Project Sheet

AQUIND Interconnector

Project type	transmission
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ENTSOE

Key Information

Cross Border Project
Offshore DC transmission cable
New

In Permitting

Description

AQUIND Interconnector is a proposed High Voltage Direct Current (HVDC) subsea and underground electric power transmission link between Great Britain (Lovedean substation, Hampshire) and France (Barnabos switching station, Seine-Maritime) with a net transmission capacity of 2,000 MW. The interconnector is designed as two parallel monopole 1000 MW circuits employing Voltage Source Converter technology.

The project will be able to:

• Boost competition by providing access to wider electricity markets;

• Help improve security of supply by creating additional source of supply and by providing ancillary services to the respective national grids; and

• Increase sustainability of energy supply by helping to integrate more renewable energy sources.

The project will consist of the following elements:

• One converter station on each end of the link,

• The 320 kV DC subsea cable route will be approximately 182 km in length between Eastney (UK) and Pourville (France).

• The British 320 kV DC terrestrial cable route will be approximately 20 km long.

• The French 320 kV DC terrestrial cable route will be approximately 36 km long.

• The 400 kV AC cable routes are several hundred meters in France and UK.

Project promoters

Aquind Limited

Countries

France
United Kingdom

National development plan(s)

France – Schéma Décennal de Développement du Réseau 2019, project number 991 (page 442) - https://www.rte-france.com/sites/default/files/sddr2019_chapitre_annexe2.pdf . AQUIND Interconnector is also included in Programmations pluriannuelles de l'énergie of France (page 194) - https://www.ecologique-solidaire.gouv.fr/sites/default/files/0-PPE%20English%20Version%20With%20Annex_0.pdf . Great Britain - Future Energy Scenarios 2019, (FES Modelling Methods 2019, page 16 - http://fes.nationalgrid.com/media/1417/fes-modelling-methods-2019.pdf). AQUIND is also included in latest available Electricity Ten Year Statement 2018, as it is part of National Grid's TEC Register (page 4 - https://www.nationalgrideso.com/document/133211/download and https://www.nationalgrideso.com/document/156486/download)

Additional information on the project

Official Websites:

English - http://aquind.co.uk/

French - http://aquind.fr/

Consultation websites:

English -
http://aquindconsultation.co.uk/

French -
https://aquindconsultation.fr/

Investment in electricity interconnectors: immediate economic benefits and key role in the French energy transition. Example of AQUIND Interconnector. (Asterès, June 2020) - https://asteres.fr/site/wp-content/uploads/2020/06/ASTERES-AQUIND-Investir-dans-les-interconnexions-19062020.pdf

AQUIND Interconnector - reducing the cost of transition to Net Zero for GB energy consumers (FTI Consulting, July 2020) - https://www.fticonsulting-emea.com/~/media/Files/emea--files/insights/reports/2020/aug/reducing-cost-transition-net-zero-gb-consumers.pdf

Project sheet backlog

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

Project Description & Context

Project Investments

Main investment(s): AQUIND Interconnector is a proposed High Voltage Direct Current (HVDC) subsea and underground electric power transmission link between Great Britain (Lovedean substation, Hampshire) and France (Barnabos substation, Seine-Maritime) with a net transmission capacity of 2,000 MW. The Interconnector is designed as two parallel monopole 1000 MW circuits employing Voltage Source Converter technology.

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	240	Lovedean (GB)	Barnabos (FR)	In Permitting	2023	Delayed	In 2018 UK Government, in accordance with the Planning Act 2008, designated AQUIND Interconnector as a Nationally Significant Infrastructure Project. This designation enables AQUIND Interconnector to apply for a Development Consent Order that would include all or nearly all permits and conditions necessary to start construction. Due to the "front-loading" approach and extremely robust evaluation and consultation requirements, which might have impact over more than one constituency, the DCO has been specifically designed to enable significant infrastructure developments. However, this process also takes longer than conventional planning application under the Town and Country Planning Act. Therefore commissioning of AQUIND was postponed by approximately a year from the date declared in the TYNDP 2018. The application for the DCO has been submitted on

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
							14 November 2019.

Is the project in the reference grid?

No

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.

