Powering our Net Zero Future- December 2020 White Paper

Executive Summary

Topic	Key Highlights
Decarbonising Energy/Industry- Wind Power	40GW of offshore wind targeted by 2030; 1GW of floating offshore wind targeted by 2030; Offshore Transmission Network Review to improve connection between offshore wind and national grid; Offshore wind to power zero carbon hydrogen + oil and gas floating platforms; Funding available as part of £505m Energy Initiative.
Decarbonising Energy/Industry- CCUS	Aim to capture 10Mt of carbon by 2030; All new gas power plants must be CCUS compatible; First utilization of CCUS in 4 industrial clusters including Net Zero Teeside; £100m fund for Direct Air CCS (DACCS), BioEnergy CCS (BECCS) and other Greenhouse Gas Removal technologies; DACCS and BECCS seen as long-term alternative heat generation/ capture technologies.
Decarbonising Energy/Industry- Hydrogen	UK is a current world leader in hydrogen production, but must up its production from 27TWh to nearly 10x that by 2050; 5GW of hydrogen production capacity by 2030; Hydrogen strategy to be released early 2021 by Government; £1bn investment into hydrogen + CCUS in 4 industrial clusters (Net Zero Teeside is one); Hydrogen to be used for industrial power, but potential also for heating & transport; £240m net-zero hydrogen fund through to 2024-25 to reduce dependency on fossil fuels for hydrogen production.
Decarbonising Transport	End of new petrol and diesel cars and vans sales by 2030; £1.3bn to support Electric Vehicle (EV) charging sites in homes; £582m in grants for those buying zero or ultra-low emission vehicles; £0.5bn for development and production of EV batteries over next 4 years; Bus2Grid system being looked, where bus batteries can help the grid in times of need; £20m fund for innovation to support net-zero HGVs; £40m innovation for best mine/off-road vehicle net zero solution; Most commuter rail systems to be made electric where feasible; £20m Clean Maritime Demonstration Competition for development of clean maritime technologies.
Green Buildings	Buildings a major source of greenhouse gas emissions, 2nd only to transport; Residential buildings to be converted to EPC Band C where economically viable by 2035; All non-residential rented properties to be converted to EPC Band B where economically viable by 2030; Several heating technologies to be trialled and rolled out, but with an emphasis on eradicating heat poverty;

	Heat pumps installations to be increased from 30k per year to 600k per year by 2028 with 20.8m sales by 2030; Biomethane could be potential replacement for conventionally produced gas for greener heating; Hydrogen to be trialled as part of Hy4Heat, with a call for evidence in late 2021; Heat networks to be set up with £122m of funding with local authority zoning by 2025, with an aim of 0.5m homes heated this way; Green Heat Network Fund and Heat Networks Investment Project together will have £590m of funding for rolling out of heat networks.
Supporting Oil and Gas Industry Transition	Emissions from offshore production and operations need to be 0.5MtCO_2e by 2050 from 19MtCO_2e in 2020; UK signed up to zero routine flaring by 2030; OGUK's Roadmap 2035, setting the challenge of having 50% less absolute emissions by 2030 and 90% less by 2040; Funding for a global underwater hub for Aberdeen to be announced with satellites in the North East and South East.
Modelling Energy	Government to set up and test a new protocol for model publication, with exemption of models in development or with sensitive information; Run modelling improvement competitions to leverage 3rd party knowledge, running a competition to improve the modelling at the heart of the BEIS Energy Demand Model; IT strategy to make modelling easier by harmonising development models and languages.

This is the Centre for Energy review of UK Government targets and funding opportunities outlined in the *Energy White Paper*[1], which was presented to Parliament in December 2020 by the Secretary of State for Business, Energy and Industrial Strategy.

[1] Energy White Paper (publishing.service.gov.uk)

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DECARBONISING INDUSTRY AND ENERGY- OFFSHORE WIND

OFFSHORE WIND TARGET IS 40GW, BY 2030, INCLUDING 1GW OF FLOATING OFFSHORE WIND

The renewable capacity of offshore wind in the UK was 10GW in 2019, a 9GW increase since 2010. The *Energy White Paper* set an aspirational target for offshore wind capacity of 40GW by 2030. The Government's 10-Point Plan highlighted floating offshore wind as a priority area, for a £1bn Net Zero Innovation Portfolio. The 40GW offshore wind energy target includes 1GW of floating offshore wind capacity. The Offshore Wind Enabling Actions programme is a £4.3m initiative to be run jointly by Defra and BEIS and funded by HM Treasury (HMT). An additional £160m funding was announced in October 2020 for the development of major port-side infrastructure hubs.

