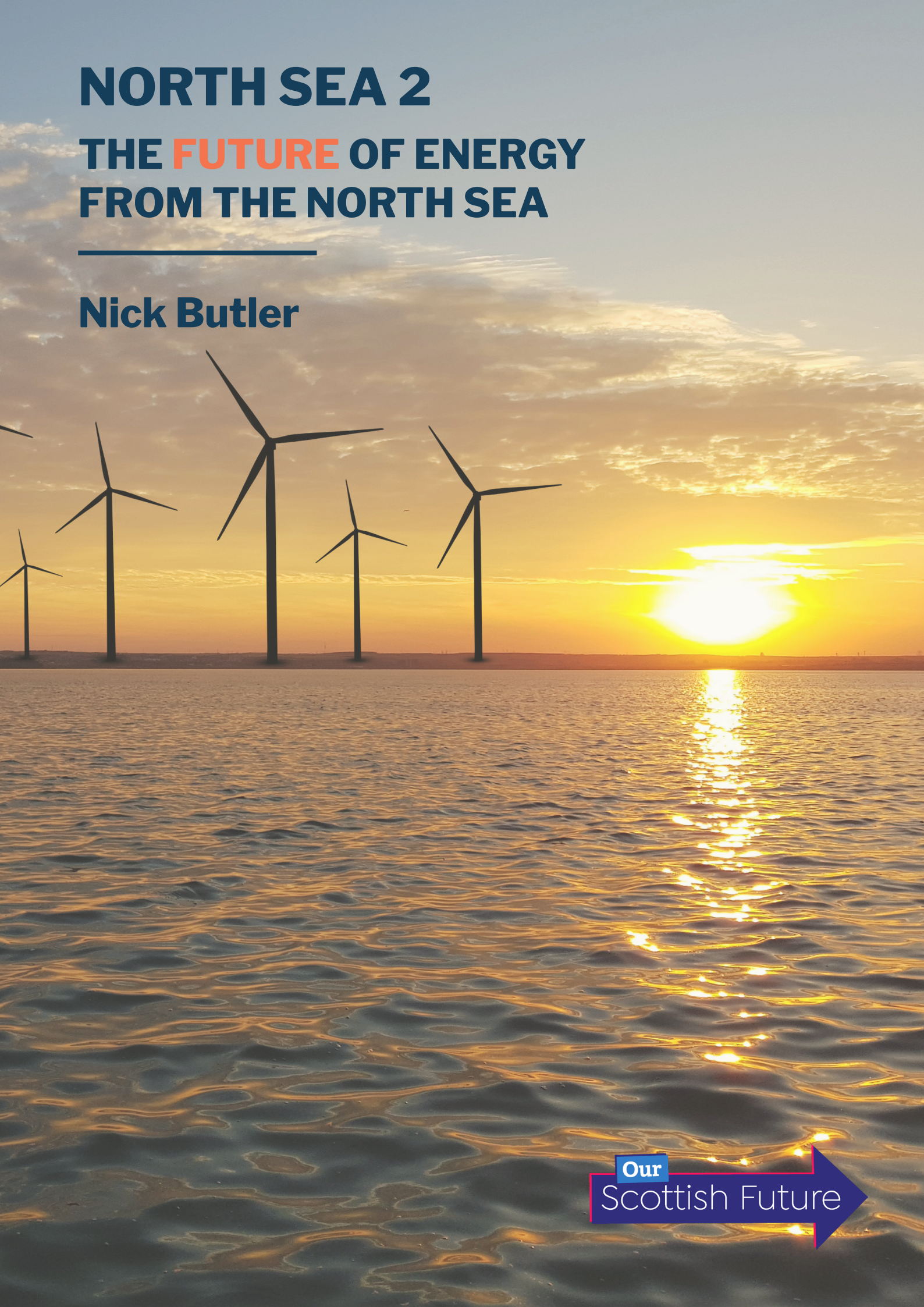
NORTH SEA 2

THE FUTURE OF ENERGY FROM THE NORTH SEA

Nick Butler



Our Scottish Future

About the Author

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Foreword by Gordon Brown

So much debate has focused on the decline and decommissioning of the first generation of North Sea production that the huge opportunities that could come from a second generation of North Sea developments have often been obscured and neglected.

