



Pathways for meeting Wales' energy needs into the future

Context

WCPP have been commissioned by the Welsh Government to provide evidence to support the work of the Wales Net Zero 2035 Challenge Group.

The Welsh Government and Plaid Cymru Cooperation Agreement committed to 'commission independent advice to examine potential pathways to net zero by 2035'. In response to this the Wales Net Zero 2035 Challenge Group has been formed, chaired by former minister Jane Davidson. The Group's work is scheduled to run until summer 2024 when it will present its final report. The group will look at the impact on society and the economy, considering the distribution of the costs and benefits and how any adverse effects could be mitigated. The Group is organising its work through a series of five challenge areas. More information on the work of the Wales Net Zero 2035 Challenge Group can be found at: <https://netzero2035.wales>.

This thinkpiece, written in a personal capacity by Andy Regan, has been commissioned by WCPP and is intended to support the Group's work on its second challenge area, 'How could Wales meet energy needs by 2035 while phasing out fossil fuels?'

Introduction

The Welsh Government has published its second carbon budget, setting a direction of travel towards net-zero emissions by 2050 alongside a suite of policy proposals and pathways for emissions reduction (Welsh Government 2021a). However, it is clear that

reaching the net-zero target by 2050 will require ambitious and far-reaching reforms across multiple sectors, especially if that target is moved forward to 2035 (Welsh Government, 2021b). While there is considerable scope for further action and direction-setting, some fundamental choices will have to be made in the coming years about what actions to take and what sort of society and economy Wales should aim to build for the future. As part of this, the Wales Centre for Public Policy is examining pathways for meeting Wales' future energy needs. This piece aims to contribute to the discussion by setting the scene and exploring possible pathways for decarbonisation. However, can we discuss pathways without first considering destinations? What future should we aim for and anticipate? Should we talk about Wales 'meeting its needs', or is it more fruitful to consider 'the role Wales can play' in the global decarbonisation mission? I summarise a number of different future visions and options below.

Some visions of Wales' energy future are rooted more in politics than in evidence-based assessments. This does not make them less desirable or less achievable; however, if we are to save the planet, we must start with the reality of where Wales is today. This work is meant to complement the [Welsh Future Energy Grid For Net Zero](#) work commissioned by the Welsh Government from the Energy Systems Catapult, which takes a technical approach to mapping pathways.

Wales' energy system in 2023

To understand any journey, one must first comprehend the starting point. What choices are available to us based on where we are now, rather than where we might wish to be?

Renewable energy generation trends

Headline figures for Wales are generally positive, with the Welsh Government's analysis stating that the 'equivalent percentage of Welsh electricity consumption met by renewable electricity generation stayed relatively stable despite a slight reduction from 56% in 2020 to 55% in 2021,' suggesting that the target of 70% by 2030 is within reach if measures are put in place to sustain growth in capacity (Welsh Government, 2022a).

Total installed capacity in Wales has risen by 79% since 2009 to 2022, comparing favourably with a 73% increase in Scotland and a 91% increase in England (DESNZ, 2023a)¹. However, the rate of this growth tells a less encouraging story. In line with other UK nations, the rate of growth has slowed considerably since peaking in 2014 with a 36% increase on the previous year, to 5.8% in 2018, 5.0% in 2019, 1.5% in 2020, 2.7% in 2021, and 1.1% in 2022.

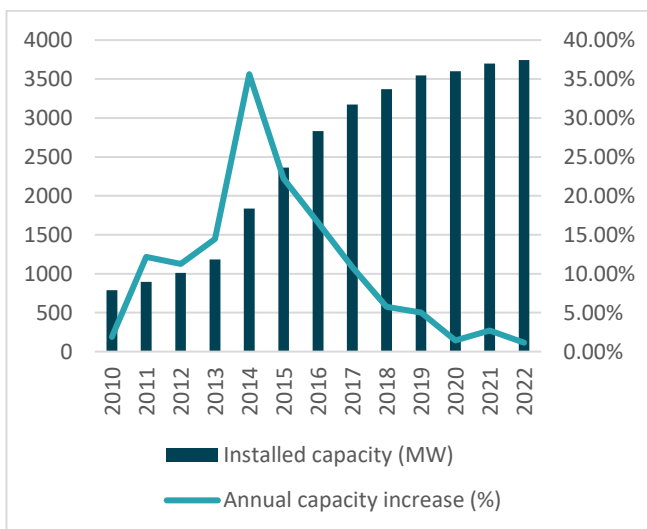


Figure 1: Cumulative installed capacity and annual increase for renewable energy in Wales, 2010-22

By comparison, growth in England peaked at 27% in 2013, dropping to 2.6% in 2020. In

¹All figures draw on DESNZ (2023a) - percentage increase calculations are author's own.

Scotland, the peak was 16% in 2012, falling to 0.6 % in 2020. Unlike Wales, both Scotland and England saw growth rates increase in 2022, returning to levels similar, or higher, to those before the pandemic.

What is driving the change in the system?

Determining the respective contributions of devolved and reserved policy to these trends is challenging. However, passages from the Welsh Government's Net Zero Wales (2021a) seem to indicate where they believe the balance lies.

