Decision

Decision on the Initial Project Assessment of the Third Cap and Floor Window for Electricity Interconnectors

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In March 2024 we published a consultation on our minded-to position for our Initial Project Assessment (IPA) of the third cap and floor window electricity interconnectors: Aminth, AQUIND, Cronos, LirIC, MaresConnect, NU-Link and Tarchon. The IPA is the first stage of the cap and floor regime process, and its purpose is to determine whether the interconnector is in the interest of GB consumers and should in principle obtain a cap and floor regime. This document summarises the responses to our consultation and provides our decision on the third window interconnectors.

We consider that **LirIC, MaresConnect and Tarchon** are likely to be in the interests of GB consumers, and therefore we have decided to grant these three projects a cap and floor regime in principle, subject to the conditions indicated in this document.

We received extensive consultation feedback covering all parts of our IPA assessment, namely the methodology of the market modelling and Ofgem's use and interpretation of third-party quantitative analyses to arrive at our minded-to position. We have conducted further analysis to address stakeholder feedback. The rationale, methodology and results of which are detailed within this document to support our approval of the projects referred to above.

Foreword

As we shift to a clean power system by 2030, we need to invest in an abundance of different technologies to ensure flexibility and resilience on our grid. Interconnection is an established technology, and a comparatively quick to implement and cost-effective solution to reach this goal. Further interconnection with Europe will play a key role in making our energy supply cheaper and less reliant on volatile foreign gas markets and associated price spikes.

A strong and varied fleet of interconnectors expands options for both consumers and producers in accessing cheaper power and using our domestic wind generation to its full potential. Due to our geography, GB is best placed to not only provide itself with clean wind power, but also to exploit export opportunities with Europe and contribute to the global net zero target. By 2030, we expect to become a net exporter with one of the lowest wholesale prices in Europe, owing to the tremendous work to date to build out onshore and offshore wind. And on days where our own wind power is more limited, we can rely on common renewable and low carbon resources across our trading partners rather than on expensive gas.

Ofgem’s cap and floor regime has been a great success in increasing interconnector capacity from 4GW in 2010 to 11.7GW operational or in construction today. We are pleased to announce today a new round of approved projects in our third investment window. These projects have the capability to serve millions of homes’ worth of electricity demand at any given moment. They will continue to provide the flexibility, security of supply and decarbonisation benefits to GB and European consumers that our cap and floor interconnectors have delivered to date.

Interconnectors enable GB to achieve decarbonisation and security of supply targets at lower cost than would be possible without them. We look forward to working with the successful developers to realise these essential infrastructure projects.

Akshay Kaul

Director General for Infrastructure

Executive Summary

Electricity interconnectors are the physical links that connect the GB electricity system with the systems of other countries and territories, enabling the trade of electricity across borders. Interconnectors are increasingly important in providing flexibility and enhancing the security of supply as we move into a renewables-dominated energy system. Ofgem's cap and floor regime is the regulated route for developing GB interconnectors and has been successfully increasing the level of interconnection. The cap and floor regime has taken GB's interconnector capacity from 4GW in 2015 to 9.8GW operational today, with an additional 1.9GW under construction and 2.7GW with regulatory approval.

Seven projects applied to the third electricity interconnector investment window (**Window 3**) for a cap and floor regime. These were assessed on socioeconomic welfare (**SEW**) as well as wider benefits including security of supply and decarbonisation. This expanded quantitative assessment framework allows us to assess interconnectors on additional strategic value to consumers beyond their impact on wholesale prices. This window also increased emphasis on the maturity and deliverability of projects ensuring they will be able to start operation prior to the end of 2032. This is in line with other Ofgem and Government policy work considering a range of reforms to adapt the grid to a decarbonised electricity system.

In parallel, we have opened a regulatory pilot scheme for Offshore Hybrid Assets (**OHAs**) and conducted an IPA for OHAs, which followed a similar assessment framework. The Window 3 projects and OHAs are included in the same quantitative modelling.

In March 2024, we published our minded-to positions on the Window 3 projects within our IPA consultation document (**W3 IPA consultation**).[1] We were only minded-to approve the Tarchon project. We have carefully reviewed the responses received from the consultation and carried out additional analysis which we considered necessary to address the feedback provided. This document sets out our decision on the seven projects following consultation.

Following feedback on the constraint analysis, National Energy System Operator (**NESO**, formerly National Grid Electricity System Operator (NGESO)) has implemented a constraint reduction factor to the constraint cost results for all OHA and Window 3

[1] Initial Project Assessment of the Third Cap and Floor Window for Electricity Interconnectors (ofgem.gov.uk)

projects. Our consultants at Arup also created a new scenario to amend the generation and demand background data for the Ireland Single Market (**I-SEM**). Finally, the configuration of the Nautilus OHA has been confirmed by the Belgian authorities and these changes have been reflected in the modelling. We have taken all of these changes into account in our final decision. These changes to the IPA results for each project have resulted in two additional interconnector projects being approved in principle for a cap and floor regime in addition to our minded-to position.

Ofgem approves LirIC to Northern Ireland, MaresConnect to the Republic of Ireland, and Tarchon to Germany for a cap and floor regime. We believe that these projects show economic and system benefit to GB at a reasonable cost to consumers and we have been persuaded by material submitted by applicants that these projects will connect within the connection deadline for the Window.

- Both LirIC and MaresConnect now demonstrate positive SEW for GB, and have switched to being importers of energy from the I-SEM to GB. These projects are likely to benefit consumers by importing cheap and clean Irish wind energy into GB, lowering emissions and domestic wholesale prices. We also consider these projects deliverable by the end of 2032.
- We confirm our approval for Tarchon. This project has high total SEW and we consider it deliverable by the end of 2032. As we grow our offshore wind capacity, we expect this interconnector to export surplus energy generated by wind farms that would otherwise need to be curtailed. It therefore enables our comparative advantage in the GB wind sector by providing an additional route to market, increasing economic growth. Although net power exports at the margin are likely to raise wholesale prices slightly, this negative impact on consumers is likely to be outweighed by reduced renewables curtailment, increased flexibility and security of supply.

We confirm our rejection of Aminth and NU-Link due to deliverability concerns. These developers have not submitted sufficient evidence which satisfies Ofgem that, on balance, it is likely that these projects can become operational by the end of 2032.

We also confirm our rejection of AQUIND, firstly due to remaining high constraint costs, and secondly due to deliverability issues. AQUIND’s constraints remain high even after the constraint cost reduction rate has been applied by NESO.

For AQUIND, analysis from the French system operator RTE[2] published during the W3 IPA consultation stage indicates that the project is unlikely to be able to connect to the French grid in time to become operational by the end of 2032. Further, the question of GB planning consent remains unresolved and there has been a request by the Ministry of Defence to extend the planning process, citing concerns that project approval would result in significant national security concerns. We note that the developer rejects these concerns. However, we are unpersuaded that the project is, on balance, likely to become operational by the end of 2032 given the clear challenges it faces in both GB and France.

Finally, we confirm our rejection of Cronos due to remaining high constraint costs. Cronos' constraints remain high even after the constraint reduction factor has been applied by NESO. In our minded-to position, Cronos also faced rejection on concerns surrounding deliverability. Through the consultation period, the developer has provided additional evidence of progress in its engagement with the Belgian authorities. We are now satisfied that the project does not face obstacles to its development in Belgium. We nonetheless confirm rejection owing to constraint costs in GB.

We will continue to engage with successful projects throughout their development, and the next step of the cap and floor regime process will be the Final Project Assessment. A decision not to grant a cap and floor regime in principle through this window does not mean that projects cannot apply again in future windows, if they meet the terms of the application guidance for that window.

Table 1: Summary of decision and reasoning for the Window 3 projects

[2] RTE supporting analysis for the March 2024 consultation on GB-FR interconnection by the Commission de Regulation de l'Energie (CRE) Opportunity for new electricity interconnection capacity between France and the United Kingdom | CRE

Project	**Minded-to position**	**Minded-to reasoning**	**Decision**	**Decision reasoning**
Aminth	Reject	Deliverability, project currently appears unviable	Reject	Reservations surrounding deliverability
AQUIND	Reject	Reservations surrounding high constraint costs	Reject	Reservations surrounding high constraint costs and deliverability
Cronos	Reject	Reservations surrounding high constraint costs and deliverability	Reject	Reservations surrounding high constraint costs
LirIC	Reject	Reservations surrounding negative SEW	Approve	Total SEW is now positive, and system impacts and maturity remain strong
MaresConnect	Reject	Reservations surrounding negative SEW	Approve	Total SEW is now positive, and system impacts and maturity remain strong
NU-Link	Reject	Reservations surrounding deliverability	Reject	Reservations surrounding deliverability
Tarchon	Approve	No material concerns identified	Approve	Project performs well across maturity, economic and system impacts assessment. No material concerns identified.

1. Introduction

Background to the cap and floor regime and the Initial Project Assessment

1.1 Electricity interconnectors are the physical links that connect our electricity system to those of other countries and territories, enabling cross-border trade of electricity. The cap and floor regime is the regulated route for interconnector development in GB, designed to facilitate the delivery of interconnection in a way that is economic, efficient and timely whilst protecting consumers' interests. Ofgem's cap and floor regime has been successful in attracting investment to increase interconnector capacity over the last decade.

1.2 It provides interconnectors with a cap and a floor to regulate revenues. A minimum level of revenue is provided by consumers if the interconnector revenues are lower than the floor level[3]. Where the interconnector revenues are above the cap level, the developer pays back revenues in excess of the cap to consumers. Interconnectors may also be delivered and operated through the merchant-exempt regulatory route, under which the interconnectors are exempted from specific regulatory and legal requirements, but their developers and operators bear the project development and operational revenue risks.

1.3 The cap and floor regime is awarded through investment windows rather than in response to ad hoc applications. Following the cap and floor regime pilot with the Nemo Link project, we have launched two cap and floor windows, one in 2014, and one in 2016, and took forward eight projects through both windows. Following this, we conducted the Interconnector Policy Review (**ICPR**) in 2020-214, to determine the effectiveness of the cap and floor regime and to consider changes to the assessment process and to the regime for future projects.

1.4 Electricity interconnectors to date have been beneficial to GB consumers mainly by giving GB access to cheaper electricity imports from mainland Europe. As we move to a decarbonised electricity system, and the further development of GB's exceptional wind resource in the future, we expect GB to become a net exporter of electricity as our wholesale price moves from being one of the highest to one of the lowest in Europe. The ICPR found that interconnectors are no longer expected

[3] However, floor payments are contingent on interconnector availability meeting the requirements of our minimum availability threshold.
[4] Interconnector Policy Review - Decision | Ofgem

to predominantly be a source of cheap electricity imports and instead a way of providing flexibility and enhancing security of supply in a renewables-dominated energy system. Following the ICPR, Ofgem opened a third window with an expanded assessment framework to account for the changing strategic case for interconnectors.

1.5 The ICPR also contained a commitment to open a pilot scheme for Offshore Hybrid Assets (**OHA**s), referred to at the time as 'Multi-Purpose Interconnectors' (**MPI**s), noting the benefits they may provide to the coordination of offshore assets and the integration of offshore renewables. It was considered that the cap and floor regime would be suitable for OHA development, and while the details of the regulatory regime for OHAs are evolving, Ofgem's assessment structure and delivery of such a regime is similar to that of the standard cap and floor process.

1.6 Following the ICPR, the OHA pilot scheme was open for applications between September and October 2022, and we conducted an IPA for the OHA pilot scheme in parallel with Window 3. This follows a similar assessment framework, and projects from both schemes have been included in the same quantitative modelling. While it is important to note that Window 3 and the OHA pilot are two separate investment windows with separate regimes and criteria, the projects are being built to the same timelines and will have tangible impacts on each other. Therefore, it was necessary to include them in the same modelling exercises to obtain rigorous results for the market modelling and system impacts analysis.

1.7 Following the IPA decision, each cap and floor project is held to the IPA conditions set out in the IPA decision. For successful Window 3 applicant projects, the IPA conditions are set out in this decision document, in Section 11. These are intended to incentivise timely delivery of projects and to ensure that consumers realise the anticipated benefits that informed our decision at the IPA stage on the needs case for the project. We then carry out the Final Project Assessment (**FPA**) to determine the specific cap and floor levels for each project before it reaches financial close and can enter the construction stage. The FPA is also the stage where special licence conditions related to the cap and floor regime are added, via the statutory licence modification process, to the interconnector licence held by the specific licensee. Finally, we carry out the Post-Construction Review (**PCR**) to determine the final cap and floor levels, taking into account our final assessment of the project's costs5.

1.8 This decision document details our decision and supporting analysis for Window 3. Please refer to our separate decision document published on our website for the OHA pilot scheme.

Overview of the Window 3 interconnector projects and minded-to position

1.9 We determined that the following applicant projects were eligible for assessment at the IPA stage in February 2023. The following table has been updated to reflect changes to the Aminth, NU-Link and LirIC projects since the W3 IPA consultation.

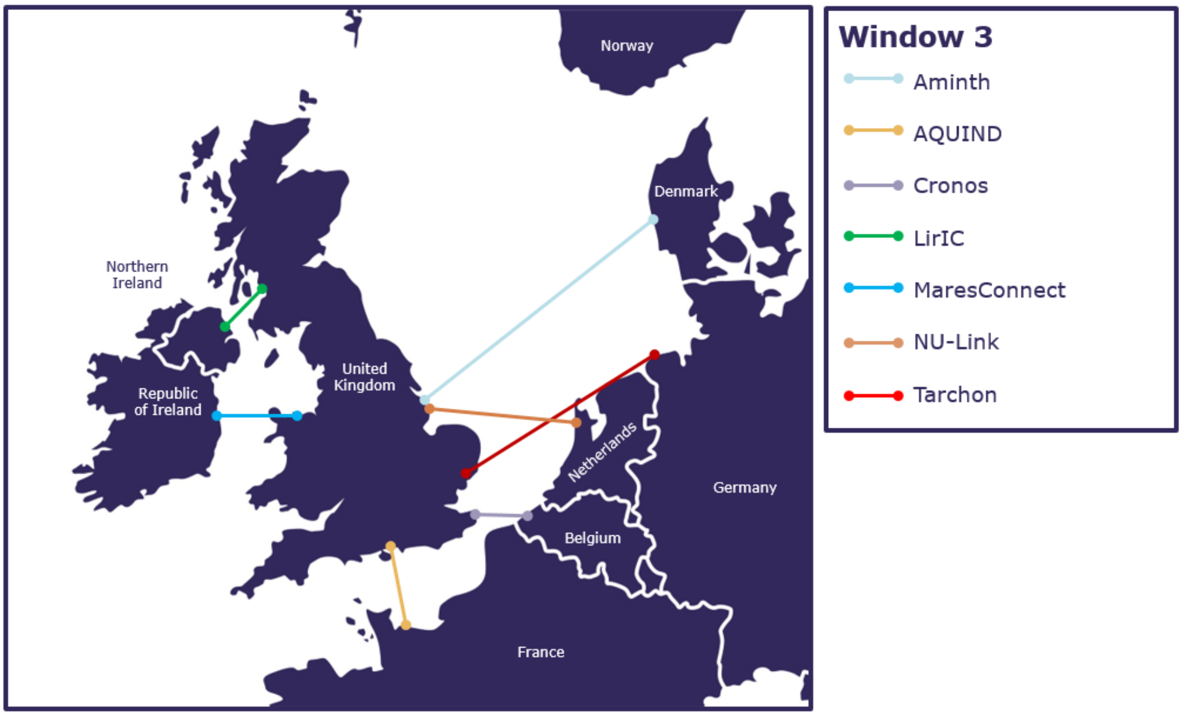
Table 2: Main characteristics of the Window 3 projects

Project	Developer	Location	Capacity
Aminth	Copenhagen Infrastructure Partners	Connection agreement terminated as of August 2024	1.4GW
AQUIND	AQUIND LIMITED	Lovedean, Hampshire, GB to Barnabos, Normandy, France	2GW
Cronos	Copenhagen Infrastructure Partners	Kelmsley, Kent, GB, to Belgium	1.4GW
LirIC	Transmission Investment	Hunterston, Scotland, GB to Kilroot, Northern Ireland	0.7GW
MaresConnect	MaresConnect Limited	Bodelwyddan, North Wales, GB, to Republic of Ireland	0.75GW
NU-Link	NU-Link Consortium	Mablethorpe, Lincolnshire, GB, to Moerdijk, Netherlands	1.2GW
Tarchon	Copenhagen Infrastructure Partners, Volta Partners	East Anglia[6], GB, to Niederlangen, Germany	1.4GW

[5] Relevant provisions are included in Special Condition 8: Process for determining the value of the post construction adjustment terms

[6] 'East Anglia' substation refers to a substation yet to be constructed, identified as an optimal location point in GB by the connections process conducted by NESO for the Tarchon project.

Figure 1: Map showing indicative connection points for the Window 3 applicant projects



1.10 In March 2024, we published our IPA minded-to position for the projects above, where we consulted stakeholders for their feedback on our positions and approach. The IPA consisted of three components in line with the Window 3 Application Guidance[7] and Needs Case Assessment guidance document[8]. In our Needs Case Assessment Guidance we noted that decision making would not be weighted across these three components. This means there is no numerical threshold by which a project can pass or fail the IPA, and the components are not prioritised in importance in relation to each other. The details of the IPA methodology can be seen in Section 3 of the W3 IPA consultation, as a high-level reminder these components were:

- **The maturity and deliverability analysis**- conducted through Ofgem analysis of applicant-submitted business plans for their projects, structured by the criteria set out in the Application Guidance.
- **The market modelling**- quantitative modelling on the SEW, decarbonisation and security of supply impacts for projects, conducted by our consultants at Arup. The indicators for this assessment were set out in our Needs Case Assessment guidance

[7] Application Guidance for the Third Cap and Floor Window for Electricity Interconnectors | Ofgem
[8] Cap and Floor Third Application Window and MPI Pilot Regulatory Framework- Guidance on our Needs Case Assessment Framework | Ofgem

document. Arup also provided 'Red-Amber-Green' (RAG) ratings for the hard to monetise impacts[9].

- **The system impacts modelling**- quantitative modelling on projects' constraint cost impacts and other system benefit derived from providing ancillary services to the grid, conducted by NESO. The indicators for this assessment were set out in our Needs Case Assessment guidance document.

1.11 The outputs from the market modelling and system impacts analysis were combined into a Multi-Criteria Assessment (**MCA**) conducted by our consultants at Arup, published alongside the W3 IPA consultation.

1.12 Based on the analysis as presented in our IPA, we outlined our minded-to decision to approve Tarchon and to reject all other projects.

1.13 We invited feedback from interested stakeholders on this publication, allowing 13 weeks for response. The W3 IPA consultation received a total of 294 responses. We have published responses marked non-confidential alongside this document.

Our decision-making process and Ofgem's duties

1.14 We assessed projects in line with the Gas and Electricity Markets Authority (the Authority)'s principal objective to protect the interests of existing and future consumers, including interests in compliance with the net zero carbon target. We will only grant in principle a cap and floor regime to projects that deliver positively in the three main parts of our assessment as stated in paragraph 1.10.

1.15 In a decarbonised future electricity system, we expect that further interconnectors will likely be net exporters, resulting in lower consumer SEW due to a marginal rise in the wholesale price in GB. However, there are additional benefits to be gained from interconnectors in meeting national and international policy goals of decarbonisation, flexibility and renewable energy integration. This means future interconnection will remain in consumer interest notwithstanding a marginal rise in the wholesale price in GB.

1.16 Section 202 of the Energy Act 2023 amends the Electricity Act 1989 to include a specific requirement for Ofgem to have regard to the Secretary of State's compliance with the UK net zero target when carrying out its regulatory functions (**the Net Zero Duty**), including while conducting the assessment of

[9] As noted in paragraph 3.23 of the W3 IPA consultation, Ofgem added to Arup's RAG scoring of hard-to-monetise impacts and we provide our own RAG rating which is treated as decisional.

interconnector and OHA projects for cap and floor support. This new amendment came into force on 26 December 2023.

1.17 Section 108 of the Deregulation Act 2015 requires certain public bodies to have regard to the desirability of promoting economic growth, for the wider UK economy, when carrying out their regulatory functions (**the Growth Duty**). From 2017, the Growth Duty applied to over 50 regulators. On 21 May 2024, the Growth Duty was extended to include Ofgem and the statutory guidance was updated10.

1.18 When making decisions to grant in principle a cap and floor regime, Ofgem must have regard to the desirability of promoting economic growth and the Secretary of State's compliance with their net zero emissions target when carrying out its duties.

Context and related publications

Initial Project Assessment of the Third Cap and Floor Window for Electricity Interconnectors

Decision on the Initial Project Assessment of the GridLink, NeuConnect and NorthConnect interconnectors | Ofgem

Interconnector Policy Review: Decision (ofgem.gov.uk)

Targeting Analysis for the Third Cap and Floor Window and MPI Pilot Regulatory Framework | Ofgem

Application Guidance for the Third Cap and Floor Window for Electricity Interconnectors | Ofgem

Cap and Floor Third Window and MPI Pilot Needs Case Framework (ofgem.gov.uk)

Decision on project eligibility for the Third Cap and Floor Window for Electricity Interconnectors | Ofgem

Consultation on changes to the financial parameters of the cap and floor regime for window 3 electricity interconnectors and risk considerations for offshore hybrid assets | Ofgem

[10] The Deregulation Act 2015 (Growth Duty Guidance) Order 2024 (legislation.gov.uk)

General feedback

We believe that consultation is at the heart of good policy development. We are keen to receive your comments about this report. We'd also like to get your answers to these questions:

1. Do you have any comments about the overall quality of this document?
2. Do you have any comments about its tone and content?
3. Was it easy to read and understand? Or could it have been better written?
4. Are its conclusions balanced?
5. Did it make reasoned recommendations?
6. Any further comments

Please send any general feedback comments to Cap.Floor@ofgem.gov.uk.

2. Consultation Responses

2.1 We received 294 consultation responses to the March 2024 W3 IPA consultation overall. The responses not marked as confidential have been published alongside this decision. We received responses from applicants to Window 3. We also received responses from non-applicant renewables and interconnector developers, community action groups, regulators and Transmission System Operators (TSOs) in connecting states. 270 of the responses were letters from the general public related only to the Tarchon interconnector which often followed the same template and points, therefore, only one of them has been published. We also received 13 new pieces of evidence from applicants showing new analysis or further project developments. We express thanks to all respondents.

2.2 The other 24 consultation responses covered the themes of:

a) Modelling approach chosen by Arup (in particular the use of the NESO’s Future Energy Scenarios 2022 (**FES22**) to estimate SEW impact

b) Validity of NESO’s results on the projected constraint costs of the interconnectors

c) Ofgem’s consideration of both quantitative analyses from Arup and NESO in coming to the final decision

d) Statutory duties

e) Procedural unfairness.

2.3 We also received new evidence from applicants regarding the maturity assessment, demonstrating how projects have progressed since initial application in their business plans. Below, we describe and respond to all consultation response arguments referring to our approach to modelling and the assessment of all projects across the window. Consultation responses specific to certain projects are referred to in project-specific sections later in this document.

Responses regarding market modelling

Use of the NESO’s Future Energy Scenarios (FES), developed in 2022, to model projections for the Ireland Single Market and other connecting countries

Figure 2: Data Availability and Milestones

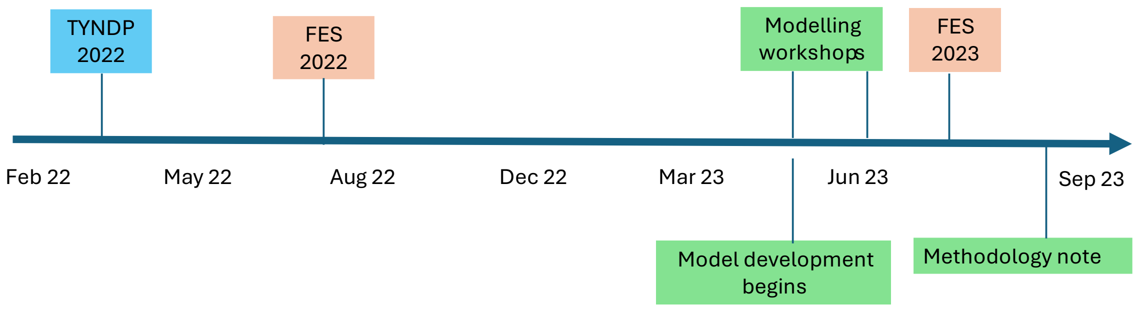
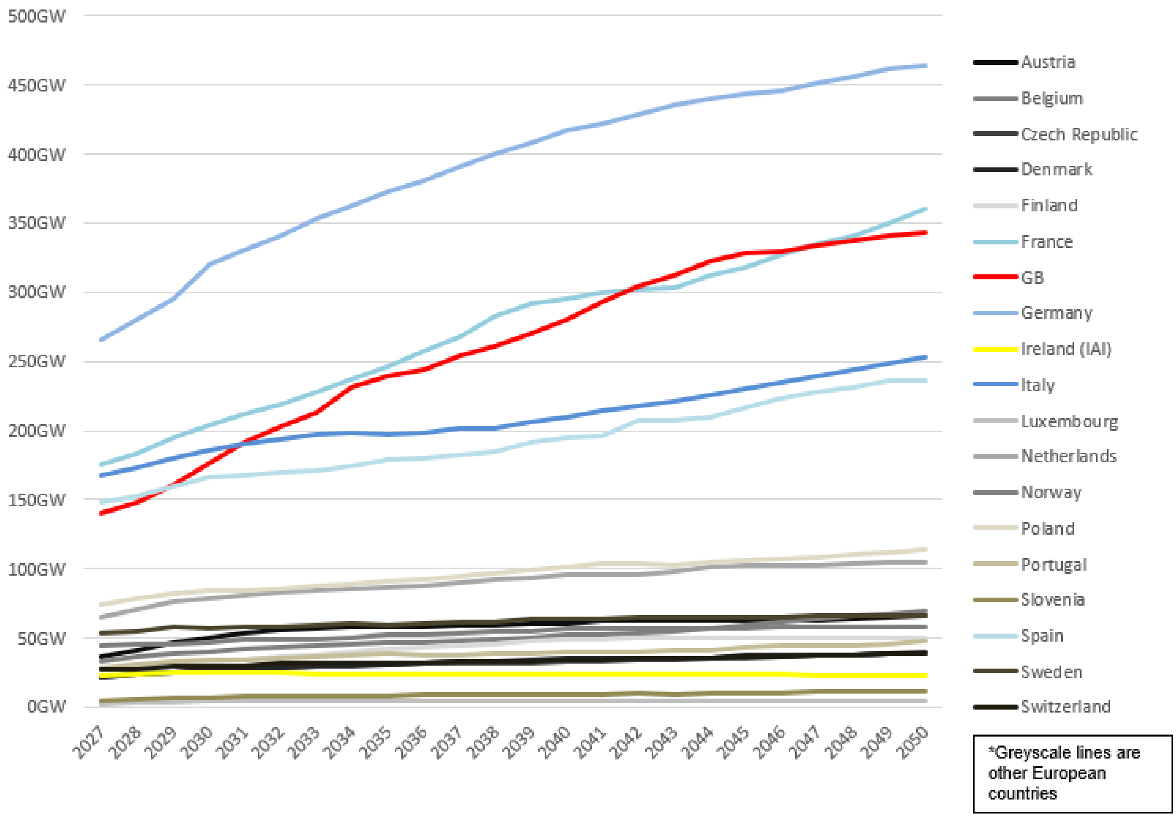


Figure 3: Chart showing projected renewable electricity capacity per country in FES22



2.4 Many respondents were critical of Arup's use of the FES22. Their concerns generally related to the application of the FES22 for the purpose of projecting generation and demand forecasts in countries outside of GB.