A North Sea grid, the North Sea 2 project, is an idea whose time has now come and instead of us being resigned to fewer jobs and wealth coming from the North Sea in the years to come -and the job numbers running down from the current 120,000 - I can see the combination of three sources of energy- wind power, carbon capture and storage and hydrogen - generating more income and employment and Aberdeen enjoying a second renaissance as a centre for the new North Sea of the future. The challenge is to manage a progressive transition - allowing North Sea oil and gas to be replaced by low carbon activity which uses the skills and repurposes the infrastructure of the North Sea platforms, pipelines and onshore facilities. That will protect jobs and the offshore supply chain which operates across Scotland and the rest of the UK and will create a new 21st century industrial base which can be deployed internationally as other countries seek to make best use of their own offshore potential.

At the moment, the connections across the North Sea are almost all related to the oil and gas fields with just a small number of interconnectors transmitting electricity between, for instance, Britain and France and Norway and Britain. A full North Sea grid would incorporate those point-to-point links and create additional links between a set of offshore wind farms into a single system. That would allow us to take full advantage of the one resource in the North Sea that the current government is failing to exploit to the full - wind, which blows more severely and consistently in the North Sea. A North Sea grid in its own right, connected not just by physical infrastructure but by technology through a central control system, could harness the wind more effectively and manage this supply of additional energy, distributing energy in a way that does more to compensate for the intermittency of onshore wind and yet maximises the use of existing reserves and thus increases their productivity. At the moment, the development of the offshore wind sector is stalled because the grid here in the UK cannot take in new supplies quickly, because there are planning constraints on bringing the power from offshore wind onshore, and because of supply chain challenges which are pushing up costs because they are yet to be addressed cost effectively. A new government must solve those problems if we are to reach our existing targets, including the target of net zero by 2050. We could also develop the emerging technology of floating wind where facilities are tethered to the sea-bed but without the massive platforms which are not viable in ultra deep waters. The important technological breakthroughs now being made possible in the use of floating wind turbines make it possible to maximize the production of wind from the deepest waters in the region, where the wind is strongest and most consistent.

Floating wind could add to supply to the point where over the next decade or so, offshore wind becomes a greater source of energy supply for the UK than the remaining oil and gas production. The loose target set by Boris Johnson for 50GW installed capacity by 2030 was never backed by substantive plans but unless we successfully develop offshore wind we will remain dependent on gas supplies and vulnerable to international price volatility.

That must be a priority, but North Sea 2 has even greater potential if we can link all the supplies in a single network across the North Sea with connections to all the countries which can produce clean power with all those who need low carbon electricity. Creating that network would help deliver energy security because once we add hydrogen and carbon capture to wind offshore there would be multiple sources of supply. And it would help decarbonization because the new secure supplies would encourage the electrification of the economy, which is a critical part of getting to net zero.

Large scale development of offshore wind could enable us to develop the production of hydrogen using surplus low carbon power allowing hydrogen to play a direct role in the transition of sectors which are not easily electrified.

An offshore electricity network is important but is not the limit of what could be done in the North Sea. We could also develop the infrastructure to capture, transmit, and then store carbon in the depths of the North Sea, removing the emissions from on-land sites and putting them into oil and gas fields which have now been depleted. All too often, carbon capture and storage plans and projects have been subject to stops and starts. Longannet was scrapped in 2011, and then the Peterhead plan was dropped in 2015. But in "Thoughts on the UK's CCS Outlook" in November 2021, the UK said it aimed to capture and store 20-30 million tonnes per annum (mtpa) of CO2 by 2030, creating the foundations for future investment and potential export opportunities. Overall, there is enormous potential for CO2 storage in the UK Continental Shelf.

As North Sea oil and gas declines, North Sea 2 provides an extraordinary opportunity to boost Britain's energy security and benefit to our balance of payments with the gains that come from making the energy transition, maximising the use of wind and delivering carbon capture and storage, making the North Sea a European hub for both to the benefit of the whole country.

So with these changes we will see falling carbon emissions as oil and gas become a smaller part of British energy supply and we could at the same time immediately decarbonize existing North Sea platforms, by using wind and renewables to power their use, thus cutting their carbon imprint.

