Community Energy in Wales

Transition challenges in the devolved nation

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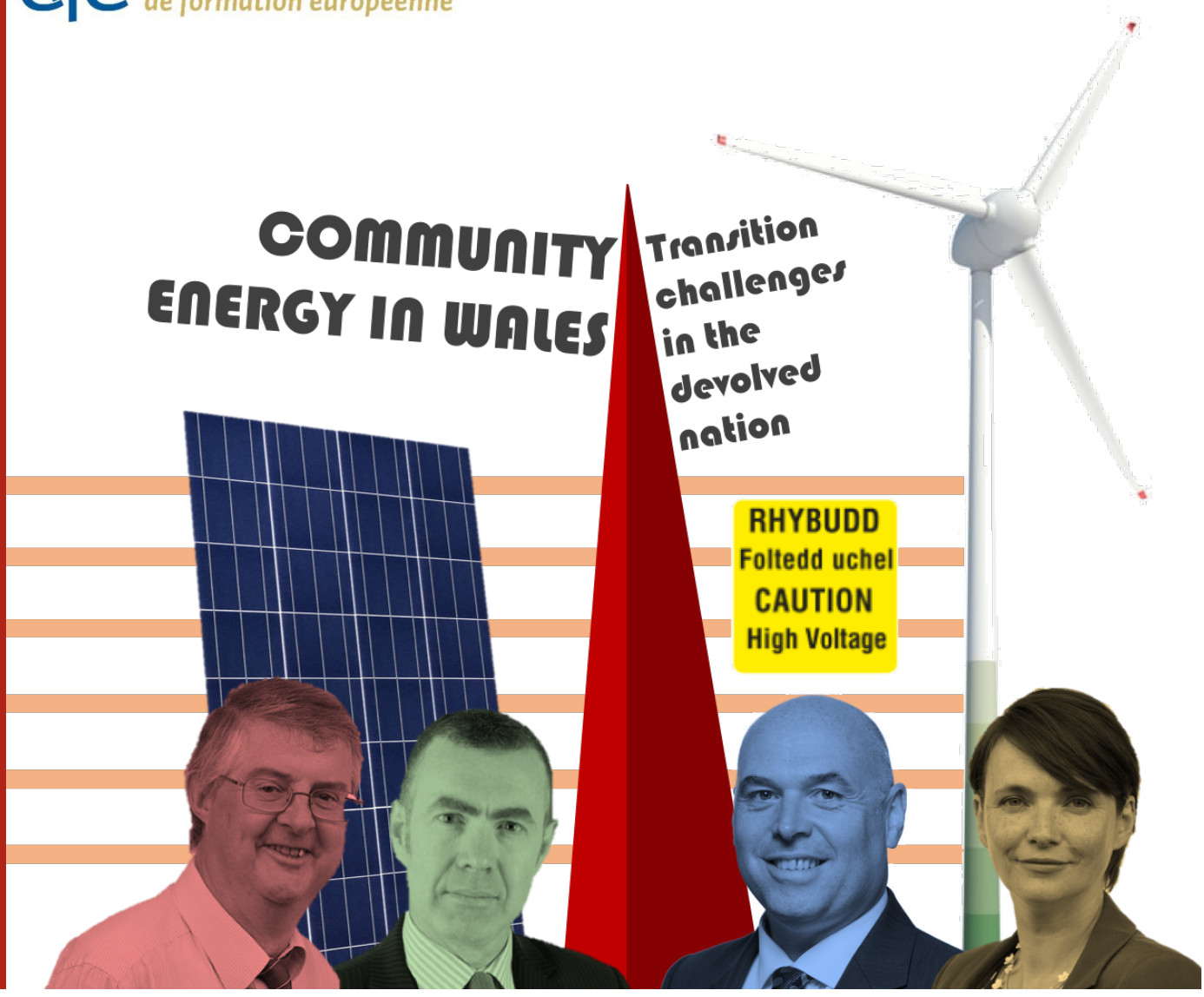

Abstract

Community energy is a form of energy production that revolves around democratic participation, shared profits, and common ownership, and is being reproduced all across Wales. The National Assembly for Wales does not have powers over energy, but still has significant control over how the transition from a centralised energy system to a decentralised one can be planned using competencies in other subjects. After 20 years of devolution, little research has been undertaken to see how this has specifically affected community energy projects, which is why this paper set out to explore what a transition is in theory, how it applies to the Welsh context, and whether the country could be doing more to aid this transition using the powers it currently has. Through understanding the actors in play and how they interrelate, the government is able to enact policy to support the growth of community energy groups through new funding mechanisms, investment in skills, and democratic inclusion. Devolution has benefitted the transition towards having more community energy groups and political will can be blamed for barriers currently being faced. Questions in the future need to be raised about whether new powers should be granted to Wales to give it more control over grid regulation following recent policy enacted by the central government.

This thesis is dedicated to both of my parents, Paul and Sara Lewis, who gave me the skills and the support needed to be able to work on what I find meaningful.

Contents

Table of Abbreviations

AM	Assembly Member
BEIS	UK Department of Business, Energy and Industrial Strategy
BOT(s)	British Overseas Territory(/ies)
CA	Citizens' Assembly
CEG(s)	Community Energy Group
CETC	Community Energy Training Centre
CEW	Community Energy Wales
CSE	Centre for Sustainable Energy
DDT	Dichlorodiphenyltrichloroethane
FiT(s)	Feed-in Tariff(s)
ITE	Initial Teacher Education
IPCC	Intergovernmental Panel on Climate Change
IWA	Institute of Welsh Affairs
LCRI	Low Carbon Research Institute
MLP	Multi-level Perspective
MMT	Modern Monetary Theory
MP	Member of Parliament
NASA	National Aeronautics and Space Administration
QTS	Qualified Teacher Status
R&D	Research and Development
SEG	Smart Export Guarantee
SME	Small and Medium-sized Businesses
TD	Teachta Dála (Assembly Delegate)
TIC	Techno-institutional Complex
UK	The United Kingdom (of Great Britain and Northern Ireland)
US	United States (of America)

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Introduction

"A spider web of local generation" [1]

Wales has declared a climate emergency. Heeding calls from the non-violent direct-action group Extinction Rebellion, the Welsh Assembly passed a declaration in late April 2019. Having supplied the world with coal during the first industrial revolution it is time for Wales to step up and show how to be a leader in tackling climate and ecological breakdown. This is not going to simply come out of individual action or market forces. Only through a combination of collective action and good governance can the nation mitigate the challenge ahead. Unless Wales decouples its energy sector from carbon it will miss its set targets, which are still below what is required for Wales to play its part to prevent a global temperature rise of 1.5ºC.

Though, Wales is not in the same situation as many regions in Western Europe, with the GDP per capita following trends seen in regions across Eastern Europe, the Balkans, Portugal and Southern Spain. Regularly rural Wales is the most economically destitute region in the UK, and with continued austerity and a no deal Brexit looking increasingly likely the situation can look bleak. But what Wales does have one thing; communities willing to fight climate change and regenerate their local economies. [2]

Community energy has many loose and overlapping definitions but its principles revolve around collective ownership, profit sharing and renewable energy production. These projects have to potential to help Wales meet its climate targets and to stave the effects of austerity that has been imposed by the central UK government. But these groups have had a hard time getting off the ground with a lack of skills, funding and support, while experiencing long delays, unfair business rates, and public backlash against onshore wind.

Wales may not be an independent state, but it does have power over a number of subjects, and while energy might not be one specifically, it can still formulate a somewhat independent energy policy from Whitehall and Westminster using what powers it does having under the system of devolution. This paper seeks out to analysis how Welsh community groups operate under devolution.

Though first, it is important to understand how to transition from an energy system that is centralised, large scale and dependant on fossil fuels, to one that is decentralised, inclusive of community energy projects and reliant on renewable energy. While many argue that industry and governments can adapt slowly, the recent special report by the IPCC warning about the risks of a warming of 1.5ºC by the end of the century shows that drastic action needs to be undertaken.

Methodology

Following a methodology of paper research and interviews with members in academia, the Welsh assembly and community energy projects, this paper sets out to explore what a transition is, how the situation currently looks in Wales and what the country has in its power to make further change.

Building upon the theories of Frank Geels' *multi-level perspective* and *regime*, Joseph Schumpeter's *creative destruction*, Gregory C. Unruh's *techno-institutional complex* and Sarah J. Whatmore's *competency groups*, Chapter 1 portrays a picture of what transition is and what prevents new technologies and management practices from entering the current energy systems. Community energy groups are themselves different management practices and rely on different technologies than what conventional energy producers use. The theories of a feedback loop and democratic inclusion are introduced as a method of planning a transition that can disrupt the interests of the incumbent actors, who favour centralised energy. The chapter concludes by listing 8 key indicators to be used to measure whether the devolved Welsh *regime* is benefiting community energy.

Chapter 2 shows the state of play in Wales, comparing the current situation to theories of the *regime* and *techno-institutional complex* discussing how institutional the Welsh Labour Party and Plaid Cymru are in the Welsh political sphere, party policy on community energy, the situation surrounding Wylfa-B Nuclear Power Station, the deep-rooted links between industry and education, and the hurdles affecting community energy projects today. The chapter concludes by comparing the 8 key indicators listed in Chapter 1 to the current context and looks to see in what ways devolution is currently benefitting community energy and to discover the gaps that need overcoming.

Chapter 3 will conclude by looking into policies that have been suggested through interviews, work in academia and think tanks, which could be used to help fill the gaps discovered in Chapter 2, all of which are possible due to the devolved powers that have been granted to Wales. These policies look at reforming Community Energy Wales, connecting education and training to community energy, setting up a Community Bank of Wales, and assisting local authorities. The current status of devolution will then be evaluated to see whether new powers could be introduced to support community energy further along its transition.

How devolution came about, and what it means

The United Kingdom has a complicated system of decision making in the form of devolution, crown dependencies and British Overseas Territories (BOTs), a decentralised model of governance born out of principles of self-determination and localised democratic control. Some regions of the UK have been granted devolved status meaning that they can exercise some independent governance, with Scotland, Wales and Northern Ireland being the most prominent, with a further example including the London Assembly, a proportionally elected 25-member body created to scrutinise decisions of the Mayor of London. The Isle of Man and the bailiwicks of Jersey and Guernsey are Crown dependencies, under the British Crown, not the United Kingdom, keeping friendly relations with the UK but having their own democratic assemblies. British Overseas Territories are another form of governance

where the 14 territories are under the sovereignty and jurisdiction of the UK but do not form part of the UK with only Gibraltar being part of the European Union.

With this intricacy explained, it is most important for this paper to delve into what makes devolution unique compared to the other systems in the UK and systems of decentralisation elsewhere in the world. What keeps this interconnection of the UK and the British Crown working cohesively is defence and international representation, which is a remnant of the colonial era. What differs the three devolved nations/regions of Wales, Scotland and Northern Ireland is that they remain part of the United Kingdom, they have significant populations, far larger in land area than the Crown dependencies and BOTs (excluding British Antarctic Territory), have elected representatives in the House of Commons and abide under those laws. While Wales, Scotland and (albeit controversial) Northern Ireland are all referred to as countries, they are not sovereign from the UK, which is still a unitary state, differing from systems of federalism see over the global. The key distinction is that all the powers exercised by the devolved countries still reside with the central government in Westminster, with the statutes that created the devolved parliaments simply requiring repeal or amendments to change the system, without the say of the devolved countries.

Welsh territory became part of the Kingdom of England following the Laws in Wales Acts 1535 and 1542. It took until 1881 until Wales was concerned as an idiosyncratic polity following the Sunday Closing (Wales) Act. Welsh political consciousness grew following the creation of Cymru Fydd (Young Wales), National Eisteddfod (traditional Welsh cultural festival) and the National Library of Wales. The Anglican Church of England was separated into a Welsh component which was then disestablished in Wales, leading to separation of church and state, further solidifying a unique Welsh identity. It was the election of the first Plaid Cymru MP, Gwynfor Evans, in 1966 that pressured the Labour government to hold a referendum in 1979 to set up a Welsh Assembly, which was rejected by voters. It took until Tony Blair's government to hold another referendum in 1997 which narrowly passed at 50.3% to lead to Welsh devolution. The Government of Wales

Act 2006 reformed the National Assembly for Wales to have an executive and legislative branch, and following a 63.49% yes vote in a referendum in 2011 the Welsh Government (executive) could propose laws bills to the national assembly (legislative) regarding certain "areas of competence". The following Wales Act 2014 and Wales Act 2017 lead to increased powers to the country allowing more fiscal and legislative powers. [3]

What powers exist under devolution?

