RenewableUK’s response to the Green Paper
This response has been compiled by RenewableUK with input from our membership. The companies we represent show the depth of the UK’s renewable energy industry, covering sectors ranging from ICT, construction, manufacturing to professional services and businesses that range from small family-owned manufacturing firms to international utilities. These companies employ a quarter of a million people and will invest more than £15.6bn in UK infrastructure between 2016 and 2021 – over 90% of which, will flow to regions outside of London and the South East. In 2016, 24.4% of the UK’s electricity was generated from renewable energy sources. 45% of this was generated by onshore and offshore wind, which provided 11.1% of the UK’s electricity needs.

This response is structured in response to the key themes of the Industrial Strategy Green Paper and across our technology groups and their supply chains. This is accompanied by a response to the specific questions asked in the Green Paper consultation.

About RenewableUK
RenewableUK is the trade and professional body for the wind, wave and tidal energy industries. It promotes the deployment of clean energy, by making politicians, the media and the general public more aware of the UK’s transition from fossil fuels to renewable sources. Formed in 1978, and with more than 400 corporate member companies, RenewableUK is the country’s leading renewable energy trade association.
Executive summary

The Industrial Strategy is looking to identify sectors and industries that can improve the competitiveness of the UK, further British excellence, drive regional productivity, enable technology innovation and guarantee affordable energy. It correctly highlights that sensible industrial policy should avoid supporting incumbent technologies but rather strive to deliver long term benefits to the UK economy. With the Government’s Clean Growth Plan due imminently, it also seems clear that the Industrial Strategy should be consistent with, and should enable, the low carbon economy.

We believe that the diverse, rapidly growing, renewables sector has solutions to the main challenges outlined in the Industrial Strategy. The five chapters in this document set out opportunities to build world-leading industries, to deliver affordable power for consumers, growth right across United Kingdom, continued investment in innovation and new export opportunities for a global Britain.

Renewable energy is a mainstream industry, delivering a quarter of the UK’s electricity, as part of a low-carbon sector which is growing faster than the rest of the economy and comparable in size to energy-intensive manufacturing. Britain has been bold in the past in transforming its energy market, in utilising our world-class natural resources and the expertise in UK businesses. The renewable energy sector is today’s big economic opportunity.

1. Enabling the UK’s industrial competitiveness through the lowest cost energy
Some forms of renewable energy are already the lowest cost form of any new generation. With others showing cost reduction that far surpasses the Government’s expectation, renewable energy technologies are the right investment today to ensure low cost energy that will enable industrial growth now and in the future.

2. Driving growth across the whole country
Renewable energy is deployed to best capture the UK’s world-class natural resources. The location of many renewable energy sites have created investment in areas of relatively low GVA. Renewable energy development also supports a diverse UK supply chain across UK regions, and is providing a significant role in the continued growth of traditional sectors, such as steel or manufacturing.

3. Encouraging trade and inward investment
The UK’s experience in established renewable energy technologies places it in an exceptional position to drive exports in high value manufacturing, skills and other sectors. The UK is also home to world-leading energy innovation, which should give us an opportunity to capture market share as countries across the world look to develop their own renewable energy markets.
4. Building a modern, flexible system
The low carbon transition and the changing energy market place offers an opportunity to establish, predictable, sustainable and cost-reflective energy market arrangements that ensure all participants compete to provide services to a smart, flexible grid. This approach can ensure lowest cost energy for consumers.

5. Cultivating world-leading sectors
The Government has been historically very good at financing both early stage commercial development and providing market stabilisation support for technologies as they scale up in the market. But by recognising and supporting innovation at different stages of development, Government can cultivate technologies and sectors for both domestic application and international export opportunities.
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Enabling the UK’s industrial competitiveness through the lowest cost energy

The Industrial Strategy’s challenge to industry: Ensure that low energy costs are a foundation of the UK’s competitiveness and regional productivity.

Renewable energy’s offer to the Industrial Strategy: Some forms of renewable energy are already the lowest cost form of any new generation. With others showing cost reduction that far surpasses the Government’s expectation, renewable energy technologies are the right investment today to ensure low cost energy that will enable industrial growth now and in the future.

Renewable energy is already central to today’s energy system – providing 24.4% of the UK’s electricity in 2016. To ensure that we modernise our ageing energy assets and decarbonise at the least cost to the consumer, it is crucial that the least cost forms of generation are deployed – where they secure local support and meet environmental requirements.

Onshore wind is now the cheapest form of new generation with a Levelised Cost of Energy (LCOE) of around £47-76/MWh for projects commissioning in 2020 - lower than CCGT, the cheapest fossil-fuelled generation. This is further supported by recent work showing that a Pot 1 CfD auction could see clearing prices around £49.40/MWh for onshore wind. It can be deployed rapidly given the pipeline of consented sites that have community support and excellent wind resources; most of which are in Scotland. This will be further supported by repowered sites that are similarly able to deploy quickly. It is therefore essential that onshore wind continues to play a role in new low carbon generation to be built over the next decade to minimise the cost to consumers.

At present the government estimates that the LCOE of offshore wind projects commissioned in 2020 will be in the range of £93-119/MWh. However, recent auctions in Europe for offshore wind have cleared at extremely low prices of €72.70/MWh in the Netherlands and even €49.90/MWh in Denmark. Although consenting regimes are different across countries, this rapid cost reduction is expected to be reflected in this year’s Allocation Round for Pot 2 auctions, demonstrating the significant progress offshore wind continues to make to reduce costs. It is therefore highly attractive for electricity bill payers for offshore wind to continue to deploy at scale in the UK given its ability to deliver both large capacity and low cost.

Renewable energy technologies where the market is only beginning to develop in the UK will see significant cost reductions in the future. The first pathfinder tidal lagoon, Swansea Bay,
would involve a CfD equivalent strike price of £89.90/MWh which would fall to a range of £60-70/MWh for larger lagoons such as Cardiff.

Similarly, innovative technologies including tidal stream, floating offshore wind and wave energy expect to realise rapid cost reduction in the medium term.

To deliver these benefits, it is important that this and other new emerging technology has a route to market and cost reduction so that the UK’s security of supply is diversified across a range of affordable low carbon technologies.

**Recommendations: Enabling the UK’s industrial competitiveness through the lowest cost energy**

To ensure costs to the consumers are minimised and enable the UK’s industrial competitiveness, the Government should -

*Horizontal policies*

1. 
   a. In the short-term, maintain the announced budget of £730m in this Parliament for Pot 2 CfD auctions
   b. Based on recent accelerated cost reduction commit to an engrossed role for offshore wind in power sector decarbonisation from the mid-2020s.

2. 
   a. Establish collective agreement across all stakeholders that further onshore wind is necessary to minimise the cost to consumers
   b. Once this agreement is established, agree on the appropriate mechanism by which investment in onshore wind should proceed

3. Make a positive and timely decision regarding the recommendations of the Hendry Review

4. Provide a route to market for emerging technologies with the potential to reach cost parity with other forms of renewables generation

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9 Under a 90-year term contract only partially linked to inflation

10 Tidal Lagoon Power (2016)
Driving growth across the whole country

Energy strategy driving industrial benefit across the UK

The Industrial Strategy’s challenge to industry: Ensure that the transformation of our energy system drives growth across the whole country.

Renewable energy’s offer to the Industrial Strategy: Deployment of renewable energy to capture the best of the UK’s world-class natural resources is directly supporting regional regeneration in areas of relatively low GVA.

As world-class, domestic sources of energy strongly tied to the UK’s regions, renewable energy is a key economic driver and opportunity for many coastal regions. The UK has exceptional domestic resources in onshore and offshore wind, tides and waves — resource that can help the UK reduce our exposure volatile global markets. Following accelerated cost reduction in renewables the potential to exploit this resource increases. Realising only a fraction of this resource would enable the UK to become a net exporter of electricity, and support a future part-electrification of transport, and heat generation.

