	0.68	1.42
bus (km/capita/year)	13	8	9	3	0.90	1.44	0.64	1.33
train (km/capita/year)	12	8	9	3	0.95	1.40	0.62	1.29
cycle (km/capita/year)	11	8	8	3	0.97	1.31	0.65	1.21
walk (km/capita/year)	14	9	7	3	0.84	1.28	0.82	1.33
passenger ferry (km/capita/year)	12	8	9	3	0.95	1.40	0.62	1.29
car ferry (km/capita/year)	12	8	9	3	0.95	1.40	0.62	1.29
air flights	16	9	12	3	0.89	1.56	0.58	1.62
Consumables and services (£ spent on… / year)								
cigarettes and tobacco	15	10	13	2	0.95	1.40	0.53	2.43
clothing	14	10	11	3	0.96	1.33	0.60	1.54
footwear	12	10	12	2	1.06	1.26	0.52	2.18
equipment for sports, games and hobbies[1]	14	9	12	2	0.94	1.44	0.54	2.25
pets and pet food[1]	16	10	11	3	0.89	1.40	0.63	1.62
cultural activities[2]	16	10	13	3	0.93	1.47	0.56	1.70
sporting events[2]	15	9	13	2	0.92	1.52	0.52	2.37
betting and the lottery[2]	16	10	12	2	0.89	1.40	0.58	2.43
telephone services	13	10	10	3	0.98	1.26	0.62	1.46
soaps, shampoo, make up shaving stuff, toothpaste etc.	14	10	10	3	0.94	1.30	0.64	1.50
newspapers books and stationery	14	10	11	3	0.96	1.33	0.60	1.54

Variable	N				WF^{cat}			
	16-64f	16-64m	65+f	65+m	16-64f	16-64m	65+f	65+m
jewellery, clocks and watches	14	9	12	2	0.94	1.44	0.54	2.25
tv, computers, cameras, MP3 players, mobile phones	12	9	8	3	0.95	1.25	0.69	1.29
furniture and household furnishings	13	10	9	3	0.96	1.23	0.68	1.42
power tools and equipment for house and garden	15	10	9	3	0.88	1.30	0.71	1.50

[1]Other recreational items and equipment
[2]Recreational and cultural services

Table A.9 Consumables FDC EF results for each case study community and LA EF values from REAPv2.17 (SEI, 2011a)

Measured FDCs	EF (gha/cap)				
	Fintry	Kinlochleven	Killin	Stirling	Highland
Tobacco	0.03	0.04	0.03	0.05	0.05
Clothing	0.06	0.03	0.03	0.15	0.14
Footwear	0.01	0.01	0.01	0.02	0.02
Furniture	0.04	0.08	0.04	0.05	0.06
Tools	0.02	0.01	0.01	0.01	0.01
Audio visual/ cameras	0.01	0.02	0.03	0.03	0.03
Sports/ hobby equip	0.20	0.15	0.20	0.19	0.21
Printed materials/ stationery	0.02	0.02	0.04	0.02	0.02
Toiletries	0.02	0.02	0.02	0.04	0.04
Personal effects	0.01	0.01	0.00	0.02	0.02
Total measured FDCs	0.42	0.39	0.42	0.58	0.60
Total unmeasured FDCs	0.13	0.13	0.13	0.13	0.13
Consumables EF	0.55	0.52	0.55	0.70	0.73

Table A.10 Primary and secondary data sources and values used to populate the REAPv2.17 input variables for the case studies' baseline EF calculation

			Fintry		Kinlochleven		Killin		LA	
REAP variable[1]	Data Source[2]	Units /cap/year	Q Value	Average[4]	Q Value	Average[4]	Q Value	Average[4]	Stirling	Highland
Transport										
Walking PKMS	Q	km	933	1,076	825	833	774	762	246	246
Cycling PKMS	Q	km	280	348	114	131	297	366	62	62
Private and rented vehicles PKMS	Q	km	17,127	18,994	13,329	14,247	12,262	13,222	9,443	9,443
Public road transport PKMS	Q	km	828	785	1,041	840	256	212	987	987
Public railway transport PKMS	Q	km	157	131	0	0	0	0	655	655
Air travel PKMS	Q	km	10,185	12,816	4,027	4,773	9,136	11,199	5,287	5,287
Other public transport PKMS[5]	R/Q[5]	km			21	17	0	0	476	476
Walking occupancy	R	%							100%	100%
Cycling occupancy	R	%							100%	100%
Private and rented vehicles occupancy	Q	%	27%	25%	27%	26%	26%	25%	32%	32%
Public road transport occupancy	R	%							30%	30%
Public railway transport occupancy	R	%							26%	26%
Air travel occupancy	R	%							69%	69%
Other public transport occupancy	R	%							50%	50%
Efficiency of cars / private vehicles	Q	%	96%	97%	102%	97%	99%	97%	100%	100%
Efficiency of public road transport	R	%							100%	100%
Efficiency of railway transport	R	%							100%	100%
Efficiency of air transport	R	%							100%	100%
Efficiency of other transport	R	%							100%	100%
Domestic energy										
LPG	Q	kWh	1,568	1,628	315	383	2,496	1,802	6,812	3,094
Electricity	Q	kWh	5,264	5,362	5,297	5,557	5,656	5,233	2,459	3,479

