Chapter 16

Scotland, United Kingdom

Rural development and renewable energy (RE) in Scotland: Summary and conclusions

Main findings. *i*) Remote rural areas can contribute to renewable energy innovation, serving as test sites for experimental technology like tidal power, smart grids and energy storage systems. *ii*) Intermediate institutions in rural communities may play a key role in linking RE deployment with development. *iii*) Scotland illustrates the challenge of harmonising small-scale interventions with large-scale deployment. *iv*) Taking into account rural dwellers' preferences for specific RE technologies reduces the cost of deployment.

Renewable energy in Scotland: A summary. Scotland is a leading energy region, including for RE. In 2006, Scottish oil and gas companies exported a total of GBP 4.7 billion in goods and services, making energy the largest Scottish export sector. Capitalising on this specialisation and on its good endowment of RE sources, in 2010 Scotland had an installed capacity of 2.6 GW of wind, 1 MW of wave and tidal, and 257 MW of biomass and waste energy (2010). These are respectively 66%, 38% and 12% of the United Kingdom's total installed capacity. The energy industry is also intertwined with the Scottish innovation system which includes universities with award-winning programmes in the field of energy, and specific demonstration processes launched by the UK government in the field of wave and tidal energy.

The primary force driving RE deployment in Scotland has been the regional economic development strategy, which aims to transition to a low carbon economy. Scotland has considerable autonomy in energy and rural development policy and this has benefited its RE strategy. The Scottish government has set aggressive RE targets, including a target for community ownership of renewables, and aims to generate the equivalent of 30% of Scotland's energy demand through RE by 2020. This compares to the UK's national target of 20%. Over time, the RE policy has been increasingly linked to economic development opportunities through both top-down and bottom-up support measures. Key top-down initiatives are designed to create the infrastructure and environment to support innovation in high-potential technologies, most notably wave and tidal power. Bottom-up efforts like the community renewables policy enhance opportunities for rural development in terms of public service provision and capacity building. In remote rural areas lacking grids, renewable alternatives have been more cost-effective than conventional energy sources like diesel generators. Community renewable projects also create revenue-generating opportunities; to date, these projects generate an estimated GBP 2 million of revenue every year (for an average project lifespan of 20 years) for local communities; the community RE approach ensures that this additional revenue is invested locally.

Remote rural areas contribute to RE innovation, serving as test sites for experimental technology like tidal power, smart grids and energy storage that can enhance RE deployment. The often-cited disadvantages of remote rural areas, such as grid isolation and a smaller customer base, can be advantages for experimenting with RE. These characteristics allow for greater monitoring and control of energy use. New techniques can be tested and developed in this relatively controlled environment. Especially for small-scale installations, the close interaction between users and producers/developers facilitates innovation by testing the capacity of a given RE technology to assure the supply of energy, while reducing its cost. For instance, in the Shetland Islands, these features are complemented by an informed and supportive population.

Future challenges. Scotland aims to use RE to generate economic growth, but the focus on large-scale initiatives risks marginalising host communities and, as a result, reducing the potential impact of RE investment on rural development. RE in Scotland, as elsewhere, has sometimes been seen as a panacea for economic growth, rather than a way to provide cheap, low-carbon energy to local communities. This is mirrored by the governance of the RE policy. The Minister for Enterprise, Energy and Tourism plays a leading role in RE policy and oversees the economic development bodies, including the Highlands and Islands Enterprise (HIE), which focuses on rural areas. However, HIE bases its work on the Scottish Government Economic Strategy and the Scottish Economic Recovery Plan, rather than on the Rural Development Plan. The HIE and Scotland Enterprise also oversee the National Renewables Infrastructure Plan, which focuses on exploiting Scotland's offshore and marine RE potential (mostly found in rural areas). There are weak links between the large testing facilities and local communities. For instance, the advanced European Marine Energy Centre (EMEC) testing facility in Scotland is working as an R&D centre exploring new technologies: connecting it with small-scale, community-owned, initiatives could lead to significant improvements in the technology based on users' feedback.

The disconnect between large-scale RE deployment and rural development can aggravate public opposition even where there is potential for substantial community benefits. While large-scale RE deployment will inevitably affect rural landscapes and economies, more effort could be made to take into account local priorities. This is particularly true for rural areas, which may have specific preferences when it comes to RE. An emerging body of research shows that rural residents and workers have distinct preferences for what type of RE is desirable or acceptable. Understanding these preferences and incorporating them into decisions about economic development could make it cheaper and faster to install RE.