'Energy policy is largely not devolved and Wales is part of Great Britain's interconnected power system. Since 1990, the UK Government has made a number of infrastructure planning decisions, which have resulted in significant additional fossil fuel generation being located in Wales. Additionally, renewable electricity deployment has slowed considerably in recent years since the UK Government reduced the level of financial support projects can access.' (Welsh Government, 2021a: 58)

It appears reasonable to attribute the slowdown in new renewable installations across the three GB nations largely to the reduction in subsidies from the UK Government. These subsidies have succeeded in their aim of lowering the overall cost of renewables. Offshore wind, in particular, achieved a much lower price earlier than the UK Government targets mandated. The failure of the September 2023 round of Contracts for Difference auctions raises concerns, yet it highlights the influence the UK Government still holds in setting the right strike price. From a climate perspective, the slowdown in new

installations is troubling. Low-cost renewables also benefit the entire system by reducing the need for expensive gas generation, which subsequently sets a higher price for all other forms of generation. The Ukraine gas crisis pushed the energy price cap to unprecedented levels, making the savings on energy bills from cutting subsidies look increasingly like a false economy.

Commercial factors have also driven change that cannot be attributed directly to Welsh Government action. The *Energy Generation in Wales 2020* report states:

'The reduction in fossil fuel generation reflects the continued focus on decarbonisation in Wales. With Wales achieving 'coal free' status five years ahead of the UK Government's commitment to close coal fired generation by 2025.'
(Welsh Government, 2022a: 33)

However, the closure of the Aberthaw coal-fired power station in South Wales was largely a commercial decision made by its owner, RWE, with their CEO citing 'market conditions' as the reason (BBC News, 2019). These 'market conditions' emerged from the UK Government's introduction of the [Carbon Price Floor](#) (Hirst, 2018), which weakened the investment case for coal. It would thus be inaccurate to say that a coal-free status was achieved due to decisions made in Wales. A stocktake of where Welsh Government's relatively limited powers are most likely to be successful in achieving the as yet undetermined goals is a useful exercise to determine future actions.

What powers does Welsh Government have over energy?

Subsidies

Given the high level of ambition for renewable energy in Wales, a casual observer could be forgiven for not knowing that this policy area

remains largely reserved to the UK Government. The UK Government, through Ofgem, is responsible for regulating the GB oil and gas industry, as well as the electricity industry, which includes generation, transmission, distribution, and supply. It is also largely responsible for the design and implementation of current subsidies through the Low Carbon Contract Company (LCCC), which administers Contracts for Difference, and legacy schemes like the Feed-In Tariff, Renewables Obligation, and Renewable Heat Incentive. These legacy schemes are closed to new applications but will continue to deliver subsidies to commercial and domestic asset owners for some years to come. Direct energy policy levers for Wales are limited to licensing and consenting for onshore oil and gas projects, onshore wind projects, and generation projects up to a 350MW capacity.

In terms of indirect levers, Wales arguably has significantly more opportunities to influence its energy system through demand-side measures such as its powers on housing (particularly on heat electrification, energy efficiency, and building standards), transport, general infrastructure, business support, and finance.

The grid

Underpinning all these ambitions is the frequently cited issue of electricity grid capacity and constraint in Wales, along with the obstacles to upgrading it. Wales' grid was primarily designed to transport energy generated by Welsh coal, gas, and nuclear power stations into England. This design generally worked well in a centralised system with large generation assets under operators' direct control. However, renewables-based systems are more variable due to fluctuations in wind and solar availability, necessitating greater flexibility – either in moving electricity around the entire system or storing it.

The way the Welsh grid has been structured limits the role Wales can play in adding flexibility. Wales still hosts a number of large power stations that will need to export power via the grid for the foreseeable future. Therefore,

any new generation necessitates an increase in the grid's capacity (the maximum capacity of the grid), and headroom (the difference between the capacity and the normal day-to-day use), all within the thermal and electrical constraints of the physical system.

These upgrades must be funded within the heavily regulated system overseen by Ofgem on behalf of the UK Government. Long-anticipated changes in Wales' generation system, specifically the closure of the Aberthaw power station, meant that significant investment in increasing grid capacity could not be justified by the regulator. Why invest in grid upgrades in the late 2010s when anticipated closures suggested increased capacity was imminent? Individual projects could fund the necessary upgrades for connection, but these costs were often disproportionate to the anticipated incomes of smaller schemes. This arguably places them at a disadvantage compared to larger developers.

A separate yet related issue is grid constraint, which Wales experiences under certain conditions. While grid capacity can be likened to the total number of cars that can fit on a motorway, grid constraint is comparable to the number of cars that can use a specific turnoff at any given moment. Grid constraints are contextual rather than absolute and depend on broader system conditions.

How might this change?

As of October 2023, the need to upgrade the energy grid infrastructure is high on the political agenda, especially for the anticipated UK general election in 2024.² The focus is on reducing energy bills, stimulating economic growth, and advancing decarbonisation. However, the Welsh Government could reasonably contend that it has been pressing this issue for a considerable period. So, what have the proposed solutions been in Wales?