			Fintry		Kinlochleven		Killin		LA	
REAP variable[1]	Data Source[2]	Units /cap/year	Q Value	Average[4]	Q Value	Average[4]	Q Value	Average[4]	Stirling	Highland
Conventional electricity	Q	kWh	4,758	4,957	5,144	5,346			n/a	n/a
Green tariff electricity	Q	kWh	506	405	153	211			n/a	n/a
Oil	Q	kWh	6,419	5,764	3,564	3,597	5,573	7,405	707	1,899
Coal	Q	kWh	1,319	1,354	1,442	1,652	1,507	1,539	239	27
Manufactured solid fuel	Q	kWh	0	0	0	0	0	0	239	27
Wood	Q	kWh	2,352	2,486	1,441	1,974	1,759	2,134	n/a	n/a
Consumables and durables										
Tobacco	Q	£	86	91	159	150	113	119	173	193
Clothing	Q	£	323	359	203	205	181	196	905	872
Footwear	Q	£	105	113	103	106	98	105	160	161
Furniture, furnishings, carpets, etc.	Q	£	166	200	448	436	190	224	301	308
Household textiles	R	£							106	109
Household appliances	R	£							66	70
Glassware, tableware & household utensils	R	£							78	78
Tools and equipment for house and garden	Q	£	121	137	68	77	84	103	52	59
Goods and services for household maintenance	R	£							116	118
Medical products, appliances & equipment	R	£							272	271
Telephone & telefax equipment	R	£							35	36
Audio-visual, photo & info. processing equipment	Q	£	108	117	145	164	199	266	335	341
Other major durables for recreation & culture	R	£	296	424	282	317	310	412	10	10
Other recreational equipment, etc.	Q	£							389	426
Newspapers, books & stationery	Q	£	202	208	172	174	384	375	226	226
Personal care	Q	£	153	169	173	168	201	200	326	314
Personal effects	Q	£	52	68	47	53	6	10	108	104
Purchase of vehicles	R	£							610	598
Services[6]										
Water supply and misc. dwelling services	R	£							93	93
Out-patient services	R	£							28	28
Hospital services	R	£							17	17

			Fintry		Kinlochleven		Killin		LA	
REAP variable[1]	Data Source[2]	Units /cap/year	Q Value	Average[4]	Q Value	Average[4]	Q Value	Average[4]	Stirling	Highland
Postal services	R	£							21	21
Telephone and telefax services	Q	£	364	364	479	461	328	340	245	245
Recreational and cultural services	Q	£	334	372	149	228	213	349	504	504
Education	R	£							119	119
Catering services	R	£							1,510	1,510
Accommodation services	R	£							109	109
Social protection	R	£							88	88
Insurance	R	£							358	358
Financial services	R	£							380	380
Other services	R	£							119	119
Actual rentals for housing	R	£							454	454
Imputed rentals for housing	R	£							1,025	1,025
Maintenance and repair of the dwelling	R	£							217	217
Demographics										
Population	Q		153		81		77		87,810	215,310
Household	Q		79		49		44		37,074	95,439

[1]The amount of food consumed by participants was not measured, so all the LA average values in REAP were used for the EF calculation.
[2]Key:Q = questionnaire, R = REAP LA average value.
[3]From REAP (SEI, 2011a).
[4]Questionnaire data weighted for age and gender to better align with the demographic profile of the 2001 Census (SCROL, 2001)
[5]Other was assumed to be by ferry. REAP LA average values were used for Fintry only.
[6]The proportion of these services produced domestically (expressed as a percentage in REAP, SEI, 2011a) were not altered, and so the LA average values for domestic productivity in REAP were used.

B.2 Businesses and community groups

Table A.11 Businesses identified in each case study (from FAME, 2012, 192.com, 2012, KAT, 2012 and local observations)

A. Fintry

Fintry business	Description
Fintry Cottages	Self-catering holiday lets
The Fintry Inn	Pub and Restaurant
Culcreuch Castle	Hotel, restaurant and function rooms
Fintry Renewable Energy Enterprise	Community owned business: wind energy.
Balgair Castle Caravan Park	Caravan park, self-catering caravan lets and caravan homes for holidays or residential living.
Knochraich	Farm and creamery
Clachan Hotel	Restaurant, bar and hotel (built in 1633 as a cattle drovers retreat)
Fintry Garage	Car repairs
TJ Plumbing	Plumber
Louise Stearn	Pilates
AJ Mearns	Electrician
Fintry Development Trust	Community development trust
Longden Homes & Gardens Ltd.	Construction of domestic buildings
Frost-Free Limited	Management consultancy activities (other than financial management)
The Code Factory Limited	Computer consultancy activities
P J Howson Properties Limited	Renting and operating of Housing Association real estate
J Mcdermott Limited	Other amusement and recreation activities
Garage DUO Ltd	Computer consultancy activities
Dunmore Property Investments Limited	Renting and operating of Housing Association real estate
Stone Arch Developments Limited	Construction of commercial buildings
Department-E Ltd	Software publishing
Medium Scale Wind Limited	Environmental consulting activities
J C Administration Ltd	Unknown
Culcreuch Home Farm	Farm
The Isles	B&B
Rockfoot	B&B
Russell Young Marketing Ltd	Promotional goods
Fintry Sports and Recreation Club	Sports club
Jamie Pearson Independent Funeral Director	Funeral Services
JM&M Maxwell	Livestock farm
Robert Aitken and Sons	Farm
GOC Engineering Services	Mechanical engineer
Lurg and Townhead Farm	Farm
William Mcghee	Furniture maker
Cutting Edge Contracts	Carpenter
William Wilson	Gas Installer
The Code Factory	Software developer
Strathendrick School of Motoring	Driving school
J&M Mundell & Sons	Farm
J&J Mckean	Truck repairs
Hideaway Country Holidays	

