Sustainable Employment, Integration and Sustainable Energy Development

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Abstract

This paper considers the development of 'green' jobs in Scotland where the government has sought to develop renewable and sustainable energy industries and associated employment. It analyses the government employment forecasts/projections and compares them to the actual results, considering the reasons for the lower actual job creation. While there are some specific skills development initiatives by the government, in general labour market policies have been driven by principles of "Work First" approaches. While moving into work is seen as the main way out of poverty for working-aged unemployed people, in some cases the type of job or job conditions, including in 'green jobs', can lead to a cycle of low-pay no-pay due to work being in most cases economically unsustainable. This indicates the need for sustainable work in order to move people out of poverty and if the productive potential of the person is to be realised. Hence the quality of jobs as well as the quantity of 'green' jobs is important.

Introduction

This paper considers the development of 'green' jobs in Scotland, part of the UK where the Scottish Government has sought to develop renewable and sustainable energy industries and associated employment. It analyses the government employment forecasts/projections and compares them to the actual results, considering the reasons for the lower actual job creation. It then considers the links between wider labour market policies and potential employment in such jobs.

The rise of 'green' jobs has arguably been disappointing in terms of the creation of sustainable in Scotland and the UK. In recent decades, governmental approaches to employment activation policy in many countries have been driven by principles of individual skills development with a focus on "Work First" approaches (Lindsay et al., 2007). While moving into work is seen as the main way out of poverty for working-aged unemployed people, this may be primarily the case where the job is not a low paid or when it is a "stepping stone" to better employment. However, in some cases the type of job or job conditions, including in 'green jobs', can lead to a cycle of low-pay no-pay due to work being in most cases economically unsustainable. This indicates the need for sustainable work in order to move people out of poverty and if the productive potential of the person is to be realised. Hence the quality of jobs as well as the quantity of 'green' jobs is important.

The next section outlines the context of energy development in Scotland. Section 3 considers energy related employment in Scotland. Section 4 discusses some related skills issues and then conclusions are presented.

Energy developments in Scotland

Scotland has some of the best renewable energy resources in Europe, especially wind, tidal and wave energy (Scottish Executive 2001, 2005). A major 'wave' of renewable hydro-electricity development occurred in the 1940 to 1960s, which was followed by the development of North Sea oil production (which started around the 1970s but has been declining since around the turn of the century). Particularly over the last decade, Scotland has been developing a policy to promote renewable energy industries; especially onshore and offshore wind energy technology.

The Scottish Government (2011) set a target to produce the equivalent of 100% of the electricity consumed in Scotland by 2020 from renewable sources as part of move to a low carbon society (APS, 2010). It is a devolved government within the United Kingdom, and has limited powers of policy-making and acting on energy issues, but does have specific competency granted over renewable energy, economic development, education and training, agriculture, forestry and fishing, tourism and public transport within Scotland (Scottish Parliament n.d.). The Scottish Government has promoted extensive domestic deployment of wind energy projects and other technologies like tidal or wave energy projects that it hopes will facilitate Scotland being a world leader in research, development, manufacturing, and commercial expertise in this industrial sector.

Sustainable energy jobs

Most employment development takes place over two time frames, with the majority during the manufacturing and construction phases of energy projects in the early decades (Bergmann, 2014). Many of these jobs are not sustainable if solely based on Scottish or United Kingdom market size due to the finite number of efficient wind farm sites and intense competition may limit the export opportunities to other countries. Effectively, there is technological-geographical saturation of the market. After the deployment of projects employment gradually rises, linked to the operation and maintenance of energy facilities. These jobs largely remain, generally for several decades, until the end of the wind farm's life, but the number of jobs remains relatively small when compared to the first phase and the value of the capital assets.

Based on a survey of 541 organisations operating within Scotland, OHC (2014) estimate employment in the renewable energy sector in summer 2013 at 11,695 FTEs (Full Time Equivalents) (see Table 1). This may be a slight underestimate of direct employment in the industry, and while several other studies have been conducted, they were either less extensive, with greater margins of error, or were UK-wide and estimating the Scottish component.

Over half of this employment (54%) occurs in the main industrial and population areas – the Central Belt of Scotland. All the major cities of Scotland lie within this region, except for Aberdeen and Inverness, which are located in the North. The Highlands and Islands account for a further 17% and the North East for 14% of employment (OHC 2014). In terms of gender 72% of employment is male and 28% female, with one quarter of the survey not providing information on gender.

