The French Energy Regulatory Commission (CRE) consults market stakeholders.

PUBLIC CONSULTATION No. 2018-015 OF 20 DECEMBER 2018 ON THE INVESTMENT REQUEST RELATING TO THE CELTIC PROJECT, INCLUDING A CROSS-BORDER COST ALLOCATION

On 20 November 2018, the operators of the French electricity transmission network (RTE) and the Irish electricity transmission network (Eirgrid) submitted an investment request[1] for the Celtic Interconnector project to the French Energy Regulatory Commission (CRE) and the Irish Regulatory Authority (CRU). Pursuant to Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructures, this investment request includes a request for the cross-border allocation of the investment costs.

The Celtic project has been identified as a European Project of Common Interest (PCI) in 2013[2]. PCIs are deemed to contribute to the implementation of the internal energy market and the achievement of the energy policy objectives of the European Union (provision of a secure, affordable and sustainable energy supply to European consumers). Furthermore, the Celtic project is of particular importance in the context of the United Kingdom's exit from the European Union (EU), as it could eventually become the only interconnection between Ireland and the rest of the EU.

The objective of the present consultation is to seek the opinion of stakeholders regarding the various elements of the investment request relating to the Celtic project.

Following this consultation, and the concomitant consultation held by the Irish regulatory authority[3], the CRE and the CRU will take a coordinated decision regarding the investment request and the request for cross-border cost allocation in spring 2019.

Paris, 20 December 2018.

On behalf of the French Energy Regulatory Commission,

The President,

Jean-François CARENCO

[1] See the TSO's investment request

[2] Commission Delegated Regulation (EU) No. 1391/2013 of 14 October 2013

[3] https://www.cru.ie/document_group/celtic-electricity-interconnector/

Respond to the consultation

The CRE invites stakeholders to submit their contribution no later than Friday 15 February 2019:

- By email, in Word format, to the following email address: dr.cp8@cre.fr;
- By directly uploading the response to the CRE website (www.cre.fr), under the "Documents/Public Consultations" header;
- By post: 15, rue Pasquier - F-75379 Paris Cedex 08, France.

For transparency reasons, the contributions will be published by the CRE and will be shared with the CRU and ACER.

If your contribution contains facts or elements which you wish to keep confidential, you will also need to submit a version that conceals these facts or elements. In such a case, only this version will be published. The CRE reserves the right to publish facts and elements that could prove essential for the information of all stakeholders, provided that this does not disclose secrets protected by law.

If a version with concealed facts and elements is not provided, then the full version will be published, provided that this does not disclose secrets protected by law.

The stakeholders are invited to respond to the questions by arguing and providing justification for their responses.

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1. CONTEXT

1.1 European framework for the development of interconnections

1.1.1 Regulation (EU) No 347/2013

Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure ("the Regulation") aims to foster the interconnection and interoperability of European energy networks. It introduces in particular the notion of the project of common interest (PCI), which, in the electricity sector, can involve transmission and storage infrastructures or smart grids. The European Commission sees these projects as contributing to the implementation of priority corridors for the construction of the internal energy market.

The list of PCIs is established by the European Commission based on proposals by the regional groups of each priority corridor.[4] This list is updated every two years. The Celtic project was identified as PCI in 2013, 2015 and 2017. It is a candidate for inclusion in the next PCI list, which will be adopted in 2019.

Amongst the measures aiming at supporting the implementation of PCIs, the Regulation provides funding mechanisms to address the commercial viability issues of projects where these prevent investment decision-making. Thus, Article 12 of the Regulation states that, following the request by the project promoters and based on a cost-benefit analysis for the concerned countries, the competent national regulatory authorities shall take coordinated decisions on the allocation of investment costs within six months after the receipt of the final investment request. This decision gives the possibility to seek financial assistance from the European Union under Article 14 of the Regulation.

The Regulation also states that the project promoters must include in their investment request a cost-benefit analysis consistent with the methodology developed by the European Network of Transmission System Operators (ENTSO-E). The second version of this methodology ("CBA 2.0 methodology") was approved by the European Commission in September 2018.[5]

1.1.2 Recommendation by ACER No. 5/2015

The Agency for the Cooperation of Energy Regulators (ACER) published a recommendation on 18 December 2015[6] outlining the good practices for the treatment of investment requests. It recommends in particular that the allocation of costs should differ from what would be *a priori* borne by the project promoters only if the net impact of the project would be negative for one of the hosting countries.

1.2 French legal framework

Pursuant to the provisions of paragraph 2 of Article L.134-3 and of II of Article L.321-6 of the French Energy Code, the electricity transmission system operator (TSO) must send his annual investment program to the CRE for approval. This investment program includes interconnection projects.

Thus, the CRE has the competence to approve new electrical interconnection projects developed by RTE.

[4] The States belonging to a priority corridor constitute a regional group entrusted with the selection of the projects of common interest, in which the representatives of the Member States, of national regulatory bodies and of grid operators participate, together with the European Commission, the EU Agency for the Cooperation of Energy Regulators (ACER) and the European Network of Transmission System Operators (ENTSO-E).