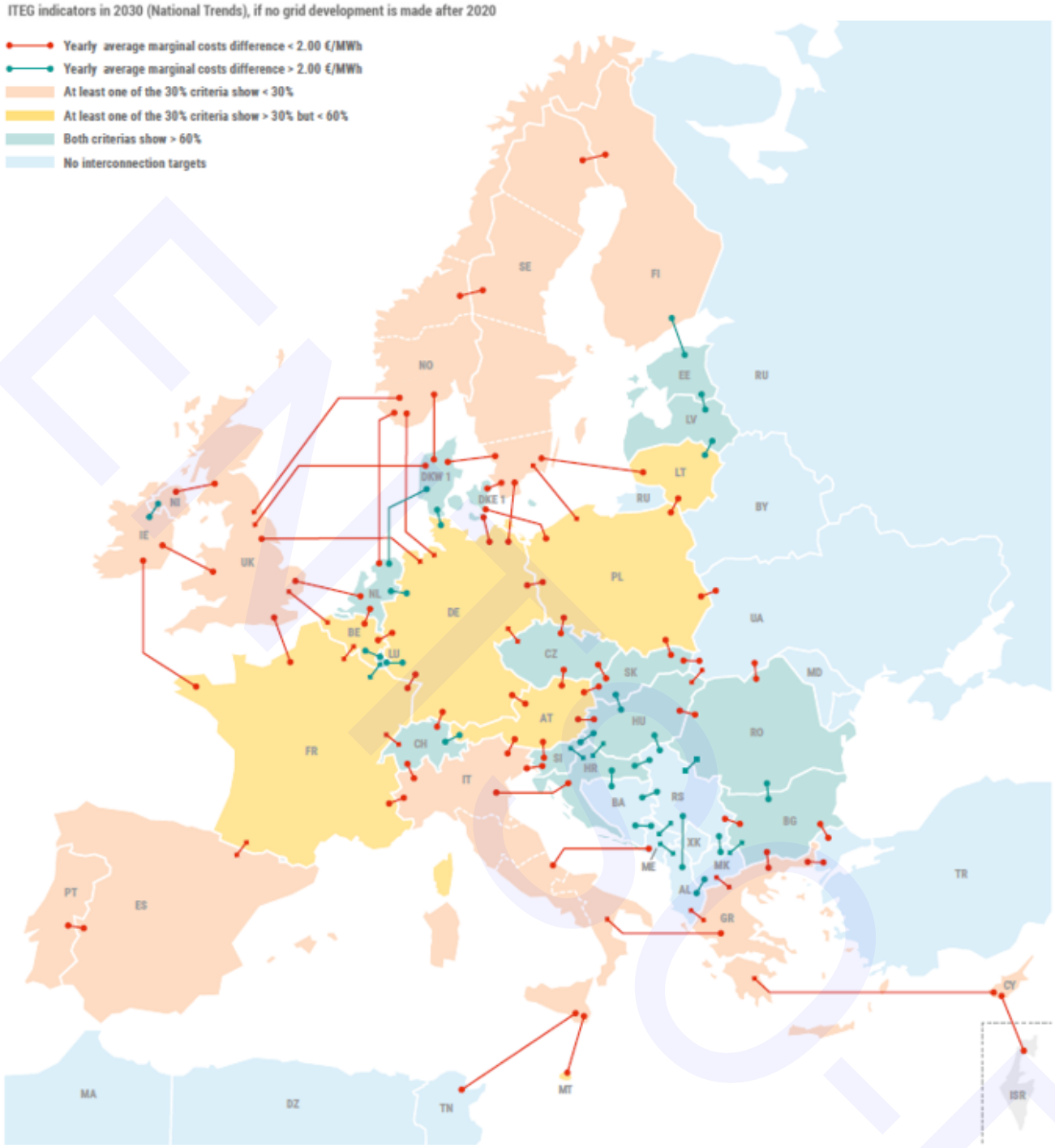
Need		How the project addresses each need (explanation provided by the project promoter(s))
€	Infrastructure to reduce price differentials between EU and/or non-EU countries	Structural differences in the wholesale electricity prices between the electricity markets in GB and France clearly demonstrate the need for more capacity. By providing additional 2GW of interconnection capacity AQUIND Interconnector will reduce price differentials on a congested France - GB border.
	Infrastructure designed to enable cost-efficient grid connection of high volumes of RES and/or reduce RES curtailment	AQUIND will provide an opportunity for the efficient dispatch of renewables in GB, France and across connected markets. The additional cross-border capacity provided by AQUIND offers the opportunity to export additional power, that otherwise could be curtailed, during periods of high renewable generation.
	Infrastructure and/or market design to provide balancing flexibility (e.g. international pooling / sharing of reserves, coordinated development of reserve capacity)	AQUIND Interconnector will facilitate more efficient generation dispatch in the connected markets required for cross-border balancing services
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	By providing additional 2GW of interconnection capacity AQUIND will contribute to reaching the objectives of the European ITEG indicators in

Need		How the project addresses each need (explanation provided by the project promoter(s))
	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%.	France and GB.