The planned rapid increase in offshore wind manufacturing, should increase annual exports of offshore wind goods and services to a value of £2.6bn, by 2030. Offshore wind is a key renewable energy, estimated to support 7,200 direct jobs, with a major industry on the north east coast of England. The planned investment will support offshore wind capacity to quadruple by 2030, backing new innovations and ensuring 60,000 jobs by the offshore wind sector by 2030, with potential for growth of the North East ports and coastal regions.

OFFSHORE ELECTRICITY TRANSMISSION NETWORKS between offshore windfarms and the onshore grid

The Offshore Transmission Network Review was launched to improve the delivery of transmission connections for offshore wind generation. This will consider the full impacts on affected communities, particularly on the east coast of England, while making sure the whole of the UK benefits from a more strategic approach. The potential of hybrid, multi-purpose interconnectors are already being explored, to get the most from offshore wind and transmission assets. These hybrid projects could integrate the transmission links needed to connect offshore wind to the grid with interconnectors to neighbouring markets.

OFFSHORE WIND IN CLEAN HYDROGEN PRODUCTION – innovation opportunities

Experts and scientist involved in offshore wind could benefit from other funds, around the interconnectivity of energy sources. For example, funding is available that supports innovation and development to integrate clean hydrogen electrolysis units with offshore wind facilities. Such methods of production would be capable of producing zero carbon hydrogen. Funding will become available as part of the £505m Energy Innovation Programme.

OFFSHORE WIND to power offshore oil and gas facilities

Regulatory and policy barriers will change rapidly, to support the use of clean electricity, such as offshore wind, to power offshore oil and gas facilities, as opposed to the current practice of using diesel or gas generators on platforms.

NEWCASTLE UNIVERSITY EXPERTISE IN OFFSHORE WIND

Subject	Staff	Expertise
Offshore wind	Dr Rose Norman	Turbines and electricity systems
	Dr Wenxian Yang	Offshore renewable energy
	Dr Pengfei Liu	Modelling renewable turbines
	Dr Mohamed Rouainia	Offshore windfarm geotechnical design
	Dr Tom Charlton	Offshore windfarm geotechnical design
	Dr Iain Evans	Renewable energy systems
	Prof Zhiqiang Hu	Offshore wind structures
Offshore wind networks	Dr Sara Walker	Supergen Energy Networks Hub
	Dr David Greenwood	Network losses

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DECARBONISING INDUSTRY AND ENERGY- CCUS

Carbon Capture, Utilisation and Storage (CCUS) is heavily featured within the *Energy White Paper.* It is seen by the Government as a key contributor in delivery of net zero energy and in providing value to the British economy. One key aim is to capture 10Mt of carbon dioxide by 2030. The added value of CCUS to the British economy is believed to be £3.6bn in export of services and skills by 2030. The Government aims to complete one gas-fired power station with CCUS by 2030, supported by the development of a new framework, which improves upon current Contracts for Difference. The first utilisation of CCUS is to be within four industrial clusters across the UK (see below). In these projects, CCUS is to sequester the CO_2 in depleted conventional oil and gas reservoirs (in the North/ Irish Sea), to enable cleaner electricity generation for industrial use in these clusters (chemical, engineering etc.).

Along with the development of conventional CCUS, the *Energy White Paper* suggests that negative emissions technologies are to be introduced. Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS) are the key technologies to be developed through capital investment, of which £100m has been assigned for funding of research. BECCS is believed to be a key contributor to the energy transition going forward, using waste biomass, providing green hydrogen, waste management and in heat for industrial process.

FUNDING OPPORTUNITIES

The Industrial Decarbonisation Challenge is a Government and UKRI initiative to develop one low-carbon industrial cluster by 2030. The challenge is split into 3 workstreams: deployment, cluster plans, **industrial decarbonisation research and innovation centre**. This is part of a £1bn[2] investment into CCUS industrial clusters. Projects so far are: Scotland's Net Zero Infrastructure; Net Zero Teeside; Humber Industrial Decarbonisation Deployment Project; HyNet CCUS; South Wales Industrial Cluster. The Government is committing to spending up to £100m from BEIS Energy and Innovation Programme to support CCUS innovation and deployment.