[5] https://docstore.ENTSO-E.eu/Documents/TYNDP%20documents/Cost%20Benefit%20Analysis/2018-10-11-tyndp-cba-20.pdf

[6] https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2005-2015.pdf

1.3 Investment request by the transmission system operators

Following the preliminary studies, RTE and the Irish transmission system operator (Eirgrid) submitted a first investment request to the CRE and the Commission for Regulation of Utilities (CRU) in September 2018. Numerous exchanges have taken place between the project promoters and the regulatory authorities, in particular regarding the elements needed for an in-depth evaluation of the project with the objective of reaching a decision to allocate the investment costs between France and Ireland.

Given the additional elements provided by the TSOs after these exchanges, the request has been deemed complete by the regulatory authorities on 20 November 2018, date on which the 6-month delay has started, as stated by the Regulation. This investment request file is published along with the present consultation.

1.4 Project description

1.4.1 Technical specifications

The Celtic project consists of a submarine high-voltage direct current power cable (HVDC) measuring approximately 500 km long and with a 700 MW capacity connecting the substation of Knockraha in Ireland to the substation of La Martyre in France. In addition to the submarine link, the project consists of the following elements for each country:

- A landfall point where the submarine cable reaches the shore;
- A land HVDC connection (underground) between the landfall point and a converter station;
- A converter station;
- An HVAC land connection (underground) between the converter station and the network connection point;
- A connection point at an existing electrical substation in the transmission system.

Celtic has a relatively low capacity (700 MW) compared to similar interconnection projects. This capacity is adapted to the size of the Irish electricity grid, in which the largest infeed today is the 500 MW EWIC interconnection. The capacity of the interconnection was determined in order to avoid major network reinforcements and changes in system operation (e.g. an increase in the level of required reserve capacities) in Ireland.

In addition, the exit of the United Kingdom from the European Union would make Celtic the sole interconnection between Ireland and the rest of the EU.

1.4.2 Project schedule

RTE and Eirgrid completed the preliminary feasibility studies in 2014, followed by a feasibility study in 2016. The project is currently in the initial design and pre-consultation phase. This phase should be completed in 2019. According to the TSO’s timetable, the detailed design and consents phase will run until 2021. The project will then be in construction from 2021, and is scheduled to be commissioned at the beginning of 2026.

2. METHODOLOGY USED TO ASSESS THE PROJECT BENEFITS

2.1 Scenarios for the development of the electricity system

2.1.1 ENTSO-E’s TYNDP scenarios used by the TSOs

Every two years, the European Network of Transmission System Operators for Electricity (ENTSO-E) publishes a Ten Year Network Development Plan (TYNDP).

This plan is based on a number of different development scenarios for the European energy system consisting notably in demand profiles, installed generation capacity, and fuel prices. ACER recommends that interconnection project promoters use these scenarios to perform a cost-benefit analysis for their projects, whilst noting that additional scenarios may also be used.

The most recent edition of the TYNDP (TYNDP 2018[7]) includes a scenario for the year 2025 and three scenarios for 2030 and 2040, whereas the previous edition (TYNDP 2016) proposed one scenario for 2020 and four scenarios for 2030.

For the cost-benefit analyses for the Celtic project, the TSOs use the *Best Estimate* scenario (BE 2025) from TYNDP 2018 to run simulations for the year 2025[8]. The analysis of the benefits for the year 2030 is based on the four following scenarios:

- Sustainable Transition (ST) of the TYNDP 2018;
- Distributed Generation (DG) of the TYNDP 2018;
- European Commission (EuCo) of the TYNDP 2018;
- Vision 1 of the TYNDP 2016.

The ST, DG and EuCo scenarios all assume that the European objectives in terms of energy transmission, as established by the European Council in 2014, will be achieved in 2030. In the ST 2030 scenario, these objectives are achieved using national regulations, the European carbon market and public subsidies. Scenario DG 2030 assumes that the objectives will be achieved mainly by means of the strong development of decentralised generation (for which the costs are assumed to be competitive and value accrued due to a strengthened EU-ETS mechanism), in particular, via photovoltaic generation and battery storage systems. Finally, the EuCo 2030 scenario is the reference scenario created by the European Commission. It simulates a situation in which, apart from the targets for 2030 determined by the European Council in 2014, an energy efficiency objective of 30% is also achieved.

At the request of the regulators, the TSOs have also analysed in their investment request a scenario in which the evolution of CO_2 emissions until 2030 is closer to historical trends. The TYNDP 2016 Vision 1 scenario was chosen to study the interest of the project if the current trends in the European energy system were to persist.

The table below summarises some of the main scenario assumptions used in the analysis. All assumptions are available on the ENTSO-E website[9].

[7] The TYNDP was published for consultation by the ENTSO-E on 3 August 2018, and sent to ACER for an opinion on 28 November 2018 (see https://tyndp.entsoe.eu/tyndp2018/).

[8] The benefits of the project are only calculated from 2026 onwards, which is the provisional commissioning date of the interconnection. Thus the BE 2025 scenario is used solely to interpolate the results between 2025 and 2030.