Climate Change Minister Julie James MS has spoken of her desire to 'devolve the grid', both in

plenary sessions (James, 2022), and in the Net Zero Wales Plan:

'The other significant barrier is the need for strategic grid investment. We are working with the network operators to clarify the scale of the investment required but these costs should not all fall on bill payers. Given the pace of change needed and the time taken to consent and build grid infrastructure, investment ahead of need is absolutely vital.' (Welsh Government, 2021a: 60)

What devolving the grid might entail requires some explanation, given that there is no standalone 'Welsh grid' and considering that the cost of any investment in the grid is ultimately borne by British consumers. Separating the power to invest in the grid from the power to regulate could create an accountability gap. The worst-case scenario would be the Welsh Government gaining the authority to make decisions about infrastructure in Wales, then significantly increasing investment without being accountable to the wider GB electorate, who would collectively foot the bill. Under the current arrangements, while energy network companies handle the expenditure, all such spending is ultimately recouped from customer bills. These costs are averaged out across Great Britain, and some are confined to specific distribution regions. Wales has two such regions, both of which also extend into England. Therefore, some of those bills would be paid by people outside Wales, complicating the political and electoral accountability for those decisions.

Balancing this risk is not impossible, but achieving it would require great care. There has been little prospect of such a change emanating from Westminster in recent years, although the

² This paper was finalised prior to the publication of the UK government's *Connections Action Plan* and *Getting Great Britain building again* (Department for

Energy Security and Net Zero and Ofgem, 2023; Department for Levelling Up, Housing and Communities, 2023).

anticipated UK general election in 2024 could alter the dynamics.

Assuming such a change is politically likely, how might it function? Upgrading the grid often presents a chicken-and-egg problem: improved grid capacity might encourage more projects, but more projects with proper finance, planning approval, and solid business plans could alleviate regulatory concerns about anticipatory investment. The worst approach would be to invest in large-scale poultry sheds without having either chickens or eggs.

In recent years, the UK Government's preferred solution has been a developer-led approach – where generation and demand projects like new housing developments and factories apply for grid connections or upgrades, essentially joining a queue. The Welsh Government has criticised this strategy for some time. Chris Skidmore MP joined this critique in his UK government-commissioned Independent Review of Net Zero, concluding that the ambitions of UK businesses were "...being hampered by slow, ponderous bureaucracy and an antiquated approach to grid connections not suitable for a modern 21st-century electrified economy," (Skidmore, 2022: 10) and that "the scale of this challenge, and the breadth, is too much to be left to the whims of individual projects." (Skidmore, 2022: 10)

Minister Julie James MS may have felt vindicated reading these comments.

A new consensus appears to be emerging around a more planned, longer-term, and locally-led approach to grid upgrades. Policies in development by Ofgem and the UK Department for Energy Security and Net Zero indicate movement in this direction, even without speculating about the next UK general election. These initiatives could create the opportunities Welsh Government has been advocating for, although the details will be crucial.

Interested parties in Wales should focus on developments in the following areas:

- Ofgem's Review on the Future of Local Energy Institutions and Governance – This review aims to ensure that "key

energy system functions are performed by institutions with the competence, appropriate skill set and incentives to drive net zero at least cost" and that there is "clear accountability and coordination" at both national and local levels.

- The Department for Energy Security and Net Zero and Ofgem's joint consultation on a Future System Operator (FSO) – The FSO is envisaged as a new impartial body that will take on key roles in both electricity and gas, adopting a 'whole energy system approach' when operating, planning, and developing the network.
- Ofgem's consultation on Frameworks for future systems and network regulation - This consultation reviews the next round of energy network price controls, covering the crucial period from 2026 (for gas and electricity transmission networks, and gas distribution networks) to 2028 (for electricity distribution networks), extending to the UK Government's current 2035 deadline for a net-zero clean power system. This will affect how networks in Wales are compensated, what infrastructure they can build, and how they make decisions.

It is this author's view that the outcomes of the aforementioned reviews will have a greater impact on Wales' energy future than any debates about where decisions are made. Many potential opportunities may be unlocked by these outcomes, and Wales should actively participate to make its voice heard in the development of these frameworks. To devolve this policy, create new institutions, and implement it would likely consume much of the time remaining to meet Net Zero Wales targets. During this period, the level of uncertainty and potential for divergence with England and Scotland could discourage developers from investing in Wales. The opportunity cost is too high, and the additional benefits are too low.

The Just Transition: Not just what, but how

There has long been a consensus in Wales that achieving a certain level of installed renewable energy is not sufficient on its own; the method of achieving it also matters. Welsh Government Climate Change Ministers have stated that renewable generation must 'deliver social and economic benefits to Wales while protecting our natural environment' (Welsh Government, 2022: 1).

To this, I would venture to add my personal view that the correct approach to this question is first to identify the quickest pathway to the greatest emission reductions, and then determine how to make that transition as 'just' as possible. Given the urgency of the situation, no other approach is defensible. Emissions reductions are cumulative, so the ones that can be achieved in the next ten years will be worth many times more than those realised from 2030 onwards.

That being said, a just transition is clearly within our reach.