The UK has a history of building an industry on the back of its natural resources. The development of the North Sea oil fields took a localised resource as a domestic source of energy that transformed the local economy as well as creating a macro-economic boom. The renewable energy sector has the same potential.

The renewable energy industry’s investment in infrastructure and UK supply chains can be found right across the UK; most often in regions of relatively low GVA. The places of renewable energy are represented across the UK including Scotland, North East of England, Scotland, Hull and Humberside and the Isle of Wight and Solent areas. Continued deployment of renewable energy is therefore crucial to maximising a UK-wide economic benefit that flows from modernising our energy system.
Figure 1. Companies active in renewables mapped against regional GVA data per head\textsuperscript{11}

\textsuperscript{11} RenewableUK analysis (2017) based on ONS GVA figures (2016): \url{Regional gross value added (income approach), UK: 1997 to 2015}
Onshore wind projects deliver circa 70% of UK content\textsuperscript{12} (defined as the amount of expenditure retained within the UK over the whole lifecycle of a project), the offshore wind sector is confident that it will deliver its aim of 50% UK content and the wave and tidal stream sectors often achieve more than 80%\textsuperscript{13}.

Extensive supply chains have developed as a consequence of this renewables demand for UK products and services; these companies span manufacturing, steel fabrication, advanced materials electronics, engineering, ports and maritime vessels, financial services among many others (see also Appendix A).

With long-term visibility of the future market, these companies can invest in their capability, maintain and further their competitiveness and support Government’s key industrial objectives.

For example, the expansion of the offshore wind industry is regenerating the east coast and other areas of relatively low GVA. The UK’s world-class natural resources in the North Sea have enabled ports from Scotland down to the Humber and East Anglia to upgrade their infrastructure\textsuperscript{14,15} and for large manufacturing facilities to be sited there\textsuperscript{16,17}.

\textbf{Case study: Siemens}

Based in Hull, Siemens have recently opened their £160m wind turbine production and installation facilities in the Humber region. The combined investment from Siemens and ABP of £310m will create up to 1,000 jobs directly, with additional jobs during construction and indirectly the supply chain. Contracts have already been signed with UK companies that include Volker Fitzpatrick, Neville Tucker Heating, Clugston as well as Hull College Group who have won a £1m contract for training.

It has similarly allowed investment in manufacturing and testing facilities and in skills in other regions that lag behind the affluent areas in London and the South East – including in the Isle of Wight and greater Solent area\textsuperscript{19}.

\textsuperscript{12} RenewableUK (2015) \textit{Onshore wind: Economic impacts in 2014}
\textsuperscript{13} RenewableUK (2017) Member survey
\textsuperscript{14} BVG Associates for the Offshore Wind Industry Council (2016) Strategic review of UK east coast staging and construction facilities
\textsuperscript{15} Peel Ports Group (2016) \textit{Outer Harbour works commence at Peel Ports, Great Yarmouth}
\textsuperscript{16} Siemens (2016) \textit{Siemens' investment in Green Port Hull}
\textsuperscript{17} Forth Ports (2017) \textit{Multimillion-pound investment in Port of Dundee}
\textsuperscript{18} Siemens (2016) \textit{Siemens' investment in Green Port Hull}
\textsuperscript{19} MHI Vestas (2014) \textit{MHI Vestas Offshore Wind to serial produce blades on the Isle of Wight, UK}
The UK’s excellent wind resources both onshore and offshore have supported businesses to make investments in Scotland, the North East and elsewhere.

**Case study: MHI Vestas Offshore Wind**

MHI Vestas Offshore Wind (MHI Vestas) started serial production of the eighty meter blades for the V164-8.0MW in June 2015, and now employs 300 directly with another 50-100 in island-based suppliers. MHI Vestas responded to a time limited funding competition for skills development, launched by Solent LEP in November 2014. The competition prioritised large-scale transformational projects and in response, MHI Vestas formed a partnership with the Isle of Wight College to create a comprehensive skills development programme for the West Medina Mills workforce, including a Level 3 NVQ in composite engineering.

The Solent LEP funding enabled the c.£1m MHI Vestas blade production training programme to go ahead, which includes NVQs in composite engineering for production staff. The relationship with the Isle of Wight College has developed into a positive, ongoing relationship, supporting the Isle of Wight College’s recent investment into a new Centre of Excellence for Composites, Advanced Manufacturing, and Marine (CECAMM).

**Beatrice Offshore Wind Case Study**

Based in North Scotland, the £2.6bn, 588MW Beatrice Offshore Windfarm is one of the largest private investments in Scottish infrastructure and driven by SSE Renewables, Copenhagen Infrastructure Partners and Red Rock Power.

Beatrice is expected to deliver around £680m into the UK and Scottish economy via employment and supply chain opportunities during the construction phase and a further £400m-£525m during the wind farm’s 25-year operational life. Supply chain contracts awarded include a BiFab’s £100 million contract to fabricate foundation jackets from 22,500 tonnes of steel in Burntisland, Arnish and Methil.
RenewableUK analysis shows that the total economic value from onshore wind to the UK based on installed capacity as of 2017 is over £13bn. This demonstrates the size of the footprint of onshore wind across all regions of the UK over the entire lifecycle of a wind farm (development, construction, operations & maintenance).

### Case study: Raymond Brown

Based in Hampshire, this construction company works in sectors as diverse as defence, rail tunnels and waste infrastructure. In addition to building and maintaining some of the UK’s major motorways and town centre regeneration schemes in Chatham, London and Bournemouth, it has completed work on over 200 wind farms throughout the UK totalling over 400 megawatts of clean energy capacity.

New innovations will further drive this investment in regions – both in less established and developing technologies. New markets in floating offshore wind will create further opportunities for companies and assets in the east coast and the Scottish Highlands that already enjoy substantial benefits from the maturing fixed offshore wind market. This floating offshore market is likely to drive investment in the Scottish Highlands and Islands where ports near the Cromarty Firth and near Fife and Rosyth are well-placed to accommodate the industry.

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21 Calculation of economic benefits to the area is based on multiplying the capacity in the region by the economic benefit figure contained within research commissioned by RenewableUK. BiGGAR for RenewableUK (2015) Onshore wind: Direct and wider economic benefits.

22 Calculation of economic benefits to the area is based on multiplying the capacity in the region by the economic benefit figure contained within research commissioned by RenewableUK. BiGGAR for RenewableUK (2015) Onshore Wind: Economic benefits in Northern Ireland.


The growth of innovative wave and tidal stream industries in the UK can drive regional investment along the west coast. The sectors are already building clusters of activity in Cornwall, the Solent and Isle of Wight, Scottish Highlands and Islands, Wales and Northern Ireland including academic research, engineering design and construction, advanced materials, ports and professional services. These sectors have already invested nearly £450m in the UK supply chain and achieved £7 investment for every £1 of public money invested with much of it coming from outside the UK as inward investment.

**Case study: European Marine Energy Centre (EMEC)**

Based in Orkney, EMEC is the world’s leading wave and tidal energy test and demonstration centre. EMEC have tested 27 devices from 17 companies from 9 countries and have been involved in over 100 R&D projects. £34m has been invested in their facilities. 50% of companies testing new technologies at EMEC are based in the UK with the rest attracted from overseas. A total of £249.6m GVA has been generated for the UK economy. In addition EMEC is exporting their knowledge and experience to 18 countries globally.

**Case study: Swansea Bay City Deal**

As part of the £1.8bn recently secured between the Swansea Bay City Region Board and the UK and Welsh Governments, Port of Milford Haven’s £76m Pembroke Dock Marine project, in partnership with Marine Energy Wales, ORE Catapult and Wave Hub, will establish a world-class facility for marine energy development, fabrication, testing and deployment in the naval dockyard.