2.5 To create the European country level data (data for all EU member states and Norway, and excluding GB) for FES22, NESO commissioned the creation of two European scenarios that were complementary to the GB FES22 (**the European FES**). These two European scenarios were net-zero compliant for the European countries considered, and were largely based on the Consumer Transformation and System Transformation FES scenarios. The two European scenarios are bespoke and derived from several data sources, one of which is the Ten Year Network Development Plan (**TYNDP**) created by ENTSO-E[11], in particular the Global Ambition and Distributed Energy scenarios from the TYNDP.

2.6 Respondents highlighted that the FES22 is not based on the data from TYNDP 2022, even though TYNDP 2022 were publicly available when Ofgem's modelling took place. Respondents argued this had the effect of creating an extreme projection of GB's export flows through interconnectors, as the FES22 assume a much faster and higher scale rollout of wind energy for GB compared to other countries. Some respondents questioned the likelihood of GB being a net exporter and therefore the likelihood of the high constraint cost impacts shown in the system impacts modelling materialising. Some respondents argued for the modelling to be re-conducted using scenarios that reflect the latest policy targets of each of the connecting countries.

2.7 The FES22 scenarios were also stated by some respondents to not resemble any 'reasonable decarbonisation pathway' for the island of Ireland, with respondents noting that generation and demand figures for Ireland within FES22 for the last 15 years of the model were very low compared to national policy targets. For example, the FES22 projects 5GW of offshore wind by 2050, whereas the most recent policy target adopted by Ireland's Government in April 2024 is for 37GW by 2050, and the TYNDP 2022, the contemporaneous study to the FES22, projects 27GW by 2050. As a result, the market modelling assumes that GB would export to the I-SEM 81% of the time in 2040, and 96% of the time in 2050. As a small island system, the isolation of the Irish market can lead to greater volatility in wholesale prices, and the impact of large renewables growth on wholesale prices is high. Some respondents suggested the TYNDP data should be considered as an alternative data source. Ireland's system operator EirGrid also responded to our W3 IPA consultation to suggest that the Tomorrow's Energy

[11] About | ENTSO-E – TYNDP (entsoe.eu)

Scenarios data from 2023 collected by EirGrid and SONI, should be considered as an alternative.

Table 3: Comparison of renewable energy projections for the I-SEM

	FES 2022	**TYNDP 2022**	**Ireland Government target in 2022**
Offshore Wind projection in Ireland to 2050	5GW	27GW	5GW to be reached by 2030 No 2050 target
Onshore Wind projection in Ireland to 2050	6.8GW	20GW	8GW to be reached by 2030 No 2050 target

2.8 The FES22 scenarios were selected for this analysis on the basis that it is a replicable, transparent and readily available dataset. These are also the default scenarios created and used by NESO for its analyses on network reinforcements and nationwide constraint costs. Using FES22 thus allowed for consistency in the modelling between Arup and NESO. The European data for FES22 was built using a range of sources including TYNDP data for Europe, which is widely recognised by European regulators and governments. The FES22 scenarios were selected to underpin both the market and system impacts modelling following engagement with all applicant developers in 2023.

2.9 However, there is an unavoidable time lag that occurs when merging the datasets together- for NESO to create the FES22, it was necessary to use draft TYNDP 2022 material as an input as that was the most recently available data at the time. The final TYNDP 2022 were published a few months in advance of the FES22, as shown in Figure 2 above. However, this was too late into the process of creating the FES22 to allow for final TYNDP material to be embedded into the FES22.

2.10 Overall, due to the time lag of including TYNDP data into the FES, the renewables growth projections for all European countries within the FES22 are more conservative in comparison to GB.

2.11 Upon consideration of stakeholders’ concerns regarding the modelling for Ireland, Ofgem considered it was reasonable to investigate the effect further. The FES22 assumes renewables growth in Ireland up to 2030 which matched Government ambitions in Ireland at the time. However, the FES22 assume very little further growth of onshore and offshore wind past 2030 in the I-SEM[12]. Onshore wind capacity in the I-SEM is also predicted to decrease slightly in the later years of FES22, going from a peak of 8.7GW of installed capacity in 2037, to 6.8GW capacity in 2050. This pattern does not occur for other European connecting countries, as shown in Figure 3. Therefore, the assumptions for the I-SEM are very conservative compared to other countries within the FES22.

2.12 For the I-SEM, the difference between draft TYNDP 2022 data and the final TYNDP 2022 data for the I-SEM is stark. This has a strong impact on results for our IPA modelling with GB being closely interconnected with the I-SEM as its immediate neighbouring market. In the final TYNDP data, renewables growth continues to occur in the I-SEM past the 2030s, as for other countries.

2.13 While investigating the FES22, Ofgem, Arup and NESO concluded that the background data for the I-SEM is likely a legitimate outlier within the FES22. Ofgem has determined upon investigation that it is necessary to amend the background data for the I-SEM. This is to bring it up to a level playing field with the way other countries were modelled, and to align with other data sources on Ireland built at the same time.

2.14 In addition to the concerns raised specifically on the I-SEM, respondents questioned the suitability of the FES22 for modelling France, as the FES22 projections do not accurately match data created by the French Government. After a cross-check of generation and demand data on France, we consider that the data for France within FES22 does not heavily diverge from other data sources, unlike the I-SEM case. Therefore, we decided it was not necessary to modify the background data for France.

2.15 There are multiple plausible scenarios for GB or European countries to meet their respective net zero targets, however, we maintain that the FES22 presents scenarios that are appropriate and fit for purpose for the analysis required to model interconnectors. When considering alternative data sources, creating bespoke scenarios based on specific countries' energy policy projections fell outside the scope and timing for this analysis, and the FES22 is already created from TYNDP data (and TYNDP is created from countries' energy policy projections). Creating bespoke scenarios for each country also opened the risk of

[12] The input data for Europe is visible publicly via the FES databook, available through this link [FES Documents | National Energy System Operator (neso.energy)]

unfair treatment in assessing projects, and we consider our chosen approach to be the most procedurally fair option.

2.16 In considering W3 IPA consultation responses, to maintain fair treatment of projects, Ofgem has not considered conducting model re-runs using any data made publicly available after the time at which the modelling methodology for the IPA was settled in August 2023. The exception for this is the constraint cost reduction factor, which has been applied equally to all projects, discussed in Section 3.

Choice of the FES22 as probable scenarios and overestimation of exports

2.17 Some respondents argued that Ofgem should have critically assessed the likelihood of the FES22 scenarios materialising and created a bespoke set of scenarios indicating Ofgem's view of probable futures. As stated in paragraph 2.6, respondents argue that the renewables growth projections in the FES22 for GB and European countries lead to an overestimation of GB's exporting potential through interconnectors. Respondents expressed scepticism at the scale of offshore wind buildout in GB and the development of other low carbon technologies in GB and suggested that the Leading the Way (**LW**) scenario is not probable.

2.18 The FES22 are informed by current policy targets for GB set by HM Government, and we maintain they are appropriate scenarios to use for the purpose of this analysis to understand the necessary scale of interconnector buildout to reach net zero (also see justification in paragraph 2.8). To test against a range of possibilities, the FES22 already contains the Falling Short scenario, which is included in this analysis, and this helps us understand the value of the applicant interconnectors in a future where GB does not meet its net zero targets.

French border capacity included in the interconnector baseline

2.19 The market and system impacts models contain all operational interconnectors connected to GB and interconnectors with existing cap and floor regulatory approval in the GB baseline, assessing the impact of the Window 3 and OHA applicant projects in addition to this baseline. Some respondents challenged the level of assumed GB-France interconnector capacity in the baseline, owing to the continued uncertainty of existing projects' regulatory route in France. At the time of starting the modelling, 14.4GW of capacity overall to GB had secured cap and floor approval, therefore, we maintain this was an appropriate projection to have used for the overall baseline in this analysis. Projects holding a cap and floor regime in principle are subject to IPA conditions and Ofgem may conduct an IPA revisit if it is determined these conditions have been breached.

Inclusion of unserved energy hours

2.20 Many respondents were not in favour of our chosen approach to quantifying security of supply. This assesses the interconnectors' ability to mitigate the occurrence of unserved energy hours, ie. periods in which supply and demand on the grid do not match. More detail on this approach can be found in the Market Modelling Report attached to the W3 IPA consultation[13]. More specifically, one of these respondents argued that the inclusion of unserved energy hours is an unusual analytical choice with unrealistic effects on market behaviour and predicted wholesale prices, which in turn affect the SEW results.

2.21 Respondents noted that the Capacity Market exists in GB[14] to prevent unserved energy hours from occurring, and the effects of this were not reflected in the market modelling. Arup's model does not assume other generation is dispatched to replace gaps, and therefore unserved energy hours occur.

2.22 The methodology for assessing security of supply, determined by our consultants at Arup, is derived from a method recommended in European body ENTSO-E's published guidance on conducting cost-benefit studies for network infrastructure projects[15]. The proposed methodology was presented to applicants in advance of the IPA modelling commencing, firstly through the needs case assessment Guidance document in July 2022[16], and then through engagement with applicants in summer 2023. No feedback was presented by applicants on this point at the time and, therefore, this was confirmed as our methodology. We consider that alternative suggestions of methods for calculating security of supply should have been proposed in the prior engagement with applicants before the methodology was settled.

Use of Marginal Additional and First Additional approaches

[13] See page 29 of the first attachment under this link Initial Project Assessment of the third cap and floor window for electricity interconnectors | Ofgem

[14] The Capacity Market was established in 2013 by HM Government to ensure sufficient reliable electricity capacity is available on reserve in moments of stress on the system. Generators compete in an auction to receive payment for remaining active at certain forecasted hours of high demand.

[15] See page 48 ENTSO-E 4th ENTSO-E Guideline for cost-benefit analysis of grid development projects (eepublicdownloads.blob.core.windows.net)

[16] Cap and Floor Third Application Window and MPI Pilot Regulatory Framework- Guidance on our Needs Case Assessment Framework | Ofgem

2.23 Some respondents questioned Ofgem’s choice to only use the Marginal Additional (**MA**) results for decision-making. MA includes all Window 3 and OHA projects together in the assessment, assuming all become operational. The individual impact of projects, where no other interconnectors become operational, is covered by the First Additional (**FA**) approach. Respondents argued that Ofgem’s minded-to position for Window 3 and the OHA Pilot makes the FA scenario more plausible than the MA. Some respondents also suggested that Ofgem should shortlist projects and conduct a re-run of the modelling, to mitigate the fact that MA and FA are two extreme ends of a range of possibilities.

2.24 We consider that relying on MA for decision-making is the most procedurally fair approach and also ensures the decisions we make are resilient and more accurately reflect consumer benefit.

2.25 Shortlisting projects to create an FA to MA ‘middle ground’ would have involved pre-emptively deciding projects’ suitability for a cap and floor regime, going against our stated assessment framework in advance of the opening of the window. We conducted a sense-check on the ranges of the figures in the market modelling going from FA to MA, and found that conducting a FA/MA mixture that put projects approximately in the middle of this range would not change the outcome of any project’s decision. Creating an FA/MA mixture for the system impacts analysis would also not have been beneficial for any project, as the FA contains higher constraint costs for all projects.

2.26 In addition, the FA case, by removing competitor projects, generally results in higher SEW attributed to projects, higher revenue projections, and higher constraint costs. If decisions were made based on FA results it is likely more projects would be selected for approval, and thus the real interconnector capacity constructed and its subsequent impacts would match the MA case. Therefore, it would be more reasonable to test projects under an MA case. Ofgem decided not to investigate this point further.

Unquantified benefits of interconnectors

2.27 Related to paragraph 2.20, respondents stated that the market model’s quantification of security of supply was too narrow in scope, and that the market modelling generally undervalues interconnectors by not quantifying several likely benefits of interconnection. Unquantified benefits listed include:

- Consumer savings incurred through interconnectors participating in the Capacity Market, displacing more expensive generation;

- Geopolitical benefit of intra-UK interconnection to Northern Ireland (NI) above interconnection to other markets;
- Cost of interconnection construction and operation in comparison to other flexibility technologies.

2.28 Additionally, it was stated that we did not:

- Test against an extreme scenario to be able to measure the benefit interconnectors bring in the event of security of supply or price shocks;
- Measure against a counterfactual comparing the cost of meeting flexibility and decarbonisation policy goals *without* interconnection, to the results *with* interconnection;
- Calculate interconnector revenue earned through interconnectors providing ancillary services and participating in the intraday[17] market.

2.29 Indicators and the methods for calculating them, were provided to developers firstly in advance of the window opening through the needs case assessment Guidance document[18], and later in advance of the modelling commencing via workshops. Some additional benefits of interconnectors were considered by Arup at the timing of the modelling workshops, such as ancillary service and intraday revenue, but later discounted owing to immaterial perceived value or technical complexity, this was clarified to developers upfront[19]. Arup have also clarified in the market modelling report which potential benefits of interconnectors they have considered out of scope for the modelling, such as competition benefits derived from the Capacity Market and SEW impacts related to trade on the intraday market[20].

2.30 We are aware that interconnectors provide security of supply benefit outside of the methodology within which we have tested that impact. There are case study examples shown through National Grid's real time data on operational

[17] Intraday trading of electricity refers to the buying and selling of power on the same day as its dispatch on the grid. It is a theoretical benefit of interconnectors that cannot yet be robustly tested, that interconnectors can switch flows and ramp up and down quickly compared to other technologies, and therefore would perform efficiently in the intraday market. All figures in this study come from day ahead trading, where capacity is secured a day before its dispatch. Intraday and day ahead markets are separate markets that run concurrently, therefore benefit from intraday trading would be seen as additional to benefits quantified in this model.
[18] See page 20 of the Guidance Cap and Floor Third Window and MPI Pilot Needs Case Framework (ofgem.gov.uk)
[19] See the 'methodology note' circulated amongst workshop attendees in August 2023, which was later published as Appendix C in the Market Modelling report attached to the W3 IPA consultation.
[20] See page 30 of the Market Modelling report attached to the W3 IPA consultation.

interconnectors, to show that interconnection provides the GB grid additional options for managing shocks in supply or price. However, this can be very difficult to value. For valuation of security of supply, we have used conventional methodologies.

2.31 As the cap and floor regime is awarded to interconnectors only, it was seen as outside of the scope of the analysis to compare the strategic benefit of interconnection to other types of technologies for generation, transmission or flexibility. Part of the purpose of the ICPR was to re-assess and re-establish the need for future interconnection, and the detail of the IPA is to consider the consumer benefit of specific projects that come forward to meet the already-defined strategic need for interconnection.

2.32 It is necessary to treat Northern Ireland separately from GB in parts of our assessment, although it is part of the UK. The island of Ireland is a separate electricity grid and market, energy policy is devolved, and Northern Ireland has its own utilities regulator. The operation of an interconnector to Northern Ireland would be the same as any cross-border interconnector. We maintain it was not necessary to assess interconnection to Northern Ireland differently to how we treat other interconnection projects. To fulfil our obligations for the Net Zero and Growth duties, we have presented net UK figures where necessary. Please see the section on LirIC, and paragraphs 3.14-17 for our consideration of interconnection to Northern Ireland in light of our Net Zero and Growth duties.

2.33 We maintain that the scope of quantified benefits remains fit for purpose for this decision.

Responses regarding system impacts modelling

Disparity in utilisation rates between models

2.34 Related to prior points in paragraph 2.6 on the perceived overestimation of exports from GB to connecting countries resulting from the FES22, some respondents argued that despite using the same inputs, there are material differences in the outputs between the market modelling and system impacts modelling. In particular, the utilisation rates of the interconnectors differed between models. The utilisation rate is measured by the proportion of an interconnector’s full capacity that is being used.

2.35 Utilisation rates in the market modelling ranged from 80-95% which some respondents believed to be unrealistically high compared to the system impacts model’s 48-87% estimations. Some respondents raised this point to question the quality of the modelling and the ability to compare the market modelling and system impacts results.

2.36 The difference in utilisation rates can be explained by the difference in assumptions regarding interconnector flow within the respective different software used by Arup and NESO. We confirm it has had no material effects on the results shown. The Plexos software used by Arup for the market modelling, assumes flows can occur on an interconnector when there is no price differential, a purist economic approach to modelling differentials between price zones. This is what has driven the high utilisation rates. However, the interconnectors are not earning revenue for the times at which this happens, so this effect is not reflected in the SEW results and cap and floor payment projections.

2.37 The system impacts modelling, conducted by NESO via BID3 software, does not assume a flow occurs when there is a very marginal price differential, reflecting the reality that trade across interconnectors is not automatic, but the price differential needs to be sufficient for a party to purchase capacity.

Disparity in flows between models

Figure 4: Net predicted flows of all interconnectors in FES22, extracted from NESO's FES22 report

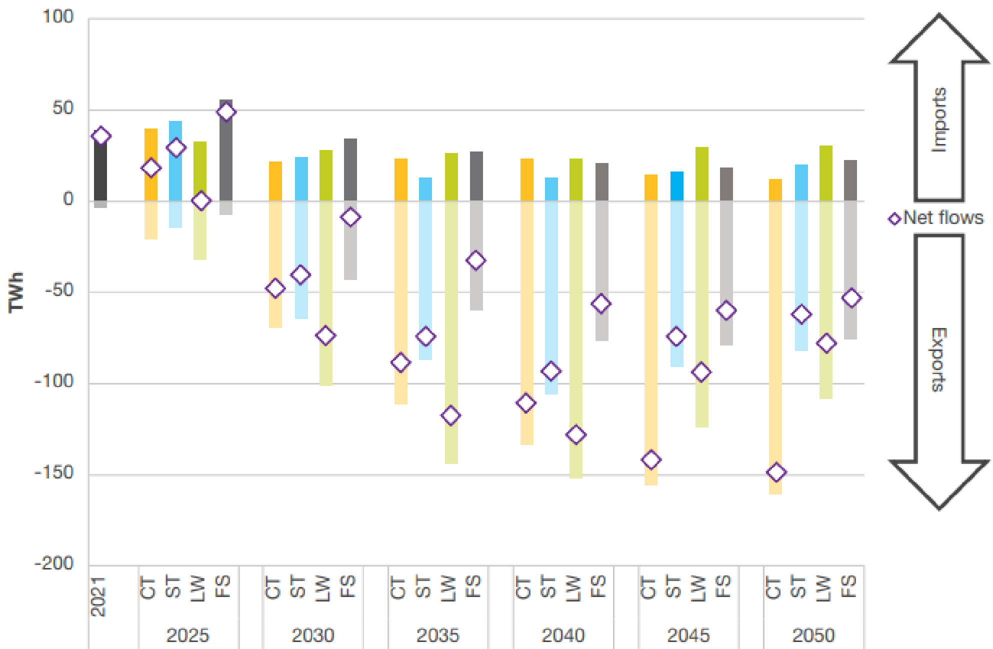


Figure 5: Flows on the Cronos interconnector, extracted from the market modelling report for the W3 IPA consultation

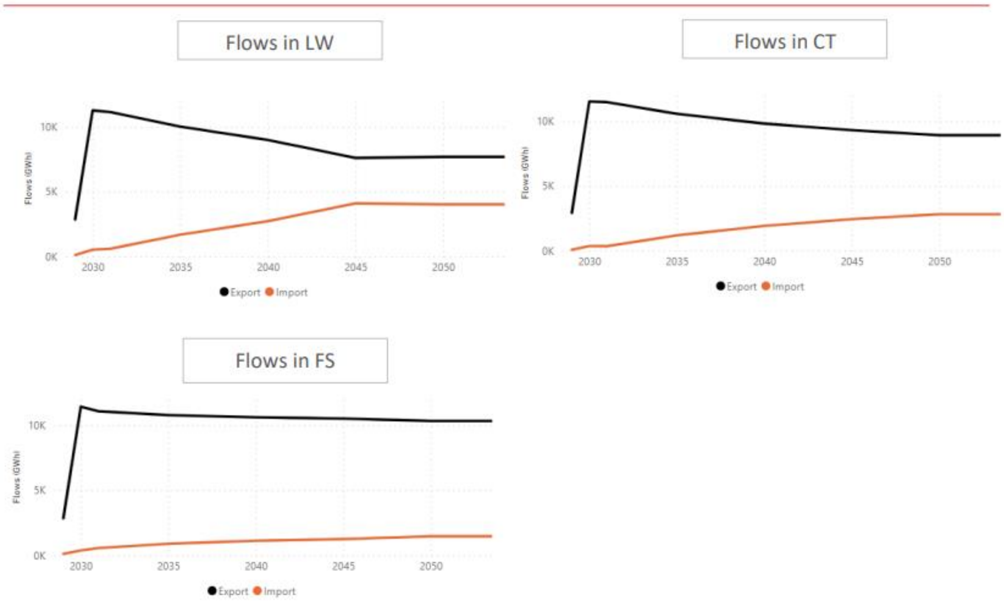


Figure 29 – Electricity flows across Cronos (black line: exports from GB, orange line: imports from Belgium) (GWh)

2.38 Some respondents also raised a point that the exact flow figures (volume and direction) of the applicant interconnectors, differ between models. The system impacts model has to extrapolate values beyond 2042. Respondents argued that because of this, the system impacts model does not capture the period of high imports seen in the 2040-2050 results in the market modelling. It was then argued by some respondents that the system impacts modelling further overestimates GB's likelihood of exporting, therefore inflating the constraint cost results.

2.39 The system impacts model only goes as far as 2042 due to the constraint cost modelling requiring a granular supply-demand background: this is only available for a 20-year forecast period within FES22. In the system impacts model after 2042, results are extrapolated, whereas the market model stretches to 2055. Therefore, some respondents view the Arup model as a more accurate prediction of an interconnector's operation, and have requested NESO's analysis to be re-run with Arup's flow predictions coded into NESO's work.

2.40 Ofgem considers that the flow difference is not material. Both models agree that the applicant interconnectors are predominantly exporters, even if the flow ratios do not match exactly. The period of high imports in 2040-2050 in the market modelling is only observed in the Leading the Way scenario, and even in this timeframe, projects export more than they import.

2.41 We cross-checked the results across all years and scenarios and determined there are more times in which the models agree on flow direction compared to when they disagree. Lower constraint costs would likely be seen, however only a small reduction. If NESO's work was to be re-run with Arup's flow ratio, it is unlikely the outcome on projects would change materially. Doing this work would have been costly, time consuming, and would have undermined the model consistency in NESO's work, for little additional benefit. We did not consider this point further.

2.42 The charts above show 1) the net predicted flows of interconnectors within FES22, which demonstrate that across the scenarios, there is only a small increase in imports in 2045-2050, 2) an example of the flows on one assessed Window 3 project Cronos, which show only a limited increase in imports in the years 2045-2050 in the Leading the Way scenario.

Disparity in choice of weather years

2.43 Following the modelling workshops the intention was for both Arup and NESO to use the same weather years in their analysis. The agreed methodology outlined using three weather years. However, during the course of the analysis, NESO communicated that it was unable to use the three weather years 1990, 2007 and 2010, as NESO found that the 1990 weather year produced results that were not credible. NESO explained that this may have been because the temporal resolution of the older weather year data was less granular than the later weather years, which may have caused errors on the output.

2.44 NESO communicated that it would use only one weather year, 2013, in its analysis, noting that this is the weather year used in much of its modelling. NESO also explained that the reinforcement background used for its analysis was based on using weather year 2013. Therefore, using an average of 1990, 2007 and 2010 would have resulted in an inconsistency of its analysis outcomes.

2.45 Arup was unable to align its own analysis to the 2013 weather year as it had already largely completed its work by the time this information became known.

2.46 Since the weather years are no longer aligned, there are differences across both sets of modelling output, including the underlying interconnector flows and wholesale prices. Therefore, we considered it inappropriate to combine the results. The consequence of using different assumptions is that it was no longer possible to obtain an "Aggregate SEW" which would have required combining both ARUP's and ESO's data.

2.47 We note that our original intention was to use the Aggregate SEW as a metric to short-list projects, and after that, carry on detailed analysis on the individual indicators of our multi-criteria assessment. Since the Aggregate SEW was never intended to be our final decisional tool, the lack of it does not affect the outcome of our decision.

2.48 We also stress that the divergence in assumptions does not mean that the modelling results cannot be used to inform our decision making. Both sets of analysis remain internally consistent and all projects have been treated in the same way by NESO and ARUP.

Responses regarding Ofgem's decision making and use of analytical data from third parties

Addressing future changes to the GB network

2.49 Several respondents raised the argument that the estimated constraint costs do not account for future changes to the GB network, and they questioned the likelihood that the full projected constraint cost impact of projects would materialise. These respondents further argue that high constraint costs should not be interpreted by Ofgem as consumer disbenefits, but rather as a signal that network reinforcement by National Grid is required.

2.50 They suggest different future policies or projects that would reduce or eliminate the constraint cost assigned to the interconnectors. The two main solutions raised are the Government's proposed introduction of zonal pricing[21] and the inclusion of further network reinforcement that has been recommended through NESO studies such as Beyond 2030[22].

2.51 After cap and floor approval, NESO includes interconnectors into the wider modelling to determine the need and costing for network reinforcement. Respondents have also queried if it is possible for NESO to provide a mapping and costing for how much network reinforcement it would take to mitigate the constraint costs of projects. NESO do not conduct this work ad-hoc for specific projects but rather holistically, considering the GB network as a whole. In other words, NESO has provided us with the constraint costs of adding the interconnector projects to the network, if no other reinforcements (other than

[21] Review of electricity market arrangements (REMA): second consultation - GOV.UK (www.gov.uk)

[22] See also on this link a separate Beyond 2030 report for interconnectors Beyond 2030 | ESO (nationalgrideso.com)

those already planned) were completed, but not the costs of the reinforcements to relieve those anticipated additional network bottlenecks. This remains a natural limitation of our analysis and was addressed in Section 3 of the W3 IPA consultation.

2.52 We acknowledge that future changes on the network could affect the constraints of each project and that the NESO's modelling report indicates that constraint costs provide a signal for the need for further network reinforcements, or non-network solutions.

2.53 It remains unclear how, when or if zonal pricing would be introduced in GB. Ofgem cannot take into account inchoate policy into our decision-making process.

2.54 Network planning commitments were outlined by NESO in their Beyond 2030 work after the modelling for Window 3 was conducted. To include these commitments in the modelling now would compromise the analytical quality of the model, as the Beyond 2030 analysis used FES23 as its basis, and the IPA modelling used the FES22.

2.55 In considering all the issues above, we conclude the following. High constraint costs are a system-wide issue not specific to interconnectors, and we cannot ignore the impact of a project which exacerbates this increasingly prevalent cost to the GB network. However, we agree in principle with respondents that it is possible that a network-wide intervention may be implemented to mitigate the full constraint costs projected across the network from materialising. To account for this possibility while remaining agnostic to which specific solutions are implemented, we have chosen to apply a reduction factor to the constraint costs in the later years on these Window 3 projects, detailed in paragraphs 3.22-3.25.

Aggregate SEW

2.56 Applicants remarked that Ofgem's decision was not based on the Aggregate SEW, which involves combining all monetisable benefits in both the market modelling and system impacts modelling, as Ofgem originally stated. They argued that if a decision was made on the basis of Aggregate SEW, projects would be approved as the Aggregate SEW value of their project would be positive.

2.57 As stated in our W3 IPA consultation document, following discussion with applicant developers in the modelling workshops in 2023, we originally sought to use Aggregate SEW as an indicator in our decision making. However, when reviewing the outputs of the modelling, and understanding the differences between the modelling approaches taken by NESO and ARUP, we determined that aggregating the results was no longer appropriate. The differences are mainly due to the Arup and NESO models being built in different software, using different approaches to modelling the years after 2042, and using different weather years (see discussion in Section 2.43-48 and in Section 2.38-42). We sought to have the inputs of the models align as closely as possible, but we were unable to find mitigations for the above differences with the resources and in the analysis time we had available. The modelling differences mean it would not have been analytically robust to simply aggregate the results in the way originally intended.