[9] https://tyndp.entsoe.eu/tyndp2018/scenario-report/

Scenario	BE 2025		ST 2030		DG 2030		EuCo 2030		V1 2030	
	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland
Wind power capacities and installed PV (GW)	51.3	6.7	74.9	8.6	84.9	12.9	53.7	7.7	34	6.3
Installed nuclear capacities (GW)	52.2	0	37.6	0	37.6	0	59.5	0	57.6	0
Annual consumption (TWh)	473	43	467	46	475	49	501	42	447	39
CO_2 price (€/ton)	25.7		84.3		50		27		17	

TABLE 1: MAIN SCENARIO ASSUMPTIONS FOR FRANCE AND IRELAND[10]

2.1.2 Preliminary analysis by the CRE

The CRE deems that the three scenarios in the TYNDP 2018 (ST, DG and EuCo), completed by scenario V1 of the TYNDP 2016, are visions that frame different potential futures for the European electricity system.

In comparison, the French multi-annual energy programme (*Programmation Pluriannuelle de l'Energie* - PPE), presented at the end of 2018, projects an installed nuclear capacity in the range of 52 GW in 2035[11], i.e. a capacity that significantly exceeds that employed in the ST and DG scenarios and which is comparable to that used in the EuCo and V1 scenarios.

With respect to renewables, the PPE project foresees between 74.4 GW and 85.3 GW wind generated power and photovoltaic power installed in 2028. These numbers are comparable with those used in the ST and DG scenarios for TYNDP 2018. The EuCo and V1 scenarios of TYNDP 2016 assume a less rapid development of renewables.

Question 1 Do you share the CRE's analysis on the framing nature of the four scenarios taken into account by the TSOs to analyse the benefits of the Celtic project?

[10] Republic of Ireland and Northern Ireland.

[11] Closure of 14 x 0.9 GW reactors and commissioning of the Flamanville power station.

Furthermore, the CRE notes that the hypotheses of the TYNDP regarding interconnection capacities may have a significant impact on the simulated costs and benefits of the new interconnections. In particular, TYNDP 2018 assumes the existence of:

- An interconnection capacity of 6.8 GW in 2030 between France and Great Britain. At present, this capacity is only of 2 GW (interconnection IFA 2000), and increase to 4 GW with the commissioning of the ElecLink and IFA2 projects. Three additional projects are also currently under study (FAB, GridLink, Aquind). Their implementation would increase the interconnection capacity between France and Great Britain to 8.8 GW;
- An interconnection capacity of 500 MW in 2030 between Ireland and Great Britain, corresponding to the interconnection capacity currently available between the two countries. This hypothesis therefore assumes that no new interconnection will be commissioned by 2030. However, the CRE notes that an interconnection project between Ireland and Great Britain, the GreenLink project, with a capacity of 500 MW, is included in the list of PCIs and has recently been declared justified by public interest by the Irish regulator as it was granted an Initial Project Assessment (IPA)[12].

The CRE is therefore questioning the relevant reference network that should be used in Celtic's cost-benefit analyses. In particular, it could be relevant to assume that the interconnection capacity between Ireland and Great Britain will be 1000 MW by 2030, given the progress made by the GreenLink project.

Question 2	Do you share the CRE's analysis, according to which a capacity of 1000 MW for 2030 between Ireland and Great Britain seems more appropriate for an analysis of the costs and benefits of the project?

2.2 Costs and benefits evaluated

2.2.1 ENTSO-E cost-benefit analysis methodology

The Regulation requires ENTSO-E to establish a methodology to assess the costs and benefits for the European community for all projects included in the TYNDP. The first version of this methodology was approved by the European Commission in 2015 ("CBA 1.0 methodology"). The methodology now in force is an update that was approved in September 2018 by the European Commission ("CBA 2.0 methodology").

As part of the CBA 2.0 methodology, ENTSO-E computes a certain number of indicators which are not all expressed as a monetary equivalent.

The monetized indicators used in the cost-benefit analyses are the following:

- **B1 – Socio-economic welfare (SEW):** this indicator represents the savings in production costs that are generated by the project due to the subsequent reduction in congestions. By construction, this indicator also takes into account, firstly, the value of CO_2 savings achieved, and secondly, the benefits derived from the reduction of the curtailment of renewable energy.
- **B5 – Power losses:** this indicator gives the variation in costs due to the compensation for power losses which can be attributed to the commissioning of the interconnector project. Although theoretically this indicator can in theory be either positive (reduction in the cost of losses), or negative (increase in this cost), it represents most of the time a cost for the community.

[12] https://www.cru.ie/wp-content/uploads/2018/10/CRU18216-Greenlink-determination-paper-1.pdf

- **B6 – Adequacy (resilience):** this indicator seeks to evaluate the benefits in terms of security of supply, in other words, in terms of improving the capacity of the electricity system to meet demand in times of scarcity. The ENTSO-E proposes two indicators:
    - The expected energy not served (EENS, in MWh);
    - The additional adequacy margin[13] (in MW) in those cases where the probability of unserved energy obtained in the simulations is zero.

With respect to costs, the investment expenditure and the operating and maintenance costs of the projects have been taken into account. Some costs can also come from the impact of the commissioning of the interconnection on the rest of the system (reinforcement, increase in required reserves etc.).

