

- ▶ **Request for Exemption: AQUIND Interconnector**

PRIVATE AND CONFIDENTIAL

© AQUIND LIMITED, 2020



Copyright

Copyright © AQUIND Limited 2020. All rights reserved. This document, and all accompanying Exhibits, is subject to contract and contains confidential and proprietary information.

No part of this document, including the Exhibits, may be reproduced without the prior written permission of AQUIND Limited.

3 Project benefits

3.1 Introduction

This section of the Request for Exemption:

- ▶ Explains the benefits that AQUIND Interconnector will deliver; and
- ▶ Summarises the analysis used to calculate the project benefits.

The revenue and social welfare analysis, and competition analysis have been included as separate Exhibits:

- ▶ **Exhibit 1:** AQUIND revenue and social welfare analysis
- ▶ **Exhibit 2:** AQUIND competition analysis.

3.2 Why AQUIND?

AQUIND Interconnector will significantly increase the cross-border capacity between GB and France delivering an additional 2000MW of capacity to the congested GB-French border. The project, which will be owned and operated by AQUIND Limited, will be the largest GB interconnector built since IFA in the 1980s.

Following the departure of the UK from the European Union, AQUIND will represent a continuation of the trend towards closer market integration between GB and mainland Europe and signal the willingness of both the UK and the European Union to continue cooperating for the benefit of their respective citizens. Cross-border interconnection such as AQUIND will still deliver considerable benefits to GB, France and Europe irrespectively of the outcome of the ongoing negotiations between the EU and the UK.¹

The pipeline of planned GB-French interconnector projects has increased since 2013 following the confirmation of the GB Cap and Floor regime. Through this Request for Exemption, AQUIND will deliver a significant French-GB interconnector capacity and enable greater competition among market participants while limiting its reliance on financial underpinning or consumer support.

Overall, the introduction of AQUIND Interconnector can deliver the following benefits:

- ▶ An increase in social welfare for France
- ▶ An increase in European social welfare, particularly in EU27 (i.e. excluding the UK).
- ▶ Competition benefits, including competition for interconnector capacity.
- ▶ Increase in security and diversity of supply for both connecting countries.
- ▶ Optimisation of the European generation portfolio (e.g. dispatch of renewables in France and in GB).
- ▶ Contribution to meeting national decarbonisation targets through emissions reductions.
- ▶ Flexibility and provision of system services to the national TSOs.

Each of the benefits set out above is described in more detail in the following subsections.

¹ The impact of Brexit for GB energy policy, wholesale electricity prices and in particular cross-border trading, does however present a significant uncertainty for AQUIND. This uncertainty creates a risk for AQUIND which is considered in full in Section 6 of this document.

3.2.1 Social welfare benefits

A Cost-Benefit Analysis (CBA) methodology is used to calculate the impact of AQUIND on society, also referred to as “socio-economic welfare” or “SEW”. The CBA considers market price projections “with” and “without” AQUIND. The difference between these modelling outcomes reveals the impact that AQUIND has on wholesale market prices in each country. The distribution of socio-economic welfare impacts is split between consumers, producers and interconnectors in GB, France and continental Europe.

The full CBA study has been provided in Exhibit 1 and 4. The main modelling assumptions and SEW results have been summarised below.

3.2.1.1 Modelling scenario overview

An economic market dispatch model is used to project market prices in GB, France and other European countries over the 25-year modelling period. This analysis incorporates three market-based scenarios developed to show a range of market outcomes. The change in market prices in each scenario determines interconnector revenues and welfare. These main scenarios summarised in Table 3-1.

AQUIND has developed a detailed set of assumptions which represent a central view of how European power markets are expected to evolve in the future, referred to as the Market Scenario (“AQUIND Market Scenario”). Compared to the TYNDP 2018 scenarios, we consider that the AQUIND Market Scenario represents a more up-to-date, consistent and comprehensive view of the evolution of European power markets, while maintaining consistency with the base TYNDP assumptions. This scenario forms the basis of the CBA assessment performed by AQUIND.