The development of a new industry in tidal lagoons will drive investment in Wales and the North West of England with the six planned lagoons likely to contribute £27bn to UK GDP during construction and a further £3.1bn each year of operation. The first project, the Swansea Bay Tidal Lagoon, is targeting 65% UK and 50% welsh content and the creation of 2,260 direct FTEs; of which 49% of those jobs would be in manufacturing of fabricated metal industry, 20% in steel casting and 11% in forging or stamping.

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25 Highlands and Islands Enterprise, RegenSW and Marine Energy Pembrokeshire (2016) Marine energy: Key steps to maintain a Great British Success Story
26 Highlands and Islands Enterprise, RegenSW and Marine Energy Pembrokeshire (2016) Marine energy: Key steps to maintain a Great British Success Story
27 Swansea Bay City Region (2017) City Deal: The Internet Coast
28 Centre for Economics and Business Research (2014) The Economic Case for a Tidal Lagoon Industry in the UK
29 The Hendry Review (2016) The role of tidal lagoons
Case study: Swansea Bay Tidal Lagoon

The Swansea Bay tidal lagoon project is the first of its kind anywhere in the world. It has already raised £1.3bn of private financing and the company involved, Tidal Lagoon Power, has developed a strong, British-based supply chain of preferred suppliers. This single project represents £800m of potential contracts for the UK’s engineering, construction, steel and manufacturing industries. New facilities for machine and turbine pre-assembly and steel component fabrications are already planned and the control systems and generators will be manufactured in Rugby by GE Power Conversion from British parts.
Renewable energy playing a role in the growth of traditional sectors

The Industrial Strategy’s challenge to industry: Ensure that the transformation of our energy system secures economic benefits for the UK.

Renewable energy’s offer to the Industrial Strategy: Renewable energy will play a significant role in the continued growth of traditional sectors.

Our offshore and onshore technologies are sharing supply chains, building partnerships to share our common challenges and growing the sector in collaboration with UK companies in traditional sectors. This shared supply chain demonstrates the diverse nature of supply chain companies and the transfer of skills across technologies. Not only do technologies share supply chains, renewables have also offered an opportunity to traditional sectors and businesses to work with a modern sector. Companies with a long history in oil and gas, aerospace, marine, maritime, defence and steel have expanded to operate within the renewables sector- bringing their learning and expertise across to renewables.
Figure 2. Shared supply chains across renewable energy technologies represented by RenewableUK\(^{30}\)

\(^{30}\) RenewableUK analysis (2017) based on [http://www.renewableuk.com/Page/SupplyChainMap](http://www.renewableuk.com/Page/SupplyChainMap)
An example of this relationship, is how onshore and offshore wind create a domestic opportunity for UK steel production and fabrication with 140 tonnes of steel incorporated in an average wind turbine, with the vast majority of this being used in the tower\(^\text{31}\). Overall, RenewableUK estimates that a total of c.2million tonnes of steel is required between 2016 and 2020 to support the deployment of offshore wind\(^\text{32}\) and the total sum of steel required for onshore projects that have been consented and are in planning is c.1 million tonnes\(^\text{33}\). Comparable to sectors such as gas where a recently built CCGT plant used 3,000 tonnes of structural steel\(^\text{34}\).

**Case study: Hutchinson Engineering**

Based in Widnes near Liverpool, Hutchinson Engineering began fabricating steel structures for the smaller end of the onshore wind market in 2010. Over that period, they have invested in technical skills and infrastructure to the point where they have now secured multi-million pound orders from MHI Vestas Offshore Wind for secondary steel structures for UK offshore wind operations.

Other examples include the oil and gas sector where yards are now building world-leading tidal arrays\(^\text{36}\) and vessels are diversifying into offshore renewable energy and in aquaculture where companies such as Inverlussa Marine Services have diversified from providing boats and marine operations for fisheries to providing specialist vessels for the offshore wind sector\(^\text{37}\). The skills development and investment by the Scottish Fishermen’s Federation and Skills Development Scotland was recently recognised for their work in enabling the fishing fleet to diversify into offshore wind\(^\text{38}\).

**Case study: Wide Blue**

Glasgow-based Wide Blue – formerly Polaroid’s R&D lab – are working with the Offshore Renewable Energy Catapult to develop, test and commercialise their optical technology into a system of cameras and sensors that can detect blade deformation. The Blade Optical Health Monitoring System would at once be able to monitor blade shape changes and allow early detection in changes of performance, meaning that maintenance time can be used more effectively.

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\(^{31}\) Biggar Economics for DECC and RenewableUK (2012) *Onshore wind: Direct and wider economic impacts*

\(^{32}\) RenewableUK analysis based on Biggar Economics for DECC and RenewableUK (2012) *Onshore wind: Direct and wider economic impacts*

\(^{33}\) RenewableUK analysis based on Biggar Economics for DECC and RenewableUK (2012) *Onshore wind: Direct and wider economic impacts*

\(^{34}\) Power Technology (accessed 2017) Great Island Combined Cycle Gas Turbine Power Plant, Wexford, Ireland


\(^{36}\) Atlantic Resources

\(^{37}\) Inverlussa Marine Services [https://www.inverlussa.com/](https://www.inverlussa.com/)

\(^{38}\) Scottish Fishermen’s Federation (2016) [http://www.sff.co.uk/scottish-fishermens-federation-scoops-green-energy-award/](http://www.sff.co.uk/scottish-fishermens-federation-scoops-green-energy-award/)

Figure 3. Map of UK steel plants against manufacturing supply chain companies that utilise steel\textsuperscript{40}.

\textsuperscript{40} RenewableUK analysis (2017) based on http://www.renewableuk.com/Page/SupplyChainMap
Recommendations: Driving growth across the whole country

To support this rich and diverse UK supply chain to increase and improve their productivity, competitiveness and skills and, thereby, the Government should -

**Horizontal policies**

5. Establish a business advisory service for businesses following the models of GROW, the Manufacturing Advisory Service and the best overseas examples across industries to reflect the diverse industries which make up our current and potential supply chains.

6. Include a stronger focus on engineering (electrical, electronic and mechanical) training and skills in the announced Technical Colleges.

7. Simplify the provision of vocational courses, including in-work training, to ensure that courses focus upon skills transferable across a wide range of sectors.

**Sectoral policies**

8. Set out a long-term, clear pipeline of future market demand for renewable energy against which supply chain companies can continue to invest in the UK for both the strong domestic market and for export to the growing global market.

9. Coordinate a fund that prospective new entrants can apply for as they move into new markets and which is then recycled back into the fund by those who are successful, reducing barriers to entry for new market entrants that make it hard to be competitive.

10. Establish a National Maritime Research Centre to bring together existing bodies and funding supporting the UK’s maritime industries with a particular focus upon innovation in marine operations and vessels that currently fall between maritime transport and the offshore renewable sectors.
Encouraging trade and inward investment

Exporting UK’s world-leading expertise in mature and less established technologies

The Industrial Strategy’s challenge to industry: Build a truly global Britain that supports trade and inward investment across the world.

Renewable energy’s offer to the Industrial Strategy: The UK’s leadership and experience in renewable energy technology places it in an exceptional position globally to drive exports in high value manufacturing, skills and other sectors to mature and emerging markets.

As the UK leaves the European Union, it is imperative that we build on the UK’s leading sectors and skills to create an expanded and stronger role in international markets.

Companies in the supply chain for renewable energy range from SMEs to large corporates. These firms cover a variety of goods and services, such as: supplying and maintaining turbines and components for offshore and onshore wind and wave and tidal energy projects; installing offshore wind turbines, wave and tidal devices and underwater power cables; inspecting and maintaining offshore wind farms; advanced materials development; providing helicopters, crew and vessels; conducting geological surveys and environmental; weather forecasting; monitoring wildlife; and providing financial, advisory and legal services.

Case study: ITP Energised

Based in Bristol, Edinburgh, Glasgow and London, ITP Energised provides consultancy services for renewable energy developers and investors throughout the lifecycle of their projects, from the feasibility stage, through the design and construction period to the operational phase. In 2016, it won offshore wind, wave and tidal energy contracts in Canada, China, Taiwan, India, Turkey, Denmark, Sweden, Singapore and the Philippines.