Societal value of carbon

2.58 A respondent argued that the market modelling contained multiple methods for measuring the carbon emissions impact of projects, and by contrast the W3 IPA consultation selectively presents only one measurement. The respondent argued that by presenting only the measurement in tonnes, we overlook the high value visible in the societal cost of carbon indicator for applicant projects. Additionally, by not presenting values for all indicators, we deviate from our stated assessment framework for projects in the July 2022 Guidance.

2.59 We maintain this is not a departure from our stated assessment framework. Our Window 3 assessment framework is not weighted. The societal value of carbon[23] is only one metric for assessing carbon impact contained within our framework and we have opted to use only the measurement in tonnes for decision-making.

CION

2.60 The Connections Infrastructure Options Note (**CION**) is created by NESO at the time a project applies for a connection agreement[24]. The CION is a comparative assessment conducted by NESO and transmission owners[25], to assess suitable connection locations for the project, based upon a select list of locations that the developer has indicated it would like to be considered for.

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[23] For clarity, there are three metrics which Arup used to measure carbon impact. Measurement in tonnes gained and removed, the market value of carbon, and the societal cost of carbon. The market value refers to the monetisable cost of carbon determined by the EU Emissions Trading Scheme. The societal cost of carbon is derived from a methodology in the HM Government Green Book and quantifies the cost of incremental units of carbon on all costs and benefits affecting the wellbeing of the population. Societal cost of carbon is a UK-defined metric showing the cost of carbon on the UK population and economy, and therefore figures for connecting countries in Arup's market modelling for this indicator could not be derived. Carbon valuation - GOV.UK (www.gov.uk)

[24] 43631-Connection and Infrastructure Options Note (CION) Process Guidance Note - Issue 003.pdf (nationalgrid.com)

[25] In GB these are National Grid Electricity Transmission, Scottish Power Transmission, and Scottish and Southern Electricity Networks, depending on area in GB.

2.61 The CION is the first point at which the constraint cost impact of the project is assessed by NESO and known to developers. For the IPA, we run our own constraint cost assessment with NESO which is wider in scope (extending to each project's whole GB impact). The assessment created as part of the CION extends only as far as the relevant area in which the assessed substation is located[26]. Therefore the differing geographical scope of the CION and the IPA constraint cost assessment renders them incomparable.

2.62 Through consultation responses, developers noted that the more recent constraint cost projections for their respective projects differ significantly to what was assessed at connection application stage through the CION. For most applicant projects to Window 3 and the OHA pilot scheme, there is an approximately eight-year gap between projects obtaining connection agreements and applying to a cap and floor window. The reality is that significant amounts of grid development and future system planning have occurred within that time, driving the difference in results.

2.63 Some respondents suggest that Ofgem should disregard the more recent constraint cost analysis, and instead use the results that were shared with developers through their respective CIONs. We do not consider this appropriate as it does not reflect the current state of the grid. We now have access to more up to date information which changes the picture materially since the CION process and that should not be ignored. We address this further in paragraphs 3.18-3.21.

Treatment of consumer and producer welfare

2.64 A respondent argued that although total SEW benefit to GB was positive among most projects, GB consumer SEW was negative and therefore this should count against the project, as consumer SEW should be the deciding figure. The respondent also notes that a project should only be compared to today's circumstances and wholesale prices, and forecasts should not be used to determine its impact.

2.65 Ofgem considers that total SEW is the best metric for decision-making as it shows a way of capturing some of the so-called 'wider' benefits of interconnectors. For example, it shows the benefit brought by exporting, which materialises within the modelling to some extent as producer SEW. Accounting for total SEW also

[26] For grid management purposes, GB is split by NESO into 17 zones.

ensures we are meeting our obligations under the Growth Duty. Projects being approved for cap and floor today will also not be operational until the early 2030s, when the energy system is projected to look different than it is today, therefore it is analytically robust and reasonable to use forecasting.

2.66 The respondent also identified that although GB producer SEW was positive, when accounting for the foreign ownership of assets the producer SEW is much reduced. In an open, liberalised, market economy, any licensed business is entitled to enter the GB market in the same way as British companies are able to enter the markets of other nations. Ofgem does not consider the national ownership status of producers in GB. Potential methods for sharing producer surplus with consumers, such as through taxation, is beyond the scope of Ofgem’s powers.

Decision conflicting with outcomes of the Interconnector Policy Review

2.67 Respondents raised that they consider the minded-to position to be in conflict with the ICPR by over-relying on the SEW as a measure of interconnector value and not placing enough attention on the wider benefits of interconnection.

2.68 Ofgem expanded the assessment framework for this window to respond to the needs of the ICPR. This window goes further than previous windows in quantifying carbon impact, security of supply impact, avoided curtailment and value brought by interconnectors’ participation in ancillary services. Indicators and the methods to calculate them were agreed upfront with applicants, see paragraph 2.23.

2.69 Additionally, if the security of supply and decarbonisation indicators were to be more heavily weighted than the SEW, we consider that this would not materially impact the overall IPA result for any project. Emissions savings, avoided curtailment, security of supply, and ancillary service benefits, were modest figures when comparing to the more traditional indicators of value such as SEW and constraint costs. We consider that we have balanced our assessment of indicators in a fair way.

Responses regarding Ofgem’s maturity assessment

Early stage nature of applicant projects

2.70 Some developers questioned the standards we used in the maturity assessment, which they perceived as being too high. Respondents noted that holding a cap and floor regime in principle is what leads to positive progress for a project in the indicators reviewed during the maturity assessment.

2.71 In the Application Guidance for this window, Ofgem stated the need for mature, later stage projects to apply for cap and floor approval, to mitigate the risk of delays to construction seen in previous windows. When considering whether to grant consumer financial support to an essential infrastructure project, it is important to consider fully the preparedness of the developer and deliverability prospect of the project. We maintain this is an appropriate standard. Holding a cap and floor regime to enable a project to progress further in its development is circular and is not an indicator of maturity.

Treatment of hard to monetise indicators

2.72 Respondents often expressed concern and asked for clarification over how Ofgem uses hard to monetise indicators in its assessment. Responses from the general public and campaign groups questioned if this assessment goes far enough in assessing a project's environmental impact. Another respondent stated that Ofgem should not view the existence of public opposition to projects as a hard to monetise impact that would count against a project's maturity rating.

2.73 As explained in Section 3 of the W3 IPA consultation, the maturity assessment helps Ofgem understand the progress and preparedness of applicants in meeting their stated connection dates. By scrutinising applicants' business plans and progress made prior to applying for a cap and floor regime, we can understand if an applicant project is capable of delivering the project to its stated connection date.

2.74 The hard-to-monetise impacts component of the assessment is high level in its nature. Projects are not expected to have completed the planning and consenting stage prior to applying for cap and floor regime, and Ofgem is not involved in the planning process. We acknowledge that applicants will have often not yet begun this process, and decisions and related studies will be conducted by the relevant authorities, with the opportunity for stakeholder engagement directly on those issues at that time. Applicant developers are expected to present plans, strategies and progress related to the hard to monetise indicators within their business plans, to show maturity and preparedness and to justify their project plan timeline.

2.75 However, where a project has begun a process in one stage of its development and has faced blockers or rejections, it is important for Ofgem to be made aware of these by the applicant, to understand how the applicant intends to respond.

2.76 Where opposition groups have responded to the W3 IPA consultation, they have raised the existence of hard to monetise impacts related to the project, which applicants may not have disclosed in their applications for a cap and floor regime. Therefore, these stakeholder responses can be investigated and considered to be material evidence to be added to our assessment of applicants' business plans.

Responses regarding Ofgem's Statutory Duties

Compliance with net zero duty

2.77 Some respondents questioned if the minded-to position was consistent with Ofgem's Net Zero Duty. They argued that interconnectors in a general sense are beneficial to the achievement of net zero, and therefore by not approving a sufficient number of projects, Ofgem may not be fulfilling this duty. Similarly, respondents noted that some rejected projects had strong results specifically in the emissions saving section of the IPA and questioned why these projects had then been rejected.

2.78 A respondent also pointed out that this duty is UK-wide and Ofgem did not give due consideration to the cost of Northern Ireland achieving net zero targets either with or without another interconnector between Northern Ireland and GB. The respondent argued that through intra-UK interconnection, Ofgem could maximise domestic UK resources to reach net zero.

2.79 In principle, with regard to the Net Zero Duty, interconnectors can provide the following benefits to GB:

- **GB direct carbon impact through imports.** Expanding interconnection is strategically beneficial as it could help reduce carbon emissions directly, by allowing for diversification of our energy supply through trading low carbon resources with other countries.
- **GB growth in low-carbon generation through exports.** Expanding interconnection could encourage the growth of GB's domestic wind energy resources through providing export opportunities, and make operating a low-carbon intermittent grid more manageable. These enable the growth of low-carbon generation in GB, further reaching the net zero carbon target.

2.80 Carbon reduction anywhere in the world is beneficial to GB. All of the applicant interconnectors contribute to positively reducing emissions overall, which reflects the contribution that GB interconnectors are making to net zero targets globally. However, as most of the applicant interconnectors are projected to export, the increase in the GB wholesale price that would result is sufficient to increase gas-fired generation in GB and thus increase GB emissions.

2.81 Our IPA process seeks to balance the positive impact of interconnection globally on decarbonisation and the impact of prominently exporting interconnectors on GB emissions. We consider that our decision fairly balances the emissions results shown for assessed projects with the other indicators in our assessment. Our model predicts that GB exports surplus wind power when prices are near zero and there is no gas-fired power on the system. However, the overall increase in effective demand from the connecting countries in our model is sufficient to raise GB wholesale prices sufficiently to trigger dispatch of peaking gas plant in some periods.

2.82 To ensure that our analysis was consistent with the UK-wide scope of the Net Zero duty, we split the emissions figures for the I-SEM to obtain a Northern Ireland figure that could be added to GB's to understand the net UK emissions impact of the applicant projects. More detail on this can be found in Section 3.

Compliance with growth duty

2.83 As noted in paragraph 1.17, Ofgem also has a Growth Duty in place. Having regard to the Statutory Guidance under s.110(1) of the Deregulation Act 2015[27], we have decided to support projects that promote environmental sustainability, contribute to efficiency gains, improve network infrastructure and drive future investment. This is supported by our maturity and deliverability assessment, economic cost-benefit analysis, and our analysis on network impact.

2.84 Expanding interconnection could generate economic growth through its contribution to security of supply and export of surplus green power. By 2035, the UK is expected to be an exporter of electricity. There is a major opportunity to grow and develop this industry and related skills, building on the comparative advantage conferred by the UK's natural resource base in offshore wind. Expanding interconnection will be necessary to enable exports to trading partners.

[27] final_growth_duty_statutory_guidance_2024.pdf

2.85 Our existing assessment of SEW, which includes producer SEW, is a reliable proxy indicator for a project's impact on economic growth. However, many projects which show high SEW values have deliverability challenges. This signals that, theoretically, the project would be beneficial but may be unlikely to overcome deliverability challenges. In other cases, positive market impacts are offset by constraints in moving energy around the system.

2.86 To ensure that our analysis was consistent with the UK-wide scope of the Growth duty, we split the welfare figures for the I-SEM to obtain a Northern Ireland figure that could be added to GB's to understand the net UK welfare impact of the applicant projects. More detail on this can be found in Section 3.

2.87 By only approving projects that are sufficiently mature, we are decreasing the risk of non-deliverability, with the aim of focusing resources on projects that are deliverable within the connection deadline for the Window. As such, the projects we are approving may create a realistic opportunity to contribute to economic growth and protect consumers from undue delays which is ultimately in consumer interest. For the projects awarded in principle a cap and floor regime, this award is subject to IPA conditions, which provide us with the ability to intervene if a project changes materially after being awarded in principle a cap and floor regime, for example if the project is no longer deliverable to specified timelines.

2.88 Similarly, by only approving projects that have positive SEW, and that do not incur disproportionate constraint costs (which is paid for by consumers), we are acting in the interest of consumers while promoting economic growth.

Responses regarding procedural fairness

Consideration of applicant-submitted cost-benefit analyses

2.89 As part of the Application Guidance, we stated that as an optional but recommended part of the IPA submission, applicants should submit a cost-benefit analysis for their own project. Some applicants questioned why developer-submitted studies have not been considered as part of the decision or used to cross-check the work conducted by Arup.

2.90 Our use of applicant-submitted studies is consistent with our stated assessment framework in the Application Guidance. The option to submit these studies was provided to allow applicants to present their own methodologies and usage of scenarios. These were used as inputs to the modelling workshops with applicants in summer 2023 to inform the methodology of Ofgem's own analysis conducted by Arup. There was no further proposed use of applicant-submitted studies.

2.91 Applicants' studies cannot be substituted for Ofgem's own analysis in coming to a final decision on the needs case of a project. The models provided by developers consider their own project in isolation and each uses their own often differing input assumptions. It is necessary to assess the impact of all projects together and with common baseline assumptions to understand their impacts.

2.92 Arup did review the applicant-studies before starting their own modelling, and a summary of their findings is within the market modelling report under Appendix D.

Hourly data

2.93 A respondent stated that the data provided through the market modelling and system impacts report was not sufficiently granular. The respondent requested Ofgem to provide the results for the market modelling and system impact modelling on an hourly scale.

2.94 We received several requests from applicants to provide additional data during the consultation stage. The stated purpose behind many of these requests was to create replica models of Arup and ESO's work by which to test their quality. To respond fully to these requests, we circulated two data books among applicants. These included 1) annual results for all projects for both the system impacts and market modelling, 2) annual constraint costs by boundary for all scenarios, 3) system marginal prices, 4) annual raw PLEXOS outputs for the market modelling. Ofgem determined this was sufficient to enable full response to the consultation and make the market modelling conducted by Arup replicable.

2.95 The NESO's model is not fully replicable as it contains NESO proprietary data which cannot be shared outside the NESO. To derive value from viewing the hourly data for the system impacts model, this requires also sending hourly data on bid and offer prices by plant. Forecasted bid and offer prices in NESO's model is NESO's proprietary data which cannot be shared outside NESO. Only the NESO's high level bid/offer assumptions are in the public domain. Arup and NESO only used hourly-scale data to create aggregated annual values, and this data was not necessary to scrutinise to arrive at our conclusions on projects' assessment.

2.96 There are additionally further administrative barriers to providing hourly data to applicants during the consultation stage. Extracting hourly data for two sets of modelling, with several indicators, countries, and modelled over a period of 25 years, translates into millions of data points for each individual indicator in the modelling. It would also have required creating a bespoke platform by which to store data and transfer it to multiple stakeholders. We consider this would have taken time beyond the consultation window to prepare, for no added benefit to consultation respondents.

Developer engagement

2.97 A respondent argued that Ofgem has not engaged sufficiently with applicants following completion of the modelling reports by Arup and NESO, and that applicants had the expectation they would review such reports before publication. Building on experience from previous windows, Ofgem has sought to improve the application process by building in open communication and engagement, for example by introducing a developer workshop stage to determine the modelling methodology based on input from all applicants. It was not a stated part of our process, that the developers of applicant projects would be provided with the reports by NESO and Arup for review prior to publication. By applying to a cap and floor window, each developer knows how they will be assessed in line with the Application Guidance and the August 2022 assessment framework, and that a consultation with results will be published thereafter, without further applicant engagement. Ofgem reserves the right to publish a minded-to rejection with results for any applicant project, without further engagement beyond due consideration of stakeholders' responses to the consultation.

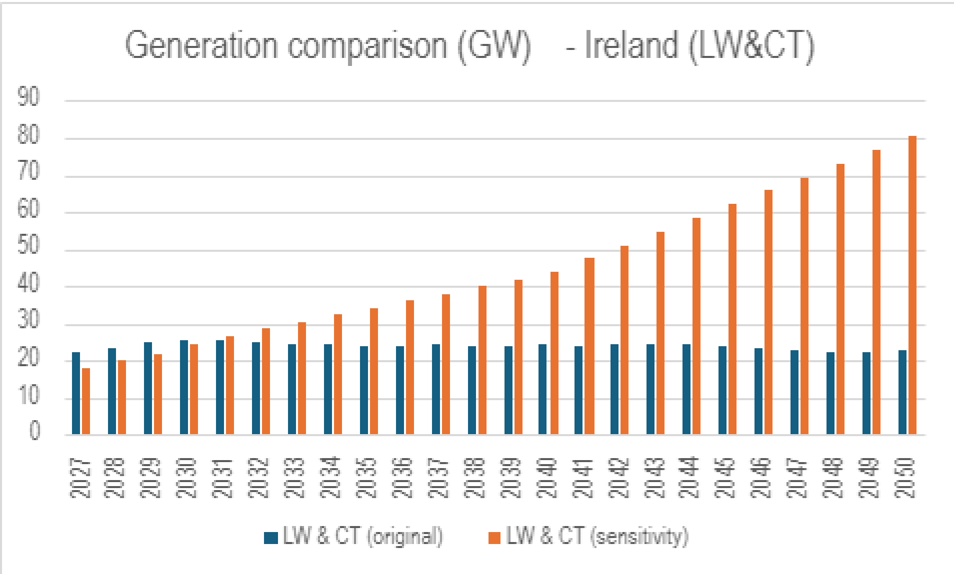
3. New analysis conducted since the March 2024 consultation

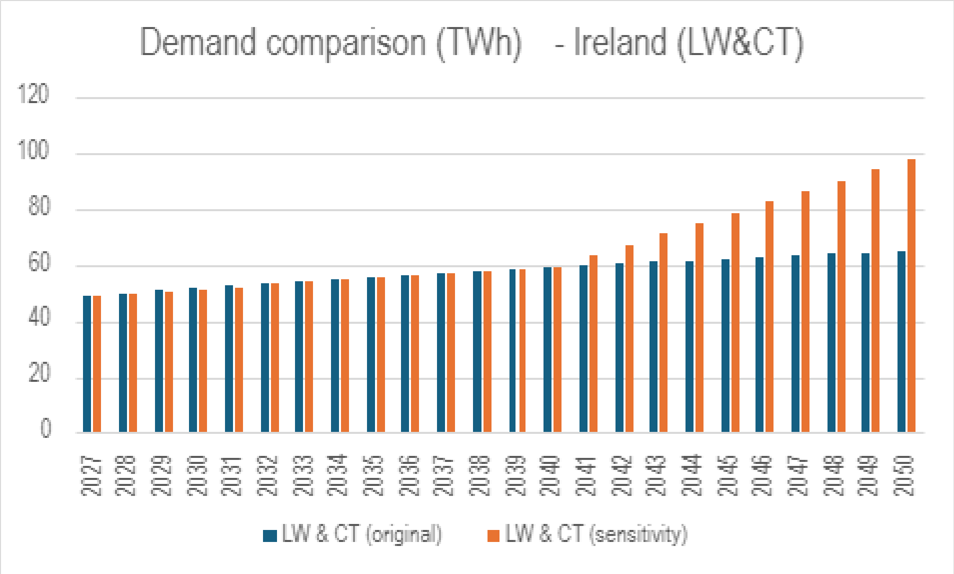
Market and system impacts model re-run

3.1 We decided to re-run both Arup's market model and the NESO's system impacts model to address stakeholder feedback. The following changes were implemented in the re-run for both models.

Changes to generation and demand assumptions for the I-SEM using Ten Year Network Development Plan (TYNDP) 2022 data

Figures 6, 7, 8, 9: Demand and generation comparisons for the I-SEM between original IPA analysis and re-run




Demand comparison (TWh) - Ireland (LW&CT)
120
100
80
60
40
20
0
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
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2046
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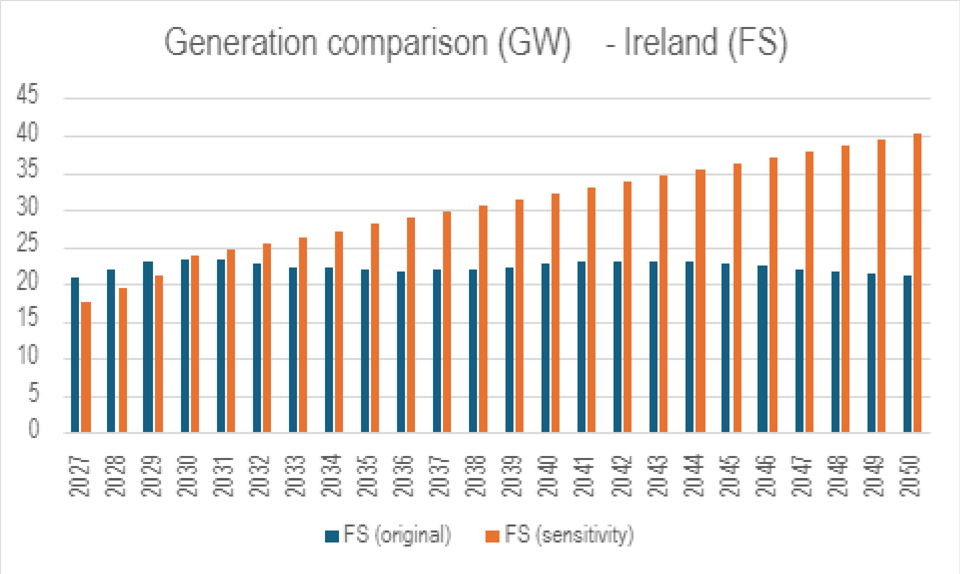
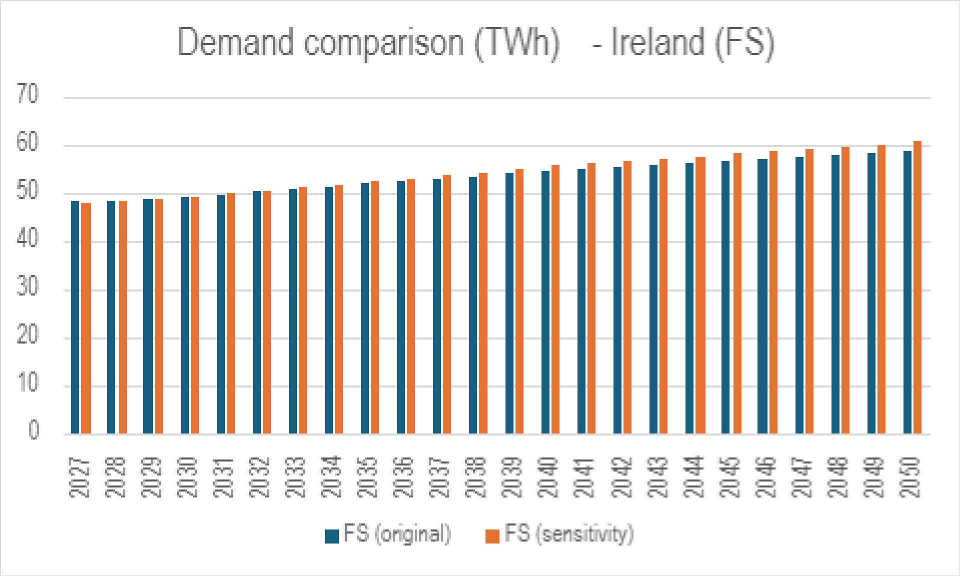
2048
2049
2050
LW & CT (original)
LW & CT (sensitivity)


Generation comparison (GW) - Ireland (FS)
45
40
35
30
25
20
15
10
5
0
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
FS (original)
FS (sensitivity)


Demand comparison (TWh) - Ireland (FS)
70
60
50
40
30
20
10
0
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
FS (original)
FS (sensitivity)

3.2 Following stakeholder feedback to the W3 IPA consultation, and a further investigation of the European FES22 (discussed in paragraph 2.11), we chose to re-run the market modelling and system impacts modelling for all projects, with the FES22 data for the I-SEM only being replaced with I-SEM data from TYNDP 2022. This re-run has been used to replace the original modelling for final decision-making.

3.3 This method is justified for the following reasons:

- The FES22 do not assume renewables capacity growth in the I-SEM past the 2030s whereas other countries within the FES22 do continue to build their renewables capacity to reach net zero. We consider this to be an outdated projection that does not match real policy ambition in Ireland, and it has a high impact on our IPA modelling as it shows a particularly conservative outlook for the I-SEM compared to other European countries and GB, impacting the market behaviour of interconnectors between GB and the I-SEM. This re-run brings the data for the I-SEM on a level playing field with the way other countries and GB were modelled, and ensures projections for Ireland are broadly aligned with real policy targets.
- It does not update our data beyond what would have been possible at the time of creating the IPA modelling, making sure every indicator is comparable and that no country or project is unfairly advantaged.

3.4 Although there are multiple plausible views on GB and Europe's ambition and progress to achieve a net zero grid, correcting for the I-SEM in this way ensures the level of progress and ambition is realistic. We consider the initial assumptions on Ireland in the W3 IPA consultation to be outdated, because of the significant divergence of the I-SEM's results compared to other markets in our initial IPA analysis, and compared to policy commitments in Ireland made at the time.

3.5 The charts above compare the difference between the demand and generation projections for the I-SEM from the original IPA analysis using the FES22 to the additional scenario that uses the TYNDP 2022 data.

3.6 This scenario was applied to both the market modelling and the system impacts modelling in combination with other changes detailed below. This had the effect of changing the SEW, emissions and constraint cost results for all assessed projects.

France-Ireland (FR-IE) notional interconnector removed

3.7 One respondent noted that the interconnector baseline for Europe within the FES22, contains a notional FR-IE project beyond the already-in-construction

Celtic interconnector, which is assumed to connect in the 2040s. The respondent suggested this should be removed as it does not represent a real project under development.

3.8 To create a consistent I-SEM TYNDP 2022 rerun, the baseline must also match that of the TYNDP 2022. As a result, in our additional analysis, the notional FR-IE interconnector has been removed.

Nautilus OHA IPA re-consultation changes

3.9 During the consultation period, we received evidence of material changes to the assumptions used in the modelling for the applicant OHA pilot project, Nautilus. Nautilus was originally modelled with a 3.5GW Line 2 capacity, and Ofgem was aware at the time of modelling this was subject to change pending a public consultation on the Princess Elisabeth Island in Belgium. Line 2 capacity has now been confirmed by authorities in Belgium as 1.4GW after the consultation’s conclusion. In addition, a cost and revenue sharing arrangement between GB and Belgium for Nautilus has now been settled.

3.10 To reflect the nature of these changes, in our re-run of the market modelling and the system impacts modelling, we have assumed Nautilus has a 1.4GW Line 2, and in the market modelling we have used the new cost and revenue sharing arrangement.

3.11 The Window 3 and OHA projects have been assessed together in the same quantitative modelling. Therefore the change in configuration of Nautilus affects results for all projects. The exact values of SEW and constraint costs change for all projects. However, the impacts on SEW are not material and does not affect our decision outcome for any Window 3 projects.

3.12 More detail on the Nautilus changes can be found in the OHA pilot scheme decision document.

Changes relevant to the market model only

Moyle and EWIC ownership assumption

3.13 Respondents raised that an error was made in the market model in its cost and revenue sharing assumptions for existing projects. All existing projects were assumed to have a 50:50 split in cost and revenues between GB and the connecting country, however existing I-SEM interconnectors Moyle and EWIC are 100% owned in the island of Ireland.

3.14 This was determined as an oversight that required correction. The new analysis presented below assumes that Moyle and EWIC are 100% owned in Ireland. This change has the effect of raising the interconnector SEW portion of the total SEW calculation for MaresConnect and LirIC. This has an impact on the cost and revenue sharing for these projects in GB which in turn has an impact on the revenues of other interconnectors in GB. When implementing this change to the original analysis at minded-to stage only as a test, it was found to increase the total SEW of MaresConnect and LirIC by £0.2-0.5bn depending on the scenario, meaning the projects would be positive in the FA case and remain negative in the MA case.