Table 1 Employment by region and technology

Region	No. of Organi-sations	On-shore Wind	Off-shore Wind	Bioen-ergy	Hydro	Wave & Tidal	Solar, Heat Pumps & Geo-thermal	Grid	Other	Total
Highlands and Islands	77	405	155	140	311	195	83	4	13	1,306
Glasgow	100	687	297	62	141	215	90	111	206	1,809
North East Scotland	78	244	510	49	34	173	31	25	6	1,072
Mid Scotland and Fife	60	160	34	172	59	10	117	7	1	560
South Scotland	26	290	61	37	13	12	43	2	22	480
West Scotland	15	75	0	167	4	0	20	0	0	266
Lothian	129	582	297	120	52	185	548	32	13	1,829
Central Scot-land	23	180	61	63	19	6	12	1	0	342
Not classifiable	33	774	427	26	17	10	4	347	3	1,608
TOTAL	**541**	**3,397**	**1,842**	**836**	**650**	**806**	**948**	**529**	**264**	**9,272**

Source: OHC (2014).

The majority of employment occurs in the wind energy subsector (60% of employment), including onshore wind technology (39%) and offshore wind technology (21%). Wave/tidal and bioenergy each employ 9%. In addition, as shown in Table 1: the main industrial city of Glasgow is the most important employment centre for hydroelectric, onshore wind, and electric grid activities and most employment in the largely rural Highlands and Islands is in onshore wind and hydroelectric subsectors. Onshore wind subsector represents 38% of renewables employment in Glasgow, compared to 60% in the South of Scotland (290 of 480 FTE) and 32% in Lothian (which incudes the capital, Edinburgh) (582 of 1,829FTE). Aberdeen and the North East have the largest concentration of offshore wind employment, followed by Glasgow and Lothian. The concentration of employment in urban areas suggests that rural areas do not receive high levels of long-term employment related economic benefits once construction is completed.

The industry in Scotland is expecting to grow at a rate substantially greater than the economy as a whole with a 20% increase between summer 2013 and summer 2014. Over half (54%) 294 of the 541 employers forecast they will increase their workforce during the next year by an additional 2,315 FTE workers (OHC, 2014). 42% of employers forecast no change in employment levels and 1.9% forecast a decrease.

The sector has significant skills gaps, particularly in construction, technical, and engineering categories (Table 2). The majority (62%) of organisations (335 of 541) reported skills gaps in at least one of the listed categories (OHC 2014). Often those jobs require graduate level education and organisations appear to have a stronger preference for graduate level personnel than other similar industries.

Table 2 'Renewables' Skills Gap in Scotland

Gap	Number of organisations citing a gap	% of total organisations identifying at least one gap	% of the total respondents in survey
Admin – other	21	6.3	3.9
Admin – graduate level	63	18.8	11.6
Apprenticeships	2	0.6	0.4
Communications	25	7.5	4.6
Consultants/senior consultants	21	6.3	3.9

Graduate level engineers	116	34.6	21.4
Instrumentation and construction engineers	93	27.8	17.2
Management and lead-ership	62	18.5	11.5
No skills gap	1	0.3	0.2
Planners	9	2.7	1.7
Policy	22	6.6	4.1
Sales	11	3.3	2
Technician engineers	98	29.3	18.1
R & D – doctoral level	31	9.3	5.7
Other	23	6.9	4.3
Don't know	5	-	0.9
“No recruitment re-quired”	194	-	35.9

Source: (OHC 2014).

A study for the UK Government study estimated that in 2011 the UK onshore wind subsector had a total direct and supply chain impact of £548 million in Gross Value Added (GVA) and 8,600 jobs within the UK. £314 million GVA occurred regionally or in the devolved countries from individual wind farms (i.e. Scotland, Northern Ireland, Wales or English regions) and 4,500 jobs (Biggar Economics, 2012). Also at the local level £84 million GVA and 1,100 jobs were generated from individual wind farms (i.e. local authority area). Direct onshore wind energy related activities including the indirect supply chain had a GVA impact of approximately £66,500 per annum per FTE (Scottish Renewables, 2012). Approximately six jobs in the supply chain (part of the multiplier effect) were estimated to be linked to each job in the development category, so the potential for substantial employment growth. Scottish Renewables (2012) also estimated that there were 11,136 FTE jobs in Scotland in 2011.

Industry and technology life cycles

There are two models of life-cycles that are useful when considering employment and economic growth in the renewable energy industry. First, in the five stage standard model of industry life–cycle the industry evolves through: product research and development; introduction into the economic system; growth and acceptance; maturity; then decline as alternatives arise. In general, much of the renewable energy industry, largely technology-based, is in the first and second stages. However, some parts of the industry, especially those associated with onshore wind energy systems, photovoltaic systems and landfill gas technologies are the growth stage both globally and in Scotland. The form of these technologies and their products will influence the architecture of the firms and their employment (Pisano and Teece, 2007).