The context

Scotland's socio-economic profile and performance

Scotland has a clear rural character. Its international image is more strongly related to rural landscapes and culture than to its cities. Rural Scotland represents 75% of the entire territory. The average population density of 66 inhabitants per square kilometre (inh/km^2) is far below the 250 inh/km^2 for the United Kingdom (UK) as a whole (Table 16.1). However, population density also varies widely within Scotland, reflecting its rich and varied landscape. Scotland's topography can be divided into three regions – the sparsely populated highlands and islands in the north, which flow into the central lowlands where population is mainly concentrated, and finally to the rural Southern Uplands (*OECD Regional Database*).

Table 16.1. **Scotland: Demographic data**

2007 data unless otherwise indicated

	Scotland	United Kingdom
Population (2010)	5 222 100	62 261 892
Population share	8.38%	
Population density (inh/km2)	66	250
Elderly dependency ratio (2006 data)	3%	21%

Source: *OECD Regional Database*.

Scotland's economic performance is strong compared to the UK as a whole, despite slightly lower GDP per capita. Lower unemployment, higher tertiary education attainment and high productivity all point to the strength of Scotland's economy (Table 16.2). Overall, rural areas have strong economic performance, with growth above the OECD average. Scotland's rural areas tend to have higher levels of income, tertiary education, employment and safer and more liveable neighbourhoods than their urban counterparts. However, remote rural areas perform less well than Scotland as a whole, particularly in the periphery and islands. Such areas are under pressure from outmigration and ageing populations, market isolation, and poor service delivery including transport and energy. Housing shortages and fuel poverty are also more widespread in remote rural areas. Remote and accessible rural areas do share some characteristics: the services sector tends to be the largest employer; landscape is highly valued; and tourism and RE are seen as promising sectors for future economic development (OECD, 2008).

Table 16.2. **Scotland: Main economic indicators**

	Scotland	United Kingdom	OECD gap
GDP per capita USD PPP	29 096	30 145	116%
GDP share USD PPP	8.15%		
Productivity USD PPP	51 021	47 130	115%
Unemployment rate (2008)	4.7%	5.7%	-1.6%
Employment rate (2006)	72.2%	71.5%	
Long-term unemployment (2008 data)	0.97%	1.4%	-1.4%
Youth unemployment (2008)	13.02%	14.9%	-2.3%
Infrastructure (motorway density)	0.08	0.11	150%
Tertiary attainment (2008)	39.9%	34.6%	57%
Patents per million	86.9	90.2	

Source: *OECD Regional Database*.

Scotland's economy boasts strong conventional energy and manufacturing sectors. In 2006, Scottish oil and gas companies exported a total of GBP 4.7 billion in goods and services, making it the largest Scottish export sector (Scottish Government, 2011c). In terms of value added, electricity, gas and water supply represented GBP 2.6 billion in 2008, up from GBP 1.7 billion in 2000. Employment in the energy sector rose 10% between 2006 and 2007 to 40 700 jobs, i.e. 23% of all jobs in the sector across the UK. Overall, energy and water accounted for 2% of Scottish employment, the same level as agriculture and fishing. Manufacturing is another historical specialisation in Scotland. In 2010, manufacturing represented more than 170 000 jobs; 9% of the total Scottish workforce (National Statistics, 2011). Secondary activities are important contributors to the regional economy, despite the recent international crisis that has wiped out more than 30 000 manufacturing jobs and reduced gross value added (GVA): export-oriented manufacturing has lost between 10 and 20% GVA since the beginning of the crisis in 2008.

Land-based activities have played a key role in the diversification of Scotland's rural economies. The *OECD Rural Review of Scotland* (OECD, 2008) describes how a "second wave" of diversification is currently underway, featuring housing and entrepreneurial activity, following a first wave linked to farm households. Landscape is increasingly a key resource for this diversification, as illustrated by the central role played by tourism. In this context, it will be important to ensure that RE development does not negatively affect land, landscape and recreation. This is particularly true for remote rural areas where hotels and restaurants accounted for 13% of employment in 2009, compared to 7% in rural areas and 6% in the rest of Scotland (Scottish Government, 2011c).