Norway is ready to discuss a North sea grid. Germany has already said it favours such a venture. All the European Union countries including France, Germany, Belgium, and the Netherlands close to the North Sea have much to gain from such an enterprise. Now that the UK has rejoined the North Sea's wind cooperation group and put offshore wind projects out to tender in a more commercial way, we could start to move forward with confidence.

It is true that Britain has lost out on the manufacturing side of renewables and nuclear. Not one of the world's 20 largest wind turbine manufacturers is based in the UK. The main elements of the Hinkley Point nuclear reactor are designed and built in France. Energy grid technology is dominated by Chinese companies and by the recent joint venture between Hitachi and ABB other than Rolls Royce's small modular reactors, which are inexplicably being held up by indecision on the part of the UK Government. But there are areas where Britain can gain industrial advantage and here in Scotland, we have the potential to be a leading player - from floating wind, storage technologies and hydrogen as well as the manufacture of electrolysis for green hydrogen.

By leading on the North sea grid and making Aberdeen its centre, Britain can be at the forefront of global progress in both offshore wind technology and carbon capture and storage.

Great British Energy, a bold new imitative proposed by Ed Miliband, the shadow secretary of state of climate change and net zero, could be at the heart of these steps. Through a set of strategic investments which serve both energy security and industrial potential, it could help ensure that most of the jobs created by that investment are located in Britain.

Grids and networks have been very important in economic history - the Romans built roads, the Victorians built railways and the sewage system, and our post 1945 world built telecoms systems, long distance energy supply lines; pipelines, grids and LNG and then the internet. Linkages such as these change the pattern of trade and alters the economics of that trade. If we do this well, North Sea 2 could be even more successful for Britain than North Sea 1.

Introduction

The North Sea has the potential to become a major source of low carbon energy supplies for the UK – making a substantial contribution to the energy transition and to the UK's energy security and in the process creating large numbers of skilled jobs. Given the enduring nature of those low carbon supplies this could create a source of wealth for the UK even greater the amount produced over the last half century through the development of North Sea oil and gas. Success in delivering this potential would give the UK the opportunity to help other countries develop their own offshore resources creating a substantive global business and materially helping to achieve net zero internationally.

Success depends critically on managing the transition from the present pattern of activity, centred on oil and gas, to a new pattern which makes use of the existing skilled workforce, the industrial base and supply chain which has been built over the last 50 years and wherever possible the infrastructure of pipelines, platforms and onshore processing facilities which is place. The North Sea should not be run down or dismissed as a historic feature of an energy economy built on fossil fuels. A gradual balanced transition is needed. The profits and revenue from continuing oil and gas development should fund the next generation of low carbon activity which can create North Sea 2. The design and development of an offshore industrial sector to take advantage of the opportunities available should be a priority for Great British Energy.

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The low carbon development of the North Sea is not a new idea. This paper draws on the numerous papers and studies which have been published in recent years and the work of many companies already operating in the sector. The possibilities are real but now need to be brought together in a form which establishes an environment in which the potential which exists can be realised.

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To achieve the potential should involve maximising the use (and where necessary the repurposing) of existing offshore and related onshore facilities, including platforms and pipelines, avoiding the possibility of those facilities being closed as existing oil and gas production declines.

North Sea 2 - The Benefits

The **potential benefits** of North Sea 2 flow from:

- **The development of power lines creating a market in electricity between the different countries bordering the North Sea**. Five electric power lines already exist including the IFA lines between France and Britain and the Nordic line which carries power to the UK from Norway. More are planned. With the development of power production from offshore wind projects in different areas of the North Sea and potentially excess supplies of hydro power from Norway the opportunity exists to create a fully integrated grid providing supplies of low carbon power from multiple sources. Such integration would enhance the security of supplies and reduce the need for back-up generating capacity – currently mainly supplied by gas fired power plants.

- **An expansion of Offshore Wind can be further developed through the use of floating wind turbines** which can be located in more distant areas where the wind is stronger and blows more consistently. Floating wind – tethered to the sea base but not requiring fixed installations – could be deployed in areas beyond the reach of the existing offshore wind facilities.