NEWCASTLE UNIVERSITY EXPERTISE IN CCUS, BECCS and DACCS

Subject	Staff	Expertise
CCUS	Dr Cees van der Land	Microbe-mineral interactions and biofilms, geomechanics
	Dr Mark Ireland	Deformation, fluid flow, and heat flow in rocks
	Prof Richard Davies	Geological Storage Characterisation
	Dr Mohamed Rouainia	Computation modelling of the sub-surface
	Dr Tom Charlton	Computational & experimental approaches in geomechanics
	Prof Frank Sargent	Hydrogen-dependent carbon dioxide reductases
	Dr Da Li	CO_2 conversion
	Prof David Manning	Soil science & geochemistry
	Prof Ian Metcalfe	Hydrogen from methane & catalysis
	Prof Lidija Siller	Nanoscale science & nanotechnology
	Dr Ben Wetenhall	Carbon dioxide transportation
	Dr Greg Mutch	Gas separation sorbents/membranes
	Prof Lidija Siller	CO_2 mineralization
BECCS	Prof Ian Head	Geomicrobiology/ microbially mediated processes
	Dr Jonathan Lee	Biofuel & chemical production from algae
	Dr Anh Phan	Biofuel processing/ plastic waste treatment
	Dr Fernando Russo Abegao	Bio-renewable chemical/ fuels
	Dr Sharon Velasquez Orta	Biofuel & sustainable energy systems
	Prof Adam Harvey	Biofuels, and biofuel combustion emission reduction

[2]Further confirmed in March 2021 publication of Industrial Decarbonisation Strategy (publishing.service.gov.uk)

DACCS	Dr John Errington Prof Frank Sargent Dr Greg Mutch Dr Wenting Hu Dr Evangelos Papaioannou Prof Lidija Siller	Metal alkoxides for catalysis As above Gas separation sorbents/membranes Gas-solid reactions, chemical reaction engineering Catalyst synthesis CO_2 mineralization

DECARBONISING INDUSTRY AND ENERGY- HYDROGEN

Hydrogen is to play a significant role in decarbonising the UK economy in the future, from utilising hydrogen in industry through to hydrogen-powered marine transportation. The UK aims to have 5GW of low-carbon hydrogen capacity by 2030, equating to 42TWh. This will support up to 8,000 jobs. This low-carbon hydrogen can be provided either by conversion of methane to hydrogen and then sequestration of the associated CO_2 or by electrolysing water into hydrogen directly. £1Bn is to be invested on innovating advanced nuclear and clean hydrogen. The government will be releasing a hydrogen strategy early in 2021, with the focus on making the UK one of the world leaders in hydrogen power. This strategy will outline the route from the current annual hydrogen production of 27TWh to the 2050 target in the CCC scenarios.

The UK must reduce emissions from industry by 90% from current levels by 2050, and hydrogen with CCUS is a strategy supported in the *Energy White Paper*. This involves £1Bn in investment into 4 industrial clusters (as described in CCUS section).

As well as utilising hydrogen for industry, and for electricity generation, the *White Paper* outlines plans to use hydrogen for residential heating. There is a need for R&D relating to hydrogen infrastructure, such as gas transmission networks and inter-seasonal storage. The government will support hydrogen-ready boilers, cookers and fires, based on evidence from the Hy4Heat programme. The government aims to trial a hydrogen neighbourhood by 2023 and a hydrogen village by 2025.

FUNDING OPPORTUNITIES

£240M Net Zero Hydrogen Fund through to 2024/25. This fund is to help establish hydrogen technology and ensure that low-carbon hydrogen can be utilised for decarbonising industrial clusters, to help establish new technologies, and ensure that existing mechanisms provide appropriate levels of support for renewable hydrogen.

EPSRC's portfolio research area for hydrogen and alternative energy vectors covers a range of outcomes, with the majority of funding currently on Fuel Cell technology, catalysis and surface science. Lower funding levels have been awarded to computational and theoretical chemistry, graphene and carbon nanotechnology, solar technology, end use energy demand, whole energy systems, infrastructure and urban systems and bioenergy.

