



Unlocking offshore wind

Why a new generation
of interconnector
holds the key

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national**grid**

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**The UK is a
world leader in
offshore wind
development.**

About

About National Grid

National Grid sits at the heart of Great Britain's energy system.

We connect millions of people and businesses to the energy they use every day. We take our responsibilities to the environment and to future generations seriously. So, we're working hard to help Britain become a world leader in the transition to a carbon neutral economy and society.

And as society aims to recover from the coronavirus pandemic, we must also ensure that we achieve our climate goals without leaving anyone behind.

That's why we're committed to working with Government and other stakeholders to maximise the potential of offshore wind while minimising the impact of infrastructure on communities and delivering real value for consumers.

About National Grid Ventures

At National Grid Ventures, we develop, build, operate and invest in technologies that decarbonise our economy and society.

We are the competitive division of National Grid, operating separately from the company's core regulated businesses. We have a diverse portfolio of low-carbon and renewable energy projects in the UK, Europe and US stretching from offshore transmission to battery storage, wind, and solar power. We also have significant experience in developing and operating subsea electricity interconnectors.



This publication in 60 seconds

Read our 60-second summary of how multi-purpose interconnectors (MPIs) could help Great Britain unlock the potential of offshore wind.

Britain's challenges

To manage the economic recovery from the coronavirus pandemic, meet demanding emissions targets and speed up the transition to a clean energy system of the future.

The potential of offshore wind

Great Britain has a world-leading offshore wind industry. But to meet the Government's Net Zero target by 2050, we need to maximise connections, minimise the impact on communities, and achieve value for consumers.

Thinking differently

Subsea interconnectors already link the GB energy system to other European countries. Right now, they work side by side with offshore wind rather than together. This needs to change.

A new generation of interconnector

What if the benefits of offshore wind and interconnectors could be combined? Multi-purpose interconnectors have the potential to bring the two technologies together in a smarter way.



'As one of Europe's leading interconnector developers we are working closely with our international partners to develop a new generation of interconnector to help realise the full potential of North Sea offshore wind.'

Jon Butterworth
Managing Director of National Grid Ventures



Unlocking the potential of offshore wind

Making the transition to a smarter, more flexible energy system is one of the biggest challenges facing society. In 2019, the UK was the first major economy to pass a law to achieve net zero greenhouse gas emissions by 2050 – an ambition that demands swift action to transform the way we produce and use energy.

Offshore wind will have a big part to play in this transformation. One pressing question is how to connect large volumes of offshore wind to the grid efficiently. The Committee on Climate Change estimates that at least 75 GW of offshore wind will need to be connected to enable the net zero target to be met by 2050. That's almost 10 times what Britain has operational today.

This publication explores one solution – a new generation of interconnectors that uses proven, existing technology in a smarter way. Multi-Purpose Interconnectors or MPIs have the potential to act as a 'green energy hub'. They connect clusters of offshore wind farms to the transmission networks in Great

Britain and beyond quickly and cheaply, capturing the benefits of sharing electricity with our neighbours. They also minimise the impact on coastal communities with fewer connections needed.

Interconnectors already play an important role in giving consumers access to a cleaner, more flexible energy system. They are transmission cables that allow renewable electricity to flow point-to-point between countries from where it is generated to where it is needed most.

At National Grid Ventures, we have been at the forefront of developing interconnector projects in Europe over the past decade, with 7.8 GW either operational or under

construction and a further 6.4 GW in development.

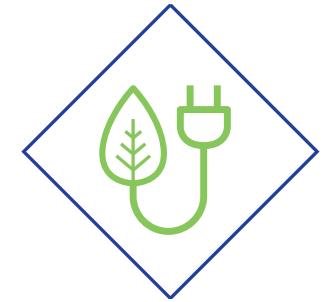
We think now is the right time to start a broader conversation on how MPIs could help the UK speed up its journey towards net zero and what the next steps need to be.

75 GW

The amount of offshore wind needed by 2050 to meet the UK's net zero target, according to the Committee on Climate Change

“The UK is a world leader in offshore wind development. The sector is already the UK's fourth largest investor in infrastructure, directly employing 11,000 people and delivering low cost power.”

Renewable UK



Why a new approach to connections is needed

Currently, every offshore wind and interconnector connection is dealt with by the Electricity System Operator (ESO) on a project-by-project basis.