Scotland's regional innovation system is linked to the regional specialisation in energy and targets high-potential RE sources, such as wave and tidal power. The sector benefits from state-of-the-art institutions like the European Marine Energy Centre (EMEC), a unique testing facility for wave and tidal RE that also offers support on regulatory issues, such as interconnection with the grid. This facility is contributing to the development of tidal power technologies: the Edinburgh-based Pelamis company, which tests its tidal turbines at EMEC, has moved on from seeking venture capital to a partnership with a major engineering firm (Marsh, 2011). Another initiative is the Saltire Prize, which seeks to accelerate the commercial development of marine energy by offering a GBP 10 million reward to the first team that can create a wave or tidal turbine that produces the most electricity (over the minimum of 100 GWh) over a continuous two-year period. Universities and corporations are also contributing to innovation with the universities of Strathclyde and Aberdeen winning recognition for distinguished RE engineering programmes and co-operation with companies.

The Shetland Islands case study

This Scotland case study focuses on the Shetland Islands, a remote and predominantly rural region in the North Sea. The Shetland Islands include over 100 islands and together have 2 702 km of coast. Flora and fauna are both diverse and admired; seabirds, marine life, and peat bogs are particularly treasured by locals and nature enthusiasts. The 22 000 inhabitants are sparsely spread throughout these islands, with about one-third of the population concentrated in the capital city, Lerwick. Average population density is very low: 15 inh./km^2.

The Shetland Islands' economy depends on energy and fishing, with a growing tourism sector. A breakdown of its GBP 800 million economic output in 2011 reveals that fisheries earn the most, at GBP 215 million, followed by oil and gas (GBP 68 million), the creative industry (GBP 29 million), tourism (GBP 18 million) and agriculture (GBP 14 million) (Angus, 2011). Shetland is home to one of the largest oil and liquefied gas terminals in Europe, the Sullom Voe Oil Terminal. Since it opened in 1978, direct and indirect jobs in the energy sector have contributed to the Shetland Islands' low unemployment rate: 1.4% compared to Scotland's overall 4 to 5%. However, these benefits are decreasing and given the finite nature of conventional energy resources, will not last forever. A deal for a new oil and gas project has been signed that could prolong current prosperity, but islanders recognise the need to find alternative sources of wealth. The tourism sector is growing, with visitor numbers increasing by 57% between 2000 and 2006. The islands have a particularly strong textile heritage and are known for their Shetland wool, but this sector is underperforming; knitwear accounts for only GBP 2 million. While agriculture presents an important financial contribution, 75% of this is from subsidies.

Scotland's energy resources

Scotland and the Shetland Islands are endowed with vast conventional and renewable energy resources. As mentioned, Scotland is a net exporter of energy due to its natural gas and oil reserves. Scotland is also home to the world's second largest energy hub: Aberdeen (behind Houston, USA). Despite its significant resources, production of conventional energy is falling; in 2010, total production of oil and gas was 5% lower than in 2009 at 2.3 million barrels of oil equivalent per day. The price volatility and limited nature of these resources make Scotland's vast RE resources more attractive. Scotland already produces 50% of existing UK wind and wave power; 40% of UK's offshore wind, wave and tidal power; 25% of Europe's wind and tidal power and 10% of Europe's wave power. Shetland, in particular, is one of the most promising areas in Scotland for deploying these technologies. The technical potential for electricity generation from wind and tides in Shetland has been estimated at over 7 000 GWh per year. Shetland has the most productive wind turbine in the world, which averages more than a 50% capacity factor.[1]

Renewable energy policy in Scotland: Objectives, opportunities and challenges

The policy drivers: Why is Scotland implementing a renewable energy policy?

Economic development and climate change mitigation are the primary drivers of Scotland's RE policies. Transitioning to a low-carbon economy is a strategic focus of the Scottish government, as laid out in the *Government Economic Strategy* (Scottish Government, 2011a). This high-level support complements UK and European efforts that target RE as a means to meet climate change, energy security, and economic development goals. The Scottish Government is firmly committed to supporting community involvement in RE, aiming to secure wider community benefits as it does so. In fact, community renewable energy schemes have been a priority since 2003 and to date the government has supported over 1 000 such schemes. The RE policy aims to ensure that all communities share in Scotland's next energy revolution, and take advantage of the opportunity to make money, save carbon and benefit from local economic regeneration. In 2011, the Scottish Government set a target for producing 500 MW of community and locally-owned renewable energy projects by 2020.