Table 3-1 Modelling main scenario descriptions

Scenario	Description
AQUIND Market Scenario	<ul style="list-style-type: none"> ▶ A central view on the evolution of the GB, FR and other European power markets. ▶ Under this scenario, Governments continues to pursue a balanced energy policy, attempting to meet and balance the goals of security of supply, competitive market structure and environmental sustainability.
AQUIND High Commodities / Renewables Scenario	<ul style="list-style-type: none"> ▶ High renewables investment is accompanied by high commodity prices and demand across Europe, with the knock on effect of higher gas to oil indexed gas prices and carbon prices relative to the AQUIND Market Scenario. ▶ These factors lead to relatively volatile prices and to increased levels of interconnector investment.
AQUIND Low Commodities Scenario	<ul style="list-style-type: none"> ▶ This represents a scenario with low commodity prices, GDP growth and demand relative to the AQUIND Market Scenario. ▶ Low commodity prices also reduce the running cost of marginal thermal generation with higher capacity margins reducing scarcity, placing downward pressure on wholesale prices across Europe. ▶ Low price volatility and cross-border spreads reduce the returns for interconnectors, therefore reducing interconnector investment compared to the AQUIND Market Scenario.

All three AQUIND scenarios are broadly based on the TYNDP assumptions but build on these assumptions to deliver an economically robust and internally consistent set of scenarios, by applying detailed assumptions and contemporary data.

3.2.1.2 Social welfare summary for AQUIND

The results of the market modelling have been used as inputs to the CBA to estimate the welfare impact of AQUIND Interconnector. The CBA also takes into account non-wholesale market effects, such as Capacity Mechanisms and Ancillary Services. The benefits for France, GB and Europe are presented in Table 3-2. The CBA identifies the distribution of SEW as follows:

- ▶ **Producer welfare:** For producers, the CBA quantifies the impact on producer gross margins – the difference between their energy revenues and production costs (production costs include fuel costs, carbon costs and non-fuel variable costs).
- ▶ **Consumer welfare:** For consumers, the CBA calculates the impact on wholesale purchase costs of electricity. The change in the purchase costs multiplied by electricity demand shows the total impact on consumer prices in each country.
- ▶ **Interconnector welfare:** Net welfare also takes into account the profitability of buying and selling electricity on AQUIND Interconnector itself, the capital and fixed costs of operation of the link, as well as the impact on the profitability of other interconnectors that are expected to be operational in GB and France by 2023.²

² A number of new GB interconnectors will be subject to Ofgem’s Cap and Floor regime. We have not modelled possible individual project cap and floor levels as part of the calculation of interconnector welfare as the project cost information, and therefore cap and floor levels, are unknown. The impact of AQUIND on interconnectors that plan to commission ahead of AQUIND is taken into account in the CBA.

The total net social welfare for GB and France combined, is strongly positive in the AQUIND Market Scenario and in the AQUIND High Commodities/Renewables scenario. The sustained premium in GB prices compared to French prices over the exemption period, drives a large volume of interconnector flows from the lower priced French market to GB. In France the impact of these flows pulls up the wholesale price to the benefit of French producers. As a result, producers receive a higher price, but French consumers would pay more for electricity. The net impact in France is a net total social welfare benefit across all three scenarios.

Table 3-2 Social welfare results – France, GB and Europe

€m NPV @ 4.0%, real 2018		AQUIND Market Scenario	AQUIND Low Commodities Scenario	AQUIND High Commodities / Renewables Scenario
GB welfare	Net producer welfare	-€ 2,136	-€ 3,842	-€ 3,068
	Net consumer welfare	€ 2,275	€ 4,032	€ 3,826
	Net interconnector welfare	-€ 1,088	-€ 770	-€ 1,265
	Net social welfare	-€ 949	-€ 580	-€ 507
French welfare	Net producer welfare	€ 4,418	€ 8,220	€ 2,023
	Net consumer welfare	-€ 2,092	-€ 5,735	-€ 598
	Net interconnector welfare	-€ 1,392	-€ 1,453	-€ 1,353
	Net social welfare	€ 934	€ 1,032	€ 72
Impact on other European Countries	Net producer welfare	€ 2,506	€ 5,070	-€ 3,040
	Net consumer welfare	-€ 1,040	-€ 4,627	€ 4,858
	Net interconnector welfare	-€ 1,064	-€ 1,078	-€ 878
	Net social welfare	€ 403	-€ 635	€ 941
AQUIND	Revenues	██████	██████	██████
	Costs	-€ 1,305	-€ 1,305	-€ 1,305
	Net AQUIND welfare	██████	██████	██████
Variation in Grid losses	FR losses	-€ 23	-€ 52	-€ 29
	GB losses	-€ 165	-€ 158	-€ 108
	Total losses	-€ 188	-€ 210	-€ 137
Security of Supply (EENS)	Total	€ 222	€ 543	€ 99
Total European welfare	Including AQUIND	██████	██████	██████
Total European Welfare	Excluding AQUIND	€ 421	€ 151	€ 468

In the Low Commodities scenario, the impact of the removal of the CPS in GB, plus lower levels of investment in renewables, reduces the wholesale prices in GB and France compared to the AQUIND Market Scenario. Combined with greater competition in wholesale markets, this leads to less scarcity and AQUIND's benefit to society is therefore reduced, but it remains positive.