Connection options must strike a balance between the cost to energy bill payers and the practical delivery of the infrastructure.

It is a time-consuming and complex process. Looking further ahead, the target of at least 75 GW of offshore wind by 2050 means that this approach could lead to significant issues.

Impact on communities

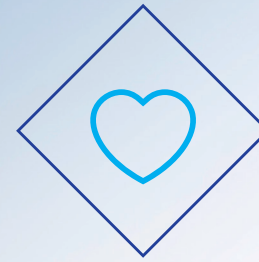
At present, each wind farm and interconnector connects directly to shore via one or more transmission cables. Coastal communities are concerned that the current approach to connections with the potential to cause disruption from increased construction activity and road traffic. These fears are amplified by the large number of individual projects that would be required.

As electricity is brought onshore, it also needs to be connected to the rest of the network. This multiplies the onshore reinforcement work needed to strengthen the grid to carry more energy inland.

A fresh approach is needed: one that allows Great Britain and our European neighbours to realise that full benefits of the rapid growth in offshore wind, while minimising the effect on coastal communities.

“Constructing individual point to point connections for each offshore wind farm may not provide the most efficient approach and could become a major barrier to delivery given the considerable environmental and local impacts, particularly from the associated onshore infrastructure required to connect to the national transmission network.”

BEIS Offshore Transmission Network Review



Thinking differently

Offshore wind and interconnector technologies currently operate side by side. Individual offshore wind farms connect directly to the shore. Existing interconnectors, meanwhile, provide point-to-point links between the electricity systems of different countries. But these adjacent technologies have the potential to work together in a way that could transform how offshore wind connects to Great Britain and our European neighbours.

A new generation of multi-purpose interconnectors (MPIs)

Interconnectors already provide a way to channel electricity between countries safely and reliably. But what if they could do much more than that? What if interconnectors could become an offshore connection hub for green energy?

Instead of dozens of individual wind farms connecting one by one to the shore, MPIs would allow clusters of wind farms to connect all in one go, plugging in offshore.

Bringing offshore wind and interconnector assets together makes sense. As well as speeding up connections, using interconnectors in a smarter way would vastly reduce the amount of grid reinforcement needed and mean much less disruption for coastal communities in terms of construction work.

The technology itself is already proven. In Germany, high-voltage direct current (HVDC) hubs connect more than 6 GW of offshore wind. Likewise, in China, multi-terminal systems are connecting renewable generation.

How quickly could MPIs be in place?

The fact that MPIs build on existing technology means that they can be developed relatively quickly. They could be able to connect large volumes of offshore wind between North Sea region countries by 2030.



“We are discussing the potential for projects that integrate international interconnectors with offshore transmission networks with governments, other regulators and industry. We will consider how best to work with developers and network firms in order to identify regulatory barriers for future international meshed or hybrid projects, and work to ensure these projects can be rigorously assessed to maximise consumer benefits.”

Ofgem Decarbonisation Action Plan

The role of interconnectors today

Interconnectors play a vital role in delivering secure, affordable energy between markets. By transporting renewable electricity from where it's produced to where it's consumed, they are helping to create a cleaner, smarter energy system.

Using subsea cables, electricity can be imported and exported between two countries to smooth out variation in supply and demand. Great Britain currently has four interconnectors linking to France, the Republic of Ireland, the Netherlands and Belgium. Together they provide about 5 GW of capacity.

National Grid Ventures has three new interconnectors under construction that will connect the GB system to Norway and Denmark, as well as a second link to France, adding 3.8 GW of extra capacity, enough to power 3.8 million homes.

The UK Government recognises the value of interconnectors in keeping supplies secure, reducing costs to consumers, and providing long-term sustainability.

There is also a clear benefit to the UK economy in terms of skilled jobs, investment in clean energy and the ability to export electricity in support of economic growth.



The next generation interconnector

Working to deliver a viable MPI by the end of the decade

Building on our experience as the leading developer of subsea interconnectors to the UK, we have been working closely with our European partners around the North Sea to develop a vision for MPIs.

We are evolving our existing interconnector pipeline to include the development of viable MPI projects. We are applying our technical expertise, commercial knowledge, and established relationships with our partners to bring these projects to life to support the UK and its neighbours to achieve their ambitious offshore wind targets.