NEWCASTLE UNIVERSITY EXPERTISE IN HYDROGEN

Subject	Staff	Expertise
Hydrogen	Prof Andy Benniston	Porphyrin derivatives for hydrogen production
	Prof Ian Head	Geomicrobiology
	Dr Cees van der Land	Reservoir and seal geology
	Dr Mark Ireland	Reservoir capacity with geophysics
	Prof Richard Davies	Geological seals
	Prof Frank Sargent	Hydrogen-dependent carbon dioxide reductases
	Prof David Manning	Soil science & geochemistry
	Prof Ian Metcalfe	Hydrogen from methane
	Dr Gareth Powells	Risk perception, acceptance and geographies of fear of hydrogen
	Dr Sara Walker	Chair of Energy Catalyst Hydrogen Working Group
	Laura Brown	Chair of Energy Catalyst Hydrogen Working Group
	Dr Wenting Hu	Hydrogen Production
	Dr Evangelos Papaioannou	Hydrogen production, catalysis and gas separation sorbents/membranes

DECARBONISING INDUSTRY AND ENERGY-NUCLEAR

Nuclear power currently delivers approximately 16% of UK annual electricity demand. Hinkley Point C is due to commission in the mid-2020s, delivering 7% of the UK's current electricity needs. However, due to the decommissioning of most of the current nuclear fleet by 2030, government analysis suggests additional nuclear power will be required in order to meet net zero targets by 2050. As such the Government aims to deliver at least one further large-scale nuclear project, bringing this through to the point of final investment decision by 2025, which is expected to support a peak of 10,000 jobs during construction.

ADVANCED NUCLEAR INNOVATION

Government to provide £385m of funding as part of the Advanced Nuclear Fund to enable the development of a Small Modular Reactor and Advanced Modular Reactor demonstrator by 2030. Of the £385m, up to £215m is to develop a domestic Small Modular Reactor design that can be built in factories and assembled on-site. This is expected to unlock £300m of private sector match-funding. £40m to be spent in developing regulatory frameworks supporting the supply chain. The remaining £170m is to fund R&D on Advanced Modular Reactors, with the aim of producing a demonstrator model in the early 2030s. Furthermore, the *Energy White Paper* outlines the goal of building a commercially viable fusion plant by 2040. This is based on the concept design Spherical Tokamaak for Energy Production (STEP).

FUNDING OPPORTUNITIES

£215m to develop a domestic Small Modular Reactor.
£170m to develop an Advanced Modular Reactor.
£40m towards developing regulatory frameworks and supply chains for nuclear energy.

NEWCASTLE UNIVERSITY EXPERTISE IN NUCLEAR

Subject	Staff	Expertise
Nuclear Power	Prof Neil Gray Dr Colin Davie	Microbial interactions within nuclear waste disposal sites Nuclear waste disposal

DECARBONISING TRANSPORT

The transport section of the *White Paper* has six strategic priorities.

1. Accelerating modal shift to public and active transport
2. Place-based solutions - addressing emissions at a local level, by understanding 'why' and 'how' emissions happen locally, and creating targeted support for local areas
3. Decarbonising goods deliveries
4. Decarbonisation of vehicles
5. Sustainable technology development and low-carbon innovation support
6. Reducing carbon in the global economy - lead international efforts in transport emissions reduction

The Department for Transport has commissioned a review of transport connectivity (Union connectivity review led by Sir Peter Hendy). The outcome of this review is expected in summer 2021, along with a Transport Decarbonisation Plan.

DECARBONISATION OF VEHICLES

The emissions from passenger cars and light goods vehicles make up over two thirds of all transport emissions, so decarbonising those forms of transport is a priority. The UK will end the sale of new petrol and diesel cars and vans by 2030, ten years earlier than previously planned. From 2035, all new cars and vans must be zero emissions at the tailpipe. To support this plan, the government has announced funding of £1.3bn to accelerate the rollout of charge points for EVs in homes, workplaces, streets and on motorways across England. All private EV charge points will be enabled for smart functionality (legislation planned for 2021), which will enable users to interact with the energy system, by charging or exporting energy to the grid. This smart charging and vehicle-to-grid technology can provide benefits for the consumer and the grid, enabling consumers to automatically charge when electricity is cheaper, or greener, while at the same time boosting the grid's resilience at times when supply is low and demand is high. The commercial passenger transportation system is also looking at bus-to-grid (Bus2Grid), to enable e-bus batteries to export to support the grid in times of high demand. £120m is planned in 2021/22 for investment in 4,000 zero emission buses. Furthermore, the *Energy White Paper* confirmed £582m in grants for those buying zero or ultra-low emission vehicles, and £0.5bn to be spent in the next four years for the development and mass-scale production of electric vehicle batteries (gigafactories). Accelerating the shift to zero emission vehicles could support around 40,000 new jobs by 2030.