Case study: Perpetuus Tidal Energy Centre

Based in the South of the Isle of Wight, the Perpetuus Tidal Energy Centre (PTEC) will support three commercial demonstration projects of 10MW each. The tidal stream project, which is fully consented and holds a signed grid connection offer, has been designed and structured to reduce risk, accelerate commercialisation and provide a blueprint for future cost reduction strategies in moderate flow sites. PTEC has partnered with Dutch and German turbine manufacturers, Tocardo International BV and Schottel Hydro GmbH, providing a significant inward investment opportunity and strong potential for establishing a UK based supply chain with the successful implementation of the project and potential expansion within the Solent region, the heart of the UK’s maritime sector.

Opportunities are available for all sizes of generation and technology. The UK already exports more small and medium onshore wind turbines than it deploys in the UK with
principal markets in Europe and the United States as well as newer markets in Japan, the Pacific islands – in total, our companies export to every continent except Antarctica\textsuperscript{41}.

**Case study: Britwind**

Based in Stroud Gloucestershire, Britwind is a leading global small wind exporter and sold more than 100 turbines around the world last year, worth more than £1 million. The company employs around 30 people from both the large and small wind industry, designing radical new wind turbines to bring lower bills and energy independence to people in Britain and abroad.

**Case study: Gaia-Wind**

Based in Glasgow, where it employs 14 people, Gaia exported 135 small wind turbines and provided components, services and training to over 100 onshore wind projects in Denmark, Italy, Japan, the USA, the US Virgin Islands in the Caribbean and Tonga. This represented over 50 contracts last year, with an average value of around £80,000 each and a total value of approximately £4 million.

Last year’s exports to Tonga build on Gaia-Wind’s initial success there in 2013, when the South Pacific island’s Prime Minister, Lord Tu’ivakano, commissioned the kingdom’s first wind turbine at Nakolo Village. At a distance of 16,109 kilometres, Tonga’s orders set the furthest ever record for an export order for the company. Gaia-Wind beat off competition from small wind turbine manufacturers in the US and Europe to win these ground-breaking orders.

Over the next 25 years, the global market for onshore wind will continue to grow. In the Americas, this will be driven in the short-term by mechanisms such as US tax incentives and in the medium term by out-competing fossil fuel technologies in many countries. Growth will be significant in the Asia-Pacific region with $3.6tn and 4,890GW added during this period – of which, onshore wind will constitute the largest share at $1.3 trillion\textsuperscript{42}.

**Case study: Windhoist**

Based in Irvine Scotland and Ireland, Windhoist provides heavy cranes to erect turbines and skilled technicians to complete the mechanical and electrical work necessary to make them fully operational. It also carries out maintenance work, with technicians replacing gearboxes, generators and blades as well as decommissioning turbines at the end of their lifespan.

In 2016, Windhoist worked on 20 projects outside the UK, in France, Germany, Belgium, Ireland, Morocco and Australia with contract values ranging from £50,000 to £4 million. The company has now installed more than 5,000 onshore wind turbines worldwide with a combined capacity of over 10 gigawatts.

\textsuperscript{41} Upcoming RenewableUK study, April 2017  
\textsuperscript{42} Bloomberg New Energy Finance (2016) \textit{New energy outlook 2016}
The Department for International Trade recognises the UK as the world leader in the deployment of offshore wind. The UK’s natural resources, maritime infrastructure, and engineering heritage have all combined to give us a leading edge, and now positioned the UK as a key partner for major economies, including China and the USA, who are developing their industries. With a future potential global pipeline of over 92GW\(^43\), the global offshore wind market provides a huge opportunity for world leading UK companies to export their goods and services across the world.

![Global offshore wind commissioning activity (MW per annum)](#)

**Case study: JDR Cables**

Based in Cambridgeshire and with its state of the art manufacturing facility in Hartlepool, JDR Cables designs and manufactures power cables for offshore wind farms, as well as supporting installation and maintenance activities.

In 2016, JDR worked on offshore wind projects in Germany and turned its attention to the North American market – resulting in the company securing an agreement in early 2017 as preferred cable supplier to US Wind for their first offshore project in America.

Last year, the company also announced plans to open a new European customer service support centre in Newcastle, potentially creating 50 more jobs. The location was strategically selected for its proximity to projects in the North Sea and Europe, JDR’s Hartlepool facility and the local UK supply chain.

\(^{43}\) RenewableUK analysis, March 2017  
\(^{44}\) Based on RenewableUK analysis, January 2017
Overall, UK offshore wind supply chain companies have already seen success in winning and completing contracts across Europe, the USA and Asia, with at least 115 contracts to help build and service 50 offshore wind projects abroad\(^\text{45}\); including examples such as MHI Vestas Offshore Wind’s UK-manufactured, 80m offshore wind turbine blades to the DONG Energy Borkum Riffgrund II offshore wind project in Germany.

Similarly, the UK has significant opportunity to become a world leader in tidal lagoon power, taking advantage of a global market estimated to be worth £30bn as the market develops and other countries seek to build tidal lagoons at commercial scale\(^\text{46}\). Canada, France, India and Mexico are some of the prime overseas markets which could develop tidal lagoons in the future and Tidal Lagoon Power has initially identified 14 sites which are suitable for large tidal lagoon projects.

\(^{45}\) RenewableUK (2016) Exporting offshore wind
\(^{46}\) Tidal Lagoon Power (2016) Ours to own: From first mover to mass manufacture
Capturing dominant market shares in new growth markets

The Industrial Strategy’s challenge to industry: Build a truly global Britain that supports trade and inward investment across the world.

Renewable energy’s offer to the Industrial Strategy: The UK’s world-leading innovations at home offer an opportunity to capture commanding market shares as countries across the world follow our lead.

The UK’s ambition in decarbonisation coupled with our world leading expertise means that we are at the forefront in developing solutions for a modern flexible system. Smart grid solutions are one such innovation. These solutions are crucial to decarbonising most cost-effectively and their market will grow as those for renewable energy do. This will grow further as the development of smart grids is likely to require 8-9,000 jobs through the 2020s and 2030s\(^47\) and could deliver the UK export earnings of £5bn to 2050\(^48\).

Storage will similarly be crucial and also constitutes a sector where the UK has the potential to become a world leader, building on our global leadership position in data analytics and software development\(^49\). We strongly support the establishment of a research institution to act as a focal point for work on battery technology, energy storage and grid technology; the case for which will be reviewed by Sir Mark Walport as announced in the Industrial Strategy Green Paper\(^50\).

In addition to mature renewable energy, countries around the world are beginning to invest in innovative technologies. Our first-mover advantage is enabling the UK to capture significant market shares for British technology in these markets.

The UK is the global market leader in wave and tidal stream and we have strong comparative advantage in a growing global industry estimated to be worth 337GW of deployment and an annual global value of $35bn by 2050\(^51\). The UK has a high to very high competitive advantage in most areas of development\(^52\). In addition, our experience in project development, testing and deploying devices means that we are already beginning to lead the world in the development of global standards for the industry\(^53\).

Almost all countries with good tidal stream and wave resource are now funding support into tidal stream and wave energy through both revenue and capital support. In Europe\(^54\), this support includes France providing revenue support through competitive tenders underway now in order to reach their target of 100MW of wave and tidal stream installed by 2023 and 2GW awarded public tenders\(^55\). Similarly, Ireland is providing revenue support for the first 30MW of deployment and further support through the Ocean Energy Development Fund and the SEAI Prototype Development Fund.