Significant heating needs and concern over fuel poverty are also motivating policy makers to promote RE, especially in remote rural areas. Most of Scotland's energy use is for heating, with many rural dwellers depending on the most expensive source of heat: fuel oil. For instance, the Shetland Islands rely on imported oil and waste gas for 93% of their energy production. This obviously affects energy prices. Rural areas in Scotland face higher prices for fuel due to limited gas grids which negatively affect competition. Higher prices lead to "fuel poverty": a household is in fuel poverty when the home cannot be heated to an acceptable standard at a reasonable cost. Fuel poverty is considered extreme when households must spend 20% or more of their income on fuel to maintain an adequate heating regime. Some 50% of remote rural residents are considered "fuel poor", 21% of whom are "extremely fuel poor" (Scottish Government, 2011c). In the Shetland Islands, a recent study conducted by the Unst Partnership found that 50% of islanders are "extremely fuel poor", spending more than 20% of household income on energy (mostly transport and heating). This is the result of both high heating demand due to the Shetland Islands' climate, and the high local cost of fuel.

The policy framework for renewable energy in Scotland's rural areas

RE policy must be co-ordinated between the EU, UK and Scottish governments, and policy co-ordination is central to meeting the objectives of each. Each of these administrative levels, and their RE policies, are outlined in the subsections below. In the UK, energy is a reserved matter for the UK Government, but to date the Scottish Government has been in control of the mechanisms to help deploy greater levels of RE. In particular, a mixture of reserved and devolved policies across a range of areas affect RE deployment, including subsidies, energy efficiency, oil and gas, carbon capture and storage, grid and transmission, consenting, and regulation of the energy markets. The importance of multi-level governance is accentuated by differences between the UK and Scottish governments' position on certain key issues. For example, Scotland is anti-nuclear and favours a biomass policy that gives preference to heat and small-scale projects, while the UK government is pro-nuclear and prefers to target biomass projects that can meet base load electricity demand. To this end, the Scottish government is actively seeking more devolved powers for energy, such as devolution of the Crown Estate (Box 16.1). Rural services are largely provided by local bodies, with the Scottish government providing the policy, financial and regulatory framework.

Box 16.1. **The sensitivities of the Crown Estate**

Crown land in Scotland is a historic estate with many elements dating back to the early days of the Scottish kingdom. It consists of varied interest ranging from ancient possessions such as Edinburgh and Stirling Castles, rights to gold and silver, the seabed, foreshore, rights and ultimate heir to ownerless property, treasure trove, oysters and whales. As noted, the Scottish Government is seeking more devolved powers with respect to the Crown Estate. The core of the sensitivity is the "seabed out to the 12 nautical mile territorial limit", which is technically under the control of the Crown. The Crown Estate leases offshore water; the revenues are paid to the UK Treasury, not the Scottish Government. The property rights and interests of the Crown Estate are a form of public land defined by Scots law, situated in Scotland but administered by a commercial property company based in London. In 2010 the Treasury Select Committee launched an inquiry into the administration and expenditure of the Crown Estate. The final report recommended a full review of the powers and functions of the Crown Estate and expressed concern of their monopoly position over the seabed.

Source: Wightman, A. (2010), *The Poor Had No Lawyers: Who Owns Scotland and How They Got It*, Birlinn Ltd.

European level

It was not until 2005 that a mandatory and comprehensive energy policy was adopted at the EU level. Before then, EU Member States pursued intergovernmental initiatives motivated initially by energy security in the 1970s and subsequently by environmental concerns in the 1990s. In 1997, in reaction to the Kyoto Protocol, the EU introduced non-mandatory targets for Member States for the RE share in total energy consumption. In 2006, the European Commission issued the *Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy* (2006). This asked Member States to implement a European energy policy built on three core objectives: *i*) sustainability – to actively combat climate change by promoting renewable energy sources and energy efficiency; *ii*) competitiveness – to improve the efficiency of the European energy grid by creating a truly competitive internal energy market; *iii*) security of supply – to better co-ordinate the EU's supply of and demand for energy within an international context. In 2007 this was translated into mandatory shares of RE production for Member States in the form of the *Renewable Energy Roadmap* (2007). This document set the overall mandatory goal of achieving 20% of RE in total energy consumption (10% of transport biofuels) by 2020, which has become part of the "Europe 2020" Strategy. The 2009 Renewable Directive set individual targets for each Member State. For the UK, the government's goal is to use RE to supply 15% of energy consumed by 2020. In the new set of rules established by the directive the EU highlights RE's potential to reduce energy dependency and promote economic development (with a specific reference to regional development).

