



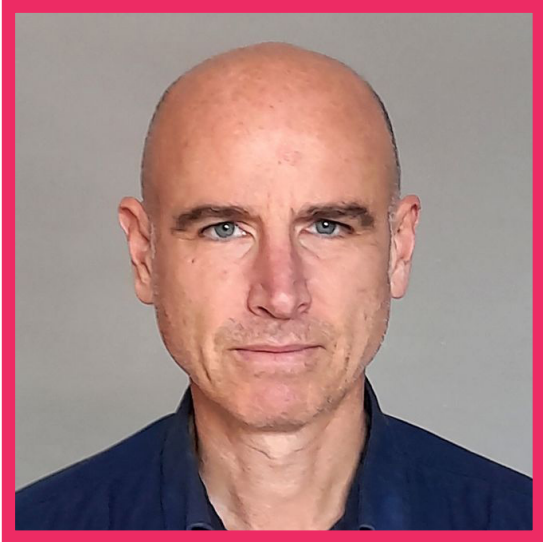
REWIRING BRITAIN

HOW SCOTLAND CAN BUILD THE NEW
NATIONAL GRID

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Our
Scottish Future

About the authors



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Foreword by Eddie Barnes

The reaction to Rishi Sunak's speech on Net Zero on September 20th focussed almost entirely on his controversial decision to scrap short-term targets on net zero.

But the Prime Minister's comments also focussed on some of the massive long-term reforms that are required if Britain is to decarbonise – particularly over the national grid.

If the UK is to hit net zero by 2050, it needs to double the amount of electricity we currently generate to compensate for the gas and oil we will no longer use to power our cars and heat our homes.

This requires a massive expansion in renewable sourced energy. It also means a multi-billion pound transformation to the national grid – after all, there's no point generating lots of electricity if we don't have the wiring to get it into communities.

Mr Sunak and Chancellor Jeremy Hunt will soon bring forward their plans to carry out this job. Prior to those plans being drawn up, this paper calls for Scotland to be at the heart of this massive UK rewiring project.

We need to learn from the introduction of wind power over the last 20 years. Britain failed to take full advantage: jobs that could have been created here were instead created abroad.

As we turn to the equally huge task of rewiring the country, we argue that, this time, we develop the skills and the supply chain to create new jobs here.

Thanks to Scotland's manufacturing and energy expertise, we are well placed to develop those jobs here. This paper by Dr Pete Wood sets out the steps the UK and Scottish Governments should take to put Scotland at the heart of the rewiring of Britain.

Introduction

The UK government recently announced that it will be bringing forward ‘comprehensive new reforms to energy infrastructure’.¹ These commitments follow analysis released by the regulator Ofgem and by the Energy Networks Commissioner, identifying the barriers to reaching Net Zero in Britain’s energy system. The following paper analyses what it means for Scotland, and proposes how action in Scotland steers a rewiring of the UK energy system. It also contains opportunities to rewire the UK’s economy, cut carbon emissions and create good jobs in the industrial specialisms of the future, what we term ‘rebalance, decarbonise, and innovate’.

In the short term, to eliminate greenhouse gases from the electricity generation system the National Grid needs to be altered. We particularly need new ‘transmission’ lines taking electricity from where it is generated to where it is used. As renewable energy is best generated in locations with significant wind, sunlight or tidal potential, and these are generally not the locations of our current fossil fuel power plants, we will need to build new electricity infrastructure to connect ‘replacement’ renewable electricity to the existing grid. In practice this means new undersea cables, new overground pylons, along with new buildings to house the interconnectors and converters that link them together. The current UK government target for this is 2035, but Labour has pledged an accelerated 2030 deadline.²

The greater challenge, over the longer term, is to create enough additional electricity to replace the power currently generated by oil, gas and coal; the petrol in cars, diesel in trains, heating gas in houses and offices, and the range of complex fuels in industry. For a detailed breakdown of the UK’s energy sector and energy efficiency measures, see our previous paper.³