DECARBONISATION OF HEAVY GOODS VEHICLES

A date for phasing out sale of diesel heavy goods vehicles (HGVs) will be consulted on. Currently, Battery Electric Vehicle (BEV) technology is ready to replace smaller HGVs in short distance and medium weight applications, such as urban distribution. However, the solution for larger, long- haul, road freight vehicles is not yet clear. £20m will be allocated for innovation to develop cost- effective, zero emission HGVs in the UK, for those applications which are not suited to BEV. A further £40m innovation programme will investigate the best fuel/vehicle combinations to decarbonise construction, mining, and other off-road heavy vehicles.

RAIL DECARBONISATION

Analysis suggests that electrification may be the best whole-life cost solution for more intensively used areas of the network, as well as for areas with significant freight flows and long-distance high-speed services. Emerging technologies such as battery traction and hydrogen rolling stock may offer alternative solutions for other areas of the rail network.

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MARITIME TECHNOLOGY

The Clean Maritime Plan is the Government's vision for the future of UK zero emission shipping, which includes a £20m Clean Maritime Demonstration Competition to support the UK design and development of clean maritime technology, including hydrogen.

AVIATION TECHNOLOGY

The Jet Zero Council was established to help develop the government strategy to reach net zero aviation. £15m is allocated for Fly Zero, and £15m to support the production of sustainable aviation fuels in the UK.

NEWCASTLE UNIVERSITY EXPERTISE IN TRANSPORT

Subject	Staff	Expertise
EVs/ Battery technology	Prof Ulrich Stimming	Electrochemical energy conversion & storage
	Dr Saisameera Mitta	Lithium-ion battery chemistry
	Dr Erli Lu	Alkali metal chemistry
	Prof Phil Blythe	Chief Scientific Advisor to DfT, Intelligent Transport Systems
	Prof Volker Pickert	EV drive trains
	Prof Barry Mecrow	Novel drive topologies, Driving the Electric Revolution (DER)
	Dr Stevin Pramana	Fuel cells
	Prof Paul Christensen	Fuel cells & electrocatalysis
	Dr Myriam Neaimeh	Electric vehicles & charging infrastructure
	Dr James Dawson	Battery, fuel cell and solar cell materials
	Dr Colin Herron	Low carbon vehicles, Zero Carbon Futures
	Dr Haris Patsios	Battery storage interaction with electricity networks
	Dr Mohammed Mamlouk	Energy storage and conversion by electrochemical technologies
Other Road Decarbonisation	Prof Margaret Bell	Transport, congestion modelling/ environmental impact
	Dr Thomas Zunder	Urban freight
	Prof Elisabetta Cherchi	Decision making for transport users
Marine Decarbonisation	Prof Alan Murphy	Airborne pollution from shipping
	Dr Kayvan Pazouki	Alternative fuels for shipping
	Dr Paul Stott	Economics of retrofitting low carbon technologies for marine
	Prof John Mangan	Environmental impact of supply chain logistics
Aviation Decarbonisation	Dr Peter Malkin	Hybrid electric aircraft technologies
Rail Decarbonisation	Dr Roberto Palacin	Energy efficiency of rail systems, mobility and sustainability
	Prof Mark Robinson	Material composites for rail applications

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DECARBONISING BUILDINGS

Buildings are the second largest source of emissions in the UK. 90% of homes in England use fossil fuels for heating, cooking and hot water. Of these homes, 16m are at Energy Performance Certificate (EPC) D or worse. The Future Homes Standard, to be implemented imminently, ensures all new-build homes are zero carbon ready. For retrofit, the plan is for as many existing homes as possible to be EPC Band C by 2035. Funding for this was announced via the £1.5bn Green Homes Grant Voucher (since the *Energy White Paper* some of this funding has been clawed back) and £0.5bn Local Authority Delivery Scheme. Meeting commitments to decarbonise the UK housing stock is estimated to cost £100bn of capital in the 2020s alone. The Government is further funding the Social Housing Decarbonisation Fund, which shall upgrade a significant amount of social housing to the minimum EPC Band C. Further details of this will be published in the dedicated Heat and Buildings Strategy due to be published 2021.

For the 1.8m commercial and industrial buildings, a focus must be on large premises of >1000^{2}m as these represent 10% of buildings but emit over half the total carbon. The target is for all rented non-domestic buildings to be EPC Band B by 2030, where cost-effective. For public buildings, £1bn has been announced for upgrade of schools, hospitals and other public sector buildings, with the Public Sector Decarbonisation Scheme.