Wales has competence over 20 subjects, presented below in *figure 1*.

- Agriculture, fisheries, forestry and rural development
- Ancient monuments and historic buildings
- Culture
- Economic development
- Education and training
- Environment
- Fire and rescue services and promotion of fire safety
- Food
- Health and health services
- Highways and transport
- Housing
- Local government
- National Assembly for Wales
- Public administration
- Social welfare
- Sport and recreation
- Tourism
- Town and country planning
- Water and flood defence
- Welsh language

Figure 1 – Devolved subjects to Wales [4]

For the context of this paper, it is important to note that energy is not a subject, however through a combination of other subjects, such as rural development, economic development, environment, housing, transport, local government, and town and country planning, Wales can develop its only independent energy policy from Whitehall and Westminster.

What is Community Energy?

Many terms and definitions are used to describe community energy, which can make it complicated to speak about, however, the World Wind Energy Association has a definition that this paper has chosen to follow, as it fairly represents the principles seen in community energy groups across Wales. [5]

Community energy is any combination of at least two of the following elements:
• Local stakeholders own the majority or all of a renewable energy project.
• Voting control rests with a community-based organisation.
• The majority of social and economic benefits are distributed locally.

In December 2018, the European Parliament and European Council agreed on the new electricity market for the EU, including the term "Citizens Energy Communities". The new legislation has mixed reviews from REScoop.eu as while it is clear that community energy groups now have more power than they did previously, there are some legal issues regarding the terms "citizen energy communities" and "renewable energy communities", with priority being given to the former. REScoop.eu's President said in regard to the change,

"While we are far from where we need to be, we need to continue working at national level and in our communities to ensure the energy transition happens." [6] [7]

Specifically, in Wales, the term most often used by the Welsh Government is "locally-owned" energy production which can range from individuals with rooftop solar panels, community energy and projects owned by local businesses. They have a set target for locally-owned electricity production of 1GW by 2030 and the aim for all renewable energy projects to be partially locally owned by 2020. As the independent think tank Institute for Welsh Affairs pushes the Welsh Government to stricter targets, with the First Minister Mark Drakeford welcoming the recent reports, it is clear that community energy has a role to play in Wales. [8] [9]

This paper hopes to answer the question, to what extent does Welsh devolution aid the transition to community energy?

Chapter 1

In order to move from the current energy system to one that is inclusive of community energy this paper will first look into theories of transition. This chapter will present the principles of Frank Geels' *multi-level perspective* and Gregory C. Unruh's *techno-institutional complex* to understand how actors within a system are interrelated and how these systems will either re-organise over time, or how more disruptive effects can dramatically make a system 'break away' from the current operational mode. The energy system in Wales is impossible to analyse in isolate as it is a product of numerous interlinking sectors, with education, industry and politics being examples brought up within the chapter and expanded upon further in a Welsh context in Chapter 2. Therefore, while energy is not a devolved subject, the energy system is a result of Welsh Government policy that has affected sectors that are intertwined with the energy sector. Following criticisms from political ecologists such as Sarah J. Whatmore, a new model of how to analyse a transition will be built, leading to 8 key indicators that need to be measured to investigate how devolution is affecting community energy projects.

What even is a transition?

Techno-economic analysis is a method used to judge the feasibility of a new technology through the lens of economics, looking into how a business model can be built and how it can enter markets. Looking at solar panels through a techno-economic view would lead transition managers to evaluate the current research and manufacturing costs and how these could reduce over time through economies of scale and speed of adoption. However, this view can be very limited as it ignores how some technology might be socially controversial, be prevented by current legislation, or have low scientific feasibility. Market diffusion, as pointed out by Frank Geels, is not the only thing that needs to be considered when looking at low-carbon transitions, as all transitions are intertwined with politics and society and that a broader range of actors needs to be looked into. Better analysis of actor interests needs to be mapped in order to accurately model the current energy system

as new innovation may perhaps be counter to the vested interests of incumbent players. More social science needs to be adopted within climate mitigation, leading to Geels' work on a socio-technical framework. [10] [11]

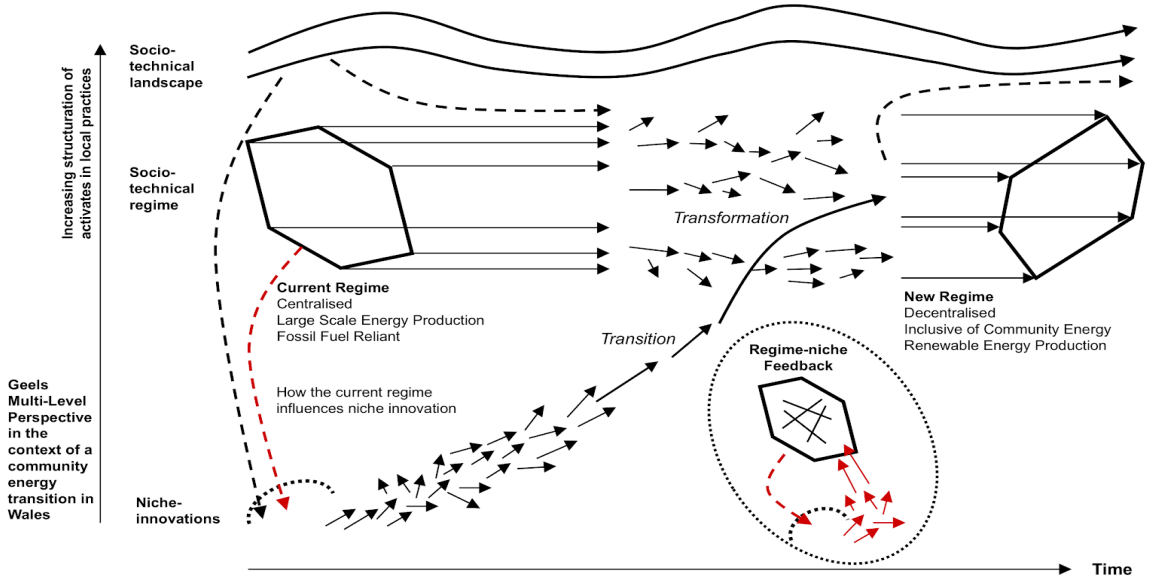

Figure 2 – Multi-level Perspective, Geels (2002), edited by author

Geels developed a model to better understand and manage transitions called *Multi-Level Perspective* (MLP) which aimed at mapping stakeholders at the level of *socio-technical regime* in order to have a wider participation of actors when focusing on how a system is organised and on how decisions should be made. The main principles are that a *regime* is organised into 6 sectors; industry, technology, markets, science, culture, and policy where actors overlap sectors and organise themselves amongst each other. A regime will often re-organise over time in a process called *transformation* and is largely seen as optimisation of the current structure, rather than a radical change.

The theory was developed upon the work of Joseph Schumpeter who popularised the economic concept of 'creative destruction', the idea that wealth under capitalism is periodically destroyed in order to bring about room for new wealth in a different form and organising. This was an intersect between Marxist economic theory and evolutionary theory, with Werner Sombart pointing out in "*Krieg und*

Kapitalismus" "the scarcity of wood and the needs of everyday life... forced the discovery or invention of substitutes for wood, forced the use of coal for heating", while Darwin points out in the *Origin of Species* that the extinction of the dinosaurs at the end of the Cretaceous Period led to the rapid diversification of mammals. Schumpeter was interested in how this destruction came about and pointed to technological innovations of entrepreneurs which could disrupt industries, which had benefited from monopolisation and surplus wealth. Though the theory was originally based in left-wing thought it was quickly adopted by the free-market economic thought of what is often coined as the "Austrian School". [12] [13] [14]

Geels went further and wanted to understand how these innovations were brought about, which would eventually disrupt the current regime. Innovations take place at the *niche-innovation level* which is more protected from the decisions of the regime, outside of the influence and many rules of policy, markets and other sectors. An example of a niche that rapidly developed new technological innovations is NASA. Outside of the mainstream economics, without the need to develop a business case for every technology, source funding or operate under industrial policy it was free to innovate. Putting the moon landing aside, NASA lead to new health care equipment, satellite communication technology, and improvements in solar panels, an energy source that is vital for decentralised community energy. [15]

The *landscape*-level is situated at the top and is the slowest level to change, and encompasses concepts such as global political beliefs and social values along with market prices and climate change.

What is being introduced in this paper is the idea of a *Regime-Niche Feedback*. An innovation at the niche level can fail, succeed, evolve and transform itself, combine itself with other innovations and fight its way into the regime, disrupting the "business as usual" and force actors to realign themselves in accordance. Rather than the simple techno-economic framework, multi-level perspective takes into account how a new innovation can change policy, interact with societal actors and can help map how the interrelations will look in the future. What is important is

how the current *regime* can influence the *niche-innovation level*, which, while somewhat protected from the regime, is still under its effects. NASA was still under control of the US Federal government, held to its commitment of beat the Soviet Union in the Space Race, interlinked with industry, and kept in check by public opinion. The regime influence on the niche-level can be seen as the long, dotted red arrow in *figure 2*. As the *regime* is influenced by the *niche-innovation level* and the *niche-innovation level* in turn by the *regime* it is not unreasonable to point out a feedback loop.

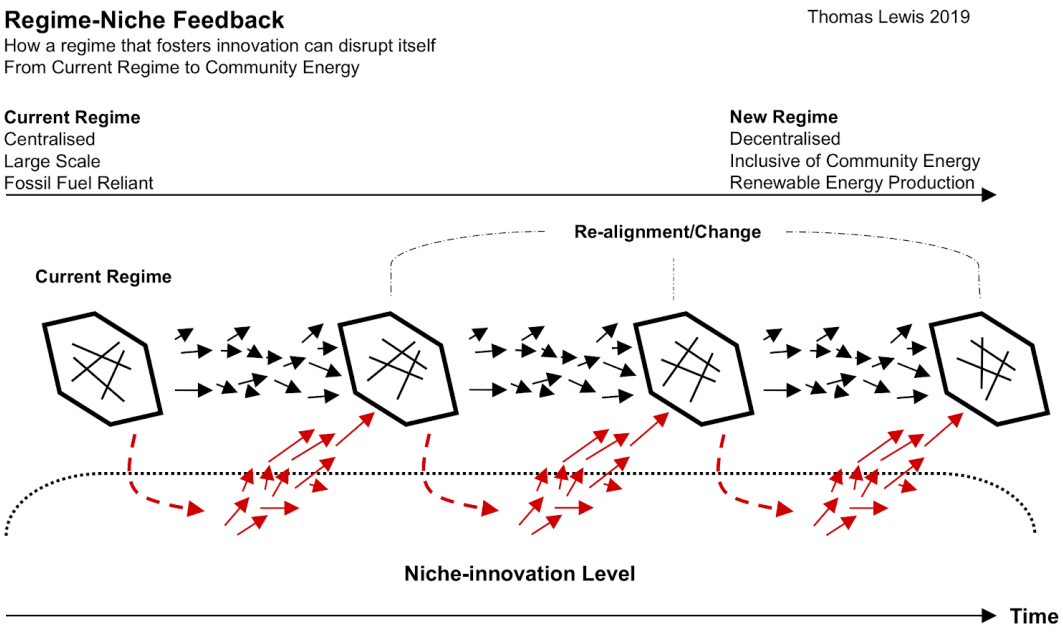

Figure 3 – Regime-Niche Feedback, by author

Figure 3 shows that the new concept of *regime-niche feedback* can be used within the context of community energy. In order to plan the transition, the first things that need to be understood is the current system; one that is focused on large scale energy production and is heavily reliant of fossil fuels, and the desired destination; one that is decentralised, inclusive of community energy and is heavily (if not totally) reliant on renewable energy. Here, one can see that a *regime* that fosters technological innovations can help rapidly realign its actors towards a new *regime*. What is key here is whether a regime encourages the niches that specifically aid a transition to the desired destination. A regime that consistently nurtures niche-

innovation favourable to decentralised community-owned energy can be a regime considered as successfully moving towards the desired location.

