The Energy Regulatory Commission (CRE) consults market player.

Public consultation no.2024-01 of 5 March 2024 on the opportunity for new electricity interconnection capacity between France and the United Kingdom

Translated from the French: only the original in French is authentic.

Three electricity interconnectors between France and the UK are currently in service, with a total capacity of 4 GW: IFA 2000, with a capacity of 2 GW, commissioned in 1986; IFA2, with a capacity of 1 GW, commissioned in January 2021; and ElecLink, with a capacity of 1 GW, commissioned in May 2022. IFA 2000 and IFA2 are operated by RTE and National Grid Interconnectors Limited and National Grid IFA 2, respectively the French Transmission System Operator (TSO) and two subsidiaries of UK TSO National Grid. ElecLink, for its part, benefits from a derogation scheme[1] .

Several projects for new interconnectors between France and the United Kingdom are under study: Aquind, FAB and GridLink. CRE was also recently informed of Getlink's intention to study a new interconnector project using the Channel Tunnel. In January 2022, Energy Regulatory Commission (Commission de Régulation de l'Energie - CRE) refused an investment application submitted by GridLink on 17 March 2021[2] because of major uncertainties about the benefits of the project, reinforced by the particular context of the United Kingdom's exit from the European Union.

CRE believes it is necessary to reassess the value of new interconnection capacity with the United Kingdom, given the new energy mix trajectories in the United Kingdom, France, and the European Union (EU), particularly in connection with the revision of the greenhouse gas emission reduction targets included in the "Fit for 55" package. In addition, the crisis on the wholesale electricity markets in 2022 and 2023 has highlighted the decisive role of interconnectors in terms of security of supply. CRE has therefore commissioned a study of the potential benefits of new interconnections with the United Kingdom, based on the most recent scenarios and on the Ten-Year *Network Development Plan* (TYNDP 2022) published by ENTSO-E[3] .

In a letter dated 13 October 2023, RTE sent CRE its analysis of the desirability of a new interconnector project between France and the United Kingdom. RTE considers that there is an interest, under certain conditions, in building a new interconnector of approximately 1 GW with the United Kingdom. RTE states that it has been approached by each of the four project developers about the possibility of jointly developing an interconnector. After comparing the different projects on a set of criteria, RTE considers that the project envisaged by GetLink is the most interesting from a technical and economic point of view.

The study commissioned by CRE also highlights the possible economic interest of a new interconnection project between France and the United Kingdom, subject to certain conditions. In particular, the project should have a capacity of around 1 GW, with insufficient additional benefits beyond this capacity. The study shows that the benefits are significantly higher for the UK than for France, which should be reflected in the distribution of costs between the two countries. It is on this condition that France could find an economic interest in such a project.

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[1] This derogation, taken in application of Article 17 of EC Regulation n°714/20093, authorises ElecLink to derogate from certain rules set out in Article 16(6) of the Regulation and Articles 9 and 32 of Directive n° 2009/72/EC. In particular, ElecLink is authorised to allocate multiannual interconnection capacity by means of Open Season procedures and to retain part of the revenue from the sale of interconnection capacity.

[2] CRE decision of 19 January 2022 concerning the investment request of GridLink Interconnector Limited

[3] European Network of Transmission System Operators for Electricity.

CRE agrees with the results of the comparison study carried out by RTE. As the projects have different levels of maturity, the choice of a project will require verification of a certain number of conditions, particularly a positive assessment of its interest by the competent authority in the United Kingdom.

Pursuant to the provisions of article L. 134-3, 2° and article L. 321-6, II of the Energy Code, the public electricity transmission system operator (TSO) must submit its annual investment programme to CRE for approval. Within this framework, CRE ensures that the necessary investments are made for the proper development of the networks and that access to them is transparent and non-discriminatory. At the end of the public consultation, CRE may, if necessary, decide whether to approve RTE's investment programme, which includes an interconnection project between France and the United Kingdom.

This public consultation concerns the analysis of new interconnection capacity between France and the United Kingdom, as well as the technical and economic comparison of the projects carried out by RTE. The report commissioned by CRE from Artelys on the benefits of a new interconnection project is published in the appendix to the consultation.

Paris, 5 March 2024.

For the Commission de régulation de l'énergie,

The President,

Emmanuelle WARGON

Respond to the consultation

CRE invites interested parties to submit their contribution by 19 April 2024 at the latest, by entering their contribution on the platform set up by CRE: https://consultations.cre.fr.

In the interests of transparency, all contributions will be published by CRE. If your contribution contains elements that you wish to remain confidential, you can use the platform to generate a version that conceals these elements. In this case, only this version will be published. CRE reserves the right to publish information that may prove essential for the information of all stakeholders, provided that it does not fall within the scope of legally protected secrets. In the absence of a blacked-out version, the full version will be published, subject to information falling within the scope of legally protected secrets.

Interested parties are invited to respond to the questions, giving reasons for their answers.

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1. Benefits reassessment of a new interconnector between France and the UK concludes that additional capacity of around 1 GW could be beneficial.

1.1. Socio-economic welfare of new interconnectors increases according to new scenarios.

The socio-economic welfare (SEW) of new interconnection capacity is evaluated for all interconnected countries in Europe and are calculated as the savings in electricity production costs made possible by the interconnector due to the reduction in border congestion that it would allow. By construction, this indicator also considers, on the one hand, the value of the CO2 quota savings made, and, on the other hand, the benefits derived from the reduction in the capping of electricity from renewable sources. This methodology is consistent with that used in previous studies carried out by CRE and with that used at European level by ENTSO-E for the TYNDP.

To estimate the future benefits of an interconnector project, the various studies described below are based on prospective scenarios. These must be contrasted to cover a sufficiently wide range of different possible futures in terms of changes in the generation mix, demand, or macro-economic parameters.

1.1.1. SEW is assessed based on updated scenarios.

CRE has commissioned the consultancy Artelys to carry out a study of the value of additional interconnection capacity between France and the United Kingdom. This study is published jointly with this public consultation.

The study estimates the value of different levels of interconnections in three forward-looking scenarios constructed from the forward-looking scenarios of the national transmission system operators (TSOs), respectively *Future Energy Scenarios 2050* (FE2050)[4] for RTE and *Future Energy Scenarios* (FES) for National Grid[5]. These national plans are supplemented by ENTSO-E's Ten-Year European Transmission Network Development Plan (TYNDP 2022)[6] for the assumptions relating to the rest of Europe. These scenarios are characterised as follows:

- **Scenario 1** envisages a trajectory of strong growth in electricity consumption in France and the United Kingdom, with generation facilities relying heavily on renewable energies, while remaining compatible with carbon neutrality in 2050. This is the most ambitious scenario in terms of the deployment of renewable energies and the electrification of uses.
- **Scenario 2** envisages a sustained growth path for electricity consumption and installed renewable capacity in France and the UK, but less than in scenario 1, while still being compatible with carbon neutrality in 2050. This is the median scenario.
- **Scenario 3** envisages a slower-than-expected deployment of energy infrastructures and low-carbon technologies, and the objectives of carbon neutrality are not achieved by 2050. This is the least ambitious scenario in terms of renewable energy deployment and societal transformation.

The three scenarios are based on common assumptions for the configuration of the electricity system outside France and the United Kingdom, as well as for the price of gas and carbon. For the other European countries, the study uses the assumptions of the TYNDP 2022 ***National Trends*** (NT) scenario for the 2030 and 2040 horizons, aligned with national energy and climate policy announcements, as well as the ***Global Ambition*** (GA) scenario for the 2050 horizon. Details of the assumptions for these scenarios are given in the study report.

CRE believes that it is important for the scenarios to be based on the latest forecasts from European countries in terms of the development of their energy mixes, while considering the possible uncertainties, both in terms of accelerating and delaying the achievement of targets.

[4] Energy Futures 2050, RTE

[5] Future Energy Scenarios, National Grid

[6] TYNDP 2022, ENTSO-E

The study compares the current situation at the border (4 GW) with two levels of interconnection capacity, 5.4 GW and 6.6 GW, i.e. the addition of 1.4 GW or 2.6 GW of capacity. The two levels of increased interconnection capacity make it possible to study different configurations:

1. the addition of around 1 GW of new capacity: this would correspond to a project with a capacity of between 1 and 1.4 GW.
2. adding additional capacity of 2 GW or more: this situation would correspond to the addition of capacity of between 2 and 2.8 GW, i.e. one project of 2 GW or two projects with a capacity of between 1 and 1.4 GW.

> **Question 1** Do you consider that the different scenarios used, and the different interconnection capacities assessed in the study are relevant?

1.1.2. Additional interconnection capacity derives much of its value from better integration of renewable energy sources in the UK and reduced reliance on thermal generation (mainly fossil) at European level.

The study commissioned by CRE shows that additional interconnection capacity will make it possible to prevent wind-generated renewable energy in the United Kingdom from being curtailed at times of peak renewable production. This renewable generation replaces the more expensive fossil-fired generation in Europe, thereby reducing the production costs of the European electricity system. In addition, a new interconnector with the UK has contrasting effects on nuclear generation (upwards in some scenarios and downwards in others).