The CBA presented in this application shows a range of welfare results which are determined by the underlying assumptions in the modelled scenarios. There are also wider benefits of AQUIND interconnector for GB and France which are not quantified in the CBA (for example security of supply benefits and benefits to the TSOs in France and GB. These benefits, and the underlying assumptions, are explained in full in Exhibit 1.

Other interconnector projects on the France-GB border reduce AQUIND’s expected arbitrage revenues. The high volume of interconnector capacity assumed in the AQUIND High Commodities/Renewables Scenario results in lower interconnector welfare. This is because the cannibalisation of both AQUIND revenues by other interconnectors, and vice-versa, is greater in this scenario than in the AQUIND Market Scenario.

For AQUIND, the impact of other interconnectors presents a significant project revenue risk. In respect of the share of AQUIND’s congestion revenues that will be subject to the exemption, AQUIND will not have access to any financial underpinning through a regulated regime in France, facing the full project downside risk in respect of the Project’s Exempt Portion. This is explained in full in Section 6.

3.2.1.3 CBA result and AQUIND’s commissioning date

The CBA analysis was completed over a 25 year period from 2024 to 2048 (both inclusive). AQUIND’s exact commissioning date will depend on progress against the programme plan, as explained in Section 4 and Exhibit 11. The social welfare impact of a change to the commissioning date, for example by delaying the project/CBA start and end date by one year, is expected to be small. This is because the small year-on year change in the GB and French price profile, as identified in Exhibit 1.

3.2.2 Grid losses

In this Request for Exemption we have estimated the impact of AQUIND Interconnector on the reduction in thermal losses on the transmission networks in France and in GB, based on calculations performed by a technical consultancy, Tractebel. The methodology for the calculation of variation in grid losses is consistent with the approach suggested in TYNDP 2018. The estimate is developed using a regional transmission grid model, calculating the hourly flows with and without the Project. This is then monetised based on the marginal costs as given by the market simulations.

Alongside the initial work undertaken by Tractebel, we have undertaken additional analysis to better align the modelling undertaken by Baringa and Tractebel. In particular, this post-processing exercise uses the flows across AQUIND Interconnector as a proxy for the total system losses generated by AQUIND in GB, France and across Europe. Whilst we recognise that this is a simplification of the losses analysis, which is a very complex piece of modelling, we consider it an appropriate step to better align the Tractebel and Baringa analysis. We expect that this step to better align the analysis improved the consistency of the SEW and losses analysis giving a more accurate CBA result.

The post-processing started by comparing the 2030 flows across the GB-France border, with AQUIND, in both the Baringa and Tractebel analysis. Our analysis showed that Baringa projected 64% of the annual flows of Tractebel. All else being equal, lower flows across the border would result in lower system losses (in the case of France) and a lower reduction in system losses (in the case of GB). Applying the same methodology to the AQUIND Low Commodities and High Commodities/Renewables scenarios gave results of 68% and 49% respectively.

Applying these scalars to the NPV of total losses used in the CBA gives a more consistent view of the losses from the AQUIND scenarios.

Table 3-3 Monetised value of the variation in grid losses resulting from AQUIND

€m NPV @ 4.0%, real 2018	AQUIND Market Scenario	AQUIND Low Commodities	AQUIND High Commodities / Renewables
Original analysis (as presented in the Investment and CBCA Request equation 3.0)			
Variation in losses, France	-€ 36	-€ 60	-€ 76

Variation in losses, GB	€ 258	-€ 221	-€ 232
Total losses	-€ 294	-€ 280	-€ 308
SCALED analysis			
Variation in losses, France	-€ 23	-€ 29	-€ 52
Variation in losses, GB	-€ 165	-€ 108	-€ 158
Total losses	-€ 188	-€ 137	-€ 210

As AQUIND's SEW estimates include the impact of losses on the Project itself, and other GB/EU interconnectors³, the estimates above exclude the estimates of losses on the Project and other GB links, to avoid double counting.

The monetised grid losses in the table above are negative when the impact of AQUIND on variation in grid losses represents a net cost, and are positive when the impact represents a net benefit. The monetised impact of the variation in grid losses in GB is a net positive value, due to the impact of the Project on marginal cost more than offsetting an increase in net losses. These estimates do not include the impact of grid losses on AQUIND Interconnector or other GB/EU interconnectors, which are monetised as a cost through AQUIND's approach to SEW estimates.