The Techno-institutional Complex, how locked-in ideas become

Geels was not the only one looking into the organisation of key actors within the energy sector. Gregory Unruh's paper "Understanding carbon lock-in" sets out how path-dependency has led to the co-evolution of technology and institutions, coining the term *techno-institutional complex* (TIC) to describe this network of interrelations. The paper explains that while many forms of technology and *management practices* can reduce carbon emissions and save money, combining both economic and environmental concerns, they diffuse very slowly into the energy system. His work suggests that technology cannot be seen simply as the materials from which it is built, the space it takes up, and the operations it performs, but rather it should be seen as a "method or knowledge imbedded in artefacts". He goes further, pointing out that it is narrow minded to see a piece of technology in isolation when, especially in the context of the electricity grid, it operates within a larger system than itself.

"Technology is better understood in terms of know-how imbedded in architecturally linked systems and subsystems ....we can consider a technological system as interrelated components connected in a network or infrastructure that includes physical, social and informational elements." [16]

How a technology is adopted is fundamentally dependant on the surrounding technology within its intended network. It can be said that technology is a synthesis between abstract thought (know-how, methods, knowledge) and the physical world (artefacts, networks), which means that social factors are intrinsic to technology. Methods and approaches to fixing problems are not a void of ideology, in fact, on the contrary, they are the products of it. Engineers, scientists, technologists and other occupations involved in the development of technology have received education on methods that have been built upon over history and that have been

seen as the best methods to tackle certain problems. However, as will be discussed later on, the field of political ecology shows that 'knowledge' and the distribution of it is subject to the whims of power relations. A university course is designed around the experience of its writers, the university professors, as well as designed in order to allow the student to enter the workforce, meaning that a course is tailored to the current TIC.

Everett Rogers came up with the *diffusion of innovation* theory which popularised the use of the S-curve, a tool used to see market share of an innovation. Initially, there is a period of increasing returns, followed by a second period of diminishing returns until maximum market share. Unruh focuses on four key mechanisms that lead to increasing returns. *Scale economies*; declining production costs with increased production volume, *learning economies*; reduced costs and better performance as knowledge and skills develop, *adaptive expectations*; increased adoption gives confidence in others adopting, and network economies. The final mechanism is how best to examine *lock-in* and TIC. [17]

The *dominant design* is a technology or a method that has effectively become the industry standard, with an example being the internal combustion engine in the automotive industry. As the current technological network will be characteristically defined by dominant designs it means that new innovations that follow similar characteristics and can fit into the network will be adopted more readily, potentially locking out alternative forms of innovation that may be able to reduce costs or cut carbon emissions, for example. As a network grows, it increases in value (like a road network), and its subsystems increase in value along with it, with this being known as *network economies*. This coevolution strengthens the interrelations, making it increasingly more difficult for alternative innovations and methods to gain any market share.

Technological systems give birth to private institutions which support the *dominant design*, where these can be lobby groups, educational institutions, industry associations, or unions. Workers understand that any threat to their industry in the

form of an alternative approach is against their interests in keeping a job, which is why unions either fight against alternatives or, as being seen more recently, fight for a just transition, preventing change without a guarantee of new jobs and stable income. Educational institutions initially offer courses to train a workforce in the *dominant design* along with other disciplines in the field, building a curriculum that can remain for years, being slow to adapt to new alternatives. Eventually those teaching the courses were the ones initially educated by them, transforming the ways in which the TIC functions but not deviating too far from the core principles. Unruh describes this interrelation as a "self-referential" system with Thomas Hughes, technology historian, calling this growth "momentum". Institutions that become part of TIC are not simply just private, but also public in the form of government institutions with the UK Department of Business, Energy and Industrial Strategy (BEIS) being very locked-in to the idea that the low-carbon transition depends on natural gas being the intermediate stage towards a carbon-neutral system. Unruh suggests that breaking up the TIC depends of government intervention. [16]

Political ecologists say Geels does not go far enough

While Geels is praised for his focus on painting a broader picture and widening the scope of actors and decision makers, his model has come under great criticism from the field of political ecology. It is key to remember that MLP is not simply descriptive of how a transition is going to occur, it can also be used prescriptively by transition managers who prescribe how the transition should occur, which is why it is argued that power-dynamics should be looked into and that there is an understanding of how, why and from whom innovations are developed.

One major criticism given by Lawhon and Murphy is the too strong of a faith put into key actors and the idea that they hold the knowledge to an objective truth that can be uncovered when working together. Another criticism is that MLP has had most of its focus in the UK and the Netherlands so it is important to point out where its limitations are and how it can be adapted when looking at a different

geographical context. Due to the background of its development it has a stronger focus on institutionalised, westernised knowledge with political ecologists emphasising the need for further democratic principles to challenge this. When it comes to power, Geels' model largely neglects this. The range of actors is narrow and while Geels himself explicitly points out that inclusion of society is critical, he does not call out right for democratic inclusion. Geels also points out that some key actors have vested interests but when his models are used there is an implication that the key actors are somewhat progressive and environmentally minded and that an arrangement can be decided upon, that allows new technology to change alignment and keep all actors accounted for, with a win-win approach. [18]

However, Avelino and Rotmans argue that conflicts are deep-rooted into environmental transitions as fundamentally there is the involvement of redistribution of resources. The outcome of this redistribution will be determined by which stakeholders are considered key actors and their power in the decision-making process. This comes as no surprise when looking at nuclear power in Wales, where Hitachi and the UK Government have a far larger say in building the Wylfa Nuclear Power Station in Anglesey (*Ynys Môn*) than the citizens of Wales. This uneven power relation leads to the wishes of the most powerful and unified actors setting the course for the future, how transitions take place, how the *niche-innovation level* is nurtured, and how innovations are adopted into a changing *regime*. While MLP might be a useful mechanism to map actors who have previously steered the decision making process, it is not one that should be used to radically transform the system, as is the case needed for Welsh community energy. [19]

Escaping lock-in, moving forward

Community Energy is an innovation, or as Unruh would put it, a *management practice*, which is at odds with the *dominant design* of energy production, which is large scale, centralised and reliant on fossil fuels. While many argue that in order to have an energy transition it is important to invest in jobs and training in the fields

of climate, environment and energy, this can be limiting if all that is happening is a larger workforce operating within the same TIC. Though the Welsh TIC is moving in the direction of decarbonisation due to societal and governmental pressure, those educated in universities focused on centralised principles could strengthen the TIC, which would be at odds with community energy. Here, we see the synthesis between Geels' *regime* and Unruh's *techno-institutional complex*, a *lock-in*, whether it be described as the interrelations of key actors or institutions, with the field of political ecology highlighting the fear of control by powerful actors.

Unruh's follow up paper "Escaping carbon lock-in" tries to tackle how to avoid alternative forms of innovations from being locked out of the TIC. He splits the discussion into two sections; exogenous technological forces and institutional change, but points out the limitation as both areas are intertwined and therefore a change in one section will give changes to the other. Exogenous technological forces are generally what has been previously discussed with Geels and Schumpeter as new innovation can come from a niche and disrupt the TIC, though here he points out that an innovation must have a "much larger order-of-magnitude performance improvement" in order to compete against technology that is institutionalised. He remarks that one method is to "evade technological lock-in by focusing new technological development in specialized niches", which perfectly backs up the idea of a *regime* nurturing the *niche-innovation level* to disrupt itself, leading to the *niche-regime feedback*, previously discussed. [20]

Government intervention and a change of recommendation coming from policy makers is only likely to come from public recognition of the current state of play and sudden change in the belief that the continued expansion of the current TIC is detrimental to society and the environment. Unruh gives examples of the decimation of the Bald Eagle in the US, a national symbol for the country, led to a critical mass of the public wanting policy to ban pesticide DDT. In order to do this, policy first needs to be pushed that educates people on the current situation to build public consensus or a major event and recognition of a real crisis needs to be in the minds of the public. Seeing as the Welsh Assembly and the UK Parliament both

voted in favour of declaring a Climate Emergency, it can be argued that policy makers are in a better position now to be setting the trend towards community energy. [21]

Building a new model, with democracy at its heart

The Welsh energy *regime* is heavily saturated with incumbent actors loyal to centralised, large scale energy production which relies on fossil fuels. A transition that has room for community energy is one that requires incumbent actors to scale back and make room. In a situation of scarcity (limited energy consumers) conflicts arise, and uneven power relations need to be addressed to prevent incumbent actors being the sole decision makers.

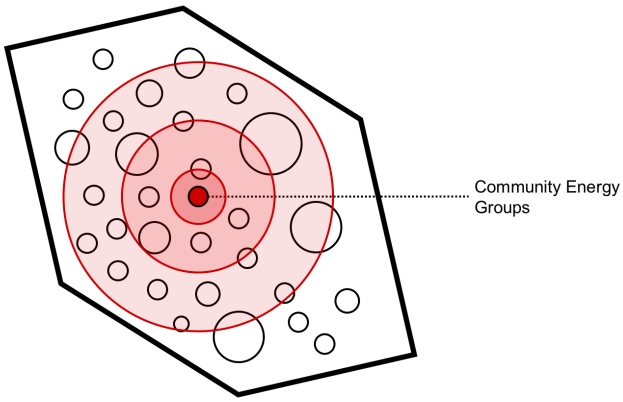

Figure 4 – CEGs within the regime, by author

Community energy is an actor that exists within the current regime. More accurately, *they* exist, as at the present time in Wales there is only beginning to become a voice that speaks for them collectively. *Figure 4* shows the actor is intertwined with the many sectors and other actors within the regime and operates within the power relations previously mentioned. In order to have a *regime* that operates in favour of community energy and one that will help nurture innovation that is beneficial to community energy, this actor needs to become more powerful, seen in the diagram as growing, overlapping other sectors and institutions, becoming more ingrained within the TIC, changing the interrelations. If

devolution can be seen as supporting this actor in its growth, then it can be seen as aiding community energy.

Whatmore argues that in order to address uneven power relations *competency groups* need developing. There is a fear of the 'rule by experts' when it comes to political ecologists, and there is the understanding that local people (often referred to as indigenous communities) have the potential to understand the local environmental in ways that would be missed by experts. This knowledge can be vital in the decision-making process, but it too can be based on uneven power relations. Societies, small and large, operate under power relations meaning that once again accepted knowledge is somewhat dictated. So even here when trying to expand our understanding of knowledge it is important to have a range of voices and have an inclusive democracy that brings in many backgrounds relating to class, ethnicity, nationality, gender, age, religion, citizen status, and importantly for Wales, language use. Building these *competency groups*, a far more diverse range of stakeholders whose knowledge has been categorised, allows for a transitional model to be build that does not leave anyone behind and removes some consequential results that would not have been considered otherwise. [22]

Community Energy is built on the principles of resource sharing and a democratic process and therefore fits in very well with the theories discussed within political ecology. The collective organisation of energy cooperatives, alongside a broad range of stakeholders and experts, could be modelled as the *competency group*. This group, given enough say in comparison to the incumbent actors, could benefit massively to the development towards a system focused on community energy.

As previously mentioned, MLP is considered as a decision-making tool for managing a transition and therefore the way in which a model is presented and what elements it highlights is vital to transition managers. This is why in diagram X community energy groups have been positioned outside of the *regime*, alongside the 6 key sectors to display the importance of inclusivity and to convince transition

managers to consider their voices as importantly as the voices expressed within the key sectors.

