FIXING THE LEAKY PIPELINE:

Securing a supply of skills in Scotland's renewable energy sector?

Close the Gap Working Paper 7

CONTENTS

INTRODUCTION

The Scottish Government has identified the renewable energy sector as one of the key sectors which will deliver sustainable economic growth for Scotland. It has described a Scotland at the heart of a renewables revolution in terms of research, development and finally commercialisation. Questions remain as to whether Scotland has the necessary infrastructure, and the necessary skilled labour force to fulfil this ambition, and whether a reliance on renewable sources will be too expensive compared to traditional energy sources, therefore increasing the unit cost of energy to the consumer beyond what can be borne by the market.

With the potential growth and development of renewable industries the focus for public discussion has been on the number of jobs that will be created. A critical issue for the sector will be ensuring there will be a sustainable supply of skills and knowledge as the sector expands and grows.

This paper will explore in further detail the extent to which stakeholders, employers and organisations have considered the underrepresentation of women in the renewable energy sector as a barrier to growth. In doing so it will consider skills and investment policies for the sector and whether the strategies for the development of the sector pay sufficient attention to addressing the gendered barriers to meeting the demand for skilled labour.

OCCUPATIONAL SEGREGATION IN THE SCOTTISH LABOUR MARKET

The Scottish labour market is characterised by occupational segregation by gender, in that men and women are distributed differently across occupational and industrial sectors.

In 2010, Close the Gap published a paper on occupational segregation, which set out the ways in which women are underrepresented in science, engineering, technology and mathematics (STEM) areas. The gender imbalance is evident along the life course, and can be seen in education, training and in work. The exceptions to STEM male dominance are seen in bioscience and medicine. A higher percentage of women study and enter bioscience occupations than men, and more women than men studying medicine. However, even within these two disciplines there continues to be an underrepresentation of women in senior or managerial positions, and a 'leaky pipeline' in bioscience that sees women detaching between higher education and the workforce at a rate that far outstrips that of male attrition.

Occupational segregation is of interest to economic development, because it functions as a drag on growth. Part of its negative impact is a result of allocative inefficiency, in that the human capital that women develop across years of education and workplace training is not being efficiently utilised by companies and sectors in which women cannot reconcile work and family life, and so detach. Further constraints on growth are occasioned by the waste of potential, in that girls and women who could become creative and dedicated engineers or physicists or mathematicians are discouraged at an early age by a variety of cultural, pedagogical, and workplace barriers. There is also evidence to suggest that individual enterprises, and occupational sectors at large, might be failing to develop products and research of the maximum possible quality because they are insufficiently diverse.

The Women and Work Commission placed a notional cost on all of these constraints, and calculated that the total return to the economy of reducing the segregation of jobs between women and men and increasing women's employment could be worth between £15 billion and £23 billion. This represents 1.3 to 2.0 per cent of GDP in the UK (Women and Work Commission, 2006)

Professor Ailsa McKay at Glasgow Caledonian University has analysed existing data to approximately estimate the economic impact of the underrepresentation of women in SET in Scotland over the period 2007-2011, which includes the renewables sector (RSE, 2012, pg12). The findings suggest a loss of £678.1 million, which takes into account the slightly higher percentage of women who do science in Scotland compared to the rest of the UK.

The Scottish Government has outlined in its economic strategy the need to tackle the causes of occupational segregation, but a consideration of gendered occupational segregation as a barrier to growth is not uniformly present in the strategies for individual occupational sectors. Ministers have expressed an aspiration for the renewables sector to be more gender-balanced than other industrial sectors, and for equality to be mainstreamed within its development.[1]

However, tackling the causes of occupational segregation requires a range of stakeholders to collate and monitor gender disaggregated information in areas such as education, training, and employment. Evidence from other sectors is informative in making clear that an understanding of women and men's different participation in education and training, and in the wider labour market, must be known before policies on skills and economic development can be effectively gendered, thereby enabling the effects of occupational segregation to be mitigated. It is crucial therefore, that stakeholders in the sector capture gender-disaggregated data on skills and employment, and gender their sectoral economic development activity.

[1] Scottish Government Economic Strategy update.

RENEWABLE ENERGY SECTOR

The ambitions for the renewable energy sector in terms of job creation and attracting investment rest partly on the abundance of renewable sources available to Scotland as a result of our geography, and partly on the legacy of the oil and gas sector. Oil and gas has dominated the energy sector for Scotland since the discovery of significant oilfield reserves in the North Sea during the 60s and 70s providing an existing base of energy-focused enterprises and a skilled labour force.

Growth plans for the sector are underpinned by a global shift towards carbon neutral sources of energy, and more sustainable use of natural resources, which is a response to the challenge of climate change, and the dwindling volumes of carbon-based energy sources. The European energy targets of 20 per cent emission cuts, 20 per cent renewable energy and 20 per cent energy efficiency across all Member States (EU 20/20/20) are a driver of growth of Scotland's renewable energy sector. The UK is committed to meet certain targets under the Renewable Energy Directive, namely 15 per cent of energy demand from renewables and, as part of sharing this target, Scotland has committed to meet a number of targets for 2020. These include:

- Renewable sources have to generate the equivalent of 100 per cent of Scotland's gross annual electricity consumption by 2020, with an interim milestone of 31 per cent by 2011.
- Renewable sources have to provide the equivalent of 11 per cent of Scotland's heat demand by 2020.
- Renewable sources have to provide 11 per cent of heat and 10 per cent of transport energy.

