Project Sheet

NorthConnect

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Index

Key Information 3
Description 3
Project Description & Context 5
Project Investments 5
System Needs addressed by the project 5
Interconnection targets 6
Project Assessment 10
Transfer capacity increase (National Trends 2025) 10
Boundary capacity diagram 10
CBA results 11
Central scenario: National Trends 11
Scenarios: Distributed Energy & Global Ambition 14
Benefits submitted by promoters based on scenarios other than the TYNDP2020 scenarios 15
Sensitivity Study: Current Trends 15
Residual impact 17
Project Costs 17

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Key Information

Cross Border Project
Offshore DC transmission cable
New

PCI number 1.10.2 (4th list, 31 Oct. 2019)
In Permitting

Description

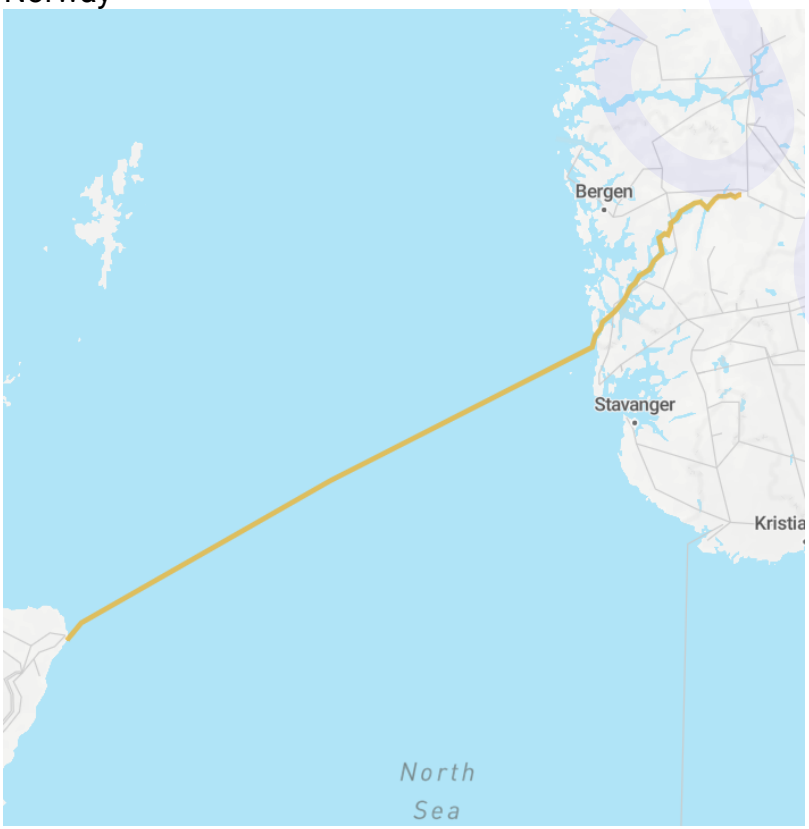
A 665 km long subsea interconnector between Norway and Scotland is planned to be realised in 2024. The interconnector is planned to be a 1400 MW HVDC subsea interconnector between western Norway (Simadalen) and eastern Scotland (Peterhead), UK.

Project promoters

NorthConnect

Countries

United Kingdom
Norway



National development plan(s)

(1) Nordic Grid Development Plan 2019

https://www.statnett.no/contentassets/61e33bec85804310a0feef41387da2c0/nordic-grid-development-plan-2019-for-web.pdf
(2) National Grid NOA (Network Options Assessment Plan 2018/2019)
https://www.nationalgrideso.com/document/137321/download
(3) National Grid ETYS (Electricity Ten Year Statement) nov 2018
https://www.nationalgrideso.com/document/133836/download

Additional information on the project

https://northconnect.co.uk/

Related projects

None.

Project sheet backlog

6 Nov. 2020 - Publication as part of the draft TYNDP 2020 package for consultation

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Project Description & Context

Project Investments

Main investment(s): A 665 km long subsea interconnector between Norway and Scotland is planned to be realized in 2024. The main driver for the project is to integrate the hydro-based Norwegian system with the thermal/nuclear/wind-based British system. The interconnector will improve security of supply both in Norway in dry years and in Great Britain in periods with negative power balance (low wind, low solar, high demand etc.). Additionally the interconnector will be positive both for the European market integration, for facilitating renewable energy and also for preparing for a power system with lower CO2-emissions. The interconnector is planned to be a 500 kV 1400 MW HVDC subsea interconnector between western Norway and eastern Scotland.

Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
Offshore DC transmission cable	665	Sima	Peterhead	In Permitting	2024	Delayed	Permitting process in Norway

Reason for investment clustering

NA

Is the project in the reference grid?

Yes

System Needs addressed by the project

Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement of voltage stability...
As part of the TYNDP 2020, ENTSO-E released a study investigating cross-border system needs in the 2030 and 2040 horizons.

Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to reduce price differentials	NorthConnect reduce price spread

Need		How the project addresses each need (explanation provided by the project promoter(s))
€	between EU and/or non-EU countries	between the hydropower dominated in bidding zone NO3 in and UK according to IoNS. The landing point Peterhead in Scotland has the highest share of RES in the UK and willl relieve internal congestion towards England (Price differentials are among the highest)
ITEG	Infrastructure to tackle a Need identified by one of the European ITEG indicators referring to the 15% interconnection target for 2030:1. Reduce the price differential between EU countries to below 2EUR/MWh.2. Contribute to pushing ratio between nominal transmission capacity and installed RES capacity past 30%.3. Contribute to pushing ratio between nominal transmission capacity and peak load past 30%.	The UK ratio between nominal transmission capacity and installed RES is 14-18% in the TYNDP 2030 reference scenario (including NorthConnect), and the ratio between nominal transmission capacity and peak load is 20-21%. NorthConnect will contribute to improve the above mentioned ITEG indicators
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	Curtailments in UK already exceeded 2.4 TWh (Sep 2020) and are expected to exceed 3 TWh by end of year. Norway also curtails hydropower in wet years. NorthConnect reduces RES curtailments both in UK and Norway.
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	NorthConnect help utilise the complementaries of wind in UK and Norways 86.5 TWH of fhydropower reservoirs, which is about 50% of Europe's total storage capacity. NorthConnect will provide balancing power in periods of calm wind, and store energy in windy periods for RES in the UK

Interconnection targets

In 2017, the Interconnection Target Expert Group proposed alternative indicators to the 15% interconnection criteria for every country and electrified island with a new methodology developed collaboratively between the European Commission, ENTSO-E, ENTSOG, industry, universities and other experts. The methodology is based on three indicators:
1. Price differential between EU countries, with an objective to reduce it below 2 EUR/MWh
2. Ratio between nominal transmission capacity and installed RES capacity, with a target of past 30%
3. Ratio between nominal transmission capacity and peak load, with a target of past 30%

The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.

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Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	United Kingdom - Norway	1400	1400

Boundary capacity diagram

Network boundary the projects helps mitigate

Great Britain – Continental Europe and Nordics

Boundary capacity diagram

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CBA results

ENTSO-E has assessed the benefits delivered by each project in 2025 (scenario National Trends 2025) and in 2030 (three scenarios: National Trends, Distributed Energy and Global Ambition). Indicators B1 to B6 were computed by ENTSO-E, while promoters had the possibility to compute and submit so-called project-level benefits (B7 to B10). The benefits must be understood as benefits for Europe as a whole, not for the promoters of the project.
Results are presented per scenario.

Central scenario: National Trends

National Trends is the central policy scenario of the TYNDP2020, designed to reflect EU member state's National Energy and Climate Plans (NECP), in line with the requirement to meet current European 2030 energy strategy targets.

			Comparison of the COP21 scenarios with NT2030 average result		
	NT2025	NT2030	DE2030 is < or > than NT2030	GA2030 is < or > than NT2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M € / year)	max average min	66 60 52	174 142 111	<	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	12 9 7	48 37 26	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	9 3 1	24 18 15	<	<	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-1348	-2528	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-48	-191	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-229	-1804	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	5713	44021	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	107	-183	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	5745	44156	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	-316 -405 -533	-929 -1324 -1728	>	<	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	15 31 67	42 95 213	< < <	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	-66	-55	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	1 5 11	9 4 43	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)		max average min	206 75 25	637 467 366	<	<	ENTSO-E assessment
B3a Connected RES (MW)	-				n/a	n/a	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses (GWh / year)		average	149	19	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ /		average	12	2	n/a	n/a	ENTSO-E assessment

year)					

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		4	n/a	n/a	ENTSO-E assessment
B6_€ Annual Socio-Economic Welfare increase resulting from reduction in Energy Not Served monetised (M€ / year)	average	n/a	0	>	n/a	ENTSO-E assessment

Scenarios: Distributed Energy & Global Ambition

DE and GA are two scenarios created in line with the COP21 targets to understand the impact on infrastructure needs agains different pathways reducing EU-28 emissions to net-zero by 2050. For these two scenarios, projects were assessed with a subset of CBA parameters.

		DE2030	GA2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	141	172	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	47	48	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	11	11	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market	average	-888	-1374	ENTSO-E assessment

simulation (ktonnes / year)				
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	6 42 121	34 89 212	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	192	246	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Benefits submitted by promoters based on scenarios other than the TYNDP2020 scenarios

	2025	2030	
B7 System Flexibility – Balancing Energy Exchange	+	+	Qualitative assessment by ENTSO-E, based on the study and values provided by the project promoter(s). Based on the information provided, ENTSO-E has not been able to confirm the consistency of the proposed indicator with the CBA Guideline 3.0. About the computation of this indicator by the project promoter(s)

This indicator was computed based on Two degrees and Two Degrees, in a study performed by National Grid ESO in 2018. The promoter(s) stated that the submitted value was computed in accordance with the CBA Guideline and explained it as follows:

Reserve contribution corresponds to the market for flexibility (reserves that can be activated from 15 min up to 1 hr), and are described as reserve & support in the study.

The promoter(s) certified that the values submitted and assessed in the study relate to countries located within the ENTSO-E perimeter only.

Sensitivity Study: Current Trends

'Current Trends' describes a future where the energy transition is slower than planned.

	CT2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	52	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	13	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	3	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-471	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	15 34 76	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	50	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

Residual impact

Information on the residual impact of the project was provided by the project promoter(s).

Project Costs

The project costs were provided by the project promoter(s).

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1382. NorthConnect	1675	Costs are based on feedback from the supply chain; CAPEX same as previous input to ENTSO-E, and OPEX adjusted from 30 to 10.	10
Total	1675		10

Explanation provided by the project promoter on the CAPEX uncertainty range:

1382 NorthConnect are owned by non-TSOs in Norway. As this is the first international transmission line built by a non-TSO in Norway, the project includes new processes.