Overall, achieving Net Zero by 2050 means more than doubling electricity generation.⁴ This will require significant expansion of the National Grid; both reinforcing the infrastructure along existing routes and building new lines altogether. Labour’s promised ‘GB Energy’ would be a publicly-owned company, with the responsibility to ‘establish the UK as a clean energy superpower and guarantee long term energy security’.⁵ The party has suggested using GB Energy to build “faster and cheaper” by “opening up new grid construction to competitive tendering”. It would do this by providing additional capacity, alongside and including strategic partnerships with the private sector, following the model successfully used in countries such as Sweden’s Vattenfall and France’s EDF.

Yet in many ways, the barriers to Net Zero are the symptoms not the cause of our difficulties. Renewable energy can now be cheaper than fossil fuel, irrespective of climate change targets. But our energy governance system is set up to minimise the costs of running the existing National Grid – it is not designed for rapid expansion to seize new technological opportunities. The outcome is an increasingly common refrain: insufficient investment in infrastructure, missed opportunities to increase productivity, a lack of interest in rebalancing the country away from the Home Counties and Lothian. In practice; costs have gone up, hard earned skills have been squandered, and good jobs have gone overseas.

Responding to this context, the main commitments on energy in the Prime Minister's speech on Net Zero in September were to:

- create a 'spatial plan for that infrastructure to give industry certainty and every community a say'
- 'speed up planning for the most nationally significant projects'
- 'end the first-come-first served approach to grid connections'

Our paper first explains the overarching problems in the UK's energy system. It then explains how the Prime Minister's commitments to a Spatial Plan, and the opposition's proposals for GB Energy, are grounded in recent analysis by government, academia and the energy regulator. The paper ends by setting out proposals for how Scotland could steer the response. It argues that taking a position of leadership within the energy union could benefit us all, rewiring the country to ensure:

- **cheaper energy** and lower emissions for the whole UK
- **investment** in Scotland's rural and ex-manufacturing areas
- **international excellence** in a growing, interconnected European market

Getting to Net Zero, bringing down bills, and ending our dependency on foreign oil and gas will require fundamental reform to how the UK energy system operates. It means radically, rapidly, increasing the amount of electricity generated from renewable sources, and particularly from

Scottish winds and tides. To achieve this the GB National Grid urgently needs investment and reform.⁶

The energy union is more successful than many realise. The UK has achieved the largest reduction in carbon emissions of all the world's largest economies (G20), and Scotland has led the UK nations' progress.⁷ For energy, Scotland has almost entirely decarbonised its existing electricity production – but it has achieved this through funding drawn together from across Britain. At one point over 30% of the UK's subsidies to develop wind, wave and tidal energy projects were being spent in Scotland, despite our nation making up only 10% of the population. Over 47% of the projects awarded 'Contracts for Difference' support were Scottish. Academic analysis has detailed how allocating funding to Scotland in this way was a political choice to renew our common market in energy.⁸

Were Scotland to leave the UK, it would have no right to access the funds pooled across the remaining union. Nor would the rUK be wholly dependent on Scottish energy. Shallower southern seas mean that most UK offshore wind energy is generated off the coast of England. Given that previous applications from Ireland to access Britain's renewables subsidy have been refused,⁹ the potential profits of Scottish energy exports would be limited by competition with French nuclear, Irish wind or Norwegian hydropower.

So our energy union has been a success. It has successfully incubated a wind industry in which new offshore wind capacity was nine times cheaper than gas at the height of the energy price crisis.¹⁰ Having built firm foundations the challenge is to scale up, until the UK – led by Scotland's greater long-term potential in tide and deep-water wind energy – can use renewables to meet its entire energy needs.