Both the European cohesion policy and the common agricultural policy (CAP) support RE production. For instance, the European cohesion policy (2007-2013) has been supporting regional initiatives through the European Fund for Regional Development (EFRD). Under the cohesion policy framework, Scotland is broken down into four regions, with the Shetland Islands forming part of the Highlands and Islands region. The Scottish programme has a budget of EUR 291 million budget (EUR 122 million from the EU) and is dedicated to making the region more competitive and innovative and also making the most of the natural and cultural heritage (European Commission, undated). The Scotland Rural Development Programme[2] receives EUR 680 million over the 2007-2013 period. The SRDP includes programmes targeting RE in rural areas, including land-based (farming and forestry) and non-land based (residents, business owners, etc.) projects.

United Kingdom

EU regulations, concern over climate change, and an ageing electricity supply mix have made increasing RE a priority for the UK government. There is a general push to increase electricity supply as almost all nuclear and coal-fired power plants in the UK will be retired by 2021, while efforts to build new nuclear plants have shown mixed results (IEA, 2006). These factors culminated in the UK taking a new policy direction in 2008/09. One new development was the creation of the Department of Energy and Climate Change, which took over the responsibility for energy and climate change policy from the Department for Business, Enterprise and Regulatory Reform, and from the Department for Environment, Food and Rural Affairs. The Office of the Gas and Electricity Markets (OFGEM) – the regulator of the electricity and gas markets that sets prices and administers RE certificates – was also restructured in 2009 to better support RE deployment, and the RE target was set at 15% by 2015 (OFGEM, 2009). In the new

framework, electricity producers were asked either to integrate a growing portion of RE into their supply mix by purchasing Renewable Obligation Certificates (ROCs), or else to pay a penalty. The price of ROCs was also altered, creating different incentive levels, or "bands", for different technologies. These are reviewed annually. UK's RE policy also supports new technologies to produce renewable heat and small-scale investment.

In 2010, the UK developed the world's first incentive to specifically target renewable heat and created a budget of GBP 860 million to support eligible producers. Targeting renewable heat is necessary because in the UK, and especially in Scotland, the majority of energy consumed is for heating. This is potentially significant for rural development as agriculture and forestry residues are a primary resource for renewable heat. Unfortunately, the introduction of the Renewable Heat Incentive was delayed the day before it was supposed to launch, deflating investor confidence (Macalister, 2011). The delay followed a notice from the EU concerning conflicts with EU state aid regulations. This highlighted the need for better policy co-ordination across the different levels of government. While the incentive scheme was eventually launched in November 2011, better policy co-ordination could have avoided this hiccup in UK RE policy.

Scotland and local involvement

Devolved powers in Scotland have been used to develop an ambitious RE agenda that goes beyond the UK's and takes advantage of Scotland's vast natural resources. The *1998 Scotland Act* granted greater autonomy to Scotland, including for energy and rural development. This expanded authority has been used to set more ambitious targets than set for the UK as a whole. Scotland's goals for 2020 are to use RE to generate the equivalent of 100% of Scotland's demand for electricity, and to meet 11% of the heating demand with renewables (Scottish Government, 2011a). Longer-term targets were laid out in the *2009 Scottish Climate Change Act* which came into effect in June 2010, including the goal of reducing GHG emissions by 80% by 2050. The Scottish Government also manages the implementation of the UK National Renewable Energy Action Plan[3] under the Scottish Renewables Action Plan (2009). Building on the UK's Renewable Heat Incentive, the Scottish Government has also created the Renewable Heat Action Plan. This focuses on building skills, providing consumer information, building Scottish supply chains, and leading by example.

As observed in other case studies, Scotland's RE policy tends to target large-scale projects, guided by central government. In this sense, the RE policy resembles an industrial policy, with large top-down investments in infrastructure, and the attempt to involve and reorient manufacturing activities. Measures include supply-side incentives, offering a subsidised price for large-scale production, and investments in key infrastructure. The policy, for instance, supports the EMEC and the National Renewable Infrastructure Plan, which will involve GBP 70 million of investment in the infrastructure needed for large-scale manufacturing, assembly, construction, operations, and maintenance of offshore RE technologies (Scottish Government, 2011a). These measures are embedded in the wider plan for transitioning to a low-carbon economy – *The Government Economic Strategy* (Scottish Government, 2011a).