Northern Ireland split of welfare and emissions figures

3.15 During the IPA process, Ofgem has acquired two new statutory duties related to net zero and economic growth (See our commentary in paragraphs 2.77-87). These are duties that require us to have regard to impact across the whole of the UK and not only GB.

3.16 To enable a view of the net UK impact of projects, we have split results for the I-SEM SEW and emissions savings between the Republic of Ireland and Northern Ireland. Using the Northern Ireland figure we have then derived a net-UK figure for SEW and emissions on all projects.

3.17 The population and energy demand of Northern Ireland is approximately 20% of the island of Ireland, therefore, we have taken 20% of the I-SEM SEW and emissions figures we hold from the market modelling and attributed this as SEW and emissions to Northern Ireland. We have used our existing data on SEW as a proxy for quantifying impact on economic growth.

3.18 The results shown in LirIC and MaresConnect's sections of this decision show net-UK figures where relevant. In summary, we are satisfied that the projects connecting to the I-SEM show a positive emissions impact and positive net SEW on a net-UK level as well as for GB only.

Onshore costs

3.19 In the Guidance on our Needs Case Assessment Framework from July 2022, we said that in the IPA process, we were going to use the developer costs stated in each project's Connections Infrastructure Options Note (**CION**) to understand the costs of connecting the project to the national transmission system and the wider reinforcement costs.[28] We stated in paragraph 3.64 of the W3 IPA consultation that these costs from the CIONs of all applicant projects are now outdated because they do not reflect changes to the network resulting from the Holistic Network Design[29] (**HND**) and other recent planning processes.

3.19 We have received updated numbers from the relevant TOs. The costs solely attributable to the applicant projects are no higher than £20 million for any one project and we do not believe they represent an obstacle to the progression of projects in our regulatory process.

3.20 In addition to the sole driver works that are attributable to the interconnector, there are also network reinforcements that are driven by several projects. This is the first cap and floor window taking place at the same time as a strategic network planning exercise, the HND and Beyond 2030[30]. We are confident that the majority of the costs related to these multi-driven works are attributable to offshore wind farms as part of the HND, and not the interconnectors.

3.21 As projects progress through our regulatory processes, we reserve the right to consider all projects' attributable network costs in any future assessment.

Changes relevant to the system impacts model only

Constraint reduction factor

3.22 Reflecting on W3 IPA consultation feedback noted in paragraph 2.49, NESO applied a reduction factor to constraint cost results from 2035 onwards across all projects. This reflects the most probable future that nationwide interventions to reduce constraint costs would occur on the system before 2050, without assuming a particular solution. The details of such solution would be uncertain and problematic to model in detail, and it would go beyond the scope of our analysis.

3.23 The constraint reduction factor methodology developed by NESO is based upon the network reinforcements recommended in its latest system planning exercise 'Beyond 2030'.[31] The methodology compares the recommended total network constraint savings to the total cost of the recommended reinforcements. This

[28] Cap and Floor Third Window and MPI Pilot Needs Case Framework (ofgem.gov.uk)
[29] A Holistic Network Design for Offshore Wind | National Energy System Operator
[30] Beyond 2030 | National Energy System Operator
[31] Beyond 2030 | National Energy System Operator (neso.energy)

provides a fixed percentage for each scenario that can then be applied to discount the constraint cost results of our analysis.

3.24 The reduction factor incorporates the most up to date effects of recommended reinforcements necessary to the system to reduce constraint costs beyond 2030. However, NESO deemed appropriate to only apply the constraint cost reduction factor from 2035. This approach was followed to reflect potential limitations that transmission owners (**TOs**) might have in delivering additional reinforcements in the early years of the decade.

3.25 More details on the methodology used by NESO can be found in the report published alongside this decision.

Discussion on the interpretation of constraint costs

3.26 In our ICPR decision, we stressed the increasing importance of the impacts of interconnectors on the electricity system. We noted that the role that interconnectors were playing was evolving and we could no longer automatically assume future interconnectors would have a positive impact on consumer welfare. In recognition of this changing role and the increasing need to ensure the entire system is working efficiently, we intended to target Window 3 geographically based on system impact analysis, market signals and project deliverability.

3.27 In our August 2022 targeting document,[32] we decided not to apply locational targeting to Window 3. However, our key takeaway from the targeting analysis was that future interconnector projects could either result in savings to constraint costs, or incur high additional constraint costs, depending on their flow direction and where they are located in GB. In particular, exporting projects in the south of the country were expected to have substantial constraint costs. We concluded that a project's whole-system impacts would be considered to a greater extent throughout our IPA.

3.28 Our final IPA results confirm that, with the exception of the Irish projects, we can expect the W3 and OHA projects to be mainly exporting over the modelled period. As these projects are located in the southern half of the country, the results show that substantial constraint costs could be expected. We acknowledge that the system needs to address network bottlenecks and therefore constraint cost

[32] Targeting Analysis for the Third Cap and Floor Window and MPI Pilot Regulatory Framework | Ofgem

forecasts may not materialise in full. In response to this, we have applied a constraint cost reduction factor in anticipation of further network developments.

3.29 In view of the principles set out in our ICPR decision, the signals provided by the NESO's targeting report and the results from developers' chosen projects, we have considered whether the increase in constraint costs is proportional to the capacity that the project adds to the system across the three scenarios. Each section of this decision corresponding to a separate project sets out our view on whether the increase in constraint costs can be justified in this context.

3.30 A disproportional increase in constraint costs would mean further inefficiency in the system requiring NESO to intervene further in the balancing market. The actions that NESO would be required to take would mean consumers having to pay even more for their energy as a result of exacerbated inefficiencies. We have assessed the ratios between the total projected system constraint costs (including the constraint reduction factor) and the project capacities, and they are shown in the tables below.

3.31 We consider that the approved projects are in the consumer interest despite the additional constraint costs they incur. We believe that an increase in constraint cost may remain in the consumer interests depending upon the wider benefits arising from each specific project under consideration. For the avoidance of doubt, our assessment of constraint costs has not been a comparative exercise across all projects.

Table 4: Individual projects' constraint cost impact on the system in the Leading the Way (LW) scenario for the Marginal Additional approach

	Capacity MW	Project constraint costs with constraint reduction factor £bn	Total system constraint cost £bn	% share of total constraint cost	Project capacity share of installed capacity in 2030	Ratio between shares 2030	Project capacity share of installed capacity in 2050	Ratio between shares 2050
Aminth	1400	0.5	54.6	0.8%	0.7%	1.3	0.4%	2.0
AQUIND	2000	3.0	61.0	4.9%	1.0%	5.1	0.6%	8.3
Cronos	1400	2.3	53.7	4.3%	0.7%	6.5	0.4%	10.4
LirIC	700	0.3	55.4	0.5%	0.3%	1.4	0.2%	2.3
Mares	750	0.3	55.4	0.5%	0.4%	1.5	0.2%	2.4
NU-Link	1200	0.6	54.3	1.1%	0.6%	1.9	0.4%	3.1
Tarchon	1400	1.3	55.0	2.4%	0.7%	3.6	0.4%	5.9

Table 5: Individual projects' constraint cost impact on the system in the Consumer Transformation (CT) scenario for the Marginal Additional approach

	Capacity MW	Project constraint costs with constraint reduction factor £bn	Total system constraint cost £bn	% share of total constraint cost	Project capacity share of installed capacity in 2030	Ratio between shares 2030	Project capacity share of installed capacity in 2050	Ratio between shares 2050
Aminth	1400	0.5	74.4	0.7%	0.7%	1.0	0.4%	1.8
AQUIND	2000	2.3	75.7	3.0%	1.0%	3.0	0.5%	5.6
Cronos	1400	2.1	71.4	2.9%	0.7%	4.1	0.4%	7.6
LirIC	700	0.2	74.4	0.3%	0.4%	0.9	0.2%	1.7
Mares	750	0.3	74.2	0.5%	0.4%	1.2	0.2%	2.2
NU-Link	1200	0.6	74.1	0.8%	0.6%	1.2	0.3%	2.3
Tarchon	1400	0.8	74.7	1.1%	0.7%	1.6	0.4%	2.9

Table 6: Individual projects' constraint cost impact on the system in the Falling Short (FS) scenario for the Marginal Additional approach

	Capacity MW	Project constraint costs with constraint reduction factor £bn	Total system constraint cost £bn	% share of total constraint cost	Project capacity share of installed capacity in 2030	Ratio between shares 2030	Project capacity share of installed capacity in 2050	Ratio between shares 2050
Aminth	1400	0.1	20.8	0.4%	0.9%	0.4	0.5%	0.7
AQUIND	2000	0.4	21.6	1.6%	1.2%	1.3	0.7%	2.3
Cronos	1400	0.6	20.0	3.1%	0.9%	3.6	0.5%	6.2
LirIC	700	0.3	20.5	1.5%	0.4%	3.5	0.2%	6.0
Mares	750	0.2	20.6	1.0%	0.5%	2.3	0.3%	3.9
NU-Link	1200	0.0	20.8	0.0%	0.7%	-0.1	0.4%	-0.1
Tarchon	1400	0.0	20.7	0.0%	0.9%	0.1	0.5%	0.1

Table 7: Total installed capacity in 2030 and 2050 in the three scenarios

Total Installed Capacity (GW)	**2030**	**2050**
Leading the Way	210	339
Consumer Transformation	197	366
Falling Short	163	282

3.32 The above ratios help guide us to assess whether a project's expected constraint costs could be regarded as disproportional. The higher the ratio, the larger the disproportionality between the project's size and the projected constraint cost impact. We have calculated ratios based on the installed capacity at both the beginning (2030) and the end (2050) of the assessment period to derive the indicator.

3.33 We note that constraint costs are a transfer from consumers to producers and should not be subtracted from total SEW results.

Comparison of all project results following new analyses

3.34 A high-level summary of the results for all projects after these new analyses discussed in this Section, is on the following page.

Table 8: Overview of the Window 3 performance across the IPA for the consultation

	Maturity	Economic modelling (welfare) £bn	Total European carbon savings mtCO2	Total GB carbon savings mtCO2	Constraint costs £bn	System operability savings (frequency, voltage, reactive) £bn	Avoided RES curtailment (TWh)
Aminth (Denmark)	Unclear Connection	0.3 to 1.0	6.8 to 11.2	-5.0 to 0.1	0.1 to 1.0	£0.21	25 to 30
AQUIND (France)	Stated timeline unachievable	1.3 to 4.3	16.3 to 25.4	2.0 to 3.5	0.4 to 3.5	£0.28	30 to 50
Cronos (Belgium)	Grid connection in BE by 2032	1.0 to 1.8	6.4 to 14.2	-13.8 to -2.0	1.3 to 4.6	£0.21	18 to 25
LIRIC (N Ireland)		-0.6 to -1.0	2.9 to 5.1	-0.3 to 0.7	-0.2 to 0.3	£0.09	1 to 20
MaresConnect (ROI)		-0.7 to -1.1	3.1 to 5.4	-0.2 to 0.6	0.3 to 0.5	£0.08	10 to 24
NU-Link (Netherlands)	Grid connection in NL by 2032	0.6 to 1.3	6.3 to 12.2	-10.1 to -1.1	0.0 to 1.3	£0.14	30 and 70
Tarchon (Germany)		1.4 to 2.1	8 to 16.1	-13.6 to -2.2	0.2 to 1.3	£0.18	45 to 110

Table 9: Updated overview of the Window 3 performance across the IPA for the final decision

	Maturity	Economic modelling (welfare*) £bn	Total European carbon savings mtCO2	Total GB carbon savings mtCO2	Constraint costs** £bn	Constraint costs (as % of total GB constraints)	System operability savings (frequency, voltage, reactive) £bn	Avoided RES curtailment (TWh)
Aminth (Denmark)	Unclear Connection	0.4 to 0.7	9.5 to 11.6	-5.8 to -0.1	0.1 to 0.5	0.4 to 0.8	0.21	20 to 31
AQUIND (France)	Obstacles in France and GB	1.5 to 2.7	18.1 to 26.8	1.8 to 3.2	0.4 to 3.0	1.6 to 4.9	0.28	36 to 53
Cronos (Belgium)		1.3 to 1.9	8.4 to 15.9	-14.2 to -2.5	0.6 to 2.3	2.9 to 4.3	0.21	12 to 26
LIRIC (N Ireland)		-0.2 to 0.0	5.7 to 6.6	0.7 to 4.9	0.2 to 0.3	0.3 to 1.5	0.09	-3 to -8
MaresConnect (ROI)		-0.2 to 0.1	5.8 to 8.6	0.8 to 5.9	0.2 to 0.3	0.5 to 1.5	0.08	11 to 21
NU-Link (Netherlands)	Commercial operations by 2032	0.7 to 1.1	7.7 to 11	-11.1 to -1.3	0.0 to 0.6	-0.1 to 1.1	0.14	28 to 41
Tarchon (Germany)		1.5 to 2.4	6.3 to 12.2	-14.0 to -2.3	0.0 to 1.3	0.1 to 2.4	0.18	46 to 105

***SEW calculations include cap and floor payments and transfers from Contracts for Difference payments. Updated for Ireland background (Nautilus at Grain)**

****Updates after consultation: Ireland background, constraint reduction factor applied (Nautilus at Grain). RES curtailment also updated for Ireland background.**

Interpretation note: The monetised figures within this table are not directly comparable. Constraint costs should not be directly subtracted from the welfare figure, as they indicate a transfer from consumers to producers only. The welfare figures are a total of consumer, producer and interconnector welfare. The welfare figures would remain unchanged.

4. Aminth

In March 2024, we were minded-to not offer a cap and floor regime to the Aminth project to the proposed Danish North Sea Energy Island. The main reason for this was that the applicant did not provide sufficient evidence to demonstrate to Ofgem's satisfaction that the project is likely to connect prior to the end of 2032.

We received no consultation responses in relation to Aminth or any further evidence to support the project connecting by 2032. Thus, we confirm our rejection of the Aminth project.

Ofgem's view of consultation responses specific to the Aminth project

4.1 No consultation response or additional evidence was received from the developer and no response specific only to Aminth was submitted from any other respondent.

New evidence submitted

4.2 No new evidence was submitted.

4.4 Since consultation, the developer has terminated the connection agreement it held for the Aminth project, and the Danish Energy Agency's timeline for the development of the North Sea Energy Island has been delayed to 2036[33].

Requests for re-modelling

4.4 No requests were received for re-modelling.

Changes to results

Maturity and Deliverability assessment

4.5 There was no need to revisit our maturity and deliverability assessment framework from consultation. This included our hard to monetise indicators. We have carefully reviewed consultation responses and assessed changes arising from certain responses on a project-by-project basis in isolation.

4.6 The hard to monetise indicator still stands as an amber RAG rating as published in the consultation document.

[33] Denmark's North Sea energy island delayed again by high costs | Reuters

Market modelling and system impacts analysis

4.7 The table below is a summary of the changes to certain project indicators since the minded-to consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts (Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
Aminth (results from minded-to position)	0.2 to 0.9	**not previously calculated**	6.8 to 11.2	0.1 to 0.9
Aminth (results for decision)	0.4 to 0.7	0.4 to 0.7	9.5 to 11.6	0.1 to 0.5

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

4.8 The SEW results for Aminth have changed since the minded-to consultation due to updates to our modelling as outlined in Section 3.

4.9 The total SEW RAG rating has not changed. This means that the project continues to deliver total SEW benefits to GB in all scenarios. The re-run results for this indicator show a decrease from £0.9bn to £0.5bn in Leading the Way (**LW**), an increase from £0.3bn to £0.7bn in Consumer Transformation (**CT**), and an increase from £0.2bn to £0.4bn in Falling Short (**FS**).

4.10 This positive SEW is largely driven by strong producer SEW and positive IC SEW across all scenarios. Consumer SEW has decreased across all scenarios, continuing to be negative in CT and FS. In LW, there has been a significant shift in the SEW distribution as the consumer SEW is no longer driving the positive total SEW with a decrease from £0.59bn to -£0.73bn. Producer SEW and interconnector SEW have increased across all scenarios.

4.11 Our re-run now anticipates Aminth being a predominant exporter across all scenarios and therefore contributing to an increase in wholesale prices in GB.

Revenue expectations

4.12 Aminth is not expected to require floor payments in any scenario. Instead, it is expected to provide cap payments to consumers in CT and FS.

Decarbonisation

4.13 Results from our re-run suggest that Aminth continues to increase CO2 emissions in GB, but contributes to a net decrease in Denmark and across Europe. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

4.14 The results for this indicator remain largely the same as well as its RAG Rating. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

4.15 NESO has undertaken further analysis on constraint costs impacts of Aminth. This takes into account all the changes to the modelling which have taken place since the publication of the W3 IPA consultation. Additionally, the constraint reduction factor has been applied from 2035 onwards to account for predicted future network reinforcements.

4.16 NESO further results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but at a lower extent mainly because of the application of the constraint reduction factor.

4.17 NESO's analysis suggests that the introduction of Aminth into the system would represent between 0.4% to 0.8% of the increase in the total constraint costs if they were to materialise. We note that Aminth's share in the projected installed capacity in GB would range from 0.4% to 0.9% when looking at the 2030 and 2050 installed capacity projections.

4.18 Although the upper bound of constraint costs in the MA case has decreased since consultation, the RAG rating for this indicator remains amber. This project continues to result in constraint costs in all scenarios ranging from £0.1bn to £0.5bn.

System Operability indicators

4.19 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

4.20 The updated curtailment analysis from the NESO shows that the addition of Aminth to the system now results in savings of 20-31TWh of curtailment across the 25-year lifetime of the regime, in the MA case. This is a very small reduction from the original analysis.

Network costs

4.21 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

4.22 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our decision

4.23 In the W3 IPA consultation, we stated that we were minded-to reject Aminth due to deliverability, owing to challenges obtaining a grid connection in the connecting country. Given no further responses or additional evidence received to support the project, we confirm Aminth's rejection.

5. AQUIND

In March 2024, we were minded-to reject AQUIND's application for a cap and floor regime, due to the very high constraint cost impact of the project.

We confirm our rejection of AQUIND, firstly as the constraint costs of the project remain disproportionately high, and pose a significant risk to consumers, and secondly as the developer has not submitted sufficient evidence to satisfy Ofgem that the project is deliverable by the end of 2032. For AQUIND, analysis from the French system operator RTE published during the W3 IPA consultation stage indicates the project will not be able to connect to the French grid in time to become operational by the end of 2032. We are also concerned by the evidence provided by the Ministry of Defence over AQUIND's route in GB. We expand on these reasons in this Section.

Ofgem's view of consultation responses specific to the AQUIND project

5.1 The Let's Stop Aquind campaign group submitted a response stating broadly the following points: 1) that Ofgem should account for the rejection of AQUIND's planning permission in France in 2021 as evidence of obstacles to its delivery, 2) that Ofgem should account for CRE's recent consultation on preferred route to GB-FR interconnection (**the CRE consultation**)[34] as evidence of obstacles to its delivery.

5.2 Ofgem notes that the 2021 rejection of AQUIND's planning permission in France was overturned through a subsequent administrative tribunal review in 2023 and is now pending another decision.[35]

5.3 The CRE consultation has merited a reinvestigation of one indicator in AQUIND's maturity and deliverability assessment, discussed below.

Requests for re-modelling

5.4 AQUIND stated that in response to the extended decision-making timeline by Ofgem on Window 3, it has revised its programme with an expected start of commercial operations Q4 2030, and the first full year of operation being 2031. It

[34] Opportunity for new electricity interconnection capacity between France and the United Kingdom, CRE.
[35] The prefect of Seine-Maritime must re-examine an electricity interconnection project between France and the United Kingdom - Administrative Court of Rouen (tribunal-administratif.fr)

has requested Ofgem to re-run the existing modelling to reflect the proposed new connection date.

5.5 We do not consider that AQUIND's reasoning for its revised connection date, from Q3 2027 to Q4 2030, is sufficient justification. We consider that the length of delay to Ofgem's decision-making within the Window 3 process is disproportionate to the length of AQUIND's stated delay of three years. We do not consider that Ofgem's decision-making would be the sole driver for such a delay, and we have not seen similar delays on other projects despite each one being impacted consistently by our decision-making timeline.

5.6 Outside of AQUIND's reasoning for the delay to its project timeline, we remain concerned over the project's ability to reach its original connection date. As noted in paragraph 6.6 of the W3 IPA consultation, AQUIND hold a GB non-firm connection agreement until December 2030. While an interconnector is operating at non-firm capacity, NESO reserves the right to curtail the interconnector or reduce its capacity, without compensation. This has implications for the project's ability to earn revenue, utilise the interconnector at full capacity, and meet the terms of the 60-day test that is required to start receiving floor payments.

5.7 A non-firm connection agreement risks the full benefits of the project not being realised until 2030 at the earliest. We have nonetheless conducted a cross-check of AQUIND's market modelling results, to test the impact of a later connection date.

5.8 We are of the view that re-modelling to remove the 2027-2030 years, and to add three additional years to the end of the regime, would not materially change the outcome for the project. We have decided not to investigate further and have maintained the original modelling years for AQUIND's assessment for the purposes of the IPA.

Changes to results

Maturity and deliverability assessment

5.9 Evidence has been published by relevant third parties since the W3 IPA consultation which affects AQUIND's maturity and deliverability assessment. We have reinvestigated two indicators below and provide new RAG ratings. There has been no need to revisit other deliverability indicators and these remain as they were at the time of publication of the minded-to consultation.

Justification of connection location, technical design and capacity

5.10 In August 2024, the Ministry of Defence provided an open witness statement to DESNZ that it had serious concerns over the route of the AQUIND project as it would "unacceptably impede and compromise the safe and effective use of His Majesty's Naval Base in Portsmouth"[36]. AQUIND has publicly refuted the Ministry of Defence's concerns and stated that they are unsubstantiated[37]. However, it is not clear to Ofgem how the developer intends to respond to this obstacle in its development, which likely has implications for whether the routing, capacity and location of the interconnector as it stands would materialise.

5.11 This development is of concern to Ofgem. AQUIND's RAG rating in this criterion has been changed to red as a result.

Plans for grid connection in the connecting country

5.12 In March 2024, the energy regulator in France, CRE, published a consultation on its view of the benefit of further interconnection with GB, with a ranking provided of candidate projects. CRE's provisional position set within the consultation is that it supports 1GW of further interconnection with GB on the condition that there is an unequal split of project costs between GB and France.

5.13 The CRE consultation also comments directly on the AQUIND project, stating that "with a capacity of 2GW, (the AQUIND project) presents socio-economic benefits that are lower than the forecast costs of such a project." Importantly, CRE states that the French system operator RTE predicts that the commissioning of AQUIND "could be delayed to 2034-2035 linked to the supply lead time for a 2GW project (4 cables and 4 converter stations)" (p.24)[38].

5.14 Ofgem has engaged with CRE on the content of the CRE consultation and we should not fetter CRE's discretion on the final outcome. We note that the system operator in France, RTE, has compiled and provided supporting evidence to CRE to inform the CRE consultation. Within this supporting analysis, RTE state that AQUIND would be likely to have a commissioning date of 2034-2035 because of the engineering works to physically connect a large project to the grid in France. We have no information suggesting this supporting evidence from RTE will change. We consider this may have a material impact on the deliverability of the AQUIND project.

5.15 In light of the above, we have changed the RAG rating for this category to red.

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[36] EN020022-005270-Ministry of Defence.pdf (planninginspectorate.gov.uk)
[37] AQUIND responds to UK Ministry of Defence's concerns over interconnector project | 4C Offshore News
[38] Opportunity for new electricity interconnection capacity between France and the United Kingdom | CRE

Updated maturity and deliverability assessment RAG rating for AQUIND

Stage	Requirement	RAG rating at consultation	RAG rating at decision
Eligibility to be considered for IPA	A GB connection agreement for connection prior to the end of 2032		
	Licence application made to Ofgem		
IPA	Project Overview		
	Qualitative assessment of risks and dependencies		
	Hard to monetise impacts		
	Project plans		
	Plans for grid connection in connecting country		
	Plans for obtaining regulatory approval in connecting country		
	Justification of chosen connection location, capacity and design		
	System operability (GC0137)		
	Financing strategy		
	Supply chain plans		

Market modelling and system impacts analysis

5.16 The table below is a summary of the changes to certain project indicators since the W3 IPA consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts (Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
AQUIND (results from minded-to position)	1.3 to 4.2	**not previously calculated**	16.3 to 25.4	0.4 to 3.5
AQUIND (results for decision)	1.5 to 2.8	1.5 to 2.7	18.1 to 26.8	0.4 to 3.0

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

5.17 The SEW results for AQUIND have changed since the W3 IPA consultation due to updates to our modelling as outlined in Section 3.

5.18 The total SEW RAG rating has not changed. This means that the project continues delivering total SEW benefits to GB in all scenarios. The re-run results for this indicator show a decrease from £4.2bn to £2.7bn in LW, the same at £2.5bn in CT, and an increase from £1.3bn to £1.5bn in FS.

5.19 This positive SEW is largely driven by strong producer SEW across all scenarios. Consumer SEW has decreased across all scenarios with a significant reduction from £6.3bn to £0.0bn in LW driven by a lower impact of the project on reducing wholesale prices. Consumer SEW continues being negative in CT and FS. The project continues having a negative impact on IC SEW across all scenarios.

5.20 AQUIND is predicted to be a predominant exporter in all scenarios.

Revenue expectations

5.21 AQUIND is not expected to require floor payments in any scenario and is expected to provide cap payments to consumers across all years in all scenarios.

Decarbonisation

5.22 Results from our re-run suggest that AQUIND continues to decrease CO2 emissions in GB and across Europe.

Security of Supply

5.23 The results for this indicator remain largely the same as well as its RAG Rating. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

5.24 NESO has undertaken further analysis on constraint costs impacts of AQUIND. This takes into account all the changes to the modelling which have taken place since the publication of the W3 IPA consultation. Additionally, the constraint cost reduction rate has been applied from 2035 onwards to account for predicted future network reinforcements.

5.25 NESO results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but at a lower extent mainly because of the application of the constraint reduction factor.

5.26 NESO's analysis suggests that the introduction of AQUIND into the system would represent between 1.6% to 4.9% of the increase in total constraint costs if they were to materialise. However, we note that AQUIND's share in the projected installed generation capacity in GB would only range from 0.6% to 1.2% when looking at the 2030 and 2050 installed capacity projections.

5.27 Looking at the ratio between shares of total constraint cost and installed capacity for LW, AQUIND's impact could be 5 times as big as its share in the total installed capacity in 2030 and 8 times as big as its share in the 2050 installed capacity projection. If AQUIND's constraint cost impact in CT was to materialise it could be 3 times as big as its share in the total installed capacity in 2030 and 5 times as big as its share in the 2050 installed capacity projection. If AQUIND's constraint cost impact in FS was to materialise it could be the same as its share in the total installed capacity in 2030 and double its share in the 2050 installed capacity projection. We consider that the likely increase in constraint costs generated by AQUIND in most of the modelled scenarios is disproportionate and represents a risk to consumers if it were to materialise.

5.28 Although the upper bound of constraint costs in the MA case has decreased since consultation, the RAG rating for this indicator remains red. This project continues to result in constraint costs in all scenarios ranging from £0.4bn to £3.0bn. Based on this information, the projected impact of AQUIND on constraint costs is high and Ofgem is not willing to take this risk to consumers.

System Operability indicators

5.29 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

5.30 The updated curtailment analysis from NESO shows that the addition of AQUIND to the system now results in savings of 36-53 TWh in curtailment across the 25-year lifetime of the regime, in the MA case. There has been a small increase in curtailment savings in the Leading the Way scenario and a small reduction in the Falling Short scenario.