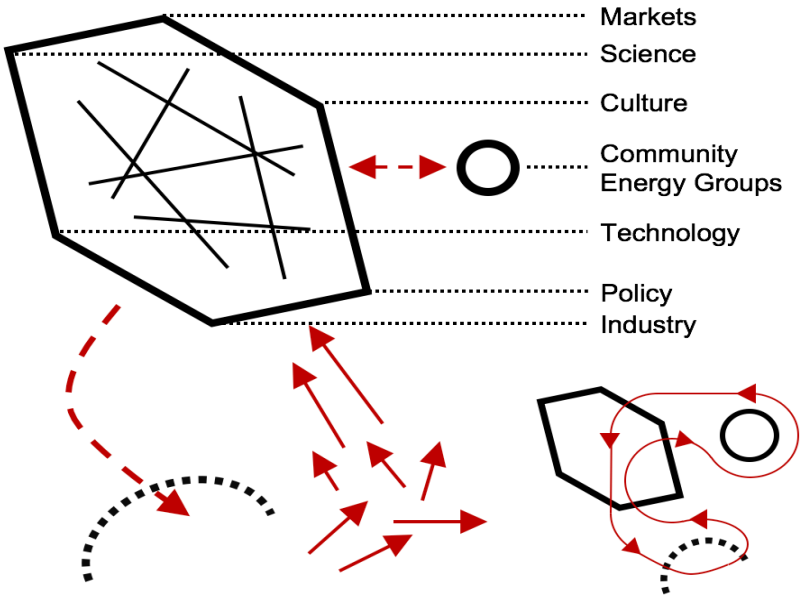

Figure 5 – Regime-Niche-CEG Feedback, by author

The actor of Community Energy Groups (CEGs), or a large assembly representing CEGs with a broad range of stakeholders and experts in the form of a *competency group*, both influences the *regime* and is influenced by the *regime*. Building upon the concept of the *regime-niche feedback*, the idea of the *regime-niche-CEG feedback* can be drawn. In *figure 5* the interrelations can be easily seen. The CEGs can influence the regime to nurture the *niche-innovation level* to produce innovations beneficial to community energy, the *regime* will then, thanks to the CEGs, be more willing to adopt these beneficial innovations and reorganise itself. A *regime* that has reorganised itself around technology that supports community energy in turn raises the power of CEGs, with the cycle starting to repeat. This feedback would be far more productive at *regime* change than a simple *regime-niche feedback* as it takes into consideration the uneven power relations, democratic inclusivity and actor interest. Any result of the devolution and the legal powers shift

to Wales that has given power to CEGs in the decision-making process, helped unify the voice of CEGs, or built any form of competency group with the inclusion of CEGs, can be seen as benefiting community energy.

Other methods of evaluation

With the theories of transition covered it is important to see how Welsh devolution can benefit community energy less abstractly. While previously what has been advocated for is large systematic change (transition) what can also be evaluated is how devolution has helped community energy during its process (transformation) to a decarbonised energy system. How the country provides funding, sets policy, targets and provides expertise are good indicators. It is not simply just the Welsh Government but how political parties set out their climate and energy plans in their manifestos, how business and industry interact with community energy groups, and how political think tanks recommend policy. This will be evaluated later in Chapter 2, looking at the current state of Welsh community energy.

The 8 key indicators: how to measure success

Geels pushed for widening the scope of technological change by looking at more sectors, rather than just looking at diffusion through the lens of markets and the economy, realising that change is heavily affected by societal factors. Technology and innovation have the ability to change a *regime* through *creative destruction* as set out in Schumpeter's work, meaning that technology relating to community energy (solar panels, data management systems, storage, small hydro turbines, etc) can force actors in the Welsh energy *regime* to realign. As the *regime* affects the *niche-innovation level*, and vice versa, a feedback can be seen, that can be used to speed up the process of transition if used correctly by transition managers. Both Geels and Unruh point out the difficulty with incumbent actors which is why it is important to use the theories from political ecology of having real democratic inclusion alongside CEGs, experts, and stakeholders in the form of *competency groups*, where knowledge has been categorised and is understood within the context

of power dynamics. The incumbent actors within the Welsh energy sector, who are discussed in Chapter 2, favour centralised energy.

Technology that has the ability to reduce greenhouse gases emissions and costs may not be taken up due to the *lock-in effect*. This can be the case in Wales for community energy as though small scale hydroelectric generation, potentially community owned, could theoretically be a good method to cover the energy needs in rural Wales, the *technological system* may favourite technology that is characteristically similar to itself, as explained by *network economies*. Unruh also says that it not simply alternative technology that comes out of the *niche-innovation level* but also *management practices* which refers to how technology is organised. Community energy is a *management practice* that is held to the same disadvantage when it comes to the TIC. Unruh recommends that in order to prevent the TIC limiting beneficial change government intervention is required, but this is only likely to happen when a critical mass of the public is on board.

These are the indicators to look out for when trying to analyse the research question. If Welsh devolution can be seen as:

1. Nurturing the *niche-innovation level*
2. Allowing innovation to change the *regime level*
3. Supporting the growth in power of CEGs
4. Unifying the voice of CEGs
5. Building *competency groups* with the inclusion of CEGs
6. Educating the public on community energy
7. Declaring the current TIC as inadequate, and
8. Changing policy to better suit community energy

then it can be said to be aiding the transition to community energy.

Chapter 2

The current situation in Wales: Stakeholder Analysis

In order to put these theories to test and see what can be learned from them, the stakeholders of the Welsh energy system have been mapped. From the point of view of Unruh's *techno-institutional complex*, the key players of industry and policy have been looked into, which are also two of the sectors of Geels' *regime*, along with a discussion on how education loyal to the *dominant design* has been institutionalised.

Political parties, a Welsh context

Since the creation of the Welsh Assembly, it has always been the Labour Party winning the most number of seats, either forming a majority government, a minority government in 2003, the 'One Wales" coalition with Plaid Cymru in 2007 and currently a coalition with one Liberal Democrat AM. The Conservative Party have generally scored poorly in Wales compared to the UK as a whole, though their greatest success was during Margaret Thatcher's victory in 1983 against Labour leader Michael Foot, a Welshman, sending 18 MPs to Westminster. In the 1997 and 2001 General Elections, Wales did not send a single Tory MP to London. This Welsh animosity to the Conservative Party has been linked to class consciousness, the Welsh 'radical tradition' and the view of the Tories being an 'English' party. The Tories have performed better in urban borough constituencies, which in the Middle Ages were considered as English outposts, where prior to the Laws in Wales Acts 1535 and 1542 the Welsh were prohibited from inhabiting these English enclaves. The rural county constituencies that the Tories managed to perform somewhat better in were more Anglican and Anglicised, though the rest of rural Wales avoided the party. Following the First World War, the Labour Party took hold of Wales, ousting the Liberal Party. The Miners' Strike 1984-85 further solidified the Welsh working class and the labour movement, combining trade unionist, socialist, and communist leanings. [23] [24]

Plaid Cymru came out of a combination of Welsh traditionalism and socialist leanings, being founded in 1925 as Plaid Genedlaethol Cymru (The National Party of Wales) as a pressure group for the Welsh language and home rule for Wales as an independent nation. The conflict between these ideologies can be seen between early founders Sauders Lewis and David James Davies, with the former being a right-leaning monarchist and seeing Welsh heritage as one of the "founders of European civilisation", and the latter being more left-wing and republican, though in an article published posthumously he argued for a Welsh monarchy. Party leader 1945-81 Gwynfor Evans was more heavily influenced by Davies' politics and in 1973 pled to "fast to death" during a hunger strike following the central Conservative Party's decision to not fund a Welsh language television channel, leading to Thatcher's U-turn and the establishment of Sianel Pedwar Cymru (S4C, Channel 4 Wales). This alliance of north-western Welsh nationalism and southern socialist thought has been a careful coalition that still exists today. [25]

The Liberal Democrats still hold weight in Welsh politics, namely challenging rural Plaid and Tory seats, though have consistently polled as fourth place in Assembly elections by vote share and seat count, and polled in fifth place in 2016 as the election ran a month before the European Union referendum, with the rise of UKIP.

Who likes community energy?

Annex 1 gives an outline of the party ideologies, positions on devolution, general energy policies, and stance on community energy along with all source material. While Labour is generally in favour of community energy and renewable energy it is Plaid Cymru, the Liberal Democrats, and the Green Party who have been most vocal about its importance, though the central Labour Party under Jeremy Corbyn has recently adopted new policy heavily in favour of community energy, and with the new First Minister Mark Drakeford being hailed as a Corbyn ally these policies may trickle over into the Welsh Labour Party. The Wales Green Party have had very little significance in Wales having never returned a seat for the Assembly,

House of Commons or European Parliament and currently have only one local councillor and are best considered as a pressure group, pushing policy on the centre-left/left-wing. While the Liberal Democrats may seem somewhat insignificant they are generally seen as Labour's first choice in building a coalition as while Labour and Plaid have overlapping policy in terms of supporting the NHS, growing childcare facilities, and introducing more renewable energy, opinions on independence are a concern. The One Wales coalition was only acceptable due to then Plaid leader Ieuan Wyn Jones avoiding the subject of independence as to not alienate voters.

The Conservative party has been largely critical of the Ynni'r Fro scheme, which was set up under the One Wales coalition as a means to promote community energy projects, arguing that almost £2.5M had been spent on the scheme leading to only one successful project after 4 years. Their closest policy that would support community energy projects being the Welsh Localism and Citizenship Bill which focuses on building skills in local communities. Their main priorities are building a shale gas sector in Wales, expanding natural gas networks and continued nuclear in the form of the Wylfa power station.

UKIP entered the scene of Welsh politics during the run-up to the UK European Union membership referendum, in which Wales voted 52.5% in favour of Leave. While the party did not gain any constituency seats in the Assembly they benefited under the proportional D'hondt method voting system and gained seats from the regional list. The party's policy on energy and climate can be considered vague, with the manifestos stating to oppose "unsightly" wind turbines and to cut the Welsh budget for climate change projects, which stood at £73M in 2016. As of May 2019, the party is splitting with four UKIP assembly members joining Nigel Farage's new party, the Brexit Party.

The strong lock-in of Labour and Plaid Cymru in Wales means that for community energy to succeed politically it will have to be adopted by these parties, with the Liberal Democrats having a small say, and the Greens acting more as a pressure

group. The Conservatives have shown little interest in small scale renewables and the far-right parties are void of any policy but comments regarding climate change as a whole point to them being openly hostile to the interests of community energy. Devolution led to Wales being able to adopt the modified D'hondt electoral system, known as the additional member system, which has one vote for the constituency and a second vote for a larger regional area. If the vote was simply based on constituencies then UKIP would not have returned a single seat in the 2016 Assembly Elections, so here it could be argued that devolution has helped prohibit community energy by promoting parties who are hostile to renewable energy policies as a whole, though at the same time Plaid Cymru returned an equal of seats in the regional lists (along with more in the constituencies) who have a stronger interest in community energy than the Labour Party so it could be argued that here the devolved electoral system has strengthened the voice of community energy groups.

Welsh politics has been shifting considerably following the EU Elections in May 2019 where the Brexit Party came in first place collecting two seats, Plaid Cymru coming in second with one and Labour in third place with another seat, with the Conservative Party having no European representative to return to Brussels. This has come out of Remain-supporting Labour voters jumping ship to Plaid Cymru and the Welsh Liberal Democrats who promoted themselves the only Remain parties in Wales able to win, and with Leave-supporting voters consolidating their vote around the Brexit Party. As many significant players move over to Plaid Cymru including Erasmus founder Hywel Ceri Jones and former Wales Green Party leader Grenville Ham, it might imply that Plaid Cymru may play an even more significant voice for community energy in Wales following the next Assembly Election in 2021. Though, many voters in the EU elections saw the opportunity to express their opinions regarding Brexit, as almost a quasi-second referendum, and will likely not reflect entirely on how the public will vote in future General or Assembly elections. Going forward it would still seem wise to suggest that Labour and Plaid Cymru would still be the kingmakers. [26]

A major conversation regarding centralised low carbon energy systems in Wales is the Wylfa nuclear power plant in Anglesey, which is useful as a case study to examine how the *regime* supports the *dominant design*.

Wylfa Nuclear Power Plant, supporting the status quo?

