



## November 2020



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AIRTO is the Association of Innovation, Research and Technology Organisations. Its membership comprises approximately sixty of the principal organisations operating in the UK's Innovation, Research and Technology (IRT) sector. The IRT sector has a combined turnover of £6.9 billion, employing over 57,000 scientific and technical staff (equivalent to the academic staffing of the Russell Group of universities) and, for comparison, it is significantly larger than the network of Fraunhofer Institutes in Germany both in size and its scope of activities. The sector contributes £34 billion to UK GDP. AIRTO's members work at the interface between academia and industry, for both private and public sector clients.

Members include independent Research and Technology Organisations, Catapult Centres, Public Sector Research Establishments, National Laboratories, some university Technology Transfer Offices and some privately held innovation companies.

# Executive summary

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The UK's ambitions to increase productivity and prosperity, and the recent legislation to set into law the requirement to become a Net Zero carbon emitter by 2050<sup>1</sup>, give impetus to the need to 'ramp up' innovation to create alternative technologies and to eradicate societal and economic reliance on fossil fuels across the full range of industrial sectors. This includes energy supply, transport, heating, food chains, telecommunications, healthcare and consumer goods. Public opinion is shifting, with a growing recognition of the need for the 'climate emergency' to be tackled as an urgent priority alongside changing public attitudes to consumption; this, combined with the government's stated intention to 'build back better' and 'build back greener' in the wake of the Covid-19 pandemic, drives increasing urgency in the many calls for greater innovation.

At the end of 2017, the UK government launched a new Industrial Strategy, a key part of which is to grow the level of investment in research and development (R&D), from 1.7% to 2.4% of Gross Domestic Product (GDP) by 2027. AIRTO has been examining this challenge, and exploring how the UK could benefit from **deploying more resources for R&D towards finding solutions that help us all to advance towards Net Zero and in the process unlock market opportunities for the UK, both at home and globally.**

As well as consulting its membership across a broad range of sectors about the measures which they consider to be necessary to achieve Net Zero, AIRTO is looking to consult extensively on this topic with stakeholders in government, industry and other allied organisations. **We have identified FOUR KEY LEVERS and critical interventions which we consider must be applied** to advance the target of Net Zero and position Innovation, Research & Technology (IRT) sector organisations to play an even more significant role in decarbonisation. We are **concluding that the government's approaches to stimulus and support for additional investment in R&D capabilities for achieving Net Zero must be based on...**

## **KEY LEVER 1: Technology and Industrial Strategy:**

INTERVENTION – Developing a co-ordinated technology strategy and an industry strategy for developing and adopting new technologies involving all the relevant stakeholder groups including the R&D community.

## **KEY LEVER 2: Driving Expansion in R&D capacity and capabilities:**

INTERVENTION – Investing in technology development capacity and capabilities by creating more test-beds across the UK to meet the demands of business and investment.

## **KEY LEVER 3: Building a better energy infrastructure:**

INTERVENTION – Investing in developing infrastructure for harnessing and distributing clean energy in an affordable manner. (R&D is required to create better methodologies for design and manufacture and operation of systems to harness renewable sources of energy).

## **KEY LEVER 4: Supporting innovation and entrepreneurship for 'building back greener':**

INTERVENTION – Create Innovation for Zero (I4Z): a scheme for SMEs and entrepreneurs to partner with IRT sector organisations to access capabilities for developing, testing and implementing new technologies for decarbonisation.

It is apparent that there is a strong appetite to work together to help the UK achieve Net Zero across the IRT sector. Shaping effective and co-ordinated technology and industry strategies for developing and adopting new solutions, involving all the relevant stakeholder groups including the R&D community, is critical for success. The UK's IRT sector stands ready to help identify investment priorities for Net Zero and to work with government more strategically.

# Background

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AIRTO – the Association of Innovation, Research & Technology Organisations - represents the **Innovation, Research & Technology (IRT) sector in the UK**, which **collectively employs 57,000 highly skilled people**, and impacts on the UK economy by contributing **over £32 billion of Gross Value Added (GVA)** per annum<sup>2</sup>. AIRTO's 60+ member organisations form a bridge between industry and academia, and therefore form a critical part of the national innovation eco-system<sup>3</sup>.

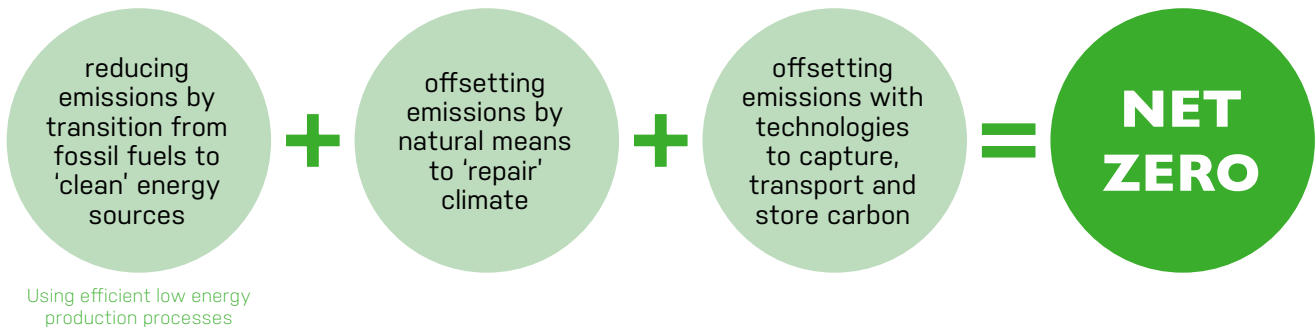
Recognising the key role that the UK's scientific and technological capabilities play in our economy, a major part of the government's plan for rolling out the Industrial Strategy is to grow the level of investment in research and development (R&D), from 1.7% to 2.4% of Gross Domestic Product (GDP) by 2027<sup>4</sup>. The objective is for the UK to be the “go to” place for R&D on a worldwide stage. This could mean around £80 billion of additional investment going into advanced technology in the coming decade, helping to transform whole sectors, create new industries, and support innovation across the country.