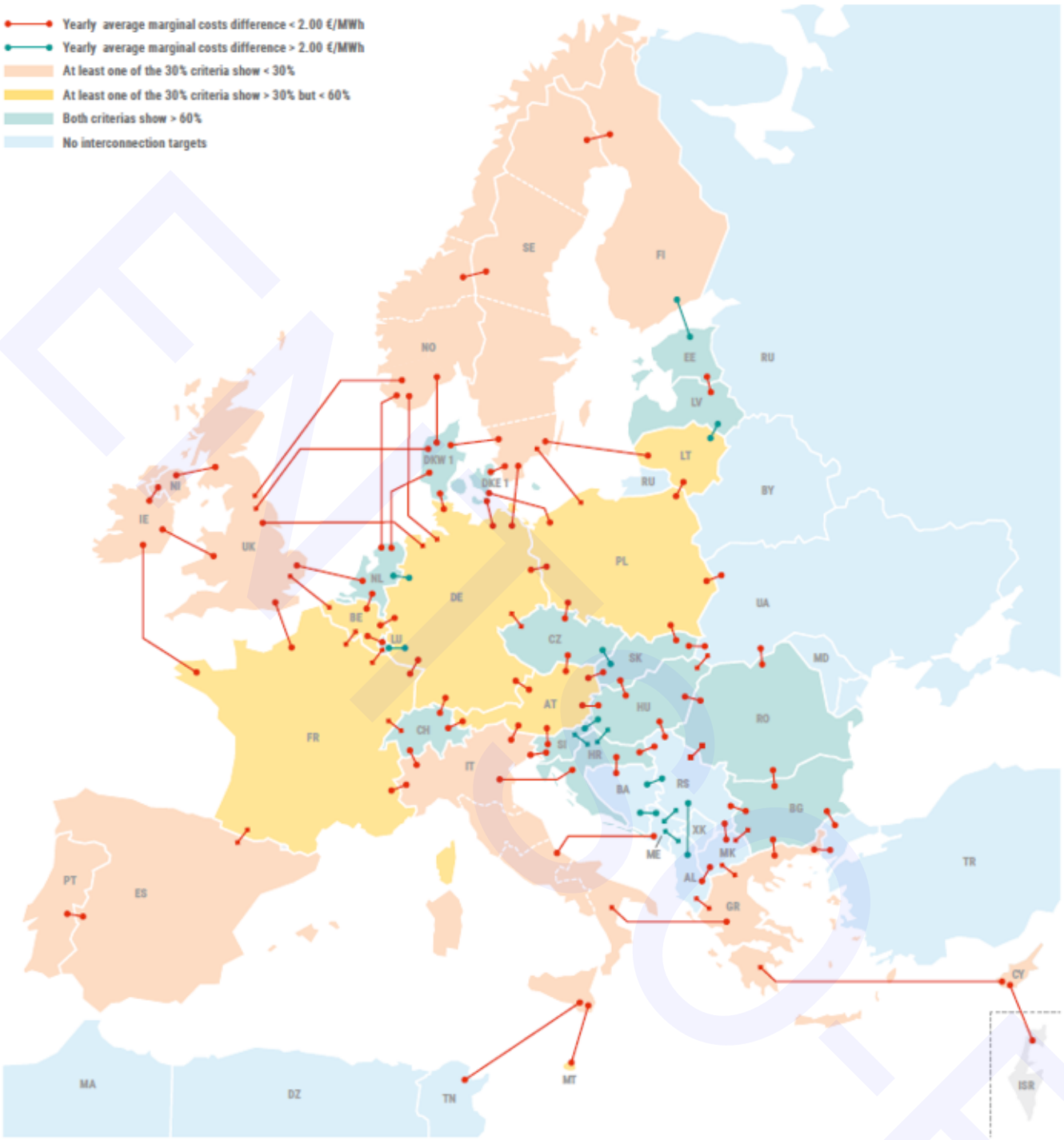
Interconnection targets

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%