The life-cycle stage of each of these technologies is important when considering the creation and expansion of renewables and associated income and employment. Each stage has its own impacts on economic development and employment. The five stages are: (1) research and development; (2) planning; (3) construction; (4) operation and maintenance; and (5) decommissioning or repowering. Repowering is the process of replacing older power technology with newer technology and equipment and this can lead to the life-cycle repeating through stages 1 to 5. In this case the reinvestment and subsequent employment may be greater or lesser than the initial cycle depending on the advancement in technology and learning-by-doing efficiencies that have been created during the previous life cycle. This iteration could continue indefinitely as the technology has limited environmental costs and the “fuel” is a renewable resource within meaningful social, economic and environmental terms.

Research and development is a sustainable activity that provides employment across a range of public, third sector and commercial bodies ranging from very small independent firms to universities and research departments in Scotland of global corporates. Scottish universities and colleges have at least 1,182 FTE working on sustainable energy research (OHC, 2014). The level of of R&D employment in the private sector in Scotland is uncertain. In addition, in 2011 approximately 150 Scottish public sector employees were involved in renewables policy and management activities (Biggar, 2012).

The *planning* stage includes project design, environmental studies, legal agreements, project funding and planning permissions. Employment in this stage covers a broad spectrum of highly skilled, and relatively well-paid, workers ranging from lawyers to scientists, financial consultants and planners. The expenditure on these is largely retained in the country, with Biggar (2012) identifying that 98% of project proposals and planning and development expenditures occurred within the UK.

Construction includes site preparation, manufacturing and the installation of the wind turbines together with connections to the transmission network. The balance of plant construction (all of the non-turbine components of a wind farm) creates the most significant opportunities for Scottish companies to participate in the on- and off-shore wind energy subsector (which is the largest related subsector). The UK share of construction expenditures has been approximately 45% of total project costs over recent years (Biggar, 2012). However, most the turbines have been manufactured outside the UK with other Europe Union countries (especially Denmark (OECD, 2012) and Germany) dominating the manufacture of turbines installed in the UK. Former turbine fabrication plants in Scotland (e.g. near Campbeltown) have closed after some years as production moved to other parts of the foreign-owned parent company with greater economies of scale and other cost advantages.

However, many of the 8,000 components required to manufacture a turbine are produced in the UK and exported to the turbine manufacturers abroad. Several major turbine manufacturers plan to set up parts manufacturing facilities within the UK or have already done so. Generally, manufacturing is high value parts and components that are small to moderate sized, thus facilitating global competition for production as transport of such items is a relatively minor cost. The larger components, such as turbine blades and towers, are the main items constrained by transportation costs and therefore more likely to be produced in Scotland, the UK or elsewhere in the EU. Asian turbine manufacturers often have a large labour costs advantage and Chinese manufacturers have started to capture international market share even with transport costs disadvantages. So, although many economic development and employment benefits from on-site construction work have been gained by Scotland, those form high value added manufacturing have largely not been captured.

European Union regulations prohibit all Member States including the United Kingdom from specifying local content provision of goods or services in all industries, including the sustainable energy sector (or of governments seeking to protect local ‘infant industries’ as was popular in some countries 50 years ago). This has assisted intra-EU trade and the achievement of economies of scale and the ability of mature and well established manufacturing firms, e.g. Siemens, Dong Energy and Vestas based on the EU, to successfully enter the Scottish market. The relatively small size of the Scottish market has resulted in few equipment manufacturing firms being established or expanding in Scotland despite the rapidly growing domestic market for wind farm components.

Operation and maintenance incorporates the operation of the energy generation facility and maintaining the turbines and all other assets for the economic life of the project; this is usually 20 to 25 years. This phase involves low levels of economic activity, in regard to the facilities, compared to the construction phase. This stage is significantly different for sustainable energy operations compared to other energy producers, as there is no ‘brought in’ fuel component to the technology, and no infrastructure or employment from the utilisation of coal, natural gas, and nuclear energy. Operation and maintenance involves a limited amount of highly skilled labour, while maintenance costs are estimated to average 2%-3% of the original construction cost per annum over the life of a wind farm project. On average, for an onshore wind farm some 90% of maintenance and operation expenditures occur within the region, e.g. within Scotland (Biggar, 2012). Other costs and benefits are difficult to measure such as the opportunity cost of employment that might exist if the other forms of energy generation were maintained. These may also be potential gains or costs to the economy in terms of different energy costs to industrial, household and other users, tax revenue and balance of payments effects.