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\(^{47}\) EY for SmartGrid Great Britain (2012) *Great Britain: unlocking the potential of smart grid*
\(^{48}\) Smart Grid Forum (2014) *Smart grid vision and routemap*
\(^{49}\) National Infrastructure Commission (2016) *Smart power*
\(^{50}\) BEIS (2017) *Building our industrial strategy: Green paper*
\(^{51}\) OES (2017) *An international vision for ocean energy*
\(^{52}\) Low Carbon Innovation Coordination Group (2012) *Technology Innovation Needs Assessment: Marine energy*
\(^{53}\) EMEC (2010) *New work on global standards*
\(^{55}\) Tidal Energy Today (2017) *France plans 2017 tidal tender*
North America is also aggressively pursuing marine energy with Canada’s FORCE Programme in the Bay of Fundy offering revenue support\(^\text{56}\) and Asia is following suit with China’s recent 5-year plan announcing dedicated support to wave and tidal stream energy.

### Case study: Chinese tidal stream and wave market

China’s recent 5-year plan announcing dedicated support to wave and tidal stream energy include –

- Wave and tidal demonstration projects in Zhejiang and Guangdong
- National facilities for maritime testing, laboratory simulation and resource data
- Investment into standardising components
- £200m investment including funding to develop a Chinese EMEC in Qingdao, Shangdong

Across South East Asia and South America, the industry has strong potential opportunities in replacing fossil fuel small generators used in remote communities where the price of electricity is above that of the current cost of wave and tidal stream energy\(^\text{57}\).

Finally, the UK is well-placed to capture significant export opportunities in fixed-bottom and floating offshore wind in countries such as the US, Japan and mainland Europe where the potential size of the market is likely to be considerable\(^\text{58}\).

The renewables industry is strongly supportive of the UK Government’s focus upon building exports across the world and the recent initiatives to increase UK Export Finance’s ability to contribute to this. It is however crucial that technologies and expertise in which the UK has the potential to hold a high market share globally can prove themselves in the UK before and during this expansion. Investing in new technologies and expertise in the domestic market provides the platform from which dominant shares in new and growth markets can be taken.

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\(^{56}\) Atlantis Resources (2017) Nova Scotia

\(^{57}\) Reuters (2016) Tidal power developers bet on sea change in Indonesia renewables sector

\(^{58}\) Carbon Trust (2015) Floating offshore wind: Market and technology review
Recommendations: Encouraging trade and inward investment

To drive exports in these world-leading UK sectors, the Government should -

**Horizontal policies**

11.  
   a. Create a sufficiently large and sustainable domestic market to drive global growth  
   b. Ensure that domestic energy innovations and technologies are supported in the UK in order for them to expand overseas.

12. Continue to ensure the UK is viewed as the destination of choice for entrepreneurial UK and global talent to commercialise and grow their businesses

13. Set out long-term visibility of events DIT will support in order for Trade Challenge Partner to prepare for the delivery of trade missions

14. Clarity of the offer from DIT and UKEF to UK companies who are looking for support to identify and secure access to export markets.
Building a modern, flexible system

The Industrial Strategy’s challenge to industry: Manage the necessary changes to energy networks required in the transition to a low carbon economy.

Renewable energy’s offer to the Industrial Strategy: Building on the existing system to create one of sustainable, predictable, long-term and cost-reflective market arrangements that ensure all participants compete to provide services to a smart, flexible grid and ensure the lowest cost for consumers.

The huge transition in our energy system is underway, inevitable and, if done in a smart way, could save consumers up to £8bn a year by 2030.\(^{59}\)

This transition to a flexible system will be driven by the decarbonisation of the power sector, with the electricity grid expected to be at 50g-100g CO\(_2\)e by 2032, the end of the legislated fifth carbon budget period. A low carbon power sector will also act as an enabler for the decarbonisation of other, more difficult, sections of the economy. The full benefits of electrification, whether of transport or heat, for example cannot be realised without a clean electricity grid.

With reform to infrastructure and markets both unavoidable and necessary, it is important that Government regulatory change keeps up in order to capture the benefit of this change. Those operating in the energy system do so with an understanding of considerable economic and technological uncertainty – risks appropriately taken on by those participants. However, avoiding policy risk which creates unnecessary uncertainty is within control of the government and can be best minimised through a predictable, mechanistic process.

In this context, the UK’s legislated fourth and fifth carbon budgets and a globally recognised electricity reliability standard (a measure of the electricity networks’ safety and security) can be a foundation for the energy system. They should form the basis of the UK’s future market demand for new low carbon generation, capacity reserve and flexibility.

The electricity market, through the wholesale price, does not currently and is not likely in future to provide an accurate investment signal of our need for generation, capacity and other energy services.\(^{60,61}\)

Rather than the wholesale price, and working towards the vision offered by the carbon budgets and the electricity reliability standard, Government should produce a stable, predictable trajectory of additional generation, capacity and flexibility that is needed to reach this future demand. To ensure maximum competition, liquidity and the scale of needed investment, these requirements should be –

- Determined by a transparent and mechanistic calculation of unmet demand;
- Robust enough to give investors sufficient confidence that the long-term future requirement set out will be committed to;
- Sufficiently predictable with respect to both expected requirements as well as to budgetary and other changes in response to over- and under-procurement; and

\(^{59}\) National Infrastructure Commission (2016) Smart Power

\(^{60}\) DECC (2011) Planning our electric future: a White Paper for secure, affordable and low-carbon electricity

\(^{61}\) Amber Rudd (2015) Amber Rudd’s speech on a new direction for energy policy
Supportive of innovation and ensure that technological advances are not restricted.

Once there is a clear pathway or trajectory in place, this should determine the services that are bought by the market and that participants compete to provide. To ensure the Government’s objectives of transitioning to a low carbon economy whilst minimising costs to consumers are met, these services should –

- Be cost-reflective;
- Be defined by open access, transparency and formalised processes in eligibility criteria and procurement (see below)\(^{62}\); and
- Make use of revenue stabilisation measures to bring forward investment in the context of a volatile and suppressed wholesale price.

Corporate PPAs will be helpful in evolving long term market mechanisms but the available PPA volumes for the foreseeable future are far too low to bring forward the required levels of capacity for decarbonisation to 2030. In the context of a persistent suppressed and volatile wholesale price and the lack of a robust carbon price, revenue stabilization measures will continue to play a crucial role for all energy technologies to ensure sufficient investment at a low cost of capital\(^{63}\).

The EMR program did not consider ancillary services markets and so procurement remains opaque and often bilateral, reducing competition. This is important given the volume of flexibility services will significantly increase over the short- to long-term and so require formalised processes and new entrants\(^{64}\). Moreover, more formalised markets open to non-traditional providers are already in place in the Netherlands and Belgium. In those markets, wind energy is already able to provide frequency response and other services to support grid resilience.

To ensure least cost delivery the UK’s ancillary services markets should be formalised towards open access in eligibility criteria and in tendering that is characterised by –

- Unbundled contracts and an increased range of contract durations;
- Regular, rolling tenders whose schedule, where possible, is aligned and that are conducted nearer to real time to support participation from non-traditional providers;
- Simpler pricing models used so that allocation risk and likely revenue from each service can be more easily forecast; and
- A lowered minimum size of 1MW to increase the number of eligible participants.

\(^{62}\) In the long term, we expect open access to be the norm. However, in the transitional period, there is likely to be practical challenges to fully achieving revenue stacking with a sufficient level of confidence to secure investment and debt and deliver against service obligations.