A new energy industry could rebalance Scotland's own distribution of jobs and opportunities. The Westminster Scottish Affairs' Committee's investigations record the potential for "Orkney, Shetland and the Western Isles to provide 50% of UK's total energy needs".¹¹ Achieving even part of this potential would boost a range of new and existing careers on our islands. Yet to do so, according to Professor Keith Bell, Co-Director of the UK Energy Research Centre at the University of Strathclyde: "Network capacity is essential, and it has to be in the right places at the right capacity at the right time". His evidence to the committee stated that a significant difficulty is "knowing where energy would be generated, sufficiently in advance, to enable grid investment." The current state of play, and a key motivator for Rishi Sunak's speech is that, in the words of Professor Bell, "More can be done to anticipate the investment needed to support renewable projects".



Why the UK needs rewiring



Net Zero means the National Grid needs to perform a new role that we have not previously built it for

The energy union is not perfect. Its rules are designed to keep costs down, but many are hangovers from a fossil fuel age. Rather than being biased against Scotland,¹² it is designed for oil, gas and coal. The National Grid minimises waste by encouraging power stations to be built close to the cities and centres of industry where that power is used. Their mechanism is to charge energy producers higher transmission costs if they add extra supply to regions already generating a surplus, such as Scotland and Northern England. Producers in areas with an energy deficit receive additional payments to incentivise extra production, such as in Wales. This is called the ‘Transmission Network Use of System Charges’.

We charge transmission in this way because balancing the surplus is expensive, and not balancing it will cause the National Grid to fail. The system successfully allowed us to quickly replace old coal and oil by slotting in new wind turbines, like upgrading an old coal fireplace with a new gas fire. But to reach Net Zero we need more fundamental change.

Renewable energy has to be managed differently to fossil fuels. It is generated where the wind, sun and tides are strongest, which is often the opposite of where we live or work – up mountains, in deserts, out at sea. Rather than producing easy-to-transport, inert, barrels of oil and gas, renewables create electricity at the point that energy is captured from nature. So Net Zero means the National Grid needs to perform a new role that we have not previously built it for, which more centrally focuses on transmission of long-distance exports from Scotland, across England and Wales, and into the rest of Europe.

Given that we cannot move where the wind blows and the sun shines, we need to invest in improved capacity for moving electricity out of the areas it gets generated. This would allow us to reduce the transmission costs paid by energy producers in our most productive, valuable areas. Pooling costs across the country creates a cooperative support and financial incentive for adding extra renewables capacity.¹³

Extra transmission capacity also allows the grid to be flexible at a larger scale. Whilst the output of any one renewable energy location varies upon the local weather at that time, at a regional scale the climate averages out. In other words, the wind is always blowing somewhere, and if it isn't then it's often quite sunny. In turn, irrespective of a desire to stop climate change and simply because of renewable energy's falling costs and increased proportion of supply, if we stuck with the current grid we would see a rise in 'annual constraint costs' from £0.5-1bn in 2022, to £2-4bn in 2030.¹⁴ This is the cost of paying electricity generators to turn off when supply outstrips demand. So not only would maintaining the status quo mean losing the income from exporting surplus electricity, we would increasingly be paying wind and solar farms to avoid generating it.

Overall, transmission charges are higher in Scotland for technological reasons. Our energy and political union now needs to be updated and rewired.

Better (together), stronger, faster

Upgrades to the National Grid are significantly hampered by the length of time it takes to move from proposal to the transmission of electricity along new lines, currently around 14 years. This is also longer than the time remaining in the UK government's current aim to decarbonise the existing electricity grid by 2035. Producers, even after accepting high transmission charges, are told they cannot be connected to the grid until well into the 2030s.¹⁵ To increase grid capacity at the rate required to replace fossil fuels by 2050, the next seven years needs to see us construct four times the capacity built in the whole period since 1990.¹⁶ In other words, 1/5 the time.