What is peculiar to the Scottish RE policy, however, is that a part of its interventions at the local level capitalise on the presence of community groups – the backbone of rural development in Scotland. The Scottish Government is also active in supporting bottom-up RE development through pioneering policy interventions. For instance, the Community and Renewable Energy Scheme (CARES) – currently delivered on behalf of

the Scottish Government by Community Energy Scotland (CES) – supports community groups in developing RE projects of up to 50 MW. This policy has been set to capitalise on a broad range of organisations and groups (intermediate institutions) active in local communities across rural Scotland. Through CARES, community trusts, charities and volunteers active at the very local level can get involved in RE. The policy supports them with loans and technical assistance provided by CES's development officers and network of experienced community groups. This policy has spurred over 1 000 RE projects since 2009, representing 163 MW of installed capacity. For communities to participate they must own the land where the project will be installed; historically, such land ownership has been more widespread in rural areas.[4]

Intermediate institutions shape RE policy in rural Scotland. Scotland has one tier of local government, which is responsible for providing services such as education, public transport, and planning. Local governments can provide these services directly, or through agreement with local organisations and groups, including volunteers. This arrangement means that community organisations are more common than in other countries and their activities are more diverse. This system of local governance also influences RE policy. Local governments can grant planning permits for RE projects under 50 MW (still a remarkable size for a RE installation). Community groups can purchase, invest in or support these projects, and benefit from specific programme such as CARES.

In the Shetland Isles, it is community groups and charities that are linking energy to economic development. For instance, the Shetland Charitable Trust (SCT) is responsible for managing a special fund that pays for public services with revenue collected from the energy companies operating in and around Shetland.[5] This body is currently looking for a new "post-oil" development model and RE is considered as an investment opportunity for the future of the islands (Box 16.2). In particular, the SCT wants to replicate the mechanism regulating oil production for regulating RE: this means that wind energy should generate constant revenue over the long term. The SCT will then invest this revenue back into the community to provide public services and create employment. However, the current connection to the main grid servicing Shetland is already operating at its maximum capacity. Since the UK system does not provide incentives to off-grid installations, the Shetlands will need to be able to generate enough electricity to pay for the installation and a new interconnection to the main UK grid. This has been proposed, and recently given the go-ahead, through the controversial Viking Energy wind farm (Box 16.2).

Assessment of policy impacts on rural development

The Scottish government's efforts to bolster RE projects are producing results. Between 2007 and 2011, 42 renewable projects (over 50 MW) received consent from Scottish ministers, compared to 10 projects under the previous parliament. This is partly due to a streamlined administrative process, which has shortened the turnaround time on application to 9 months. In addition, the proportion of electricity consumption met by renewables between 2007 and 2009 increased by one-third, while the portion of Scotland's heat demand met by renewables between 2009 and 2010 doubled. This progress explains Scotland's large share in the UK's total RE production, discussed above.

Box 16.2. **The Viking Energy project**

The SCT has been promoting the creation of one of the largest wind farms in Europe on the Shetland's main island. SCT argued that given its excellent wind resource, the Shetlands would attract developers sooner or later and therefore it would be better to have the wind farm developed with the direct involvement, and under the control, of the local community. This would also guarantee long-term revenue, without the need to design a new development trajectory for the post-oil Shetland economy.

This vision is being implemented in the form of Viking Energy, a partnership between private investors – Viking Energy Limited and Scottish and Southern Energy – and the SCT. Viking Energy will involve 103 turbines to produce a total of 370 MW on Shetlands' central mainland. The wind farm is expected to last for 25 years, following a 5-year construction period, and will cost an estimated cost of GBP 566. It has been estimated that the SCT will receive an average annual income of more than GBP 20 million, with an initial investment of GBP 62 million.

However, the proposed large turbines would be visible from most of the island, affecting the natural landscape and prompting some local opposition to the Viking project. A 2010 survey showed that 60% of local people were for the project, while 40% were against it. Opponents organised themselves into a local group, Sustainable Shetland, to argue that the wider community's interests were not taken into account when designing the project. In particular, this group argues that the large-scale and corporate financial backing of the Viking project is out of sync with the niche-oriented, territorial approach which is increasingly supporting the regional economy. Sustainable Shetland is not opposed to wind farms or RE, they are opposed to the scale and siting of the current Viking proposal. They suggest scaling down RE production to just meet the needs of the island, and launching a development strategy that involves a large number of stakeholders and many different local sectors, including tourism. While providing an advice in this field goes beyond the scope of this report, it is interesting to see how RE deployment, even if conceived at the very local level, can affect the regional debate about economic development and negatively influence the regional endowment of social capital. Other more focused assessments of the Viking project conclude that a lack of mobilisation of social capital is indeed the biggest threat to realising the development goals in this local community. In particular, bridging the gap between competing visions, linking public and private efforts, and increasing local participation are all issues limiting the development of the rural web that should underpin this development (Kanemasu and Horlings, 2010).