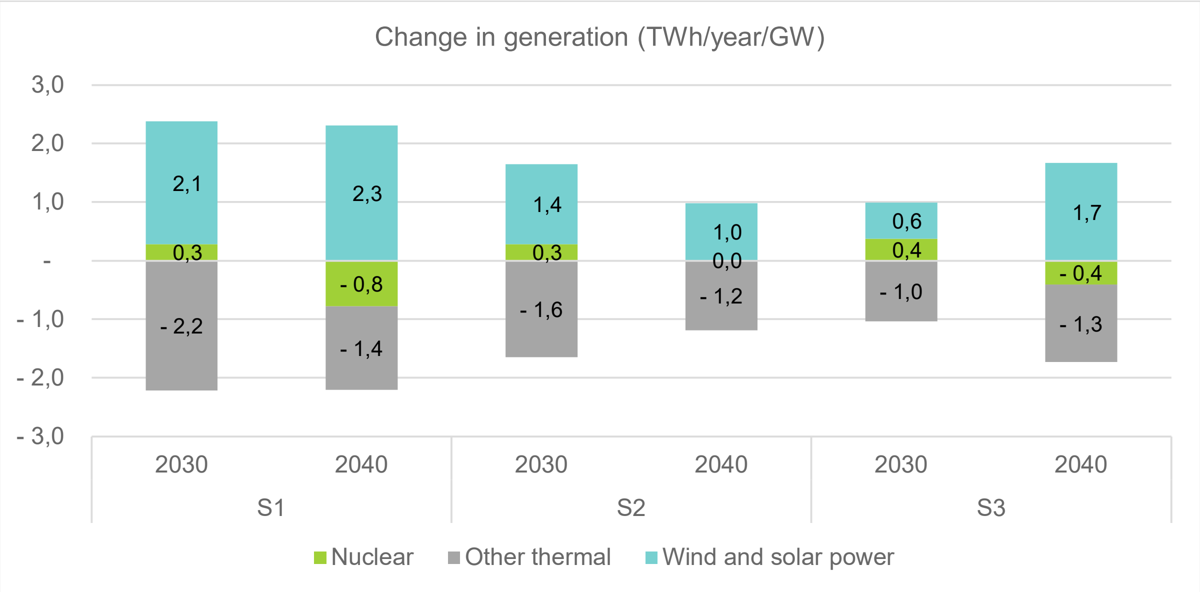


Figure 1: Variations in generation by sector across the whole geographical perimeter made possible by the addition of an initial interconnection project of 1.4 GW (source: Artelys study report)

An initial interconnector project with a capacity of around 1 GW would therefore make it possible to avoid about 1 to 2 TWh/year of renewable energy curtailment (mainly wind power) mainly in the United Kingdom, and to reduce by the same amount the use of mainly fossil-fuelled thermal resources in the countries of the European Union. The modelling shows that from 2030 onwards, most of the energy will be imported from the UK into France. This represents a significant change compared with the observed operation of interconnectors already in service, and with previous analyses of future trends at the border. This dynamic is due to the significant increase in renewable energy production capacity planned to be installed in the United Kingdom and considered in the scenarios.

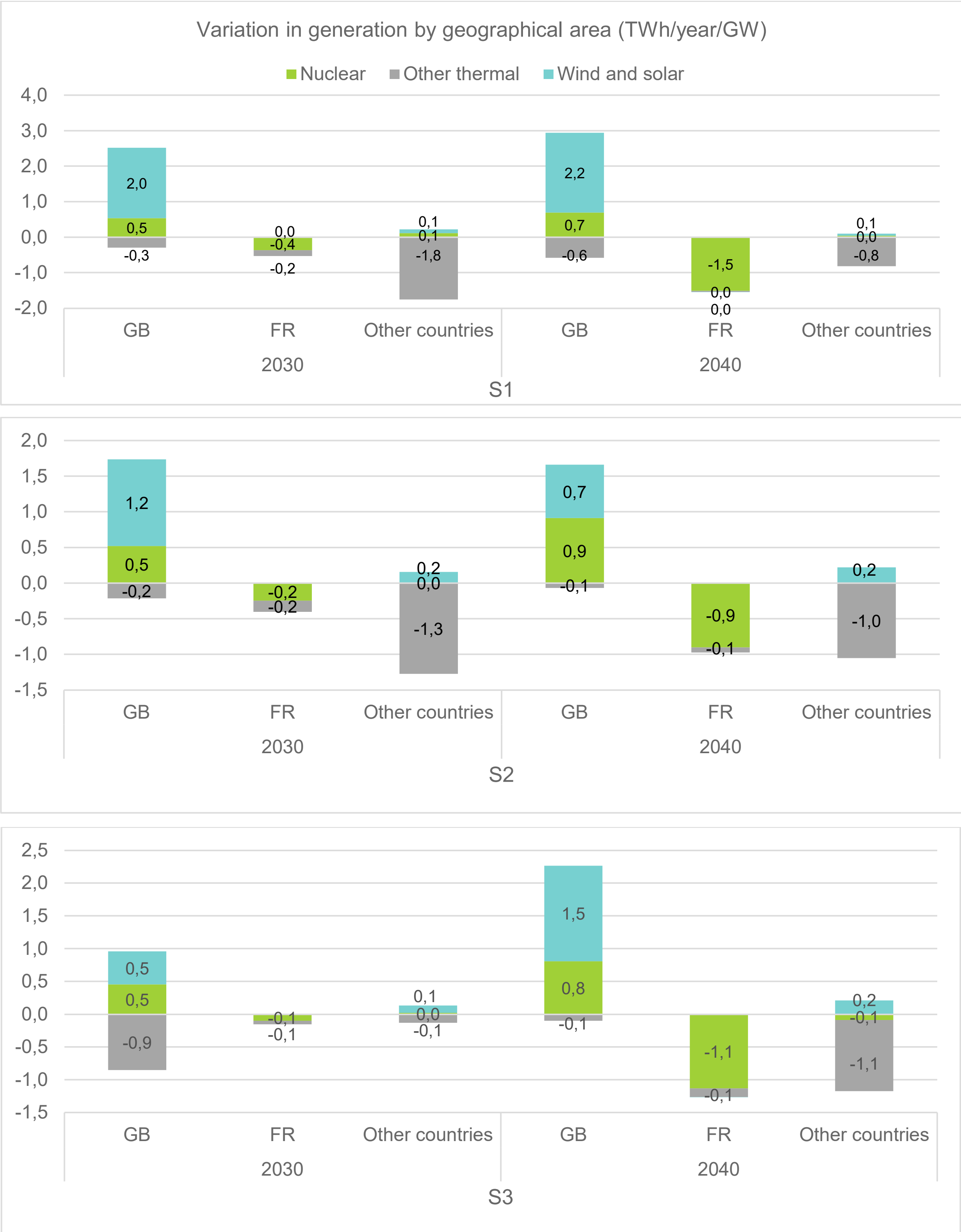


Figure 2: Variations in generation by type and by geographical area for the addition of the first interconnector project of 1.4 GW (source: Artelys study)

By 2030, the interconnection will make it possible to avoid wind load curtailment and to increase nuclear generation in the UK. The location of displaced thermal generation differs according to the scenario:

- In scenarios 1 and 2, this more competitive generation enables fossil-fired generation in the rest of Europe to be phased out, making France essentially a transit country.

- In scenario 3, the UK becomes an exporter during periods of high wind generation, which essentially leads to a downward modulation of nuclear generation in France. Conversely, the UK becomes an importer during periods of lower production, which leads to an increase in nuclear generation in France. On average over a year, additional wind generation in the UK essentially offsets fossil generation in the UK. The UK thus benefits from the inter-seasonal flexibility provided by the European plate.

By 2040, in addition to reducing the use of fossil fuels in the rest of the European Union by around 1 TWh/year, these imports from the UK could lead to downward adjustments in nuclear generation in France of less than 1 TWh/year. These variations are the result of a combination of two opposing effects:

- when the UK relies on fossil-fired generation and nuclear power stations are not operating at full capacity, the additional interconnector allows French nuclear generation to be imported into the UK, thereby boosting French nuclear generation.
- in the event of a peak in renewable generation in the UK, when part of the generation must be curtailed, the interconnection capacity allows renewable generation from the UK to be imported into France, which can lead to a reduction in French nuclear generation.

The second effect slightly outweighs the first.

These differences between the two timeframes can be explained by the assumptions about changes in the energy mix at European level, which predict a greater reliance on fossil fuels in 2030 than in 2040.

The increase in interconnection capacity would generate gross socio-economic benefits of around €145 million[7] /year/GW on average by 2030 and 2040, due to the overall reduction in production costs made possible by the optimisation provided by interconnection at European level. The table below shows the estimated values for the various scenarios.

SEW (M€/year/GW)	S1	S2	S3	Average scenario
2030	202	149	92	148
2040	164	123	140	142
Average for 2030 and 2040				**145**

Table 1: Gross SEW (€M/year.GW) from a 1.4 GW increase in interconnection capacity between France and the UK

The gross SEW of new interconnection capacity with the United Kingdom have therefore almost doubled since the last study carried out by CRE. In its public consultation of 17 June 2021 on the GridLink interconnection project[8] , CRE estimated the gross socio-economic benefits by 2030 of a new project at 75 $M€_{2020}$/year/GW based on the 2020 TYNDP and CRE's study of target electricity interconnection capacity between France and the United Kingdom in 2019[9] .

1.1.3. SEW is lower for 2 GW capacity than for 1 GW capacity.

The study commissioned by CRE assesses the expected SEW of two additional levels of interconnection: 1.4 GW and 2.6 GW. The addition of 2.6 GW may correspond to the addition of two interconnector projects of around 1 GW, or one larger project.

The study shows a significant reduction in the socio-economic benefits expected for the highest level of interconnection compared with the first level of additional capacity studied. This reduction is between 10% and 15% for most scenarios and time horizons, 7% for scenario 1 by 2050 and 20% for scenario 3 by 2030.