Fintry business	Description
Motor Tint Ltd	Tinted windows
J&E Aitken	Poultry farmers
Knights Pearl Restringing	Gems and precious stones
Courtyard Café	Café
Katy Rodger Making Interiors	Interior designer
Drew Johnston Joiners	Carpenter
Bruce Landscaping Contracts	Decking
John W Mcewan & Son	
A Mitchell	Livestock breeder
D&A Willison & Sons	Livestock farm

B. Kinlochleven

Kinlochleven business	Description
Kinlochleven Community Trust	Charity
Kinlochleven Community & Sports Centre Limited	The provision of facilities for recreation and other leisure time occupations.
K.C. & Sons Limited	Haulage
Leven Homes Ltd.	Construction of commercial buildings
Lochlann Productions Limited	Other research and experimental development on natural sciences and engineering
BJC Kitchen Company Limited	
Ecoe Homes Ltd	
Ice Factor	Recreational
River Leven Ales	Brewery
Blackwater Youth Hostel	Hostel accommodation
Tailrace Inn	Pub and accommodation
Forest View B&B	Accommodation
The Antler Bar	Pub
Highland Getaway B&B and Restaurant	Pub, restaurant and accommodation
Tigh na Cheo B&B	Accommodation
Quiraing B&B	Accommodation
Edencoille B&B	Accommodation
Bob & Chris's B&B	Accommodation
Allt-Na-Leven B&B	Accommodation
MacDonald Hotel & Campsite	Hotel and campsite
Hermon B&B	Accommodation
Failte B&B	Accommodation
A H Macdonald Joiners & Building Contractors	Carpenters
Lochleven Community Minibus Association	Community project
CC Plant	Plant hire
Royal Bank of Scotland	Bank
Sheri's Headquarters	Hairdresser
The Salvation Army	Charity
Riverside Chippy	Fish and chip shop
The Co-operative Food	Supermarket
Rio Tinto Alcan	Electrical distribution
Mamore Holiday Lodge	Hotel
Post Office	Post office
Harlequin Catering Supplies and Bakery	Catering
A&L Laundry Services	Laundry
Stuart Symmers	Tree Surgeon
AH Macdonald	Joiner

C. Killin

Killin business[1]	Description
Killin Care Trust	To provide education of to promote training programmes.
Killin And Ardeonaig Community Development Trust Limited	To manage community land and associated assets for the benefit of the community and the public in general.

Killin business[1]	Description
Breadalbane Lifelong Learning Trust	To promote, establish and operate other schemes of a charitable nature.
UQ Consulting Limited	The provision of training and development consultancy.
Killin Community Bus Company	Other passenger land transport n.e.c.
Kaim Investment Company Limited	Activities of open-ended investment companies
LIX Toll Garage Limited	Sale of used cars and light motor vehicles
Stitt Bros Limited	Site preparation
Access Anywhere Limited	Other business support service activities n.e.c.
John Morris Safety Ltd	Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) n.e.c.
Lochdochart Hydro	
NJS Cost Management Services (Uk) Limited	Other information technology and computer service activities
Breadalbane Planning Services Limited	Management consultancy activities (other than financial management)
Mccolm, Buchan, Ramsay Limited	Management consultancy activities (other than financial management)
Nuclear Project Associates Limited	Management consultancy activities (other than financial management)
ABQ Projects Limited	Engineering related scientific and technical consulting activities
Ellim Consulting Limited	The provision of business development and training consultancy.
Pace Transformation Services Limited	Management consultancy activities (other than financial management)
Machinery House Ltd	Unknown
Falls Of Dochart Inn Limited	Pub and accommodation
M L L F Limited	Unknown
BEN Ghlas Limited	Unknown
Macro Hospitality Ltd	Unknown
Alexanders Finance Ltd.	Unknown
J Ronald Ltd	Unknown
Mackerel & Rhubarb Ltd	Unknown
Corrycharmaig Farming Partnership	Unknown
Duncroisk Farming Partnership	Unknown
The NEW Corrycharmaig Partnership	Unknown
The NEW Duncroisk Farm Partnership	Unknown
The National Trust for Scotland	Conservation charity
Douglas Mcrobbie Electrical Contractors	Electrician
Bridgend Mill	Gift Shop
Grant & Welsh	Painter and decorator
C Grant Painters and decorators	Painter and decorator
Kristy's Kitchen	Takeaway
Capercaillie	Restaurant
Breadalbane Guest House	Accommodation
Fairview House	Accommodation
The Wee Bakeshop	Baker and cafe
Forster	Electrician
A C Fraser & Sons	Plumber
A & B Services (Scotland)	Farm Engineers
Grants Laundry	Laundry
The Studio	Craft Shop
Falls Of Dochart Retirement Home	Care Homes
Bank Of Scotland Plc	Bank
Eureka	Discount Centre
The Co-Operative Food	Supermarket

