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The regional employment returns from wave and tidal energy: A Welsh analysis

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ABSTRACT

The paper examines the expected regional employment returns connected to the development of tidal stream and wave-based electricity generation in a UK region – Wales. New employment provides economic development opportunities and the paper demonstrates that there is a need to develop the evidence base on these regional employment impacts. It addresses how far a region which is adjacent to significant marine resources is likely to benefit from a change in the energy generation mix which could feature more wave and tidal stream technologies.

1. Introduction

The objective of this paper is to examine the expected regional employment returns connected to the development of tidal stream and wave-based electricity generation in the UK. New employment provides economic development opportunities. Renewables in general link to three major policy goals: an energy goal, an environmental goal and an economic goal [32]. In terms of the economic goal, understanding the economic development dimensions of wave and tidal energy in terms of employment is becoming more important in Europe. Here there are debates on the extent to which new patterns of electricity generation can be transformative for more needy peripheral parts of Europe in terms of providing new economic opportunities [2,17,22]. These issues are particularly important in relation to wave and tidal energy where European regions adjacent to the best-quality resource sometimes face real challenges in capitalising on their proximity to this resource.

In examining the employment potential from marine renewables, the focus is on tidal stream and wave-based electricity technology in Wales (UK) an area long recognised as having a major resource [33]. While these technologies are at an early commercial stage, it is important to consider how the structure of the evolving industry might determine regional employment and economic returns. Precisely how growth in marine renewables in general might be transformative in terms of job creation in needy areas is unclear with prior analysis of renewables technologies revealing limited regional economic returns [28], but with a series of regional strategies in the UK targeting marine renewables such as wave and tidal energy as a source of growth opportunities and employment [38,39]. Whilst the leverage of local socio-economic returns from renewable energy generation is not the chief aim of regional, national and EU renewables policy, due attention still needs to be given to potential economic consequences such that planners and policy makers can better understand the competing claims of firms developing marine renewables schemes.

The remainder of the paper is structured as follows. Section 2 reviews research that has explored the economic and employment effects associated with changing patterns of electricity generation, and examines some of the analytical problems involved. Section 3 provides some background on the development of the wave and tidal energy sector in the UK in general and Wales in particular. Section 4 focuses on the method employed in this study. Section 5 reports the findings from the analysis and the final section concludes the paper.

2. Wave and tidal power: employment effects

The development of renewable energy technologies can be linked to a series of energy, environmental and economic goals [32], and under the latter come issues relating to the role of

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renewables in meeting socio-economic goals such as employment creation or employment diversification. Indeed Lund and Hvelplund [24] show that the desire for sustainable energy during times of economic recession can be used as a development tool. In the Danish case they revealed that investment in decreasing fossil fuel use and reducing harmful emissions can be undertaken such that there is a stronger influence on employment creation and general economic development.

Kerr et al. [17] argue that research on marine renewables in particular, has been focused upon issues of resource assessment [15], technical viability and environmental impacts. There is rather less of an evidence base available relating to issues of economic and employment consequences of such technologies [27]. This is surprising given that social acceptability of marine renewables schemes is likely to be an important determinant of project success [10,21], and that factors that can influence social acceptability include job creation potential [28]. Indeed Kerr et al. [17] argue that the current balance of research effort, and funding, inadequately reflects the role of society in the development of marine renewables or its potential for socio-economic impacts on coastal communities. Employment is among the most critical of the socio-economic impacts to understand, and the paucity of evidence in this respect is one of the issues that this paper addresses.

Estimating the employment effects associated with wave and tidal power is complicated. In making connections between marine renewables and employment it is unlikely that close parallels can be drawn from on-shore renewable electricity generation technologies because of the different nature of the technological challenge, the different policy/governance context, and different natural environment [1].