This result shows that there is less interest in increasing interconnection capacity at the border by around 2 GW than in increasing it by around 1 GW.

[7] Unless otherwise stated, all values are expressed in constant euros for the year 2022.

[8] Public consultation of 17 June 2021 n°2021-07 on the GridLink interconnection project and on the advisability of a new interconnection between France and the United Kingdom

[9] CRE study: Determination of a target electricity interconnection capacity between France and the United Kingdom

1.1.4. Results are robust to different sensitivities on the assumption used.

The study carried out by Artelys evaluates eight variations around scenario 2 to assess the sensitivity of the SEW to the assumptions considered in the initial scenarios. These sensitivities make it possible to assess the robustness of the scenario in the face of several hazards:

- upward and downward variations in the price of gas (+/- €20/MWh around the central scenario of €40/MWh);
- increased or slower development of competing interconnections between the UK and continental Europe (excluding France);
- low availability of nuclear power, based on feedback from the historically low availability of France's nuclear fleet in 2022 because of stress corrosion;
- the delay in developing electrolysis capacity for hydrogen production;
- the delay in the deployment of offshore wind farms in the United Kingdom.
- the delay in developing interconnections between France and the rest of continental Europe.

Three factors could have a significant downward or upward impact on the socio-economic benefits expected from an increase in interconnection capacity. A fall in the price of gas limits the production costs avoided when fossil generation is replaced by renewable generation. This in turn reduces the value of the interconnector. Conversely, a rise in the price of gas would increase the benefits of a new interconnector.

Furthermore, the increased development of interconnectors between the UK and continental Europe (Aminth Interconnector with Denmark, Tarchon Energy Interconnector with Germany, Cronos Interconnector with Belgium) would allow the UK's renewable generation to be valorised via other borders and would therefore reduce the interest in adding interconnection capacity between France and the UK. Indeed, as France is interconnected with other Northern European countries, interconnections with France are, from the point of view of economic value, in competition with those linking the UK to other countries.

	Year	UK-NO	UK-DK	UK-DE	UK-NL	UK-BE
Current level	2023	North Sea Link (1.4 GW)	-	-	BritNed (1 GW)	Nemo (1 GW)
Central scenario	2030		Viking (1.4 GW)	NeuConnect (1.4 GW)		
	2040	NorthConnect (1.4 GW)	Viking	NeuConnect	LionLink (2 GW)	Nautilus (1.4 GW)
	2050	NorthConnect	Viking	NeuConnect	LionLink	Nautilus
Low sensitivity	2030		Viking	NeuConnect		
	2040		Viking	NeuConnect		Nautilus
	2050		Viking	NeuConnect		Nautilus
High sensitivity	2030	NorthConnect	Viking	NeuConnect	LionLink	Nautilus
	2040	NorthConnect	Viking + Aminth (1.4 GW)	NeuConnect + Tarchon (1.4 GW)	LionLink	Nautilus + Cronos (1.4 GW)

	2050	NorthConnect	Viking + Aminth	NeuConnect + Tarchon	LionLink	Nautilus + Cronos

Table 2: Details of the interconnector projects considered in the sensitivity analysis assessing the impact of level of interconnexion between the UK and the rest of Europe (source: Artelys study report)

Finally, a delay in the deployment of offshore wind farms in the UK would reduce the generation to be developed via the additional interconnection capacity and therefore reduce the interest in new interconnection capacity. The development of renewable generation, particularly offshore wind in the UK, is therefore an important factor in the value of interconnection capacity.

Overall, CRE considers that the sensitivity analyses highlight both upward and downward uncertainties concerning the value of new interconnection capacity, but that they do not call into question the results obtained for the average of the three scenarios used in the study.

Other uncertainties may exist as to the value of new interconnection capacity between France and the United Kingdom, particularly as regards the operation of the markets or the regulatory framework. CRE notes, for example, the publication of an Ofgem study in October 2023 on the introduction of locational signals on the UK wholesale market[10]. Such a change in market rules in the United Kingdom remains hypothetical, but its implementation would require specific analyses of the benefits of interconnection capacity in this new context.

Question 2 Do you agree with CRE's analysis of the gross SEW of new interconnection capacity at the border between France and the UK?

1.2. The cost of HVDC project has risen in recent years.

1.2.1. Project investment costs are rising, in line with increasing tension on supply chain.

Investment costs for HVDC projects have risen because of major tensions over supply chain, due to increased demand for these projects. Many countries have ambitious targets for the development of offshore wind power, with the emphasis on high-power wind farms located far from the coast. These choices are leading to the predominant use of HVDC technology, which was previously only used on an ad hoc basis. Although specialist suppliers in this field have announced the construction of new production capacity, it remains highly uncertain whether this will be able to meet all the demand in Europe.

RTE has provided CRE with a methodology for estimating the costs of the interconnection projects submitted to it according to their technical design, based on feedback from recently concluded HVDC contracts, including the Celtic interconnection (700 MW between France and Ireland) and the Bay of Biscay interconnection (2,000 MW between France and Spain). The amounts derived from the contracts have been adjusted to take account of the technical design of each project: voltage level, cable cross-section, conductor, etc. This analysis leads to a significant increase in the order costs of a new project, which would be in the region of €1,350m for a capacity of around 1,250 MW, or €1.1bn/GW.

These costs represent an order of magnitude of the cost of a new project and will depend on the choice of project (length, route, organisation, etc.) and the results of the calls for tender. A detailed analysis of each project can be found in the second section of this public consultation.

[10] https://www.ofgem.gov.uk/publications/assessment-locational-wholesale-pricing-great-britain

1.2.2. Operating costs must take account of operating cost and additional losses on the network.

Project operating costs are estimated based on forecast interconnector maintenance costs and non-maintenance costs (personnel, IT equipment, premises, etc.). RTE estimates maintenance costs (and the cost of associated insurance) at around €10m/GW/year, in line with the current maintenance of several interconnectors. As operating costs excluding maintenance depend on the organisation chosen for each project, their estimate is not as reliable as that for maintenance costs. They could be between €5m and €10m/GW/year.

In view of the uncertainties involved, CRE has estimated the total operating costs of a new project at around €20m/GW/year. This amount is consistent with the data communicated to CRE by the various project developers at the border.

In line with its previous analyses and the methodology adopted in the TYNDP 2022, it is necessary to consider the additional losses generated by a new interconnector on the networks of the various European countries. These additional losses are made up of losses on the interconnector itself, as well as additional losses linked to transits in the different countries. These additional costs can represent significant amounts, estimated at around €30m/GW/year in the analyses carried out by RTE. In view of the forecast impact of the interconnection, which would notably increase transits in France, CRE considers that more detailed analyses of these costs linked to losses will be necessary if one or more projects are pursued.

1.2.3. Additional cost in terms of impact on the electricity network are still uncertain.

RTE has carried out network simulations to quantify the impact of a new interconnector with the UK on network congestion costs between 2030 and 2035. This study does not show any need for major network reinforcements in connection with a new interconnector[11]. Nevertheless, this increase in capacity could have an unfavourable effect on congestion costs over this timeframe. Indeed, a new interconnector with the UK would exacerbate the constraints that could arise on the French grid in the event of strong wind-generated electricity (mainly in the north-south direction). The aggravation of these constraints would lead to the need for additional *redispatching*, by shutting down certain more efficient power stations in the north to commission others in the south of France. RTE estimates these additional costs at around €10m/GW/year.

CRE does not have any additional data for the other countries. However, Ofgem recently published a public consultation on the assessment of new projects (including the Aquind project) as part of the third application window for the *Cap & Floor* mechanism[12]. This study highlights an equally adverse effect of the commissioning of new interconnectors in the UK, which could exacerbate congestion between the north and south of the UK. In the case of the Aquind project, these costs are estimated at between £400m and £3.5bn in total over a 25-year period. However, these results cannot be directly transposed to CRE's current study, as Ofgem's assumptions consider the completion of the FAB and Gridlink projects. CRE is therefore not making any quantified assumptions about the additional costs associated with congestion in other countries but considers that they could be significantly higher than those estimated for France alone. CRE will coordinate with Ofgem over the coming months to obtain additional data and refine its estimates.

Question 3 Do you agree with CRE's analysis of the projected costs of a new interconnection project with the United Kingdom?

[11] Except in the case of Fablink, for which the reinforcement of the "Gironde Loire-Atlantique" network currently under study would resolve the constraint (see second section).

[12] See Ofgem publication [Initial Project Assessment of the third cap and floor window for electricity interconnectors]

1.3. A new project of capacity around 1 GW could be justified by the benefits it would bring at European level, but the interest in France is limited.

1.3.1. The benefits of a new 1 GW project are sufficient compared to the costs of a new project, but the benefits of additional capacity beyond 1 GW are more uncertain.

The table below details the net present values of the various costs considered in the cost-benefit analysis of additional interconnection capacity of 1 GW[13].

NPV (€M)	Order of magnitude of costs
CAPEX[14]	987
OPEX	249
Losses	373
Leave (France only)	124
Total	**1 733**

Table 3: Net present values of the expected costs of the interconnection projects between France and Great Britain (NPV @4.5%, 25 years)

The graph below, taken from the study commissioned by CRE, summarises the expected benefits of a new interconnection in net present value terms for the different scenarios.