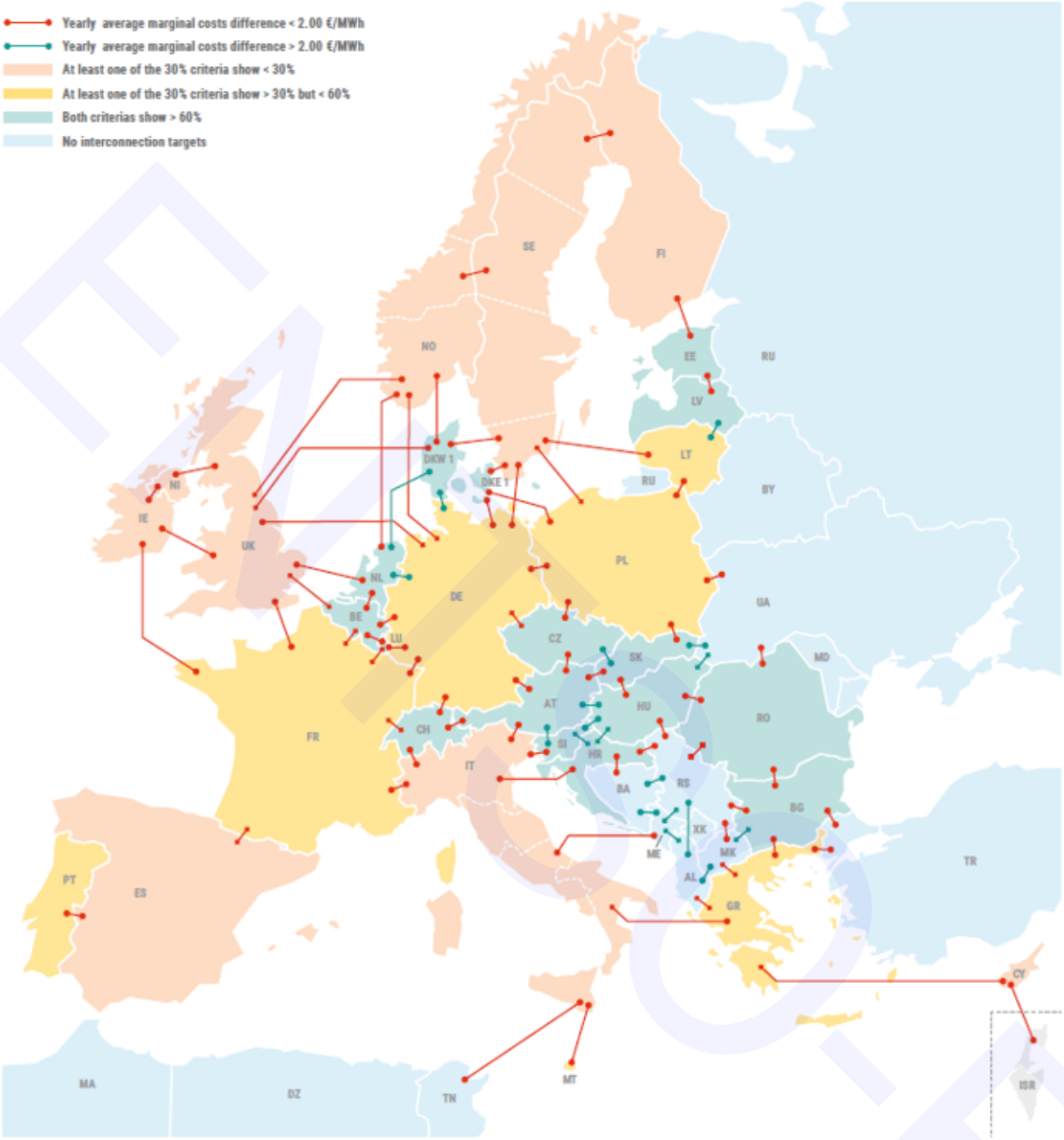
The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.