At the same time the Scottish Government is committed to reduce carbon emissions by 80 per cent by 2050, with an interim target of a 42 per cent reduction by 2020. To date, Scotland has reduced its carbon emissions by 21.2 per cent since 1990, which is half the 2020 target (Scottish Government, 2011[c]).

Early in 2012 the Scottish Parliament's Economy, Energy and Tourism Committee launched an inquiry into the Scottish Government's 2020 renewable energy targets, specifically looking at the *'merits of targets and the risks and barriers in achieving them.'* The inquiry includes questions on infrastructure, investment and skills and workforce development. The Committee is due to publish the report in the autumn of 2012, with a response from the Scottish Government expected soon after.[2]

It is anticipated that much of the expansion of the renewable energy sector will be concentrated in the offshore wind and marine energy industries, where Scotland benefits from having the largest offshore renewable energy resources with 25 per cent of EU offshore wind, 25 per cent of EU tidal and 10 per cent of EU wave power (Scottish Government, 2011[C] pg 9). This is also where the highest number of jobs are expected to be created.

There are a number of totemic developments underway, including the establishment of the European Marine Energy Centre, which is based in Orkney, and is the only grid connected wave and tidal energy research facility in the world. The Pentland Firth is a locus for much of the tidal energy research, and the Scottish Government has just announced additional investment in companies based at its shores (Scottish Enterprise, 2012). Significant industry players Gamesa and Samsung have announced the establishment of manufacturing operations in Scotland. Gamesa have already established an R&D facility in Scotland and plans to locate its 150 million Euro UK offshore wind manufacturing base in Leith in Edinburgh, which has the potential to create 800 jobs. Samsung Heavy Industries (SHI) plans to build its first European offshore wind manufacturing base in Scotland. Mitsubishi Power System also plans to invest £100 million in renewable energy research with a possibility of establishing an offshore wind turbine manufacturing base (SDI, 2012).

The global nature of climate change, and the range of international agreements that bind state parties to delivering against targets and ambitions for reducing emissions, mean that Scotland is one of a number of countries that has ambitions to develop its renewables sector. Modelling of the future of the sector undertaken by Scottish Renewables suggests that important decisions about investment must be made almost immediately with regard to some sub-sectors. Unless the required infrastructure is in place by 2014, to develop Scotland's offshore wind industries, the opportunity to maximise return and secure Scotland's energy future as a leader in renewable energy may be lost.

[2] Scottish Parliament Parliamentary Business Economy, Energy & Tourism Committee http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/46125.aspx Accessed October 2012

RENEWABLE ENERGY LABOUR MARKET

Scottish Renewables is the key organisation that represents the interests of renewable industries in Scotland. Their publication, *Delivering the Ambition: Employment in Renewable Energy in Scotland* is the first comprehensive study of the number of jobs currently across the renewable energy sector. Table 1 shows the total employment in the development and supply chain of the renewable energy sector.

Table 1: No of employees in development and supply chain by technology

Technology	Employees
Bioenergy	1410
Grid	3223
Solar and heat pumps	161
Hydro	503
Onshore wind	2235
Offshore wind	943
Wave and tidal	521
Working across multiple sectors	1231
Higher and further education	757
Public sector	152
Total	**11136**

Source: Scottish Renewables (2012) *Delivering the Ambition: Employment in Renewable Energy in Scotland* www.scottishrenewables.com Accessed March 2012

Prior to this employer survey in 2010, Scottish Renewables commissioned IPA Energy to analyse the potential Gross Value Added (GVA) and employment potential for the offshore wind sector, a sub sector within renewables (IPA Energy, 2010). Table 2 provides a summary of four

different scenarios proposed by IPA Energy outlining the potential GVA and the number of jobs that could be created. Each scenario relies on a number of assumptions such as the level of investment required to meet the full 10.6GW capacity of offshore wind, the willingness of European and international markets to import energy from Scotland, and an established supply chain coupled with the availability of skills and experience.

Table 2: Summary of scenarios outlined by Scottish Renewables-IPA Energy[3]

Scenario	Assumptions	Direct FTE number of jobs created	Indirect number of jobs created	Value added (GVA)
1	• 10.6GW capacity • strong supply chain established • Scotland a major exporter	28,000	20,000	£7.1 billion
2	• 10.6GW capacity • strong supply chain • extend development timescale beyond 2020 target	19,000	13,000	£4.5 billion
3	• 10.6GW capacity • Undeveloped supply chain • Rely on importing equipment and services	6,000	13,000	£1.6 billion
4	• No or little changes made to existing infrastructure, investment etc.	900	730	£224 million

Source: IPA Energy and Water Economics (2010) Scottish Offshore Wind: Creating an Industry Scottish Renewables www.scottishrenewables.com accessed November 2011

Scenarios one and two demonstrate the impact a fully developed offshore wind industry could make on Scotland. However, the report states that both these figures assume the infrastructure and skills required to support this are in place by 2014.

