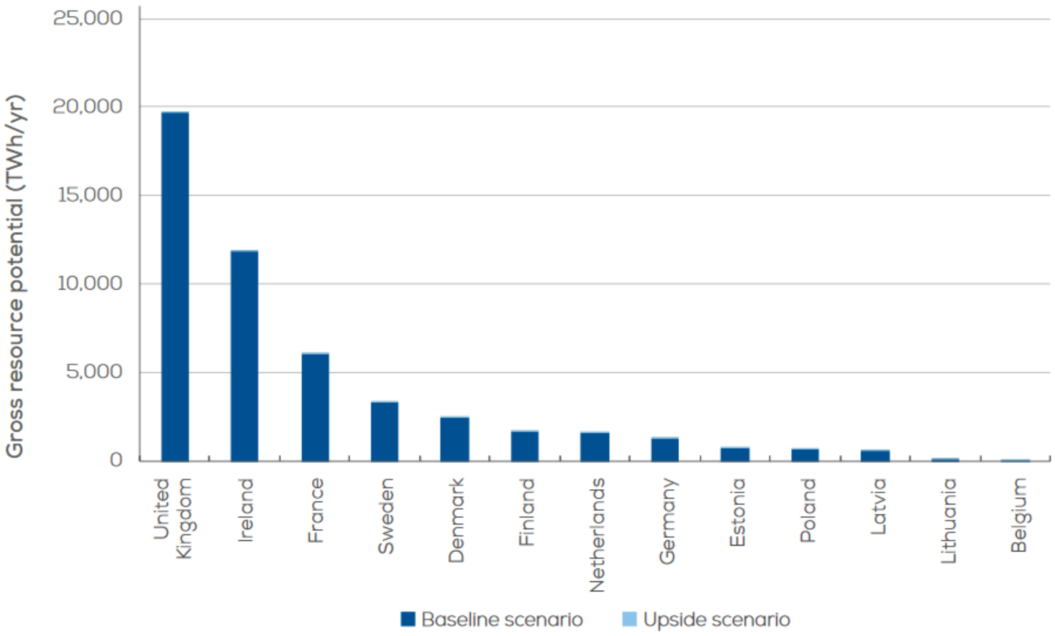
PROGRESS IN DELIVERING A NORTH SEAS GRID

The UK has the highest offshore wind potential in Europe, with a resource of nearly double that in any other country (see Figure 1)[1]. This is because the UK Exclusive Economic Zone (EEZ) allows access to resources in both the Atlantic and North Sea basins. The growth of UK wind has been remarkable since the first offshore windfarm was built two decades ago off the coast of Northumberland. The sector's share of electricity supply grew from only 0.8% in 2010, to 6.2% in 2017, before leaping to 10% in 2019[2]. The UK now has 10GW of offshore wind capacity, which is a quarter of the global total and makes the UK's offshore wind sector the largest in the world.

Figure 1: Gross resource potential in 2030 by country



Source: BVG Associates for WindEurope

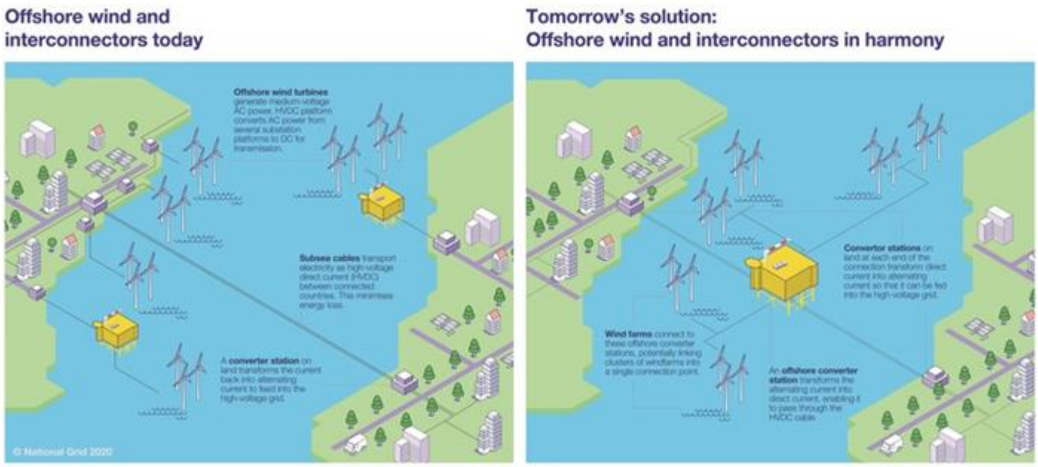
In October 2020, the Prime Minister increased the 2030 target for offshore wind capacity to 40GW. He also created a new target for floating offshore wind of 1GW by 2030, thereby opening the potential to access improved wind resources

[1] Wind Europe (2017): **Unleashing Europe's offshore wind potential A new resource assessment**

[2] BEIS (2020) Digest of UK Energy Statistics

further out to sea. Reaching these targets and continuing with the necessary expansion thereafter will require a huge growth of the sector, domestic supply chain, and electricity network infrastructure.