Killin business[1]	Description
Clachaig Hotel Trading Co	Hotel
Maureen H Gauld	Antique Dealers
Shutters Restaurant	Restaurant
Killin Kutz	Hairdresser
Corrie Craft	Craft Shop
Ross Anderson	Accommodation
Stitt Bros Ltd	Builders
Craigbuie Guest House	Accommodation
Killin Post Office	Post Office
Killin Outdoor Centre	Shop and cycle hire
News First	Newsagent
B L Decorators	Painter And Decorator
Caravan Club Maragowan	Caravan Park
Town & Country	Caterers
Dall Lodge Country House	Accommodation
Coach House Hotel	Accommodation
Kenneth Somerville	Unknown
Ardlochay Lodge	Accommodation
Invertay Guest House	Accommodation
Dundaramh Hotel	Hotel
The Caravan Club Ltd	Caravan Pak
The Bridge Of Lochay Hotel	Hotel
Killin Highland Lodges	Accommodation
High Creagan	Caravan Park
Killin Golf Club	Golf club
Dave Hunt Photographer	Photography
Boat House Restaurant	Restaurant
Loch Tay Highland Lodge Park	Accommodation and hotel
Cruachan Caravan & Camping Park	Caravan park
Old Flax Mill The Restaurant	Restaurant
A & J Anderson	Livestock farm
County Catering	Caterers
A J Brown	Nurseryman
Ecological Architecture	Architect
Loch Tayside Community Interest Co	Community enterprise
Brockie, Keith	Painter
Bernard Mallett-Griffiths	Painter
Heather Walker	Painter and Potter
Killin Gallery	antiques
Swords	textiles
Carlotta Fraser	Catering
Cruachan Restaurant	Restaurant
The Old Smiddy	Restaurant
Duncan Anderson	Plumbing
Bridge of Lochay Hotel	Hotel
Craigard Hotel	Hotel
Kevin Horsley	DIY
Donald Hancock	Metal fabricator
Drumfinn Guest House	Accommodation
Dunlochay	Accommodation
Eric McAllister	Carpet fitter
Franny Morrison	Music tuition
Henry Paterson Architect	Architect
J. Campbell	Plumbing
Jane Watts	Music tuition
Auchlyne Farm	Farm

Killin business[1]	Description
Balbeg Farm, Perthshire	Farm
Boreland Estate/Farm, Glen Lochay	Farm
Bovain Farm, Glen Dochart	Farm
Braes of Ardeonaig	Farm
Carie Farm, Lawers	Farm
Craignavie Farm, Killin	Farm
Cruachan Farm, Perthshire	Farm
Duallin Farm, Perthshire	Farm
Finlarig Estate, Killin	Farm
Innischoarach, Estate	Farm
Innishewan Farms, Auchlyne Estate, Glen Dochart	Farm
Kinnell Estate/Farm, Killin	Farm
Ledcharrie Farm, Glen Dochart	Farm
Moncreiffe Farming, Ardtalnaig	Farm
Morenish Farm, Perthshire	Farm
National Trust for Scotland, Ben Lawers	Farm
Pitcastle Estate, Glen Lochay	Farm
Tullich Farm, Glen Lochay	Farm

[1]There are additional businesses at Tombreck and Ardeonaig but these were excluded as outside the study area.

Table A.12 Community groups identified in each case study

A. Fintry

Community group	Description
Fintry Development Trust	Community Development Trust
Fintry Sports & Recreation Club	Rugby, indoor bowling, gym, sauna, squash courts, small shop and bar/coffee shop. Newly installed biomass heating system (2012)
Fintry Amateur Dramatic Society	Very popular and active society staging several performances per year
Fintry Parent and Toddler Group	
Fintry Parent Teacher Association	
Fintry Out of School Care	An asset to the village and draws in children from outside Fintry where there is no out of school provision
Village Hall Committee	
Fintry Accordion and Fiddle Association	
Fintry Energy Efficient Transport	Car sharing club with two cars, set up by FDT
Fintry Renewable Energy Enterprise	The community business managing the wind farm investment.
Religious: Fintry Parish Church (Church of Scotland)	
Strathendrick Rugby Football Club	
Fintry Bowling Club	
Fintry Football Club	
Fintry Squash Club	
Fintry Music Festival	
Fintry Focus Newsletter team	

B. Kinlochleven

Community group / service	Description
Kinlochleven Community Library and Highland Council Service Point	Book bug pre-school group Saturday morning kid's craft club
Book bug pre-school group	
Saturday children's crafts	
Religious groups: Kinlochleven Parish Church (Church of Scotland) St Paul's Episcopal Church The Good Shepherd, Roman Catholic Church	
University of Highlands and Islands, West Highland College Learning Centre	Incorporated within the Leven Centre, providing access to courses, computer and video conferencing facilities
Community centre and hall	
Youth club	Meets weekly in the Leven Centre
Dramafish Studios, opened 2011 (KCT, 2011)	Drama studio opened September 2011 (KCT, 2011)
Community compost	Community run and maintained compost site
New Start Highland	Provided second hand furniture and other goods to the local community. Present at the time of the survey in 2010. Closed down in 2012 (KCT, 2012b)
Salvation Army	

C. Killin (KAT, 2012, p7 – 8)

Community group / service
Badminton Club
Book Clubs (two)
Bowling Club
Breadalbane Lifelong Learning Centre
KAT
Brownies
Carpet Bowling
Church of Scotland Guild
Cinema Club
Craft Group
Drama Club (Killin Dramatic Club) http://www.killindramaclub.co.uk
Environmental Action Killin http://eakillin.webplus.net
Killin Golf Club: Food and bar http://www.killingolfclub.co.uk
Heritage Society
Killin Breadalbane Angling Club
Killin Community Choir
Killin Youth Group
National Trust for Scotland, Green Team (for young children), Talks and presentations
Quilters
Sports and Social Club: Bowls, Tennis and Pitch and Put
WRI Killin
WRI Ardeonaig
Tuesday Club
Women's Guild
Killin News team
Village Hall committee

B.3 Current state of Fintry: focus group participant views

Table A.13 shows the results of an additional focus group discussion, which was not undertaken in Killin and Kinlochleven.