The UK's ambitions to increase productivity and prosperity, and the recent legislation to set into law the requirement to become a Net Zero carbon emitter by 2050, give impetus to the need to ‘ramp up’ innovation to create alternative technologies and to eradicate societal and economic reliance on fossil fuels across the full range of industrial sectors. This includes energy supply, transport, heating, food chains, telecommunications, healthcare and consumer goods. Public opinion is shifting, with a growing recognition of the need for the ‘climate emergency’ to be tackled as an urgent priority alongside changing public attitudes to consumption; this drives increasing urgency in the many calls for greater innovation.

This position statement has been written to ‘start the conversation’ about the role of the IRT sector in helping the UK to achieve Net Zero; AIRTO is planning to consult more widely with allied stakeholders on this topic in the coming months. Some of AIRTO's members, particularly the network of Catapult Centres, and others have done significant thought-leadership in this arena, looking at current activities in support of Net Zero and what is needed in the future. Our intention is to build upon that thinking to broaden the debate across the remainder of the IRT membership and beyond to other interested stakeholders.

# Introduction

Achieving the UK's Net Zero target by 2050 will require some fundamental changes to our way of life and to our economic model, which has hitherto largely been built with dependencies on the extensive use of fossil fuels for energy supply:



**Figure 1:** Changes necessary to achieve Net Zero greenhouse gas emissions.

Reaching this goal will be **impossible without enormous amounts of innovation driven by R&D**. The UK needs to develop new technologies and services to, for example, repair our climate, remove our reliance on fossil fuels and reduce consumption (in a phased manner to avoid triggering a global financial crisis). In short, the fundamental scientific understanding is now in place to underpin most of the changes that need to be made. As a nation we now need to focus our efforts to build on this understanding and to **develop our way to a more sustainable future**.

Achieving Net Zero carbon by 2050 is absolutely possible, as recognised in a report by the Energy Systems Catapult - if the UK supports innovation and scale-up across three essential areas: Low Carbon Technology, Land Use and Lifestyle<sup>5</sup>. However, this mission will be a huge strategic challenge for the UK, as highlighted in a new report from the Royal Academy of Engineering's National Engineering Policy Centre<sup>6</sup>. It will require the coordinated effort of all the relevant stakeholders, including government, industry, academia, the IRT sector, and the general population. As well as meeting the UK's aim of Net Zero carbon by 2050, there is a significant opportunity for the country to be a leading source of pioneering green technology worldwide – a key part of the government's aim of the UK becoming a 'Science *and Innovation* Superpower'.

The IRT sector in the UK has a key role to play in providing applied research, development and technology demonstration support to government and industry, engaging in market-led activities but also collaborating with the academic base. Such a unique role allows AIRTO members to direct support to industry, and also is a vehicle for taking inventions and translating them into commercial opportunities and successes. A good example of this is the roles played by both the Energy Systems Catapult and the Offshore Renewable Energy Catapult in the [Offshore Wind Sector Deal](#)<sup>7</sup>.

AIRTO, therefore, contends that its members will play a key role in developing and applying the technology that will be needed to achieve Net Zero by 2050. This position statement identifies:

- Current decarbonisation activities and assets of the IRT sector organisations (section A).
- What more IRT organisations can do (section B).
- Key levers for government to deploy, with proposed interventions, in order to support the IRT sector to play a full and extended delivery role in developing technologies for Net Zero (section C).
- A look forward to next steps for further, more detailed, work.