Network costs

5.31 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

5.32 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our Decision

5.33 Having carefully considered the consultation responses as well as the different aspects of our IPA, we have decided to reject AQUIND's application for a cap and floor regime as we are concerned with the potential negative effect this project has on the system. NESO's analysis suggests that the introduction of AQUIND into the system would generate significant constraint costs. We consider the modelled increase in constraint costs generated by AQUIND is disproportionate and represents a risk to consumers if it were to materialise.

5.34 We are now also of the view, following RTE's analysis on the timing of the project's construction in France, that AQUIND has not provided sufficient evidence to demonstrate to Ofgem's satisfaction the project is deliverable by the end of 2032.

6. Cronos

In March 2024, we were minded-to not offer a cap and floor regime to Cronos. This was based on two key reasons. Firstly, the project did not provide sufficient evidence to Ofgem's satisfaction to demonstrate that it is likely to connect prior to the end of 2032. Secondly, the constraint cost impact was very high.

The developer of the Cronos project submitted sufficient additional evidence throughout the consultation period, to demonstrate to Ofgem its progress in achieving a grid connection agreement and regulatory approval in Belgium.

However, we confirm our rejection of the Cronos project, as the constraint costs of the project remain disproportionately high.

Ofgem's view of consultation responses specific to the Cronos project and new evidence submitted

Cronos submitted new evidence for consideration for specific indicators within the maturity and deliverability assessment. We review these below.

Plans for grid connection in the connecting country

6.1 At the time of the W3 IPA consultation, Belgian TSO, Elia, provided the Cronos developer with a grid feasibility study by which it indicated that 2032-2035 would be the likely connection date for the project. This was due to necessary reinforcements on the Belgian grid, which are not anticipated to be completed before 2032 at the earliest.

6.2 In response to the consultation, the developer informed Ofgem that it has been in discussion with Elia to accelerate the connection schedule for the project, with permitting stages reduced owing to the project's PMI (Project of Mutual Interest) status[39]. The developer and Elia began a detailed grid study on connection at Bruegel.

6.3 After consultation closure, the developer provided the preliminary results of this detailed grid study to Ofgem, with correspondence from Elia. Although the detailed grid study is yet to be finalised, Ofgem understand from Elia's correspondence to the developer, that the project is to be granted connection at Bruegel in the year 2032, and a connection agreement will soon follow.

[39] Projects of Common Interest and Projects of Mutual Interest (europa.eu)

6.4 As a result, we have amended the RAG rating for this criterion from red to green.

Plans for regulatory approval in the connecting country

6.5 In the W3 IPA consultation, Ofgem expressed concerns over the regulatory route for private interconnector projects such as Cronos in Belgium. It was not clear for us whether and to what extent a third-party developer not aligned with Elia, the TSO, could construct, own and operate an electricity interconnector in Belgium. It was not sufficiently demonstrated to Ofgem's satisfaction, by the evidence submitted by the developer, as to how the developer and the Belgian authorities intend to resolve this issue within a timeframe that allows the project to connect prior to the end of 2032.

6.6 At consultation stage, the developer has since provided Ofgem with correspondence from the Belgian Ministry of Economy (FOD), which states that the FOD has confirmed that any necessary regulatory adjustments can be analysed and taken up by a new federal government in time for a 2032 energisation of Cronos.

6.7 Following consultation closure, a series of working groups has also been set up by the FOD including the developer, FOD, Elia and the regulator CREG. The objective is to review the legal framework surrounding interconnectors in Belgium and to remedy any identified blocking points to their development. CREG has also confirmed that owing to Cronos' Project of Mutual Interest status, despite the remaining uncertainties surrounding the project, its development should not be hindered.

6.8 The evidence above shows to Ofgem that the authorities in Belgium are engaging positively with the developer to reach a regulatory settlement for the Cronos project. Despite this welcome collaboration to find a route forward for the project, we note that there remains no readily available legal framework for the development of privately owned interconnectors in Belgium, and introducing it may involve legislative changes in Belgium. We consider that there is no room for delay to the project's connection date to continue to meet the eligibility criteria for Window 3. We have retained the amber rating for this criterion.

Changes to results

Updated Maturity and deliverability assessment for Cronos

6.9 The RAG rating for the 'plans for grid connection in the connecting country' criterion has changed from red to green following submission of evidence of the project's progress from the developer of Cronos. As a result, deliverability as a reason for rejection of the project from Window 3, has been removed.

Stage	Requirement	RAG rating at consultation	RAG rating at decision
Eligibility to be considered for IPA	A GB connection agreement for connection prior to the end of 2032		
	Licence application made to Ofgem		
IPA	Project Overview		
	Qualitative assessment of risks and dependencies		
	Hard to monetise impacts		
	Project plans		
	Plans for grid connection in connecting country		
	Plans for obtaining regulatory approval in connecting country		
	Justification of chosen connection location, capacity and design		
	System operability (GC0137)		
	Financing strategy		
	Supply chain plans		

Market modelling and system impacts analysis

6.10 The table below is a summary of the changes to certain project indicators since the W3 IPA consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts (Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
Cronos (results from minded-to position)	1.0 to 1.8	**not previously calculated**	6.4 to 14.2	1.3 to 4.6
Cronos (results for decision)	1.3 to 1.9	1.3 to 1.9	8.4 to 15.9	0.6 to 2.3

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

6.11 The SEW results for Cronos have changed since the W3 IPA consultation due to updates to our modelling as outlined in Section 3.

6.12 The total SEW RAG rating has not changed. This means that the project continues to deliver total SEW benefits to GB in all scenarios. The re-run results for this indicator show a decrease from £1.8bn to £1.5bn in LW, an increase from £1.8bn to £1.9bn in CT, and an increase from £1.0bn to £1.3bn in FS.

6.13 This positive total SEW remains being largely driven by strong producer welfare. Consumer SEW continues being negative in all scenarios with results decreasing across all scenarios. The IC SEW is marginally positive in LW and CT and marginally negative in FS.

6.14 We continue to anticipate Cronos to be a predominant exporter and therefore contributing to an increase in wholesale prices in GB.

Revenue expectations

6.15 Our re-run continues to suggest that Cronos is not expected to require floor payments in any scenario and is expected to provide cap payments to consumers throughout a large proportion of the modelled period in all scenarios.

Decarbonisation

6.16 Results from our re-run suggest that Cronos continues to increase CO2 emissions in GB, but contributes to a net decrease in Belgium and across Europe. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

6.17 The results for this indicator remain largely the same as well as its RAG Rating. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

6.18 NESO has undertaken further analysis on constraint costs impacts of Cronos. This takes into account all the changes to the modelling which have taken place since the publication of the W3 IPA consultation. Additionally, the reduction rate factor has been applied from 2035 onwards to account for predicted future network reinforcements.

6.19 NESO results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under all scenarios but at a lower extent mainly because of the application of the constraint reduction factor.

6.20 NESO's analysis suggests that the introduction of Cronos into the system would represent between 2.9% to 4.3% of the increase in total constraint costs if they were to materialise. However, we note that Cronos' share in the projected installed generation capacity in GB would only range from 0.4% to 0.9% when looking at the 2030 and 2050 installed capacity projections.

6.21 Looking at the ratio between shares of total constraint costs and installed capacity for LW, Cronos' impact could be 7 times as big as its share in the total installed capacity in 2030 and 10 times as big as its share in the 2050 installed capacity projection. If Cronos' constraint cost impact in CT was to materialise it could be 4 times as big as its share in the total installed capacity in 2030 and 8 times as big as its share in the 2050 installed capacity projection. If Cronos' constraint cost impact in FS was to materialise it could be 4 times as big as its share in the total installed capacity in 2030 and 6 times as big as its share in the 2050 installed capacity projection. We consider that the likely increase in constraint costs generated by Cronos in most of the modelled scenarios is disproportionate and represents a risk to consumers if it were to materialise.

6.22 Although the upper bound of constraint costs in the MA case has decreased since consultation, the RAG rating for this indicator remains red. This project continues to result in constraint costs in all scenarios ranging from £0.6bn to £2.3bn. Based on this information, the projected impact of Cronos on constraint costs is disproportionately high and Ofgem is not willing to take this risk to consumers.

System Operability indicators

6.23 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

6.24 The updated curtailment analysis from the NESO shows that the addition of Cronos to the system results in a 12-26TWh saving in curtailment over the 25-

year lifetime of the regime, in the MA case. The curtailment saving has reduced significantly in the Consumer Transformation scenario only.

Network costs

6.25 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

6.26 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our decision

6.27 Having carefully considered the consultation responses received as well as the different aspects of our IPA, we have decided to reject Cronos' application for a cap and floor regime as we are concerned with the potential negative effect this project has on the system. NESO's analysis suggests that the introduction of Cronos into the system would generate high constraint costs. We consider the modelled increase in constraint costs generated by Cronos is disproportionate and represents a risk to consumers if it were to materialise.

6.28 Following receipt of new evidence during the consultation stage, we are now satisfied that the project will receive a grid connection in Belgium within the timelines of Window 3, and that authorities in Belgium are engaging with the developer to reach a regulatory settlement for the project. We have therefore removed deliverability as one of the reasons for rejection.

7. LirIC

In March 2024, we were minded-to not offer a cap and floor regime to LirIC based on its negative total SEW impact on GB. In the market modelling, LirIC had a negative total SEW impact on GB in both the FA and MA cases. Wider benefits that were assessed in the modelling, such as the project's positive decarbonisation and security of supply impacts, were modest by comparison, and did not justify approving the project, in light of the project's negative SEW impact.

The LirIC developer's consultation response stated that 1) connection to Northern Ireland, rather than another country, makes LirIC a strategically beneficial connection above projects to other countries, 2) the constraint savings, among other benefits, are not accurately accounted for in the consultation, 3) the Arup study is an outlier with unexplainable errors, when reviewing the results for LirIC's FA case.

Further to our investigation of the FES22 for Europe, we decided to re-run the market modelling and system impacts analysis using TYNDP 2022 as background data for the I-SEM. The results of this analysis now produce marginally positive SEW in the MA case. The composition of consumer SEW as a proportion of this is now also significantly higher.

We now consider this project to be in the interest of GB consumers and have decided to award in principle a cap and floor regime to LirIC.

Ofgem's view of consultation responses specific to the LirIC project

Unexplainable errors in the market modelling

7.1 The developer for LirIC conducted an independent investigation of the results of the market modelling on the FA case for the project. The developer argued that Arup's work contains 'unexplainable' errors, which therefore render it inappropriate for Ofgem's decision making. The developer noted that when LirIC becomes operational, this results in: 1) a particularly large decrease in the I-SEM wholesale price, 2) a reduction in renewables supply in the I-SEM, 3) an increase in unserved energy in the I-SEM, 4) a sharp fall in other projects' revenues.

7.2 These errors were found only in LirIC's detailed scrutiny of the FA case with the Consumer Transformation scenario. Ofgem stated in the W3 IPA consultation that the FA case is not decisive, however the developer argued that if errors can be found in this situation, it can be assumed that the whole model is unreliable and not robust. Arup have confirmed, after further scrutiny, that these are small observances in only one case that do not lead to material differences to the MA case if changed.

Strategic benefit of connection to Northern Ireland

7.3 The LirIC developer also argue that there are unquantified benefits in Ofgem's IPA which would reveal the full benefits of the LirIC interconnector. These include the enhanced strategic benefit of a project connecting to Northern Ireland above other connecting markets. The developer highlights the geopolitical and security of supply benefit of a connection to Northern Ireland from GB, rather than any other country. In addition, the developer notes that by maximising UK domestic resources, interconnection to Northern Ireland assists the UK's achievement of net zero targets.

7.4 Modelling workshops with all applicants were conducted by Ofgem, Arup and NESO in summer 2023 to discuss the modelling and criteria that would factor into the decision-making process in advance of our IPA modelling commencing. These benefits above were not raised at the time, where it would have been most beneficial to do so.

Ofgem's statutory duties to engage with Northern Ireland authorities

7.5 The LirIC developer argued that Ofgem's specific public law duty to engage with authorities in Northern Ireland (Section 3F Electricity Act 1989 'Authority to consult and cooperate with other authorities') mean that the LirIC project should be progressed. The developer states that the Northern Ireland regulator, UREGNI, and Ofgem have not created a joint strategy for enabling interconnection between the two nations, and that therefore Ofgem has not engaged with UREGNI sufficiently.

7.6 As stated in the W3 IPA consultation, Ofgem is satisfied that the LirIC developer has submitted sufficient evidence to indicate that it can achieve regulatory approval and grid connection in Northern Ireland to enable its connection in 2032. Ofgem has been in conversation with UREGNI to support its assessment of the merit of further interconnection between Northern Ireland and GB, and the development of a regulatory regime for interconnectors in Northern Ireland.

7.7 Ofgem does not consider that our statutory duties merit approving the LirIC project purely on the basis that it is proposed to connect intra-UK. We should assess the LirIC project in the same manner as the other applicant projects in the IPA to protect the interests of consumers.

7.6 The LirIC developer argued that Ofgem's IPA minded-to position underplays the system benefit of the project. Two scenarios show LirIC with a constraint saving rather than a cost. Savings are incurred specifically at the B6 boundary in southern Scotland40, which the developer argues is the highest priority and impact boundary to relieve congestion on the GB network.

7.9 Following the creation of the additional scenario for the I-SEM background changes, LirIC's constraint cost projections have changed. More detail is provided below.

Request for re-modelling

7.10 As stated in the minded-to consultation, the LirIC developer has secured a revised connection agreement with NGEO to connect to Hunterston substation in the year 2032. Within their consultation response, the developer provided Ofgem with revised information for the IPA regarding justification for its connection location and it's hard to monetise impacts at the new substation. The developer requested that Ofgem re-run its market modelling to reflect the new connection date.

7.11 After receiving a revised connection agreement for LirIC, we cross-checked LirIC's data and determined that re-modelling to remove the 2030-2032 years and to add two additional years to the end of the regime, would not materially change the outcome for the project. We have decided not to investigate further and have maintained the modelling years for LirIC's assessment for the purposes of the IPA.

7.12 The system impacts analysis does not require to be updated, as Hunterston is in the same zone of GB as the previous connection location, Kilmarnock South.

Changes to results

Maturity and deliverability assessment

7.13 As stated above, the developer for LirIC submitted a revised connection agreement at Hunterston in 2032. This was supported by revised information for the IPA with regards to justification of its connection location and its hard to monetise impacts at the new substation. We have revisited these specific indicators below. There has been no need to revisit other deliverability indicators and these remain as they were in consultation.

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[40] Scottish boundaries | National Energy System Operator (neso.energy)

Justification of connection location, capacity and technical design

7.14 The developer noted that connection to Hunterston would reduce consenting risk as the onshore cable route from landfall is much shorter than at the previous location and is a brownfield site without sensitive environmental features surrounding the site. Ofgem is reassured that the developer has carefully considered the connection point and have engaged thoroughly with NESO, they have the most up to date information on their project from NESO. We have updated the previous amber rating for LirIC in this indicator to green.

Updated maturity and deliverability assessment for the LirIC project

Stage	**Requirement**	**RAG rating at consultation**	**RAG rating at decision**
Eligibility to be considered for IPA	A GB connection agreement for connection prior to the end of 2032	Green	Green
	Licence application made to Ofgem	Green	Green
IPA	Project Overview	Green	Green
	Qualitative assessment of risks and dependencies	Green	Green
	Hard to monetise impacts	Green	Green
	Project plans	Amber	Amber
	Plans for grid connection in connecting country	Green	Green
	Plans for obtaining regulatory approval in connecting country	Green	Green
	Justification of chosen location, capacity and design	Amber	Green
	System operability (GC0137)	Green	Green
	Financing strategy	Amber	Amber
	Supply chain plans	Green	Green

Market modelling and system impacts analysis

7.15 The table below is a summary of the changes to certain project indicators since the minded-to consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts (Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
LirIC (results from minded-to position)	-1.0 to -0.6	**not previously calculated**	2.9 to 5.1	-0.2 to 0.3
LirIC (results for decision)	-0.2 to 0.04	0.0 to 0.2	5.7 to 6.6	0.2 to 0.3

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

7.16 The SEW results for LirIC have changed since the minded-to consultation due to updates to our modelling as outlined in Section 3.

7.17 The total SEW RAG rating has changed from red to amber. This means that the project now delivers total SEW benefits to GB in at least one scenario. The re-run results for this indicator show an increase from -£1.0bn to £0.04bn in LW, an increase from -£0.6bn to -£0.1bn in CT and an increase from -£1.0bn to -£0.2bn in FS.

7.18 The drivers of the total SEW have changed since our consultation. Consumer and interconnector SEW have now become positive in all scenarios and drive the marginally positive total SEW in LW. In CT and FS, consumer and interconnector SEW have not been high enough to outweigh the negative producer SEW. Producer SEW has decreased across all scenarios, becoming negative in LW and CT.

7.19 LirIC is now anticipated to predominantly import. This means that the project contributes to a decrease in the wholesale price in GB, rather than an increase as expected in our minded-to consultation. The impact in the price is the underlying factor driving the changes to the SEW results as a decrease in the wholesale price benefits consumers but negatively impacts producers.

Revenue expectations

7.20 LirIC is not expected to require floor payments in the FS scenario, and only small floor payments in the first year for the LW and CT scenarios. LirIC is expected to provide cap payments to consumers across the later years in all three scenarios.

Ofgem is satisfied that LirIC would not be a detriment to consumers in terms of requiring excessive floor support and could provide benefits to consumers through cap payments.

Decarbonisation

7.21 Results from our re-run suggest that LirIC has changed to now decrease CO2 emissions in all scenarios in GB. The project shows a net decrease in one scenario for Ireland and a net decrease in all scenarios for Europe. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

7.22 The RAG Rating for security of supply remains the same. There are marginal changes to the figures. For LW the cost of EENS has slightly increased from £0.03bn to c. £0.1bn. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

7.23 NESO has undertaken further analysis on constraint costs impacts of LirIC. This takes into account all the changes to the modelling which have taken place since the publication of the minded-to consultation. Additionally, the reduction rate factor has been applied from 2035 onwards to account for predicted future network reinforcements.

7.24 NESO further results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but at a lower extent mainly because of the application of the constraint reduction factor.

7.25 NESO's analysis suggests that the introduction of LirIC into the system would represent between 0.3% to 1.5% of the increase in the total constraint costs if they were to materialise. We note that LiriC's share in the projected installed capacity in GB would range from 0.3% to 0.4% when looking at the 2030 and 2050 installed capacity projections.

7.26 The RAG rating for this indicator has moved from green to amber. This is because this project no longer results in a constraint saving in the LW scenario. This project now results in constraint costs in all scenarios ranging from £0.2bn to £0.3bn. Based on this information, the range of constraint costs remain manageable and would not pose considerable risk to consumers.

System operability indicators

7.27 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

7.28 The updated curtailment analysis from the NESO shows that the addition of LirIC to the system results in an increase in curtailment of 3-8TWh over 25 years, in the MA case. This effect is due to the increased imports to GB through the LirIC project.

Network costs

7.29 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

7.30 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our Decision

7.31 Having carefully considered the consultation responses received as well as the changes in results, Ofgem has decided to approve in principle LirIC's application for a cap and floor regime. The updated analysis on SEW shows that the project now delivers positive total SEW to GB. The project is overall in the interest of GB consumers.

8. MaresConnect

In March 2024, were minded-to not offer a cap and floor regime to MaresConnect, based upon the negative total SEW impact on GB of the project. In the market modelling, MaresConnect has a negative total SEW impact on GB in both the FA and MA cases. Wider benefits that were assessed in the modelling, such as the project's positive decarbonisation and security of supply impacts, were modest by comparison, and did not justify approving the project, in light of the project's negative SEW impact.

Further to investigation of the FES22 for Europe we decided to re-run the market modelling and system impacts analysis using TYNDP 2022 as background data for the I-SEM. The results of this analysis now produce marginally positive SEW in the MA case.

We now consider this project to be in the interest of GB consumers and confirm the award in principle of a cap and floor regime to MaresConnect.

Ofgem's view of consultation responses specific to the MaresConnect project

8.1 Consultation response points related to the MaresConnect project have all been addressed in Section 2 in the wider discussion of responses related to our modelling assessment of all projects.

Changes to results

Maturity and deliverability analysis

8.2 There has been no need to revisit any deliverability indicators and these have not changed since the time of the publication of the minded-to consultation.

Market modelling and system impacts analysis

8.3 The table below is a summary of the changes to certain project indicators since the minded-to consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts (Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
MaresConnect (results from minded-to position)	-1.1 to -0.7	**not previously calculated**	3.1 to 5.4	0.3 to 0.6
MaresConnect (results for decision)	-0.2 to 0.2	0.0bn to 0.3bn	5.8 to 8.6	0.2 to 0.3

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

8.4 The SEW results for MaresConnect have changed since the minded-to consultation due to updates to our modelling as outlined in Section 3.

8.5 The total SEW RAG rating has changed from red to amber. This means that the project now delivers total SEW benefits to GB in most scenarios. The re-run results for this indicator show an increase from -£0.7bn to £0.0bn in LW, an increase from -£0.8bn to £0.2bn in CT and an increase from -£1.1bn to -£0.2bn in FS.

8.6 The total SEW results in LW and CT are now being driven by strong consumer SEW and marginally positive IC SEW across all scenarios. Consumer and interconnector SEW have become positive across all scenarios from being negative in all of them. Producer SEW has become negative in all scenarios and drive the negative total SEW results in FS.

8.7 MaresConnect is now anticipated to predominantly import into GB. This means that the project contributes to a decrease in the wholesale price in GB, rather than an increase as in our consultation stage. The impact in the price is the underlaying factor driving the changes to the SEW results as a decrease in the wholesale price benefits consumers but negatively impacts producers.

Revenue expectations

8.8 MaresConnect is not expected to require floor payments in FS. However, it is anticipated to require floor payments in the first year in LW and CT. The project is expected to provide cap payments to consumers through most of the modelled years in all scenarios. Ofgem is satisfied that MaresConnect would not be a detriment to consumers by requiring excessive floor support.

Decarbonisation

8.9 Results from our re-run suggest that MaresConnect now causes a decrease in CO2 emissions in GB and in Europe. In Ireland, the project is expected to cause a slight increase in emissions in LW and FS and a decrease in CT. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

8.10 The RAG Rating for security of supply remains the same. There are marginal changes to the figures. For LW the cost of EENS has slightly increased from £0.03bn to c. £0.1bn. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

8.11 NESO has undertaken further analysis on constraint costs impacts of MaresConnect. This takes into account all the changes to the modelling which have taken place since the publication of the minded-to consultation. Additionally, the reduction rate factor has been applied from 2035 onwards to account for predicted future network reinforcements.

8.12 NESO further results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but at a lower extent mainly because of the application of the constraint reduction factor.

8.13 NESO's analysis suggests that the introduction of MaresConnect into the system would represent between 0.5% to 1.0% of the increase in the total constraint costs if they were to materialise. We note that MaresConnect share in the projected installed capacity in GB would range from 0.2% to 0.5% when looking at the 2030 and 2050 installed capacity projections.

8.14 Although the upper bound of constraint costs in the MA case has decreased since consultation, the RAG rating for this indicator remains amber. This project continues to result in constraint costs in all scenarios ranging from £0.2bn to £0.3bn. Based on this information, the range of constraint costs is manageable and would not pose considerable risk to consumers.

System Operability indicators

8.15 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

8.16 The updated curtailment analysis from the NESO shows that the addition of MaresConnect to the system results in 11-21 TWh in curtailment savings over 25 years, in the MA case. This is a small reduction from the previous analysis in the Leading the Way and Consumer Transformation scenarios.

Network costs

8.17 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

8.18 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our Decision

8.19 Having carefully considered the consultation responses received as well as the changes in results, Ofgem has decided to approve in principle MaresConnect’s application for a cap and floor regime. The updated analysis on SEW shows that the project now delivers positive total SEW to GB. The project is overall in the interest of GB consumers.

9. NU-Link

In March 2024, we were minded to not offer a cap and floor regime to NU-Link. The main reason for this is that the project did not provide sufficient evidence to demonstrate to Ofgem's satisfaction that it is likely to become operational prior to the end of 2032.

The developer for NU-Link submitted additional evidence to Ofgem regarding its progress in achieving a grid connection agreement and regulatory approval in the Netherlands.

We confirm our rejection of the NU-Link project. We remain of the view that we have not received sufficient evidence from the developer to demonstrate to our satisfaction that the project can reach commercial operations before 2032.

Ofgem's view of consultation responses specific to the NU-Link project and new evidence submitted

9.1 NU-Link submitted new evidence for consideration for specific indicators within the maturity and deliverability assessment. We review these below.

Grid connection in the connecting country

9.2 At the time of the publication of the W3 IPA consultation, the NU-Link developer had informed us that the system operator in the Netherlands, TenneT, had rejected a grid connection application from NU-Link, on the grounds that there is no unrestricted capacity on the Dutch grid to connect a project in the year 2031 that the developer had requested. The NU-Link developer later provided evidence to Ofgem that they were disputing TenneT's decision (with the determination in relation to this dispute to be made by the regulator ACM). In addition, the NU-Link developer submitted a grid connection application to TenneT at an alternative location, as well as with correspondence from TenneT that it will consider this new application.

9.3 Subsequently, the NU-Link developer provided evidence to Ofgem indicating that in April 2024, ACM issued its decision on the dispute between TenneT and the NU-Link developer with the outcome in favour of the developer[41]. Within the public document describing the outcome of the dispute, ACM stated that TenneT's decision was not compliant with the applicable relevant law, and NU-Link's

[41] Geschilbesluit Frontier Power - TenneT | ACM.nl
This publication is available, in Dutch, on the ACM website.

request should be assessed again, as TenneT did not follow complete and due process in coming to its decision. We understand that TenneT disagrees with ACM's decision, has initiated legal proceedings in this regard, but is currently obliged to act in accordance with ACM's decision.

9.4 The developer provided Ofgem with a letter from TenneT from spring 2024 which offers connection to Moerdijk in the year 2031 to the NU-Link project, however with no offer of transport capacity until further investigations are concluded on the availability of transport capacity. Transport capacity refers to the right of the project to transmit electricity across the interconnector and to the Dutch grid, and is a necessary prerequisite to the interconnector commencing commercial operations. The NU-Link developer also submitted TenneT's commitment to begin a 'basic design' for the project, which is the process of determining the required works at the substation to connect the project. The 'basic design' is to take place in mid-2029.

9.5 TenneT notified Ofgem on 4 November that its conclusion on the transport capacity investigations had been reached, and the developer notified of the outcome via letter, on 1 October 2024. Ofgem was not made aware of this by the developer despite it being relevant to Ofgem's consideration of whether the commencement of commercial operations prior to the end of 2032 is achievable for NU-Link. The developer subsequently provided a copy of this letter on 11 November 2024. This letter confirms that TenneT continues to reject the NU-Link developer's request for transport capacity, but references that there may be sufficient transport capacity in the longer term (ie. end of 2030s). Accordingly, NU-Link is currently without transport capacity that would enable the commencement of commercial operations prior to the end of 2032.

9.6 The NU-Link developer presents the ACM dispute decision and TenneT's subsequent letter as evidence that it has a grid connection offer for Moerdijk in 2031. The NU-Link developer also stated to Ofgem that it is not necessary for the project to be in possession of a transport capacity agreement to meet the terms of Window 3.

9.7 However, the definition of the connection date in page 16 of the Application Guidance clarifies that a project must become operational prior to the end of 2032, to retain a cap and floor regime under Window 3. It is Ofgem's view that NU-Link cannot become fully operational without transport capacity, and we have received no evidence that this will be in place to facilitate commercial operations prior to the end of 2032. A connection offer without specified and sufficient transport capacity has serious implications for the operation of the interconnector and the implementation of the cap and floor regime.