[3] IPA Energy modelling approach had four constants: Capacity forecast for Britain, Europe and the rest of the world to 2025; assumptions are of capital expenditure and operational expenditure and the resultant learning rates; multipliers for GVA and employment. The two variables were the capacity forecast for Scotland and retention factors. Each scenario was presented according to the variables and GVA (based on offshore wind investment and the difference in production costs) and employment effects to 2020 were calculated. A more detailed methodology can be found in IPA Energy and Water Economics (2010) *Scottish Offshore Wind: Creating an Industry Scottish Renewables*

Scenarios three and four compensate for a number of factors which would impact on growth and job creation. The former suggests that if the supply chain was not developed further, but developers still aim for 10.6GW of offshore wind then the sector would rely on importing equipment and services, which is likely to lead to increase costs. If the Scottish Government and industry fail to capitalise on the potential growth of the sector, then the situation outlined in scenario four would be more realistic, with only £224 million of value added and 900 full-time equivalent jobs created and an additional 730 indirect jobs over the decade to 2020. In this situation it would be likely that the sector would not develop sufficiently and would rely on importing equipment and services when required (IPA Energy, 2010 pg ii).

The difference between the scenarios equates to a difference in approximately £6.8 billion and 27,100 full-time equivalent jobs. This is a substantial difference which the report argues could be mitigated if the right balance between investment and development is reached.

There do not appear to be similar models for other sub-sectors, but other forecasting work predicts a significant volume of job creation. Skills Development Scotland's Skills Investment Plan for the Energy Sector suggests that there could be a demand for up to 40,000 jobs within a range of renewable energy technologies by 2020, with the largest share being within offshore wind (Skills Development Scotland, 2010). Scottish Power has also stated that it will need to create 1500 extra jobs in electricity networks to deliver its business plan, which will be supporting its renewables infrastructure, and the Marine Energy Group has estimated 2600 direct jobs, and up to 5000 jobs in total if its forecasting scenario of 1000MW of installed capacity by 2020 is realised (Scottish Renewables, 2011).

Forecasts of the growth of the sector have not been disaggregated by job type, and have not provided a clear sense of the number of each type of job that is likely to be created. Although there are clearly issues with developing a typology of job types in a new and emerging sector, Scottish Renewables' employer survey does not appear to have asked about even the broadest possible categories of these.

Skills Development Scotland (SDS) has suggested that the main skills required for the whole renewables sector can be broadly recognised as engineers, (including civil, marine, structural and mechanical), project

managers, welders, turbine technicians and divers. They suggest that many of these future jobs will be filled by people already in the labour market, including unemployed people, and those transferring from other areas of the energy sector. This is problematic in terms of the profile of the energy sector itself, which is likely to face its own skills shortages and gaps in the face of an ageing workforce. It is also problematic in terms of gender segregation, in that the existing energy sector is male-dominated. Without a concerted policy focus, and programme of work, that challenges the gendered employment practice and culture within the energy sector, the same barriers that currently exist are likely to be replicated in the renewables sector.

There are no gender-disaggregated figures on the existing renewables workforce. Scottish Renewables' employer survey (Table 1) has no gender breakdown of the workforce within the findings, and without the methodology available to view it can be assumed that the gender composition of the workforce was not asked as part of the survey.

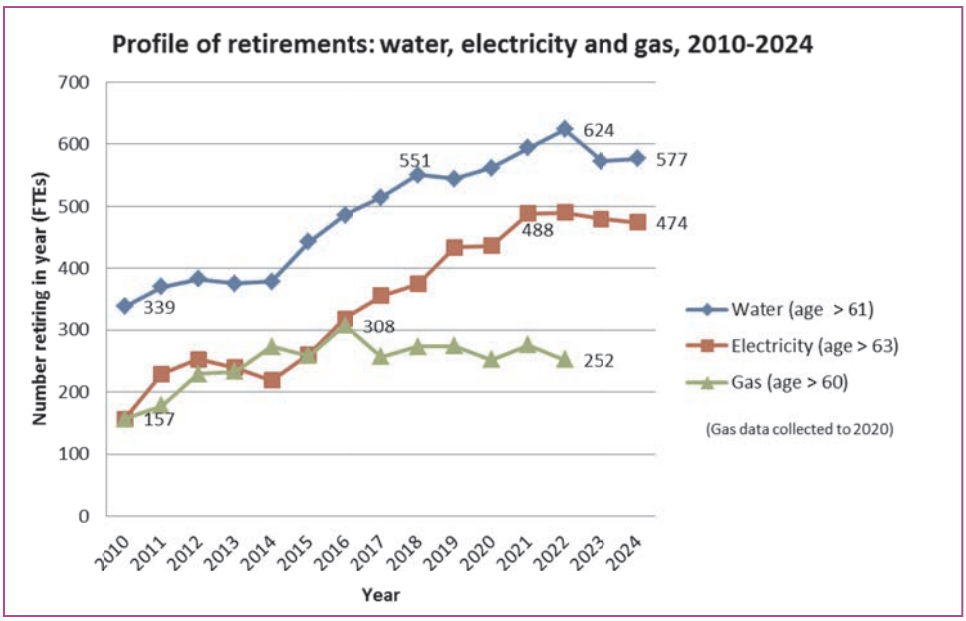
Despite the very positive predictions about the possibility for growth and job creation within the sector, there is a lack of clarity about the detail of this. Given the very stark underrepresentation of women in related sectors, then it is almost certain that any patterns of occupational segregation will be replicated in renewables unless there is a concerted effort to develop gender disaggregated data on employment, and to include a gendered analysis in plans for the development and growth of the workforce within the sector.