3.2.3 Competition

Interconnection enables cross-border electricity flows, providing market participants access to connecting markets and increasing the size of the energy markets. This allows participation from a larger number of market participants and can allow new entrants, placing competitive pressure on incumbents.

AQUIND Interconnector will provide an additional 2000MW of tradeable capacity across the congested GB-France border. The capacity will be made available to all market participants under the relevant trading arrangements as determined by the regulations in place.

At a macro level, AQUIND Interconnector will increase competition in Europe by creating new opportunities for cross-border trade. This will increase liquidity and, the opportunity to trade across a larger market, should displace more expensive generation in the importing market leading to price convergence.

Two competition metrics have been used to ensure that AQUIND will not increase market concentration or instances of pivotality in GB or France. Pivotality has been measured through the Residual Supplier Index (RSI), and market concentration, measured through the Herfindahl-Hirschman Index (HHI), as explained in the following paragraphs.

3.2.3.1 Residual Supplier Index analysis (RSI)

The RSI analysis considers whether AQUIND will increase the ability of the largest energy suppliers in GB and France to significantly influence market prices. This is an assessment of pivotality. The analysis focuses on the position of EDF Energy in GB and Électricité de France in France, as the largest suppliers in both markets.

³ Technical line losses are an input to the modelling in Plexos.

The analysis shows that the introduction of AQUIND Interconnector will not increase the opportunities for EDF to influence market prices in GB or France. The introduction of AQUIND marginally reduces the number of hours in the modelled years where EDF is the pivotal supplier.

3.2.3.2 Herfindahl-Hirschman Index (HHI)

This simple HHI assessment considers the impact of AQUIND on generation market share in GB and France. The size of AQUIND Interconnector compared to the generation market in GB and France means that AQUIND's impact is measured to be small. As the interconnector capacity is competitively allocated to a range of market participants, the analysis shows that AQUIND will not increase concentration in GB or France.

3.2.4 Security and diversity of supply

AQUIND Interconnector will provide a reliable alternative source of electricity for GB and French consumer and network users over its operational life. The nature of interconnection technology is such that AQUIND is projected to achieve over 98% availability over the exemption period, significantly higher than most conventional thermal assets.

The security of supply benefit provided by AQUIND Interconnector will be rewarded through participation in the GB and French capacity markets and result in possible deferred/avoided generation investment or a decrease in the probability of unserved energy. The differences in the GB and French generation mix will ensure that AQUIND provides a degree of diversification for both GB and France.

3.2.4.1 Capacity market participation

The GB CM will directly compensate AQUIND for the de-rated capacity that it provides at times of system stress. The de-rating factor will be calculated based on AQUIND's technical reliability and the extent to which AQUIND will import into GB during a system stress event in that country. In GB, the de-rating factor will be determined by the Government and National Grid through the AQUIND de-rating factor. Whilst the precise details of the French CM are not available, we anticipate a similar approach.⁴

AQUIND will be remunerated through the GB CM, with the outturn payments based on the direction and volume of interconnector flows during periods of system stress.

The European Clean Energy Package⁵ envisages a move towards direct cross-border participation of generators in Capacity Mechanisms in Europe. While the specifics have not yet been established, we assume that interconnectors will continue to be able to capture the value they create by increasing cross-border capacity (regardless of whether interconnectors or foreign capacity participate in the Capacity Mechanisms).

3.2.4.2 Opportunity for deferred generation investment

AQUIND Interconnector's participation in the GB CM, and expected participation in the French CM may result in deferred or avoided investment decisions for other domestic generation assets. In this instance, by participating in the CM, AQUIND Interconnector would be relied upon to meet GB security

⁴ The approach to de-rating in France is yet to be established. For the revenue analysis presented in this Request for Exemption, a proxy has been used based on the de-rating factors published for existing or planned GB-FR interconnectors.

⁵ Regulation (EU) 2019/943.

of supply. As a price-taker in the GB CM auction, AQUIND would push other more expensive marginal generation out of the CM auction. For the same security standard, AQUIND would reduce the cost of capacity in the GB CM. We anticipate the same principle will apply to the French CM.

3.2.4.3 Reduction in unserved energy

AQUIND may alternatively provide a benefit to GB or France in the form of a reduction in unserved energy. In this instance, the introduction of AQUIND would increase the GB or French security standard. This would reduce the probability of unserved energy in the market. This benefit is not captured in the CM itself. It may therefore represent an additional security of supply benefit attributable to AQUIND that has not been quantified in the economic modelling.⁶

The additional benefit provided by AQUIND through either deferred generation investment or a reduction in unserved energy are mutually exclusive. The precise additional benefit will depend on the extent to which AQUIND is relied upon to meet the national security standards in GB and France.