- **The development of Carbon Capture and Storage facilities** – taking the carbon resulting from the use of fossil fuels and burying it in secure geological sites rather than allowing it to be emitted into the atmosphere. With oil and gas for the moment continuing to supply the majority of energy needs in the UK and (alongwith coal) across the EU carbon capture will be essential if UK and European targets for reductions in emissions are to be met. The North Sea contains numerous potential sites for such storage.

- **The development of Hydrogen as a means of decarbonising sectors of the economy such as manufacturing industry and transportation where electrification is not yet a feasible option**. Hydrogen can be produced from multiple sources. Blue hydrogen produced from natural gas is the main option at present but with the development of increasing volumes of power generated from renewables the potential exists for the production of green hydrogen, which can be produced without emissions.

Realising these opportunities will require the development of offshore infrastructure, an upgrading of the onshore grid and a matching process of transition on the demand side of the energy market enabling households and businesses to switch from fossil fuels to low carbon sources of supply. The range of activity will generate extensive supply chains.

The Oil and Gas Technology Centre estimate is that as many as 200,000 high skilled jobs will be created through the full development of the opportunities available.

In addition there is a substantial opportunity for research and development in the UK to find solutions to the challenges – particularly in respect of cost – which are holding back the transition to low carbon. A study produced by Wood Mac for the OGTC identified a range of areas where technical innovation is required including the integration of offshore power with the existing grid, the digitalisation of the supply system, the development of the hydrogen supply chain including transportation and storage and improvement of the understanding of CO2 reservoir behaviour. In addition work is needed to design offshore energy hubs which can combine the operation, production storage and transportation of all forms of supply.[1]

Work in these areas of innovation will also provide high quality jobs and global export opportunities.

The renewal of North Sea energy development in this way is possible and practical but must be managed with care.

- The transition cannot be achieved instantly but can build upon the limited projects already in place.

- The investment required will only be available if private sector participants have confidence in the stability and continuity of policy and Government support. One potentially important measure would be the establishment of a distinctive tax regime for the UKCS with the objective of maintaining and growing activity across the energy sector.

- The full potential can only be achieved if the skills which already exist in offshore development are retained, and where necessary renewed to match the new areas of activity. The industrial base which has supported oil and gas development over the last half century in Scotland and the North East of England in particular must be retained and refocused.

- To achieve the potential should involve maximising the use (and where necessary the repurposing) of existing offshore and related onshore facilities, including platforms and pipelines, avoiding the possibility of those facilities being closed as existing oil and gas production declines.

- Making use of existing facilities wherever possible will reduce the risk of a surge of decommissioning activity which given the existing tax system would place a significant burden on the UK Exchequer. A managed transition also matters for financial reasons. Under the North Sea tax regime developed in the 1970s the costs of decommissioning oil and gas fields which cease production falls in part of the UK Government – with the companies reclaiming tax previously paid. This process has already begun – eg at Shell's Brent field – but there is much more to come. An estimate by the North Sea Transition Authority published in 2022 suggested that the total industry costs between 2022 and 2067 for decommissioning all upstream UK oil and gas infrastructure would be £ 46bn. The Exchequer cost in the form of tax repayment and reduced income from Offshore Corporation Tax is estimated at £ 21.8bn. The risk is that these costs will come much sooner if investors decide that the limited opportunities and the political risks attached to further investment in oil and gas development do not justify any further substantial spending. If as a result they choose to initiate the decommissioning process the costs to the Treasury through the next Parliament would be considerable.

- Existing oil and gas production from the UKCS will continue to decline. Existing fields are mature and new developments under existing licences will be smaller in scale making their viability more dependent on global prices. UK oil and gas demand has also begun to fall but still accounts for for 80 per cent of final energy requirements. That number will decline as the energy transition proceeds but authoritative forecasts covering a range of scenarios from the Committee on Climate Change suggest that the UK will continue to use oil and gas to meet between 47 and 54 per cent per cent of its energy needs for the next thirty years. Over the next ten years that figure on the CCC's "balanced scenario" oil and gas are modelled to account for 72 per cent of cumulative energy demand.[2]

Even if in due course electricity is completely supplied from low carbon sources major sectors of the economy including industrial use and freight transportation will still rely on oil and gas. The UK therefore has every incentive to maintain production of oil and gas from the UKCS whilst working to accelerate the transition to a lower carbon economy. This twin stepped approach will help as far as is possible to insulate the UK from the volatile international energy markets.