Occupational segregation in the energy sector

The Energy and Utility Renewables Skills Analysis focuses on an overriding concern that the supply of skills for the sector will not be able to keep up with the demand as the renewable sector grows. Within the energy sector as a whole, the ageing profile suggests that there will be unmet demand for graduates within oil and gas, as well as unmet specific demand for graduates within STEM subjects related to the renewable energy sector.

The E&U Sector Skills Assessment for Scotland illustrates the concerns regarding the ageing profile for the sector and the year on year increases in retirement for the foreseeable future. Figure 1 from the report illustrates the trends from 2010-2024. Although this is not exclusively the renewable energy sector, it illustrates further a concern about the supply of transferrable skills and knowledge the renewable energy sector is expected to draw from including oil and gas.

Figure 1: Projected retirement rates for water, gas and electricity industries 2010-2024



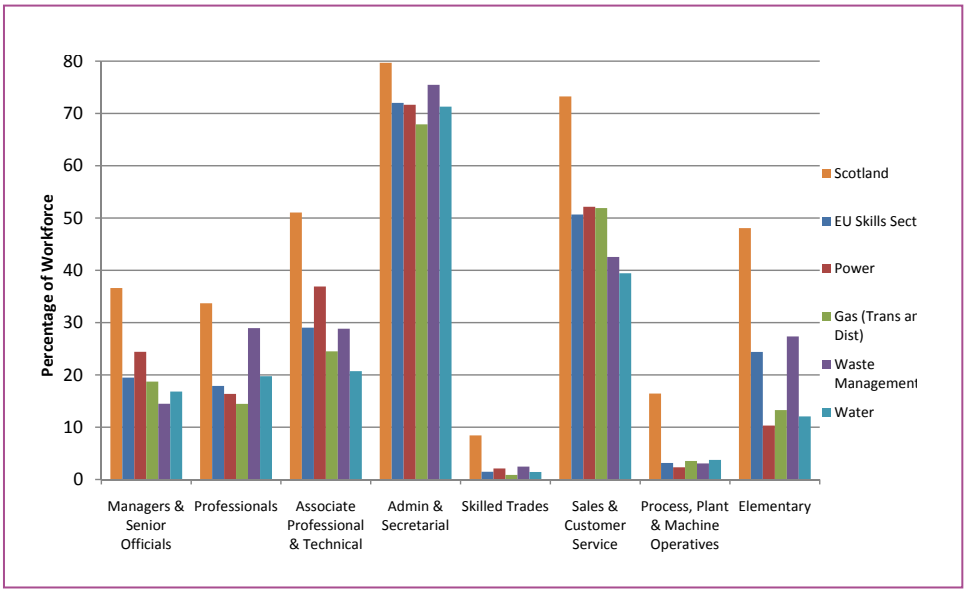
Source: EU Skills Workforce Planning Model as referenced in EU Skills (2009) Renewable Sector Skills Assessment– Scotland

Within onshore and offshore wind developments, there are a number of areas which may present problems in relation to the supply of labour. This includes a shortage of suitable technicians and people with offshore and wind analysis experience and a shortage of people with programme management experience. In some cases employers are starting to increase their graduate trainee programmes, but there is considerable competition and a high turnover, and reward practices are felt to be unsustainable (Skills Development Scotland, 2010). Employers within the sector also feel it is difficult to find engineers with a broad range of skills, and external recruitment relies on the traditional oil and gas industry. For example, it is possible that a turbine technician working in generation industries could transfer those skills to the offshore wind industry (Energy and Utility Skills, 2009).

OPITO, the skills and workforce development agency for the oil and gas industry is concerned over the skills shortages the oil and gas sector faces, and challenges assumptions that expertise and skills will be easily transferred from oil and gas to renewable energy. It points to high levels of demand for highly skilled engineers in the oil and gas sector, with robust requirements that engineers have knowledge and expertise of a highly developed health and safety culture, which leads to a very small pool of talent that the oil and gas sector can draw from. OPITO contends that the

scarcity of these skills inflates the cost to companies. This, it suggests, has the potential to impact on the growth of other sectors, including renewables, that require similar sets of skills and knowledge. OPITO is clear on the challenge to renewables industry companies to reward their engineering workforce at commensurate levels. Existing practice has led to significant levels of gender segregation in the wider energy and utilities sector as a whole, where 25 per cent of the energy and utilities workforce is female compared to 43 per cent across all other sectors. Very few female employees are in skilled trades and professional roles, and they occupy a higher percentage of administration and secretarial roles than the Scottish average (Energy and Utility Skills, 2007).

Table 3: Proportion of women across occupational group within the energy and water sectors in the UK



Source: Energy and Utility Skills (2010) Sector Skills Assessment Scotland, pg 46 Solihull, UK

Women's representation in the renewable energy sector

Available data suggests that patterns on significant gender segregation currently exist in renewables. Estimates for the sector suggest that women account for only 17 per cent of employees and the majority tend to work in administration (Energy and Utility Skills, 2007, pg 51).

Furthermore, less than 10 per cent of women account for jobs directly related to renewable technologies. A crude estimate from Scottish Renewables' recent job analysis equates to approximately 1114 women currently working in the development and supply chain activity. The evidence suggests that strategies are urgently required to address the skills

and knowledge pipeline, including a robust analysis to identify and tackle both demand and supply side factors limiting women's participation. An additional barrier to women's participation in the renewables sector is perhaps presented by the recruitment practices of young companies, which is compounded by the relative lack of entrenched skills and career paths within the sector.