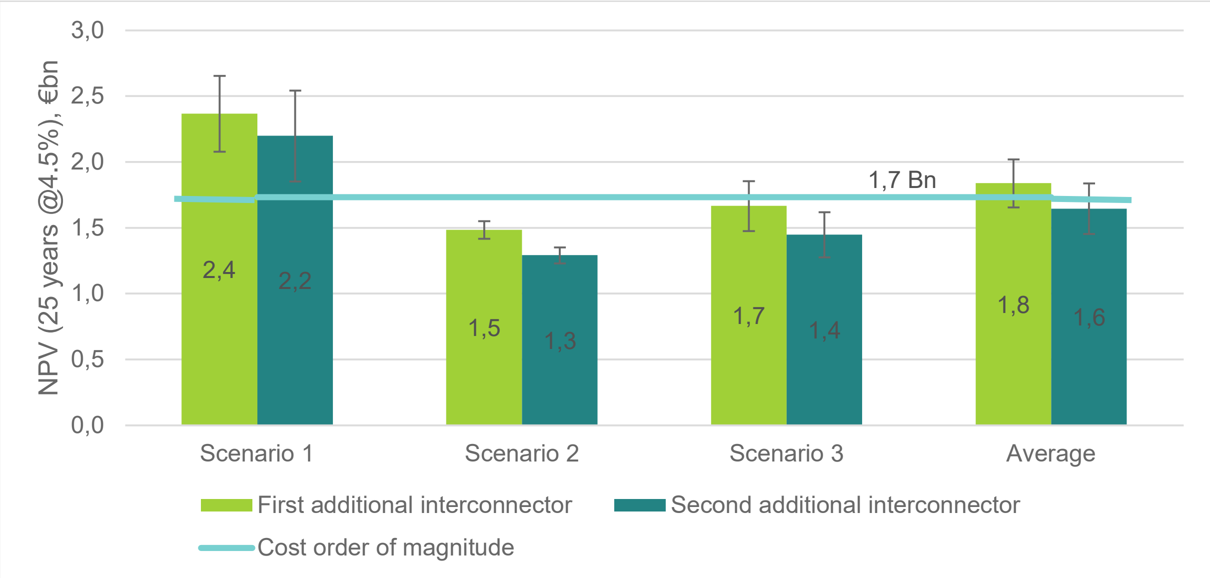


Figure 3: Net present values of the expected benefits of the interconnection projects between France and Great Britain (NPV @4.5%, 25 years), source: Artelys report

CRE notes that the SEW of a new project of around 1 GW are greater than the costs of projects in the average scenario. In particular, the benefits could be significant in scenario 1, but insufficient in scenarios 2 and 3. In view of this balance sheet, CRE considers that such a project is likely to be of economic interest on the scale of the European Union and the United Kingdom.

However, the benefits provided by an increase of 2 GW, or more are insufficient, as the average SEW over the three scenarios are lower than the order costs. This observation is further reinforced by uncertainties about the costs of supplying the main components and about congestion costs in the United Kingdom. CRE therefore considers at this stage that an increase of 2 GW or more in

[13] Using the same methodology as that used in the published report, i.e. a 2025 baseline, commissioning of the interconnector in 2030 and a 25-year timeframe.

[14] Investment costs are spread over a normative period of 4 years before the project is commissioned. This value will need to be refined according to the planning of each project. Their net present value is therefore lower than the order costs mentioned above.

interconnection capacity does not provide sufficient value. However, future developments in component prices and energy mix scenarios over the next few years could call this analysis into question. If necessary, they would require a new detailed study to be carried out.

Question 4 Do you agree with CRE's analysis of the potential benefits of a new project of around 1 GW for the European electricity system (EU + UK) and the inadequacy of the benefits of an increase in capacity of 2 GW or more?

1.3.2. The methodology for estimating the additional benefits of reducing CO1 emissions is not sufficiently robust to be considered.

The study commissioned by CRE shows that increasing interconnection capacity reduces greenhouse gas emissions by reducing thermal generation and better integrating renewable energies. These effects are fully considered in the estimates of the socio-economic benefits presented above, in particular through the valuation of the costs of avoided CO2 emissions for electricity producers. Some studies consider that the price of CO2 on the EU-ETS market, paid by producers, imperfectly represents the societal benefit linked to the reduction in greenhouse gas emissions. They consider it necessary to take account of additional benefits linked to the reduction of greenhouse gas emissions, over and above the market value of CO2.

In the public consultation on the GridLink interconnection project and on the appropriateness of a new interconnection between France and the United Kingdom[15], CRE did not include any additional benefits in terms of reducing CO2 emissions, due to significant doubts concerning the methodology used by ENTSO-E to estimate these benefits within the TYNDP.

CRE considered that the socio-economic benefits already included the value of CO2 quota savings insofar as the production cost of the power plants includes the purchase of CO2 quotas. In addition, the valuation of an underestimation of the value of CO2 presents significant methodological biases because it does not consider the operation of the European carbon market and its potential impact on the energy mixes of the various countries.

CRE maintains its analysis on this subject and does not consider any additional benefits linked to the reduction of CO2 emissions at European level over and above those already included in the savings in production costs made possible by interconnection.

Question 5 Do you agree with the CRE's opinion not to consider any additional benefits beyond the savings in production costs in terms of reducing CO2 emissions?

1.3.3. Additional interconnection capacity could contribute significantly to security of supply in France.

In addition to SEW, increasing interconnection capacity can bring additional benefits, particularly in terms of security of supply in cases where the interconnector makes it possible to avoid unserved energy in the event of insufficient generation.

For France, the contribution to security of supply could be significant.

In the TYNDP 2022, ENTSO-E calculates an indicator representing the contribution of an interconnector to security of supply for different scenarios up to 2030. This additional value would amount to around €4m/year/GW for all European countries and €2.5m/year/GW for France[16] in the *National Trends* scenario in 2030. The methodology developed by ENTSO-E to estimate the contribution of interconnectors to national security of supply consists mainly in modifying the generating fleets in the various countries to comply with national security of supply criteria. In most cases, peak power plants

[15] Public consultation of 17 June 2021 n°2021-07 on the GridLink interconnection project and on the advisability of a new interconnection between France and the United Kingdom

[16] Estimate provided by RTE using the same methodology as that used by ENTSO-E.

are removed from the initial assumptions because the fleets have excess capacity. As a result, SEW and the security of supply benefit are estimated based on different assumptions, giving inconsistent results. CRE had already pointed out the weaknesses of this methodology in its previous consultations[17].

However, the crisis on the energy markets in 2022 demonstrated the contribution of interconnectors to security of supply. At a time of particularly low availability of France's nuclear fleet, France became a net importer of electricity for the first time in 40 years, importing 57 TWh of electricity in 2022. The net balance of electricity exchanges was -16.5 TWh, and interconnectors were heavily used in the direction of imports during peak full stops.

CRE bases the contribution of additional interconnection capacity to security of supply on feedback from 2022. This method compares the number of hours with unserved energy with and without the additional interconnection capacity, in a variant of the S2 2040 scenario reproducing the low nuclear availability observed in 2022 (54% average annual availability of the nuclear fleet). The addition of 1 GW of capacity would then make it possible to avoid 6.4 GWh of unserved energy in France, representing a benefit of around €165 million over one year, given the very high cost of unserved energy (of the order of €26 k/MWh). Nevertheless, such a situation, resulting from a generic anomaly affecting the French nuclear fleet, has a low probability of occurrence. CRE is therefore assuming a single occurrence of this situation over the 25-year study period, which would result in an annual contribution to security of supply of around €6m/year/GW.

This evaluation method is based on strong and questionable assumptions, which makes it imperfect and difficult to reproduce. CRE therefore considers that the estimated value of a new interconnector in terms of security of supply should be considered as an order of magnitude.

Question 6 Do you consider the evaluation method developed by CRE for the contribution of additional interconnection capacity to security of supply to be relevant?

Question 7 Do you think that the parameters used by CRE provide a reasonable order of magnitude for assessing these additional benefits?

1.3.4. SEW is unevenly distributed between France and the UK

The results presented above focus on the SEW for all European countries. These benefits represent the sum of avoided production costs for the various European countries resulting from the addition of new interconnection capacity. It is possible to break down SEW by country into variations in the economic welfare of the various categories of player: consumer, producer, interconnection operator.

For consumers, the variation in welfare is derived from the change in price resulting from electricity imports or exports made possible by the additional interconnection capacity. For consumers SEW may be positive if the interconnection allows prices to fall via imports, or negative if the interconnection causes prices to rise via exports.

For producers, welfare is defined as the difference between market prices and the cost of volumes produced. The variation in producer welfare is derived from changes in prices and production volumes resulting from imports or exports made possible by the additional capacity. For producers SEW may be positive if the interconnection leads to an increase in prices or production volumes through exports, and negative if the interconnector leads to a decrease in prices or production volumes through imports.