Finally, the *decommissioning or repowering* stage affects all renewable energy projects, as they have a finite life span due to the ageing of the assets, increased maintenance costs and reducing generating efficiency. Major hydroelectric dams may continue for more than 50 to 100 years before decommissioning, but windfarms are likely to have an economic lifespan of 20-30 years. Each technology has its own life-cycle, although this is influenced by changes in other technologies and costs and developments in the technology itself. Onshore wind has is starting to consider decommissioning, but these older wind turbines are very small relative to current installations, less than 1 MW per turbine in capacity. The large multi-MW turbines will not usually face these questions for at least a decade or more.

An alternative decommissioning is repowering the wind farm. This involves removing and replacing many components necessary for the operation of a fully functioning facility, which also needs to meet current economic and environmental efficiency standards. Given the sunk costs of infrastructure (such as access roads and power links as well as parts of the turbines given the modular nature of the turbines, this may have considerable economic appeal especially as the wind farm can continue restricted operations while undergoing modernisation and refurbishment.

Skills issues

Much has been written on the potential growth of ‘green jobs’ (OECD, 2010, 2011; CEDEFOP, 2012; Pearce and Stilwell, 2008; Renewable Energy, 2011). The Scottish Government has set up specific programmes like *The Energy Skills Challenge Fund* and the *Low Carbon Skills Fund* (Scottish Government, 2012; SDS, nd) have set up to help provide training for new or transitional workers to join the energy industry workforce. A wide range of training is eligible for support, including: renewable energy, low carbon technologies and microgeneration; energy efficiency, environmental and clean technologies; waste management and re-use; and reducing carbon in supply and energy management.

The quality of ‘green jobs’ is an important issue if a range of employed and unemployed people are to enter and be productive in the subsectors (Kalleberg, 2011).The types of jobs or job conditions can lead to a cycle of low-pay no-pay due to work being in most cases economically unsustainable (Shildrick et al., 2012). This indicates the need for sustainable employment if the productive potential of the person is to be realised. “Work first” approaches are concerned with the rapid labour market entry of unemployed people, who are encouraged to take any job as quickly as possible with limited consideration given to the “quality” of employment or its suitability for the individual (Bivand et al., 2006). However, while “Work first” approaches do not prioritise intensive and long-term interventions, such as high quality training, for those facing complex barriers to the labour market (McQuaid and Lindsay, 2005; Lindsay et al., 2007).

Changing the incentives for those who deliver active labour market policies related to ‘green jobs’, so as to take greater consideration of progression after entry into employment and longer-term career progression to better jobs in the subsectors (for those that want progression), are likely to lead to more sustainable and productive employment outcomes. Employment policies in the area need to give greater emphasis on a “Career first” approach rather than purely a “Work first” approach (McQuaid and Fuertes, 2014). Here, career is taken to be a person’s “occupation undertaken for a significant period of a person’s life and with opportunities for progress” (Oxford Dictionary), so it includes sustainability in terms of long-lasting employment and opportunities for progress in the occupation. A career ladder involves having a skills set that facilitates long-term employment security, support for skills development, and promotion, but may also include job mobility and moving between employers, with employers helping to improve the employability and careers of employees (Inkson 2006, Ballout 2009, Clarke 2009). It also encourages a person’s own career self-management. Most research has been on higher-skilled rather than blue-collar workers (Hennequin 2007), yet many ‘green jobs’ are medium skilled. There is a need to also consider low-skilled entry-level jobs in terms of their sustainability and progression, as these are more likely to be relevant for the long-term unemployed. In addition, staff in support agencies must be suitably trained and supported.

In summary, the promotion of ‘green jobs’ should not only consider “Work first” approaches aimed at helping people into ‘green jobs’ are likely to be concerned with the rapid labour market entry of unemployed people, but also consider significant investments in the human capital of people in or entering the industry to promote productivity and improve the “quality” of employment and its sustainability.

Conclusions

The Scottish Government has pursued a policy of promoting renewable energy based on two key issues: the abundance of renewable energy sources in the country, including wind and water, and the potential employment and economic development linked to the creation of a new and expanding industrial sector. However, the actual job creation has been lower than suggested by the political rhetoric and there has been a lack of monitoring and investigation of the skills needed for the labour force. There have been specialised skills programmes put forward to meet industry needs, although it is too early to evaluate the full effects of these over the long term. Overall, the development of renewable industries and their equipment and related specialties in Scotland are highly integrated with the European Union. Job creation can be have been seen as happening on two scales; manufacturing promotion within the EU, and construction and operation/maintenance within the region. There are many opportunities for the future expansion and reconfiguration of renewable energy subsectors but it is crucial that the necessary skills and infrastructure are adequately developed to support this.

The links between support for those moving from unemployment into jobs linked to sustainable industries have been under researched. Rather than relying on general 'Work First' policies and separate industry specific skills initiatives for those already in work, more attention needs to be given to developing sustainable employment with career progression for unemployed people moving into the industry.

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