2.2.2 Proposal by the TSOs

The cost-benefit analysis performed by the transmission system operators takes the following parameters into account:

- Socio-economic well-being (SEW);
- The cost of power losses;
- The benefits in terms of security of supply;
- Investment expenditure (CAPEX);
- Operating and maintenance costs (OPEX).

The TSOs have estimated the costs and benefits relating to the commissioning of Celtic for the years 2025 and 2030 using the ANTARES and PLEXOS models. The average of the results are considered in their investment request[14]. A linear interpolation of these estimates is used between 2025 and 2030 and the costs and benefits simulated for 2030 are assumed to be constant from this date.

The operating costs and benefits (SEW, losses, security of supply) have been reduced by 5% to reflect the projected interconnection availability rate, estimated at 95% by the TSOs.

In order to estimate the benefit in terms of security of supply, the TSOs have simulated the impact that the Celtic project could have on the capacity of the electricity grid to supply the entire demand for power at all times and given numerous uncertainties. To do so, the TSOs have developed a new experimental methodology, applied for the first time to the TYNDP 2018 projects, whilst emphasising that it does not aim at reflecting the functioning of capacity markets in Europe. The approach of the TSOs shares some similarities with the techniques employed in the *Mid-Term Adequacy Forecast* (MAF) of the ENTSO-E, namely the use of Monte Carlo simulations based on 34 climate years that was constructed for the needs of TYNDP. The method developed by the TSOs is described in Appendix 4.2 of the TSO's file.

Finally, some non-monetary benefits are described in qualitative terms by the transmission system operators. These benefits include societal and environmental aspects, as well as European solidarity considerations.

2.2.3 Analysis by the CRE

The costs and benefits taken into account by the TSOs are consistent overall with the CBA 2.0 methodology developed by ENTSO-E. Nevertheless, the CRE notes that certain aspects of the analysis do not necessarily follow a strict application of this methodology.

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[13] In other words, the additional margin available above the required security margins.

[14] The results provided by each of these models are provided in Appendix 5 of the file of the TSOs.

Firstly, the costs of reinforcing the Irish system due to Celtic (15.7M€) are not taken into account[15]. Secondly, the Celtic project will represent the largest infeed into the Irish transmission system (700 MW versus 500 MW currently), which will lead to an increase in the cost of reserves, estimated at 5.6 M€/year by the TSOs[16], a cost which has not been considered by the TSOs on the grounds that certain benefits, such as the blackstart service[17], are also not taken into account in the analysis.

Secondly, the CRE expresses a certain number of concerns regarding the methodology used by the TSOs to compute the project security of supply benefits. Due to the relative over-capacity aspect of the TYNDP scenarios, this methodology consists mainly in re-adapting the generation fleets in the different countries in order to comply with the security of supply national criteria. Consequently, the savings in fuel costs and the security of supply benefits are estimated based on different assumptions. This raises the question of whether it is relevant to add both these benefits.

In addition, the TSOs do not analyse the economic profitability of power generation facilities in their simulations, even though the rational decisions of competing investors would yield different generation capacities than the ones assumed within the TSOs' methodology. Furthermore, situations of lost load often correspond to difficult periods for the high voltage transmission grid, therefore national congestion could limit the capacity of a new interconnection to serve the regions where the balance between supply and demand is difficult to meet.

Finally, the price at which non-distributed energy savings are valued could be over-estimated to a certain extent. Firstly, "non-market" measures (interruptible contracts, voltage reduction, etc.), whose cost is lower than the value of lost load (VOLL), are not taken into account. Secondly, the recent work by ACER on the value of loss load suggests that it could be meaningful to assume a lower VOLL.

Question 3	Do you share the CRE's analysis regarding the methodology proposed by the TSOs to assess the project value in terms of security of supply?
Question 4	Do you think that other costs or benefits should be included in the cost-benefit analysis? If so, which ones?

2.3 Net present value

2.3.1 Proposal by the TSOs

The Net Present Value (NPV) of the Celtic project is calculated using the project's estimated costs and benefits (SEW and benefits in terms of security of supply, from which the costs of power losses are deducted) in each of the four scenarios.

In line with the CBA 2.0 methodology of ENTSO-E, the TSOs use a rate of 4% (actual) to update the annual investment costs as far as the provisional putting into service of the interconnector in 2026, then the estimated net benefits over a period of 25 years (i.e. until 2050). The residual value of the interconnector is assumed to be zero.

2.3.2 Analysis by the CRE

Apart from the concerns expressed in Section 2.2.3, the methodology used by the TSOs is in line with the CBA 2.0 methodology of ENTSO-E.

[15] On the French side, RTE confirms that the commissioning of the interconnection will not involve any reinforcement costs for the transmission system in Brittany.

[16] Nevertheless, the TSOs only assign 25% to 50% of these costs to Celtic, assuming that one to three wind farms of a size comparable to Celtic could eventually be constructed.

[17] In other words, those units that are able to start without an external power supply to gradually supply the grid users again.