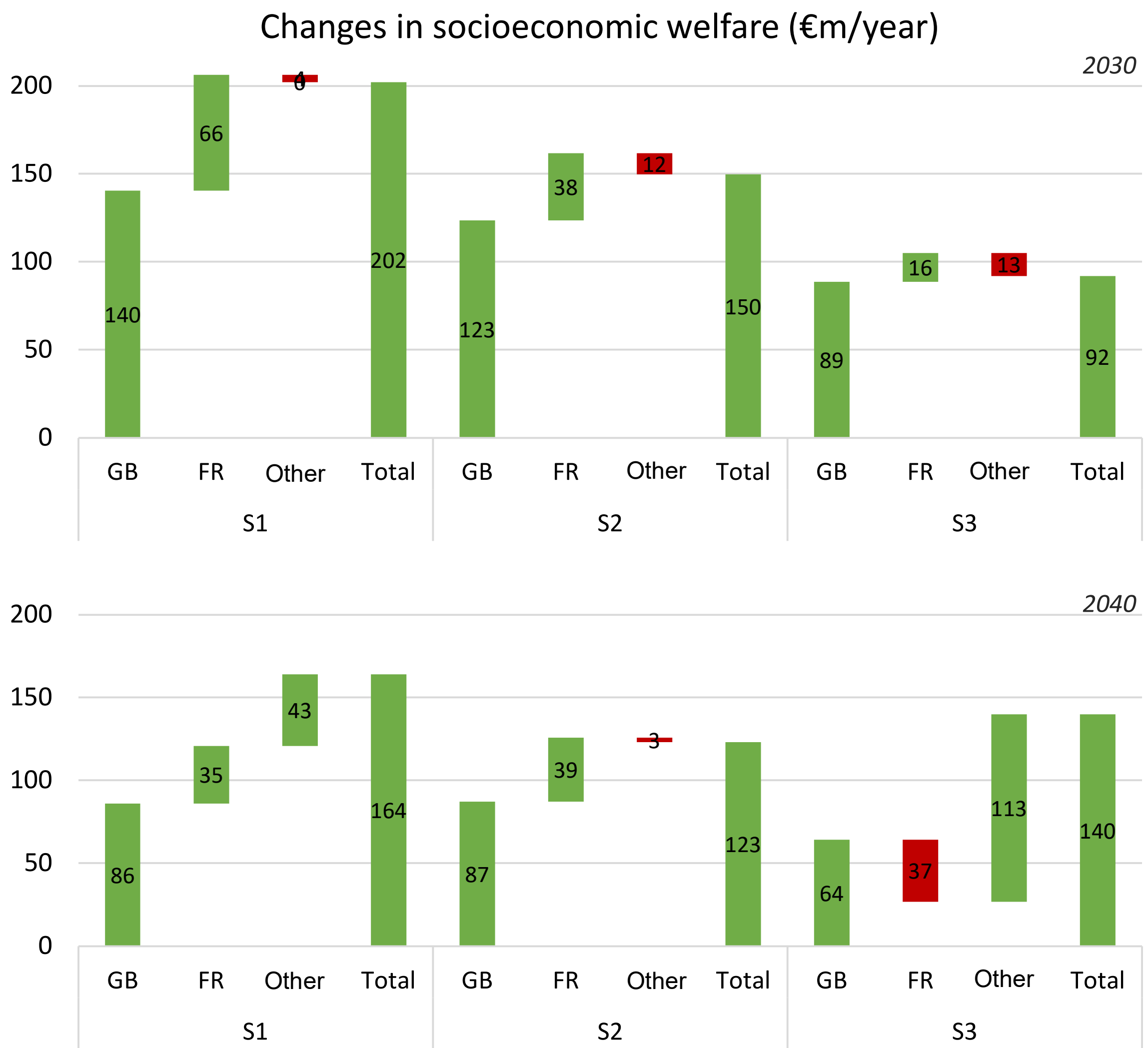
For interconnector operators, welfare is defined as the revenue from the sale of interconnection capacity, which depends on the price differential between the two countries. The change in the interconnector operators' welfare results from the change in the price differential and the volumes exchanged made possible by the additional interconnection capacity. SEW benefit for interconnector operators can be positive if the volume effect outweighs the price effect (sale of more capacity without any change in price) or negative in the opposite case (price convergence leading to a fall in the price of capacity).

[17] See for example: Public consultation of 17 June 2021 n°2021-07 on the GridLink interconnection project and on the advisability of a new interconnection between France and the United Kingdom.

Or Public consultation n°2018-015 of 20 December 2018 on the investment request for the CELTIC project including cross-border cost sharing.

Overall, this breakdown at country level aggregates these different effects and does not consider possible transfers between different categories of users. It also does not consider any redistribution mechanisms that might be put in place by the State (renewable energy financing schemes, specific mechanisms such as ARENH in France, etc.). It is therefore not representative of the electricity prices paid by consumers over the time horizons considered.

The study commissioned by CRE shows that, although the interconnector benefits both France and the United Kingdom, the benefit is distributed in very different proportions between the two countries. In fact, the United Kingdom mainly benefits from a reduction in renewable energy spillage, which could prove very costly in the future. France, on the other hand, would mainly benefit from an increase in interconnector revenues at the border with the United Kingdom due to the increase in imports.



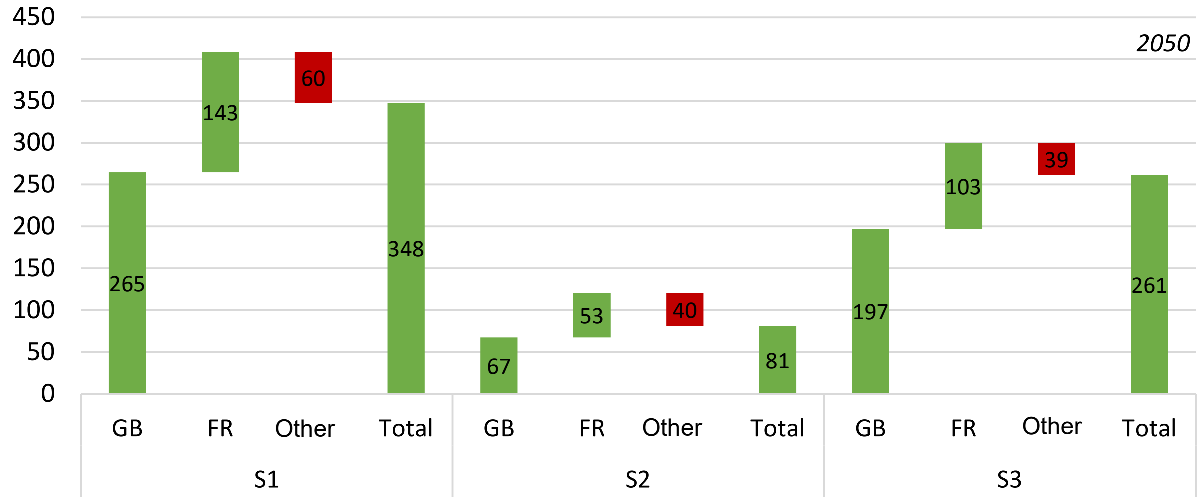


Figure 41: Variations in overall economic surplus by geographical area, for the addition of the first interconnection project by 2030 and 2040 (source: Artelys study)

Overall, on average over the different scenarios and timeframes, SEW of a new interconnector for France would amount to 30% of the total benefits of the project. This distribution of benefits varies slightly according to the scenarios simulated (between 20% and 40% of total benefits for France), confirming the trend observed on average. This result is explained by the lower value of additional interconnector revenues for France compared with the significant value of avoided spillage generation for the United Kingdom.

However, there are two special cases:

- the expected benefits of new interconnection capacity are negative overall for France in scenario S3 in 2040. This effect is mainly linked to a significant drop in exports from France in this scenario in favour of exports from the United Kingdom transiting through France;
- the expected benefits of new interconnection capacity are higher for France in scenario S2 in 2050. This effect is due to an overall decrease in the value of interconnection at this horizon, with France retaining higher relative benefits from additional interconnection revenues.

Question 8 Do you agree with CRE's analysis of the unbalanced distribution of the benefits of new interconnection capacity between France and the United Kingdom?

1.3.5. Cost distribution of a new project will have to take account of the unbalanced distribution of the benefits and costs it generates for Frace.

Costs envisaged for a new interconnector project between France and the United Kingdom within France are twofold:

- Costs associated with the impact of the project on the network amount to around €10m/year/GW for costs associated with managing additional congestion on the network and around €20m/year/GW for costs associated with additional electricity losses on the French network. The additional losses on the French network represent a significant proportion of the total cost of additional losses on the interconnector, due to the relatively low marginal cost of electricity in the UK at the time horizons considered.
- Costs of building and operating the interconnector (capital expenditure and operating costs), which are not necessarily symmetrical between the two countries, and may depend, for example, on the geographical distribution of the assets or the expected benefits for the countries concerned.

CRE notes that, if the costs of building and operating the interconnector were shared equally between France and the United Kingdom, the expected benefits of new interconnection capacity

would be insufficient for France in all scenarios, even considering the additional benefits linked to security of supply.

The table below summarises the net present values of the benefits and costs for France, using a net present value calculation methodology as described above.