ITEG indicators in 2030 (National Trends), if no grid development is made after 2020
Yearly average marginal costs difference < 2.00 €/MWh
Yearly average marginal costs difference > 2.00 €/MWh
At least one of the 30% criteria show < 30%
At least one of the 30% criteria show > 30% but < 60%
Both criterias show > 60%
No interconnection targets
SE
FI
NO
EE
RU
LV
LT
DKW 1
DKE 1
RU
BY
NI
IE
UK
PL
NL
DE
UA
BE
LU
CZ
SK
MD
AT
HU
RO
FR
CH
SI
HR
IT
BA
RS
BG
XK
ME
MK
AL
TR
PT
ES
GR
CY
MA
DZ
TN
MT
ISR

ITEG indicators in 2030 (Distributed Energy), if no grid development is made after 2020



ITEG indicators in 2030 (Global Ambition), if no grid development is made after 2020



Project Assessment

Transfer capacity increase (National Trends 2025)

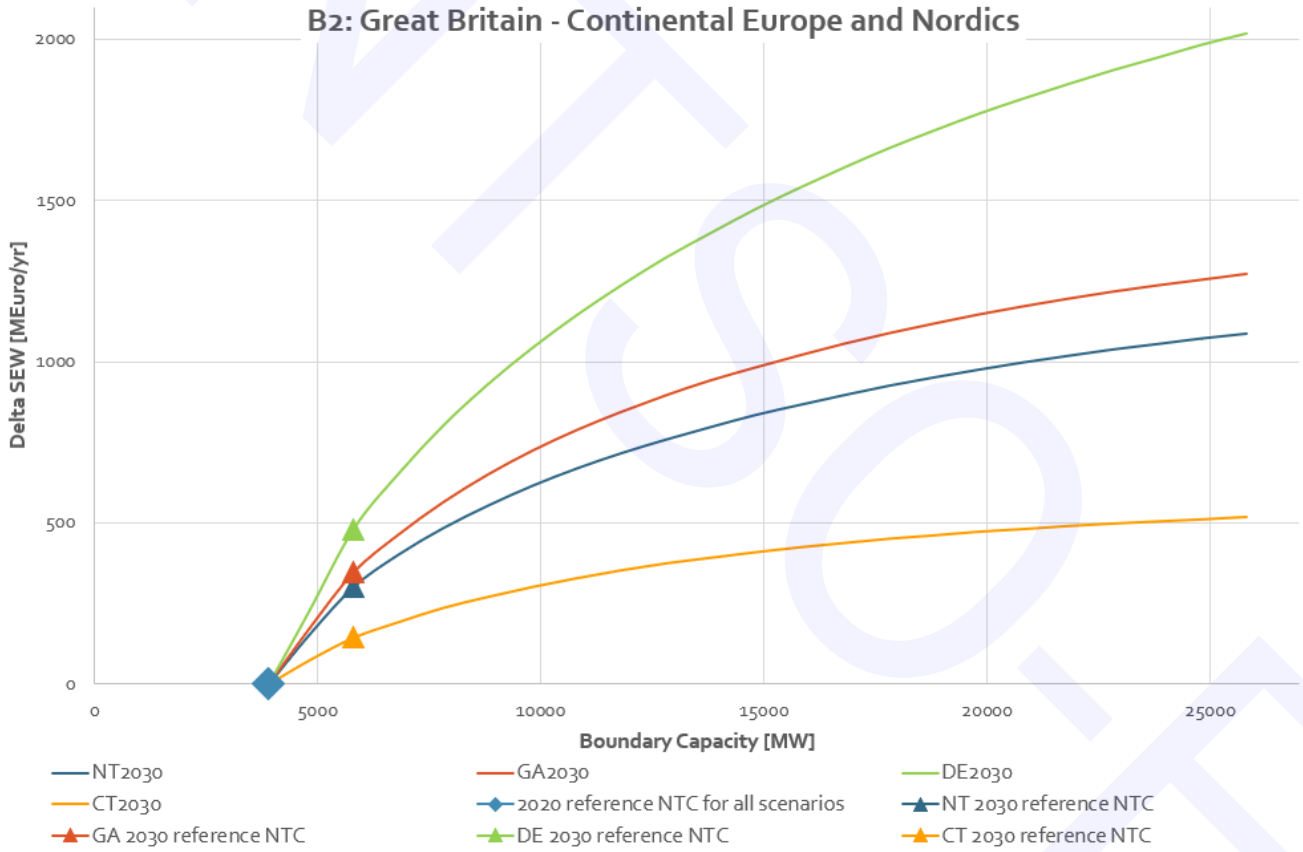
	Border	A B	B A
Transfer capacity increase (in MW)	France - United Kingdom	2075	2075