Figure 2: Radial and integrated grid designs



Source: National Grid

Currently all UK offshore wind farms have their own direct link onshore to transfer the electricity they generate to where it is needed – the so-called 'radial' approach. Separately, there are also cross-border interconnectors that allow the direct trade of electricity between the UK and European neighbours. There is already a significant body of evidence that radial connection and separate interconnectors are not the right approach to support significant expansion of offshore wind capacity[3]. Not only would it be unnecessarily expensive, but it would require a large amount of new infrastructure with associated environmental impacts. This is in addition to conflicts with other spatial demands such as military and fishing. An alternative integrated offshore grid design, which would combine these two types of infrastructure, offers the prospect of allowing more offshore renewable energy to be developed, cheaply and efficiently by limiting the amount of grid infrastructure involved (see Figure 2). This could be achieved either through combining wind farms and interconnectors into so-called 'multi-purpose interconnectors' or by creating a fully 'meshed' offshore

[3] See, for example: Goran Strbac, Rodrigo Moreno, Ioannis Konstantelos, Danny Pudjianto, Marko Aunedi, July 2014 Imperial College London "**Strategic Development of North Sea Grid Infrastructure to Facilitate Least-Cost Decarbonisation**".

grid[4]. However, a more integrated approach raises challenges relating to network planning and regulation, and the way the electricity is traded.

These challenges and potential solutions have been under consideration for some time. The North Seas Countries' Offshore Grid Initiative was a regional cooperation of 10 countries, including the UK, formalised by a memorandum of understanding in 2010. The objective was to facilitate the coordinated development of a possible offshore electricity grid in the greater North Seas area. Following the Paris Climate Agreement, this initiative was re-booted in 2016 with the establishment of the North Seas Energy Cooperation, which aimed to facilitate the cost-effective deployment of offshore renewable energy, in particular wind, and promote interconnection between the countries in the region. The UK left this initiative when it departed the EU in January 2020.

In July 2020, the UK Government announced a review into the way that the offshore transmission network is designed and delivered, consistent with the ambition to deliver net zero emissions by 2050[5]. Analysis by the Electricity System Operator in support of the Government review[6] suggests:

> An integrated approach offshore could save GB consumers approximately £6bn, or 18%, in capital and operating expenditure between now and 2050 provided this new approach is implemented in 2025. The benefit would reduce to £3bn if it is delayed until 2030.

> There are potentially significant environmental and social benefits, as the number of onshore and offshore assets, cables and onshore landing points could potentially be reduced by around 50% (30% if delayed until 2030).

The Energy Minister stated in Parliament on 5th November 2020 that: 'the argument for some form of offshore network system has been won' and the key point of debate has become 'when' rather than 'whether' a new approach

[4] A multi-purpose interconnector is where offshore windfarms (or other energy resources) are connected directly into an interconnector with a single onshore connection in both countries that it links. A meshed offshore grid is where different offshore energy assets are connected through a more complex electricity network, including several onshore connections.

[5] It is also working on a hydrogen strategy that is due to be published in 2021. Also, the Treasury announced a £4.3m Offshore Wind Enabling Actions Programme as part of the Comprehensive Spending Review to be jointly run by DEFRA and BEIS which is 'designed to increase understanding of the environmental impacts of offshore wind and find strategic solutions to reduce barriers to its expansion in English waters'.

[6] Offshore Co-ordination Phase 1 Final Report, 16th December 2020

should be adopted. However, the relative lack of progress that has been achieved over the past decade, despite the compelling evidence, suggests that the problems raised are not easy to solve. The key obstacles that need to be overcome are:

> *Strategic planning*: Regulators/governments are concerned about 'picking winners' and landing future consumers with the burden of recovering stranded costs. Also, the transmission system operators that traditionally assume this role are not independent or expert in all relevant technologies and should not be making the big policy 'decisions' that are implicit in the planning process.

> *Trading between jurisdictions*: The UK is now operating outside the EU internal energy market and the new rules for electricity trading still need to be defined[7]. However, even within the current EU rules, many issues relating to the regulation of offshore grids and markets remain to be resolved[8].

> *Co-location of resources*: Currently, offshore wind and storage/electrolyser projects need to be developed and progressed separately and they cannot be combined to share network capacity and reduce network costs. This links directly to the absence of a clear strategic planning process.

> *Market design*: Defining a price for renewable generation that retains incentives to invest and supports efficient use of resources when renewable capacity is large compared to demand is a problem that regulators and policy makers are grappling with around the world. This problem is particularly acute offshore where demand will be low and renewable generation high. The government has indicated that it will be considering these issues in a forthcoming Call for Evidence on Renewable Support.

None of these obstacles are insurmountable given sufficient political will. The following sections reinforce the increasing economic and political imperatives that demand appropriate actions are taken.

[7] Alternative arrangements which allow trade and mutual support for security of supply to continue are being implemented in the interim and will endure until the agreed trading model can be put in place.

[8] What is the licensing regime and how would it be governed (e.g. decommissioning obligations, economic regulation)? How would the costs of the shared offshore network be recovered – including costs associated with anticipatory investment? How would market support be allocated and how would renewable energy production be settled between countries?