Wylfa Newydd is a proposed second nuclear power plant to be built by Horizon Nuclear Power, initially a joint venture between E.ON and RWE, now owned by Hitachi. The construction of this plant has always had controversy after its approved construction. The opposition group People Against Wylfa-B (PAWB, Welsh for "everyone") held a 300-person protest in Llangefni alongside Greenpeace and Cymdeithas yr Iaith Gymraeg (Welsh Language Society). PAWB argue that the site would be unsafe, economically unfeasible, have issues with nuclear waste and would not bring any prosperity to the region, in place they argue for community energy projects. Hitachi has suspended construction over funding issues. [27]

The Labour Party position is that the project should go ahead with an oversight committee, the Conservatives and Liberal Democrats believe the power is needed and the jobs will bring benefits. The Greens are staunch anti-nuclear, while Plaid Cymru has only recently come around to being against the plans. Initially, it was accepted as an inconvenience but former leader Leanne Wood and current leader Adam Price have come out against the project as unfeasible and in response to calls from local residents, who are concerned about house prices as workers from outside the community will move in. Welsh nationalism has had a history opposing typically wealthier English homeowners in Wales, with the group Meibion Glyndŵr setting English-owned holiday homes on fire between 1979 to the mid-1990s. Professor Richard Cowell reported in the interview that Labour's focus is on jobs and growth within the energy sector, which would explain their positive position toward Wylfa-B. [28]

This shows how the *regime* is supporting the *dominant design* and the status quo in large scale energy. The questions that need to be answered here are whether this

resistance to the project has come out of devolution and whether this resistance could lead to a break from the *dominant design* and toward community energy.

It is important to once again mention that Wales does not have devolved powers in energy, meaning it is limited as to what the Welsh Government can do in its support of Wylfa-B, though having members in the Welsh Government criticising the project does give the opposite more of a voice and potential power to lobby against the central government.

Industry and Education, the unlikely bedfellows

Unruh's *techno-institutional complex* highlights the interconnections between education and industry, as a workforce needs to be trained in the *dominant design* and professors eventually become ones who were initially trained in the very same practices. *Annex 2*, complete with source material, shows that universities in Wales in general support centralised fossil fuel energy with Cardiff University having industrial links to BP, Exxon Mobil, National Grid, Tata Steel and npower, where students can take industrial placement years to gain skills in the field before finishing their degrees. Swansea University also has links with Tata Steel who work within the fields of the exploration, extraction and distribution of oil and gas. RWE npower bought RUMM in 2015, a spin-off company from the University of South Wales involved in energy management, showing how the *niche-innovation level* is supporting the current *regime*. Leaders of Glyndŵr University praised the Wylfa-B nuclear programme extension, citing jobs and investments as key, going on to say that their partnership with Coleg Menai would "ensure the industry is supplied with graduates ready to apply their skills and experience and hit the ground running as nuclear energy professionals". The university became a member of the National Skills Academy for Nuclear in connection with Skills Academy Wales which was set up by the Welsh Government. Horizon Nuclear Power, donated £1.2M towards Coleg Menai's Nuclear Engineering Centre, after the Welsh Government funded £5M towards the project. Coleg Menai currently has 30 apprenticeships with

Horizon Nuclear Power, whose futures seem unclear following Hitachi's decision to suspend construction. [29] [30]

It is not simply education turning to industry, but also vice versa. Aberthaw coal-fired power station (owned by npower) set up Aberthaw Centre for Energy and Environment (ACE2), a program that had partnerships within the Welsh National Curriculum, to educate high school pupils on the importance of sustainability and energy efficiency, with the then First Minister Carwyn Jones of Labour at the official opening in support. Here the clear interconnections between education, politics and industry in the t*echno-institutional complex* are outlined.

When it comes to research the story is more mixed between benefitting centralised energy and research being done into community energy and decentralised technology. The Low Carbon Research Institute (LCRI) was an initiative set out by six Welsh universities backed financially by European Union structural funds, industry, and the universities themselves. One field was the Large Scale Power Generation with mainly revolved around Cardiff University's Gas Turbine Research Centre, looking at how renewable gases could be used in replacement to natural gas, though the fields of Smart Operation for a Low Carbon Energy Region (SOLCER) and Solar PV (SPARC) did put research into decentralised technologies with a focus on local authorities and communities.

In an interview with Professor Richard Cowell, the scope of Cardiff University's research into community energy was clarified. The Centre for Integrated Renewable Energy Generation and Supply is an engineering group focused on decentralised technology and microgrids, though it is the Energy Research Cluster that is most significant for community energy under the School of Geography and Planning, with the listed subjects being important for the work being covered here:

• Community engagement in energy projects
• The impact of devolution on the planning and delivery of renewable energy
• The role of space, scale and state in climate change politics

• Regional resilience and innovation studies

So, while education is still strongly linked to centralised energy, many of which is fossil fuel based, research seems to be partially focused on decentralised community energy.

The situation for the Community Energy Groups themselves

Through interviews with Professor Richard Cowell, Neil Lewis of Carmarthenshire Energy, and Plaid Cymru AM and Welsh Shadow Minister for the Environment Llŷr Gruffydd, the following actors were mapped out in *figure 6* in regard to setting up and maintaining a community energy project. [28] [31] [1]

• Local authorities
• National Resources Wales (NRW)
• Welsh Government
• UK Government
• European Union
• Community Energy Wales / Ynni Cymunedol Cymru
• Loan companies/community banks

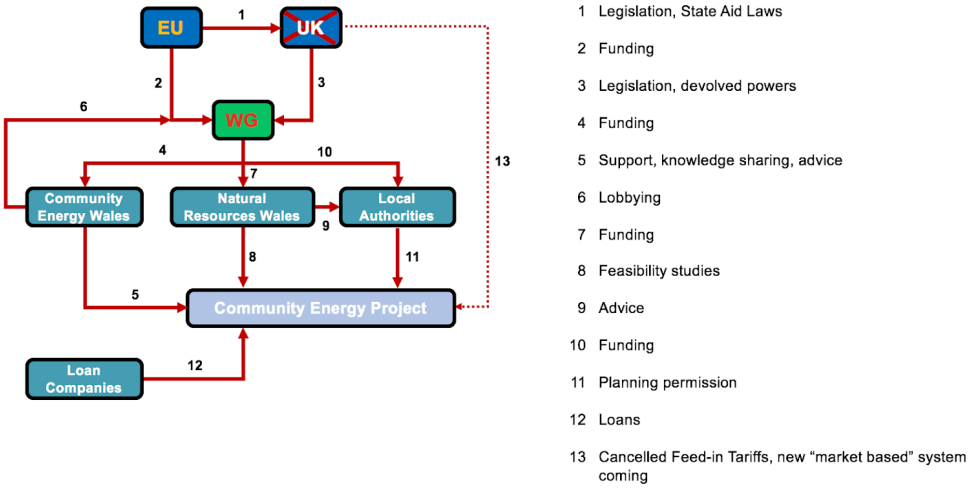

Figure 6 – Map of influence surrounding CEGs, by author

Community Energy Wales was set up in 2012 after the failure of Ynni'r Fro to deliver many community energy projects, initially being funded by the Welsh Government but currently has further diversified its income. It is linked to the Renew Wales program who aim at bringing community groups together through a 'peer-to-peer' network that can support and train groups and create peer mentors who are willing to share their knowledge from their previous experience. They collect information on what makes projects successful and where the barriers lie and campaign on the behalf of the field and promote policies in Wales that benefit the groups.

Local authorities and NRW are most significant when it comes to planning and feasibility, with the UK government being responsible for the previous FiT scheme, the European Union being open for funding and the Welsh Government setting policy. Loan companies and community banks have come into play due to the inability to have a grant and use FiT due to European Union State Aid laws.

So, you want to start your own community energy group?

There are 6 main steps to setting up a community energy project, identified by the IWA. [8]

- Initial ideas
- Feasibility
- Permissions
- Construction financing
- Construction process
- Generating energy

To begin with members of a community must have the initial ideas to generate energy in the area. This might come out of a desire to lower prices, distribute profits to the community, or from environmental concerns. Deciding what natural resource can be used to generate power and how the team will be organised along with

getting community support are further steps. The group then has to go about getting permissions for the project from both the local authorities and Natural Resources Wales, and only through approval of feasibility studies and planning applications by both can this go ahead.

Before building can take place all the financing must be in order. A common method used is issuing bonds, normally around £1000 with an interest of 6% to be collected after 7 years, though these values differ depending on the project with smaller investment options sometimes being available to local residents. These bond offers are shared amongst the local community and online via crowdfunding websites. While it may seem simple for the Welsh Government to simply offer grants and loans to these projects, this would exclude them from being accepted by the Feed-in Tariff scheme due to pressure from EU State Aid Laws, therefore some organisations look towards private loan companies. Finally, the project can be constructed and energy can be produced.

Why community energy groups fail

One of the most commonly occurring complains is the length of time it takes from the initial idea to producing energy, with delays being very common. The issue with delays is that investors want to see a fast return on their money, volunteers want to see their fruits of their labour, and as the Feed-in Tariff dropped every year it was important that the project could get started as soon as possible.

Gaining permissions from local authorities and Natural Resources Wales has proved difficult with research from the Institute of Welsh Affairs pointing out that there is a perception that local authorities are fairly conservative and not as on board with the same climate agenda that community energy groups follow. NRW has proved difficult when trying to gain consent, with them saying that they are bound by law to dismiss any second attempt applications if they have shown no signs of improving.

While it is not always hard to find passionate people at the beginning, it can be tough to find those with the required expertise. While Community Energy Wales does offer advice, and tries to help projects share information and setup peer mentors, it is being reported as not going far enough. As schemes can be delayed this expertise are even more vital.

The state of play measured up against the key indicators

Using the key indicators from Chapter 1, the state of play in the Welsh energy system can be measured against them to determine how Welsh devolution is affecting the transition to community energy.

1. Nurturing the *niche-innovation level*

The *niche-innovation level* is where new technologies and management practices can arise and disrupt the current *regime* or be absorbed by it, with technologies and practices that have similarities to the *dominant design* having an advantage when being diffused due to *network economies*. Research is a major way in which new innovation comes about, whether this comes through state-supported university research, company R&D or start-ups.

In Wales, it can be seen that the *niche-innovation level* is being supported by both the main principles of the *dominant design* within the *regime/techno-institutional complex* and research beneficial to community energy. The LCRI is supported by the HEFCW and European Region Development Funds with the research split between supporting the principles of the *dominant design*, with an example being the Gas Turbine Research Centre, while also researching photovoltaics. The purchase of RUMM by RWE npower shows that innovations by start-ups are still benefiting the *regime*. Cardiff University's Energy Research Cluster has a heavy focus on *management practices* with much of the work solely on phenomena surrounding community energy, which is a sign that the *regime* is evolving to

beginning to nurture the *niche-innovation level* in favour of *management practices* that would disrupt it.

2. Allowing innovation to change the regime level

In order to complete one cycle of the *regime-niche feedback*, there needs to be the process of nurturing of the *niche-innovation level* as well as the process of niche-innovations entering and disrupting the *regime*. The nurturing from industry with university-industry placements for students and industry absorbing start-ups produced in universities shows the feedback currently benefiting the *dominant design.* While there is limited evidence of technological innovation in Wales benefiting community energy, there is a link between the research in *management practices* being accepted by political parties. Research undertaken by Cardiff University's Energy Research Cluster and research and policy produced by the IWA have entered political manifestos shown by the discourse within the Senedd with the National Assembly for Wales' Environment and Sustainability Committee launching an inquiry in 2016 into Smarter Energy Future for Wales, looking at community energy and local profit sharing. This committee had members from Welsh Labour, Plaid Cymru and a Welsh Liberal Democrats AM.

3. Supporting the growth in power of CEGs
4. Unifying the voice of CEGs

These two key indicators have been the aim of Community Energy Wales and Renew Wales, organising CEGs within Wales together, providing assistance and knowledge to encourage more communities to engage in projects and to make sure the ones underway are successful. Rather than community energy groups simply being many actors scattered across Wales, they are beginning to be formed as a more unified actor. As these groups become more unified their common interests and aims can be argued cohesively meaning that the Welsh Government can become aware of the needs around the country, giving CEGs a seat at the table when it comes to planning the transition. [32]

5. Building competency groups with the inclusion of CEGs

Very little sign that this is being considered in the Welsh *regime*, specifically.