Table A.13 The state of Fintry in 2008 from comments from focus groups and personal communications

Good	**Needs improvement / lacking**
Sustainable consumption • Opportunities to recycle with Stirling Council Transport and connectivity • Have the benefits of a remote community but close enough to commute • School bus service is good. • Mobile food vans – fish, farm produce Health, well-being and education: • Fintry Primary School and Balfron High School: "brilliant", "excellent" • Feel safe at night and there is very little vandalism (apart from occasional at caravan site) Environment and ecocentrism • "*Good landscape and physical environment*" Community, culture and social capital: • Lots of social activity in the community • Social networks and friends "*everyone knows everyone*" • Friendly community: welcoming and respecting diversity • Facilities: Sports centre, post office, small garage, shop, village hall, pubs, church – bring people together – social cohesion	Sustainable consumption • Central composting facility and extension of plastic recycling facility needed. • Local produce be more available to the community. • Community food production. Governance and land tenure • Lack of consultation on local plans and lack of ability to influence and make local decisions. "Why can't we have a vision of what we want as a local community?" Transport and connectivity: • Public transport poor with only 1 return bus per day to Stirling and Glasgow. • Co-ordination of supermarket deliveries. • Return bus for after school clubs. • Community car / car pool / car sharing. • Young people tend to socialise with those that they went to school with so their social circles are dispersed around many local villages. Health, well-being and education: • Everybody should take advantage of [the landscape] – health aspect. Built environment: • Concern over empty properties not contributing to the community and possibility of some second homes. • Affordable housing is needed to sustain the population and support the village. Community, culture and social capital • Youth club needed. • Church is well attended but there are only three in Sunday School. • Welcome pack for new inhabitants. Sustainable energy to fuel life: • Lack of reliable and cheap energy source (e.g., mains gas). Economy: • No outlets for locally produced goods (e.g., crafts). Village shop needs to be bigger and better supported. • Local distribution of farm produce e.g., lamb. • Very little local employment. • Community based jobs are needed, e.g., growing vegetables, driving a bus to Balfron, over-seeing energy use.

Appendix C Modelling data and analysis

C.1 Tables of variable values for modelling transport and energy scenarios

Table A.14 Transport modelling: baseline and CAR scenarios' variable values for each case study

Variable	Unit /cap	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
Fintry								
Car PKMS	km	18,994	15,195	80%	11,396	60%	28	0%
Car Occupancy		0.25	0.40	159%	0.60	238%	1.00	396%
Car Efficiency		0.97	0.77	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	610	488	80%	305	50%	12	2%
Bus PKMS	km	785	2,684	342%	4,584	584%	6,483	826%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	131	1,080	826%	2,030	1553%	3,929	3005%
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	348	538	155%	1,297	373%	2,247	646%
Walk PKMS	km	1076	1,261	117%	1,446	134%	1,817	169%
Ancillary transport PKMS	km	476	476	1.00	476	1.00	476	1.00
Air PKMS	km	12,816	12,816	1.00	12,816	1.00	12,816	1.00
Kinlochleven								
Car PKMS	km	14,247	11,398	80%	8,548	60%	59	0%
Car Occupancy		0.26	0.40	155%	0.60	233%	1.00	388%
Car Efficiency		0.97	0.78	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	598	478	80%	299	50%	12	2%
Bus PKMS	km	840	2,265	270%	3,689	439%	5,114	609%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	0	712	n/a	1,425	n/a	2,849	n/a
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	131	273	209%	843	644%	1,556	1187%
Walk PKMS	km	833	1,018	122%	1,204	144%	1,574	189%
Ancillary transport PKMS	km	29	29	1.00	29	1.00	29	1.00
Air PKMS	km	4,773	4,773	1.00	4,773	1.00	4,773	1.00

Table A.14 Transport modelling: baseline and CAR scenarios' variable values for each case study (continued)

Variable	Unit /cap	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
Killin								
Car PKMS	km	13,222	10,578	80%	7,933	60%	29	0%
Car Occupancy		0.25	0.40	163%	0.60	245%	1.00	408%
Car Efficiency		0.97	0.77	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	610	488	80%	305	50%	12	2%
Bus PKMS	km	212	1,534	723%	2,857	1346%	4,179	1970%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	0	661	n/a	1,322	n/a	2,644	n/a
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	366	499	136%	1,027	280%	1,688	461%
Walk PKMS	km	762	947	124%	1,132	149%	1,502	197%
Ancillary transport PKMS	km	0	0	n/a	0	n/a	0	n/a
Air PKMS	km	11,199	11,199	1.00	11,199	1.00	11,199	1.00

Table A.15 Transport modelling: baseline and LDT scenarios' variable values for each case study