\(^{63}\) Newbery (2016) *How do we get to an electricity market with government making as few decisions as possible by 2025?*

\(^{64}\) National Grid (2016) *Flexibility Workstream – NGSO, Presentation to RenewableUK members*
Recommendations: Building a modern, flexible system

To build a modern energy system and ensure costs to the consumers are minimised, the Government should:

**Sectoral policies**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15</strong></td>
<td>The Government’s legislated five carbon budgets to 2032 and target of 100MtCO2e by 2050 should determine future demand for low carbon generation</td>
</tr>
<tr>
<td><strong>16</strong></td>
<td>The UK’s legal electricity reliability standard of 3hrs Loss of Load Expectation (LOLE) should determine future demand for capacity reserve</td>
</tr>
<tr>
<td><strong>17</strong></td>
<td>Published assessments of unmet market demand for new low carbon generation, capacity reserve and flexibility services should determine budget allocation and should be published sufficiently in advance to create as liquid a market as possible</td>
</tr>
<tr>
<td><strong>18</strong></td>
<td>The current carbon floor price should be maintained in the short term and increased over the longer term</td>
</tr>
<tr>
<td><strong>19</strong></td>
<td>The Levy Control Framework’s successor should set out a clear long-term trajectory for low carbon generation and use an accounting system based on the net cost to consumers</td>
</tr>
<tr>
<td><strong>20</strong></td>
<td>A regular schedule of Contracts for Difference (CfD) and Capacity Market auctions with appropriate contract tenors should be continued beyond 2025</td>
</tr>
<tr>
<td><strong>21</strong></td>
<td>Substantial reform should be undertaken to formalise the ancillary services markets and their procurement, ensuring increased competition</td>
</tr>
</tbody>
</table>
Cultivating world-leading sectors

The Industrial Strategy’s challenge to industry: Build on the UK’s excellence in basic and early stage research to further its ability to commercialise later stage innovation.

Renewable energy’s offer to the Industrial Strategy: New approaches will support innovative technologies to full competitiveness.

Bringing innovative technology to the point where it is able to compete in the market is extremely difficult and an issue that has exercised successive Governments65. As recognised by the Green Paper, the UK excels in basic and early stage research but continues to struggle to support later stage innovation to full competitiveness66.

This challenge arises from a number of issues that include uncertain or insufficient near-term commercial markets to justify investment (e.g. in drug development, energy innovation) despite long term market opportunities and product-based innovation support, often with difficult rules, which can in some case represent a disincentive to carrying out R&D in the UK versus other markets.

We believe that the initiatives put forward in the Industrial Strategy strengthen the UK’s ability to support early stage innovation focused on Technology Readiness Levels (TRL) 2-7. This builds on the success of the Industry Catapults as effective and strategic institutions for dedicating grant funding towards critical industries in the UK and furthering academic and industry collaboration and we welcome the recently announced Industrial Strategy Challenge Fund and the establishment of the new UK Research & Innovation organisation.

The Industrial Strategy Green Paper does not sufficiently address the crucial issue of how to progress technologies from TRLs of 8 and above through Commercial Readiness Levels (CRLs) and to full competitiveness in the market.

65 For example, House of Commons (2012-13), Industrial Strategy Green Paper (2017)
66 BEIS (2017) Industrial Strategy Green Paper
The Industrial Strategy White Paper should establish a clearer and more substantial policy for progressing innovation from TRL 7 and through the CRLs that cuts across industries and whose principles include:

- Prioritising the creation of and removing barriers to a near-term market for innovative technologies, creating the market pull through to drive innovation
- Providing an appropriate revenue stream that rewards performance and drives cost competitiveness
- Encouraging small innovative and larger companies to work together on R&D activity

In the energy system, the existing schemes, including the CfD, have been successful at achieving very significant cost reductions and volume of deployment in technologies including onshore and offshore wind. As this becomes a mechanism for procuring large volumes of mature and less established low carbon technologies at increasingly low costs, there is now a widening policy gap between innovation funding for Technology Readiness Levels 2-7 and competitiveness in the CfD mechanism.

For all innovative technologies in the energy sector, we consider that the US Production Tax Credit model could be adapted towards an Innovation PPA where cutting-edge technologies will compete for support via sales of electricity from companies wanting to support innovation. In this mode, buyers of energy from innovative energy technologies will receive

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an inflation-adjusted kWh tax credit at government-set levels for the support to innovative technologies that is in excess of market rates and that is controlled through:

- Being tied to generation and so only rewards successful technology development;
- Being capped by capacity at sub-utility scale for 15 years after the facility is commissioned;
- Strong degression mechanisms based on deployment to ensure that budgetary risk is limited

As a proposal that would apply across all innovative technologies, we consider that this would be funded through a reduction in corporate taxation rather than specific mechanisms such as the Levy Control Framework and thereby will not impact consumer bills or require long-term budget commitment from the BEIS. As with the market for corporate PPAs more generally, we consider that this will be a limited market but will be sufficient to support new innovative technologies.

**Worked example: wave and tidal stream**

Wave and tidal stream generate electricity through turning the kinetic energy of waves and tidal currents into electrical energy respectively and the UK holds 50% and 35% of Europe’s tidal stream and wave potential respectively\(^{68}\).

Through such a commercialisation model, the sector can reach commercialisation and cost parity with other forms of generation through providing a clear path from developing the technology through TRLs 2–7 in test centres and demonstration projects, to smaller capacity projects where technology is being scaled up and thereby progressing from TRL 8 and through the early CRL stages to full competitiveness in an open CfD auction.

<table>
<thead>
<tr>
<th>Role</th>
<th>Existing capital grant funding</th>
<th>Innovation PPA</th>
<th>Bridging mechanism from IPPA to CfD</th>
<th>CfD mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology innovation</td>
<td>Conduits for proving the technology and building a market</td>
<td>Low cost energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage of technology</td>
<td>TRLs of 2–7</td>
<td>TRLs 8+ and early CRLs</td>
<td>Late-stage CRLs</td>
<td></td>
</tr>
<tr>
<td>Sites</td>
<td>Dependent on test centres and locally consented sites</td>
<td>Leased sites and test centres</td>
<td>Leased sites only</td>
<td></td>
</tr>
<tr>
<td>Capacity control</td>
<td>3MW or less</td>
<td>10MW or less</td>
<td>10MW+</td>
<td></td>
</tr>
<tr>
<td>Cost control</td>
<td>Grant fund allocation</td>
<td>Degression mechanisms</td>
<td>Competitive allocation within the sector</td>
<td>CfD budget allocation</td>
</tr>
<tr>
<td>Competition</td>
<td>Not yet cost-competitive</td>
<td>Not yet cost-competitive</td>
<td>Not yet cost-competitive</td>
<td>Cost-competitive</td>
</tr>
</tbody>
</table>

In line with the path of all emerging technologies, the cost of tidal stream technology is currently higher than other renewables technologies. However, the industry has potential for

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\(^{68}\) BEIS (2013) *Wave and tidal energy: part of the UK’s energy mix*
significant cost reduction rates due to being able to take advantage of the UK’s engineering expertise built through our experience in oil & gas and offshore renewables, excellent marine resources and infrastructure in addition to standard cost reduction mechanisms around technology optimisation and economies of scale. Its unique predictability will also create opportunities and benefits for our electricity grid’s resilience.

In the UK, the foundation for this accelerated cost reduction will rest on the Pentland Firth and Orkney Waters’ exceptional characteristics of extremely energetic tides and nearby supporting infrastructure.

By exploiting this resource first, tidal stream will ensure that second generation technologies are proven and learning is achieved at least cost\(^69\). Succeeding projects in lower resource sites will be able to make use of this learning to continue to reduce the industry’s cost of development, installation and ongoing management.

Both floating and fixed tidal technologies will make use of lower cost of capital and the savings associated with moving from first of a kind (FOAK) to next of a kind (NOAK) build through greater installed volume, lower risks and increased learning. Further cost reductions will be found through improvements in structures and mooring, higher yield, greater reliability, improved installation methods and non-specialist vessels being used for installation and maintenance, lower mobilisation costs, more automated processes and through optimising operation and maintenance practices and strategies.

We consider that this will deliver learning rates by deployment in line with the experience of other technologies as tidal stream reaches cost parity and ensure that there is a net benefit to the UK economy from their investment to support the industry.

Through this, the sector (fixed and floating) expects and is willing to commit to Government to be able to reach cost parity with new nuclear generation\(^70\) after 2GW of deployment in the UK and assuming global deployment progresses as expected.

