Opportunities and barriers to interconnector expansion in the North Sea Region

Policy Insights:

- Informing the public and industry of the benefits of electricity interconnectors and cross-border energy cooperation could help challenge negative sentiments towards interconnection expansion.
- UK should remain integrated with Europe's Internal Energy Market (IEM) and increasing integration in the future would help to protect Europe's electricity grid and ensure that market coupling can support grid balancing, which could lead to significant cost-savings for consumers.
- Europe should increase its interconnection target beyond 15% by 2030 to further support the target of climate neutrality by 2050.
- Streamlining the licensing of interconnectors would result in significant cost savings and greater certainty about future intermittent renewable energy capacities.
- Greater regional collaboration in the North Sea Region can create a foundation for the development of future energy infrastructure projects and promote better coordination regarding spatial elements.

Electricity interconnection in the NSR

The North Sea Region (NSR) has some of the greatest potential for both on-and offshore wind power in Europe and is well placed to develop more low-carbon and renewable energy resources from hydrogen and biomass and offshore solar. Whilst EU North Sea states already have considerable renewable energy resources, expansion in the NSR is needed to meet climate and energy objectives. Interaction with the UK and Norway is key to Europe reaching climate neutrality by 2050. The UK, with its expanding offshore wind capacity, can provide clean energy to Europe. Norway, with over half of Europe's hydro reservoir capacity, can offer non-intermittent renewable energy resources which can support EU grid expansion and help to balance systems by utilising the energy storage capacities of reservoirs. In order to utilise these capacities, national electricity systems around the NSR need to be better connected. By expanding the interconnector capacities, large amounts of energy needed to support electrification of the heat and transport sector and Energy Intensive Industries (EIIs) can be generated, transmitted, and stored across Europe.

Current and planned interconnection of the NSR

Currently 12 transnational electricity interconnectors are operational in the NSR (Table. 1). There are 16 more interconnectors planned in the next decade. Of these, three are currently under some stage of construction, two are currently awaiting consent and licensing, and 11 are in the early planning and concept stage [2]. As large energy infrastructure projects, building new interconnectors is expensive. Due to the considerable time it takes to develop and plan, license and then construct an interconnector, it is possible to know years in advance the level of interconnection that will be available in the future. Currently, EU North Sea states have either already met or are on target to meet the 15% interconnection target for 2030. However, if Europe is to meet its climate neutrality goal, more interconnection will be required by 2050.

Interconnector	Capacity	Country	Country
Skagerrak 4	700MW	Norway	Denmark
BritNed	1000MW	UK	Netherlands
Norned	700MW	Norway	Netherlands
Baltic Cable	600MW	Germany	Sweden
Kontek	600MW	Germany	Denmark
Skagerrak 1 & 2	500MW	Norway	Denmark
Konti-Skan 1	380MW	Denmark	Sweden
Konti-Skan 2	360MW	Denmark	Sweden
Bornholm	60MW	Denmark	Sweden
Oresund 132kV	1350MW	Denmark	Sweden
Nemo Link	1000MW	UK	Belgium
COBRA	700MW	Denmark	Netherlands

Table 1. North Sea transnational electricity interconnectors, as of May 2020 [1].

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How much interconnection is needed to meet EU targets?

In a paper published by the Forskningssenter for Miljøvennlig Energi (Research Centre for Environmentally Friendly Energy) and the Centre for Sustainable Energy Studies (CenSES), an estimation of the most optimal development of the European power system was conducted. In this, it was estimated that Europe will need to increase its overall interconnection by 701% whilst utilising Carbon Capture and Storage technologies (CCS) to reduce the remaining emissions, and by 811% without utilising CCS, if Europe is to reduce its emissions 90% by 2050 relative to 2010 levels [3]. The NSR is key in this with a large amount of offshore wind and solar photovoltaic being sent between North Sea states, requiring a substantially increased interconnection level to help balance Europe's electricity.

Even at a 90% reduction of emissions by 2050, Europe is still short of its climate neutrality target. To compensate for the 10% of emissions that remain, Europe will either need negative emission technologies to develop rapidly, or a level of interconnection that goes well beyond what is estimated to reach net-zero emissions. As intermittent renewables increase within the energy system, interconnectors will become vital as significant peaks and troughs in generation will result in difficulty meeting Europe's growing energy demand and maintaining a stable and secure energy supply.