We have reclassified two of our existing interconnector projects as MPIs. We are partnering with Dutch Transmission System Operator TenneT to connect offshore wind to the British and Dutch markets. Similarly, we are working with Belgian Transmission System Operator Elia to connect offshore wind to the British and Belgian markets.

By collaborating with our partners, policy makers, regulators and other industry stakeholders, and with the right policy in place, we are optimistic that we can deliver MPIs by the end of the decade.



Six interconnector projects - three operational and three in development

6.4 GW of potential MPI projects to connect offshore wind and European markets

6.4GW

Partnerships with Transmission System Operators (TSOs) in five European countries



The world's longest subsea HVDC link

The world's largest capacity subsea HVDC link



Cooperation agreements are in place to deliver MPIs with partners in the Netherlands and Belgium

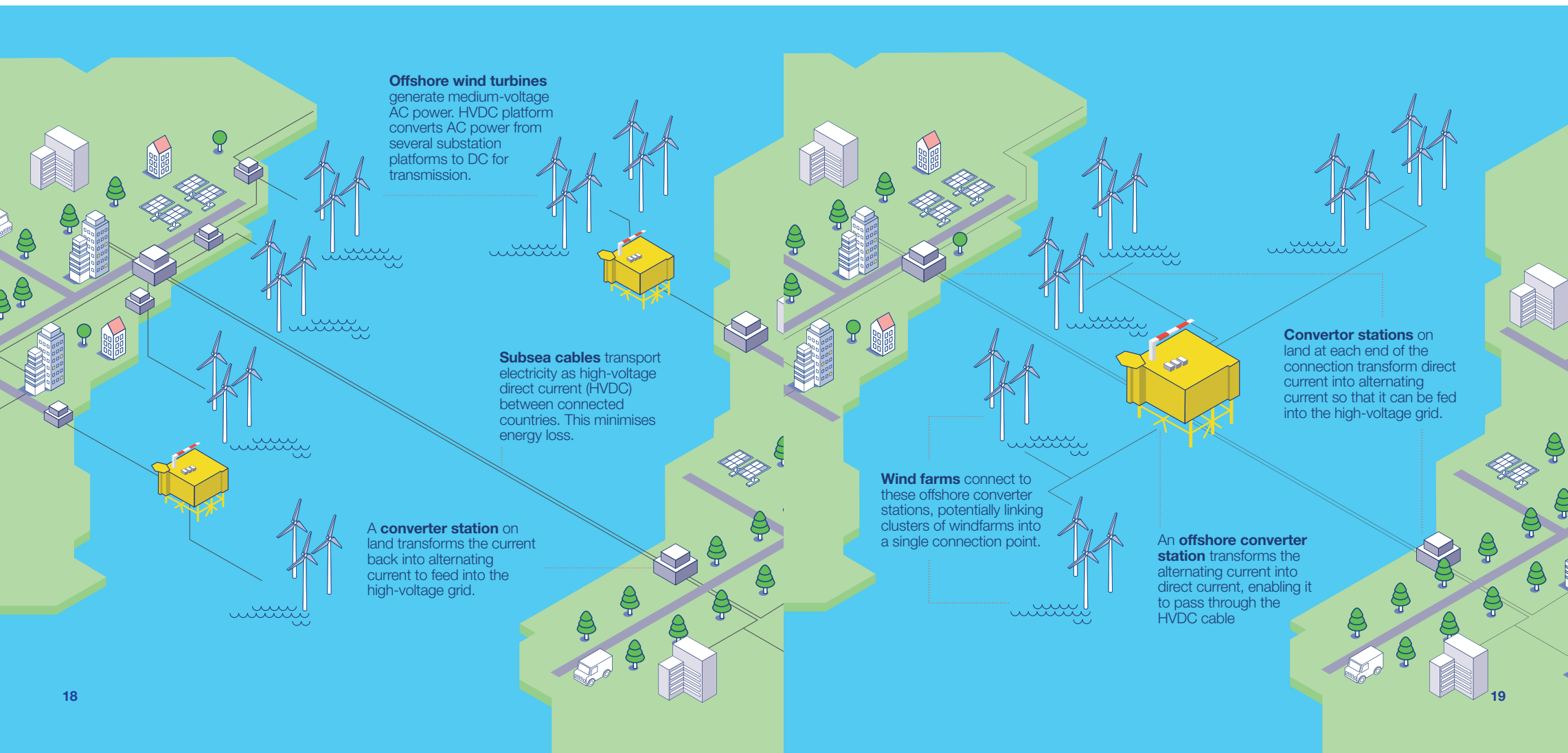


Today: offshore wind and interconnectors connect separately

At present, offshore wind and interconnectors operate alongside each other.