The WCPP has published [its own overview](#) (Price, Roberts & Bristow, 2021) of how to deliver a just transition. It recognises that the concept of 'justice' will differ among individuals and also depending on the specific decarbonisation pathways under consideration. For example, spatial versus sectoral approaches raise different questions about justice and equity. The WCPP has also released a report that focuses on the skills needed for a just transition (Silva et al., 2022).

The Institute of Welsh Affairs' Re-energising Wales project (to which I was a contributor) set out a practical plan for achieving 100% renewables by 2035. The project aimed to bring economic returns to Wales, either by investing in sectors where Wales has a comparative advantage – locally-based firms in the foundational economy that provide essential services and goods – or by fostering community benefits through partial ownership in sectors dominated by foreign firms.

The [follow-up report](#) (Lloyd & Reagan, 2021) to the original Re-energising Wales project highlighted Welsh-owned marine energy as a key success story for Wales-based firms since the project's initiation in 2017. However, marine energy accounts for just 0.6% of the total growth in installed capacity in Wales since 2009 to 2022, while solar and wind contribute around 42% and 50% respectively³. Given that these sectors are largely dominated by developers from outside Wales, and indeed the UK, it is clear that the aspiration for renewables to be driven by Welsh firms is still some way off.

This leads to the question of whether the economic opportunities for Wales from renewables should be seen as coming from buying and selling energy generated within Wales, and simply meeting our own needs. We will revisit this issue later.

Wales's integration into the GB energy market, and what this means

A recurring meme in discussions on energy policy in Wales is that "Wales is a net exporter of energy."

This wording, taken from the web page of the Welsh Affairs Select Committee's 2021 inquiry into Wales renewable energy opportunities, goes even further: 'Wales generates double the energy it consumes (30.2 TWh to 14.9 TWh). It is the fifth largest exporter of electricity in the world.' (Welsh Affairs Committee, 2021). The notion is prevalent across political manifestos and understandably appeals to many in the independence movement.

However, a more precise statement would be that 'more electricity is generated in Wales than is consumed in Wales.' The central issue is that Wales is a devolved nation within the UK, served by a complex, interconnected set of energy systems and networks that do not conform to its borders, unlike in Scotland. These networks operate in regulated wholesale and

³ Based on author's own analysis of UK Gov energy trends data, above.

retail energy markets covering all of Great Britain.

It is crucial to understand why the idea that Wales is an 'exporter' of energy is, at worst, incorrect and, at best, not a useful basis for long-term policy decisions aimed at achieving net zero.

Networks

Wales is served by two electricity distribution grids, both of which extend significantly into England. These grids are functionally single pieces of infrastructure, managed and owned by National Grid Energy Distribution in South Wales (formerly known as Western Power) and by Scottish Power Energy Networks in the North. These companies are known as Distribution Network Operators (DNOs). Additionally, Wales has a single gas distribution network operator: Wales and West Utilities (WWU).

The distribution networks operate at lower voltages and are more localised than the transmission network. The latter moves electricity at higher voltages across all of England and Wales and is owned, operated, and maintained by the National Grid Transmission Operator (NGTO).

Balancing supply and demand across these networks is currently the remit of the National Grid Electricity System Operator (commonly known as NGEN or 'the ESO'). This entity is separate from NGTO. As noted earlier, the ESO's task becomes increasingly complex in a decentralised and more variable electricity system with lower 'inertia'.

A key role of the ESO is to maintain the overall system frequency at around 50Hz. If this frequency varies too significantly – whether due to rapid changes in supply or demand – it can result in power outages or even damage. The concept of 'inertia' indicates that system conditions alter based on the physical properties of the generation assets.

When a traditional fossil fuel power station with large turbines fails, those turbines usually continue to spin, thus generating power for a short period after the failure. This provides the

ESO with potentially several minutes to react, either by restoring that station, activating another, or cutting some demand. In this context, it is literally inertia that slows down the system, although 'inertia' is also used figuratively to refer to the overall rate of change in the system.

With renewables, the transition from generating to not generating can occur much more quickly. For instance, in the case of a battery asset – which counts as generation when emitting power – the change can be almost instantaneous. Quick rebalancing must then occur to avoid broader system failures and power cuts.

In renewables-based systems, inertia is generally lower, making the job of balancing both more challenging and more expensive. In the future, more of this balancing will occur at the DNO level, transitioning these operators to Distribution System Operators (DSOs), a role yet to be fully defined. This transition presents real opportunities for local energy generation, as long as it can combine supply with flexibility, for example by being paired with storage, particularly in batteries. However, the *Energy Generation in Wales 2020* report (Welsh Government, 2022a) highlights that Wales currently has only three large-scale battery projects.

Given these factors, it is not meaningful to discuss 'export' within these systems. Electricity may flow either in or out of Wales, depending on the system conditions at any given time. While there are grid constraints that could limit the role of generators in the balancing system, these are due to the physical properties of the grid, not the Welsh border.

Markets

Any imbalance between supply and demand, which the ESO must correct, incurs costs. These are met by energy suppliers and generators and ultimately passed on to bill payers. Suppliers face financial charges, known as imbalance or 'cash out' payments, if they fail to match their customers' supply and demand.