- So long as oil and gas remain significant sources of supply it will be important to reduce the emissions from their production and use. The development of North Sea 2 will help both by providing the means of capturing and storing carbon and by providing offshore power which can be used to replace the fossil fuels currently used to run production facilities.

> ***The development of North Sea 2 will not eliminate the use of oil and gas but will speed the transition away from fossil fuels by supporting the development of alternatives and will bring forward the moment at which dependence on oil and gas imports can be reduced. That is the real test of the value of the development.***

As things stand the UK's development of the North Sea's low carbon potential is limited and well behind the level of activity evident in other littoral states.

A number of local projects are under development.

In **Humberside** a set of developments are planned including the capture of CO2 from power generation, fuel production and industrial process across the region which will be stored offshore under the Southern North Sea and the development of hydrogen for use, blended with natural gas for home heating and in industrial manufacturing where high temperatures are required as in steel and chemicals.

On **Teeside** infrastructure is being developed to enable the CO2 produced in the operations of a range of local businesses to be captured and transported to secure offshore storage in the North Sea. Net Zero Teesside Power will be the first of a kind gas fired power station linked to this carbon capture and storage facility and capable of providing low carbon back up to intermittent forms of renewable energy such as wind and solar.

In **Aberdeen** the Hydrogen Hub aims to deliver scalable, green hydrogen supplies plus storage and distribution facilities beginning with a refuelling facility for buses and trucks powered by a solar farm. The aim is to expand the project in phases – adding both production from offshore wind and new users in the road, rail, freight and marine sectors.

At Sullom Voe in Scotland EnQuest are in the process of adapting the terminal which has been processing oil since the late 1970s to enable the site to host new energy opportunities such as hydrogen production. They are also exploring the potential for a connection to the Shetland grid which would allow the terminal to operate on sustainable electricity from onshore wind farms.

These projects are additional to the 44 offshore wind farms now in operation which have the capacity to produce some 12.7 GW of power. Several more offshore wind farms others are at various stages of planning and development although a number of these projects are struggling to get connected to the UK's onshore power grid.

All these projects provide valuable learning experience but fall far short of the potential. Larger scale and more advanced projects are being developed in other countries bordering on the North Sea

- In **Denmark**, one of the world's leading suppliers of wind turbine technology, Orsted and its partners are planning the world's first offshore energy island – 100 km off the Danish coast. Facilities on the island which will sit between 10 offshore wind farms will collect and distribute large amounts of green energy to Denmark and into the European market. With a capacity set to rise from an initial 3 GW to 10 GW the island will also have facilities to convert the green electricity produced into fuels for use in aviation and sea transport.

- In **Germany** the challenges of identifying suitable areas for onshore wind has led to a surge in offshore developments – with a target of 70 GW of offshore capacity in German waters by 2045. Because of the limited offshore acreage available in German waters many projects are based on joint ventures with neighbouring countries. Artificial offshore islands are being planned to allow offshore conversion of the power produced to direct current and to provide facilities for the production of hydrogen.[3]

- Leadership in offshore development, however, undoubtedly lies with **Norway**. Carbon capture and storage began in 1996 and the facilities at Sleipner and Snohvit are currently the only two currently operational CCS projects in Europe. The Northern Lights facility will add substantially to the amount of carbon stored. Norway is also the world leader in the development of floating wind technology and is home to the leading centres of research across a range of offshore low carbon technologies. In addition the Norwegian maritime industry is the focus of developments to covert the country's extensive network of more than 200 ferries from their current reliance on diesel oil to the use of hydrogen.

In all three countries climate change is seen not as a burdensome challenge but as a commercial and industrial opportunity.

It is noticeable that many of the low carbon projects which are under development in the UKCS are being led by companies based in Norway and Denmark. Such projects do create jobs in Britain but the skills, experience and industrial leadership – and therefore the potential for exporting the technology beyond the North Sea - will be located elsewhere.