As with tidal stream and other innovative technologies, the cost of wave energy is currently higher than more mature technologies. However, the sector has strong potential for extremely rapid cost reduction particularly through further developments in the main structures and their manufacturing processes, improvements in power take off systems, moorings and installation and maintenance costs\(^71\).

Finally, for innovative floating offshore wind, it will be crucial that the technology can be proved in situ. This will require policy support to make available leased sites through BEIS working with the Scottish Government to ensure that leasing rounds by The Crown Estate and The Crown Estate Scotland for floating offshore are carried out in a co-ordinated fashion and SEAs are joined up.

With improvements to reduce structural weight, introduce novel component technologies, improve installation methods, adopt serial fabrication processes, and benefit from scale

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69 Carbon Trust (2011) Accelerating marine energy
70 Estimated at £92.50/MWh following Hinkley Point C CfD strike price
effects more generally, floating offshore wind has strong potential to reduce costs to parity with other generating technologies when deployed at scale\textsuperscript{72}. This will be coupled with very high yields with Statoil’s Hywind project estimating capacity factors in excess of 50\%\textsuperscript{73}. With the right support and ability to deploy, the technology could reach \textasciitilde\,\textsterling85/MWh in the medium term\textsuperscript{74}.

For both innovative floating and fixed offshore wind, it will be important to overcome the commercial barriers to establishing demonstration sites – both within and outside commercial farms. This could involve Government support to provide some degree of de-risking to sites as well as exploring further the potential to supply power to offshore assets such as ageing oil rigs\textsuperscript{75}.

**Recommendations: Cultivating world-leading sectors**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Details</th>
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<tbody>
<tr>
<td>To improve the UK’s ability to develop competitive products and services from its world-leading research, the Government should –</td>
<td></td>
</tr>
<tr>
<td><strong>Horizontal policies</strong></td>
<td></td>
</tr>
<tr>
<td>22. Establish a clear and supported horizontal policy for progressing innovation from TRL 7 and through the CRL framework.</td>
<td></td>
</tr>
<tr>
<td><strong>Sectoral policies</strong></td>
<td></td>
</tr>
<tr>
<td>23. Continue to support existing world class test and demonstration facilities across the UK to enable their support of innovative companies and facilitate greater collaboration.</td>
<td></td>
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<tr>
<td>24. Establish an Innovation Power Purchase Agreement mechanism whereby cutting-edge technologies can compete to win support from companies wanting to invest in innovation.</td>
<td></td>
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<tr>
<td>25. Develop de-risked demonstration sites for the pre-commercial stage of innovative fixed and floating offshore wind that includes potential for further build-out as it reaches commercial stage\textsuperscript{1}.</td>
<td></td>
</tr>
<tr>
<td>26. As the market in floating offshore wind matures, undertake a Strategic Environmental Assessment followed by appropriate leasing rounds\textsuperscript{1}. This could be conducted in conjunction with the further leasing rounds that will become necessary towards the end of the decade.</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{72} Carbon Trust (2015) [Floating offshore wind: Market and technology review](#)
\textsuperscript{73} Carbon Trust (2015) [Floating offshore wind: Market and technology review](#)
\textsuperscript{74} Carbon Trust (2015) [Floating offshore wind: Market and technology review](#)
\textsuperscript{75} Carbon Trust (2015) [Floating offshore wind: Market and technology review](#)
Appendix A: UK content of renewable energy investments

Onshore wind
Analysis commissioned by RenewableUK demonstrated 69% (£2.06m per MW) of total expenditure over the course of a project’s 25-year lifecycle is retained within the UK economy\(^{76}\). Forty-eight is spent either in the English region or devolved nation in which a typical wind farm is located\(^ {77} \) - creating a value of £1.43m for every MW installed. At the most local level, 27% (£0.81m) of overall spend is retained within the local authority area.


<table>
<thead>
<tr>
<th></th>
<th>% of local spend</th>
<th>% of national/regional spend</th>
<th>% of UK spending</th>
<th>GVA per MW (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td>13%</td>
<td>59%</td>
<td>98%</td>
<td>40,631</td>
</tr>
<tr>
<td>Construction</td>
<td>12%</td>
<td>36%</td>
<td>47%</td>
<td>159,251</td>
</tr>
<tr>
<td>Operations &amp; Maintenance</td>
<td>42%</td>
<td>58%</td>
<td>87%</td>
<td>22,347</td>
</tr>
<tr>
<td>Overall</td>
<td>27%</td>
<td>48%</td>
<td>69%</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 7. Share of Investment across the lifecycle of onshore wind*\(^ {78} \)

Further to this, the 31% lifetime spend not immediately captured domestically is likely to underestimate the eventual value to the UK as a proportion of this investment will be spent with UK supply chain companies working abroad\(^ {79} \).

Offshore wind
Analysis commissioned by the Department of Energy and Climate Change, The Crown Estate and RenewableUK on behalf of the Offshore Wind Programme Board, demonstrated 43% of the expenditure incurred in planning, building and running our offshore projects goes to UK companies\(^ {80} \).


<table>
<thead>
<tr>
<th></th>
<th>Lower</th>
<th>Upper</th>
<th>Weighted average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Expenditure</td>
<td>16%</td>
<td>90%</td>
<td>57%</td>
</tr>
<tr>
<td>Capital Expenditure</td>
<td>12%</td>
<td>32%</td>
<td>18%</td>
</tr>
<tr>
<td>Operational Expenditure</td>
<td>64%</td>
<td>82%</td>
<td>73%</td>
</tr>
<tr>
<td>Total Expenditure</td>
<td>30%</td>
<td>57%</td>
<td>43%</td>
</tr>
</tbody>
</table>

*Figure 8. UK content figures of operating offshore wind farms*\(^ {81} \)

In 2015 alone, an estimated £840m of investment in the UK’s offshore wind industry was retained in the country. Current and future figures could be significantly higher due to a

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\(^{76}\) RenewableUK (2014) *Onshore wind: Economic impacts in 2014*

\(^{77}\) BiGGAR for RenewableUK (2015) *Onshore wind: Direct and wider economic benefits*

\(^{78}\) RenewableUK (2014) *Onshore wind: Economic impacts in 2014*

\(^{79}\) BiGGAR for RenewableUK (2015) *Onshore wind: Direct and wider economic benefits*

\(^{80}\) DECC, The Crown Estate, RenewableUK (2015) *The UK content of operating offshore wind farms*

\(^{81}\) DECC, The Crown Estate, RenewableUK (2015) *The UK content of operating offshore wind farms*
number of major UK offshore wind manufacturing and fabrication facilities coming on stream during or after 2015; examples include two offshore wind turbine blade manufacturing facilities, a transition piece fabrication facility, an offshore wind turbine tower fabrication facility with many other investments further along the value chain.

The offshore wind industry has committed to reporting annual UK content figures. These will be published in June 2017 by RenewableUK.

**Wave and tidal stream energy**

The wave and tidal stream sectors have already invested nearly £450m in the UK supply chain\(^{82}\) and achieved £7 investment for every £1 of public money invested\(^{83}\). In the Scottish Highlands and Islands, EMEC (European Marine Energy Centre) has alone achieved a cumulative GVA of £103m to the Highlands and Islands and £249.6m to the UK as a whole\(^{84}\). Similarly, in Wales, combined total investment is £68.3m spent to date\(^{85}\).

Achieving this level of investment has required UK content of projects of often more than 80% and the sector is committed to bringing forward and proving the technology that will ensure this continues as the sector develops.

**Tidal lagoons**

The Swansea Bay tidal lagoon project is the first of its kind anywhere in the world. It has already raised £1.3bn of private financing and the company involved, Tidal Lagoon Power, has developed a strong, British-based supply chain of preferred suppliers. This single project represents £800m of potential contracts for the UK’s engineering, construction, steel and manufacturing industries\(^{86}\).

