

<b>Institution:</b> Cardiff University		
<b>Unit of Assessment:</b> Business and Management Studies (17)		
<b>Title of case study:</b> Influencing renewable energy investments in Wales through a regional economic modelling framework		
<b>Period when the underpinning research was undertaken:</b> 2006 – 2019		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g. job title):</b>	<b>Period(s) employed by submitting HEI:</b>
Calvin Jones Max Munday	Professor Professor	02/10/1998 – present 01/01/1990 – present
<b>Period when the claimed impact occurred:</b> 2013 – 2020		
<b>Is this case study continued from a case study submitted in 2014?</b> No		
<p><b>1. Summary of the impact</b> (indicative maximum 100 words)</p> <p>Investment into energy generation has not always led to economic gains for Wales; as part of Wales' transition to clean energy, the Welsh Government wanted renewable investments of value to Wales. Cardiff University modelling of the local benefits of different electricity generation technologies highlighted how local ownership could be transformative in realising local economic benefits. As a result:</p> <ul style="list-style-type: none"> <li>• The Welsh Government set ambitious targets for local ownership of energy infrastructure; invested £87M in renewable energy; and used Cardiff research evidence to support a decision against licensing fracking;</li> <li>• Marine Energy Wales and Natural Resources Wales prioritised local ownership, leading to £100M of investment in marine energy projects and two new large-scale wind energy sites being made available for development prioritising local ownership.</li> </ul>		
<p><b>2. Underpinning research</b> (indicative maximum 500 words)</p> <p>Energy generation is a key driver of the Welsh economy but sustained economic benefits to Wales were not being realised. Cardiff researchers at the Welsh Economy Research Unit, led by Munday and Jones, undertook a wide-ranging programme of economic modelling and supply chain analysis of established and proposed energy investments for a variety of organisations such as the Welsh Government, Marine Energy Wales, and Natural Resources Wales. The research – published in series of commissioned reports as well as academic papers – was able to demonstrate:</p> <ul style="list-style-type: none"> <li>• how a transition to a low carbon economy (a Welsh Government aim) could be economically transformative for Wales through pursuing <b>local ownership</b> and supply chain planning, and</li> <li>• the use of a framework to enable policy actors, including NGOs, to assess the potential for renewables projects to bring local benefits.</li> </ul> <p><b>2.1 Local ownership of supply chains</b></p> <p>The Cardiff research highlighted how financial benefits from electricity generation investments in Wales have typically returned to capital investors outside Wales [3.1, 3.2, 3.5, 3.6], bypassing areas of local economic need. The research placed energy development in the context of persistent socio-economic problems facing Wales, connected to a lack of local capital ownership of energy generation capacity and associated supply chain infrastructure [3.1, 3.2]. It recommended a transformation in underlying economic and proprietary relationships (including local ownership), with a broader focus on potential beneficiaries in local communities and in regional supply chains.</p>		

## 2.2 A new framework to assess the scale and timing of economic impacts

A key contribution of the Cardiff research [3.2] was the extension of the Welsh Economy Research Unit's Input-Output model of the Welsh economy to incorporate power generation. This extended model provided an understanding of how different electricity generation technologies might support regional economic activity directly. It also highlighted the importance of indirect benefits, both in terms of businesses supported in regional supply chains and of local employment creation based on additional household incomes and spending. The modelling approach additionally assessed the scale of the economic benefits at different lifecycle points (construction and operation phases), as well as potential implications for carbon footprint reduction.

Through application of the model to a range of projects on gas [3.4], wind [3.2], marine [3.3], as well as nuclear and conventional energy generation projects [3.2], the research established that:

- while all renewable electricity generation technologies reduce carbon emissions, particular technologies (tidal, wind, solar) each have different regional economic and employment effects [3.2];
- there exist trade-offs between generation scale (carbon benefits) and employment intensity (economic benefits), and that these need to be considered [3.2];
- it is increasingly important for policymakers scrutinising competing energy developments to consider the entire employment supported by a project over its lifespan, and to consider any potential benefits offered by regional supply chain opportunities in both development and operational phases [3.2].

In a series of commissioned research projects, the research approach was applied in more detail to specific energy technologies, namely fracking, marine and wind energy.

### a. Fracking

The application of the research to hydraulic fracking for hydrocarbons was commissioned by the Welsh Government to support their policy development following devolution of licensing powers from Westminster. The research highlighted the financial, supply chain and public acceptance difficulties of scaling-up fracking in Wales and the wider UK, demonstrating that [3.4]:

- fracking offered poor local employment returns for Wales;
- the lack of a regional supply chain to serve the industry would limit its economic contribution in Wales;
- a moratorium on fracking would have very little adverse impact on regional economic development opportunities.

### b. Marine

Commissioned by the Welsh Government, the Cardiff team assessed the potential economic impact of marine energy in Wales. They demonstrated the high potential of supply chain development and the ways in which the marine energy sector could support gross value added in the more peripheral parts of the Welsh economy (i.e. coastal regions) [3.3].