Tomorrow: offshore wind and interconnectors in harmony

In the future, multi-purpose interconnectors could enable offshore wind and interconnection to work together as a combined asset.



What are the benefits

Combining offshore wind and interconnectors will bring a range of benefits to consumers and to Great Britain as a whole. Importantly, this goal can be achieved this decade.



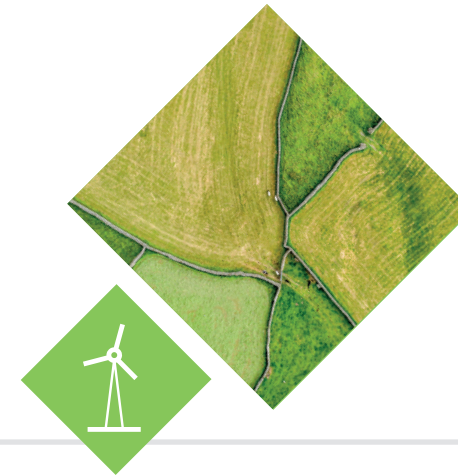
Sustainability

- Supporting UK efforts to meet 2030 and 2050 climate targets
- A practical, large-scale step in the transition to a clean economy
- Access for consumers to renewable energy from domestic and overseas markets
- Improved public acceptance by co-ordinating investment and projects in a smarter way
- Reduced pressure on the consenting process with fewer projects delivering higher value



Affordability

- Significant cost reductions by using shared assets and clusters of connections
- Faster and cheaper integration of offshore wind using existing interconnector grid access



Environmental impact

- Speeding up decarbonisation with an increased proportion of UK generation coming from offshore wind
- Reducing grid reinforcement on a like-for-like basis
- Reduced impact on coastal communities with fewer individual connections and less construction needed
- Knock-on effect of carbon reduction through reduced construction activities and materials



Security

- A reliable flow of electricity that can be turned up or down when needed
- A greater proportion of electricity generated from the North Sea via offshore wind

What happens next?

We've explored how a new generation of interconnector could maximise the benefits of offshore wind for Great Britain. But what are the next steps? How do we bring the concept to life?

There are many kinds of stakeholders that need to come together. These include offshore wind and interconnector developers, HVDC technology providers, and offshore installation and service specialists. But the challenge also encompasses a much wider set of stakeholders, both in Britain and the rest of Europe. Above all, we need to take a coordinated approach.



This is because there are complex questions to resolve around financing, regulation, and many other issues, but for now we see the need for three critical elements:

1. Political support

We need the UK government to support the development of a route to market to unlock the right level of investment in MPIs. We have already seen significant progress with the establishment of the UK government's Offshore Transmission Network Review, which will evaluate the potential role of MPIs to deliver offshore wind more quickly and more effectively.

2. Regulatory support

We welcome Ofgem's recognition of the potential role of MPIs in their Decarbonisation Action Plan. We need to have a regulatory regime in place to enable a new generation of interconnector to begin connecting large volumes of offshore wind by 2030.

3. International cooperation

We need cross-border cooperation to make this happen. MPIs will deliver significant benefits to UK consumers and consumers in neighbouring countries. We are therefore committed to working together with our partners and their government and regulatory stakeholders to design a solution that works for everyone.



The key to unlocking offshore wind

We believe that multi-purpose interconnectors are one of the most efficient and effective tools to unlock the potential offshore wind. At National Grid Ventures, we have a pipeline of projects that can help realise this opportunity.

Combined assets make economic and environmental sense. They have the power to connect offshore wind more quickly and cheaply, and they place a lower burden on communities.

Great Britain needs a plausible route to a clean energy future. Nobody has all the answers, but a smarter approach to offshore wind and interconnection could be a big step in the right direction.



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