To build and expand transmission capacity the Energy Networks Commissioner identified that the process could be sped up, simplified and reduced in price. This gives rise to the main points in the Prime Minister's speech, as quoted in section 1: a spatial plan, prioritisation for nationally significant projects, and an end to 'first come first served'. The Commissioners full report argues that 'New power lines can be built in half the time', which would be 7 years. This means moving away from the current model for new transmission to be identified, planned, given permission and built individually, on a 'slow, iterative, and case-by-case process.'¹⁷



The proposed new system would create a pre-agreed national spatial plan. This would simplify the process of:

- **Evidencing and forecasting the need for new power lines**
- **Integrating network design and fit with the overall energy system**
- **Estimating business cases, including expected transmission costs**
- **Gaining regulatory approval, including assessing environmental, social and economic impact**
- **Agreeing detailed design**
- **Consulting with affected individuals and communities**
- **Ordering specialised, in-demand high voltage grid components**
- **Building supply chains, including through strategic permissions to reduce competition in procurement**
- **Construction and connection**
- **Training and coordinating a skilled workforce for ‘one of the most complex electricity transmission systems in the world’¹⁸**

Simplifying the process for building new transmission capacity could also simplify the connection of new renewable generation. Firstly, it could clear the backlog of projects finished but unconnected or intentionally delayed. Secondly, the current system for connecting new generation capacity to the grid is run on a ‘first come first served’ principle; a queuing system in which everyone moves up the line in the order their application to be connected was accepted. However, this means that where projects are delayed or paused they slow down everyone behind them in the queue. Together, it can result in a number of finished projects sitting idle, or projects intentionally planned to finish at a later date than would be otherwise possible. The ‘queue’ to connect is now 230GW, against around 80GW renewables connected to date; some delayed, some taking up slots they are unlikely to ever use. A new system could not only speed up the whole queue, but make it easier to move successful projects towards the front. Extra speed could not only support Net Zero, but bring down the costs of electricity generation and pass on the savings in reduced bills.

Labour's publicly-owned energy company, GB Energy, could provide further flexibility. Being able to draw on government finances and interest rates, acting as an anchor institution in the supply chain, ensuring that risk is pooled across the country, could deliver new economies of scale that drive down cost. It could also provide the forms of institutional stability or standardisation, both sector-wide and in relationships with individual companies, that allow greater risk taking in research and development, leading to faster innovation.

From the perspective of devolution, the current 'overlapping matrix of rules, obligations and permissions' are sufficiently complex to deter investment.¹⁹ Following the Prime Minister's speech, the Holyrood Net Zero, Energy and Transport Committee called on 'the Scottish and UK Governments to work urgently together to agree amendments to the [Energy] Bill that will ensure the law in this area is coherent and clear.' The simplicity and stability of the Spatial Plan applies not only to actions by Westminster or Holyrood, but would require **improved cooperation** between them.

Planning and education are two of the main devolved areas of the energy system, with the remainder largely reserved to Westminster. Here, streamlining community engagement and consultation are recommended changes. Currently, each project or level of review has to make its own case within the planning system. Reforms could give strategic priorities clear presumptions in planning, policy and guidance. For example, whether the situation is appropriate for expensive solutions such as underground cabling, which cost 5-10x traditional pylons, or what types of mitigating or adaptation community benefit are available.²⁰ This could be supported by national information campaigns 'so that when individual proposals for reinforcement are made, communities have some context in which to view them'. The Commissioner has also recommended guidelines on the size of lump sum payments available to individual households close to new lines, and how community funds for the areas around new lines could be established.'