Anecdotal evidence presented to Close the Gap through the Women in Renewable Energy Scotland (WiRES) network suggests that recruitment is heavily dependent on access to, and participation in, informal networks. Experience in other sectors, suggests that organisations and sectors that operate recruitment and promotion in a way that is highly contingent on individuals being well-networked, tend towards male-dominated management structures and corporate cultures.

REMOVING BARRIERS TO WOMEN'S PARTICIPATION IN RENEWABLES

The barriers to women's full participation in the labour market are not unique to STEM occupational areas, but are symptomatic of the stereotyping of women's and men's roles in the wider labour market and indeed society more generally.

A recent report by the Royal Society of Edinburgh, *Tapping all our Talents*, rehearsed the causes and consequences of the barriers facing women studying STEM subjects, with a focus on those in higher education. This follows a number of other investigations and reports, including the SET Fair Report in 2002 (Greenfield, S., *et al,* 2002). The SET Fair Report included recommendations for demand-side interventions to address barriers such as inflexible workplaces, research grants that do not accommodate maternity breaks, long-hours cultures that impact on work-life balance, and promoted posts that appear to require such lengthy working hours that they are incompatible with caring responsibilities. That such workplace interventions are required is evident from the patterns of occupational segregation found in the bioscience sector, where women account for 66 per cent of graduates in biological sciences, but 35 per cent of professional engineers, scientists and technologists in the sector (Close the Gap, 2010).

Response to the various investigations into women's experience of science careers has been patchy and poorly mainstreamed, with the majority of activity taking place in discrete projects with time-limited funding. Details of some of this activity, currently taking place, or having recently taken place, in Scotland, are below.

Supporting women working in STEM industries

The Scottish Resource Centre for Women in Science, Engineering and Technology (SRC) provides support to women working in STEM occupations and those studying STEM subjects at college and university through their Interconnect project. Its sister organisation, the UK Resource

Centre (UKRC), administers the SET Fair Standard and Athena Swan award schemes to encourage employers in STEM sectors to improve their work practices and address the barriers facing women pursuing a career in their industry. The relative fragility of such initiatives, which have proven track records of success, is demonstrated by the withdrawal of UK Government funding from the UKRC. The centre is now moving towards a new model of partnership working without the certainty of sustainable funding.

With a more specific sector focus, WiRES is a newly established women's network whose aim is to *'inform, educate, support and encourage women currently involved in the renewable energy industry.'* WiRES is in its infancy but is modelled on successful networks in other industry areas such as Women in Property. The founders of WiRES established the forum as a response to barriers to their own progression, and a desire to support and empower women to manage their own careers within the sector.

With support from Close the Gap, WiRES held its inaugural event in Aberdeen and attracted over 40 women from the sector. Participants completed a questionnaire about their experiences in the sector, and a number of the women were interested in attending sessions to develop their technical skills, and were also interested in receiving mentoring and coaching support. It was clear from discussions with women working in renewable energy industries that their companies were finding it difficult to source the right combination of skills and expertise to achieve their ambitions for growth, and felt there was a general lack of awareness about the opportunities available in the renewable energy sector. WiRES third event at the Scottish Parliament, which attracted 150 women, heard from John Swinney, Cabinet Secretary for Finance and Sustainable Growth. He outlined the Scottish Government's aspirations for growth in the sector, and the possibilities for women's engagement, describing the ambition of Government to achieve more gender-balance in renewables Modern Apprenticeship frameworks, compared to other stereotypically male frameworks.

Gender stereotyping in early education

The scope of these interventions focuses on women currently working in the labour market. Substantial evidence exists which illustrates that gender stereotyping is one of the main barriers which prevents girls and boys studying 'non-traditional' subjects. Expectations based on the traditional ideas of the roles of women and men in society affect the types of choices girls and boys make about what they want to do when they leave school.

Engineering is one of the occupational groups which sector stakeholders, such as OPITO, are suggesting employers are finding difficult to source sustainably. The perception that engineering is a 'boy's job' is still evident across many classrooms in Scotland. The Institute of Civil Engineering has specifically developed a programme to challenge the image of engineering as being a dirty, male-dominated profession by delivering outreach work in schools, and particularly to try and attract more girls to study engineering. Close the Gap's campaign 'Be What You Want' also adopted a schools outreach model. This was launched in 2011, and aimed to challenge perceptions and stereotypes about the suitability of certain occupations for girls and boys. The campaign included materials specifically on careers in renewables. There are a range of other similar programmes, and some colleges and universities have developed their own gendered outreach work.

At the Women and Employment Summit in September 2012, the First Minister announced a £250,000 funding commitment to CareerWISE, a programme to encourage girls into STEM careers. There is certainly evidence to support intervention. In Scotland, 86.5 per cent of those studying engineering and technology at university are men (MacPherson, 2010) Engineering UK conducted research to investigate the low representation of women in engineering in the UK (as a comparison to other European countries). It identified three main factors which contribute to the lack of women in engineering occupations: the low numbers of girls who select maths and physics post-compulsory curriculum in schools (although the numbers are higher in Scotland); the enjoyment factor where the researchers felt science, engineering and technology subjects were perceived as less enjoyable; and finally careers information, advice and guidance was reinforcing gender stereotypes (Kiwana *et al*, 2011). Scottish Engineering has also highlighted the critical nature of the low representation of women in engineering and has called for actions to address this.