This market-based settlement of the system does not, again, pay any regard to Welsh borders. Generators bid into capacity markets to make themselves available for balancing services as required by the ESO. This process occurs within a single market, or more accurately, a set of dynamically interacting markets, rather than involving imports from one market to another – unless, of course, we are discussing imports from outside Great Britain.⁴

In both examples cited here, the term 'export' is used informally, given that the energy system operates across the nations of Great Britain.

Ownership

We have established that the geography of Wales does not align with its energy system. Additionally, Wales neither owns nor controls the entities that are 'exporting' energy. The grid infrastructure in Wales is owned by private companies, and the cost of building this has been spread across all British consumers, not just the 1.4 million energy bill payers in Wales. Similarly, most companies investing in grid-level renewable energy generation in Wales are not Welsh-owned, although there are some notable exceptions. Yet again, the contribution from bill payers via subsidies has come from across Britain, not solely from Wales.

There are reasonable criticisms to be made about the ownership of energy infrastructure and businesses in Britain, and about how Wales' energy system has been primarily designed to meet England's needs. Some might argue that if more of these businesses had remained in public ownership, the situation today could potentially be quite different. However, transitioning private energy companies to public control in Wales would carry a significant opportunity cost, as well as a financial one, as it would require a large investment of time and political energy that could be better used for advancing decarbonisation.

To plan for the future, we should recognise that the notion of 'Wales' being an 'exporter' of

energy is misleading. When deciding on the needs of Wales' future energy system, it is prudent to be cautious about relying on solutions deeply rooted in views that may not actually pertain to energy at all.

Energy security

Russia's invasion of Ukraine and its subsequent impact on global energy markets have underscored how central energy is to geopolitics, elevating energy security to a high priority. The war in Ukraine is not the only factor driving high prices; it has compounded several cold winters that depleted Britain's gas reserves. Additionally, there have been sales of some of the country's gas storage capacity (some of which was subsequently repurchased and reopened), periods of low wind generation, and planned as well as unplanned outages of nuclear power stations both in the UK and the EU. All of these factors have pushed up the wholesale price of gas, affecting pricing across the entire market as we entered the winter of 2022-23. The UK is particularly vulnerable to gas price fluctuations, given that a high proportion (85%) of homes are heated by gas (82% in Wales) (DESNZ, 2023b).

In response, Ofgem is now adjusting the energy price cap every three months for the foreseeable future. Although costs have fallen since their peak in the winter of 2022-23, energy prices remain high compared to historic levels, significantly impacting household incomes. The UK Government's [British Energy Security Strategy](#) advocates for increasing the sourcing of fossil fuels from the North Sea, greater investment in renewable generation, and underpinning these by 'investing massively' in nuclear power. The strategy also emphasises investment in hydrogen to ensure the UK is not dependent on imports in future (UK Government, 2022).

There is a growing push towards self-reliance in energy generation across the EU. Renewables are currently the cheapest sources of energy in

⁴ Northern Ireland is part of Ireland's single energy market which also serves the Republic of Ireland. This market has its own

regulator. Hence Wales is part of the GB market alongside England and Scotland.

the British wholesale market; however, the market-clearing price is still set by the most expensive marginal unit, which is usually gas. While Britain was not particularly reliant on Russian gas before the war (around 5% of our usage), the global high demand for gas, which drives up prices, does affect domestic gas prices and has a knock-on effect on the costs of all power generation.

Although we can foresee a day when Wales and Britain could consistently meet our energy demand for extended periods without any gas generation, that day may still be some time off. Renewables will need to outcompete gas not only in wholesale markets but also in flexibility and capacity markets. This implies that investment in grid-level electricity storage will be as crucial as generation itself.

System resilience

The interdependence of the energy system, along with the need for flexibility and interconnection, becomes evident when considering a counterfactual situation in which a country opts to run its energy system in a wholly self-contained manner. The example that comes most readily to mind is Texas. If it were a sovereign state, Texas would rank as the world's ninth-largest economy. It is also the only state in the USA with its own self-contained electricity grid and an independently regulated internal energy market, albeit with some interconnections to other states – one of which has been used only once. The reasons for this self-sufficiency are mainly political, rooted in Texas' unique relationship with the wider USA and its wish to avoid federal energy regulation. With decisions on the energy system overseen by Texas' state legislature, investment in the infrastructure which would see the state safely through unusually cold winters was not prioritised. This culminated in the winter of 2021-22 when an extreme cold front over a period of week took out power stations, leaving five million Texans without power. An estimated 246 people died from hypothermia or from accidents resulting from makeshift attempts to heat their homes. Investigations into the crisis revealed

that the system was so overwhelmed that at one point it came within minutes of a total, state-wide grid failure.

Defining destinations

Having established our starting point, what directions might we choose for Wales' future energy needs?

Businesses, communities, civic society, and the public sector all have significant roles to play. The Minister for Climate Change has expressed a preference for a more planned, less market-driven approach. A planned approach has the potential provide all stakeholders with the confidence to invest time, money, and scarce resources, knowing that the landscape will remain stable. Although a shift towards planning seems more likely than ever, it is still improbable that all decisions will be made by the Welsh Government.

Developing such a plan requires a clear organising principle for prioritisation. Simply listing all intended actions alongside all the plausible outcomes they could contribute to is neither strategic nor helpful in making tough decisions when there are trade-offs and sectors and stakeholders to consider.