NPV (€M)	Scenario 1	Scenario 2	Scenario 3	Average
Forecast benefits for France	**935**	**570**	**266**	**590**
of which socio-economic benefits (SEW)	866	501	197	521
of which additional benefits linked to security of supply	69			
Estimated costs for France	**991**			
of which capital expenditure (assumed 50/50 split)	493			
of which operating expenses (assumed 50/50 split)	124			
of which additional network losses	249			
of which additional congestion on the network	124			
Net present value for France	**- 56**	**- 421**	**- 725**	**- 401**

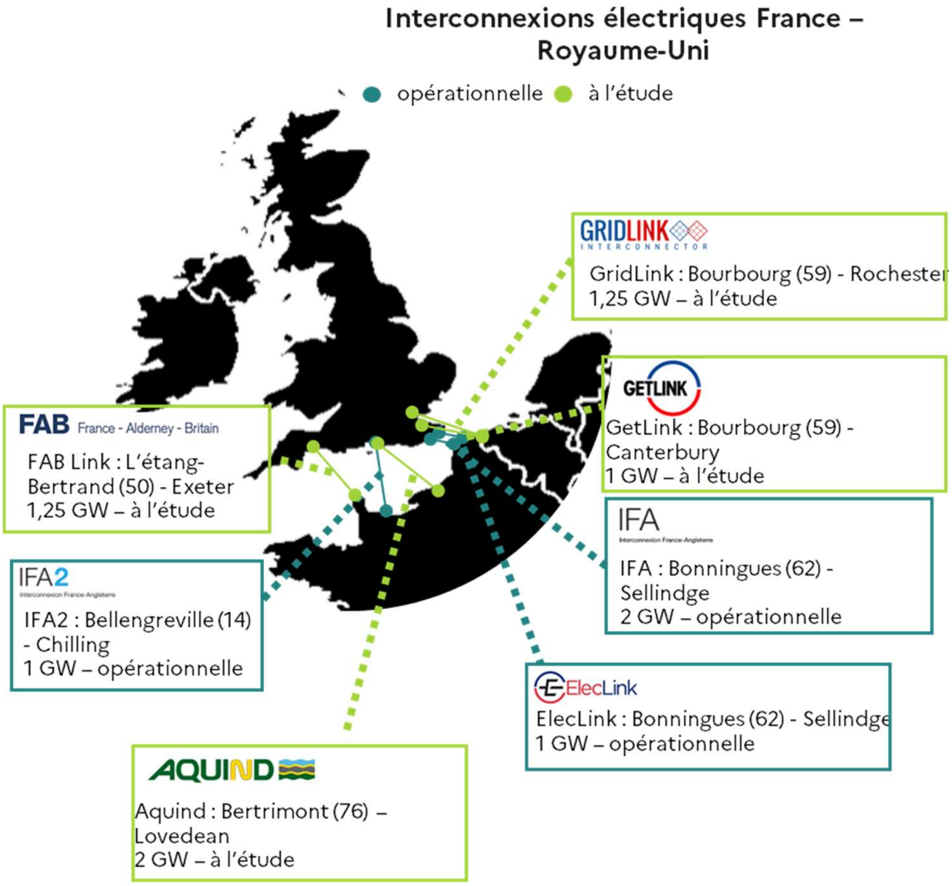
Table 4: Net present values of the expected costs and benefits of the interconnection projects between France and Great Britain, for France (NPV @4.5%, 25 years)

CRE considers that this result does not call into question the overall interest of a new project for the European electricity system. Nevertheless, CRE considers that it will be necessary to take account of the inadequacy of the benefits for France to define the envisaged breakdown of the investment and operating costs of a new project. Similar situations have already been encountered in the past with the Celtic and Bay of Biscay projects, leading to an asymmetrical distribution of project costs and revenues, and to EU subsidies being granted to the projects.

Question 9 Do you agree with the CRE's analysis of the need to take account of the insufficient benefits for France when allocating the investment and operating costs of a new project?

2. Project ranking must consider technical risks and respective levels of maturity of each project.

2.1. Description of interconnector projects between France and the UK



The four border projects are presented below, in alphabetical order.

2.1.1. Aquind: 2,000 MW

2.1.1.1. General presentation of the project

Aquind is a HVDC interconnector project between France and the United Kingdom with a capacity of 2,000 MW (2 independent circuits of 1,000 MW). It will link Lovedean (Hampshire) in the UK to the Barnabos substation at Bertrimont (Seine-Maritime) in France, a distance of 240 km, including 182 km under the sea. Initiated in 2014, the planned commissioning date is 2028.

The project promoter is Aquind SAS in France and Aquind Ltd in the United Kingdom.

2.1.1.2. Project progress

The technical and environmental studies for the project, as well as the onshore and offshore geophysical and geotechnical campaigns, have been completed. The project has signed connection agreements with the national grids and carried out several public consultations.

Various permit applications have been the subject of several administrative appeals. In January 2022, the Secretary of State for Business, Energy, and Industrial Strategy refused to grant development consent for the project (DCO). In January 2023, the UK High Court of Justice asked the UK Government to review this decision. Aquind's new application is still being considered.

On 2 June 2020, Aquind had applied to CRE and Ofgem for an exemption under Regulation (EU) 2019/943. However, in view of the terms of the Trade and Cooperation Agreement concluded between the United Kingdom and the EU on 24 December 2020, the regulators considered that the exemption application process defined by Regulation 2019/943 was only possible between EU Member States. The regulators have therefore decided to put an end to the examination of this exemption request.

The project is currently being examined by Ofgem as part of the third window of the *Cap and Floor* regulatory mechanism in the UK. Ofgem has recently published a public consultation on the investigation of applications for this third window, in which it indicates that it is considering not granting such a regime to the Aquind interconnector[18].

2.1.1.3. Estimated costs.

The project developer has indicated investment costs of €1,565m, including provisions for risks.

The operating and maintenance costs (excluding taxes) reported by the project developer amount to €23m/year.

2.1.2. FAB: 1,250 MW

2.1.2.1. General presentation of the project

FAB is a HVDC interconnector project between France and the UK with a capacity of 1,250 MW (1 cable of 1,250 MW at 320 kV). It will link Exeter (Devon) in the UK to Etang-Bertrand (Manche) in France, a total length of 218 km, 171 km of which will be underwater. The planned commissioning date is 2031.

FAB Link and RTE are the companies behind this interconnector project and have been in partnership since 2013. FAB Link is jointly owned by Transmission Investment (TI) and Alderney Renewable Energy (ARE). This project initially included the insertion of renewable energy generation off the island of Alderney by ARE, but this development has now been abandoned. TI is an interconnector developer and manager of offshore transmission connections to eleven offshore wind farms in the UK and is expected to manage FAB Link's assets during construction and operation. The investment fund Copenhagen Investment Partner (CIP) is expected to take a stake in FAB Link Ltd in the near future. CIP is a long-term investor in renewable energies, mainly in OECD countries, and in direct current offshore wind connections in Germany in partnership with the TSO TenneT.

2.1.2.2. Project progress.

The project has obtained the various administrative authorisations, secured the land, and concluded crossing agreements with the structures concerned. FAB has also initiated the procedures for connection to the grid in France and the United Kingdom.

In 2015, the project was approved by Ofgem and granted a *Cap and Floor* scheme covering 65% of the project costs, consistent with the geographical spread of the investment, with 65% of the route in the UK. Ofgem reviewed its approval decision in 2022 and decided to maintain the FAB authorisation. This regime provides the project with minimum and maximum revenues to secure financing. Ofgem is due to carry out a further review of this decision during 2024.

2.1.2.3. Estimated costs.

The investment costs communicated by FAB amount to €1,343m, including the provision for risk.

According to the project developer, operating and maintenance costs (excluding tax) will amount to €21m/year.

2.1.3. Getlink: 1,000MW

2.1.3.1. General presentation of the project

GetLink, the owner of the ElecLink interconnector, has announced its intention to develop a new electricity interconnector between France and the UK in partnership with the French TSO RTE. The new project, known as Cobalt, will replicate the technical characteristics of the existing ElecLink interconnector, which will come into service in May 2022. It is a direct current interconnector with a capacity of 1,000 MW (1,014 MW cable at 320 kV) and a length of around 112 km, of which around 50 km are in the Channel Tunnel.

2.1.3.2. Project progress.

The GetLink project is a recent project at an early stage of development. An application for connection to the UK grid has been submitted with a bid from National Grid ESO expected in March 2024. Feasibility studies on the routing of cables in Great Britain have also been carried out. Detailed studies will have

[18] See Ofgem publication Initial Project Assessment of the third cap and floor window for electricity interconnectors

to be carried out to define the best connection solutions in both countries and to obtain the necessary administrative authorisations.

The project does not currently have a regulatory framework in the UK.

2.1.3.3. Estimated costs.

The investment costs communicated by Getlink and RTE amount to €1,052 million, including provisions for risks.

Operating and maintenance costs (excluding tax) are estimated by the project developer at €21m/year.

2.1.4. Gridlink: 1,250 MW

2.1.4.1. General presentation of the project.

GridLink is a HVDC interconnector project between France and the UK with a capacity of 1,250 MW (1 cable of 1,250 MW at 320 kV). Initially developed as a 1,400 MW 525 kV project, the project design has recently been revised following discussions between RTE and the project developer, to standardise interconnections at 320 kV voltage level. The project will link Kingsnorth in the UK to Warande in France, a distance of 158 km (109 km in the UK and 49 km in France), 140 km of which will be under the sea. The planned commissioning date is 2031.

GridLink, the company behind the interconnector project, is wholly owned by iCON Infrastructure Partners III LP, an infrastructure fund exclusively managed and advised by iCON Infrastructure LLP ("iCON"). iCON's investors include pension funds, asset managers and insurance companies in the UK, Europe, the US, Canada, the Middle East, and Asia. iCON's affiliated funds hold investments in a portfolio of different companies covering a range of infrastructure sectors including transport, utilities, telecommunications, energy and environment and social infrastructure.

2.1.4.2. Project progress.

GridLink has signed grid connection agreements with RTE and National Grid, completed the acquisition of land in France and the UK, obtained development and environmental permits, and carried out the geophysical and geotechnical studies required for the project.

In 2018, the project was approved by Ofgem and obtained a *Cap and Floor* scheme covering 50% of project costs. This scheme provides the project with minimum and maximum revenues to secure financing. However, this decision will be reviewed again in 2024.

2.1.4.3. Estimated costs.

The investment costs communicated by Gridlink amount to £1,128m, or approximately €1,300m[19] .