Having a robust gender analysis to identify the trigger points for girls and women throughout the skills pipeline is crucial to plug long term skills shortages and gaps. Representative bodies are starting to realise the cost of occupational segregation and how a shortage of skills in the wider energy and utilities market will have a long term detrimental impact on the quality of skills in the labour market and essentially the potential growth of the renewable energy sector. The consistent analysis of gender disaggregated labour market information is vital to ensure renewable energy skills policy development does not repeat the patterns of the wider energy sector.

GENDER IMBALANCE IN INVESTMENT AND BUSINESS SUPPORT

Investment and enterprise have a critical role in ensuring economic development of the renewable energy sector. IPA Energy's job analysis report relies heavily on the assumption that investors are willing to support technological developments into commercial markets. Investment in the renewable energy sector is crucial if Scotland is to realise its potential and meet energy and carbon emission targets.

Scottish Renewables calculated the total capital investment in the Scottish renewable energy projects from 2009 to April 2012 as £2.8 billion, with the largest share being in onshore wind at £1.6 billion (Scottish Renewables, 2012). Scottish Renewables has also calculated that there has been a 10 per cent expansion of the renewable electricity sector per year during this time, despite the recession. Other sources of investment include the Scottish Government's £103 million Renewable Energy Investment Fund[4] which aims to attract further private investment to the sector and the Marine Renewables Commercialisation Fund (MRCF) administered by the Scottish Government, The Carbon Trust and the Enterprise agencies has £18 million available specifically to support wave and tidal energy industries towards commercialisation. This is part of the £35 million which is directly available to wave and tidal industries over the next three years. Further steps to encourage small-scale enterprise and investment include the Saltire Prize for Marine Energy which is worth £10million.

There do not appear to be conditions attached to any of this funding that might incentivise activity to address the gender imbalance within the sector. Models of investment embedded in economic development include the concept of 'smart specialisation', which is rooted in the ability of a region to capitalise on the application of advances in science and technology. It requires a region to concentrate on its niche technological areas most likely to contribute to regional economic

[4] From Scottish Renewables 'Welcoming renewable energy investment' http://www.scottishrenewables.com/news/scottish-renewables-welcomes-renewable-energy-inve/ accessed March 2012

growth. For example, applying information technology to the management of knowledge about archaeological sites in a particular region rich in archeological activity or using nanotechnology in the quality control of wine production in specific regions that produce wine (Foray, D., *et al* 2009). However, it is postulated that key to the success of identifying a regions specialism is in the role of entrepreneurs to 'drive the process of discovery' rather than 'top down' industrial policy.

Criticism of current regional economic development suggest that industrial policy within each country of Europe can lead to the stifling of the application of science and technology inventions and can also lead to the duplication of those applications, thereby stretching already limited resources further. It is thought this leads to unnecessary competition and as a result the potential return that those technologies could bring to the country's economy.

Under smart specialisation, public policy has a different role to play than is traditionally associated with local and national economic development. Industrial policy within each region has a place, but it is not to promote inter-European competition, but rather to facilitate the emergence of entrepreneurs to drive innovation by incentivising the 'process of discovery' and ensure that education and training is adequate to support innovation (Foray, D., *et al* 2009). The collaboration across boundaries and the co-application of innovation specific to a particular niche sector is the backbone of smart specialisation. Whether Scotland is in a position to advocate for a new framework for science and technological innovation leads to the question of who is likely to be driving that change. An investment model which facilitates the emergence of entrepreneurs must also be mindful of the underrepresentation of women in enterprise in Scotland.

Women's enterprise in Scotland

There is a lack of clear data on women's entrepreneurship in the energy sector, and indeed on women's entrepreneurship at all. Enterprise activity is supported through two main routes, start-up companies are supported through local authorities via Business Gateway services, and potential high growth enterprises are supported by, Scottish Enterprise and Highlands and Islands Enterprise. Women's Enterprise Scotland (WES) found that gender disaggregated data was not available for either start-up or high growth enterprises (Waring, J. and Brierton, J., 2011). WES's own figures suggest that 60 per cent of women-owners would like to grow their

businesses. It calculates that if half of this number created one new part-time job then this could generate up to 8500 new jobs and generate an additional annual £170 million Gross Value Added to the Scottish economy.[5] Subsequently, WES has recently completed the first survey since 2005 which focuses on women-owned businesses in Scotland. Its aim was to provide a snapshot into the business environment in Scotland for women-owned businesses. Despite the fact a large percentage of women-owned businesses aim to grow over the next 2 years, the survey respondents found there was a lack of support beyond start-up and early stage business development (WES, 2012).

The Global Entrepreneurship Monitor (GEM) Report indicates that the Total Entrepreneurial Activity (TEA) rates in 2010 shows that Scotland (4.2 per cent) has a significantly lower level of early-stage entrepreneurial activity than England (6.7 per cent), Wales (5.8 per cent) and Northern Ireland (6.4 per cent) (GEM, 2010). Throughout the UK, levels of female early-stage entrepreneurship were 44 per cent of male activity. Although it is good that Scotland records the highest female to male TEA ratio at 65 per cent, considerably higher than the UK average, the reason for this is the significantly lower Scottish male TEA rate compared to the other nations.