9.8 Based on the developer's explanation to Ofgem, in the Netherlands it is possible for an interconnector to be physically connected to the grid, but not to have a right to transport capacity onto the grid. The interconnector may be connected, however not operating, for an indefinite period of time. If this is the case, then in Ofgem's view, the project would not be able to undertake the 60-day test under the cap and floor regime, to demonstrate 60 days of continuous operation, which an interconnector is required to complete successfully before the floor protection under the regime is activated. Without the right to capacity on the grid, the interconnector may be curtailed at will by the system operator and would not be compensated by the system operator if curtailed.

9.9 Whilst the NU-Link developer has a connection offer for 2031, its ability to commence commercial operations prior to the end of 2032 is dependent on the resolution of the transport capacity issue. Due of lack of transport capacity, Ofgem does not consider that the developer has provided sufficient evidence to demonstrate to our satisfaction that reaching operations prior to the end of 2032 is achievable.

Changes to results

Maturity and deliverability assessment

9.10 Based on the above evidence submitted at consultation, we have not amended any of the RAG ratings in our maturity assessment of NU-Link.

Market modelling and system impacts analysis

9.11 The table below is a summary of the changes to certain project indicators since the W3 IPA consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts** **(Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
NU-Link (results from minded-to position)	0.6 to 1.3	**not previously calculated**	6.3 to 12.2	0.0 to 1.3
NU-Link (results for decision)	0.7 to 1.1	0.7 to 1.1	7.7 to 11	0.0 to 0.6

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

9.12 The SEW results for NU-Link have changed since the W3 IPA consultation due to updates to our modelling as outlined in Section 3.

9.13 The total SEW RAG rating has not changed. This means that the project continues to deliver total SEW benefits to GB in all scenarios. The re-run results for this indicator show a decrease from £1.2bn to £0.9bn in LW, a decrease from £1.3bn to £1.1bn in CT and an increase from £0.6bn to £0.7bn in FS.

9.14 This positive SEW remains being largely driven by strong producer SEW and marginally positive IC SEW across most scenarios. Consumer SEW has decreased across all scenarios and continues being negative in all of them. Producer and interconnector SEW have increased in all scenarios and continue being positive across all of them.

9.15 We continue anticipating NU-Link to predominantly export and therefore contributing to an increase in wholesale prices in GB.

Revenue expectations

9.16 NU-Link is not expected to require floor payments in any scenario and is expected to provide cap payments to consumers in the early years of LW, in all years for CT and in the later years in FS.

Decarbonisation

9.17 Results from our re-run suggest that NU-Link continues to increase CO_2 emissions in GB, but contributes to a net decrease in the Netherlands and across Europe. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

9.18 The results for this indicator remain largely the same as well as its RAG Rating. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

9.19 NESO has undertaken further analysis on constraint costs impacts of NU-Link. This takes into account all the changes to the modelling which have taken place since the publication of the W3 IPA consultation. Additionally, the reduction rate factor has been applied from 2035 onwards to account for predicted future network reinforcements.

9.20 NESO further results suggest that the project continues having positive and negative impacts across different boundaries of the system, though the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but to at a lower extent mainly because of the application of the constraint reduction factor.

9.21 NESO's analysis suggests that the introduction of NU-Link into the system would represent between 0% to 1.1% of the increase in the total constraint costs if they were to materialise. We note that NU-Link share in the projected installed capacity in GB would range from 0.3% to 0.7% when looking at the 2030 and 2050 installed capacity projections.

9.22 Although the upper bound of constraint costs in the MA case has decreased since consultation, the RAG rating for this indicator remains amber. This project continues to result in constraint costs in all scenarios ranging from £0bn to £0.6bn. Based on this information, the range of constraint costs are manageable and would not pose considerable risk to consumers.

System Operability indicators

9.23 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

9.24 The updated curtailment analysis by the NESO shows that the addition of NU-Link to the system results in 28-41 TWh in curtailment savings over 25 years. This is consistent with the previous analysis.

Network costs

9.25 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

9.26 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our Decision

9.27 Having carefully considered the consultation responses received as well as the changes in results, Ofgem confirms its decision to reject NU-Link's application for a cap and floor regime. Following consultation, the developer has not provided sufficient evidence to demonstrate to Ofgem's satisfaction that connection in the Netherlands that allows the project to reach commercial operations prior to the end of 2032 is feasible.

10. Tarchon

In March 2024, we were minded-to offer a cap and floor regime to Tarchon, on the grounds of total SEW benefit to GB, and that the developer provided evidence that satisfies Ofgem that the project is mature and is likely to connect prior to the end of 2032.

We confirm the award in principle of a cap and floor regime to Tarchon. We maintain that Tarchon is projected to deliver value to consumers through the flexibility benefit it brings, and the applicant has provided sufficient evidence to demonstrate to Ofgem's satisfaction that the project is deliverable by the end of 2032.

Ofgem's view of consultation responses specific to the Tarchon project

10.1 Consultation responses in regard to Tarchon were all opposed to Ofgem's approval of this interconnector project. Ofgem received a response from Sir Bernard Jenkin, MP for Harwich and North Essex, the Essex Suffolk Norfolk pylons group and from 270 members of the general public including four parish councils. Some of these responses were direct endorsements of Sir Bernard Jenkin's letter of opposition.

Project location

10.2 Responses from the general public generally were requests to change the location of the Ardleigh substation from the greenfield site near Dedham Vale to a brownfield site such as Bradwell, Tilbury or Grain. Additionally, they requested the project to convert to an OHA and this was perceived to therefore remove the requirement for the Ardleigh substation. Opposition stems from concerns of harm to the local countryside, listed buildings, agricultural land, water supplies, house prices and noise pollution from construction. Additionally, the potential negative impact on the local economy including tourism and leisure was emphasised.

10.3 Ofgem is not involved in planning and consenting processes. NESO firstly determines a location through the grid connections process. There is then a later planning and consenting process with relevant authorities which is required before a development starts construction. Following the award in principle of a cap and floor regime, we monitor projects' progress to construction.

10.4 Sir Bernard Jenkin also questioned why a decision for Tarchon was not aligned with NESO's wider East Anglia Study[42]. The cap and floor regime is applicable only to interconnectors and the scope of our IPA is to determine the consumer benefit brought by individual projects. Interconnectors are not substitutable for other types of network infrastructure such as those considered in NESO's East Anglia Study. Interconnectors, as importers and exporters of electricity from other markets, trade differently, and can act as both an input to the GB grid and a network asset - this involves a different licensable activity to transmission. As a result, Ofgem does not compare the consumer benefit of building an interconnector in relation to other assets.

Ofgem's interpretation and use of modelled data

10.5 Responses from Sir Bernard Jenkin, the general public and the Essex Suffolk Norfolk Pylons Group are all critical of the constraint costs results presented in the W3 IPA consultation. This criticism is due to an assumption that Tarchon would primarily be exporting because high constraints on the system would prevent it from importing. This assumption by the respondents is not present in our system impacts analysis and is factually inaccurate. The same consultation responses suggest that moving Tarchon's onshore location will allow it to import. High constraints on the system do not stop interconnectors from importing. The flow direction of an interconnector is instead determined by the wholesale price difference between GB and the relevant connected foreign market.

10.6 Although Tarchon contributes to an improvement to energy security in the LW scenario, Sir Bernard Jenkin points out that this scenario is an outlier and in most scenarios Tarchon contributes minimally to GB energy security. He also states that Tarchon is projected to increase GB emissions. As detailed in the IPA consultation, on balance against other indicators and savings, we consider that it is appropriate to approve an interconnector which shows sufficient value beyond its GB-only emissions impact, see the commentary on our net zero duty in the Introduction.

Changes to results

Maturity and deliverability assessment

10.7 There has been no need to revisit the deliverability indicators and these remain as they were in consultation.

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[42] download (neso.energy)

Market modelling and system impacts analysis

10.8 The table below is a summary of the changes to certain project indicators since the minded-to consultation. The full table of results across all indicators can be referenced in the Annex.

	Total SEW for GB (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total SEW for UK** (real 2022 GBP, NPV 3.5% discount rate) **£bn**	**Total European carbon savings** (EU + GB & Norway) **mtCO2**	**Balancing market impacts** **(Constraint costs)** (real 2022 GBP, NPV 3.5% discount rate) **£bn**
Tarchon (results from minded-to position)	1.4 to 2.3	**not previously calculated**	8.0 to 16.1	0.2 to 1.3
Tarchon (results for decision)	1.5 to 2.4	1.5 to 2.4	6.3 to 12.2	0.0 to 1.3

Numbers expressed in range of results between all scenarios for the MA approach. Each indicator shows the total result for the project over a 25-year period.

Socio-Economic Welfare

10.9 The SEW results for Tarchon have changed since the W3 IPA consultation due to updates to our modelling as outlined in Section 3.

10.10 The total SEW RAG rating has not changed from green. This means that the project continues to deliver total SEW benefits to GB in all scenarios. The re-run results for this indicator show a decrease from £2.3bn to £1.7bn in LW, an increase from £2.1bn to £2.4bn in CT and an increase from £1.4bn to £1.5bn in FS.

10.11 This positive SEW continues to be largely driven by strong producer SEW and marginally positive IC SEW across all scenarios. Consumer SEW has decreased in LW and FS, and slightly increased in CT. The consumer SEW continues being negative in all scenarios. The producer SEW has increased across all scenarios and remains positive in all of them. The interconnector SEW has increased in CT and FS, and decreased in LW.

10.12 Tarchon continues being anticipated to be a predominant exporter and therefore contributing to an increase in wholesale prices in GB.

Revenue expectations

10.13 Tarchon is not expected to require floor payments in any scenario, and is expected to provide cap payments to consumers in all years for LW and CT, and from 2036 onwards in FS. Ofgem is satisfied that Tarchon would not be a detriment to consumers by requiring excessive floor support.

Decarbonisation

10.14 Results from our re-run suggest that Tarchon continues to increase CO2 emissions in GB, but contributes to a net decrease in Germany and a net decrease in Europe. A cross-border approach to decarbonisation is important for progressing global climate ambitions.

Security of Supply

10.15 The results for this indicator remain largely the same as well as its RAG Rating. As at the consultation stage, no unserved energy (USE) hours are observed in the CT and FS scenarios. Overall, there remain benefits in the LW scenario and thus this project continues to deliver benefits to consumers in this indicator.

Constraint costs (balancing market impacts)

10.16 NESO has undertaken further analysis on constraint costs impacts of Tarchon. This takes into account all the changes to the modelling which have taken place since the publication of the W3 IPA consultation. Additionally, the reduction rate factor has been applied from 2035 onwards to account for predicted future network reinforcements.

10.17 NESO further results suggest that the project continues having positive and negative impacts across different boundaries of the system, although the negative impacts outweigh the positive impacts. On balance, the project continues to increase constraint costs under most scenarios but at a lower extent mainly because the application of the constraint reduction factor.

10.18 NESO's analysis suggests that the introduction of Tarchon into the system would represent between 0% to 2.4% of the increase in the total constraint costs if they were to materialise. We note that Tarchon share in the projected installed capacity in GB would range from 0.4% to 0.9% when looking at the 2030 and 2050 installed capacity projections.

10.19 Although the upper bound of constraint costs in the MA case has stayed the same since consultation, the constraint saving is no longer seen in the results. The RAG rating for this indicator remains amber and this project now results in constraint costs in all scenarios ranging from £0bn to £1.3bn. Based on this information, the range of constraint costs are manageable and would not pose considerable risk to consumers.

System Operability indicators

5.35 The system operability indicators were not re-run by NESO because the change in modelling assumptions was understood to not produce a material change in the results. Therefore, we have used the same results that were published in our minded-to consultation. The RAG ratings have not changed for these indicators.

RES curtailment

10.20 The updated curtailment analysis from the NESO shows that the addition of Tarchon to the system results in 46-105 TWh of curtailment savings over 25 years, in the MA case. As in the original analysis, the impact in the Consumer Transformation scenario is particularly high.

Network costs

10.21 Network costs have been assessed by Ofgem and are found to be satisfactory for this project. The details of onshore works are not disclosed in this decision due to commercially sensitive data.

Hard to monetise impacts

10.22 Hard to monetise impacts were not affected by the updates to modelling conducted since the consultation. These indicators have not been reassessed and therefore our RAG ratings have not changed.

Our Decision

10.23 Having carefully considered the consultation responses received as well as the changes in results, Ofgem has decided to approve Tarchon's application and grant it a cap and floor regime in principle. The project delivers high total SEW to GB across its 25 year regime, and delivers significant savings in renewables curtailment, enabling efficient grid operation and use of GB's renewables resources. The project is deliverable to reach operations by the end of 2032. The upper boundary of the possible constraint costs is low enough for the consumer risk to be manageable and the project is overall in the interest of GB consumers.

10.24 Concerns over the siting and planning of an interconnector fall outside of Ofgem's remit and will be decided upon by relevant local authorities later in the development process, who will decide on the appropriate studies and stakeholder engagement to be undertaken at that point.

11. Conditions relating to our decision

11.1 Our IPA conditions remain an important tool to protect consumers as they provide Ofgem with the ability to intervene if a project has materially deviated from the basis upon which it was awarded in principle a cap and floor regime. It also ensures that projects make consistent progress towards the connection deadline for Window 3, to become operational prior to the end of 2032.

11.2 Our decision to award in principle LirIC, MaresConnect and Tarchon a cap and floor regime is contingent upon the following conditions (the 'IPA conditions'):

a) **Operations prior to the end of 2032**: If there is a change in circumstances before the FPA decision that means it is no longer feasible for a project to become operational by the end of 2032, we may choose to conduct an IPA review of the project. This would involve Ofgem undertaking a reassessment of the IPA in order to confirm whether or not the project continues to be in consumers' interests and should continue to hold a cap and floor regime in principle. Following an IPA review, Ofgem may decide to allow the project to retain in principle its cap and floor regime or may decide to revoke the regime.

b) **Material change**: If any information given to us before FPA decision leads us to consider that the project no longer meets the basis upon which it was granted in principle a cap and floor regime, then we may choose to conduct an IPA review of the project. This information includes changes to project parameters such as timelines, connection date, project configuration, commercial arrangements, regulatory support or grid connection in the connecting country, and costs. The developer must give Ofgem formal written notice of any material changes to the project. The developer must explain the rationale for the change and the implications on project cost and delivery.

c) The developer must submit detailed information on costs for our FPA to start within three years of an IPA decision. This information will need to be informed by detailed discussions with the supply chain and tender returns.

d) The developer must submit quarterly written reports on progress against a number of key development milestones, including (but not limited to) development work, consenting and permitting, procurement, financing, operational management plans and costs, project management and other factors that had an impact on the IPA assessment under which the project was granted a cap and floor regime.

e) The developer must confirm the timing of FPA submission in writing to Ofgem at least two months before the expected submission date.

12. Next Steps

12.1 Developers which pass the IPA and are awarded in principle a cap and floor regime will have three years to submit detailed cost information for the FPA stage. The provisional cap and floor levels will be set on a project-by-project basis at the FPA stage following our cost assessment.

12.2 We will confirm our thinking on the need for, and timing of, of a fourth window within the next few months.

Market Modelling Annex

Methodology of the changes to the I-SEM assumptions

In 2022, ENTSO-E and ENTSOG (ENSTO-E/G) published a joint report with a set of energy system scenarios to develop their TYNDP.[43] This report presents three scenarios: National Trends (NT), Global Ambitions (GA) and Distributed Energy (DE). These scenarios set out different pathways to reach carbon neutrality by 2050 and contain assumptions across different European bidding zones.

In this re-run, Arup used the three scenarios that ENSTO-E/G published in their TYNDP 2022 report for the bidding zone in Northen Ireland and the Republic of Ireland to obtain the new supply and demand assumptions for I-SEM.

Arup paired the FES scenarios and ENSTO-E/G scenarios based on the scale of RES deployment and speed of decarbonation. FES LW and FES CT were paired with ENSTO-E/G DE. FES FS was paired with ENSTO-E/G GA.

The DE and GA scenarios start from 2030 and run until 2050. On the other hand, the NT scenario starts in 2025. As our analysis starts in 2027, for the period 2027-2029, Arup interpolated the NT inputs to the DE/GA inputs to obtain a complete set of assumption from 2027 to 2050.

Aminth

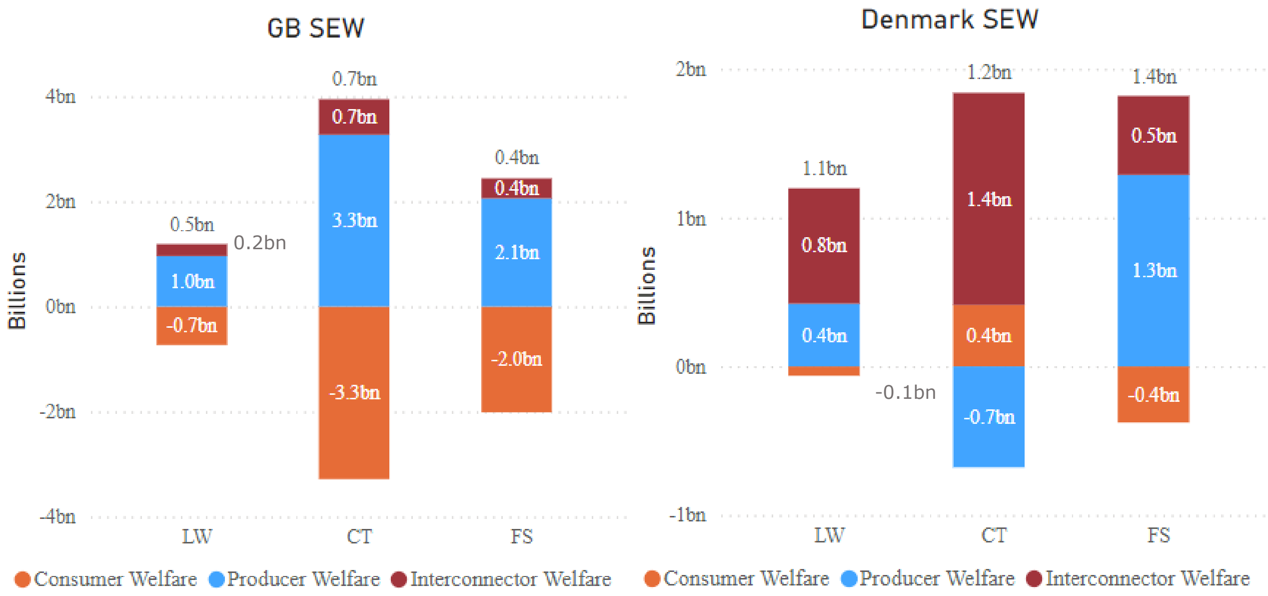
Overview and SEW impacts

The Aminth project has been modelled as a 1.4 GW interconnector between GB and the energy island under development in Danish national waters (L1). The island is assumed to operate from 2031 as an offshore bidding zone (OBZ)[44] and will connect to Denmark and Belgium via the TritonLink project.

[43] TYNDP 2022 Scenario Report – Introduction and Executive Summary (entsos-tyndp-scenarios.eu)

[44] Offshore bidding zones: key to efficient market integration (tennet.eu): ‘Offshore bidding zones are separate price regions for offshore hubs, within the European electricity market.’

Figure 1.1 – SEW impacts of Aminth in GB and Denmark (£bn, real 2022, NPV)



Stacked column charts presenting the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and Denmark.

In GB, the total SEW impacts are positive in all scenarios. This is due to strong Producer SEW and positive IC welfare. Aminth delivers negative consumer SEW in all scenarios.

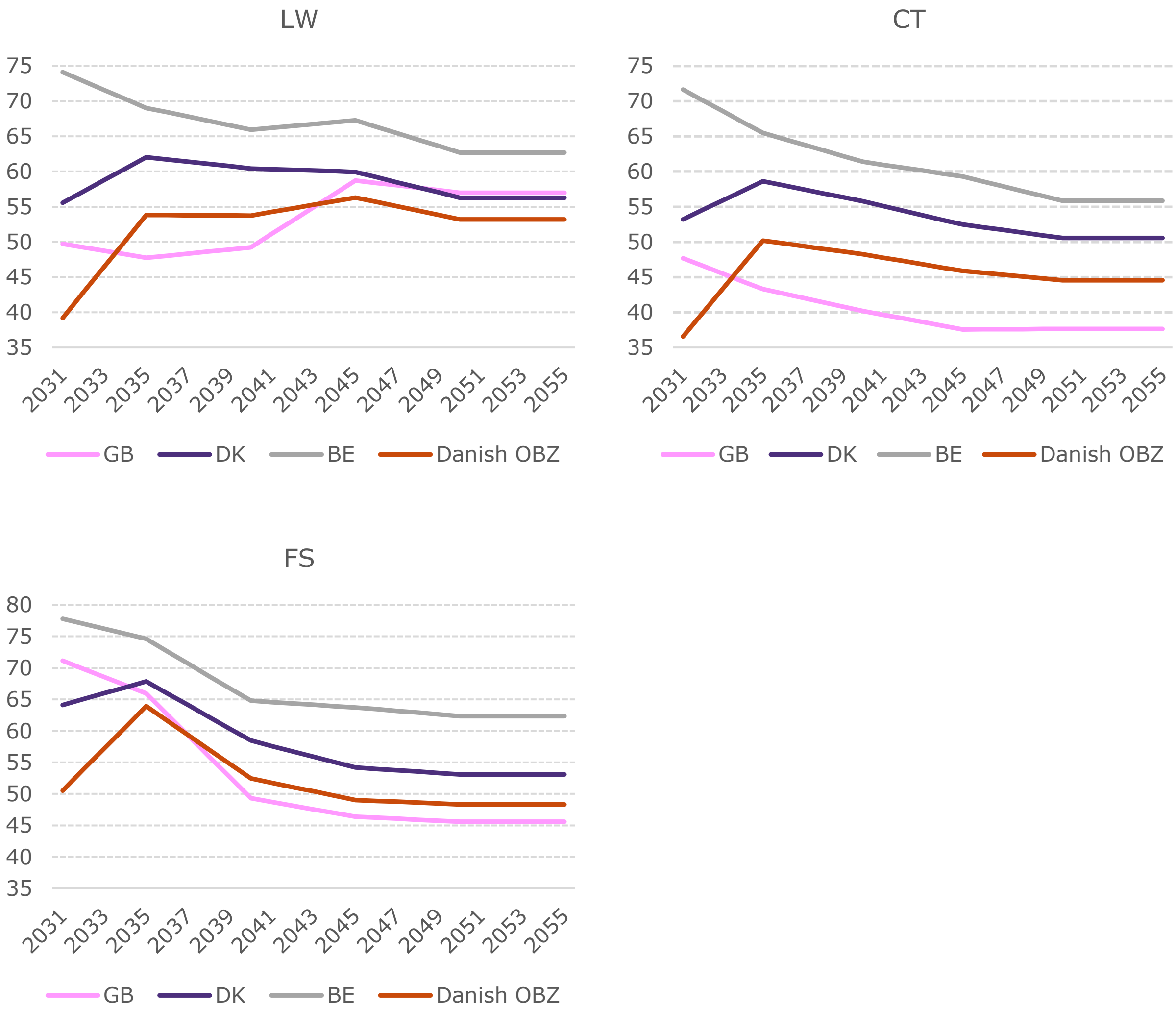
Aminth is predominantly used to export electricity from GB across the three scenarios. This increases wholesale prices in GB compared to the counterfactual[45]. This in turn increases producer SEW and reduces consumer welfare.

In Denmark, Aminth delivers positive total SEW in all scenarios. This is largely driven by strong interconnector and producer SEW in LW and FS, and interconnector and consumer SEW in CT.

Price differentials and flows

Figure 1.2 – Price differentials between GB, Denmark, Belgium and the Danish OBZ (£/MWh)

[45] The counterfactual indicates the impacts in a scenario without the project being modelled.

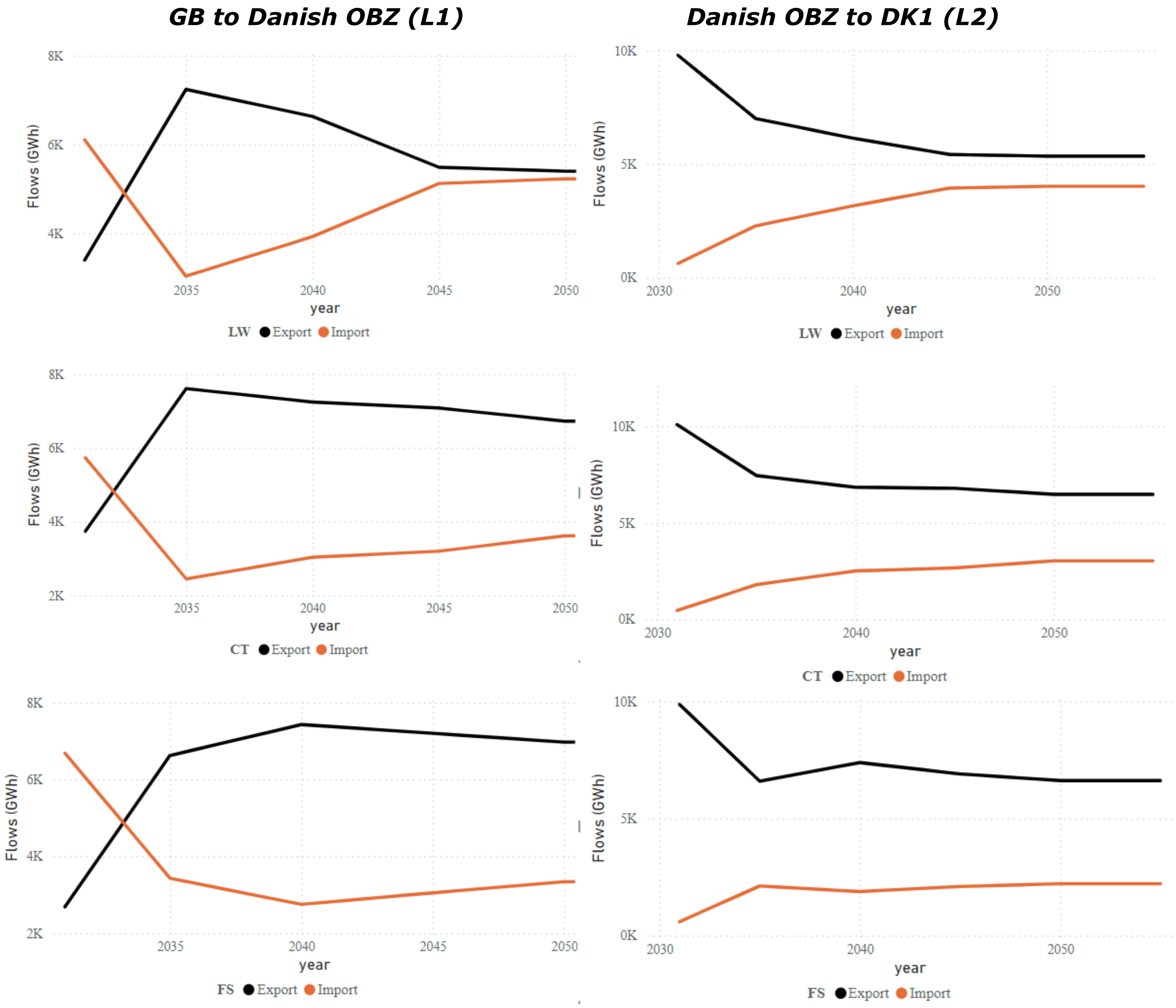


Line charts representing the wholesale price in GB, Denmark, Belgium and the Danish OBZ.