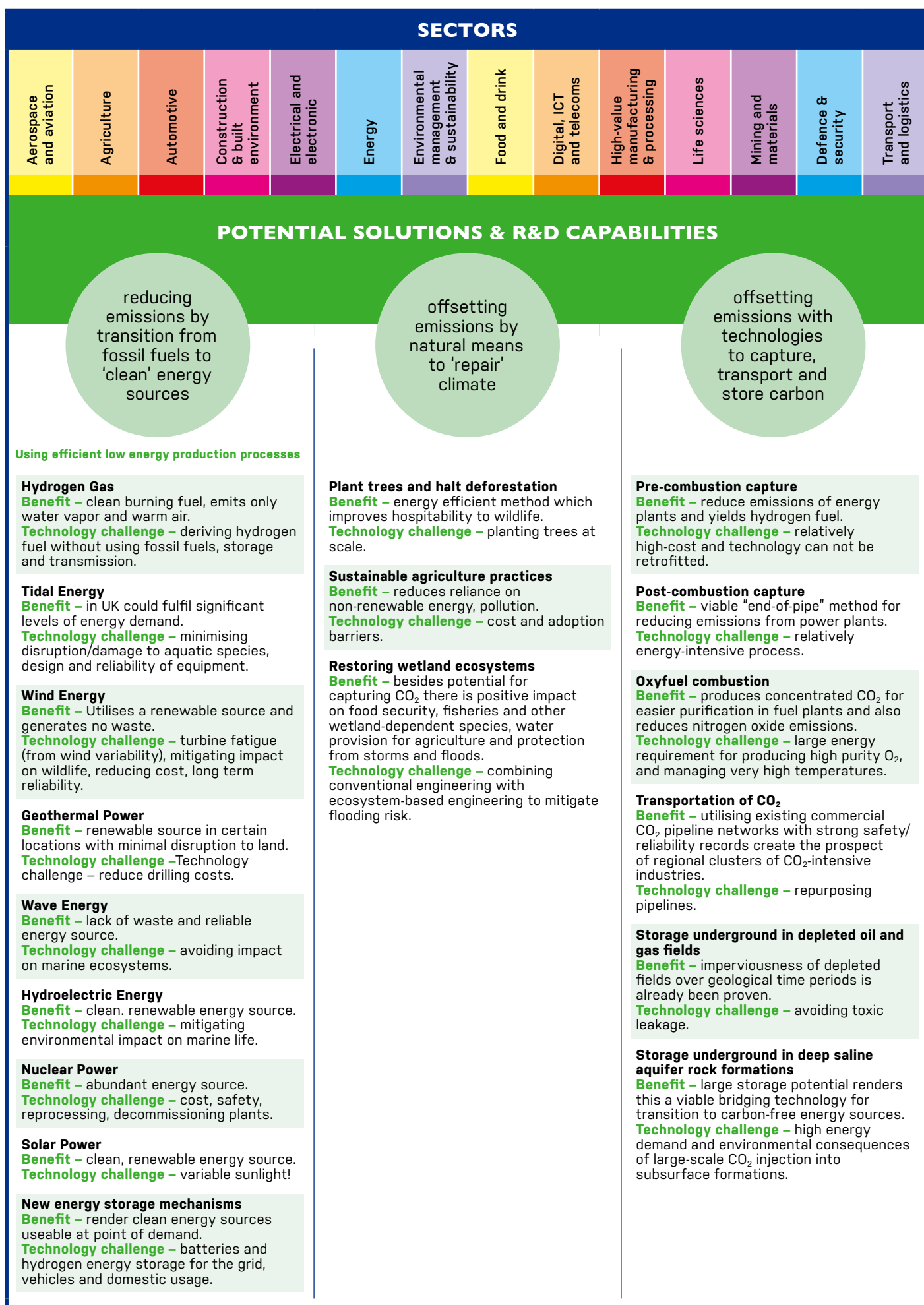
## A. Current decarbonisation activities and assets of IRT sector organisations

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Although IRT organisations have a range of ownership and governance models (from government owned, through not -for-profit companies limited by guarantee, to fully commercial private companies), they all have the shared aim of promoting innovation by turning new ideas and inventions into commercially exploitable products and processes. This is achieved by partnering with both industry and academia, to fulfil their roles as great incubators for innovative developments.

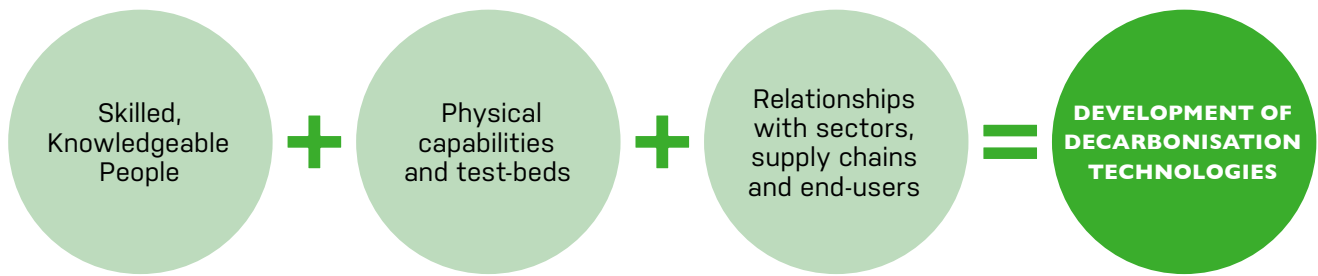
Some IRT sector organisations serve specific industrial sectors including agri-tech, nuclear, construction for example, whereas others provide cross-cutting capabilities in diverse technology areas including materials, precision manufacturing, measurement and structural integrity. Each of these organisations has a role to play in the applied R&D necessary to achieve Net Zero.

There are many examples of the work that IRT sector organisations are already undertaking to develop and exploit technologies aimed at reducing or capturing and storing emissions. These are summarised in Figure 2.



**Figure 2: Critical assets for decarbonisation – Technological Strategies.**

All the decarbonisation activities described in Figure 2 rely upon a number of **critical assets** which IRT sector organisations have, as summarised in Figure 3:



**Figure 3:** Critical assets for decarbonisation.

A useful example of how IRT sector organisations endeavour to deploy their assets strategically to deliver technologies for decarbonisation in partnership with industry and end-users in their local communities is the work of EMEC, which operates on Orkney as a 'living laboratory' for a carbon neutral future (CASE STUDY I).



# ORKNEY EMEC: A LIVING LABORATORY

## CASE STUDY 1

Established in 2003, The European Marine Energy Centre (EMEC) Ltd is the first and only centre of its kind in the world to provide developers of both wave and tidal energy converters – technologies that generate electricity by harnessing the power of waves and tidal streams – with purpose-built, accredited open-sea testing facilities. Orkney is an ideal base for this activity with its excellent oceanic wave regime, strong tidal currents, grid connection, sheltered harbour facilities and the renewable, maritime and environmental expertise that exists within the local community.

With 13 grid-connected test berths, there have been more marine energy converters deployed at EMEC than at any other single site in the world, with developers attracted from around the globe to prove what is achievable in some of the harshest marine environments. EMEC also operate two scale test sites where smaller scale devices, or those at an earlier stage in their development, can gain real sea experience in less challenging conditions than those experienced at the grid-connected wave and tidal test sites. In addition to wave and tidal sites, EMEC has an onshore hydrogen production plant in Eday where green hydrogen is generated from surplus tidal and wind energy. With a view of developing a hydrogen economy in Orkney, our demonstration site for new hydrogen technologies is a key element of various hydrogen research projects.