Stimulating local economies

As well as providing clean power, RE policy also enhances public service provision and capacity building in rural communities. In rural Scotland, for example, improved access to energy has increased the provision of public services, such as longer operating hours for community or childcare centres. Renewable alternatives have proved more cost-effective than conventional sources in remote areas, creating a more stable environment for public services and business. For instance, the Unst Heritage Centre and Museum in the Shetlands uses a wind turbine to power electric heaters. This system has dramatically reduced the cost of heating and provided some revenue, allowing the museum to stay open longer in the season and promote a series of cultural initiatives for locals and tourists.[6] Another example is the 900 kW wind turbine installed in Westray, one of the Orkney Islands, where the local community reinvests the revenue it produces to develop the island's tourism potential. The isles of Eigg and Foula have both developed independent energy grids that have allowed for increased tourism and business start-ups. Overall, these small interventions generate an estimated GBP 2 million of revenue every year for local communities; they last on average 20 years. The community RE approach

ensures that this additional revenue is invested locally. For community groups, developing RE builds their capacity in private enterprise development and investment. Collaboration with other public/private or national/international institutions helps to build key connections and networks, as well as allowing for the important transfer of technical expertise from private developers to the community.

Stimulating innovation

Remote rural areas which contribute to RE innovation serve as test sites for experimental technology that can enhance RE deployment. What are often cited as disadvantages of remote rural areas, such as grid isolation and a smaller customer base, can be advantages for experimenting with RE. These characteristics allow for greater monitoring and control of energy use. In Shetland, these features are complemented by an informed and supportive population and there is interaction between users and producers/developers – a key element in innovation (Kamp *et al.*, 2004). This feature also attracts business. For example, the Pure Energy Centre (PEC), a private company, is developing new approaches to energy storage through hydrogen. It is training people from around the world in their development and use. Through training alone, the PEC has injected approximately GBP 65 000 into the local economy. When searching for a test site for its new tidal turbine, Nova Innovation decided to partner with the North Yell Development Council, which manages a port on North Yell, one of the Shetland Islands. This community-owned project will benefit from a supportive local government and close user-developer collaboration. A collaborative approach to innovation is also evidenced by the Scottish and Southern Energy smart grid project that aims to treble the amount of renewable power from wind within three years by developing an innovative energy storage system. Energy storage will be managed by centrally controlled "smart" water and storage heaters in 1 000 Shetland homes. Stabilising the grid with these heaters would allow up to 10 MW of extra wind power to be connected to the Shetland's current system. Through this project, small-scale wind farm entrepreneurs in Shetland will earn feed-in tariffs by supplying electricity to the smart grid.

Main challenges

Despite these promising rural initiatives, Scotland's RE policy does not take full advantage of the potential contribution of rural stakeholders. There is also a disconnect between RE and rural development policy. For instance, energy policy is planned by Scottish government ministers with advice from the Energy Advisory Board. This board is chaired by the First Minister of Scotland; its subgroups – including the Renewables Industry Advisory Group (RIAG) – are chaired by the Minister for Enterprise, Energy and Tourism. The Scottish Government also oversees the economic development bodies: Scottish Enterprise for lowland Scotland, and Highlands and Islands Enterprise (HIE), both of which work through networks of Local Enterprise Companies. HIE and Scotland Enterprise also oversee the National Renewables Infrastructure Plan focused on exploiting Scotland's offshore and marine RE potential, which is concentrated in rural areas. However, HIE bases its work on the Scottish Government Economic Strategy and the Scottish Economic Recovery Plan – not the Rural Development Plan. This disconnect between RE and rural development policy is also mirrored in the weak links between the large testing facilities promoted by the RE policy and rural communities. The EMEC, for instance, does not involve locals in its R&D activities, which are mostly focused on large scale production. Connecting it with community-owned initiatives, like the North Yell

project, could enable users' feedback to bring about significant improvements in the technology.