The aim here is to outline these various pathways without judging their merits. It is evident that some visions for the future are mutually exclusive. We cannot pursue both renewables-led growth and degrowth simultaneously. If the goal is a balanced, circular or 'doughnut' economy with consumption kept in balance, then views will differ on whether the path to that steady state requires a period of 'green growth' (a contentious term itself) or begins with the systematic dismantling of current consumption models.

To the extent that Wales has policy levers, these will only be relevant if we commit to a particular direction and stay the course. We must determine both what the energy system should achieve and what it will look like. At a fundamental level, different scenarios will require different types of investment in electricity grid capacity and flexibility.

What, then, are these competing visions for the future, and how might they manifest in Wales?

Ecomodernism

Ecomodernism, as described by one of its founding thinkers Ted Nordhaus, is 'an alternative framework for protecting the environment that is consistent with a world of nine billion people living something that looks like modern lives.' (Nordhaus cited in Nijhuis, 2015).

The [Ecomodernist Manifesto](#) (Asafu-Adjaye et al., 2015) explicitly rejects the notion that humans must 'harmonise' with nature to protect the environment. Instead, it advocates for rapidly accelerating technological innovations to diminish our impact through greater 'intensity', such as by concentrating more people into cities or adopting intensive, highly efficient farming practices that reduce the land mass needed to food production.

Ecomodernists contend that historical trends in technological progress have made us less dependent on nature's ecosystems. Rather than resisting this trend, we should embrace and accelerate it, becoming increasingly reliant on human ingenuity and thereby reducing our impact on nature.

'Transitioning to a world powered by zero-carbon energy sources will require energy technologies that are power dense and capable of scaling to many tens of terawatts to power a growing human economy.'

Most forms of renewable energy are, unfortunately, incapable of doing so. The scale of land use and other environmental impacts necessary to power the world on biofuels or many other renewables are such that we doubt they provide a sound pathway to a zero-

carbon low-footprint future.' **(Asafu-Adjaye et al., 2015: 23)**

An ecomodernist Wales might envisage new nuclear energy not just on Ynys Môn, but also on other suitable sites, along with large-scale hydrogen production, intensive farming practices, and a further migration from rural communities into cities.

Renewables-led growth

Renewables-led growth is somewhat more challenging to define, partly because – unlike other options under discussion – it does not clearly align with a single ideological framework and lacks a manifesto to quote. Economically, this scenario continues to prioritise growth but shifts the focus from environmentally damaging activities towards job and wealth creation in sectors that decarbonise the economy and improve sustainability. This would encompass renewable energy, battery storage, heat pumps, hydrogen vehicles, and a general shift from high to low carbon intensity in sectors like manufacturing.

In technological terms, this approach favours existing technology. The challenge for policymakers lies in implementation rather than invention. To slightly complicate matters, there are a few options for this direction, which are, thankfully, not mutually exclusive. The first option envisages green growth leading to energy self-sufficiency for Wales, aligning generation and consumption more closely compared to today's 'export' scenario. In this steady state, jobs and wealth would stem from managing and maintaining the system. The second option is more export-led, whereby Wales could continue to host a system which serves England's energy consumption as well as its own, necessitating additional generation infrastructure and job creation. In the future, more of this infrastructure might be Welsh-owned, constituting a true economic 'export'.

The third option focuses on green manufacturing, which looks beyond the energy we generate to materials that might be produced

in Wales and needed by other nations for their own energy decarbonisation, and which Wales is well placed to benefit from economically. This need not be high end, cutting edge technology that is 'green' in and of itself. For example, concrete rebar will be a key part of the supply chain for the developing offshore wind industry across Europe, and could be made in and exported from Wales' ports.

Each of these options presents different needs and thus requires distinct decisions about Wales' future energy system and transport networks. They all continue to rely on a growth-based model and do not indicate an end state.

Beyond those discussed so far, what other options are available will be outlined next.

The Circular / Doughnut Economy

Economist Kate Raworth first articulated the idea of the 'doughnut' economic model, in which human consumption resides in a 'safe and just' space within a regenerative and redistributive economy. In this vision, our resource consumption neither exceeds the limits of sustainability nor falls short in delivering social outcomes like good health, access to education, and gender equality.

An offshoot of this idea is the 'circular economy' which focuses on waste reduction through the reuse or recycling of materials, use of fewer virgin materials, and increased collective utilisation of resources or manufactured goods. The circular economy is named as a 'policy' in the Welsh Government's [Net Zero Wales](#) (Welsh Government, 2021b) plan, and a [Circular Economy Strategy](#) (Welsh Government, 2020) was consulted on in 2020, becoming the [Beyond Recycling](#) (Welsh Government, 2021c) strategy in 2021.

Circularity is the only concept from this list with explicit strategic commitment from the Welsh Government. How significantly does this commitment translate into energy policies and implementation? Beyond Recycling commits to a moratorium (Welsh Government, 2021c: 32) on the development of energy-from-waste facilities in Wales, aiming to 'ensure the capacity

we have for generating energy from waste is in line with the capacity needed during our transition to a circular economy, with the long-term solution being to move away from incineration.' (Welsh Government, 2021c: 26). Wales had 53 MW of installed capacity for energy from waste in the second quarter of 2023 (DESNZ, 2023c), which is 1.4% of total installed capacity.