2.4 Sensitivity analyses

2.4.1 Proposal by the TSOs

The TSOs have performed several analyses in order to assess the extent to which the NPV for the Celtic project is sensitive to the assumptions used. Given the complexity of the simulations used to estimate the cost of power losses, these sensitivity analyses focus primarily on the generation cost savings allowed by the interconnection (and in some cases, on security of supply).

The TSOs have in particular evaluated the effects of variations in the following parameters:

- A delay in commissioning;
- A variation in the prices of fossil fuels and CO_2;
- A rise/reduction in investment expenditure and/or in operating and maintenance costs;
- A variation in the security of supply benefits;
- A reduction of the wind power generation capacities connected to the Irish Single Electricity Market in 2030 (- 2 GW);
- Decoupling between the British market and the rest of Europe due to the exit of the United Kingdom from the European Union (Hard Brexit);
- An additional 500 MW interconnection between Ireland and Great Britain;
- Lower interconnection capacity (- 2.8 GW) between France and Great Britain;
- A reduction in the availability rate of all interconnections between France and Great Britain (-5%);
- Variations in the installed nuclear power capacities in France (+/- 5 GW depending on the scenarios);
- Lower growth in the demand for electricity in France and Ireland.

2.4.2 Preliminary analysis by the CRE

The CRE deems that there are enough sensibilities performed by the TSOs and that these are generally relevant to assess the sensitivity of the results to the assumptions taken.

Question 5	Do you think that the sensitivity analyses performed by the TSOs cover all relevant sources of uncertainty with respect to the project value? If not, which of them do you consider missing or lacking credibility?

3. RESULTS OF THE COST-BENEFIT ANALYSIS

3.1 Assessment of project costs and benefits

3.1.1 Assessment of costs

Elements provided by the TSOs

RTE and Eirgrid have estimated investment costs at 930 M€, with an uncertainty margin of -110 /+140 M€. TSOs consider that costs are evenly split on a geographical basis.

The pre-construction phase represents a cost of 34 M€. The remaining 896 M€, corresponding to the construction phase, follow the timeline below:

Date	2022	2023	2024	2025	2026
CAPEX (M€)	50	160	310	286	90

TABLE 2 : SCHEDULE OF CAPITAL EXPENDITURES DURING THE CONSTRUCTION PHASE

The operating and maintenance costs are estimated at 8.4 M€ per year by the TSOs.

Finally, TSOs estimate the reinforcement works for the Irish grid at 15.7 M€. Additional costs between 1.4 M€ and 2.8 M€ per year should occur due to the need for additional reserves in Ireland following the commissioning of the interconnector (see Appendix 3 of the TSOs' investment request).

Preliminary analysis by the CRE

The CRE notes that the margin of uncertainty for the CAPEX provided by the TSOs is wider than the margin suggested by ACER in its recommendation No. 5/2015. Indeed, ACER recommends that, for a project to be deemed sufficiently mature to request a cost allocation decision, uncertainty regarding costs must not exceed +/- 10%. However, the margin presented by the TSOs is mainly due to uncertainties regarding prices emerging from the procurement process, and therefore cannot be removed before the call for tenders, that is after the approval of the investment request by the regulators.

The CRE also notes that the low interconnection capacity imposed by the small scale of the Irish electricity system makes the Celtic project more costly (1.3 bn€/GW) than other similar projects in France (0.75 bn€/GW for IFA2, €0.9 bn€/GW for Biscay Gulf, or 0.8 bn€/GW for Savoie Piémont).

Nevertheless, the CRE estimates that the project exhibits a significant risk of cost overruns given its technical characteristics and the elements provided by TSOs.

3.1.2 Cost of power losses

TSOs assessment

Apart from investment expenditure and operating and maintenance costs, the simulations by the TSOs facilitate estimations of the cost of power losses resulting from the project in the various scenarios analysed. These costs are summarised in the table below for the reference scenarios employed by the TSOs.

Scenario	BE 2025	ST 2030	DG 2030	EuCo 2030	V1 2030
Total losses (M€/year)	17	22	22	26	29
Of which losses on the FR network (M€/year)	12	12	12	16	19
Of which losses on the IE network (M€/year)	4	11	9	8	11

TABLE 3 : ESTIMATE OF THE COST OF POWER LOSSES

Preliminary analysis by the CRE

The results are consistent with those of TYNDP 2016 (scenario V1) and 2018 (other scenarios).

However, these results assume an interconnection availability rate of 100%, whilst the TSOs have estimated this rate at 95%, due mainly to failures that can affect the cable throughout its lifetime. Consequently, as the cable does not cause power losses when unavailable, only 95% of the estimated cost of the losses are taken into account in the cost-benefit analysis, in line with the proposal by the TSOs.

3.1.3 Socio-economic welfare (SEW)

TSOs assessment

Production costs savings, which include the benefits of reducing greenhouse gas emissions and lowering the amount of curtailed renewable production, represent the main benefits from the project.

The following table shows an overview of the results obtained by the TSOs:

Scenario	BE 2025	ST 2030	DG 2030	EuCo 2030	V1 2030
Total SEW (M€/year)	47	91	82	76	66
Of which SEW FR (M€/year)	18	41	38	32	38
Of which SEW IE (M€/year)	31	74	57	47	43

TABLE 4: ESTIMATED SEW IN THE BASE CASE USED BY THE TSOS

Preliminary analysis by the CRE

The results of the TSOs are consistent with those of TYNDP 2016 (scenario V1) and 2018 (other scenarios). The ST and DG scenarios are those in which the project delivers the highest benefits.