6. Educating the public on community energy

Other than publications coming out of the Welsh Government, community energy has not been on the forefront of public discourse, with issues regarding Brexit generally taking up much of the UK media, with Wales discussing issues such as the M4 relief road and loss in manufacturing.

7. Declaring the current TIC as inadequate

In April 2019, the Welsh Assembly declared a Climate Emergency following non-violent direct action protests of the environmental group Extinction Rebellion. This is a very direct message that the current TIC is inadequate and change must be brought about to address this. However, what change needs to be brought about was not declared. [21]

8. Changing policy to better suit community energy

The creation of Ynni'r Fro and its transformation into Community Energy Wales is the most significant pieces of policy to come out of the Welsh Assembly as a means to better suit community energy. FiT allowed these groups to earn a profit from production but this came from the central government, and its cancelation in March 2019 led to a 94% drop in new panel installations in the first month, with the government introducing legislation on June 10th that would guarantee small scale production under 5MW will be guaranteed payment per unit, but the amount remains to be seen. The inability to control policy like this is a concern to the Welsh Government, leading it to releasing a report urging the central government to ensure the benefits experienced in Wales would not be lost due to a change of scheme.

This uncertainty can lead to a delay of investment to CEGs as investors do not know how successful a CEG will be without its profit-making abilities being secured. [33] [34]

Gaps exist but does Wales have the powers to fill them?

After looking over the 8 key indicators and the state of play in Wales there are barriers that CEGs are facing that would need to be addressed in order to lead to a transition that is inclusive of community energy. The party context at the start of the chapter reveals how the centre-left to left has always held the majority in the Welsh Assembly and for a policy to be passed its easiest root is by being adopted by the Welsh Labour Party and Plaid Cymru.

A commonly reported barrier is delays, as CEGs have to go through numerous different hurdles to secure funding, planning permission and feasibility studies with a limited number of experts who can help them along. NRW and local authorities seem to be the greatest barriers and therefore it is important to consider whether new policy can be introduced by the Welsh Government to combat these issues.

There is a skills gap but education is still focused on the *dominant design*, benefitting the large industrial incumbents while being actively supported by government policy. Education is a devolved subject to Wales and therefore it has the space to go about changing these interconnections.

Then, finally, there is the question when it comes to setting any form of policy and that is how any change will be paid for. Chapter 3 sets out to explore how these gaps can be filled by looking at what powers Wales has under devolution and what would convince dominant parties to take these ideas on board.

Chapter 3

Energy might not be a devolved subject, but as previously discussed a lot can be done by the Welsh Government to lead a transition from a centralised, large scale system to one that is decentralised, reliant on renewable energy, and inclusive of community energy. This chapter will first give examples of what policies can be enacted that can further benefit community energy in Wales using the powers granted under devolution, followed by a section discussing Welsh devolution in its current form and whether a change is necessary. As the *regime* is so heavily interlinked, these policy recommendations cover a wide range of powers that can be exercised under devolution in order to build a system that offers new support mechanisms, challenges assumptions made about project financing, and helps train a workforce ready for the next generation of energy. With the combination of the Conservative Party in central government who practice fiscal conservatism, the ongoing effects of continued austerity, and economic hardship forecasted after Brexit, the policies that are being suggested in academia and political think tanks call for strong economic reform using what powers are possible to protect Wales and fund community energy projects. The premise here is to see whether it is in fact devolution that is preventing the transition to community energy, or simply political will.

Community Energy as a means of local regeneration

Wales has some of the most economically deprived areas in the United Kingdom and the European Union as a whole, while Inner London (West) has a comparable GDP per capita to Monaco, West Wales and the Valleys can be compared to Malta, with the latter region having the lowest GDP per capita in the UK. Following the 2008 crash, Conservative Leader David Cameron coined the phrase “age of austerity”, campaigning against what he saw as excessive government spending. Following the 2010 UK General Election, the elected coalition government of the Conservative Party and the Liberal Democrats enacted the austerity programme which, while ring-fencing education and the NHS (which are devolved in Wales),

still lead to £30B worth of cuts between 2010-2019 primarily in the sectors of welfare, housing and social security. The reduced budgets for social services and councils lead to household incomes becoming more squeezed and in times of economic hardship, households become more reliant on social services. During this process, along with leading to a doubling of food bank use and the UN's publishing of a report stating that austerity had led to 14 million Britons living in poverty, household spending reduced, risking the continued shrinking of the economy. This lack of disposable income means there is less security for communities to pool resources together to start community energy projects. [2] [35] [36]

The Bank of England had a different approach which was backed by Gordon Brown at the end of his term; quantitative easing. Brown combined this with the selling off of government assets to reduce the deficit and increased government spending. This process is one where the Bank of England buys gilt-edged securities (government-backed bonds) from financial institutions in order to effectively create money in the hands of the banks by creating a deficit in the Bank of England. This money creation meant that the banks could use this money for lending, which would in principle increase spending to stimulate the economy. While the Bank of England continued quantitative easing, the Conservatives (along with the Liberal Democrats) cut government spending. Anti-austerity movements become popular under the notion that the banks got bailed out but not those in the most precarious positions. [37]

As a method of regeneration of local communities, an option is to use community energy projects as a medium through which increased spending could be spread throughout the country with profits being reintroduced into the community via a Community Wealth Trust. A community wealth trust is where a portion of the profits are pooled after paying back loans, investors and maintenance costs. These funds are then allocated into the community services that have been agreed on through a one-member-one-vote democratic process. A report written by Dan Gregory of Local Trust entitled "Strong resourceful communities: The case for a Community Wealth Fund" sets out a proposal to create a Community Wealth Trust to reinvest money in community infrastructure to build resilient civil societies and

states that “a mix of funding pressures, market forces, myths about charity overheads, and flawed policy responses” have prevented civil society from reaching its full potential. The report even explicitly mentions how the trust can fund shared assets, with wind turbines being an example, showing that profits from shared renewable energy assets can lead to further ones. While Gregory is promoting a national independent scheme to allocate money into communities, community energy projects have already been doing this at a local scale. [38] [39]

On the Isle of Mull, Garmony Hydro has successfully installed 400kW of hydroelectric power with a lifespan of 20 years with a predicted turnover of £5.04m, £2.4m of which will be invested directly into the community. Community clubs, sports organisations, school summer camp projects, the library and parks have already received the benefits. Friends of Taff Bargoed, associated with a community hydroelectric project in Merthyr Tydfil, Wales reinvested their profits to secure the jobs of two park employees who were facing redundancy due to the limited council budget. Islay Energy Community Benefit Society are planning to reinvest profits into new projects that can earn the community further profit, support local services, and fund home refurbishment to tackle fuel poverty during cold winters. [40] [41] [42]

Investing further into community energy projects that have Community Wealth Trusts could allow local economies to be rejuvenated through better public services, lead to more low carbon means of energy production, and encourage more community energy projects.

But how will it all be paid for?

The Conservative Party have historically been the party of reduced government spending, following fiscal conservatism as advocated by Margaret Thatcher following years of the previous Labour Government’s deficit spending. Wales does have control over its own budget, however it is a product of limited tax collection powers under devolution and money allocated by the central government through

the Barnett formula. A mass investment scheme such as this requires alternative methods to get around the inability to follow Keynesian economic principles of deficit spending to revitalise an economy. The recent U-turn on the M4 relief road has freed up £1.4B which can be used to set up these new policy proposals, but other sources of wealth need to be looked into. [43]

Sharing risk: Community banking

Neil Lewis of Carmarthenshire Energy set up Robert Owens Community Banking which has a community energy fund, with its initial purpose to be give CEGs the ability to take out loans to help with planning permission and construction costs, and allow the groups to still apply for Feed-in Tariffs and not be excluded due to EU State Laws. These loans have high-interest rates due to the higher risk involved as CEGs are more than often a collective of people embarking on a project for the first time without a portfolio of any previous work in the field. The profit earned through FiT by generating energy can then be used to pay back the loan with the interest on top. Whereas this might seem like a great risk for a CEG if they fail to get through the procedures of planning permission application, feasibility studies and construction there is a safety net in the form of shared risk. Only groups that successfully produce energy will be required to pay back the loans meaning any costs endured by the bank by failures will be recovered by the higher interest rates of the other groups. This gives CEGs the option and confidence to take out loans, while at the same time giving the bank the motivation to support the groups in their project management to ensure they recover the money given out. Though, Lewis also added that the high interest rates meant that most of the FiT was absorbed back by the banks meaning CEGs sometimes need to source funding through alternative means (e.g. selling bonds), which would prevent profit being circulated back into local public services. He warned that as delays built up and the final construction date was shifted back that the assumed money received from FiT would lower, making it harder for a group to pay back its debt. [31]

Creating Welsh money without the Bank of England

Rather than relying solely on these small examples of independent community banks, a larger system can be created which takes influence from the economic thinking that produced quantitative easing. A paper released by the New Economics Foundation and the Copenhagen Business School entitled "Making Money from Making Money" discusses how in modern digital economies the ideas surrounding the concept of money need to be re-evaluated. Whereas previously *seigniorage* was seen as the difference between the costs required to manufacture physical money (coins and notes) and its purchasing power (how much it is worth as money in the economy), this term now acts differently in the UK where only 3% of the money supply is physical, with 97% of it is essentially just numbers changing on a bank sheet, or "lent in to economies as the digital IOUs of commercial banks". There is an assumption that it is the state who has the monopoly on wealth creation, which would mean Wales, lacking sovereignty, could not go about creating money needed to invest in services such as community energy projects, however, this paper goes on to point out that commercial banks have money creation abilities through lending. The *seigniorage* is considered as the additional costs that the commercial bank would normally occur if it would have to borrow money that it lends out to the market, rather than having it money creation abilities through lending which cost virtually nothing. The paper discovered that on average 1.23% of the UK's annual GDP was created through this process in commercial banks, compared to 0.064% of GDP that the central banks' issuing of banknotes has provided. If true, this money generation shows that Wales has the ability to increase its spending capability through loans by its commercial banks, but this does not guarantee that this money will go towards CEGs with Community Wealth Trusts. [44]

How to democratise wealth creation

Craig Johnson of the Public Policy Institute of Wales published a paper entitled "Time for a Full Public Bank in Wales?" discussing setting up a bank in Wales that would meet the issues associated with small and medium-sized businesses (SMEs)

lacking sufficient credit, while simultaneously providing services to local communities and households. This bank would be publicly owned meaning it would be willing to support projects that private banks may believe have too high risk, which is the reasoning many community energy projects have been given when being refused loans. Johnson points out that Wales has already created the Development Bank for Wales which is a public limited company under the parentage of the Welsh Government, which supports SMEs through loans. However, the paper points out that this scheme lacks in two key areas when compared to a public bank; lack of services that a regular bank provides, and money creation, citing the paper "Making Money from Making Money". [45]

A public bank can either be a single Public Bank for Wales as the title implies or a network of smaller branches that would supply loans and assistance to local communities, mimicking Sparkassen in Germany. These Community Banks would act as a means of local development, with democratically elected boards with individuals from the region. This local insight could possibly lead to a greater understanding of and cooperation with community energy projects, as small banks have an advantage at collecting "soft information" when compared to the larger banks. Having face-to-face discussion between banks and CEGs would allow for improved assistance and understanding.

The wealth generated through loan making can then be further invested into local economies, held accountable through the Community Bank's membership to support further investment in social services and energy cooperatives. The profits generated through energy production would then enter the Community Wealth Trusts which invest profits further into social services, also being held democratically accountable through the one-member-one-vote system. With a network of democratised wealth creation and distribution, Wales has the potential to protect itself somewhat from austerity while simultaneously supporting the transition to a system inclusive of community energy projects.