Operating and maintenance costs (excluding deconstruction costs) are estimated by the project developer at £26m/year, or around €30m/year.

2.1.5. Summary of characteristics and reported costs of each project.

	Aquind	FAB	Getlink	Gridlink
Power (MW)	2 000	1 250	1 000	1 250
Voltage level (kV)	320	320	320	320
Number of cables	4 (2 x 2)	2	2	2
Length of route (km)	240	218	112	158
Commissioning	2028	2031	2032	2031
CAPEX (€M)	1 565	1 343	1 052	1 300
OPEX (M€/year)	23	21	21	30

Table 5: Characteristics of interconnection projects communicated by project developers.

[19] 1£ ≈ 1,15 €

2.2. Technical and economic comparison of projects carried out by RTE.

The four project developers mentioned in the previous section approached RTE to explore a partnership to develop a new interconnector between France and the UK. Based on discussions with the project developers, RTE has compared their respective advantages and disadvantages to select a preferred project. RTE plans to carry out more detailed studies of this preferred project with a view to submitting an investment request to CRE.

In a letter dated 13 October, RTE sent CRE the results of its comparison of the projects. The projects were ranked according to a points system based on 14 criteria relating to two themes: the profitability of the project and the quality of the partnership on the one hand, and the technical quality of the interconnection on the other. The first theme examines the cost-benefit analysis of the projects as well as qualitative criteria. The second theme focuses on the technical characteristics of the interconnector and its operating mode. RTE's comparison is summarised below.

CRE analysed the results of RTE's comparison method, and in particular the methodology used to assess project costs. In addition to in-depth discussions with RTE, CRE met with each of the project sponsors. CRE's analysis is also detailed below.

2.2.1. Estimated project costs.

2.2.1.1. Comparison provided by RTE.

As mentioned in paragraph 1.2.1, RTE has estimated the costs of projects according to their technical design, based on feedback from recently concluded HVDC contracts, including the Celtic interconnection (700 MW between France and Ireland) and the Bay of Biscay interconnection (2,000 MW between France and Spain). These estimates were made during 2023. The amounts derived from these contracts have been adjusted to take account of the specific technical design of each project: voltage level, cable cross-section, conductor, etc. The same methodology has been applied to all four projects.

The results of the estimated investment costs are shown in the table below:

	Aquind	FAB	Getlink	GridLink
Project developer's estimate (€M)	1 565	1 343	1 052	1 300
RTE estimate (€M)	2 400	1 343	1 052	1 274
RTE estimate (€M/GW)	**1 200**	**1 074**	**1 052**	**1 019**

Table 6: Project investment cost estimates provided by RTE.

RTE states that the capital expenditure estimates are consistent with those submitted by the project sponsors, except in the case of Aquind, where RTE states that it does not have sufficient information to justify the costs presented.

Three of the four project developers (FAB, GetLink and GridLink) provided RTE with information on maintenance and operating costs. RTE has indicated that discussions with the project developers have not led to the data provided being called into question.

For Aquind, RTE is proposing an estimate based on the operating costs of other projects at €40m/year (two links, four stations), i.e. €20m/year/GW.

2.2.1.2. CRE analysis

CRE carried out an in-depth audit of the methodology used by RTE to compare project costs.

Regarding investment costs, CRE agrees with the analyses carried out by RTE. The latest cost estimates for the Aquind project were made in 2021, i.e. before the period of inflation and tension on the supply markets. CRE considers it appropriate to base the estimates on the latest calls for tenders issued by RTE.

The costs of the main components (cables and converter stations) per GW for the Aquind and Getlink projects appear to be higher than for the other projects. This difference is due to a technical choice to limit the interconnection capacity to 1,000 MW, whereas the technical maximum could be 1,250 MW, with a moderate increase in the cost of cables. This effect is offset for the Getlink project by the lower cost of the work in the tunnel compared with laying the cables at sea and the use of aluminium cables (unlike the other projects with copper cables). This effect also explains why the comparison carried out by RTE shows higher unit costs per GW for the Aquind project.

As regards the other three projects, CRE notes that the investment costs per GW are very similar, which means that RTE cannot define a preferred project based on this criterion alone.

Regarding operating costs, CRE considers that at this stage of development, there is too much uncertainty about the organisation of projects to have more detailed estimates. It therefore accepts the order of magnitude developed by RTE. Nevertheless, these elements should, if necessary, be specified when an investment request is submitted.

Question 10 Do you have any comments on the cost estimates (CAPEX and OPEX) for the projects?

2.2.2. Integration of projects to the French network

In addition to their own costs (CAPEX, OPEX), these new projects modify the flows on the national transmission networks. By increasing extractions and injections at the ends of the networks, interconnections entail additional costs for compensating for electricity losses and resolving network congestion. In some cases, interconnections may require network reinforcements.

2.2.2.1. RTE analysis

2.2.2.1.1. Variation in electrical losses on the network

RTE has estimated the volume and cost of the additional losses generated by each of the projects using the TYNDP method. The impact of the project on the volume of losses depends on the grid connection points on either side of the border and therefore differs from project to project.

The network studies carried out by RTE show that the losses are located close to the grid connection points. In France, the projects are located on the north-west coast (Normandy for Aquind and FAB and Hauts-de-France for the GetLink and GridLink project). The network will be particularly stretched between now and 2030-2040, with significant growth in production and consumption in the north of France. The additional flows generated by a new interconnector will therefore create significant additional losses.

Volume of losses (GWh/year)	Aquind	FAB	Getlink	GridLink
Network losses France	688	602	561	614
Network losses United Kingdom	1 748	1 027	706	872
Interconnection losses	167	300	176	218
Network losses outside France and the United Kingdom	- 45	- 151	43	-31
Total	2 558	1 778	1 486	1 673

Table 7: Volume of additional losses per project (GWh/year)

Estimates of the cost of losses are made using marginal means at the time of occurrence. The average cost in €/MWh is significantly higher in France than in the UK, mainly because of the importance of renewable energies in the UK generation mix, where marginal costs are low.

Cost of losses (€M/year)	Aquind	FAB	Getlink	GridLink
Network losses France	30	24	26	28

Network losses United Kingdom	12	5	4	5
Interconnection losses	7	12	7	9
Network losses outside France and the United Kingdom	1	-4	2	0
Total	51	39	39	43

Table 8: Cost of additional losses per project (€M/year)

2.2.2.1.2. Variation in network congestion.

RTE has carried out network simulations to quantify the impact of new structures on network congestion costs up to 2030. The projects have an impact on the weak areas identified in the 2019 Normandy-Manche-Paris (west-east) and Massif Central (north-south) Ten-Year Network Development Plan (SDDR), although no single project justifies reinforcement.

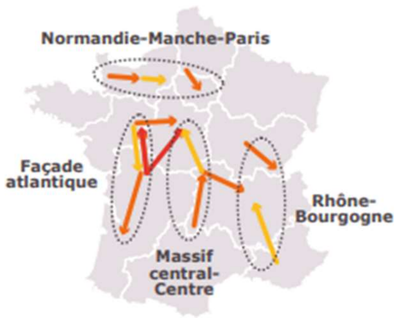


Figure 5: Areas of vulnerability identified in the SDDR 2019, source: RTE, SDDR 2019

The Aquind project has significant congestion costs due to its large size. As for the FAB project, network analyses show a significant impact on the Atlantic seaboard, which reinforces the project's network integration costs.

The results are presented in the table below.

M€/year	Aquind	FAB	Getlink	GridLink
Congestion costs France	18	23	7	9,5

Table 9: Additional congestion costs per project (€m/year)

However, it is important to note that the need to reinforce the Atlantic seaboard has been identified by RTE independently of the FAB project. This reinforcement project is not directly linked to the development of a new interconnector. CRE has approved the launch of studies to reinforce the Atlantic seaboard as part of the mid-year review of RTE's 2023 investment programme[20]. The commissioning of the "Gironde Loire-Atlantique" reinforcement project would significantly improve the integration of the FAB project into the network since congestion costs are estimated to be less than €5m in this configuration.

[20] CRE deliberation of 21 September 2023 on the implementation report for the 2022 investment programme and approval of RTE's revised 2023 investment programme

2.2.2.2. CRE analysis

The impact of interconnector projects on the network can be significant and could aggravate situations of constraint or create additional losses on the network. CRE considers that the costs associated with these effects should therefore be fully integrated into the cost-benefit analysis.

The additional losses generated by the addition of a new interconnector with the United Kingdom are significant in France. These estimates are consistent with the envisaged operation of the interconnector, in which France mainly plays the role of a transit country in most scenarios. These additional transits would place a strain on facilities that are already heavily loaded, significantly increasing additional losses. These loss costs are of the same order of magnitude for projects of around 1 GW, and higher for the Aquind project, essentially because of its capacity.

The additional costs associated with resolving congestion are much higher for the FAB project, because of the location of its landfall in France, which could exacerbate constraints in western France. However, once the project to reinforce the "Gironde Loire-Atlantique" network has been commissioned, the additional congestion costs of the FAB project would be of the same order of magnitude as for the other interconnections. CRE considers that the studies will need to be updated if the "Gironde Loire-Atlantique" project were delayed or modified.

> **Question 11** Do you have any comments about the impact of projects on the network?

2.2.3. Technical criteria

2.2.3.1. RTE analysis

RTE has compared the technical designs of the four interconnector projects. Following the revision of Gridlink's design to reach the 320 kV level, the voltage level and the technology chosen are identical for the four projects. The Aquind project differs only in size: it is a double project with 4 cables and 4 converter stations, compared with 2 for the other projects. RTE considers that the projects' technology is mature and complies with HVDC standards.