EMEC operates to relevant test laboratory standards (ISO17025) enabling the Centre to provide independently verified performance assessments, and is accredited to ISO/IEC 17020 offering independent technology verification on marine energy converters and their sub-systems. Beyond technology demonstration and testing, EMEC provides a wide range of consultancy and research services, and is working closely with Marine Scotland to streamline the consenting process. EMEC is at the forefront in the development of international standards for marine energy, and is forging alliances with other countries, exporting its knowledge around the world to stimulate the development of a global marine renewables industry.

EMEC is right at the centre of a successful 'cluster' approach where the academic, private and public sectors work together to develop R&D:

- **Orkney has become a true hotspot for innovation, with natural resources and an island advantage as a 'living laboratory'.**
- **Learning by doing or 'action research' is absolutely key to technology development.**
- **Facilities like EMEC which are set up to provide the necessary infrastructure is the best model to do this as it generates collaborative learning and further R&D opportunities.**

As announced by the Prime Minister on a recent visit to Orkney to announce the Islands Deal, there is an aspiration to create an Island Centre for Net Zero in Orkney to build on the pioneering low carbon projects and research infrastructure.



Credit EMEC - Aerial View of Stromness (Credit: Colin Keldie)

## B. What more can Innovation, Research & Technology organisations do to accelerate green innovation?

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There is an opportunity to accelerate the development of technologies by supporting individual organisations to scale-up their R&D and test-bed capabilities. However, there is also more that could be done to leverage the expertise and capabilities of the IRT sector by taking a 'systems approach', coordinating use of the assets identified in Figure 3, as follows:

### **Nurturing green talent – developing the supply of skilled, knowledgeable people:**

The UK government is committed to growing the number of 'green collar' jobs. The levelling of economic opportunity and realisation of the UK's ambition to be a 'Science *and Innovation* Superpower' in decarbonisation over the coming decades will require development and expansion of the existing skilled workforce. Provision for training at all stages of career development should be a priority and the IRT sector, which is a 'breeding ground' for people skilled in multiple disciplines, is an ideal 'provider' for developing a pipeline of 'green' talent to fuel the advancement of technology towards Net Zero. Growing this training activity would provide valuable support to UK industry and attract international funding for R&D to the UK. This role of the IRT sector in nurturing and developing the applied R&D and innovation skills base requires government support to expand its scale and scope.

AIRTO recommends that the government should invest in a programme to co-ordinate the activities of industry, Higher Education Institutions, Further Education Colleges and the IRT sector to create a package of measures for building an innovation-ready 'green' workforce. This programme will include:

- Access to public funding for Masters-level courses, much requested by industry. Increased support for PhDs undertaking industry led applied research in decarbonisation technologies in non-academic environments.
- Trialling of new schemes to boost translation of academic learning in environmental sciences to the 'shop floor', including enhancements/expansion to the existing and successful Knowledge Transfer Partnership (KTP) scheme. AIRTO proposes a 'Net Zero KTP' scheme to include IRT sector organisations as well as universities to be the 'knowledge base' partner for graduates seeking to develop careers in decarbonisation.
- Putting increased numbers of 'green' industry ready graduates through 'sandwich' and industry tailored environmental-related degrees. This should include innovation management and green entrepreneurship, as well as applied technical aspects of decarbonisation.
- Development of a national apprenticeship scheme for green innovation, with a focus on management and leadership in innovation for decarbonisation technologies.
- Further investment into lifelong learning, to provide opportunities for the UK workforce to re-skill into new technology and application areas during their career spans.

These measures would support the demand for more skilled people to work in applied environmental R&D, innovation and green entrepreneurial ventures, all of which are needed to exploit the UK's reservoir of research-derived knowledge. Such skills are also required to introduce green innovation to businesses, and to bring new decarbonisation products and services to market.

### **Capitalisation of physical capabilities and test-beds:**

Increasing investment is needed to further equip IRT organisations with the critical capital assets to expand their provision of R&D services for decarbonisation of the UK economy. The Faraday Battery Challenge is a good example of effective investment<sup>8</sup>, where a large-scale battery manufacturing facility has been established to enable vehicle electrification. Proper capitalisation of the IRT sector is necessary to allow it to develop the resources and capabilities that will be needed in the future, to keep pace with the expanding green economy. This applies to the range of organisations that make up the IRT sector, but is particularly significant for the non-profit distributing RTOs (Research and Technology Organisations) which do not have the strength in their financial balance sheets to embark on rapid expansion unaided. They are not able to raise conventional capital from shareholders and generally do not have sufficient unencumbered assets against which to borrow significant amounts for investment in growth. This resource constraint has been exacerbated by the COVID-19 crisis. There is no current government programme to support the capitalisation of the RTOs, although some core finance is available for government owned Public Sector Research Organisations (PSREs) and the more recently created Catapult Centres.

With severe restrictions on the ability of many industries to invest in the wake of COVID-19, publicly-funded programmes for development of green technologies undertaken by the IRT sector will be a highly effective use and means of leveraging investment of public money because the results and outcomes of such programmes will be disseminated through the sector's networked relationships to all interested UK organisations/stakeholders. **AIRTO contends that a recapitalisation fund for independent RTOs which do not have recourse to shareholder financing should be a priority for 'green' interventions, recovery from the COVID-19 crisis and the 'levelling-up' agenda, as exemplified by CASE STUDY 1.**

- **Leveraging relationships with academia, industrial sectors, supply chains and users:**

By virtue of their collaborative nature, IRT organisations generally have strong networked relationships in place with academia, industrial sectors, supply chains and end-users. This is particularly true for R&D to underpin the technologies that will help the UK move towards Net Zero. One such example is BRE's Smart Home Initiative (CASE STUDY 2).