Community banks are (probably) going to happen

During the 2019 Welsh Labour leadership election, which would determine the next First Minister after the resignation of Carwyn Jones, the winner Mark Drakeford had a section on Community Banking in his manifesto. The Community Bank of Wales would begin to operate before the end of the current assembly term (next election May 2021) and would spread throughout Wales after the next assembly election, assuming that they are in government. The reasons cited were the closure of traditional bank branches across the country, a low level of savings and 'poverty premium', problems that could be tackled by setting up an institution which relies on a one-member-one-vote basis, offers face-to-face service to local customers and SMEs, operate as a living wage employer and has a fixed ratio between the highest paid employee and lowest. The manifesto explicitly mentions that the Development Bank for Wales provides a useful service but more can be done, going on to say that a Community Bank would make funds available locally and "recycle local savings" into local loans. This scheme would likely not be possible under a Conservative government in Westminster without the devolved powers and electoral system in Wales allowing for the possibility a differing government. From a small independent community bank made to support community energy groups in the form of Robert Owen Community Banking to the setup of a new Welsh institution, made possible under devolution. [46]

While it may seem expected that the Welsh Conservatives would be hostile to community banking it is actually a policy that AM Russell George was calling on the Welsh Government to explore back in 2014 as a method of saving rural communities, something not discussed by the central party. Plaid Cymru has also called for a publicly owned-bank for similar reasons to the Welsh Conservatives, though neither made references to "savings" like Mark Drakeford. This term is more than likely referring to the *seigniorage* without raising suspicion that this would be operating under the context of Modern Monetary Theory (MMT), a controversial form of economics that has been debated heavily on the Left, with

examples being in Tribune Magazine's articles "Against MMT" and "For MMT". [47] [48] [49]

Regardless of whether this money creation is physically or politically feasible, having community banks being able to give CEGs loans could allow for the issue of initial capital required by CEGs to be tackled. There is political support by the governing Welsh Labour Party, and opposition parties Plaid Cymru and the Welsh Conservatives.

Tying Community Energy and Education institutionally

In Unruh's theory of the *techno-institutional complex*, the link between education and industry is discussed as being strongly locked-in with educational institutions training a workforce in the *dominant design* and as the curriculums are slow to change over time the professors are eventually ones that were initially trained in the *dominant design*. In Wales, this link can be seen in both research (primarily higher education) and more vocational training (primarily further education), though many engineering degrees in universities can be considered as a mix of the two, as a lot of theoretical and research based education is involved but the skills acquired are primarily aimed at preparing students for the workforce. Universities (higher education) have industrial links within the fossil fuel industry for students to gain experience during the degree, while colleges (further education) often integrate the education with apprenticeships and traineeships, where the student will continue their employment with the company following graduation. University research is moderately split between research focused on the *dominant design* and community energy and decentralised technology.

A key barrier for CEGs mentioned by both Neil Lewis and the findings in the IWA report was the lack of skills. CEGs are often set up by those in the community who have normally not had previous experience with community energy or project management, meaning relying on external experts, many of whom are provided by Renew Wales. A focus on knowledge sharing has been useful with Renew Wales's

peer-to-peer scheme but peer mentors are limited in numbers, not having been trained for the field specifically, just gaining knowledge from previous projects. One subject that devolution does offer Wales the ability to escape *lock-in* is education, where policy can help break the TIC.

Training the next generation of community energy experts

Training schemes such as those designed in Coleg Menai for the Wylfa-B nuclear power station can be made for training as community energy experts. Programmes would be tailored to the needs facing CEGs allowing them to have apprenticeships and traineeships under a reformed CEW as peer mentors, assisting groups with projects, and being guaranteed a job afterwards. As previously stated, the governing Labour Party's position in the energy sector has primarily been a focus on jobs, therefore adopting a policy that creates jobs while dismantling the current TIC and building a new one would be politically feasible. By using the Welsh Government's Skills Academy Wales and funding a new Community Energy Training Centre (CETC), a new workforce can be trained in engineering, project management and energy policy while working closely with NRW and local authorities. Currently training has been offered in the form of workshops by the Centre of Sustainable Energy (CSE) based in Bristol, England, near the Welsh border. This programme gives CEGs a collection of courses covering funding opportunities, tendering processes, shares and bonds, governance structures, landscape knowledge, community involvement, recruitment, energy assessment, and more. Following the CSE courses as a template would allow for a fully-fledged programme, though under devolution Wales can only set the syllabi for primary and secondary education (ages 3 - 11, and 11 - 17), as institutes of further education construct courses more independently. What would be required here is incentives, to bring in teachers, students and colleges, which is where Welsh Ministers do have powers under section 14-17 of the Education Act 2002, an Act passed through the Houses of Parliament which gave the National Assembly of Wales new powers of grant making within education. [50] [51]

Currently, Wales issues grants to those undertaking postgraduate degrees in Welsh universities in Initial Teacher Education (ITE) courses with the amount differing depending on the qualification classification and subject, with degrees aimed at secondary education in key subjects, such as mathematics, physics, chemistry, Welsh and computer science, receiving higher grants of £22,000. Here, the Welsh Government can incentivise those leaving university to look at a career in teaching and influence which subjects need more support, though these schemes are to get people into teaching within primary and secondary education, not further education. In Wales, all state schools can only hire those with Qualified Teacher Status (QTS), with those rules being relaxed in England, whereas institutes of further education can choose what level of teaching qualification their lecturers have, including none at all.

A further education institute in Wales can set up a community energy management course using experts in community energy, such as those who have been teaching courses with CSE and peer mentors under Renew Wales who have the skills but not QTS, while offering grants to those who have completed their secondary education to take these courses. While the grant system for teaching is focused on students going on to study teaching in higher education, nothing in the Education Act 2002 limits the Welsh Government's ability to provide incentives to allow people to study any course in further education, with grants up to £1500 already available to those on lower incomes to continue their education. The setting up of a CETC is possible within the powers granted under devolution, with the ability to fund a centre, employ lecturers and incentivise students to join the course. Linking the education to traineeships and apprenticeships with the reformed CEW connects community energy, education and politics building a new *techno-institutional complex* to break away from the current one.

Nurturing the niche through research

Research into the future of the Welsh energy system is already underway under the Low Carbon Research Institute (LCRI), encompassing six universities, aimed at

finding solutions to meet the energy and climate goals set by the Welsh Government. LCRI was set up in 2008 with funding sourced from the Higher Education Funding Council of Wales (HEFCW), going on to collect funding from a range of research councils. HEFCW is a Welsh Government sponsored body, and while it was set up before devolution, subsequent acts (Government of Wales Act 1998 and Wales Act 2017) make it a full non-departmental public body. [52]

Welsh ministers have the power to set the direction of sponsored bodies and therefore can direct how funding is allocated. What can be set up under the LCRI is a department specifically looking at technology relating to community energy emphasising small scale hydro, local biofuel and bio waste technologies, community-owned storage, efficiency measures, and regional weather prediction technologies as these are not well covered in academia, especially within the context of community energy. Offering funding to the universities under LCRI to explore these fields could lead to new research, helping nurture the *niche-innovation level*.

Reforming Community Energy Wales, for a second time

Following the complaints laid out in Chapter 2 regarding delays, planning permission, feasibility studies, lack of experts and shared knowledge, one suggested idea by Neil Lewis was that when setting up a CEG everything needed to be done in parallel where possible and streamlined. He complained that early on there was a lot of ambition to get community energy all across Wales but their "ducks just weren't in line", implying that the full potential was missed due to poor planning and mismanagement. Rather than starting from scratch, he suggests building upon Community Energy Wales to develop a system that prevents delays.

What could be possible is that the application procedure is processed through CEW which would be in close contact with NRW and local authorities, giving them deadlines to respond to requests to go through with planning permission applications and to look over feasibility studies. Holding these two other actors

accountable rather than putting the pressure on CEGs would encourage the actors to work together, rather than the CEG volunteers having to be the ones to chase up on emails and regularly be calling their local councils.

The conservative nature of local councils in regard to climate change as reported by the IWA report, can be counteracted when having peer mentors working so closely with them, taking the strain off them having to learn all of the inner workings of CEGs and educating them on the benefits that can be provided locally through Community Wealth Trusts. The education plans outlined above will provide the workforce required to work for CEW to support CEGs and local authorities, using the money saved from the M4 relief U-turn to fund the reforms.

Giving citizens a real say in their communities

A citizens' assembly (CA) is a form of sortation, where citizens of a state are selected at random and take part in the larger debates that are shaping the country with the aim of taking a diverse range of thought from differing backgrounds, to suggest policy that should be voted for within the state's legislative process. Ireland has had its CA (*An Tionól Saoránach*) since 2016 to tackle a range of issues from abortion and referendums to climate change, with all climate change measures being passed by the CA setting a mandate for political parties to take action. This is not a form of direct democracy, nor is it a *competency group*, but it is a way of taking a sample of public opinion to inform Irish TDs and senators. [53]

A CA for Wales has been discussed before in the form of a Citizens' Chamber, brought before the Senedd by Welsh Conservative AM David Melding as a means of increasing the political participation of citizens while also pointing out that politics had been slow to adapt to the speed of technological change. He went further to suggest that this participation could be spread to lower levels of government, including citizens in the decision discussions in towns and community councils. This was backed by another Welsh Conservative AM Suzy Davies, while UKIP AM Gareth Bennet dismissed the plans stating that it was an AM's elected

job to represent the people, though in his 2019 UKIP Leadership Manifesto, under the policy "abolishing politicians", he calls for a referendum on the future of the Welsh Assembly. Leader of the House of the National Assembly for Wales and Welsh Labour Party AM Julie James considered the plan as "exciting" but had concerns that this chamber would become in effect a second chamber of the Welsh Assembly and could become self-selecting, especially if there was a desire to include expert opinion. [54] [55]

The inclusion of expert advice was the same warning that Whatmore discussed in her paper "Mapping knowledge controversies: science, democracy and the redistribution of expertise", advising that all knowledge needs to be categorised to be properly understood as all knowledge is subject to power-relations and that experts can be an authority on knowledge, even when wrong, and that citizens are also misinformed. The inclusion of experts is important so that members of the chamber can make informed decisions but this would need to be kept in check with an independent regulator. When issues regarding the climate would be discussed in such a chamber the inclusion of CEGs and experts could be put together, independently regulated, so that knowledge is fair and unbiased, in order to form a *competency group*. As David Melding points out, technology is developing rapidly, faster than the speed at which politics adapts to it. *Competency groups* within a Citizens' Chamber for Wales could allow these technologies to be discussed, and allow for policy to be set that would help these technologies be diffused, rather than being locked-out by *network economies*.

Meeting the key indicators

Table X shows how each key indicator can be met through the use of policy. What can be deduced here is that Wales does have powers under devolution to fill the gaps that are preventing a transition from a centralised, large scale power generating system, to one that is more inclusive of community energy. When it comes to meeting these indicators it comes down to political will, rather than limited powers. The policies have been designed with the assumption that the Welsh Labour Party

and Plaid Cymru are the two parties who are both locked-in to the Welsh political system and would be supportive, with a big focus on job creation, which is a key Labour issue. When possible the voices of the Welsh Conservative Party have been mentioned as, though they score poorly in comparison to the UK as a whole, they still make up a significant proportion of the Assembly and where collaboration is possible, moving through policy for community energy would be even easier.

No.	**Key Indicator**	**Policies**
1	Nurturing the *niche-innovation level*	Funding research under LCRI
2	Allowing innovation to change the *regime level*	Citizens' assembly, *competency groups*
3	Supporting the growth in power of CEGs	Reformed Community Energy Wales, Community Banking, Community Energy Training Centre
4	Unifying the voice of CEGs	Reformed Community Energy Wales
5	Building *competency groups* with the inclusion of CEGs	Citizens' Assembly, *competency groups*
6	Educating the public on community energy	Community Energy Training Centre, Citizens' Assembly, *competency groups*
7	Declaring the current TIC as inadequate	Build upon Declaration of Climate Emergency
9	Changing policy to better suit community energy	Local Regeneration, Community Wealth Trusts, Funding research under LCRI, Reformed Community Energy Wales, Community Banking,

		Community Energy Training Centre, Citizens' Assembly, competency groups

Figure 7 – Key indicator gaps filled with policy

Along with the key indicators, these policies set out to explore how further funding could go towards CEGs and towards the policies supporting them, while tackling the issues involved with delays in seeking planning permission and completing feasibility studies. Though how CEGs will make a profit in the future is something that Wales will struggle to decide for itself.