To create the Spatial Plan, planning reforms and reform the connections system, a number of new institutions have been proposed. These include:

- **A 'Future System Operator' to 'bring together the planning for the electricity and gas systems, and potentially systems for new technologies like hydrogen and carbon capture and storage' (Energy Network Commissioner Recommendation SS1)**
- **Energy System Delivery Board 'to monitor and drive delivery of the electricity transmission network delivery programme... focussed on transmission infrastructure' (Recommendation OU1)**
- **Digital programme including improvements to the Planning system such as automation of route design and corridor routing (Recommendation AR1 & AR2)**
- **Public-facing campaign and website on careers and opportunities across the sector (Recommendation NC3)**
- **A strategic Marine Environmental Assessment, to identify priority offshore locations and reduce assessment duplication (Recommendation SS2)**
- **Cooperation across government, industry and academia to identify and fill skills gaps in the workforce (Recommendation SJ1)**

We (can) have the technology

The equipment, infrastructure and supply chain required to grow our electricity transmission capacity is truly international. The European market for the key components of High Voltage Direct Current (HVDC) infrastructure has been dominated by three suppliers of HVDC converters and three primary suppliers of HVDC cable.²¹ Within this context, and throughout our EU membership, the British energy market has had many unique requirements which limit our participation in the development and adoption of new innovations or standardisation.²² At the same time, British competition regulations prevent collaboration with the supply chain to develop new manufacturing capacity in the UK, or to increase certainty and secure manufacturing slots or bulk purchase agreements with existing producers. This issue is becoming more pressing as the wider world seeks to decarbonise in similar ways, at the same time, competing for limited HVDC manufacturing capacity.²³

Moving towards standards that are better harmonised with Europe would simplify the ability to purchase vital equipment. It would support the creation of a UK manufacturing base capable of contributing to both domestic demand and international export. With or without a publicly-owned energy company, successfully retaining more of the high-value added manufacturing and supply chain within the UK would be a significant economic benefit: the recent ‘Western Link’ between Scotland and Wales cost £1.2bn²⁴ whilst the ‘Scotland to England Green Links’ undersea cables are planned to cost £3.4bn.²⁵ Yet in contrast, whilst the UK has been an acknowledged international leader in installing wind farms, the UK employment created has tended towards the low-value end of the supply chain, with high-skill, profitable, high wage, elements largely procured overseas.²⁶

Overall, estimates are that the total £4-11bn investment required to upgrade the grid could create 50,000 to 130,000 jobs around the country.²⁷ Involvement of recognised Trade Unions in both the growing and declining industries of Net Zero is widely seen as essential for smoothing the transition.²⁸ Their participation is able to ensure wider consent for and engagement with the changes, leading to more effective, popular action. In Scotland, trade unions are represented alongside civil society, academic and business groups on the Just Transition Commission.²⁹

Acting strategically, the UK has the potential to grow its presence in the higher value links of the supply chain. Although the UK does not currently have a significant manufacturing facility, it has the ingredients required to develop one. The National Grid has been a pioneer in supporting new entrants to the market, via the NEMO Link interconnector joint venture with Belgium.³⁰ It has developed a reputation as a ‘consistent, reliable, repeat purchaser of HVDC cable which in turn encourages competition and innovation within its tenders’. One of the largest European suppliers, GE Grid Solutions, holds a pioneering HVDC valve testing facility in Stafford, alongside a mid-sized converter manufacturing plant.^{31 32} The start-up XLCC is aiming to create the UK’s first HVDC subsea cable manufacturing plant in North Ayrshire.³³

Education and training is an essential precursor. The Commissioner has recommended (SS6) that each part of the industry should identify the skills and resources required for the future. Work with government departments responsible for education and skills will be required ‘from school years through to retraining of experienced workers’. This will require consideration ‘in the geographical location of training opportunities as this can support community acceptance of new infrastructure’.³⁴ Given that more than 80% of UK oil workers have reportedly considered leaving the industry, but require replacement jobs, electricity transmission could provide a significant source of retraining and employment.³⁵

Successfully cooperating to bring about institutional, technological and social change would allow Britain to not only achieve cheaper, greener electricity, and a range of good jobs. It would show that the union can be more than an identity project, it can practically improve lives.