The four projects will be confronted with a particularly tight supply chain situation for HVDC materials. However, RTE anticipates that the Aquind project will face even greater difficulties because of the double link. RTE estimates that projects of around 1 GW (FAB, Getlink, Gridlink) could be commissioned between 2031 and 2033. The projected commissioning of the Aquind project could be delayed to 2034-2035 due to constraints linked to the supply lead time for a 2 GW project (2 links and 4 stations).

The Getlink project differs from other projects in that it crosses the Channel in a tunnel, which avoids the difficulties and hazards associated with maritime works (weather, nature of the ground, explosive devices, installation method, density of maritime traffic in the Channel). In addition, the GetLink project developer has indicated that it plans to reproduce the design of the existing ElecLink link to exploit synergies, particularly regarding obtaining permits and maintenance procedures. As a result, RTE expects a lower proportion of risk provisions for the Getlink project.

In the case of the GridLink project, RTE anticipates possible difficulties in reaching the rated power of 1,250 MW in operation due to cable heating constraints, which could lead to the project's power being reduced to 1,150 MW. Surveys should be carried out during the detailed study phases to resolve these uncertainties.

2.2.3.2. CRE analysis

CRE notes that the technological choices made for the projects are in line with the standardisation of technologies, with a voltage level of 320 kV for projects with a capacity of around 1 GW. This technology is identical to that chosen for the connections of the direct-current offshore wind farms (Centre-Manche 1 and 2 and Oléron).

CRE notes that the projects do present different risks: work at sea is subject to various hazards (weather, nature of the ground, explosive devices, etc.) whereas work in the tunnel will require specific authorisations and operating procedures. Nevertheless, the reproduction of an interconnection in service with a proven design is likely to reduce the uncertainty associated with obtaining the necessary permits for the project.

GridLink, the project developer, has confirmed that there are still uncertainties regarding the nominal operating capacity of the interconnector, which will have to be confirmed by the detailed studies. Gridlink has nevertheless used smaller margins than RTE in estimating this capacity, which it puts at around 1,215 MW. CRE notes that this uncertainty could, depending on the estimates, reduce the economic interest of the project by 3 to 8%, which is significant.

2.2.4. Project management

2.2.4.1. RTE analysis

RTE examined various criteria relating to the quality of the partnership, and in particular the partner's ability to manage the project in its various phases (construction, commissioning, operation).

Analysis of these criteria tends to favour the experience of GetLink and FABLink over other project developers with less experience in the construction and operation of HVDC infrastructures. GetLink has demonstrated experience with the ElecLink interconnector, which has been commissioned in 2022. FABLink could benefit from the experience of its investors Transmission Investment (TI), which operates several offshore wind connection projects as an *Offshore Transmision Owner* (OFTO) in the United Kingdom and CIP, which is involved in the Dolwin 3 project of Tennet, the German-Dutch TSO. For their part, the Aquind and GridLink project owners have no similar experience of HVDC electricity transmission infrastructures. RTE also points out that there is uncertainty about the partner envisaged for the long-term operation of the facility in the event of an asset sale for one of these two project developers.

2.2.4.2. CRE analysis

CRE emphasises the complexity of HVDC interconnector projects. Feedback from these projects shows that they present technical challenges throughout the construction phase, right up to commissioning, and then during operation. In particular, the management of the converter stations and their associated monitoring and control are a critical part of the operation of the interconnection.

2.2.5. Project ranking

2.2.5.1. RTE analysis

RTE ranking	Project	Justifications
1	Getlink	+ Least risky project + Project size (1 GW) + Experience of the project developer
2	FAB	+ Experience of the project developer + Project size (1.25 GW) – Offshore risk – Additional network congestion
3	GridLink	+ Project size (1.25 GW) – Project developer with little experience and uncertainty about partner for long-term operation – Offshore risk – Uncertainties over the project's operating capacity
4	Aquind	– Project cost higher than others – Size of the project (2 GW) leading to difficulties in integrating it into the grid – Project developer with little experience and uncertainty about partner for long-term operation – Offshore risk

Table 10: Ranking of RTE projects

The project led by GetLink is RTE's preferred project, as it obtains the best score on all criteria. This choice is justified by several comparative advantages of the project. The project is less risky because it is a tunnel rather than a submarine. Because of its small size, the project has the lowest total costs (CAPEX, OPEX, losses) and fits in well with the French network. Lastly, the project developer's experience is recognised with the recent commissioning of the ElecLink project, which could serve as a benchmark for the new interconnection.

The FAB project came second. The project stands out from the lower-ranked projects because of the project developer's experience and long-term commitment. Nevertheless, this project stands out for its more unfavourable impact on the network, which would be lifted by the commissioning of the project to reinforce the "Gironde Loire-Atlantique" network.

Finally, the GridLink and Aquind projects are ranked after the FAB project. Variants have been considered by RTE to rank the Aquind project because of uncertainty on certain criteria due to a lack of information. These variants modify the ranking marginally. Because of its size (2,000 MW), the Aquind project has the highest total costs and is difficult to integrate into the grid.

2.2.5.2. CRE analysis

CRE considers that the comparative analysis carried out by RTE correctly identifies the challenges of the different projects. This choice is motivated by objective criteria relating to project costs, their level of risk and their integration into the French grid. CRE considers it appropriate to prioritise projects of around 1 GW based on the cost-benefit analysis set out in this consultation. In particular, the Aquind project, with a capacity of 2 GW, presents socio-economic benefits that are lower than the forecast costs of such a project. Therefore, from a technical and economic point of view, CRE considers the order chosen by RTE to be appropriate.

CRE points out, however, that the GetLink project is at the least advanced stage of development, particularly in terms of UK regulation. To date, the project does not have a regulatory framework in the United Kingdom, since it has neither obtained Ofgem's approval via the *Cap and Floor* mechanism, nor obtained an exemption. A possible fourth *Cap and Floor* window for Getlink's project has not been announced by Ofgem. Aquind is being assessed under the third *Cap and Floor* window. GridLink and FAB are also due to be further assessed by Ofgem during 2024.

The further development of an interconnector project between France and the United Kingdom will require close coordination between the regulators of the countries concerned, in this case France and the United Kingdom. CRE has approached Ofgem to coordinate this work. In the light of these discussions, CRE may have to review its analysis of the ranking of projects to consider, in particular, the constraints linked to the authorisations required in the United Kingdom.

Question 12 Do you have any comments on CRE's analysis of RTE's ranking?

3. CRE preliminary orientations

As indicated in part 1, the study commissioned by CRE shows that increasing interconnection capacity between France and the United Kingdom would enable better integration of renewable energies and a reduction in fossil-fired generation in Europe. The resulting savings in production costs for the European and UK electricity systems are the expected benefits of the interconnection.

A comparison of these expected benefits with the costs of the projects leads CRE to consider that a new interconnector project of around 1 GW between France and the United Kingdom could be economically relevant. In fact, the expected benefits for the European Union and the United Kingdom for projects of around 1 GW are higher than the costs in the average scenario. This is not the case for additional interconnection capacity of around 2 GW, which would correspond to several 1 GW projects or one project with a capacity of around 2 GW.

CRE notes that the expected sharing of benefits between France and the United Kingdom is unbalanced, with the United Kingdom benefiting more from the increase in interconnection capacity. CRE considers that the sharing of project costs between France and the UK should reflect this imbalance.

As explained in part 2, the comparison study carried out by RTE concludes that the project led by Getlink is the preferred project for the conclusion of a development partnership. CRE takes note of this analysis, which it considers to be based on relevant comparison criteria.

However, CRE points out that the continuation of a project would require approval from Ofgem. To date, the GetLink project does not have a regulatory framework in the United Kingdom. In this context, the development of the FAB project, which is ranked second by RTE and has a *Cap and Floor* mechanism, could be considered.

Question 13 Do you share CRE's preliminary views on the development of new interconnection capacity between France and the UK?

List of questions

Question 1: Do you consider that the different scenarios used, and the different interconnection capacities assessed in the study are relevant?

Question 2: Do you agree with CRE's analysis of the gross SEW of new interconnection capacity at the border between France and the UK?

Question 3: Do you agree with CRE's analysis of the projected costs of a new interconnection project with the United Kingdom?

Question 4: Do you agree with CRE's analysis of the potential benefits of a new project of around 1 GW for the European electricity system (EU + UK) and the inadequacy of the benefits of an increase in capacity of 2 GW or more?

Question 5: Do you agree with the CRE's opinion not to consider any additional benefits beyond the savings in production costs in terms of reducing CO2 emissions?

Question 6: Do you consider the evaluation method developed by CRE for the contribution of additional interconnection capacity to security of supply to be relevant?

Question 7: Do you think that the parameters used by CRE provide a reasonable order of magnitude for assessing these additional benefits?

Question 8: Do you agree with CRE's analysis of the unbalanced distribution of the benefits of new interconnection capacity between France and the United Kingdom?

Question 9: Do you agree with the CRE's analysis of the need to take account of the insufficient benefits for France when allocating the investment and operating costs of a new project?

Question 10: Do you have any comments on the cost estimates (CAPEX and OPEX) for the projects?

Question 11: Do you have any comments about the impact of projects on the network?

Question 12: Do you have any comments on CRE's analysis of RTE's ranking?

Question 13: Do you share CRE's preliminary views on the development of new interconnection capacity between France and the UK?