The CRE notes that the TYNDP scenarios, used as a reference by the TSOs, consider that the available interconnection capacity between Ireland and Great Britain is 500 MW. Yet, a new interconnection of 500 MW between Ireland

and Great Britain could be commissioned before 2030 (see Section 2.1.2). The following table details how the estimated fuel savings from the Celtic project could be impacted by the commissioning of this interconnection.

Scenario	BE 2025	ST 2030	DG 2030	EuCo 2030	V1 2030
Total SEW (M€/year)	47	68	54	61	55
Of which SEW FR (M€/year)	18	34	26	30	37
Of which SEW IE (M€/year)	31	43	38	29	29

TABLE 5 : ESTIMATED SEW IF A NEW 500 MW INTERCONNECTOR IS BUILT BETWEEN IRELAND AND GREAT BRITAIN

In addition, in line with the assumptions regarding the cost of power losses, only 95% of the benefits estimated as part of the TYNDP are taken into account in the analysis.

3.1.4 Security of supply

TSOs assessment

The TSOs estimate that the Celtic project will deliver substantial benefits in terms of security of supply, which, in their opinion, are not sufficiently taken into account in the CBA 2.0 methodology.

Consequently the TSOs have developed an *ad hoc* methodology that aims at better capturing the project benefits relating to an improvement of security of supply. Indeed, the TSOs state that the TYNDP scenarios are characterised by low volumes of expected lost load, reflecting situations of relative over-capacity. Hence, in a first step, the TSOs start by decreasing installed generation capacities in order to meet the security of supply legal criteria enforced in the different countries (3 hours/year in France, 8 hours/year in Ireland). In a second step, the TSOs calculate the reduction in the anticipated volume of unserved energy which is achieved following the commissioning of the interconnection. This reduction is monetized at the value of lost load (13 k€/MWh in France, 11 k€/MWh in Ireland).

The following table provides the results obtained by the TSOs.

Scenario	BE 2025	ST 2030	DG 2030	EuCo 2030	V1 2030
Total gains associated with the security of supply (SoS[18]) (M€/year)	32	42	38	24	25
Of which SoS FR (M€/year)	9	18	16	1	3
Of which SoS IE (M€/year)	16	15	14	19	19

TABLE 6 : ESTIMATE BY THE TSOS OF THE BENEFITS IN TERMS OF SECURITY OF SUPPLY IN THEIR BASE CASE

Preliminary analysis by the CRE

[18] Security of supply

The CRE has a number of concerns regarding the methodology proposed by the TSOs (see Section 2.2.3), especially since the results obtained can reach very high values (up to 42 M€/year for the ST 2030 scenario).

This value appears to be highly uncertain and potentially over-estimated. As such, while it constitutes a qualitative element potentially useful for the overall evaluation of the project, it should not be taken into account as such to determine how to allocate the costs of the project between the users of the French and Irish grids.

Question 6	Do you think that the security of supply benefits in as estimated by the TSOs should be taken into account in the cost allocation decision? If so, then how?

3.1.5 Non-monetised benefits

In their investment request, the TSOs also highlight a certain number of qualitative benefits which, although difficult to express in monetary terms, increase the potential interest of the Celtic project. These benefits are described in Part 6 of the TSOs' investment request. The main elements are:

- European solidarity towards Ireland, which would see the construction of an electrical cable connecting it physically to the continental power grid, allowing Ireland to remain in the internal energy market no matter the practical consequences of Brexit;
- Externalities in terms of market integration, security of supply and sustainable development, that are considered imperfectly captured by the indicators used in the cost-benefit analysis.

3.2 Computation of the project NPV

3.2.1 Analysis by the TSOs

TSOs investment request contains a cost-benefit analysis for the project at the European level. This analysis considers capital expenditures, operating and maintenance costs, the cost of power losses, the savings on fuel costs for electricity generation and the assumed benefits in terms of improved security of supply.

The following table summarises the results obtained at the European level.

Scenario	ST	DG	EuCo	V1	Mean
NPV (CBA 2.0 methodology, i.e. without SoS *ad hoc*)	-105	-200	-295	-420	-255
NPV (proposal by the TSOs with SoS *ad hoc*)	350	220	-15	-130	106

TABLE 7 : PROJECT NPV ACCORDING TO THE TSOS

3.2.2 Preliminary analysis by the CRE

TSOs' results suggest that, in the absence of any *ad hoc* monetisation of the benefits in terms of security of supply, the project NPV at the European level is negative in the four scenarios analysed.

Taking into account the estimates by the TSOs relating to the additional benefits in terms of security of supply allows the NPV to become positive in the ST and DG scenarios of ENTSO-E, and on average over the four scenarios analysed in the investment request.

Furthermore, the project NPV becomes highly negative in almost all scenarios as the interconnection capacity between Ireland and Great Britain rises to 1000 MW, even including the security of supply benefits as estimated by the TSOs.