Boundary capacity diagram

Network boundary the projects helps mitigate

Great Britain – Continental Europe and Nordics

Boundary capacity diagram



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	45 40 37	155 149 137	>	>	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	15 11 7	58 55 51	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	2 2 1	22 16 10	<	<	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-1349	-3306	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-72	-140	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-1656	-3354	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	8710	43913	n/a	n/a	ENTSO-E assessment
B4e Particulate		-82	-212	n/a	n/a	ENTSO-E

matter 10	average					assessment
B4f Non-methane volatile organic compounds	average	8758	44109	n/a	n/a	ENTSO-E assessment
B2a Annual CO2 variation from market simulation (ktonnes / year)	max average min	-298 -463 -639	-1805 -1949 -2072	<	>	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	17 36 77	62 140 314	< < >	< < <	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)	average	161	245	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	-7 -12 -27	-15 -18 -74	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	max average min	54 36 13	605 423 270	<	<	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	266	1058	n/a	n/a	ENTSO-E assessment
B5_€ Variation of network losses monetised (M€ / year)	average	13	31	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		5129	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	51.29	>	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	367	184	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	148	67	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting	average	-1	8	ENTSO-E assessment

from RES integration			

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-2789	-1928	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	20 131 379	48 125 297	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	-15	201	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
AQUIND Interconnector (New HVDC)	++	++	+ (between sync areas)	Qualitative assessment by ENTSO-E based on information on the project technology provided by the project promoter(s). This indicator is not dependent on scenarios or time horizons.

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	61	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	17	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	1	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-615	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	20 44 99	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	21	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

Comments on the CBA results by the project promoter(s)

The draft TYNDP 2020 project results are very encouraging and indicate that AQUIND is highly beneficial. For example, by 2030, AQUIND is estimated to generate €149m/year socio-economic welfare. This is much higher than TYNDP 2018 results and closer to TYNDP 2016 results.

However, we remain concerned about the TYNDP 2020 results for year 2025. Taking into account that the France-GB border has some of the widest price spreads in Europe, the NT 2025 results seem lower than could have been expected and AQUIND's own forecasts. It is not clear to us why this should be the case.

Nevertheless, I am very glad to see that the results of this TYNDP confirm, as well as AQUIND's forecasts, that the interconnector will play an important role in implementing Net Zero targets and help reduce the cost of energy transition.

In addition to the SEW benefits, we welcome ENTSO-E's findings that AQUIND contributes positively to the security of supply by reducing the total amount of energy not served (estimated at €51m/year), which significantly offsets any potential increases in the network losses (€31m/year).

Losses

The result for losses variation B5 in GWh in NT 2030 seems too high. The AQUIND's analysis shows that in 2030 the flows will still be primarily from France to GB. Normandy, the region where AQUIND connects to the French national transmission system, is also a net exporter within France, while Lovedean in England is located in the area near large consumption centres, including London. We note that the level of detail of the available information is not sufficient for third-party promoters to be able to replicate the ENTSOe losses analysis precisely.

Process:

As AQUIND has indicated to the ENTSO-E in the past, it is critical for the transparency and the robustness of the TYNDP development process to ensure that all prospective developers have equal access to the relevant information that underpins the modelling. In particular, it is important that all the data that ENTSOe uses in preparing the analysis are made available to prospective developers, such that the analysis can be replicated through the use of an appropriate modelling tool (e.g. Plexos®). This information also needs to be available at the appropriate degree of granularity – again, to enable a reasonable degree of scrutiny and to enable modelling results to be replicated.

Residual impact

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

Residual environmental impact

Investment	Investment status	Distance (km)	Type of sensitivity

Additional information by the project promoter(s)

All environmental impacts associated with the project are either avoided or mitigated. The cost is fully included in the CAPEX.

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity

Additional information by the project promoter(s)

All social impacts associated with the project are either avoided or mitigated. The cost is fully included in the CAPEX.

Project Costs

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

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1381. AQUIND Interconnector	1400	+/-10	14
Total	1400		14

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

1381 The capital costs of the project are based on two rounds of supply chain engagement. The costs will be fixed as part of the EU public procurement process, that has commenced. Primarily, the costs might be affected by the following risk factors (i) commodity prices fluctuations (primarily, copper), (ii) labour rates, (iii) vessel chartering rates, (iv) availability of manufacturing capacities. These risks are addressed as part of the procurement process. Additional environmental mitigation obligations might be requested by permitting authorities, but are not expected to add significantly to the already embedded and proposed mitigation measures.