3.2.5 Optimisation of the European generation portfolio

AQUIND Interconnector will double the current GB-FR capacity and provide a >30% increase in capacity when other planned links (1 GW ElecLink, 1 GW IFA and 1.4GW of either GridLink or FABLink) are taken into account. The French electricity market is already well connected to other central European Member States. The large structural difference in the electricity prices in GB and France provides a clear signal for further interconnection to facilitate efficient cross-border trade and GB-French, as well as wider European, price convergence.

AQUIND will provide an opportunity for the efficient dispatch of renewables in GB, France and across connected markets. As renewable investment increases in GB and France, the probability of curtailment of intermittent generation also increases. The additional cross-border capacity provided by AQUIND offers the opportunity to export this additional power during periods of high renewable generation.

In the AQUIND Market Scenario, the Project is estimated to increase renewable generation across Europe by 6.2TWh over the modelling period.

3.2.6 Emissions reduction

Similar to the benefits of RES integration, our detailed power market modelling shows that carbon dioxide emissions fall overall with the introduction of AQUIND.

In the AQUIND Market Scenario, the Project is estimated to reduce CO₂ emissions across Europe by 2.8 MtCO₂ over the modelling period.

3.2.7 Flexibility and system services

AQUIND will use VSC technology and therefore be in a position to provide a range of ancillary services to the national TSOs, National Grid and RTE, to improve flexibility in real time trading timeframes (further detail is provided in Section 4). This may include the provision of mandatory and commercial ancillary services (for example voltage control, frequency control and black start capability services)

⁶ In theory, this could be calculated by considering the change in expected unserved energy at different de-rated capacity margin. The assumed reduction in unserved energy as a result of AQUIND, multiplied by the value of lost load (VoLL) would provide an estimate of the benefit from a reduction in expected unserved energy.

and for emergency assistance and cross-border balancing. Some of these ancillary services will be provided voluntarily based on publicly tendered commercial agreements with National Grid, further enhancing the competition in this market for the benefit of National Grid users. Similarly in France, AQUIND may provide frequency and voltage ancillary services to RTE.

AQUIND will also be able to provide emergency assistance to both National Grid and RTE. AQUIND is in discussions with National Grid in relation to mandatory and commercial ancillary services National Grid might require. AQUIND will engage in similar discussions with RTE as the project development process progresses.

In addition to more competitively priced ancillary services, AQUIND will have the potential to earn revenue from ancillary services markets. This may in turn result in welfare transfers to network users in case the revenues exceed a pre-defined threshold⁷ and would be, partially, shared out by AQUIND.

As part of a consultation with the TSOs undertaken in Summer 2019, we have sought views from National Grid and RTE on the most recent valuation of the benefits that AQUIND Interconnector is expected to provide from an ancillary services perspective, but neither of them have been able to provide a quantitative estimate at this stage. We will keep the NRAs updated on any further information available from the TSOs over the course of the Project's development.

3.3 Local benefits

In France, AQUIND's converter station and its compound and associated infrastructure will be subject to a number of taxes that arise from the fact of owning such physical assets and, in the case of IFER, additional taxes relate specifically to electricity transmission installations. AQUIND has obtained tax advice in respect of those taxes, but at this stage, any estimate of taxes is provisional.

The taxes are distributed locally, between a local commune, a Terroir de Caux, Department (Seine-Maritime) and Normandy region in different proportions, depending on the tax and the exact location of the installation, as well as regional regulations. The level of tax rates of the real estate tax and CFE also differs depending on the commune.

AQUIND's tax contributions represent a significant public benefit in these regions. Additionally, AQUIND's local investment in the region facilitates the creation of more tax revenues in locations that are involved in significant developments.

Exhibit 13 provides our estimate of AQUIND's contribution to local tax revenues if the converter station is located in one of the three communes immediately adjacent to the Barnabos switching station in the commune of Varneville-Bretteville. AQUIND estimates this tax contribution will be approximately €4.6m per year. According to the approved stakeholder engagement strategy, AQUIND cannot at this moment make a public announcement in respect of the exact siting of the converter station within the communes identified above, but we aim to announce that in the near future.

⁷ For example, Eleclink's exemption features an upside sharing mechanism above a pre-defined level of Internal Rate of Return for the project.