Unless the UK acts now much of the economic potential of the North Sea will be developed from outside Britain. The result of that would be that the UK's move to Net Zero will continue to rely on imports.

If that happens the number of North Sea related jobs will fall as oil and gas production declines. Facilities such as Grangemouth will be closed or be reduced to being no more than import terminals.

The supply chain created over the last half century which reaches across the UK will shrink. The economic benefit to particular areas including the North East of Scotland and some regions of England will be lost and the UK Government will be faced with paying their share of the cost of decommissioning North Sea oil and gas facilities as production comes to an end.

These risks are already evident. In the absence of a coordinated transition plan there are clear signs that companies are holding back from investment and reassessing the value of maintaining current levels of operation. At a moment which private investment is essential to stimulate growth and revive the UK economy the loss of such companies would be very damaging.

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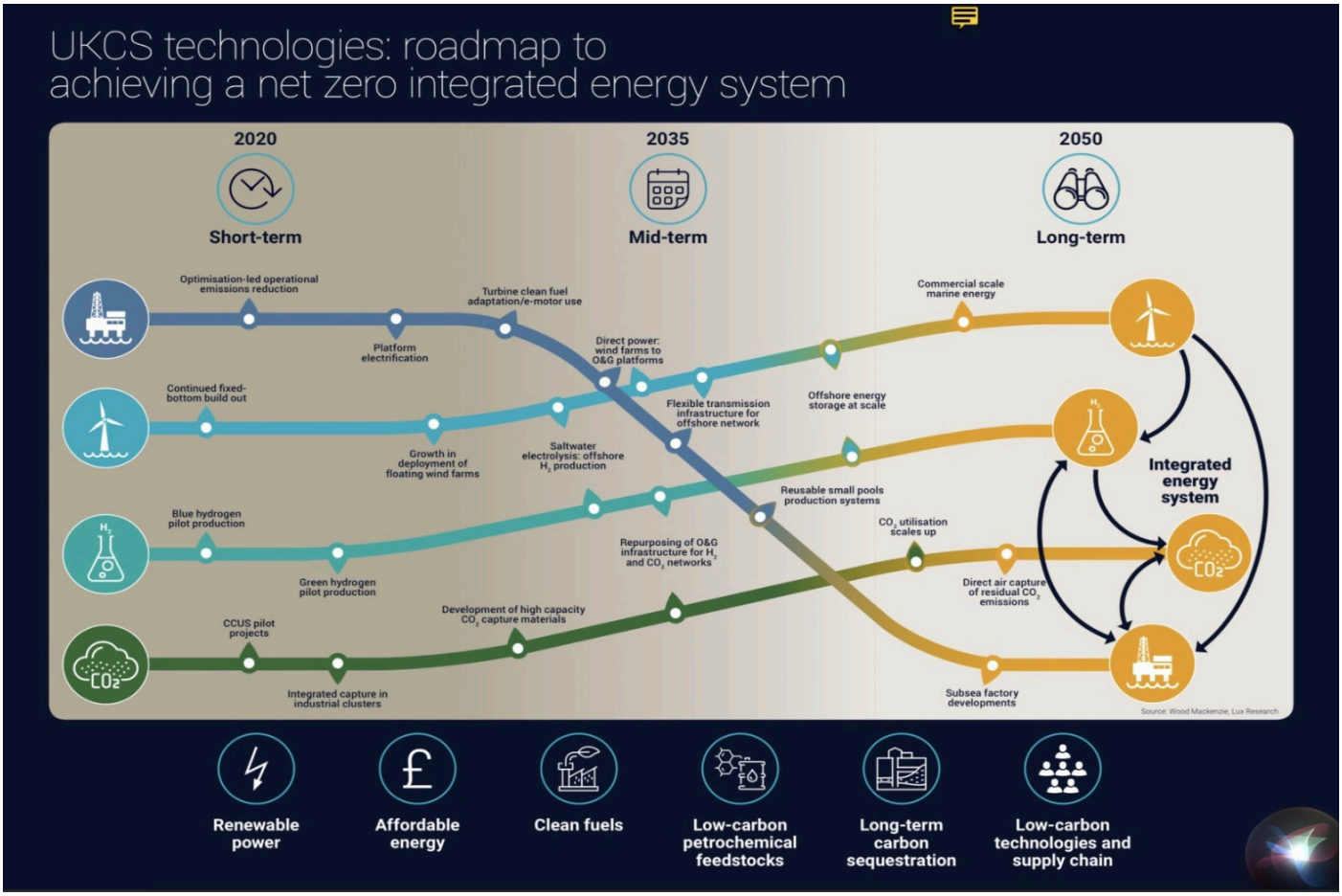
Country by country development of low carbon opportunities has begun but the greater prize lies in the creation of networks which are linked across the whole of the North Sea.