## BRE: THE SMART HOME

### CASE STUDY 2

In 1998 BRE and partners created the highly innovative Integer House. Designed to give people a glimpse of what future homes might be like, thousands of professionals from around the world came to see it and were inspired to design and build in a better way.

It had one of the first green roofs, an early photovoltaic array, a greywater recycling system, and a ground source heat pump and prototype intelligent electronics – new to market technologies that are more commonplace today.

The house has undergone an extensive retrofit. Now called The Smart Home, it tackles some of our key built environment challenges: the need for our existing homes to be more energy efficient, to adapt to the effects of climate change and to address the needs of the ageing population.

Through a joint BRE and British Gas project, it has been re-equipped with a host of ultra energy-efficient features and functions, making it super fit for the future. Using cutting-edge technology, design and building techniques, the innovative retrofit has made the house 50% more energy efficient and halved its carbon emissions, upgrading it from an E to an A/B EPC rating. An intelligent, whole house living system with occupation sensors for a range of purposes controls the heating, lighting, ventilation, water and security. The latest air source heat pump technology has been integrated to provide heating via app-enabled advanced controls, and improvements have been made to the solar thermal water heating and air tightness.

The house has a new-to-market solar thermal system, and an integrated PV array has been installed into the conservatory glazing to generate most of the home's energy requirements and shade clear glass against excess heat. Innovative 3 mm thick insulating plaster has been applied finished in heat-reflective paint to improve thermal performance, whilst paint with light-reflective particles on the internal walls dramatically increases brightness and reduces lighting needs. To counteract upper floor overheating, Phase Change Material (PCM) has been incorporated into the upper floor walls. Ducted skirting, reclaimed timber floors and an FSC certified kitchen have been fitted, and doors and windows have been replaced with the latest uPVC double glazing incorporating recycled uPVC. The very latest Velux windows have been installed, and the front door showcases new generation electronic locking, including a car style remote key.



Credit BRE Group - The Smart Home



## CALL TO ACTION

More can be done to further develop relationships with academia and industry, which are currently heavily focussed on the technical aspects of innovation. Work with end-users is needed to identify the behavioural innovation necessary to unleash technology adoption by the UK population, a key factor in translating technology solutions to market.

## HOW COULD THINGS WORK BETTER FOR GREEN INNOVATION?

### **Engage IRT organisations in developing the understanding of behavioural science for adoption of green technologies:**

The cultural innovation required to deliver Net Zero is immense, and involves exposing society and individuals to change. Understanding behavioural factors is key to paving the way for this. Utilising the convening power of IRT sector organisations to bring together industry bodies, academic groups, regulators, policy makers, consumers groups with operators and suppliers, could help identify potential adoption challenges for emerging green technology solutions.

## C. Key levers

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**We have identified FOUR KEY LEVERS which we contend the UK government must utilise to support the UK's advancement towards Net Zero...**

### **KEY LEVER I: Technology and Industry Strategy:**

**Having a cohesive and national strategic technology plan and roadmap for reaching Net Zero is critical if the UK is going to succeed in moving towards decarbonisation of the economy.**

INTERVENTION – Developing a co-ordinated technology and related industry strategy involving all the relevant stakeholder groups, including the IRT community.

For the UK, achieving Net Zero carbon by 2050 will require an increasing level of effort by all the relevant stakeholders. This can continue in an *ad hoc* way which will be inefficient and will not serve the national interest well. Alternatively, developing a co-ordinated strategy involving all the relevant stakeholder groups will ensure a more efficient and effective national approach to technology development. This approach will enable the different types of technology in planning to be blended optimally. In this way the UK will be positioned to hit the 'sweet spot' for combining a portfolio of methods for decarbonisation, thus increasing the likelihood of achieving Net Zero carbon in the target timescale.

Additional benefits of a coherent technology strategy will be:

- **Shared focus of all stakeholders on a common goal.**
- **Support for government in planning and funding appropriate areas of R&D.**
- **Allowing all stakeholders to see technological gaps and opportunities.**
- **Signposting industry to the best partners for meeting their technology and application needs.**
- **Gaining a comprehensive understanding of the total UK capability for promotion to potential overseas investors, customers and partners.**

For example, the technology strategy for energy generation needs to be evidence based, with consideration for the wide variety of renewable and low carbon forms of energy available to a "UK plc" energy mix. The UK is endowed with an abundance of accessible renewable and/or low carbon energy sources, such as wind, tidal, solar, hydroelectric and advanced nuclear. Extensive analysis should generate an approach for a resilient energy mix, with affordable infrastructure investment, to provide for a new generation of energy supply generation, storage and distribution, removing the dependency on fossil fuels. To account for the mis-match of energy availability with demand (i.e. we may not need the energy when the wind blows), the UK will need to develop technologies and infrastructure to create robust energy vectors and storage systems, to balance supply and demand, phasing in changes for our society such as green hydrogen production in a timely manner. It is critical that such a green technology strategy for the UK is developed with wide consultation, and is transparent in its reasoning and conclusions. Conclusions and recommendations should then be matched by consistent and sustainable government policy. The significant investment required (which is anticipated to be of many hundreds of billions of pounds), is likely to require new forms of financing, which would need to be developed with the strong UK financial sector and a significant increase in responsible and patient funding.

## **KEY LEVER 2: Expand R&D capacity and capabilities:**

INTERVENTION - Investing in technology development capabilities by creating more test-beds across the UK to meet the demands of business, entrepreneurs, investors, potential users and potential customers.