### c. Wind

Supply chain mapping of the different components for wind farm development, undertaken for Renewable UK, the Welsh Government and Natural Resources Wales, identified the potential to increase local benefits through shifts in purchasing behaviour. While the highest value components needed to be sourced outside Wales, economic modelling highlighted significant benefits for local suppliers of basic components and services. The research called for policy instruments to specifically encourage local benefit, in particular through adopting a strategy of increased local ownership of energy resources and infrastructure [3.2, 3.5, 3.6].

Overall, the research provided a holistic analysis of the economic potential of renewable energy investments, as well as detailing how such investments could bring maximum economic benefit to key stakeholders in Wales.

### 3. References to the research (indicative maximum of six references)

[3.1] Bere, K., Jones, C., Jones, S., and Munday, M. (2017) Energy and Development in the Periphery: A regional perspective on small-scale hydro-projects, *Environment and Planning C* 35 (2), 355-375. <https://doi.org/10.1177/0263774X16662029>

[3.2] Bryan, J., Evans, N., Jones C., and Munday, M. (2016) Regional electricity generation and employment in UK regions, *Regional Studies* 51, 414-25. <https://doi.org/10.1080/00343404.2015.2101516>

[3.3] Fanning, T., Jones, C., and Munday, M. (2014) The regional employment returns from wave and tidal energy: A Welsh analysis. *Energy* 76, 958-966. <https://doi.org/10.1016/j.energy.2014.09.012>

[3.4] Evans, N., Jones, C., Munday, M. and Song, M. (2019) Economic effects in the UK periphery from unconventional gas development: Evidence from Wales, *Energy* 166, 1037-1046. <http://dx.doi.org/10.1016/j.energy.2018.10.060>

[3.5] Munday, M., Bristow, G., and Cowell, R. (2011) "Wind farms in rural areas: how far do community benefits from wind farms represent a local economic development opportunity?" *Journal of Rural Studies*, 27, 1-12. <http://dx.doi.org/10.1016/j.jrurstud.2010.08.003>

[3.6] Jones, C. (2010) "Less and less favoured? Britain's regions in the energy crunch". *Environment and Planning A* 42 (12), 3006-3022. <https://doi.org/10.1068/a43206>

### 4. Details of the impact (indicative maximum 750 words)

The Cardiff team's research findings fed directly into:

- Welsh Government **policy** decisions and **investment** in renewable energy;
- NGOs' and stakeholders' financing and enabling of **marine** and **wind** energy investments.

#### 4.1 Impact on Welsh Government policy and investment in energy projects

The Cardiff research on different energy investments and their benefits for Wales [3.2, 3.3, 3.4] were published in a range of reports used by the Welsh Government to inform policy decisions around renewable energy investments. The reports a) underpinned a Programme for Government measure which outlined Welsh Government opposition to fracking, b) informed national targets for local ownership in energy infrastructure, and c) led to Welsh Government investment strategies on renewable energy.

##### a. Fracking

From October 2018, the Welsh Government was given devolved powers over licensing the exploration and development of Wales' onshore petroleum and natural gas resources. Cardiff University's research on the socio-economic impact of fracking hydrocarbons in Wales [3.4] was communicated to the Welsh Government via economic reports and as technical advice notes to officials.

Richard Griffiths, Oil and Gas Licensing Manager for the Welsh Government's Division for Decarbonisation and Energy, confirms that the reports "*formed a core component of Welsh Government's understanding of the impacts of petroleum [and gas] extraction on the economy, jobs and local communities*" [5.1]. The research provided "*the evidence necessary to both formulate a preferred petroleum extraction policy position and understand its likely impact on the wellbeing and prosperity of Wales and its citizens*" [5.1].

The research played a key role in shaping debate during the Welsh Government's public consultation on fracking, influencing both public and political opinions on the matter. In particular, the public and campaign groups frequently used research evidence in strongly voicing their concerns over fracking in Wales. Griffiths states that "*the reports clearly informed*

*public thinking on the issues, as evidenced by **consultation responses** and **social media discussions** referencing specific sections of the socio-economic report” [5.1].*

The outcome of the evidence and public debate was that the research “**contributed significantly and directly to the delivery of a Programme for Government measure**” including “*a policy where we [the Welsh Government] will not undertake any new petroleum licensing in Wales, or support applications for hydraulic fracturing petroleum licence consents*” [5.1]. This is now established firmly in Welsh Government policy.

#### **b. Local ownership**

The Welsh Government aims to transition to a low carbon economy to meet carbon zero aspirations. Jonathan Oates, Head of Clean Growth in the Welsh Government Decarbonisation and Energy Division explained that there was an evidence gap in understanding where “*the economic benefits for Wales in a transition to a low carbon economy might emerge*” [5.2] which had stalled progress. The Cardiff team provided economic modelling to fill this evidence gap, and the research findings [3.2] provided “*new insights*” and an evidence base for “*tacitly held knowledge*”, in particular that “*the greatest benefit from large scale developments will typically leak from Wales unless the capital position can be changed*” [5.2].