In addition to the above there are a series of general issues that the analyst seeking to explore the employment effects of increases in wave and tidal energy have to contend with. One issue is how far a study can provide a complete system-wide accounting of economic and employment effects. Wei et al. [36] show that critiques of 'green job' studies often cite incomplete accounting, poor understanding of opportunity costs, and with renewable technologies sometimes working to crowd out other business investment. Similarly Wei et al. also note the limited attention given to lower environmental costs associated with low carbon electricity generation technologies, together with more difficult-to-value savings in terms of healthcare and benefits in terms of reduced risk and reduced dependency on energy imports. Comprehensive research might also explore the effects linked to changes in household spending connected to higher electricity prices [20]; the loss of activity in conventional power generation; and give due consideration to the direct and indirect employment connected to changes in the energy generation mix [3,12,18,19].

Care is also required in terms of how the employment benefits of new electricity production technologies such as wave and tidal power are denominated. Studies point to low carbon electricity generation producing a relatively higher number of jobs per unit of installed capacity [23]. However, Frondel et al. [12] show that the common conflation of labour-intensive energy provision with efficient climate protection works to sully the waters in the debate on the economic costs and benefits of renewable energy technologies.

General analysis of the employment effects of electricity production tends to separate the development and construction phase, from operation and maintenance. This allows differentiation of shorter-term from longer-term effects which can be important for economic development policy. Common approaches are to use job ratios in terms of direct employment per MW installed capacity during the operation phase of the life of the power station, and then person years of employment through development phases [23]. The distinction is important as the employment supported during the installation phase can be significant particularly for more peripheral economies, but short lived and unsustainable. Moreover, several studies have pointed to the very small number of regional economic opportunities associated with on-shore wind operation and maintenance, but have pointed to a greater level of relative economic impact for marine-based renewables connected to the more severe environmental conditions around devices, and resulting transportation and handling issues [8,28]. In addition while studies commonly produce employment factors these are rarely analysed to explore the distribution between local jobs and jobs for immigrant workers, which is an important consideration for small regions with a limited supply side capability such as that examined later in this paper.

A further issue confronting studies examining the economic effects is how far they can identify indirect economic effects associated with the development and operation of power generation facilities. For example, this includes employment and activity supported in regional supply chains, and induced wage effects associated with regional employment [5,25,26,40].

To conclude, the review reveals that there is a need to better understand the employment effects associated with marine renewables such as wave and tidal power, particularly given links to issues of the social acceptability of projects. It is likely that studies investigating the employment effects associated with marine renewables face similar issues to more general studies of the employment effects of different renewable electricity production. Variation in methods employed results in few benchmarks on which to examine the expected employment and economic effects of the take-up of new methods of electricity production, particularly where regional supply sides are limited in their ability to meet the demands during development phases. Moreover, the early evolutionary stage of wave and tidal power technologies means that there are relatively few studies exploring employment impacts in this specific case, although a rather larger number of studies that have explored the consequences of tidal impoundment projects, and with interest in the latter driven in the UK by initial plans for a Severn Barrage [14].

3. Background: wave and tidal power in the UK and Wales

The focus here is on electricity generation linked with wave and tidal stream devices rather than tidal impoundment. The UK is committed to an 80% reduction in greenhouse gas emissions by 2050 [7]. Meeting these targets requires major transformation in the technologies adopted for electricity generation. While the employment effects associated with renewables such as onshore/offshore wind are fairly well understood, marine technologies around wave power, and tidal stream (and tidal impoundment) are less well understood because of limited activity at anything near commercial scale.

Interest in the scope of wave and tidal stream technologies is associated with the size of the potential UK resource. The UK wave resource is estimated at between 40 and 70 TWh/year, while the tidal stream resource is variously estimated at between 12 and 29 TWh/year [11]. Unfortunately, harnessing greater-velocity tidal streams often goes hand in hand with high installation, servicing and design costs. For example, the [6] estimated that (in 2012) the cost of electricity from wave and tidal power would need to fall by up to 75% to around £100/MWh by 2025 to be competitive, and that this would require considerable innovation and the achievement of significant economies of scale.

The UK Government recognising that private capital will not likely be forthcoming because of the risks, costs and uncertainties involved has set in place a number of funds to leverage new