Offshore hubs, similar in concept to the one now being developed off Denmark could provide gathering points reducing the costs of constructing multiple direct lines from offshore wind and other facilities to the shore. Such hubs could be linked across the North Sea enabling all the available resources to be managed as a single system – reducing costs and providing an added level of energy security. Hubs could be used to help the remaining oil and gas producers to decarbonise the running of their platforms and production facilities as well as providing electric power for the production of hydrogen.



This graphic produced by the OGTC illustrates the scale of the potential over the short and medium term.

Some limited initial steps are already being taken.

The North Sea Transition Authority has developed a new tool designed to maximise the repurposing of existing oil and gas infrastructure for the purposes of the energy transition. As fields near the end of their producing lives operators will be required to identify opportunities prior to proceeding with full scale decommissioning. NSTA's own work suggest that more than 100 projects and facilities could be suitable for CCS or hydrogen developments.[4]

One early example of this approach in practice is the plan being developed by ENI to reuse existing pipelines and platforms for its Liverpool Bay CCS project, part of the HyNet CCS and hydrogen scheme. The CCS project itself will use the Lennox Hamilton North and Hamilton field structures.[5]

Another interesting example of what is possible is the proposal which is under discussion in Germany for a hydrogen pipeline from the UK which could harness our extensive offshore wind potential to produce hydrogen, which Germany will need to import as it goes through its own energy transition.[6]

The initial steps being taken are encouraging but represent only a fraction of the potential. 50 years ago when the first oil and gas projects began to be developed in the North Sea no one envisaged the scale of what could achieved over time. Now there is an opportunity not only to rescue the North Sea from decline but also to use the natural resources of the area not only to create jobs and produce revenue but also to enhance energy security and cooperation with our neighbours and to make a lasting and unique contribution to addressing the challenge of climate change.

Great British Energy

Great British Energy should have a crucial role – in designing the system, linking it to energy markets in this country and elsewhere, and in establishing a common approach with the other littoral states.

Investment from the private sector will depend on the level of confidence in the direction of energy policy.

GBE could provide investment guarantees and could take the leading role in building alliances with comparable state-owned companies in countries such as Norway and Denmark. Great British Energy should also coordinate the necessary scientific and technical research which is needed in the areas where costs remain a barrier to development.

GBE's role would help ensure that investors have the confidence to fund the development of the new energy system.

GBE should be charged with creating and then implementing a low carbon development plan for the UKCS and in conjunction with others for the wider development of the full North Sea potential. This should build on the projects already underway but be driven by the ambition to see North Sea 2 built over time so that it can form a full-scale replacement for both the energy supply and economic benefit which has been created by the existing offshore oil and gas production business.

Conclusion

The costs of developing North Sea 2 to its full potential are considerable but the development will be spread over many years and as with the development of the oil and gas produced over the last half century will rely on private capital invested in individual projects. The role for Government and for entities such as Great British Energy should be to establish a clear and enduring fiscal and regulatory framework within which such investment can begin.

Endnotes

1 https://woodmac.wistia.com/medias/ofylc8uwyl
2 https://oeuk.org.uk/energy-demand-scenarios-a-window-into-the-future/
3 https://www.cleanenergywire.org/factsheets/german-offshore-wind-power-output-business-and-perspectives
4 https://www.nstauthority.co.uk/news-publications/new-tool-to-maximise-infrastructure-repurposing/
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6 https://www.politico.eu/article/germany-and-uk-in-talks-over-400-mile-hydrogen-pipeline-under-the-north-sea/

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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