The strategy also highlights Wales as 'one of the few nations in the world to have universal weekly separate collections of food waste, fuelling anaerobic digestion plants which generate renewable energy around the country.' (Welsh Government, 2021c: 8). Wales had 21 MW of installed anaerobic digestion capacity in the second quarter of 2023 (DESNZ, 2023c), making up 0.6% of total installed capacity.

Compared to the installed capacity of wind (53%) and solar (35%) by the first quarter of 2023 in Wales (DESNZ, 2023c), these two 'circular' energy generation methods constitute a relatively small percentage of total installed capacity.

Degrowth

Degrowth as an economic philosophy is defined, to an extent, more by what it is against and what it is not, rather than by what it is. It is difficult to fundamentally disagree with its core insight that continued economic growth will, sooner or later, become incompatible with the Earth's finite resources and capacity to absorb carbon emissions without disastrous consequences. Degrowth is perhaps best viewed as a method, rather than a destination.

It is important to acknowledge that there is no clear line between 'degrowth' and the concept of a doughnut economy. One could view the former as a means to achieve the latter, although it is uncertain whether any kind of growth can be sustained long enough to reach the steady state envisioned by the doughnut. The key questions are when this point will arrive and how far into the future we can delay it by enhancing the sustainability of our consumption. The clear answer is certainly not 'indefinitely'.

Advocates of degrowth articulate its focus on wellbeing as a measure of a nation's overall success, either as a counterbalance or as a replacement for traditional economic measures like GDP or GVA. While this is an important aspect, it is somewhat beyond the scope of this piece, which aims to examine what degrowth could mean for the energy system.

For the purposes of this piece, we will take as our assumption that a 'degrowth Wales' would not aim to expand its capacity for renewable energy generation, nor use this infrastructure to support large-scale manufacturing exports or any other activity that would deliberately grow the economy. What, then, would the energy system in Wales look like under such a framework? In 2021, Wales had a generation capacity that was 28% renewable, with the remaining 72% being gas-fired power stations. This represents a decrease from 33% in 2020, due to an uptick in electricity generation from gas in 2021, even though the absolute figure for renewable generation increased (Welsh Government, 2022b).

Avoiding a semantic debate of how we might convert two thirds of Wales' generation from gas to electricity without 'growing' our renewables sector, it may be most helpful to define the goal of degrowth in our energy system as reducing our total energy output to a level that merely meets Wales' demand, and no more.

Conclusions

Some visions of Wales' energy future are incompatible and cannot be pursued in parallel, while others have ideological origins that are unrelated to energy. The Welsh Government is not the primary actor in our energy system, a situation that seems unlikely to change. Accordingly, its policy choices should reflect this reality.

Change in the energy system is unfolding rapidly, driven by market forces in the UK and beyond, whether we like it or not. A devolved government must, therefore, decide if it can best achieve decarbonisation by working with or against these forces. Little prospect exists that

this underlying political reality will soon change, and no emissions reductions will be gained by opposing it.

We should be pragmatic about how much evidence we can and should gather to inform our plans. By the time we develop a perfect or complete model of the system as it exists today, it will already be out of date. A balance must be struck in facing this urgent, era-defining challenge.

We ought to value policies that deliver multiple outcomes. However, if we are clear that the quickest path to decarbonisation is the priority, we should tailor our policies accordingly, accepting that we may need to deprioritise other objectives.

Most of the pathways mentioned above could be successful, each benefiting Wales in different ways. The Welsh Government must commit to one pathway and clearly articulate it to its partners. This will entail taking risks, ruling out some options, and potentially upsetting some stakeholders. The alternative is a muddled policy approach and stagnant progress.

Interdependence is clearly valuable for energy security, and also serves as a means of deriving an economic return on the energy we use. The risks associated with pursuing energy independence through degrowth for a small nation are considerable, as exemplified by the experience in Texas.

Although this paper questions the idea of Wales as an 'exporter' of energy, the ideal goal, in the author's view, is to maximise the role the nation plays in both the wider GB system and the global drive towards net zero. Wales has the natural resources and industrial heritage to make a successful transition to renewable energy, and it has the potential to play a significant role in global decarbonisation – should we choose that path.

Author: Andy Regan

Andy Regan, writing here in a personal capacity, is Mission Manager for A Sustainable Future at Nesta Cymru. He has previously worked for the IWA, Ofgem, and Citizens Advice.