Understanding rural communities' preferences for RE, and incorporating them into decisions about economic development could make RE deployment cheaper and quicker. The engagement of local authorities to act in the community's interest does not always prevent local conflicts. This is the case for the Viking project, which attracted strong local opposition (Box 16.2). The need for public consultation on RE projects is greater as the scale of projects increases; late engagement can be costly for developers. Opposition to the Viking wind farm has contributed to the lengthy approval process for the project, which has only just been approved after almost a decade. While large-scale RE deployment will inevitably affect rural landscapes and economies, more effort could be made to take into account local priorities. This is particularly true for rural areas, which may have specific preferences when it comes to RE. In fact, an emerging body of research shows that rural residents and workers have clear views on what is desirable or acceptable in terms of RE deployment (Box 16.3).

Box 16.3. **Urban *versus* rural preferences for renewable energy**

An analysis of Scottish preferences for RE installations revealed distinct differences between rural and urban residents. They found that rural residents had a higher willingness to pay for RE, especially when it improves job opportunities in their area. This contrasts with urban residents who were more sensitive to the landscape impacts of RE. Commonalities were also identified: Scottish citizens generally support the expansion of renewable energy projects, with the most valued attribute being the reduction in air pollution. In addition, there was general support throughout the sample for large off-shore wind farm projects because of the absence of air pollution and relatively minor landscape impact. This was followed by small on-shore wind farm projects (Bergmann *et al*., 2010). Another relevant analysis looked at how one's view of what rural places are/should be, i.e. place of leisure and pristine nature vs. place of work, influences one's reaction to wind energy. It found that those who complain about wind turbines' flickering or noise tended to be outside the group who personally benefitted from wind turbines. It also found that the most vociferous complainers about these effects were people that felt excluded from the decision-making process (Pedersen *et al*., 2007).

The most apparent impact of these preferences is on the social acceptance of RE. Current UK RE targets require rural people to accept large levels of RE construction in their areas. For instance, Scotland, which is 75% predominantly rural according to the OECD classification, can contribute up to 50% of the UK's goal for RE generation laid out in their National Renewable Energy Action Plan, which charts a course to producing 15% of the UK's energy from RE by 2020. Without rural buy-in, it is possible that local opposition will be a formidable obstacle to future development. Following the "first generation" of recent RE development where large investors were better prepared to seize opportunities, some communities have expressed the opinion that large-scale investors are pocketing the profits rather than the local areas where the projects are installed. The perception by local communities that RE production only benefits outsiders can hamper social acceptance. In addition, as deployment levels rise, the availability of land for new projects decreases. If local populations don't see the benefit from RE projects they are more likely to oppose future ones.

Source: Bergmann, A., S. Colombo and N. Hanley (2008), "Rural versus Urban Preferences for Renewable Energy Developments", *Ecological Economics*, Vol. 65; Pedersen, E., L.R.-M. Hallberg and K.P. Waye (2007), "Living in the Vicinity of Wind Turbines – A Grounded Theory Study", *Qualitative Research in Psychology*, Vol. 4, No. 1-2.

Notes

1. The capacity factor is the portion of time that a variable RE source is actually producing energy. In this case, a 50% capacity factor means the turbine is spinning and generating electricity half of the time. Generally speaking, a capacity factor of 33% is considered world class.

2. The SRDP is a programme of economic, environmental and social measures, utilising European Agricultural Fund for Rural Development funding plus Scottish Government match funding. The programme is designed to support rural Scotland from 2007 to 2013. For more information consult *www.scotland.gov.uk/Topics/farmingrural/SRDP*.

3. The NREAP asks for the path and measures that will enable the UK to reach its target for 15% energy consumption in 2020 to be from renewable sources. (European Commission, 2009).

4. Community ownership of land is a predominately rural phenomenon in Scotland. Approximately 425 000 acres of land in Scotland are owned by community organisations. The increase in community ownership grew out of protracted landlord absenteeism and a desire to improve land use and promote development where previous landowners had neglected property or sold off valuable land or other assets. The *2003 Land Reform (Scotland) Act* extended the right to buy land to the "crofters" and the "community" (Community Land Ownership, Highlands & Islands Enterprise, 2010).

5. The Shetland Charitable Trust was established in the 1970s to manage funds received from the oil industry when they began operations at the Sullom Voe Terminal in Shetland. A board of 23 Shetland residents determines how the funds are spent. As both a trust and a charitable organisation, the potential activities that can be funded are limited, and must be in the interests of the Shetland community.

6. The Unst Museum benefits from the Wind2Heat policy. Created especially for this purpose, the Wind2Heat policy covers 17 projects, 12 of which are in Shetland. Through this initiative a cost-effective method of converting the available wind resource into valuable heat energy within community buildings is introduced.

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