DECARBONISING HEATING

A particular cause for concern is the lack of public awareness of low carbon heating with 1/3 of gas-users believing they have environmentally friendly heating. The *Energy White* Paper discusses heat pumps, biomethane, hydrogen and heat networks as approaches to decarbonisation of heating. The government will consult on whether it is appropriate to end gas grid connections to new homes, alongside support for heat pumps as an alternative. The target is to increase installations of electric heat pumps from 30,000 per year to 600,000 per year by 2028, supported by a proposed Clean Heat Grant. The growth in heat pumps, and electricity powered heating has implications for the electricity grid. Biomethane produced from processing biomass can be used as a natural gas replacement. A Green Gas Support Scheme (GGSS) is planned autumn 2021, running for 4 years, to support biomethane injection into the natural gas system. The GGSS could deliver annual generation of 2.8TWh of renewable heat, enough for 230,000 homes. Hydrogen could also be injected into the existing natural gas system. The *Energy White Paper* proposes a Hydrogen Neighbourhood trial by 2023, and a large Hydrogen Village trial by 2025. A
Heat Network Transformation Programme will be implemented with £122m of funding by 2025, as a successor to the existing £320m Heat Network Investment Project.

FUNDING OPPORTUNITIES

£122m heat networks, £1bn for public building retrofit, £2bn Green Homes Grant. Funding for hydrogen trial, including research and development for assessment of major hydrogen infrastructure and interseasonal storage.

NEWCASTLE UNIVERSITY EXPERTISE IN BUILDINGS

Subject	Staff	Newcastle Expertise
Green Buildings	Dr Ben Bridgens	Sustainable architecture
	Dr Neil Burford	Zero energy buildings
	Dr Neveen Hamza	Energy conscious façade design, impact of building regs
	Dr Mohammad Royapoor	Modelling building energy performance
	Dr Sara Walker	Active Buildings
	Dr Carlos Calderon	Spatial energy infrastructure planning
	Dr Kheng Lim Goh	Composite materials
	Prof Lidija Siller	Composite materials insulation, aerogels
	Dr Carlos Calderon	High rise building retrofits/ heat electrification

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Shared Heat	Dr Kew Hong Chew Prof Nilanjan Chakraborty Dr Mohammad Royapoor	Industrial heat demand Heat transfer and combustion modelling Modelling heat networks
Geothermal Energy	Prof David Manning Dr Mark Ireland Dr Sara Walker Prof Ole Pedersen Dr Mohamed Rouainia	Soil science & geochemistry Deformation, fluid flow, and heat flow in rocks Geothermal energy systems Energy law Computation modelling of the sub-surface

ASSISTANCE FOR THE OIL AND GAS INDUSTRY

In order to meet net zero, emissions from offshore production and operations for oil and gas need to be 0.5MtCO_2e by 2050 (from 19MtCO_2e in 2020). The UK has signed up to "zero routine flaring" by 2030 (a World Bank initiative). The industry has signed up to the OGUK's Roadmap 2035, setting the challenge of having 50% less absolute emissions by 2030 and 90% less by 2040. As part of this the industry must focus scope 3 (supply chain related emissions), as well as scope 1 (direct) & 2 (processing) emissions. Government will agree a North Sea Transition Deal in early 2021 focussing on the economic opportunities of net zero to the oil and gas industry. As part of this existing jobs are to be safeguarded. The transition deal will also focus on the low carbon export opportunities of the oil and gas industry. The Government also plans regulatory clarity for repurposing of end-of-life oil and gas assets for CCUS. A resilient supply of fossil fuels are still required during the transition to net-zero emissions, and alternatives to these are part of the strategy for decarbonisation of industry. Non-biogenic wastes are to be converted into fuels, which will require the processing skills present in the downstream oil and gas sector, for example.

FUNDING OPPORTUNITIES

Funding for a global underwater hub for Aberdeen to be announced with satellites in the North East and South East. These hubs focus on world-leading subsea engineering, technology and services.

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MODELLING ENERGY AND CYBER SECURITY

The *Energy White Paper* puts forward a new strategy to increase transparency and collaboration in modelling energy. As part of the new strategy the government aims to:

- Set up and test a new protocol for model publication, with exemption of models in development or with sensitive information,
- Update whole energy system models and their inter-operation,
- Develop an IT strategy to make modelling easier for analysts, contractors and collaborators by harmonising development models and languages.