Prices in Belgium are constantly higher than in Denmark, the Danish OBZ and GB. In LW, prices in Denmark are generally higher than in GB and the Danish OBZ but prices in GB exceed prices in Denmark, starting from late 2040s. In the majority of modelled years in LW, GB prices are higher than the Danish OBZ, with the exception of the time period between 2034 to 2043. In CT, prices in Denmark are higher than in the Danish OBZ and GB, and with the exception of early years prices in GB are lower than in the Danish OBZ. A similar trend can be observed in FS, with the exception of the early 2030s, when GB prices exceed prices in Denmark.

The price differentials described above are the main drivers of the direction of electricity flows across the project. As the below line charts show, the project is mostly used for exporting electricity from GB. The exceptions to this are the early years across all scenarios, where the project is forecast to import more than to export.

Figure 1.3 – Electricity flows across Aminth and L2 (GWh)

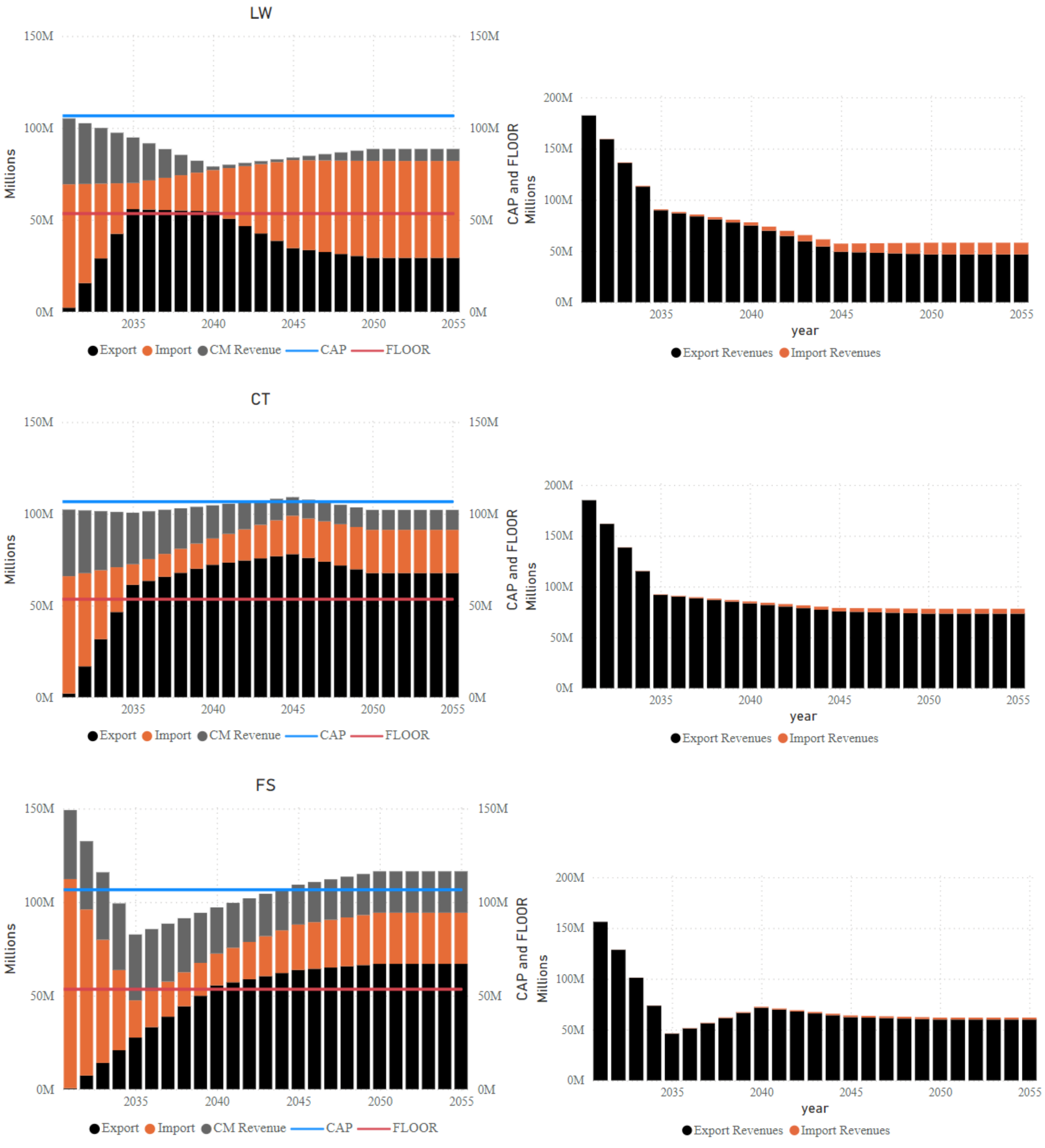


Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 1.4 – GB portion of revenues earned by Aminth and L2, based on a 50:50 split with Denmark (£m, real 2022)

GB to Danish OBZ (L1) ***Danish OBZ to DK1 (L2)***

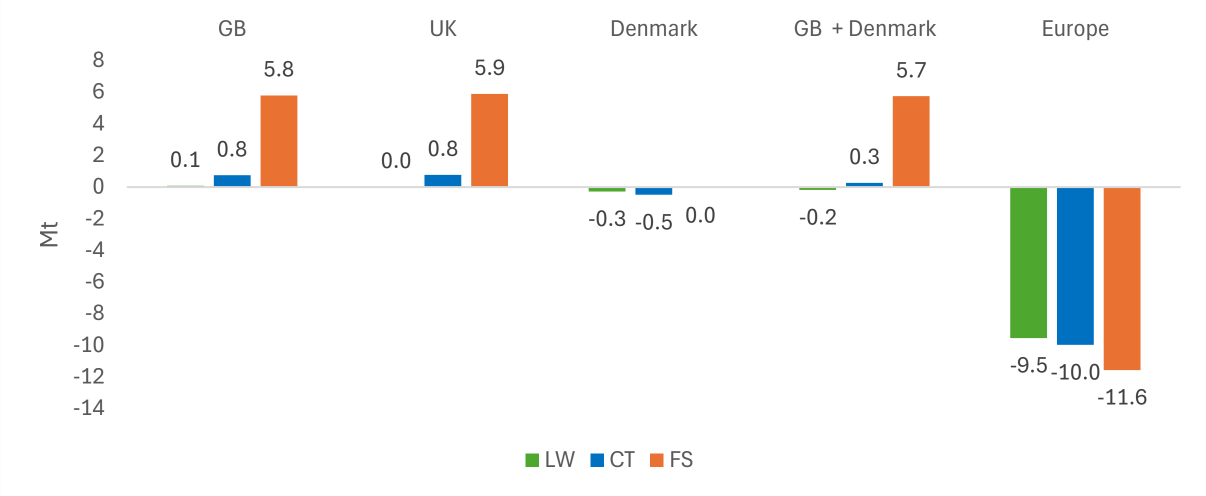


Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2031 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels.

Aminth is forecast to earn most of its revenue through exports from GB. Aminth's revenues generally fall between the cap and floor levels, and as such, no floor support is likely to be required. In CT and FS, Amith is expected to make payments above the cap.

Decarbonisation impacts

Figure 1.5 – Decarbonisation impact in GB, Denmark and Europe



Column chart representing the impact of Aminth on CO_2 emissions in GB, Denmark and Europe.

The introduction of the Aminth project is likely to increase CO_2 emissions in GB across all scenarios. This is because the project increases the dispatch of thermal generation in GB by increasing GB wholesale prices. The project is likely to reduce emissions in the Denmark and across Europe in all scenarios.

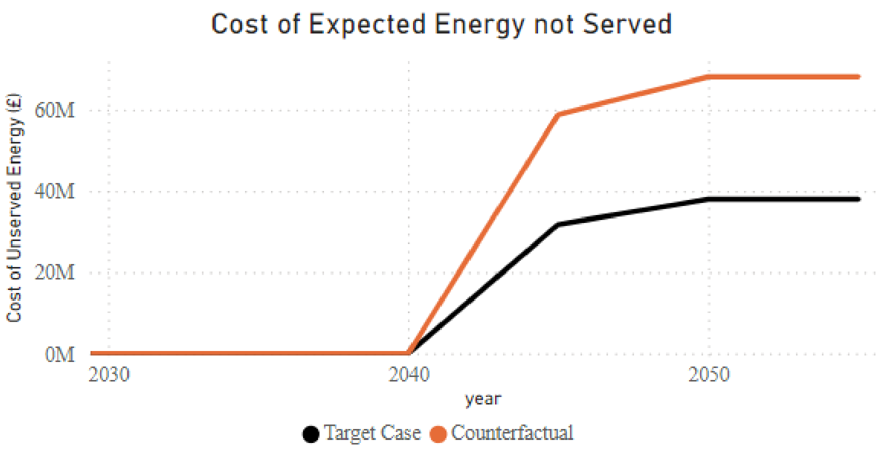
Table 1.1 – Decarbonisation indicators for Aminth

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	-982.6	46.9	362.3
CO_2 reduction (societal value)	GB	£m real 2022 NPV	21.7	152.8	567.2
Overall decarbonisation	Europe	Mt	-9.5	-10.0	-11.6

As shown in Table 1.1 above, the increase in CO_2 emissions in GB leads to energy consumers paying electricity at a higher cost compared to the counterfactual. The additional CO_2 also leads to higher societal costs in GB.

Security of supply impact

Figure 1.6 – Cost of Expected Energy Not Served (EENS) in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of Aminth's introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of Aminth leads to a reduction in the number of USE (unserved energy) hours in GB compared to the counterfactual in LW. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £375.8m.

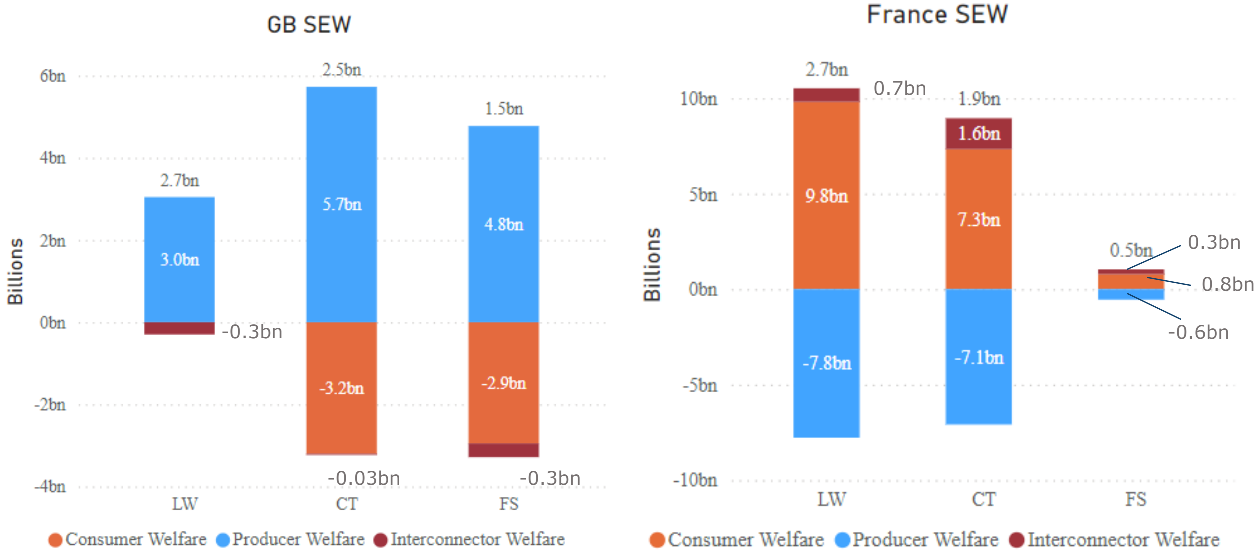
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that Aminth does not have positive nor negative impacts on SoS (security of supply) in GB.

AQUIND

Overview and SEW impacts

The AQUIND project has been modelled as a 2GW point-to-point interconnector, connecting GB and France from 2027.

Figure 2.1 – SEW impacts of AQUIND in GB and France (£bn, real 2022, NPV)



Stacked column charts presenting the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and France.

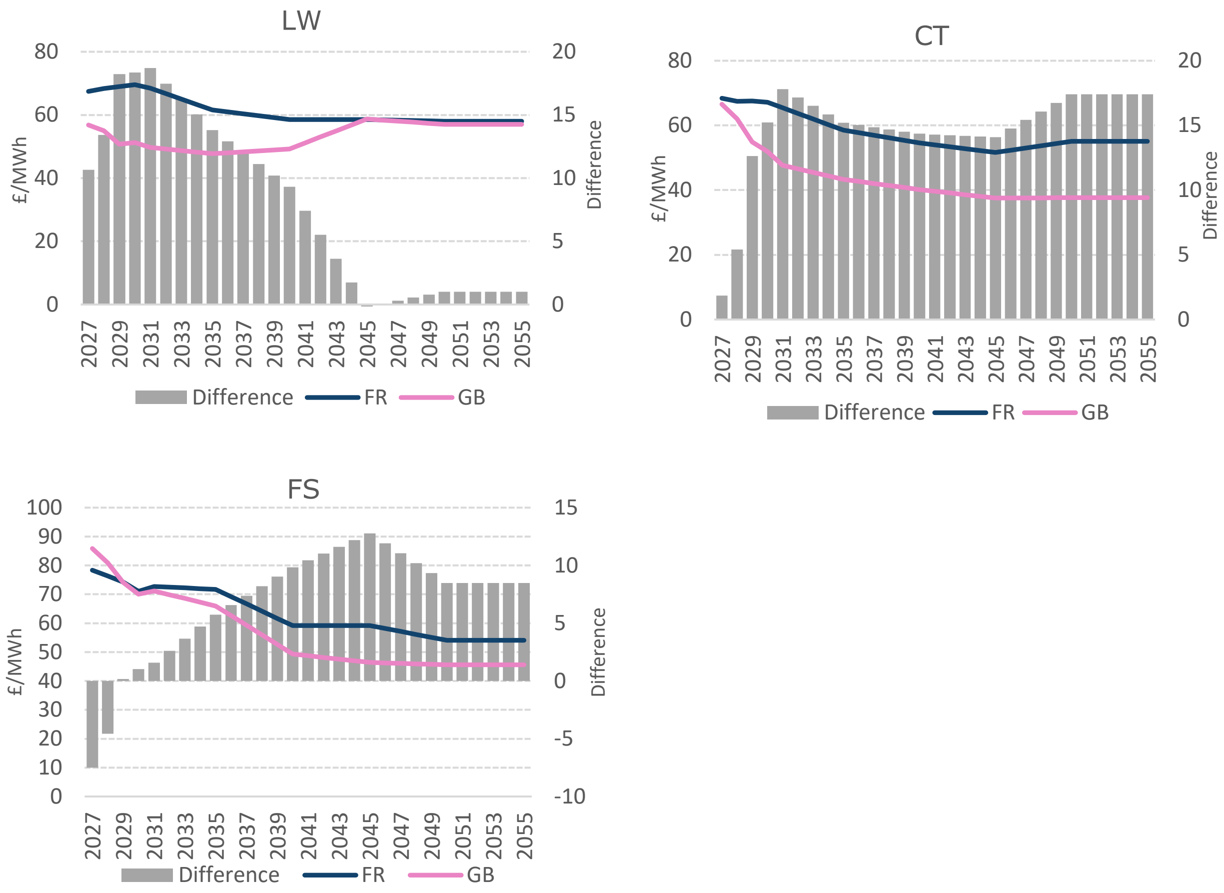
In GB, the total SEW impacts are positive in all scenarios. This is mainly due to the strong Producer SEW. AQUIND's impact on Consumer SEW is marginally positive in LW and negative in CT and FS scenarios. The interconnector SEW in GB is negative in all scenarios.

AQUIND is predominantly used to export electricity from GB across the three scenarios. This increases wholesale prices in GB compared to the counterfactual. This in turn increases producer SEW and reduces consumer welfare.

In France, AQUIND delivers positive total SEW in all scenarios. This is largely driven by strong positive consumer SEW and positive interconnector welfare. Producers are negatively impacted in all scenarios.

Price differentials and flows

Figure 2.2 – Price differentials between GB and France (£/MWh)

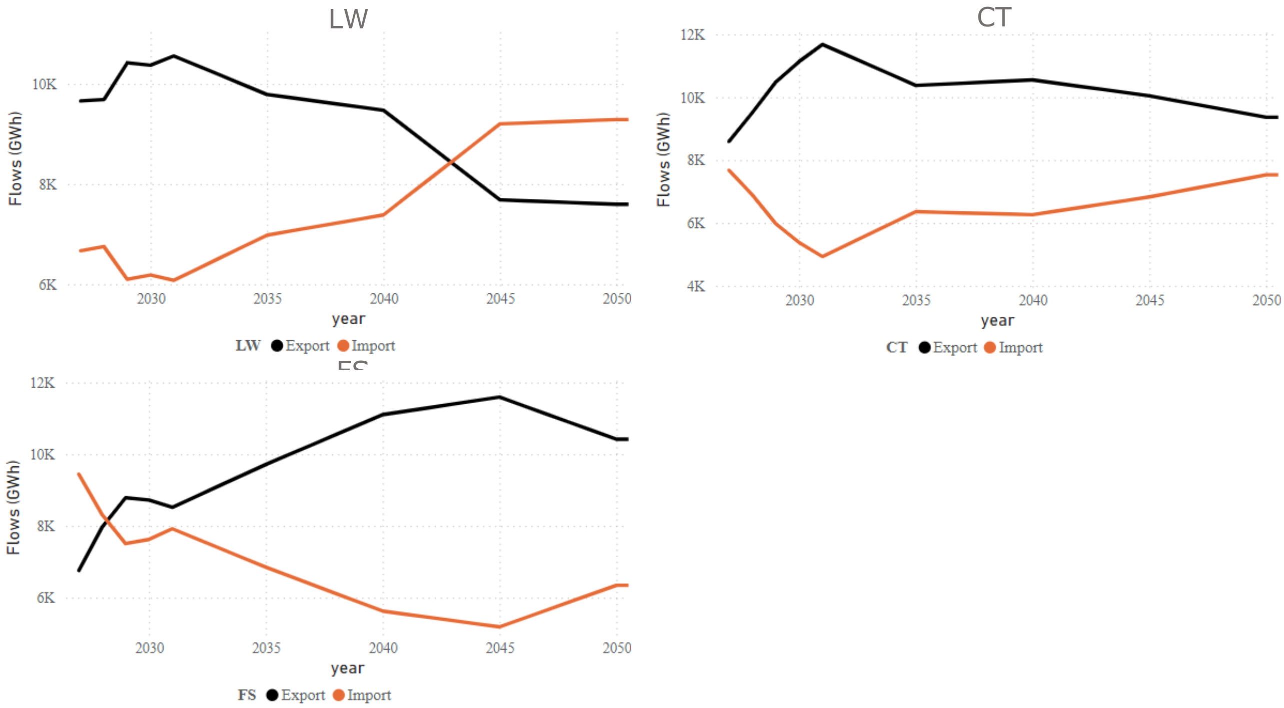


Combined column and line chart comparing the annual wholesale prices in GB and France from 2027 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in France are higher than prices in GB in most scenarios and years observed, except in FS where prices in GB are higher in the first couple of years of operation. In LW prices tend to converge from 2045 onwards but prices in FR remain higher in the majority of years.

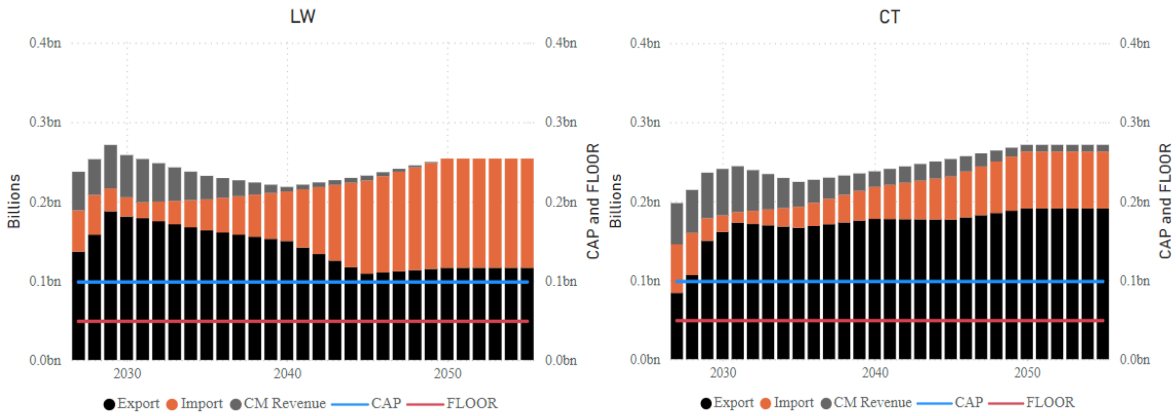
The price differentials described above are the main drivers of the direction of electricity flows across the project. As the below line charts show, the project is mainly used for exporting electricity from GB, apart from some years in FS and LW. In FS, AQUIND imports more than exports over the first couple of years. In LW, the project becomes a net importer from 2043 onwards.

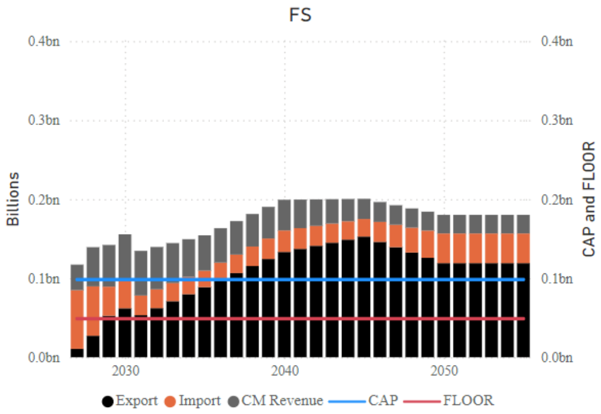
Figure 2.3 – Electricity flows across AQUIND (black line: exports from GB, orange line: imports from France) (GWh)



Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Figure 2.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)



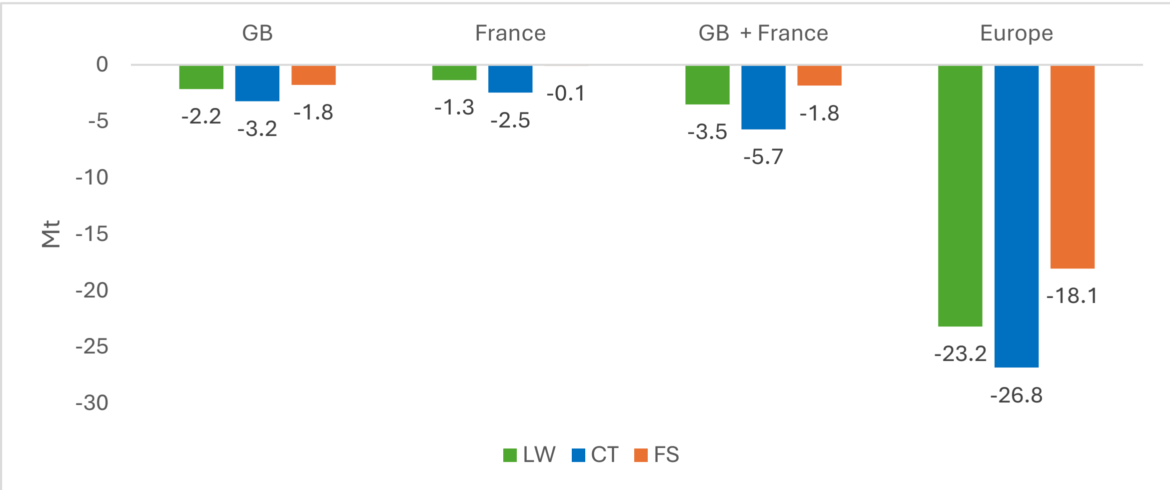


Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2027 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

AQUIND is forecast to earn most of its revenue through exports from GB to France in all scenarios. There is an exception in LW where revenues from imports exceed export revenues starting from 2045. AQUIND's revenues are forecast to be constantly above the cap level across all scenarios.

Decarbonisation impacts

Figure 2.5 – Decarbonisation impact in GB, France and Europe



Column chart representing the impact of AQUIND on CO_2 emissions in GB, France and Europe.

The introduction of the AQUIND project is likely to reduce emission in GB across all scenarios. This is because the project is used to import electricity from France during peak hours, displacing carbon intensive plants in GB. This effect is higher than the opposite effect the project has when exporting from GB. In France, the project leads to a decrease in emissions in LW and CT but a marginal increase in FS. The project is likely to reduce emissions across Europe in all scenarios.

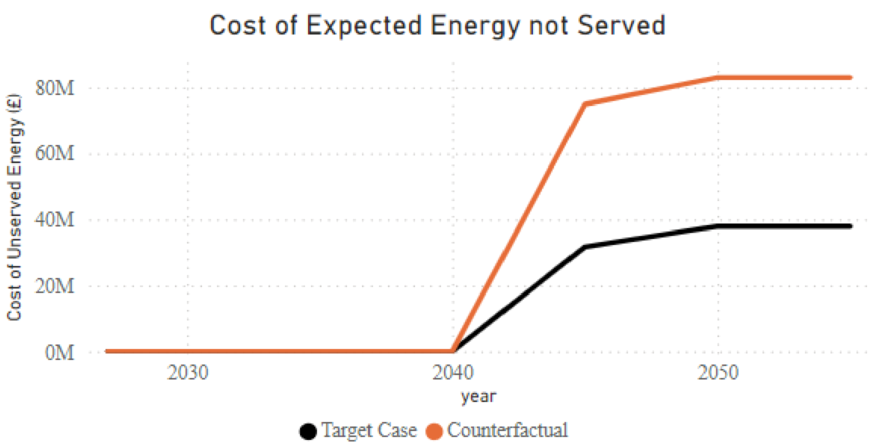
Table 2.1 – Decarbonisation indicators for AQUIND

Indicator	**Applies to**	**Unit**	**LW**	**CT**	**FS**
CO_2 reduction (SEW)	GB	£m real 2022 NPV	-223.0	-291.2	-194.2
CO_2 reduction (societal value)	GB	£m real 2022 NPV	-790.1	-755.4	-237.2
Overall decarbonisation	Europe	Mt	-23.2	-26.8	-18.1

As shown in Table 2.1 above, the decrease in CO_2 emissions in GB leads to energy consumers paying electricity at a lower cost compared to the counterfactual across all scenarios. Lower emission levels also lead to lower societal costs in GB.

Security of supply impact

Figure 2.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of AQUIND's introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of AQUIND leads to a reduction in the number of USE hours in GB compared to the counterfactual in LW. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £396m.

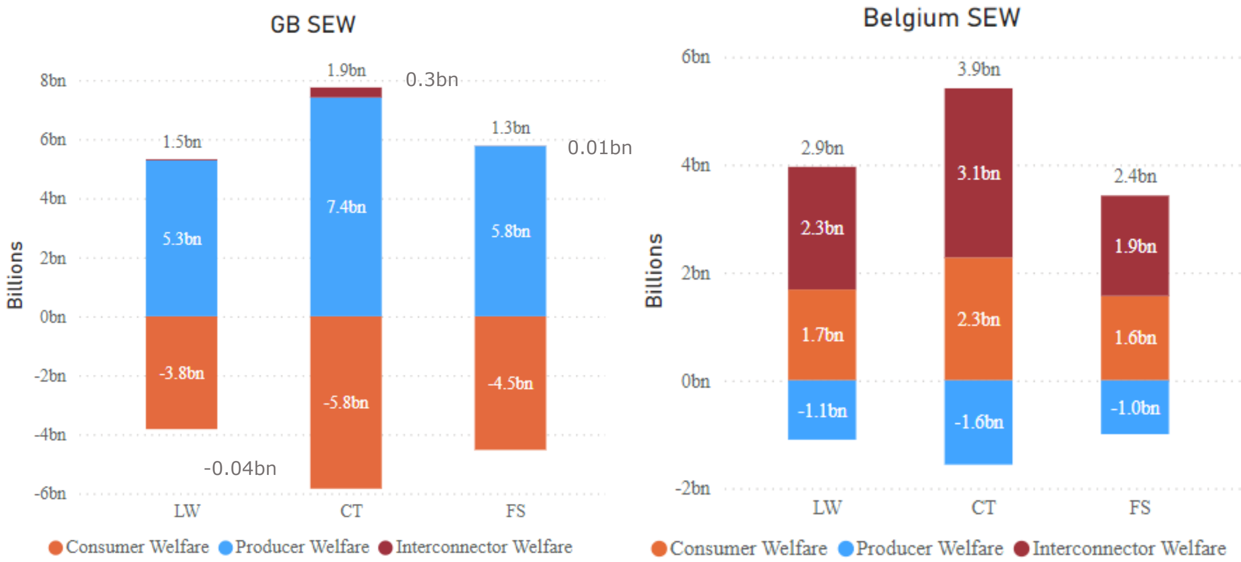
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that AQUIND does not have positive nor negative impacts on SoS in GB.