Variable	Unit /cap	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
Fintry								
Car PKMS	km	18,994	19,171	101%	19,171	101%	18,994	100%
Train PKMS	km	131	3,163	2419%	3,671	2808%	1,312	1004%
Train occupancy		0.26	50%	192%	70%	269%	80%	308%
Ancillary transport PKMS	km	476	476	100%	703	148%	795	167%
Air PKMS	km	12,816	7,489	58%	2,657	21%	0	0%
Domestic flights PKMS	km	2,189	0	0%	0	0%	0	0%
European flights	km	3,375	1,687	50%	844	25%	0	0%
Long-haul flights	km	7,252	5,801	80%	1,813	25%	0	0%

Table A.15 Transport modelling: baseline and LDT scenarios' variable values for each case study (continued)

Variable	Unit /cap	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
Kinlochleven								
Car PKMS	km	14,247	14,459	101%	14,459	101%	14,247	100%
Train PKMS	km	0	470	n/a	726	n/a	368	n/a
Train occupancy		0.26	50%	192%	70%	269%	80%	308%
Ancillary transport PKMS	km	29	29	100%	173	600%	164	569%
Air PKMS	km	4,773	3,357	70%	1,129	24%	0	0%
Domestic flights PKMS	km	257	0	0%	0	0%	0	0%
European flights	km	851	425	50%	213	25%	0	0%
Long-haul flights	km	3,665	2,932	80%	916	25%	0	0%
Killin								
Car PKMS	km	13,222	13,399	101%	13,399	101%	13,222	100%
Train PKMS	km	0	1,355	n/a	1,944	n/a	898	n/a
Train occupancy		0.26	50%	192%	70%	269%	80%	308%
Ancillary transport PKMS	km	0	0	n/a	260	n/a	310	n/a
Air PKMS	km	11,199	7,685	69%	2,580	23%	0	0%
Domestic flights PKMS	km	879	0	0%	0	0%	0	0%
European flights	km	1,905	952	50%	476	25%	0	0%
Long-haul flights	km	8,416	6,733	80%	2,104	25%	0	0%

Table A.16 Transport modelling: baseline and PT scenarios' variable values for each case study

Variable	Unit /cap	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
Fintry								
Car PKMS	km	18,994	15,372	81%	11,573	61%	28	0%
Car Occupancy		0.25	0.40	159%	0.60	238%	1.00	396%
Car Efficiency		0.97	0.77	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	610	488	80%	305	50%	12	2%
Bus PKMS	km	785	2,684	342%	4,584	584%	6,483	826%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	131	4,113	3146%	5,570	4260%	5,111	3909%
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	348	538	155%	1,297	373%	2,247	646%
Walk PKMS	km	1,076	1,261	117%	1,446	134%	1,817	169%
Ancillary transport PKMS	km	476	476	100%	703	148%	795	167%
Air PKMS	km	12,816	7,489	58%	2,657	21%	0	0%
Domestic flights PKMS	km	2,189	0	0%	0	0%	0	0%
European flights	km	3,375	1,687	50%	844	25%	0	0%
Long-haul flights	km	7,252	5,801	80%	1,813	25%	0	0%
Kinlochleven								
Car PKMS	km	14,247	11,610	81%	8,760	61%	59	0%
Car Occupancy		0.26	0.40	155%	0.60	233%	1.00	388%
Car Efficiency		0.97	0.78	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	598	478	80%	359	60%	12	2%
Bus PKMS	km	840	2,265	270%	3,689	439%	5,114	609%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	0	1,182	n/a	2,151	n/a	3,217	n/a
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	131	273	209%	843	644%	1,556	1187%
Walk PKMS	km	833	1,018	122%	1,204	144%	1,574	189%
Ancillary transport PKMS	km	29	29	100%	145	500%	164	569%
Air PKMS	km	4,773	3,357	70%	1,129	24%	0	0%
Domestic flights PKMS	km	257	0	0%	0	0%	0	0%
European flights	km	851	425	50%	213	25%	0	0%
Long-haul flights	km	3,665	2,932	80%	916	25%	0	0%

Table A.16 Transport modelling: baseline and PT scenarios' variable values for each case study (continued)

		Baseline	Step 1		Step 2		Step 3	
Variable	Unit /cap	Value	Value	% of baseline	Value	% of baseline	Value	% of baseline
Killin								
Car PKMS	km	13,222	10,755	81%	8,110	61%	29	0%
Car Occupancy		0.25	0.40	163%	0.60	245%	1.00	408%
Car Efficiency		0.97	0.77	80%	0.58	60%	0.19	20%
Expenditure on new vehicles	£	610	488	80%	305	50%	12	2%
Bus PKMS	km	212	1,534	723%	2,857	1346%	4,179	1970%
Bus occupancy		0.30	0.50	167%	0.70	233%	0.80	267%
Train PKMS	km	0	2,016	n/a	3,266	n/a	3,543	n/a
Train occupancy		0.26	0.50	192%	0.70	269%	0.80	308%
Cycle PKMS	km	366	499	136%	1,027	280%	1,688	461%
Walk PKMS	km	762	947	124%	1,132	149%	1,502	197%
Ancillary transport PKMS	km	0	0	n/a	260	n/a	310	n/a
Air PKMS	km	11,199	7,685	69%	2,580	23%	0	0%
Domestic flights PKMS	km	879	0	0%	0	0%	0	0%
European flights	km	1,905	952	50%	476	25%	0	0%
Long-haul flights	km	8,416	6,733	80%	2,104	25%	0	0%