In Scotland, a new initiative has started which aims to collate information on women-owned businesses. The RBS Scotland Index of Women-Owned Business aims to have a minimum of 6000 women-owned businesses over the next 18 months and will provide a report twice a year on the state of women's entrepreneurship in Scotland. This is in response to recognising the potential contribution women's enterprise could make to Scotland's economy and the need to have up to date information available which measures gendered entrepreneurial activity.

This is encouraging, but as WES has illustrated, there is a lack of consistent and quality data on women-owned businesses and women's enterprise activity disaggregated by sector, industry and geographical area. This is crucial if economic development strategies are to identify the barriers to women's enterprise. WES suggests there are two main ways in which to increase economic growth through women's enterprise, which is to increase the growth potential of women-owned businesses and secondly increase the number of women starting businesses (increase the TEA rates).

It is likely that there will be an underrepresentation of women's enterprise in science, engineering and technology (SET) sectors, as there is an

[5] Women's Enterprise Scotland http://www.wescotland.co.uk/News/rbs-index-launch-with-wes/ce744680-107e-43cb-a8eb-ebe9b657ff4b accessed 14 March 2012

underrepresentation of women studying and working in STEM areas, and renewable energy. There is, however, clear evidence which points to the innovation made possible by diverse teams with different perspectives.

For example, Gendered Innovations is a project which brings together experts from the USA and Europe to ask researchers, companies, institutions and funders to consider sex and gender in all aspects of research, policy and practice.[6] One of its case study examples is the development of Text to Speech technologies (TTS). TTS users formulate social identifies and sustain identities through the use of their 'voice'. In many respects TTS technologies are social actors. Initially the engineers developed TTS technologies using only male voices, which left women with no choice but to have a male calibrated voice. As TTS was ostensibly for formulating a sense of social identity, women were significantly less likely to use the product and it did not succeed. As the case study illustrates a gender-sensitive R&D process could have increases the market potential by designing a product that women would want to use. TTS was subsequently developed to include female synthetic voices, to broaden the user base i.e. include women.

However, the next phase for researchers is to expand speech databases to include other factors such as regional dialect and characteristics such as age which interact with sex and gender. The aim is to produce a flexible TTS package which conveys a more accurate representation of the TTS user's gender and social identity, which was not considered in its initial conception. Gendered Innovations was convinced the male default TTS was the result of unconscious bias due to a male dominated professional field.

The WES and RBS survey suggests that women are not content with existing provision of business support services. Inadequacy of data currently collected by enterprise companies and local authorities makes it more difficult to identify changes to mainstream services that would effect an increase in the number of women-owned start-ups, or growth businesses. As with skills strategies and policy development, the invisibility of gendered information and analysis within investment and support activity is very likely to be functioning as a barrier to growth.

There are particular issues with regards to development in rural areas. *Speak up for Rural Scotland* highlights the opportunities in rural areas regarding the development of renewable energy projects. Local

[6] Gendered Innovations in Science, Health and Engineering Project http://gendered innovations.stanford.edu/

communities would like to see skills training and support for business start-ups to help the development of renewable projects and the subsequent supply chain. (Scottish Government, 2010 pg 12). These concerns are echoed in the rest of Scotland, but rural and fragile communities are more sensitive to changes in economic development.

Although the barriers to entry for women with regard to the renewables labour market are not unique to rural areas and are experienced by women throughout Scotland, the geography and the lack of diverse employment opportunities exacerbate the impact of these. Rural areas are likely to see even fewer opportunities for flexible work, especially quality part-time work that will take into account longer travel times in rural areas, and reduced public transport options. Given the geographical location of many growth renewables enterprises, policy attention that focuses on the intersections between gender and rurality is essential.

CONCLUSIONS

There are critical questions to be asked about whether there will be a sustainable supply of labour which meets the growth aspirations for, and of, the renewables sector. The evidence suggests that there are significant issues at each stage of the skills pipeline that require a concerted focus on the part of economic development, education and skills, and industrial policy makers. Such a focus requires a robust evidence base, and it is clear that the quality and quantity of gender disaggregated data must improve across a number of policy areas.

The renewable energy sector in Scotland is at a critical phase of development and needs targeted interventions to increase the number of girls studying STEM subjects, to tackle gender stereotyping in education and training and to encouraging employers in the renewable energy industries to realise the economic benefits of attracting and retaining women, otherwise occupational segregation will continue to be a drag on renewables growth.

REFERENCES

Blackett, G., *et al* (2011) *Powering Scotland* Reform Scotland, Edinburgh

Close the Gap (2010) *'Women: the missing link?' A discussion paper on occupational segregation within science, engineering and technology.* Close the Gap, Glasgow

Energy and Utility Skills (2007) *Sector Skills Agreement Scotland stage 5 report-Scotland* Accessed from www.euskills.co.uk on November 2008

Energy and Utility Skills (2008) *Response to the Scottish Parliament on the Apprenticeship (Scotland) Bill Energy & Utility Skills,* www.euskills.co.uk Accessed November 2008

Energy and Utility Skills (2009) *Renewable Sector Skills Assessment-Scotland* Solihull, UK

Energy & Utility Skills (2011) *Gas, Power, Waste Management and Water Industries: Scotland Sector Profile 2011 Alliance Sector Skills Council Scotland* www.alliancescotland.org Accessed November 2011

Foray, D., David, Paul. A., and Hall, B., (2009) *Smart Specialisation-The Concept* Knowledge Economists Policy Brief no. 9, European Commission