As part of this strategy the government will aim to improve the access to existing models and newly released models including providing an open access data source for the National Household Model. The Government also aims to run modelling improvement competitions to leverage 3rd party knowledge, running a competition to improve the modelling at the heart of the BEIS Energy Demand Model.

FUNDING OPPORTUNITIES

Possible funding associated with being a 3rd party modeller of national energy budgets.

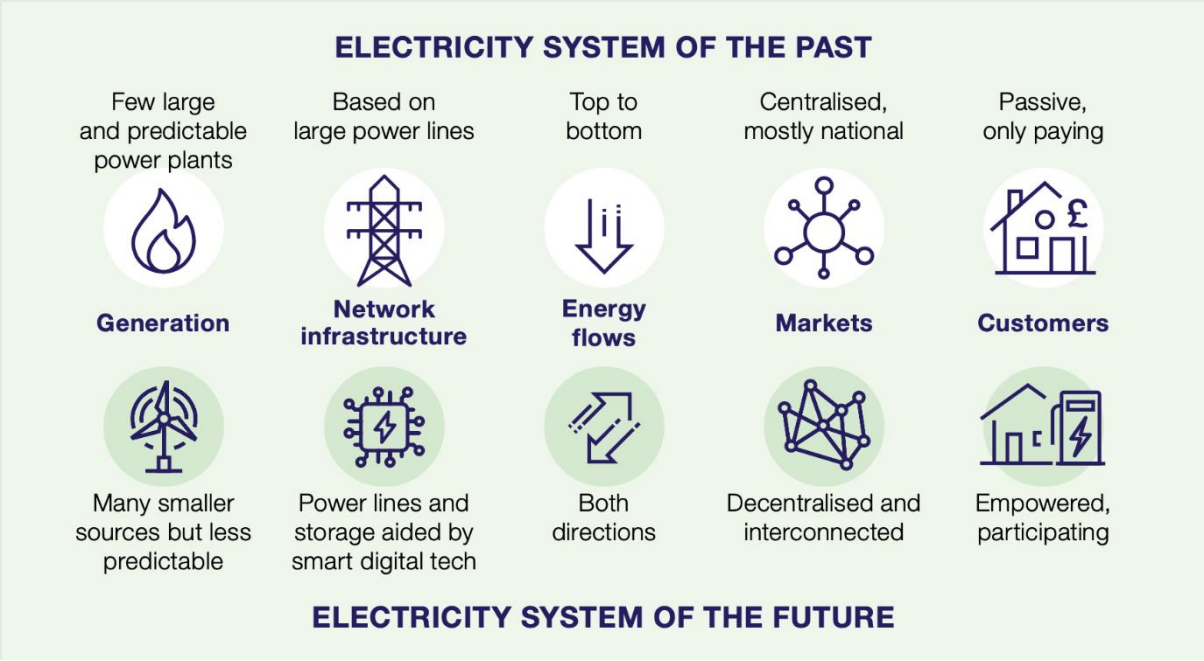
NEWCASTLE UNIVERSITY EXPERTISE IN ENERGY MODELLING

Subject	Staff	Expertise
Modelling Energy	Dr Kevin Wilson	Uncertainty estimation
	Dr Mohammad Royapoor	Modelling buildings/thermal energy
	Dr David Greenwood	Whole systems approaches to energy
	Dr Marcos Santos	Electric power systems, modelling and AI
	Ali El Hadi Berjawi	Integrated Whole Energy Systems
	Dr Chris Mullen	Modelling energy demand
	Dr Matthew Deakin	Smart Grids, co-simulation of gas + electricity systems, whole energy system analysis
	Dr Hamid Hosseini	Simulation and analysis of energy systems
	Dr Helen Wareham	Large public datasets
	Prof Atanu Ghoshray	Commodity prices
	Dr Pavan Naraharisetti	Data analytics, systems analysis for sustainable development; Conceptual process design and techno-economic evaluation/feasibility studies
	Dr Damian Giaouris	Controls modelling
	Dr Carlos Calderon	Energy modelling
Energy Policy/ Attitudes to Energy	Prof Bernhard Malkmus	Ecological imaginaries
	Prof Richard Davies	Attitudes to unconventional energy
	Prof John Mathers	Public health
	Prof Natasha Mauthner	Philosophy & ethics of data sharing and big data
	Prof Tom McGovern	Business history and management
	Prof Savvas Papagiannidis	Electronic business
	Prof Louise Crawford	Accountability and practise & business legislation
	Dr Ole Pedersen	Law
	Dr Sue Farran	Law
	Prof Anthony Zito	European public policy
	Dr Helen Wareham	Public data for social inequality and social justice
	Prof Andy Pike	Inclusive growth and inclusive economies within cities
	Dr Carlos Calderon	Energy infrastructure planning, household attitudes to energy/ local area energy planning policy
	Dr Gareth Powells	Interactions between energy, economy, workers, health & other geographies