References

Asafu-Adjaye, J., Blomqvist, L., Brand, S., Brook, B., Defries, R., Ellis, E., Foreman, C., Keith, D., Lewis, M., Lynas, M., Nordhaus, T., Pielke Jr, R., Pritzker, R., Roy, J., Sagoff, M., Shellenberger, M., Stone, R., and Teague, P. (2015). **An Ecomodernist Manifesto**. Retrieved from <https://static1.squarespace.com/static/5515d9f9e4b04d5c3198b7bb/t/552d37bbe4b07a7dd69fcd9dbb/1429026747046/An+Ecomodernist+Manifesto.pdf>

Department for Energy Security & Net Zero (DESNZ). (2023a). **Energy Trends: Table 6.1. Renewable energy capacity and generation**. Retrieved from <https://www.gov.uk/government/statistics/energy-trends-section-6-renewables>

Department for Energy Security & Net Zero (DESNZ). (2023b). **Digest of UK Energy Statistics (DUKES): natural gas**. Retrieved from <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

Department for Energy Security & Net Zero (DESNZ). (2023c). **Energy Trends: September 2023**. Retrieved from <https://www.gov.uk/government/statistics/energy-trends-september-2023>

Department for Energy Security and Net Zero and Ofgem. (2023). **Connections Action Plan: Speeding up connections to the energy network across Great Britain**. Retrieved from <https://assets.publishing.service.gov.uk/media/655dd873d03a8d001207fe56/connections-action-plan.pdf>

Department for Levelling Up, Housing and Communities. (2023). **Getting Great Britain building again: Speeding up infrastructure delivery**. Retrieved from <https://www.gov.uk/government/publications/getting-great-britain-building-again-speeding-up-infrastructure-delivery/getting-great-britain-building-again-speeding-up-infrastructure-delivery>

James, J. (2022). **Response to Laura Anne Jones MS**. Senedd Plenary, 18 May 2022. Retrieved from <https://record.assembly.wales/Plenary/12842#C426928>

Hirst, D. (2018). **Carbon Price Floor (CPF) and the price support mechanism**. Retrieved from <https://researchbriefings.files.parliament.uk/documents/SN05927/SN05927.pdf>

Lloyd, H. and Reagan, A. (2021). **Renewing the Focus: Re-energising Wales Two Years On**. Retrieved from https://www.iwa.wales/wp-content/media/Renewing_the_Focus_v2.pdf

Nijhuis, M. (2015). **Is the “Ecomodernist Manifesto” the Future of Environmentalism?** Retrieved from <https://www.newyorker.com/tech/annals-of-technology/is-the-ecomodernist-manifesto-the-future-of-environmentalism>

Price, J., Roberts, M., and Bristow, D. (2021). **Towards a Just Transition in Wales**. Retrieved from <https://www.wcpp.org.uk/wp-content/uploads/2021/01/Towards-a-Just-Transition-in-Wales.pdf>

Silva, L., Tilley, H., and Price, J. (2022). **Developing skills for a just transition**. Retrieved from <https://www.wcpp.org.uk/wp-content/uploads/2022/08/Developing-skills-for-a-just-transition.pdf>

Skidmore, C. (2022). **Mission Zero**. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1128689/mission-zero-independent-review.pdf

UK Government. (2022). **British Energy Security Strategy**. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069969/british-energy-security-strategy-web-accessible.pdf

Welsh Affairs Committee. (2021). **What are Wales’ renewable energy opportunities?** UK Parliament. Retrieved from <https://committees.parliament.uk/committee/162/welsh-affairs-committee/news/146982/what-are-wales-renewable-energy-opportunities/>

Welsh Government. (2020). **Beyond Recycling**. Retrieved from: https://www.gov.wales/sites/default/files/consultations/2020-09/beyond-recycling-summary-of-responses_1.pdf

Welsh Government. (2021a). **Net Zero Wales: Carbon Budget 2 (2021-25)**. Retrieved from <https://gov.wales/sites/default/files/publications/2021-10/net-zero-wales-carbon-budget-2-2021-25.pdf>

Welsh Government. (2021b). **Net Zero Wales: Carbon Budget 2 (2021 – 2025) Summary Document**. Retrieved from <https://www.gov.wales/sites/default/files/publications/2021-10/net-zero-wales-summary-document.pdf>

Welsh Government. (2021c). **Beyond Recycling: A strategy to make the circular economy in Wales a reality**. Retrieved from <https://www.gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

[ons/2021-03/beyond-recycling-strategy-document.pdf](https://www.gov.wales/sites/default/files/publications/2022-06/energy-generation-in-wales-2020.pdf)

Welsh Government. (2022a). **Energy Generation in Wales 2020**. Retrieved from <https://www.gov.wales/sites/default/files/publications/2022-06/energy-generation-in-wales-2020.pdf>

Welsh Government (2022b). **Energy Generation in Wales 2021**. Retrieved from <https://www.gov.wales/sites/default/files/publications/2022-12/energy-generation-in-wales-2021.pdf>

Find out more

WCPP's work for the Net Zero 2035 challenge group is available at <https://www.wcpp.org.uk/project/net-zero-35/>

About the Wales Centre for Public Policy

Here at the Centre, we collaborate with leading policy experts to provide ministers, the civil service and Welsh public services with high quality evidence and independent advice that helps them to improve policy decisions and outcomes.

Funded by the Economic and Social Research Council, Welsh Government, and Cardiff

University, the Centre is based at Cardiff University and a member of the UK's What Works Network.

For further information contact:

Jack Price

+44 (0)29 2087 5345

jack.price@wcpp.org.uk

Wales Centre for Public Policy

Cardiff University, Sbarc/Spark, Maindy Road, Cardiff CF24 4HQ



www.wcpp.org.uk



029 2087 5345



info@wcpp.org.uk



@WCfPP