Table A.17 Energy modelling: energy scenarios' variable values

Variable[1] / Consumption[2]	Baseline[1] (kWh/cap)	E1 kWh	E1 % of baseline	E2 (kWh/cap)	E2 % of baseline	E3 (kWh/cap)	E3 % of baseline	Percentage of baseline total: Baseline	E1	E2	E3
Fintry											
LPG	1,628	1,042	64%	488	30%	0	0%	10%	6%	3%	0%
Oil	5,764	3,689	64%	1,729	30%	0	0%	35%	22%	10%	0%
Coal	1,354	866	64%	0	0%	0	0%	8%	5%	0%	0%
Wood	2,486	2,753	111%	3,250	131%	2,906	117%	15%	17%	20%	18%
Green electricity	405	1,409	348%	2,090	516%	1,938	479%	2%	8%	12%	11%
Conventional electricity	4,957	2,761	56%	791	16%	0	0%	30%	17%	5%	0%
Total	16,593			8,292		4,768		100%	75%	50%	29%
Kinlochleven											
LPG	383	245	64%	115	30%	0	0%	3%	2%	1%	0%
Oil	3,597	2,302	64%	1,079	30%	0	0%	27%	17%	8%	0%
Coal	1,652	1,057	64%	0	0%	0	0%	13%	8%	0%	0%
Wood	1,974	2,109	107%	2,574	130%	2,114	107%	15%	16%	20%	16%
Green electricity	211	1,166	553%	1,992	945%	1,999	948%	2%	9%	15%	15%
Conventional electricity	5,346	3,174	59%	1,091	20%	0	0%	41%	24%	8%	0%
Total	13,162			6,808		4,055		100%	76%	52%	31%
Killin											
LPG	1,802	1,153	64%	540	30%	0	0%	10%	6%	3%	0%
Oil	7,405	4,739	64%	2,222	30%	0	0%	41%	26%	12%	0%
Coal	1,539	985	64%	0	0%	0	0%	8%	5%	0%	0%
Wood	2,134	2,641	124%	3,400	159%	3,187	149%	12%	15%	19%	18%
Green electricity	203	1,185	584%	2,088	1029%	2,196	1082%	1%	6%	11%	12%
Conventional electricity	5,030	3,033	60%	1,072	21%	0	0%	28%	17%	6%	0%
Total	18,112			9,286		5,335		100%	76%	51%	29%

[1]Excludes manufactured solid fuel, gas, peat and energy sourced from the ground or air through GSHPs/ASHPs.
[2]Accuracy of all data in this table can only be assumed to two significant figures.

C.2 Transport modelling results

Table A.18 Transport modelling EF results compared to the baseline EF for each case study

A. FINTRY

FDC	Stirling-shire	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
CAR scenario EF (gha/cap)								
Cars	0.52	1.18	0.54	46%	0.24	20%	0.00	0%
Rail	0.02	0.00	0.02	427%	0.02	571%	0.04	968%
Buses	0.05	0.04	0.09	205%	0.10	250%	0.13	309%
Air	0.19	0.46	0.46	100%	0.46	100%	0.46	100%
Ancillary	0.05	0.05	0.05	100%	0.05	100%	0.05	100%
Total Transport EF	**0.83**	**1.73**	**1.15**	**66%**	**0.87**	**50%**	**0.68**	**39%**
LDT scenario EF (gha/cap)								
Cars	0.52	1.18	1.19	101%	1.19	101%	1.18	100%
Rail	0.02	0.00	0.05	1249%	0.04	1034%	0.01	324%
Buses	0.05	0.04	0.04	100%	0.04	100%	0.04	100%
Air	0.19	0.46	0.27	58%	0.09	21%	0.00	0%
Ancillary	0.05	0.05	0.05	100%	0.07	148%	0.08	167%
Total Transport EF	**0.83**	**1.73**	**1.60**	**92%**	**1.44**	**83%**	**1.32**	**76%**
PT scenario EF (gha/cap)								
Cars	0.52	1.18	0.55	46%	0.24	21%	0.00	0%
Rail	0.02	0.00	0.07	1622%	0.06	1568%	0.05	1261%
Buses	0.05	0.04	0.09	205%	0.10	250%	0.13	309%
Air	0.19	0.46	0.27	58%	0.09	21%	0.00	0%
Ancillary	0.05	0.05	0.05	100%	0.07	148%	0.08	167%
Total Transport EF	**0.83**	**1.73**	**1.02**	**59%**	**0.58**	**33%**	**0.26**	**15%**

Table A.18 Transport modelling EF results compared to the baseline EF for each case study (continued)