**It is critically important to better understand and fulfil the needs of the markets to develop technologies that will help advance to Net Zero across multiple different sectors. We need to provide the conditions that could attract more businesses to grow their R&D** portfolio for decarbonisation technologies, and **make the UK become ‘the place’ to develop revolutionary, world-changing innovations.** Much of the fresh private investment in R&D that the UK needs to see realised to reach 2.4% of GDP is going to need to come from Foreign Direct Investment (FDI). To encourage investor interest and confidence, the UK needs to plan for strategic investment in capabilities for **‘More D!’** over the coming decade. This will help to anchor high-value jobs, revitalise neglected communities and contribute to the creation of wealth and wellbeing.

When the UK gets this kind of planning right, great benefit can be seen in local communities. However, there are also numerous examples of where industry has decided to go elsewhere. A recent example can be seen in the decision by Tesla to choose Germany over the UK for its new battery plant, in spite of the UK government’s Faraday Initiative<sup>8</sup>. On the other hand there are also examples of successful test-beds which are helping the UK to become leaders in development of new energy technologies; one such example is the Energy Systems Catapult’s Living Lab (CASE STUDY 3). Test-beds of this type need to be further expanded and should be seen as a blue-print to attract FDI in development of technologies that will advance the UK towards Net Zero.

## **A TEST BED FOR ENERGY TECHNOLOGIES: ENERGY SYSTEMS CATAPULT'S LIVING LAB**

### **CASE STUDY 3**

The Living Lab is a unique real-world trial facility of 100 connected homes spread across Newcastle, Manchester, South Wales and the West Midlands, where innovative businesses can rapidly design, market-test and launch smart energy products and services. All homes are owner-occupied with a range of building types and occupancy, including:

- **All have smart heating controls and sensors, connected to a cloud-based digital platform.**
- **Some homes have air source heat pumps installed alongside gas boilers, most have regular gas boilers.**
- **Smart meter integration is available.**

Since 2016, the Energy Systems Catapult has been developing unparalleled insights into running energy services trials in real-world homes, undertaking detailed analysis of the vast array of consumer and technical data captured. Expert teams from across the Catapult, including Consumer Insight, Digital & Data, and Systems Integration can help innovators rapidly design, market-test and launch smart energy products and services in the Living Lab.

There are a number of benefits to companies trialling products and services in the Living Lab, including:

- **Gaining a better understand of how people use a product/service and how well it works.**
- **Improving the offering using feedback from real consumers.**
- **Saving time – our 100 homes are ready to go.**
- **Getting value for money because they don't need to build a lab of their own!**

Energy providers, device manufacturers and technology companies can trial a range of products and services in a proven, government-backed 100-home test bed. The Living Lab allows innovators to learn how to sell energy as a service with real consumers. Industry has been talking about energy as a service for years, but few companies have developed a market proposition – the Living Lab changes that. Uniquely, businesses can market-test smart energy services through a digital, online marketplace. As these are real homes, services or product are offered to residents in a market trial – a great way to find out if people like the offer and consider what they might be willing to pay for it. Suppliers can learn:

- **Who buys their service offering and why (and who doesn't and why not) including consumer demographics.**
- **What consumers like about a service/product and how much they are willing to pay.**
- **What it costs to serve it to consumers.**
- **Insights into how consumers use your product and how it performs in a real-world home environment (e.g. how fast does it warm rooms up, is it cheaper/better with your product than before, what is the overall impact on homes and consumers).**



## CALL TO ACTION

Provide more facilities to test clean energy and decarbonisation technologies at scale. Creating green technology demonstrators and using local clusters of capability as test-beds for developing new technology opportunities is a tried and tested mechanism for supporting the pursuit of solutions for market need in sectors pursuing green technologies.

## HOW COULD THINGS WORK BETTER FOR GREEN INNOVATION?

### **Create more test-beds across the UK to meet the demands of business:**

A way of helping more businesses to bring their development activities to the UK, will be to provide more test-bed facilities and demonstrators. There are two types of test-bed: those used for evaluation and those used for technology performance validation. Both types are essential to successfully develop an innovation and translate it to the market. Businesses will benefit from accessing more ready-made and cost-minimising test and demonstration facilities in key sectors such as renewable energy. Such flexible infrastructure makes it easy for technology developers to learn by doing, with access to impartial expertise to build a bank of performance data on their products in development. Facilities of this sort enable developers and suppliers to learn lessons at minimal cost by reducing the need for their own investment in large testing plants/facilities. These facilities allow companies to work on continuous improvement of technologies. Manufacturing demonstrators help companies to identify problems in production processes and develop solutions. This is especially important for SMEs seeking to experiment before investing in their own facilities. Such facilities enable businesses to operate in a more agile and swifter manner to develop products by tapping into readily available development infrastructure.

### KEY LEVER 3: Building infrastructure:

**INTERVENTION** – Investing in developing infrastructure for harnessing and distributing clean energy, and minimising energy consumption in an affordable manner.

The IRT sector's capabilities are being deployed to support the formation of a co-ordinated, effective UK infrastructure for distribution of clean energy. There is a clear role for R&D activities in helping achieve better design, so that renewable energy sources can be harnessed and distributed. An example of this is the Offshore Renewable Energy Catapult's work on the design, testing and operation of turbine blades for wind farms through its' WIND BLADE RESEARCH HUB (CASE STUDY 4).

## WIND BLADE RESEARCH HUB

### CASE STUDY 4

The Wind Blades Research Hub is a £2.3 million, five-year research partnership between the Offshore Renewable Energy Catapult and the University of Bristol that aims to help unlock larger, more powerful wind turbines than ever before. This Research Hub marks the first strategic investment from ORE Catapult to increase the depth of its partnerships with academia, ensuring that the offshore renewable energy sector has a gateway to world-leading research and innovation developments across the Technology Readiness Level scale.