The importance that the research [3.1, 3.2] placed on encouraging greater **local ownership** of energy projects was subsequently firmly embedded in Welsh Government policy, as confirmed by Welsh Government’s Energy Generation in Wales report: “*The Welsh Government has **set a target that at least 1 GW of renewable energy capacity should be locally owned by 2030***” [5.3, pp.12-13]. Having set this ambitious target, local ownership became a core pillar of economic resilience policy during the post-Brexit planning for a new regional investment framework in Wales (on which Munday advised). Lesley Griffiths, Minister for Energy, Environment and Rural Affairs reported in 2018: “*We expect all new energy projects to include an element of **local ownership***” with the aim that this will “*maximise the value [of such investments] to Wales*” [5.3, p.3]. This expectation is now established firmly in Welsh Government policy for new energy developments.

Jonathan Oates also confirmed further benefits of the research: “*Cardiff Business School’s work for Welsh Government on the subject of regional economic effects of energy generation has contributed to not only Welsh Government policy on renewable energy generation, but also on wider decarbonisation policy*” [5.2].

#### **c. Investment in renewables**

Having demonstrated the economic potential of local ownership, the Cardiff “*insights led to the initial question of whether Welsh Government or other Welsh bodies could invest in renewables*” [5.2]. The Welsh Government began to assess the potential opportunities offered by their own infrastructure – including those of other public bodies – and using their weight as a sizeable organisation to begin to make change in the sector. After reviewing options and identifying “*a pipeline of approximately £500m of energy efficiency and renewable energy projects*”, the Welsh Government was able to shift its focus towards providing financial support for Welsh public sector investment in local renewables schemes. This led to the commitment of “**£60m of zero-interest loans**”, with a further “**£27m of energy and efficiency projects, where finance was secured from alternative routes**” [5.2]. The Welsh Government estimates this will realise “*savings of £138m*” over the life of these investments, contributing significantly to their wider decarbonisation agenda [5.2].

### **4.2 Impact on NGO approaches to facilitating marine and wind developments**

The research applying the economic modelling approach to marine and wind energy technology was summarised in reports for a) the Welsh Government, who supported significant investment in marine energy through **Marine Energy Wales**, and b) **Natural Resources Wales**, who opened two new sites for wind energy projects.

**a. Marine energy**

Wales has an abundance of quality marine resources but has not fully capitalised on this natural advantage for energy generation. The specific work on economic modelling of wave and tidal energy in Wales “*completed the jigsaw*” for Marine Energy Wales, evidencing “*the economic potential of the sector, and how it could support economic activity in the wider Welsh economy*” [5.4]. The research was used to promote the development opportunities in the sector, and was “*instrumental in making the economic case, and showing the potential in terms of supply chain development and how the marine energy sector could support gross value added in some of the more peripheral and needy parts of the Welsh economy*” [5.4].

Specifically, as Marine Energy Wales were seeking to increase the number of wave and tidal energy devices being tested in Welsh waters, the economic potential of the sector as demonstrated by the research was used to “*justify the targeting of European funds on the marine energy sector in Wales*”, an economic case that led to “*£100m [being] prioritised for marine energy in Wales*” [5.4]. By 2019 almost all of this had been committed, and “*a total of £96m had been invested in Wales by 16 marine energy developers...with over 500 person years of employment to date*” [5.4].

**b. Wind energy**

In a context of “*uncertainty around the future development of onshore wind capacity in Wales*” [5.5], Natural Resources Wales commissioned the Cardiff team to review evidence on the energy options for the national forest estate which covers 40% of the Welsh forest resource. A Senior Land Agent for Natural Resources Wales confirmed that the organisation used the research to make the case to open up two new sites to tender for wind development (with a combined capacity of over 140MW).

In particular the “*Cardiff research assisted in preparing the tender documents for these projects and for developing the scoring mechanism to consider the socio-economic factors to sit alongside financial and technical issues*” [5.5]. The Senior Land Agent further notes that the research set the expectations for the bids; the fact that “*the issue of local ownership (covered in the Cardiff research) was tied into the tender process*” [5.5] resulted in “*the successful companies...[making] contractual commitments to make available significant share[d] ownership of the projects to local investors at both community and public sector level*” [5.5].

Overall, the wide-ranging Cardiff research enabled new nationwide policies on fracking and local ownership, supported investment of £87M in renewable energy projects, helped secure £100M for marine energy projects, and opened up new forest resources for wind farms.

**5. Sources to corroborate the impact** (indicative maximum of 10 references)

[5.1] Written statement from Dr Richard Griffiths, Oil and Gas Licensing Manager, Welsh Government

[5.2] Written statement from Jonathan Oates, Head of Clean Growth, Decarbonisation and Energy Division, Welsh Government

[5.3] Welsh Government Report, *Energy Generation in Wales*, 2018

[5.4] Written statement from the Project Director and the Chair of Marine Energy Wales

[5.5] Written statement from Senior Land Agent, Natural Resources Wales