The remaining limitations of devolution

A major limitation currently facing community energy projects across the whole of the UK is the cancellation of Feed-in Tariffs, a scheme originally set up by the central government as setting up a Welsh only FiT scheme is not possible due to powers regarding grid regulation not being devolved, an activity monitored by OFGEM. On June 10th 2019, the UK Government finally released its proposals for the Smart Export Guarantee (SEG) in which all energy suppliers are bound by law to offer an export guarantee, meaning that small energy generation schemes (under 5MW) can sell their excess power to the grid. However, in the new scheme the price per unit is set by the supplier, unlike previously how government would set the price each year, and there is no floor price. As long as it is above zero then it is within the law. The idea is that the energy suppliers will compete to offer the best available prices to those wishing to export energy and that as the costs of solar panels and other technologies have fallen, the incentives do not need to be as high and set by the government.

It remains to be seen what effects this new policy will have on the long-term future of CEGs, however the recent past and short-term future have issues. It has already been discussed previously that the sudden cancellation of the scheme brought about a huge reduction in new solar panel installations leading to a Welsh Government

response advising the UK Government to make sure that projects (some of which were CEGs) were not put on hold from gaining access to the market. In the short term there will likely be a period of price fluctuations before something adequate for CEGs will be reached, if reached at all. With CEGs not knowing what price they will be selling at in the future it is harder to build a business case, which may scare off investors. As CEGs already have issues regarding initial capital, this could exacerbate the problem. The Welsh Government held a position that was looking out for CEGs but was powerless to make these decisions under the current form of devolution. Questions arise about whether further powers under energy should be devolved to Wales, with Llŷr Gruffydd AM recommending in his interview that further powers such as having a devolved portion of OFGEM and powers to municipalise would be other routes to lead to diverse forms of energy ownership. [56]

Conclusion

The Welsh energy *regime* is diverse; encompassing actors that at first glance would seem out of place in a conversation regarding a transition to a system highly inclusive of community energy groups. Whereas it would often seem normal to simply list the big players in the sector, devolution offers a unique lens towards stakeholder analysis and allows a transition manager to examine a wider range of interconnections. Ambient music artist Brian Eno has always pointed to limitations being the real source of creativity, where without the freedoms of boundless opportunity an artist must get smart and explore new avenues, discovering something new in the process. As Wales celebrates 20 years of increased "freedom" in the form of devolved powers it is still held to the limitations set by the UK Government. As energy is not a devolved subject, a wider approach needs to be taken to see where the Welsh *regime* is currently affecting community energy groups, and what it has in its powers to make further change. This new approach to analysing the energy sector is not one that is solely confined to devolution, however one that was discovered through it. The principles of analysing how a transition occurs, the state of the *techno-institutional complex* and policies that can be enacted can be made universal and expanded throughout the UK and further into Europe.

In order to explore how this transition can be planned, the paper first set out to answer the question "what is a transition?", first using the principles set out by Geels' multi-level perspective. What was discovered here is that a wide range of actors needs to be examined when looking at how change, either through niche-innovation (transition) or system efficiency (transformation), is taking place and can take place in the future. From this theory, the ideas of *niche-regime feedback* were explored; the first indication that the *regime* needs to nurture the *niche-innovation level* in favour of community energy, and then absorb these innovations to disrupt itself.

Unruh's *techno-institutional complex* set out the limitations to creating a feedback loop that would benefit community energy, highlighting how interconnected the

incumbent actors are. Using the theory of *network economies* it can be understood that technologies and *management practices* that would be beneficial to community energy would be "locked out" of the market meaning intervention of some kind would be required.

The work from political ecology pointed out that in a situation of scarcity, conflict arises. A market has scarcity, in this case in the form of a limited value of kilowatts need to be generated each year to fulfil the demand of the Welsh population. While energy can be sold across the border into England there is a limit here too on consumers. It can be argued that as markets grow new players can enter but with the trend of energy efficiency the value of kilowatts needed decreases. This why the paper states that in order to include more community energy the incumbent actors need to "scale back" and make room. In order to force this scale back, there would have to be more democratic inclusion, through the use of *competency groups*, leading to the idea of the *niche-regime-CEG feedback*. This initial theoretical approach led to the 8 key indicators that needed to be evaluated.

This more abstract work then needed to be put into a Welsh context in Chapter 2 to see how well the ideas would work in the real world, and then to evaluate the way in which Wales is affecting this transition. The general conclusion is that the theory fitted well into a Welsh context giving examples of the *niche-regime feedback,* the *dominant design* and the interconnections between politics, education and industry.

When it comes to the policy that would benefit community energy going through the Senedd in Cardiff, historical research suggested that it will likely happen through the Welsh Labour Party and Plaid Cymru. They are not the only parties in favour of policies benefitting community energy but both are strongly locked-in to the political scene, with the Welsh Conservatives kept at bay in Wales when compared to the UK as a whole, though this is perhaps not at all certain following the rise of the far-right parties UKIP and the Brexit Party.

Through interviews and paper research the main steps of setting up a community energy project were outlined which further laid out what gaps need addressing with the key findings being lack of funding, lack of skills and application delays.

The 8 keys indicators were evaluated to see gaps needed to be addressed in the transition, highlighting weaknesses in technological research at the *niche-innovation level* whereas research more focused on policy and *management practices* is somewhat supporting community energy. There was no policy towards *competency group*s however there was progress towards unifying the voices of CEGs and supporting their growth.

In order to determine whether the current shape of devolution was limiting community energy groups, Chapter 3 set out to show what policies can be enacted to further benefit the transition with a focus on powers in education and setting up public bodies to give support to CEGs and local economies. The policies set out to fill all the gaps in the 8 key indicators, tackle the barriers the CEGs have been facing, make them appealing to both Welsh Labour and Plaid Cymru, and provide a funding mechanism through Community Banking. The results from this work show that the powers granted to Wales give the country the possibility to counteract the policies set by the central government and that it is political will, not devolution, that is prohibiting community energy. However, the results of the new Smart Export Guarantee need to be evaluated in the future to determine whether new powers need to be granted to Wales to control grid regulations.

This paper does come with limitations of its own. At the start of research (November 2018), articles looking into the state of play of CEGs within Wales existed, but few were framed through devolution, and when it was mentioned only a brief comment. Most of the much-needed research for the thesis came out in the later months between April and June 2019, which, when matched with the rapidly changing politics in the UK at the current time and the pressure to keep the paper relevant and update-to-date, means that the current situation was hard to evaluate due to time constraints. Response to change and new information within academia

was narrow. The UK Government's sudden cancellation of FiT during the writing and the sudden announcement of its replacement two days before submission are examples of this.

When answering the question "to what extent does Welsh devolution aid the transition to community energy" the verdict would be that devolution has given Wales politicians that are more in favour of policies that would benefit CEGs along with their transition when compared to the ideological makeup in the Houses of Commons. This, combined with an array of devolved powers, has led to the set-up of bodies such as Community Energy Wales, which is the first step to having a strong representation of CEGs in the decision making the process. Topics regarding community energy have been more readily discussed in Welsh political party manifestos and within the Senedd when compared to party politics in Westminster.

Though Wales has only scratched the surface on building a system that would give CEGs the power to compete within a system that is loyal to the *dominant design*, the majority of the powers are there to create a system that puts Welsh energy in the hand of the Welsh people. There is an indication that the political will to enact these decisions is rising but it remains to be seen with the outcome of Brexit, the contest for the next Prime Minister, and the upcoming Assembly elections in 2021 being key factors in the future of the UK and Wales, with the economic and political fallout possibly affecting community energy in turn.

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Annex 1

Political Party	Political Ideology	Devolution	Energy Policies	Community Energy
Welsh Labour *Llafur Cymru* **S&D** [1][2]	• Centre-left/Left-wing • Social Democracy • Democratic Socialism • Lean Pro-European Union	• Pro-devolution • Further powers • British Unionism	• Tidal lagoons • Smart meters • Welsh Mutual Energy Body • Tackle energy poverty • Investment in ”Wind, Water, and Waves” • Continued nuclear with Expert Committee • Wylfa: Impact assessment required	• Promote community-owned energy • Set up Ynni’r Fro under coalition
Plaid Cymru *Party of Wales* **EFA** [3]	• Centre-left/Left-wing • Welsh Nationalism • Social Democracy • Democratic Socialism • Pro-European Union • Republicanism*	• Full Independence • Further powers • Pro-devolution	• Tidal lagoons • Energy Efficiency • Full devolution of energy and natural resources • National Infrastructure Commission: includes energy • Energy Atlas for Wales • Ynni Cymru: national energy company • Large scale generating and storage capacity • Against continued nuclear	• Small-scale renewable energy schemes • Planning legislation: fast-track route for community-owned energy schemes • Network of municipally owned regional or local energy companies • Set up Ynni’r Fro under coalition
Welsh Conservatives *Ceidwadwyr Cymreig* **ECR** [4][5][6]	• Centre-right • Conservatism • Economic Liberalism	• British Unionism • Pro-devolution (majority) • Abolish Assembly (minority)	• Competitive and affordable energy costs • Industrial energy efficiency scheme • “Diverse” energy mix • Pro-shale gas • Tidal lagoon “development and supply chain technologies” • Continued nuclear	• Criticised Ynni’r Fro • Welsh Localism and Citizenship Bill

Welsh Liberal Democrats *Democratiaid Rhyddfrydol Cymru* **ALDE** [7][8]	• Centre/Centre-left • Social Liberalism • Classical Liberalism • Pro-European Union	• Pro-devolution • Further powers • British Unionism	• Devolve powers over energy • Encourage private funding in renewables • Tidal lagoon • Carbon capture and storage • Continued nuclear • Energy storage, smart grid technology, hydrogen technologies, off-shore wind	• Expand community energy schemes • Presumption in favour of development, given priority access to the grid and enabled to sell energy within their own locality
Wales Green Party** *Plaid Werdd Cymru* **Greens** [9]	• Left-wing • Green Politics • Eco-socialism • Progressivism • Pro-European Union • Republicanism*	• Further powers • Increase AMs to 80 • "Devolve" to local councils • British Unionism***	• Cut energy use • Anti-fracking • Anti-nuclear • Tackle fuel poverty • Investment in renewables • Passivhäuser • Tidal lagoons	• Small scale renewable generation projects • Require all councils in Wales to implement community energy strategies • Support housing associations', local authorities' and other public bodies to set up energy supply companies • Give communities a say on big decisions on planning and energy infrastructure
Brexit Party/UKIP**** *Plaid Brecsit/Plaid Annibyniaeth y DU* **EFDD/ENF** [10]	• Right-wing/Far-right • Anti-European Union • Right-wing Populism • Economic Liberalism	• Abolish assembly • British Unionism • British/English Nationalism • "Devolve" to local councils	• Oppose "unsightly" wind turbines • Axe Welsh budget for climate change projects	• Nothing

* Anti-monarchy
** Semi-autonomous within the Green Party of England and Wales
*** 65% of voting members voted in referendum to keep Green Party of England and Wales combined in 2018
**** Members splintering as of May 2019. Policy taken from UKIP manifestos.

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Annex 2

Facility/Programme	**Research, Education**	**Links**
Cardiff University [1][2][3]	• Electrical and Electronic Engineering • Energy and Sustainability • Gas Turbine Research Centre (LCRI) • Small Scale Electronics • Community Energy	BP National Grid Exxon Mobil RWE (npower) Tata Steel
Swansea University [4]	• Electrical and Electronic Engineering	Tata Steel
University Of South Wales [5]	• Electronic Engineering • Renewable and Sustainable Energy	RWE npower (buying RUMM, spin-off)
Low Carbon Research Institute [6]	• Hydrogen Technologies • Large Scale Power Generation (LSPG) • Low Carbon Built Environment (LCBE) • Marine Energy • Scenario Modelling • Smart Operation for a Low Carbon Energy Region (SOLCER) • Solar PV (SPARC) • Welsh Energy Sector Training (WEST)	Cardiff University Swansea University Aberystwyth University Bangor University Glyndwr University University of South Wales
Glyndŵr University [7]	• Electrical and Electronic Engineering	Wylfa-B Nuclear (support)
Aberthaw Centre for Energy and Environment (ACE2) [8]	• Coal • Energy Efficiency	RWE (npower) Aberthaw Power Station National Curriculum, schools, colleges and community groups

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