The Hub's objective is to support turbine blade research that will reduce the cost of wind energy through cost reductions in capital and operational expenditure and increased energy yield, or a combination of these. The Hub is set up to focus on three key aspects of blade research to achieve this:

- Enabling 10 MW-plus turbine platforms to come to fruition through advances in blade design and structural modelling, reducing blade loads and facilitating the transition to longer, larger blades without losses in operational performance.
- Improving the longevity and structural integrity of blades by developing the next generation of materials tailored to operational conditions, preventing degradation and maximising aerodynamic performance.
- Maximising operational performance through novel condition monitoring methods which identify blade damage and performance degradation.



Credit ORE Catapult – Wind Blades Research Hub

## CALL TO ACTION

Invest more in R&D capabilities for developing infrastructure for green energy and decarbonisation.

## HOW COULD THINGS WORK BETTER FOR GREEN INNOVATION?

### **Raise the priority accorded to developing the infrastructure needed to deploy green technologies:**

A potential way of helping more businesses to bring their green technology development activities to the UK, could be to invest in more R&D capabilities focused on the infrastructure that will be needed to deploy innovation.

### **KEY LEVER 4: Supporting innovation and entrepreneurship for ‘building back greener’:**

**INTERVENTION – Innovation for Zero (I4Z):** develop a scheme for SMEs and entrepreneurs to partner with IRT sector organisations to access capabilities for developing, testing and implementing new technologies for decarbonisation.

It is very important to consider the potential for innovative and agile SMEs to generate significant growth for the UK’s green economy, representing a vital source of new ideas for developing solutions to the decarbonisation challenge. Embarking on the journey of turning an idea into a real, tried and tested effective and safe product or service, SMEs frequently need to partner with other organisations that can supply the myriad of expertise, facilities and capabilities needed for them to succeed. Helping SMEs to source the expertise and capabilities they need can be a challenge as they require mechanisms for collaboration that are simple and quick, which help them to solve technology problems as they arise and which deliver innovation to the market in a timely manner. Blue-prints already exist for tried and tested mechanisms for engaging SMEs with IRT sector organisations, helping them to navigate the complex technical, regulatory and funding landscape that is prevalent in the UK. These exemplars, such as the Analysis for Innovators (A4I) programme – as described in CASE STUDY 5, should be expanded and replicated to stimulate green innovation.

## ANALYSIS FOR INNOVATORS (A4I) PROGRAMME

### CASE STUDY 5

A4I – Analysis for Innovators is a scheme which can help boost productivity and competitiveness in businesses through solving existing problems. The programme gives UK businesses of any size access to cutting-edge applied R&D expertise and facilities to help solve problems that they have been unable to tackle using standard, widely available technologies and techniques laboratory analysis techniques. Such problems may pertain to product reliability, cost or lifetime. The programme aims to help boost a company's productivity or competitiveness by enabling the UK's top scientists and innovators to utilise their world-class expertise and facilities, which are often otherwise inaccessible, to work with companies to address problems in innovative ways.

Key to the success of A4I are the brokerage meetings that are arranged between the companies and experts from the A4I partners. These meetings allow the company to discuss their problem with experts who are in a position to address the problem. The current fifth round of the programme continues to focus on brokering successful relationships between UK companies and some of the UK's National Measurement Laboratories (NPL, NEL, NML and STFC) and then funding grants for follow-on projects to address a company's technology problems.

Each round of the competition is divided into three distinct parts:

- Phase 1 - expression of interest
- Phase 2 - Brokerage meetings
- Phase 2 - Applications for grant funding for a project

### CALL TO ACTION

Provide more effective schemes for SMEs to contribute to the green economy that are simple and swift for businesses to engage with, helping them to better access existing knowledge and capabilities and to move ideas for development of decarbonisation technologies forward into innovative green products and services without delay.

### HOW COULD THINGS WORK BETTER FOR GREEN INNOVATION?

**Extend successful models for supporting and engaging with later stage development challenges such as the A4i scheme. Arguably, a new version of the scheme could be expanded with considerable benefits to businesses working to develop technologies for the green economy.**

A potential way of helping more businesses and SMEs to develop clean energy and decarbonisation technologies, could be to utilise the engagement models already tried and tested with schemes such as A4I, and translate them into other areas. For example, the A4I scheme is focused firmly on bringing laboratory analysis capabilities in physics, chemistry and biological sciences to bear to solve product issues. However, the same model could be used to apply scientific and technical expertise specifically to commercial conundrums for businesses developing green technologies, by creating a mechanism for them to work with organisations in the IRT sector, something we are dubbing 'I4Z', INNOVATION FOR ZERO.

# Looking forward

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This position statement is intended to ‘start the conversation’ about the role of the IRT sector in helping the UK to achieve Net Zero; as stated, AIRTO’s intention is to consult more widely with allied stakeholders on this topic. In addition to the four levers identified in this position statement (Technology strategy, Expanding R&D capabilities, Building infrastructure, Supporting innovation and entrepreneurship for ‘building back greener’), responding to new requirements for development of workforce training across a number of sectors is going to be crucial to optimise and nurture ‘green talent’ (as referenced in Section B). Reaching Net Zero will also depend on the introduction of appropriate policies for market development, alongside advancing some other key enablers<sup>5</sup>, including development of:

- Digital systems (e.g. smart control / platforms for trading) and data.
- Commercialisation support (e.g. for product development; SME engagement; financing).
- Regulatory frameworks.
- Low energy design / manufacturing methods / construction.
- Low power semiconductors / electronics.
- Supply chains and logistics optimised for low carbon emission.
- Systems integration and whole system engineering to minimise wastage of resources.