Scenario	ST	DG	EuCo	V1	Mean
NPV (CBA 2.0 methodology, i.e. without SoS *ad hoc*)	-340	-480	-445	-530	-449
NPV (proposal by the TSOs with SoS *ad hoc*)	65	-135	-390	-410	-218

TABLE 8 : PROJECT NPV IN THE EVENT OF AN INCREASE OF 500 MW IN THE INTERCONNECTION CAPACITY BETWEEN IRELAND AND GREAT BRITAIN

The economic interest of the project for the European community thus seems to be very sensitive to the assumptions made. As a consequence, the potential justification of the Celtic project would lie primarily in the willingness to construct a physical link connecting the Irish electricity grid to the Continental electricity grid. This constitutes a major aspect to preserve the internal energy market and the possibility for Ireland to remain part of it, in the context of Brexit.

3.3 Sensitivity analyses

3.3.1 Analysis by the TSOs

TSOs' investment request includes a large number of sensitivity analyses.

In particular, there is a major downward impact on the profitability of the project in the event of:

- An increase to 1000 MW of the reference capacity between Ireland and Great Britain;
- A slower development of wind power generation in Ireland. The NPV obtained at European level falls by approximately 200 M€ in the ST and DG scenarios if the wind power capacity achieved in 2030 is 2 GW below the projections of TYNDP 2018;
- A reduction of the projections for 2030 of the fuel and CO_2 prices compared to the TYNDP assumptions.

Conversely, the profitability of the project could increase in the event of a hard Brexit that would result in giving up several interconnection projects between Great Britain and the Continent, and in a decoupling of markets between the United Kingdom and the EU.

Finally, a certain number of sensitivity analyses (variation in the level of demand in France and Ireland, or even in the installed nuclear capacity in France through to 2030) have a relatively milder influence on the project NPV.

3.3.2 Preliminary analysis by the CRE

The sensitivity analyses performed by the TSOs allow a better understanding of the risks that may affect the profitability of the project.

The CRE notes in particular that a certain number of these risks derive from energy policy decisions in Ireland (interconnection capacity with Great Britain, the development of wind power).

3.4 Preliminary conclusion on the cost-benefit analysis for the project

To summarise, the cost-benefit analysis does not make it possible to conclude with certainty that the Celtic project is in the interest of the European community. Indeed, the project NPV is negative in several scenarios and is highly sensitive to assumptions. However, some benefits are not easy to monetize, but reinforce the interest of the project, notably European solidarity with Ireland.

Hence, the CRE will ensure in its decision that the costs borne by the users of the French electricity transmission system are not disproportionate in relation to the benefits that they may get from the project. In particular, as proposed by the TSOs in their investment request, a large European subsidy would be a mean to reduce the costs and the risks borne by the users of the French and Irish electricity transmission systems.

Question 7 Do you share CRE's analysis according to which the project is primarily justified by European energy policy, and thus requires a subsidy in light also of the risks and uncertainties associated with the project, which the French and Irish users should not bear alone?

4. CROSS-BORDER ALLOCATION OF THE PROJECT INVESTMENT COSTS

4.1 Cost-benefit analysis at French and Irish level

4.1.1 Analysis by the TSOs

The investment request by the TSOs also proposes a cost-benefit analysis for the project respectively at the French and Irish perimeters. The corresponding NPVs are shown in the table below, assuming a 50/50 split of the project costs between France and Ireland.

The analysis by the TSOS thus concludes that, in the absence of a suitable sharing of project costs, the project has an interest for Ireland, but has a negative economic impact in France.

NPV (M€ 2018)	Scenario	ST	DG	EuCo	V1	Mean
France	NPV (excluding SoS)	-120	-160	-250	-220	-190
	NPV (with SoS)	70	15	-235	-180	-83
Ireland	NPV (excluding SoS)	245	100	10	-70	70

	NPV (with SoS)	420	260	215	145	260

TABLE 9 : PROJECT NPV IN FRANCE AND IRELAND IN THE BASE CASE USED BY THE TSOS

4.1.2 Preliminary analysis by the CRE

In light of the analysis by the transmission system operators, the CRE deems that a sharing of costs would be necessary to take into account the low benefits of the project for France, compared to the cost spent in France. This is also confirmed by the sensitivity analyses, in particular in the event of an increase in the interconnection capacity between Great Britain and Ireland.

Scenario	ST	DG	EuCo	V1	Mean
SEW 2030 FR (M€/year)	34	26	30	37	32
NPV FR (M€ 2018)	-190	-275	-270	-230	-241

TABLE 10: PROJECT SEW AND NPV FOR FRANCE IN THE ABSENCE OF COST SHARING IN THE EVENT OF AN INCREASE TO 1000 MW OF THE INTERCONNECTION CAPACITY BETWEEN IRELAND AND GREAT BRITAIN (WITHOUT TAKING INTO ACCOUNT THE BENEFITS IN TERMS OF SECURITY OF SUPPLY)

Thus, the CRE plans to condition the approval of the project to the enforcement of conditions ensuring a satisfactory level of expected net benefits in France. This will consist in particular, *as a minimum*, in guaranteeing that the NPV at the perimeter of France is non-negative on average for the scenarios considered.