Rewiring the Union - our proposals

The UK's energy reforms should build upon Scotland's world leading strengths in a range of sectors, using Net Zero as an opportunity to rebalance the country. In turn, Holyrood should take the chance to regenerate communities and rebuild job prospects in some of the most deprived parts of our nation. Together we can steer a path to Net Zero that leaves our communities stronger than they were before.

Our Scottish Future firstly proposes that the UK government focus the investment and management required by the Spatial Plan on Scotland, drawing upon our leading expertise in energy. Each initiative named below is estimated by the Energy System Catapult to comprise a multi-million pound investment in the host area:

- **Glasgow to host the Future System Operator, drawing upon the existing presence of the existing energy regulator, Ofgem. Regional offices could be founded in Humberside and Liverpool, to ensure expertise is drawn from across the UK.**
- **Edinburgh to host the Energy System Delivery Board's secretariat at the UK Government campus.**
- **Dundee to be the focus of the digital programme to speed up planning for infrastructure. This would link the city's heritage in heavy industry to its new successes in digital innovation. The programme would comprise the energy industry's proposed data sharing system, transmission route design tool, along with the integrated web portal for supporting community engagement and careers advisory services.**
- **Aberdeen to be the coordination hub for the strategic Marine Environmental Assessment, supporting the diversification and future-proofing of the North East energy sector's transition into offshore renewables.**
- **The Highlands and Islands' education providers to host a Scottish consortium for identifying skill gaps in rural areas.**

Secondly, the mass construction of High Voltage Direct Current (HVDC) transmission cable is an opportunity to renew Scotland's manufacturing industry. Yet we must learn the lessons of wind farm roll out. The environmental benefits of the move to Net Zero should not mean buying in high-level expertise from overseas, with Scotland retaining only the last and lowest value parts of the supply chain.

- The Scottish and UK governments, working in cooperation, should incubate an international specialist advantage in one area of HVDC research, development and deployment.

- GB Energy, Labour's proposed publicly-owned energy company, should have a duty to build the UK supply chain written into its founding charter, including a requirement to support high-value research and advanced manufacturing facilities outside the South East. This would be equivalent to the BBC's charter duty to provide public services beyond chasing market share, commonly known as the duty to 'inform, educate and entertain'. For GB Energy, the charter duty could be to 'rebalance, decarbonise, and innovate'.

- We suggest the investments and institutions be based in Scotland, with a network of high growth firms facilities incubated across the UK. Two anchors for priority investigation could be the proposed HVDC manufacturing cluster in Ayrshire, and/or the transport and planning support in place to support existing wind farm fabrication yards, particularly along the coast of Fife. This work would take in Labour's aim for GB Energy to increase competition, by supporting Scottish manufacturing to anchor a new British supply chain.

Rapidly growing renewable electricity transmission is impossible unless the communities who are most affected see direct benefits. We support existing proposals for communities directly impacted by the construction or operation of transmission infrastructure to receive financial support for domestic energy efficiency improvements, such as home insulation. Yet the rural parts of our nation where transmission infrastructure is most commonly sited are seeing their population, particularly their young adults, moving to the cities for education or career opportunities and not returning. To rebalance this, we propose that Community Benefit funds be allowed to support:

- **Community scholarships to support local individuals in taking up Further or Higher Education qualifications. These would be targeted at training students from remote areas in the energy sector, with guaranteed job opportunities in the local supply chain upon the successful completion of their qualification.**
- **Specialist business support for small or medium enterprises with high growth seeking to remain rurally-based, with a focus on the Highlands and Islands supply chain.**
- **Scholarships to aim at being competitive with Armed Forces university study bursaries. This would be worth around £5,000 per year of university study, tied to four years of guaranteed remote rural employment after graduation.**

Net Zero is a once-in-a-generation opportunity to rewire the UK. Applying the principles in this report would ensure that decarbonisation goes beyond the environment, to re-create a country that actually works for the people who live in it.

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Our Scottish Future believes that good government in Scotland and across the United Kingdom has to be based on the values of cooperation, empathy, solidarity and reciprocity.

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