This technology is ready to be developed in the UK at scale and there are already blueprints for five additional lagoons around the country, which could provide 8% of the UK’s electricity supply. It’s estimated these six lagoons could also contribute £27bn to UK GDP during construction and a further £3.1bn each year of operation\(^{87}\).

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\(^{82}\) Highlands and Islands Enterprise, RegenSW and Marine Energy Pembrokeshire (2016) *Marine energy: Key steps to maintain a Great British Success Story*

\(^{83}\) Welsh Government (2017) *Funding boost announced for South Pembrokeshire Demonstration Zone – the largest wave energy seabed lease in the world*

\(^{84}\) Highlands and Islands Enterprise (2015) *Economic Impact study*

\(^{85}\) Marine Energy Wales (2017) *Investment, Jobs, Supply Chain 2017*

\(^{86}\) Tidal Lagoon Power (2016) *Ours to Own*

\(^{87}\) Centre for Economics and Business Research (2014) *The Economic Case for a Tidal Lagoon Industry in the UK*
Appendix B: Summary of recommendations

Enabling the UK’s industrial competitiveness through the lowest cost energy

To ensure costs to the consumers are minimised and enable the UK’s industrial competitiveness, the Government should -

*Horizontal policies*

1. a. In the short-term, maintain the announced budget of £730m in this Parliament for Pot 2 CFD auctions

1. b. Based on recent accelerated cost reduction commit to an engrossed role for offshore wind in power sector decarbonisation from the mid-2020s.

2. a. Establish collective agreement across all stakeholders that further onshore wind is necessary to minimise the cost to consumers

2. b. Once this agreement is established, agree on the appropriate mechanism by which investment in onshore wind should proceed

3. Make a positive and timely decision regarding the recommendations of the Hendry Review

4. Provide a route to market for emerging technologies with the potential to reach cost parity with other forms of renewables generation through the deployment of technology to bring down costs to ensure cost competitiveness over time

Driving growth across the whole country

To support this rich and diverse UK supply chain to increase and improve their productivity, competitiveness and skills and, thereby, the Government should -

*Horizontal policies*

5. Establish a business advisory service for businesses following the models of GROW, the Manufacturing Advisory Service and the best overseas examples across industries to reflect the diverse industries which make up our current and potential supply chains

6. Include a stronger focus on engineering (electrical, electronic and mechanical) training and skills in the announced Technical Colleges

7. Simplify the provision of vocational courses, including in-work training, to ensure that courses focus upon skills transferable across a wide range of sectors.

*Sectoral policies*
Set out a long-term, clear pipeline of future market demand for renewable energy against which supply chain companies can continue to invest in the UK for both the strong domestic market and for export to the growing global market.

Coordinate a fund that prospective new entrants can apply for as they move into new markets and which is then recycled back into the fund by those who are successful, reducing barriers to entry for new market entrants that make it hard to be competitive.

Establish a National Maritime Research Centre to bring together existing bodies and funding supporting the UK’s maritime industries with a particular focus upon innovation in marine operations and vessels that currently fall between maritime transport and the offshore renewable sectors.

**Encouraging trade and inward investment**

To drive exports in these world-leading UK sectors, the Government should -

*Horizontal policies*

11. a. Create a sufficiently large and sustainable domestic market to drive global growth

11. b. Ensure that domestic energy innovations and technologies are supported in the UK in order for them to expand overseas.

12 Continue to ensure the UK is viewed as the destination of choice for entrepreneurial UK and global talent to commercialise and grow their businesses

13 Set out long-term visibility of events DIT will support in order for Trade Challenge Partner to prepare for the delivery of trade missions

14 Clarity of the offer from DIT and UKEF to UK companies who are looking for support to identify and secure access to export markets.

**Building a modern, flexible system**

To build a modern energy system and ensure costs to the consumers are minimised, the Government should -

*Sectoral policies*

15 The Government’s legislated five carbon budgets to 2032 and target of 100MtCO2e by 2050 should determine future demand for low carbon generation
The UK’s legal electricity reliability standard of 3hrs Loss of Load Expectation (LOLE) should determine future demand for capacity reserve

Published assessments of unmet market demand for new low carbon generation, capacity reserve and flexibility services should determine budget allocation and should be published sufficiently in advance to create as liquid a market as possible

The current carbon floor price should be maintained in the short term and increased over the longer term

The Levy Control Framework’s successor should set out a clear long-term trajectory for low carbon generation and use an accounting system based on the net cost to consumers

A regular schedule of Contracts for Difference (CfD) and Capacity Market auctions with appropriate contract tenors should be continued beyond 2025

Substantial reform should be undertaken to formalise the ancillary services markets and their procurement, ensuring increased competition

Cultivating world-leading sectors

To improve the UK’s ability to develop competitive products and services from its world-leading research, the Government should –

Horizontal policies

22 Establish a clear and supported horizontal policy for progressing innovation from TRL 7 and through the CRL framework.

Sectoral policies

23 Continue to support existing world class test and demonstration facilities across the UK to enable their support of innovative companies and facilitate greater collaboration.

24 Establish an Innovation Power Purchase Agreement mechanism whereby cutting-edge technologies can compete to win support from companies wanting to invest in innovation

25 Develop de-risked demonstration sites for the pre-commercial stage of innovative fixed and floating offshore wind that includes potential for further build-out as it reaches commercial stage

26 As the market in floating offshore wind matures, undertake a Strategic Environmental Assessment followed by appropriate leasing rounds. This could be conducted in conjunction with the further leasing rounds that will become necessary towards the end of the decade
Dear Secretary of State,

Our organisations welcome the challenge set out in the Industrial Strategy Green Paper to deliver affordable energy and clean growth. Technological advances and competition are demonstrating that a modern, low-carbon energy system offers increasing potential to improve the competitiveness of our economy, while delivering investment and employment across the UK – particularly in regions outside London and the South East.

Low carbon sources are now the low-cost energy option – with cost reductions more akin to those seen in electronics than traditional infrastructure. The nature of renewables infrastructure also guards against inflationary pressures and growing import dependency.

If we act early to develop the right frameworks, low-cost, clean energy combined with new storage solutions and the adoption of smart digital technologies will drive innovation and investment across the UK’s regions and potentially enable exceptional export opportunities across the world.

To maximise the value of these technological advances to the UK economy and realise the vision of an energy sector in which smart management, innovation and competition deliver growth, consumer savings and clean energy, we believe the Industrial Strategy should prioritise:

- Providing a robust assessment of our future energy needs and a plan, consistent with our carbon objectives, to meet these which provides clear investment signals – particularly to domestic supply chains
- Ensuring that the market is competitive and can deliver low-cost, clean power supplies to replace retiring capacity and meet future demand from wider electrification
- Delivering lowest cost for consumers and businesses by opening-up markets for smart technology to develop the most efficient and cost-effective power network
• Regulatory and market reform to encourage energy storage, including the definition and treatment of storage
• Supporting British research and innovation so that new and emerging technologies continue to move down the cost-curve and into commercial competitiveness
• Setting a clear plan to support the bioeconomy, which can accelerate decarbonisation, particularly in difficult sectors such as heat and transport

Our organisations are committed to working with Government on these priorities and to develop a modern, clean energy system at lowest cost to Britain’s businesses and households.

Yours sincerely,

Paul Barwell
CEO
Solar Trade Association

Merlin Hyman
CEO
Regen

Hugh McNeal
Chief Executive
RenewableUK

Anthony Price
Chairman
The Electricity Storage Network

Dr Nina Skorupska CBE FEI
Chief Executive
Renewable Energy Association

Niall Stuart
Chief Executive
Scottish Renewables
Appendix D: Ocean Energy Race

The Ocean Energy Race report, maps the new marine energy clusters which have sprung up around the country - in the South West of England, the Solent and the Isle of Wight, Wales and the Scottish Highlands and Islands. The sector is providing jobs and attracting millions of pounds in investment to some of the areas of the UK which need them most. Universities around the UK are playing a leading role in global research.

The report can be accessed here: Ocean Energy Race