	Dr Natalia Yakovleva Dr Elisabetta Cherchi Dr Ian Corrick	Sustainable development goals & business strategy Electric vehicles & their interaction with society Macroeconomics
Cyber Security	Dr Zoya Pourmirza Dr Charles Morisset Dr Ricardo Melo-Czekster Dr Myriam Neaimeh Prof Aad van Morsel	Digitalisation, smart energy & cyber security Cyber security and resilience Cyber security EV charging and security Security, privacy and trust

FUTURE ENERGY INFRASTRUCTURE

More than 50% of final energy demand could be provided by electricity by 2050, and as such the existing infrastructure must be improved to a new smart electricity system. The electricity network is gradually becoming more decentralised, meaning more numerous and smaller sites of energy assets across the country and a greater role for flexibility. Storage is seen as a key flexibility asset, and the Government, together with Ofgem, will define electricity storage in law in 2021. Through the Net Zero Innovation Portfolio, the Government will launch a competition to accelerate the commercialisation of longer duration energy storage, which is part of the £100m investment into storage and flexibility innovation, with delivery from spring 2021. The *Energy White Paper* proposes greater competitiveness in network construction, and to encourage more whole-system innovation in gas and electricity networks.



Alongside the Government investment of £1.3bn to accelerate the rollout of EV chargepoints in homes, there is £950m planned for future-proofing grid capacity to better enable this. The Government will also work with Ofgem, developers and the EU to realise at least 18GW of interconnector capacity by 2030, representing a 3-fold increase from current levels. Linking to targets for offshore wind, there are plans through the Offshore Transmission Network Review, to improve delivery of network connections for offshore wind and reduce impact for local communities.

By 2050 the domestic market for smart systems, including EV smart chargers and smart network equipment could contribute almost £1.3bn to the UK economy, with exports of these products adding a further £2.7bn, supporting up to 24,000 jobs.

DIGITAL INFRASTRUCTURE

The government aims to build world-leading digital infrastructure for our energy system, based on the vision set out by the Independent Energy Data Taskforce and associated Energy Data Strategy. The Taskforce suggested that a lack of access to energy data creates a barrier to innovation. The government are therefore creating a national energy data catalogue, with a prototype launched by summer 2021. A £2m Modernising Energy Data Access competition has been announced to develop digital structure needed for innovators to build new products, compatible across different systems and sectors.

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FUNDING OPPORTUNITIES

£1.3bn for rollout of EV charging facilities, development of efficient and compact charging facilities is essential. Associated £950m grid capacity improvement. £100m storage and flexibility R&D. £2m Modernising Energy Data Access competition.

NEWCASTLE UNIVERSITY EXPERTISE IN ENERGY INFRASTRUCTURE

Subject	Staff	Expertise
Smart grids	Dr Jianfang Xiao	Smart Grids & energy management
	Dr Benjamin Horrocks	Nanowires & semiconductors
	Prof Janusz Bialek	Power systems & smart grids
	Dr Marcos Santos	Electric power systems modelling & AI
	Dr Chris Mullen	Modelling energy demand
	Dr Matthew Deakin	Co-simulation of gas & electricity systems, whole energy system analysis
	Dr Sadegh Soudjani	Computational analysis of smart grids
	Dr Anurag Sharma	Micro grids, storage & distribution planning
	Dr Damian Giaouris	Smart control
	Dr Haris Patsios	Electricity network and storage modelling
Storage and flexibility	Dr Haris Patsios	Storage modelling and associated network services
	Dr Mohamed Mamlouk	Energy storage
Energy Data	Dr Zoya Pourmirza	Data reduction for energy systems, ICT and IoT and Data communication
Whole energy systems	Dr David Greenwood	Whole systems approaches to energy
	Ali El Hadi Berjawi	Integrated whole energy systems
	Dr Sara Walker	Whole energy systems, energy systems integration