B. KINLOCHLEVEN

FDC	Stirling-shire	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
CAR scenario EF (gha/cap)								
Cars	0.53	0.91	0.43	47%	0.19	21%	0.00	0%
Rail	0.02	0.00	0.01	n/a	0.02	n/a	0.03	n/a
Buses	0.05	0.04	0.07	162%	0.08	188%	0.09	228%
Air	0.18	0.16	0.16	100%	0.16	100%	0.16	100%
Ancillary	0.05	0.00	0.00	100%	0.00	100%	0.00	100%
Total Transport EF	**0.82**	**1.11**	**0.67**	**60%**	**0.45**	**40%**	**0.28**	**26%**
LDT scenario EF (gha/cap)								
Cars	0.53	0.91	0.92	101%	0.92	101%	0.91	100%
Rail	0.02	0.00	0.01	n/a	0.01	n/a	0.00	n/a
Buses	0.05	0.04	0.04	100%	0.04	100%	0.04	100%
Air	0.18	0.16	0.11	70%	0.04	24%	0.00	0%
Ancillary	0.05	0.00	0.00	100%	0.02	604%	0.02	568%
Total Transport EF	**0.82**	**1.11**	**1.08**	**98%**	**1.03**	**92%**	**0.97**	**87%**
PT scenario EF (gha/cap)								
Cars	0.53	0.91	0.44	48%	0.20	23%	0.00	0%
Rail	0.02	0.00	0.02	n/a	0.02	n/a	0.03	n/a
Buses	0.05	0.04	0.07	162%	0.08	188%	0.09	228%
Air	0.18	0.16	0.11	70%	0.04	24%	0.00	0%
Ancillary	0.05	0.00	0.00	100%	0.01	500%	0.02	568%
Total Transport EF	**0.82**	**1.11**	**0.64**	**57%**	**0.36**	**32%**	**0.14**	**13%**

Table A.18 Transport modelling EF results compared to the baseline EF for each case study (continued)

C. KILLIN

FDC	Stirling-shire	Baseline Value	Step 1 Value	Step 1 % of baseline	Step 2 Value	Step 2 % of baseline	Step 3 Value	Step 3 % of baseline
CAR scenario EF (gha/cap)								
Cars	0.52	0.87	0.40	46%	0.18	21%	0.00	0%
Rail	0.02	0.00	0.01	n/a	0.02	n/a	0.03	n/a
Buses	0.05	0.01	0.05	434%	0.06	578%	0.08	739%
Air	0.19	0.40	0.40	100%	0.40	100%	0.40	100%
Ancillary	0.05	0.00	0.00	100%	0.00	100%	0.00	100%
Total Transport EF	**0.83**	**1.28**	**0.86**	**67%**	**0.66**	**51%**	**0.51**	**40%**
LDT scenario EF (gha/cap)								
Cars	0.52	0.87	0.88	101%	0.88	101%	0.87	100%
Rail	0.02	0.00	0.02	n/a	0.02	n/a	0.01	n/a
Buses	0.05	0.01	0.01	100%	0.01	100%	0.01	100%
Air	0.19	0.40	0.27	69%	0.09	23%	0.00	0%
Ancillary	0.05	0.00	0.00	100%	0.03	n/a	0.03	n/a
Total Transport EF	**0.83**	**1.28**	**1.19**	**93%**	**1.03**	**81%**	**0.92**	**72%**
PT scenario EF (gha/cap)								
Cars	0.52	0.87	0.40	46%	0.18	21%	0.00	0%
Rail	0.02	0.00	0.03	n/a	0.04	n/a	0.04	n/a
Buses	0.05	0.01	0.05	434%	0.06	578%	0.08	739%
Air	0.19	0.40	0.27	69%	0.09	23%	0.00	0%
Ancillary	0.05	0.00	0.00	100%	0.03	n/a	0.03	n/a
Total Transport EF	**0.83**	**1.28**	**0.76**	**59%**	**0.40**	**32%**	**0.15**	**12%**

Table A.19 Transport scenario results as a percentage of the baseline and fairshare for each case study community

Community	Variable	Unit	Baseline	Step 1	Step 2	Step 3
CAR1-CAR3						
Fintry	EF	gha/cap	1.73	1.15	0.87	0.68
	Percentage of baseline	%	100%	66%	50%	39%
	Percentage of fairshare	%	96%	64%	49%	38%
Kinlochleven	EF	gha/cap	1.11	0.67	0.45	0.28
	Percentage of baseline	%	100%	60%	40%	26%
	Percentage of fairshare	%	62%	37%	25%	16%
Killin	EF	gha/cap	1.28	0.86	0.66	0.51
	Percentage of baseline	%	100%	67%	51%	40%
	Percentage of fairshare	%	71%	48%	37%	28%
LDT1-LDT3						
Fintry	EF	gha/cap	1.73	1.60	1.44	1.32
	Percentage of baseline	%	100%	92%	83%	76%
	Percentage of fairshare	%	96%	89%	80%	73%
Kinlochleven	EF	gha/cap	1.11	1.08	1.03	0.97
	Percentage of baseline	%	100%	98%	92%	87%
	Percentage of fairshare	%	62%	60%	57%	54%
Killin	EF	gha/cap	1.28	1.19	1.03	0.92
	Percentage of baseline	%	100%	93%	81%	72%
	Percentage of fairshare	%	71%	66%	57%	51%
PT1-PT3						
Fintry	EF	gha/cap	1.73	1.02	0.58	0.26
	Percentage of baseline	%	100%	59%	33%	15%
	Percentage of fairshare	%	96%	56%	32%	15%
Kinlochleven	EF	gha/cap	1.11	0.64	0.36	0.14
	Percentage of baseline	%	100%	57%	32%	13%
	Percentage of fairshare	%	62%	35%	20%	8%
Killin	EF	gha/cap	1.28	0.76	0.40	0.15
	Percentage of baseline	%	100%	59%	32%	12%
	Percentage of fairshare	%	71%	42%	22%	8%