Question 8	Do you share CRE's analysis on the criteria to which the approval of the investment request should be conditioned in order to preserve the interest of the users of the transmission system?

4.2 Sharing of costs between France and Ireland

4.2.1 Proposal by the TSOs

In their investment request, the transmission system operators proposed a 50/50 allocation of project costs between France and Ireland, which follows the geographical distribution of these costs. This allocation is subject to the attribution of a subsidy equal to 50% of the project investment costs.

4.2.2 Analysis by the CRE

The CRE estimates that TSOs' proposal of cost allocation is not sufficient to compensate the negative impact of the project for France.

In elaborating a joint decision to share the costs of the Celtic project with the CRU, the CRE is instead considering to apply two principles:

1) The sharing of investment costs must reflect the distribution of the anticipated benefits ;
2) The investment expenditure approved for RTE must be capped in order to maintain a non-negative NPV for the project for users of the French grid.

Both these principles are detailed below.

4.2.2.1 Distribution of the gross project benefits

The estimated gross benefits for the Celtic project vary slightly from one scenario to another in the analyses by the TSOs. Nevertheless these analyses suggest that the majority of the project benefits will be in Ireland, with France capturing only 20 to 45% of the benefits depending on the scenario.

The following table illustrates this asymmetry.

Scenario		ST	DG	EuCo	V1	Mean
Base case of the TSOs	M€	250	210	115	145	180
	%	29%	31%	23%	33%	29%
Sensitivity with 1000 MW interconnection between Ireland and Great Britain	M€	180	95	100	135	128
	%	37%	25%	33%	44%	35%

TABLE 11: ESTIMATED GROSS BENEFITS FOR FRANCE (EXCLUDING SOS)

Thus, the CRE estimates that the sharing of project investment expenditure should reflect this asymmetry in the distribution of expected gross benefits.

Question 9 Do you agree with CRE's analysis according to which the network users in each country should bear a share of the investment costs in line with the distribution of the expected benefits of the project?

4.2.2.2 Investment expenditure borne by the tariff for the use of the public electricity transmission system (TURPE HTB)

Various risks may impact the project and could have a negative impact on its value for France. These are notably:

- The increase in the interconnection capacity between Ireland and Great Britain (1000 MW instead of 500 MW);
- Uncertainty regarding the benefits estimated by the transmission system operators with respect to an improvement in the security of supply;
- A slower development than forecasted for wind power in Ireland;
- The realisation of scenarios in which there is a delay in the achievement of the European energy transition objectives (scenario V1);
- Overruns in investment and operating costs.

Consequently the CRE plans to base its analysis on more cautious scenarios with respect to these risks, that assume an interconnection capacity of 1000 MW between Ireland and Great Britain in 2030, and that do not take into account the additional benefits in terms of security of supply as simulated by the TSOs.

According to these assumptions, the results of the simulations by the TSOs suggest that the NPV of the Celtic project for France, calculated as an average of the four scenarios studied, becomes negative as soon as the investment costs by RTE exceeds 160 M€.

At this stage, the CRE thus envisages to cap the investment costs authorised for RTE at 160 M€. If necessary, a substantial European subsidy may be needed to bear the remaining investment costs allocated to France under a cost-sharing agreement.

Question 10	Do you agree with the CRE's analysis according to which the investment expenditure by RTE should be capped in order to ensure that the expected project NPV is non-negative for France?
Question 11	Do you think that other risk factors should be taken into account to determine the maximum expenditure level that would be borne by RTE?

5. LIST OF QUESTIONS

Question 1	Do you share the CRE's analysis on the framing nature of the four scenarios taken into account by the TSOs to analyse the benefits of the Celtic project?
Question 2	Do you share the CRE's analysis, according to which a capacity of 1000 MW for 2030 between Ireland and Great Britain seems more appropriate for an analysis of the costs and benefits of the project?
Question 3	Do you share the CRE's analysis regarding the methodology proposed by the TSOs to assess the project value in terms of security of supply?
Question 4	Do you think that other costs or benefits should be included in the cost-benefit analysis? If so, which ones?
Question 5	Do you think that the sensitivity analyses performed by the TSOs cover all relevant sources of uncertainty with respect to the project value? If not, which of them do you consider missing or lacking credibility?
Question 6	Do you think that the security of supply benefits in as estimated by the TSOs should be taken into account in the cost allocation decision? If so, then how?
Question 7	Do you share CRE's analysis according to which the project is primarily justified by European energy policy, and thus requires a subsidy in light also of the risks and uncertainties associated with the project, which the French and Irish users should not bear alone?
Question 8	Do you share CRE's analysis on the criteria to which the approval of the investment request should be conditioned in order to preserve the interest of the users of the transmission system?
Question 9	Do you agree with CRE's analysis according to which the network users in each country should bear a share of the investment costs in line with the distribution of the expected benefits of the project?
Question 10	Do you agree with the CRE's analysis according to which the investment expenditure by RTE should be capped in order to ensure that the expected project NPV is non-negative for France?
Question 11	Do you think that other risk factors should be taken into account to determine the maximum expenditure level that would be borne by RTE?