The opportunities that interconnector expansion bring

Expanding Europe's electricity infrastructure will be costly. However, it must be viewed in the context of the benefits it brings and the costs it will mitigate in the long-term. ENTSO-E estimate that up to €5 billion could be saved by increasing interconnection across Europe, optimising storage and renewable generating capacity in a more efficient and interconnected system [4]. Numerous studies have also shown that greater electricity interconnection provides substantial social welfare benefits. Some estimate that €300 million per year could be saved should planned line expansion projects in Northern Europe alone be implemented by 2030 [5]. This could translate to a 5% reduction in electricity prices. This is an important benefit to be aware of, as concern over electricity price increases has resulted in strong public and industry opposition to interconnector expansion, when in fact greater interconnection will likely lead to lower electricity prices.
Expanding interconnection supports renewable energy expansion in areas with the most optimal wind and solar resources. Furthermore, the curtailment of energy production is also reduced, meaning producers can generate without needing to be compensated through expensive subsidy schemes, with energy being sent to where it is needed, alleviating congestion and bottlenecks. The costs of electrical energy storage are also mitigated by transmission line expansion as the synergy between national energy systems over different geographical locations is realised.

EU-wide cooperation in expanding interconnection brings overall benefits for grid design synchronisation. Knowing what the capacity of interconnection will be in the future allows for appropriate financial and risk-sharing decisions and emboldens political commitments. In the wake of COVID-19, the economic recovery of Europe should ensure that interconnector expansion is at the heart of its New Green Deal, making sure to support market and grid coupling. Turning potentially stranded offshore energy assets into hubs and bases of support for electrical interface could also reduce costs significantly in the NSR. Interconnectors enhance the capacity of networks to distribute electricity to consumers and support the security of the electricity supply.
By expanding interconnection, the import and export of energy also provides commercial opportunities and uses excess 'spare' capacity. Expanding interconnection in the NSR will assist national networks and support network stability, as well as promoting diversification of generation sources, and importantly, supporting a more 'level playing field' amongst North Sea states and Europe as a region in sustainable industrial developments [6].

Barriers to increasing NSR interconnection

Expected transmission line expansion projects are estimated to cost in excess of €40 billion in investments between the period of 2018 and 2024 [7]. This will increase to €53 billion by 2028 and beyond, with the cost increasing substantially until 2050 – if the target of net zero emission is to be met [3, 7]. Investments in these projects are highly cost-intensive and risky, as the future energy price is difficult to estimate, especially as depreciation in currency values and reductions in economic activity have consequences for project financing and cost margins. Uncertainty over COVID-19 and the UK's role in Europe's Internal Energy Market (IEM) have already partly resulted in projects being put on hold [8].

EU energy regulations also prevent energy producers from owning key energy infrastructure, which means that projects need to be financed by Transmission System Operators (TSOs) or through collective partnerships or funded via other avenues such as through the European Green Deal [9]. The Projects of Common Interest (PCIs) aim to support cross-border energy infrastructure projects. Whilst PCIs has supported energy infrastructural development, prioritising the Trans-Europe Networks for Energy (TEN-E), it has not been without problems. It is estimated that over a quarter of PCI are delayed, with half of the reasons for these delays related to the permit process. The average duration of the permit granting process is around four years. When factoring in construction time and other issues, it takes on average nine years from concept to the commission of an interconnector [7]. Streamlining this process, through quicker licensing and permit granting would have benefits to costs, emissions reduction, and for Europe in meeting its energy and climate targets.

A barrier to interconnector expansion is public and industry acceptance. The concern in most contexts is

electricity prices, as systems with different price differentials become interconnected having a potentially levelling effect. This means that as one country with a high unit price becomes connected with a country with a lower unit price, the costs decrease and increase respectively – levelling out. Whilst this assumption is not necessarily borne out in practice, it has been a major barrier in supporting cross border interconnection in the NSR [8, 10].

NorthConnect, the planned cable between Scotland and Norway, is currently indefinitely suspended after overwhelming opposition from EIIs in Norway, which in turn has placed significant pressure on politicians there to react. This has become a familiar narrative in many EU countries. Overcoming this narrative will be difficult, however, communication with countries and communities about the overwhelming benefits of interconnector expansion, as well as mitigating anti-EU sentiment that often comes to the fore in these debates, is instrumental in informing on the net-benefits and importance of interconnection in combating climate change and creating a competitive and sustainable economy. Furthermore, dispelling the myths that interconnection leads to higher energy prices in all scenarios, is also necessary.

The NSR is one of the busiest offshore regions in the world. Spatial elements require consideration of shipping lanes, fisheries, and existing infrastructure [11]. With so many different interests in the NSR, significant delays to interconnector projects have occurred. To combat this, coordination amongst North Sea states, with clear and informed planning and the involvement and representation of North Sea stakeholder's interests, is key to ensuring that interconnectors are prioritised and delivered in line with Europe's energy needs.

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