Gendered Innovations in Science, Health and Engineering Project http://genderedinnovations.stanford.edu/ Accessed January 2012

GEM (Global Entrepreneurship Monitor) *United Kingdom 2010 Monitoring Report* Accessed Women's Enterprise Scotland http://www.wescotland.co.uk/gem-2010-report-for-uk/3ef16696-30cf-41c5-bc66-7156b48ff609 Accessed 14 March 2012

Greenfield, S., Peters, J., Lane, N., Rees, T., & Samuels, G. (2002). *SET Fair: A Report on Women in Science, Engineering and Technology* Department of Trade and Industry, London

IPA Energy and Water Economics (2010) *Scottish Offshore Wind: Creating an Industry* Scottish Renewables www.scottishrenewables.com Accessed November 2011

Kiwana, Kumar and Randerson (2011) *Investigation into why the UK has the lowest proportion of female engineers in the EU, EngineeringUK* Accessed May 2012 from Research Online http://www.researchonline.org.uk/sds/search/download.do?ref=B23198

MacPherson (2010) *Tackling Occupational Segregation a Review of Key Evidence and National Policies,* Scottish Government Social Research, Edinburgh. Available from www.scotland.gov.uk/socialresearch

Royal Society of Edinburgh (2012) *Tapping all our talents. Women in science, technology, engineering and mathematics: a strategy for Scotland* RSE, Edinburgh

Skills Development Scotland (2010) *Skills Investment Plan for the Energy Sector,* Skills Development Scotland www.skillsdevelopmentscotland.co.uk

Scottish Government (2010) *Speak up for Rural Scotland* Scottish Government, Edinburgh

Scottish Government (2011) *Routemap for Renewable Energy in Scotland* Scottish Government; Edinburgh

Scottish Government (2011) *Energy efficiency and microgeneration in the built environment, skills research for Scotland,* Scottish Government www.scotland.gov.uk. Accessed December 2011

Scottish Government (2011) *Low Carbon Scotland: meeting the Emission reduction targets 2010-2022: Report on Proposals and Policies* http://www.scotland.gov.uk/Publications/2011/03/21114235/3 Accessed June 2011

Scottish Parliament Parliamentary Business Economy, Energy &Tourism Committee http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/46125.aspx Accessed October 2012

Scottish Renewables (2011) *Evidence on the Scottish Government Budget 2011-2012 and Spending Review 2012-2015* Scottish Renewables www.scottishrenewables.com. Accessed November 2011

Scottish Renewables *'Scotland's renewable energy sector in numbers'* accessed August 2012 http://www.scottishrenewables.com/scottish-renewable-energy-statistics-glance/#chart7

J. Waring and J. Brierton (2011) Women's enterprise and the Scottish economy *International Journal of Gender and Entrepreneurship* Vol 3 (2) pg 144-163

Women's Enterprise Scotland (2012) *Survey of Women-Owned Businesses in Scotland 2012.* Women's Enterprise Scotland www.wescotland.co.uk

Women and Work Commission (2006) *Shaping a Fairer Future* Department for Trade and Industry, London.

News releases

Scottish Enterprise 'new wave of marine energy investment from Scottish Enterprise' http://www.scottish-enterprise.com/News/2012/08/New-wave-of-marine-energy-investment.aspx Accessed September 2012

Scottish Development International news release accessed August 2012 http://www.sdi.co.uk/news/2012/08/Scotland-attracting-growing-international-renewable-energy-investment.aspx

Scottish Renewables *'Welcoming renewable energy investment'* http://www.scottishrenewables.com/news/scottish-renewables-welcomes-renewable-energy-inve/ accessed March 2012

Women's Enterprise Scotland http://www.wescotland.co.uk/News/rbs-index-launch-with-wes/ce744680-107e-43cb-a8eb-ebe9b657ff4b accessed 14 March 2012

Press articles

'Warning independence adds to doubts over renewables', Scotsman Friday 11 November 2011 www.scotsman.com accessed November 2011

'Scotland can lead the world in renewables' The Herald Monday 12 December 2011 www.heraldscotland.com accessed December 2011

'Surge in interest as firms join new gold rush' The Herald Monday 26 December www.heraldscotland.com accessed January 2012

'Scotland running out of time for wind farms' The Herald Monday 26 December www.heraldscotland.com accessed January 2012

'Scottish Power to create 1500 jobs' Scottish Power Press Release Accessed January 2012 http://www.scottishpower.com/PressReleases_2211.htm

'Samsung to base first European offshore project in Fife' Scottish Enterprise accessed February 2012 http://www.scottishpower.com/PressReleases_2211.htm

Websites

www.wirescotland.com
www.scotland.gov.uk
www.scottishrenewables.com
www.skillsdevelopmentscotland.co.uk
www.scottish-enterprise.com
www.hie.co.uk

THE PROJECT

Close the Gap works across Scotland with employers to encourage and enable actions to address the gender pay gap. The project has been operating since 2001.

The project partners are Scottish Government, Equality and Human Rights Commission, Scottish Enterprise, Highlands and Islands Enterprise, Skills Development Scotland, and Scottish Trades Union Congress.

Close the Gap
333 Woodlands Road
Glasgow
G3 6NG
0141 337 8110

info@closethegap.org.uk
www.closethegap.org.uk

@closethepaygap

www.facebook.com/closethepaygap

close the gap

Published March 2013