For the UK, achieving Net Zero carbon by 2050 will need an increasing level of effort on the part of all relevant stakeholders. This could come about in an *ad hoc* uncoordinated way which will be inefficient and will not serve the national interest well. There is much to be gained by government developing a co-ordinated technology strategy and roadmap involving all relevant stakeholder groups; this will help to ensure a more efficient and effective UK approach to developing technology and it will increase the likelihood of achieving Net Zero carbon in the target timescale. The benefits of such a plan will be:

- **Concentration of all stakeholders on a common goal.**
- **Support for government in planning and funding appropriate areas of R&D.**
- **Allowing all stakeholders to see technological gaps and opportunities.**
- **Signposting industry to the best partners for meeting their technology and application needs.**
- **Gaining a comprehensive understanding of the collective UK capability for promotion to potential overseas investors, customers and partners.**

In 2021, as part of its ongoing thought-leadership on innovation, AIRTO intends to continue the dialogue on Net Zero with other stakeholders beyond its membership base. This will be an important exercise in identifying where new resources for applied R&D are needed, and where there are innovation capabilities that are not being utilised to their full potential – including facilities, skills and knowledge (e.g. for technology exploration around the need and technical requirements for the gas distribution infrastructure to be deployed in the future shift for use in hydrogen distribution). This work will involve mapping the untapped potential of the IRT sector in the next phase of consideration about advancing towards Net Zero. Further thinking also needs to go into the scope of the IRT sector to add value to understanding the human-technology interface, to contribute to culture change in society, and to grow crucial interactions with other stakeholders.

# Conclusions and recommendations

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AIRTO members are already extremely active in developing the technology that will be necessary for achieving Net Zero carbon by 2050. However, there is significant scope for increasing this level of activity – indeed it can be argued that this level of activity must be increased if Net Zero is to be reached. A part of this increase in activity will be down to individual organisations to plan future areas of work in consultation with government and their industrial and academic partners. There is also an immediate need for the current and future activities of AIRTO members to be co-ordinated within the membership, and also to be co-ordinated with other stakeholders in the Net Zero ambition including with government, wider industry and academia. This will ensure effective, efficient R&D, and strategic planning of activities. It will also allow the effective promotion of the UK's expertise in Net Zero carbon technology around the World.

This crucial coordination must be balanced by technical support for entrepreneurs and SMEs that will ensure disruptive technologies can be developed and assessed, and supply chains nurtured (Key Lever 4).

AIRTO on behalf of, and with the support of its members, is willing to play a full role in this co-ordination of the UK infrastructure. To avoid missing the 2050 target and failing to prevent the much-predicted shift of the climate into chaos, **AIRTO contends that** a significant increase in public investment in applied development activities at mid and higher Technology Readiness Levels is required. This will result in more 'pull through' of decarbonisation technologies by the market across key industry sectors and will result in the more effective use of the UK's public expenditure initiatives designed to advance the economy towards Net Zero. We conclude that critical **INTERVENTIONS** in the UK's R&D landscape are necessary to achieve Net Zero by 2050, and have identified **FOUR KEY LEVERS** which must be applied. **Our recommendations are that the government's strategy must be based on...**

## **KEY LEVER 1: Technology and Industry Strategy:**

INTERVENTION – Developing a co-ordinated technology strategy and an industry strategy for adopting new technologies involving all the relevant stakeholder groups including the R&D community.

## **KEY LEVER 2: Driving Expansion in R&D capacity and capabilities:**

INTERVENTION – Investing in technology development capacity and capabilities by creating more test-beds across the UK to meet the demands of business and investment.

## **KEY LEVER 3: Building a better energy infrastructure:**

INTERVENTION – Investing in developing infrastructure for harnessing and distributing clean energy in an affordable manner. (R&D is required to create better methodologies for design and manufacture and operation of systems to harness renewable sources of energy)

## **KEY LEVER 4: Supporting innovation and entrepreneurship for 'building back greener':**

INTERVENTION – Create Innovation for Zero (I4Z): a scheme for SMEs and entrepreneurs to partner with IRT sector organisations to access capabilities for testing and implementing new technologies for decarbonisation.

**In conclusion, the UK has a thriving IRT sector, offering people with the right skills and expertise, and substantial resources, to deliver the UK's Net Zero ambitions by playing a critical independent role in working with industry, academia and government to address the market needs for decarbonisation across key sectors.**

# References

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1. 'UK becomes first major economy to pass net zero emissions law'. 27 June 2019, Department for Business, Energy & Industrial Strategy:
2. [The Impact of the Innovation, Research & Technology sector on the UK Economy; Oxford Economics November 2014.](#)
3. [A taxonomy of the UK's Innovation Research Technology sector, February 2018, AIRTO](#)
4. Industrial Strategy White Paper - [Building a Britain fit for the future; Her Majesty's Government 2017](#)
5. Innovating to Net Zero. Energy Systems Catapult, 10 March 2020.  
<https://es.catapult.org.uk/reports/innovating-to-net-zero/>
6. Beyond COVID-19: Laying the foundations for a net-zero recovery. National Engineering Policy Centre, Royal Academy of Engineering, 2 November 2020.  
<https://www.raeng.org.uk/publications/reports/beyond-covid-19-laying-the-foundations-for-a-net-z>
7. Industrial Strategy: Offshore Wind Sector Deal. HM Government, 7 March 2019.  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/790950/BEIS\\_Offshore\\_Wind\\_Single\\_Pages\\_web\\_optimised.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790950/BEIS_Offshore_Wind_Single_Pages_web_optimised.pdf)
8. Faraday battery challenge: Industrial Strategy Challenge Fund, 8 March 2018. UKRI  
<https://www.gov.uk/government/collections/faraday-battery-challenge-industrial-strategy-challenge-fund>



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