Cronos

Overview and SEW impacts

The Cronos project has been modelled as a 1.4GW interconnector between GB and Belgium, connecting in 2029.

Figure 3.1 – SEW impacts of Cronos in GB and Belgium (£bn, real 2022, NPV)



Stacked column charts presenting the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and Belgium.

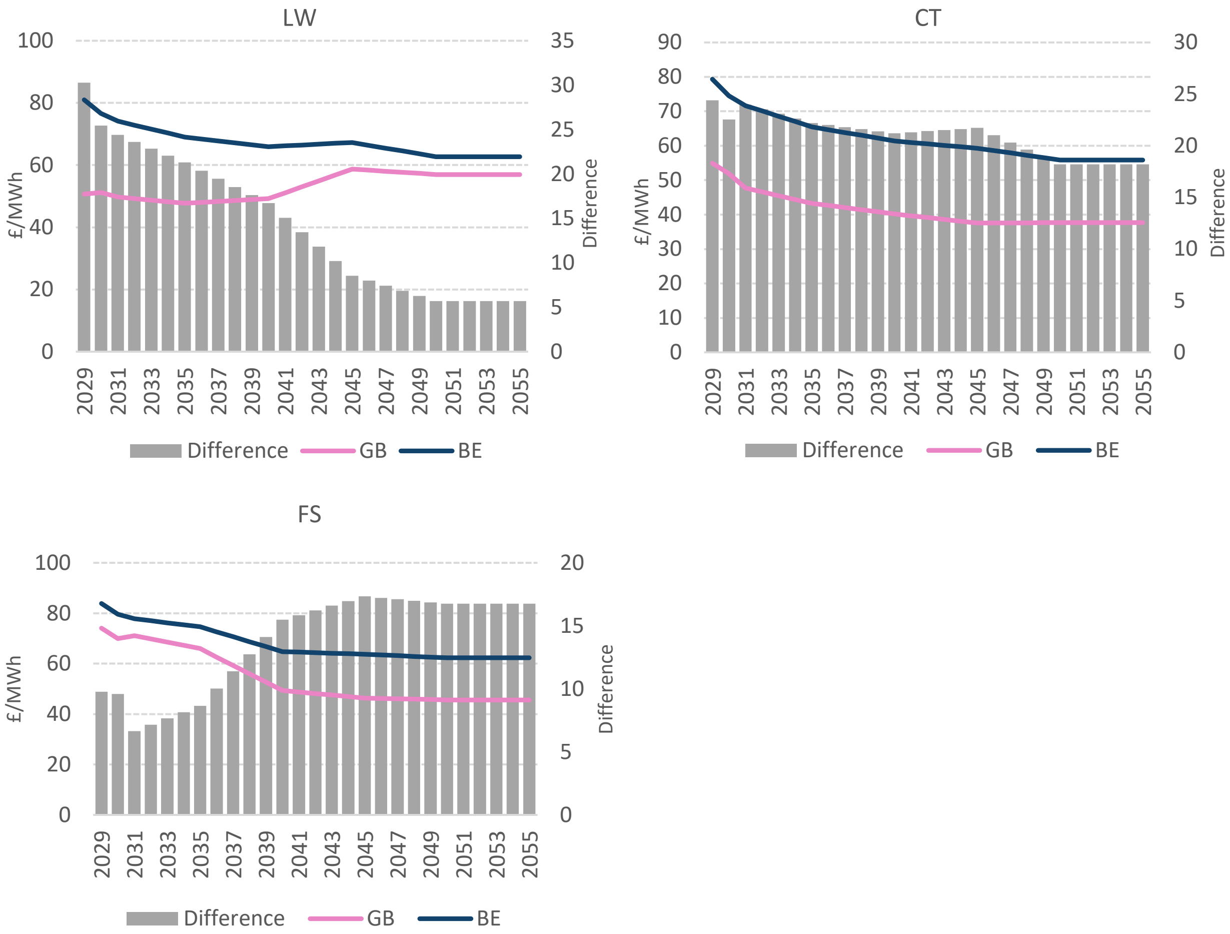
In GB, the total SEW impacts are positive in all scenarios. This is mainly due to a strong producer SEW. Cronos delivers negative Consumer SEW in all scenarios. The Interconnector SEW in GB is positive in LW and CT but marginally negative in FS.

Cronos is predominantly used to export electricity from GB across the three scenarios. This increases wholesale prices in GB compared to the counterfactual. This in turn increases producer SEW and reduces consumer SEW.

In Belgium, Cronos delivers positive total SEW in all scenarios, largely driven by strong interconnector and consumer SEW.

Price differentials and flows

Figure 3.2 – Price differentials between GB and Belgium (£/MWh)

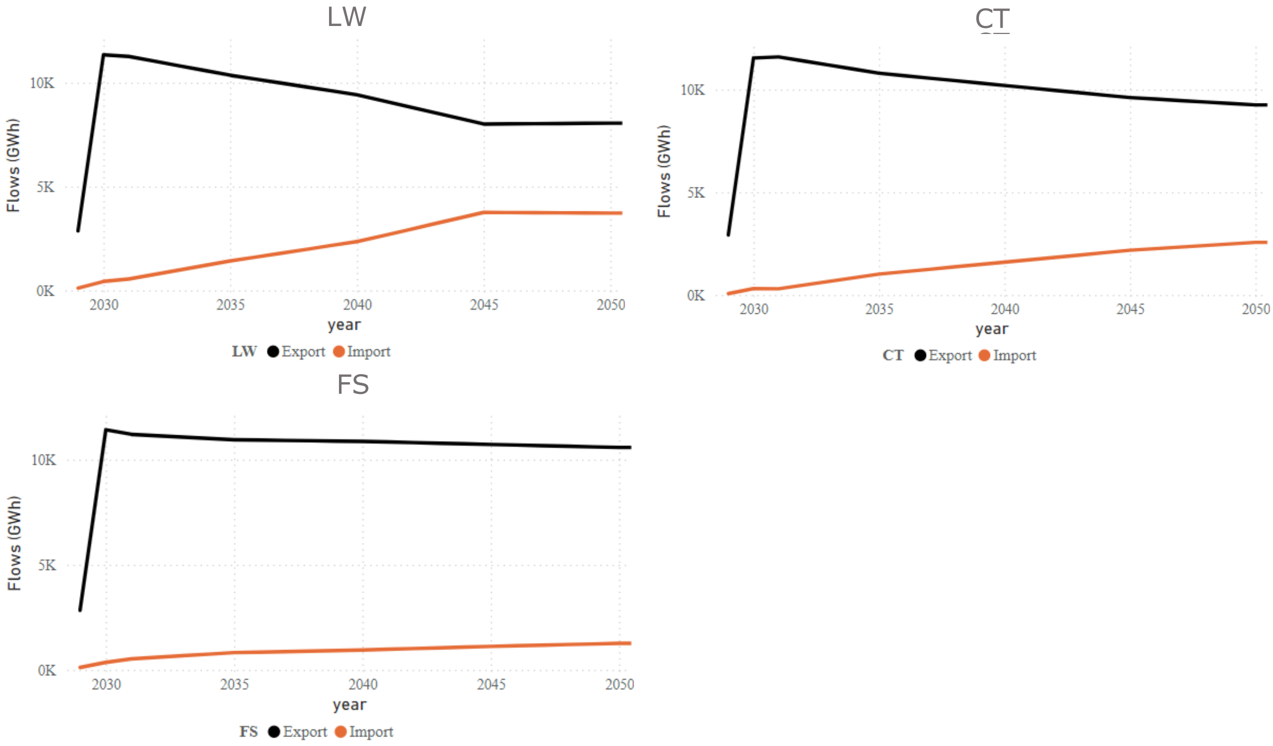


Combined column and line chart comparing the annual wholesale prices in GB and Belgium from 2029 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in Belgium are constantly higher than prices in GB in all scenarios. The price differentials are significant across the three scenarios. In LW, GB prices increase after 2040, narrowing the price differentials between the two countries. In CT, the price differentials remain stable over most of the modelled period. In FS, GB prices decrease at a higher rate than in Belgium, widening the prices differentials between the two countries.

The price differentials largely determine the direction of the electricity flows across the project. As the below line charts show, the project is predominantly used for exporting electricity from GB.

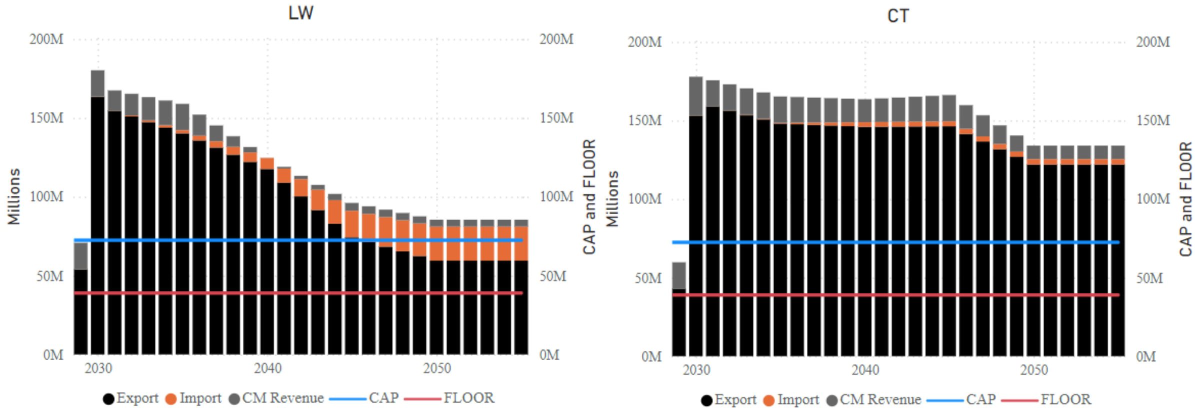
Figure 3.3 – Electricity flows across Cronos (black line: exports from GB, orange line: imports from Belgium) (GWh)

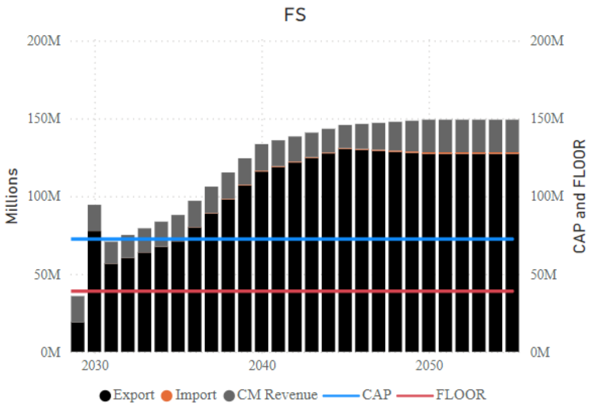


Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 3.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)



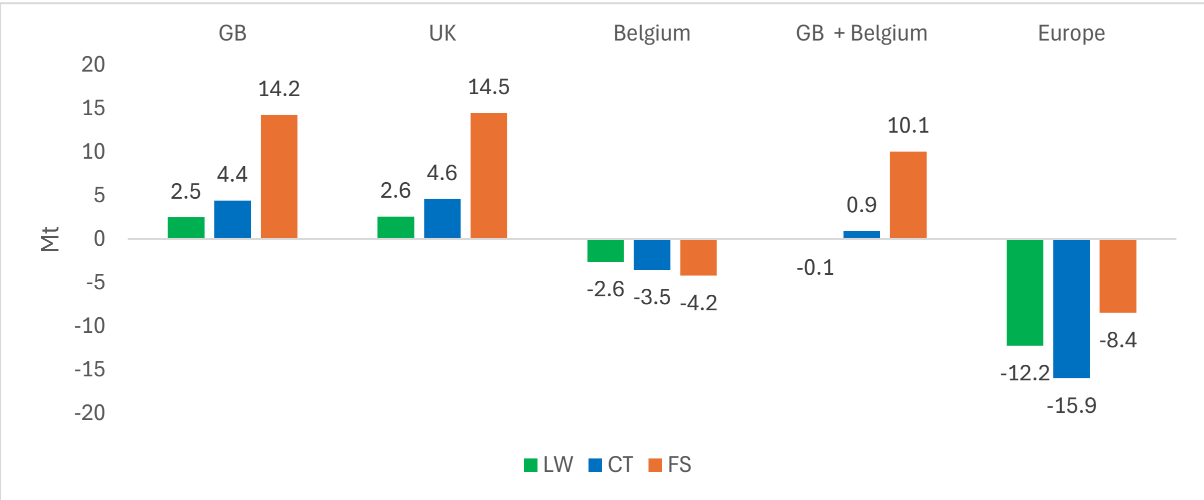


Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2029 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

Cronos is forecasted to earn most of its revenue through exports from GB in every scenario. Cronos' revenues are likely to be above the cap level over most of the modelled period across all scenarios. The exception is year 2029, as in LW and CT, revenues fall between the cap and floor levels, and below the floor in FS.

Decarbonisation impacts

Figure 3.5 – Decarbonisation impact in GB, Belgium and Europe



Column chart representing the impact of Cronos on CO_2 emissions in GB, Belgium and Europe.

The introduction of the Cronos project is likely to increase CO_2 emissions in GB across all scenarios. This is because the project increases the dispatch of thermal generation in GB by increasing GB wholesale prices. The project is likely to reduce emissions in Belgium and across Europe in all scenarios.

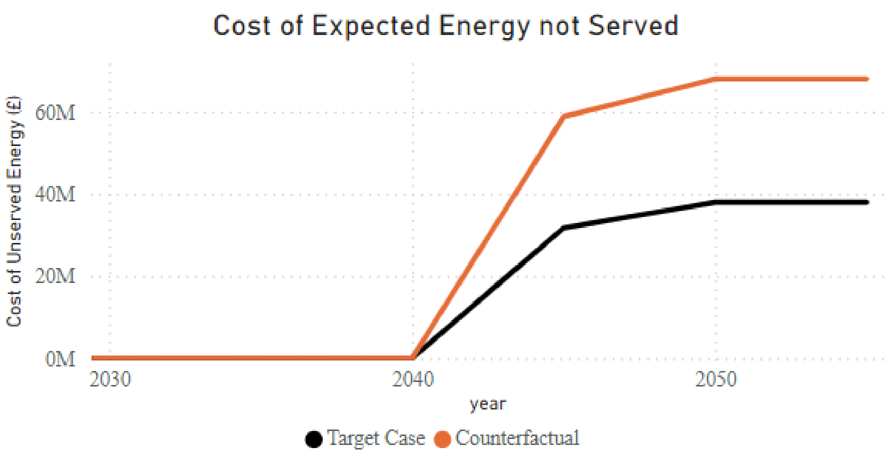
Table 3.1 – Decarbonisation indicators for Cronos

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	197.0	344.7	993.1
CO_2 reduction (societal value)	GB	£m real 2022 NPV	866.8	1,004.3	1,499.7
Overall decarbonisation	Europe	Mt	-12.2	-15.9	-8.4

As shown in Table 3.1 above, the increase in CO_2 emissions in GB leads to energy consumers paying electricity at a higher cost compared to the counterfactual. The additional CO_2 also leads to higher societal costs in GB.

Security of supply impact

Figure 3.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of Cronos' introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of Cronos leads to a reduction in the number of USE hours in GB compared to the counterfactual in LW. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £315.9m.

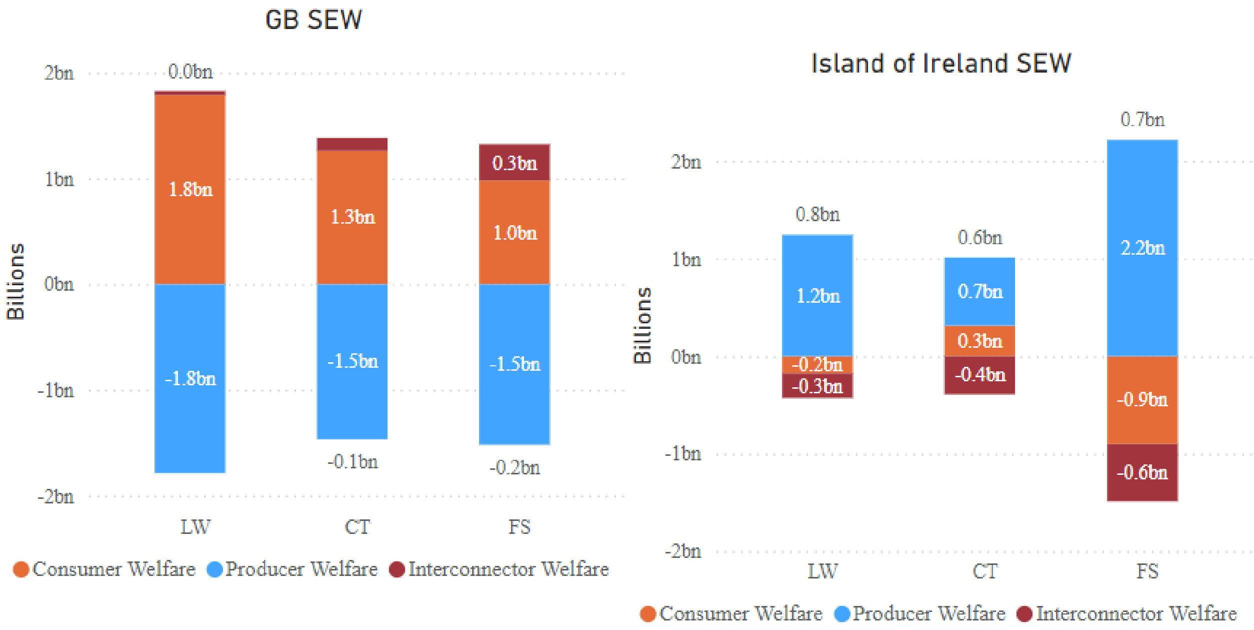
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that Cronos does not have positive nor negative impacts on SoS in GB.

LirIC

Overview and SEW impacts

The LirIC project has been modelled as a 700MW interconnector, connecting GB and the island of Ireland in 2030.

Figure 4.1 – SEW impacts of LirIC in GB and the island of Ireland (£bn, real



Stacked column charts presenting the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and I-SEM.

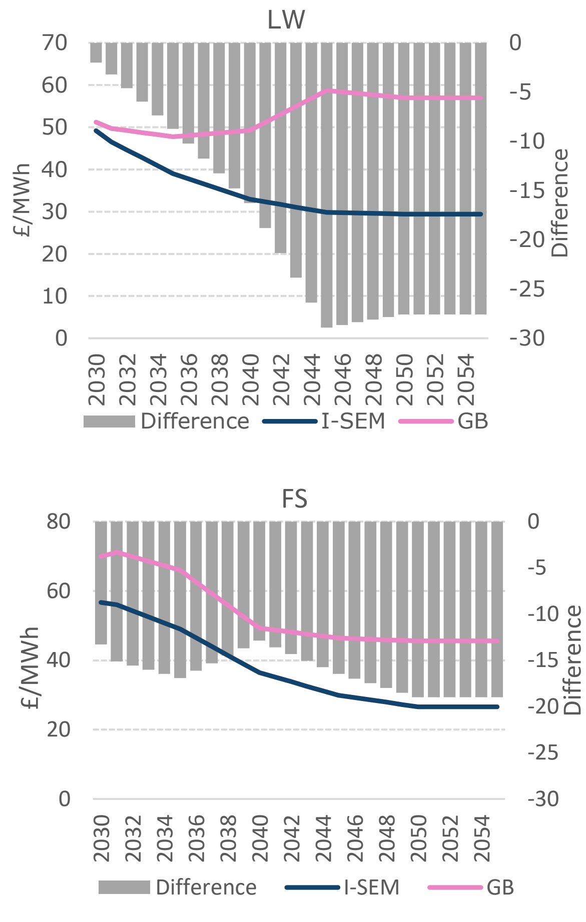
In GB, the total SEW impact is marginally positive in LW and marginally negative in CT and FS. LirIC delivers positive consumer and interconnector SEW, and negative producer SEW in all scenarios.

LirIC is predominantly used to import electricity to GB across the three scenarios. This decreases wholesale prices in GB compared to the counterfactual. This in turn decreases producer SEW and increases consumer welfare.

In the island of Ireland, LirIC delivers positive total SEW in all scenarios, largely driven by positive producer welfare. Interconnectors are negatively impacted in all scenarios. The impact on consumers is negative in LW and FS, and positive in CT.

Price differentials and flows

Figure 4.2 – Price differentials between GB and I-SEM (£/MWh)

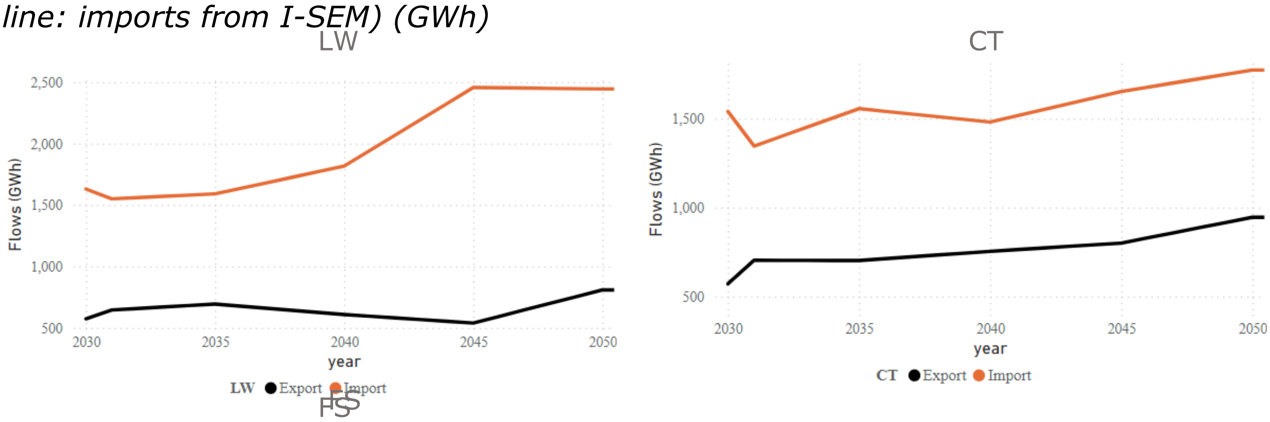


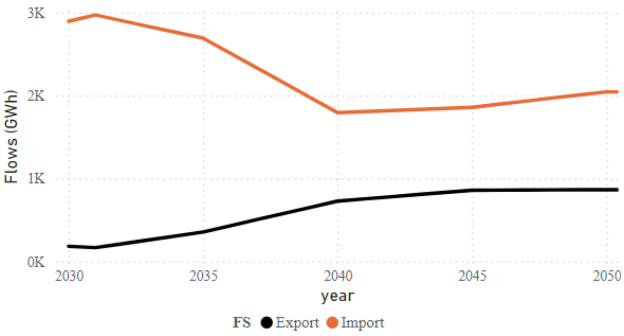
Combined column and line chart comparing the annual wholesale prices in GB and I-SEM from 2030 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in the I-SEM are constantly lower than prices in GB, except in the early years in LW and CT. In LW, there is a large increase in price differentials from 2040.

The price differentials largely determine the direction of the electricity flows across the project. As the below line charts show, the project is mostly used for importing electricity from GB.

Figure 4.3 – Electricity flows across LirIC (black line: exports from GB, orange line: imports from I-SEM) (GWh)

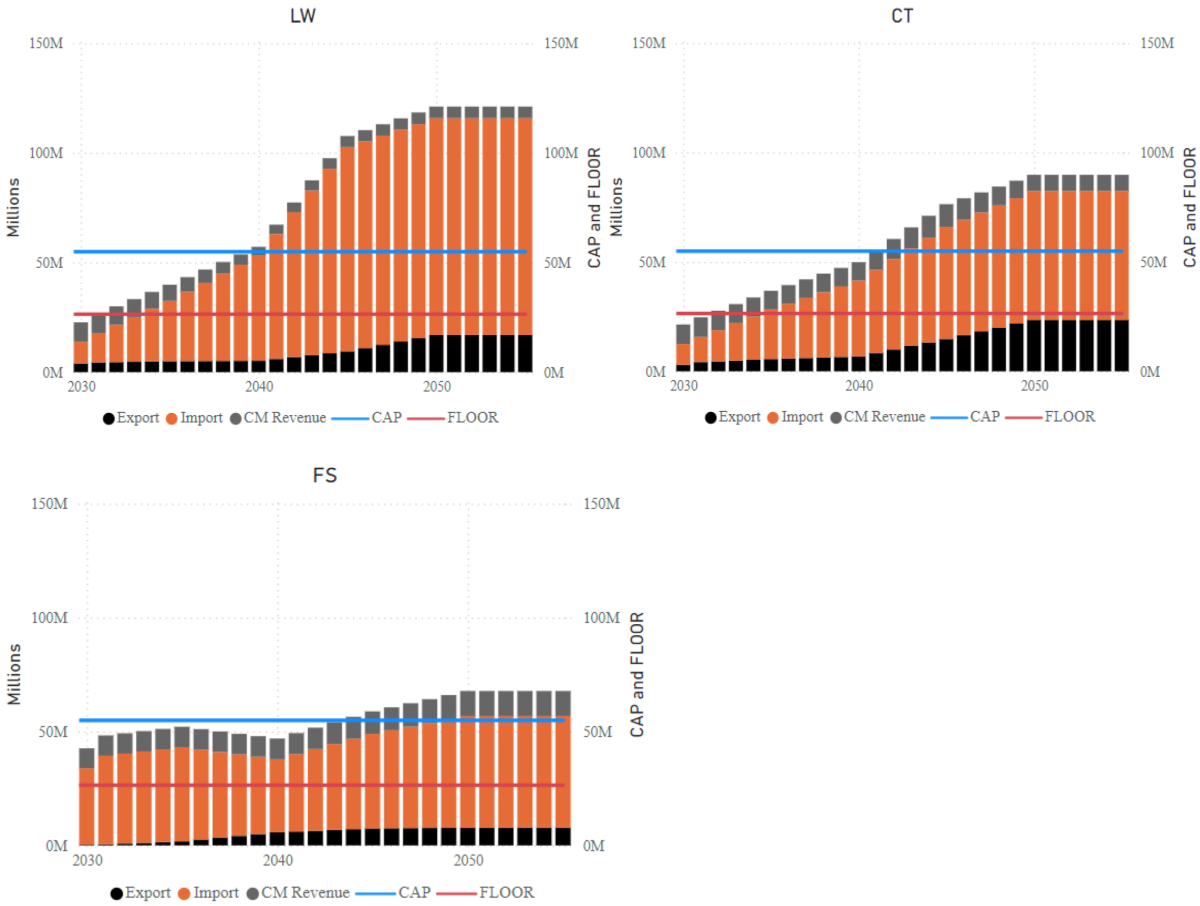




Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 4.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)



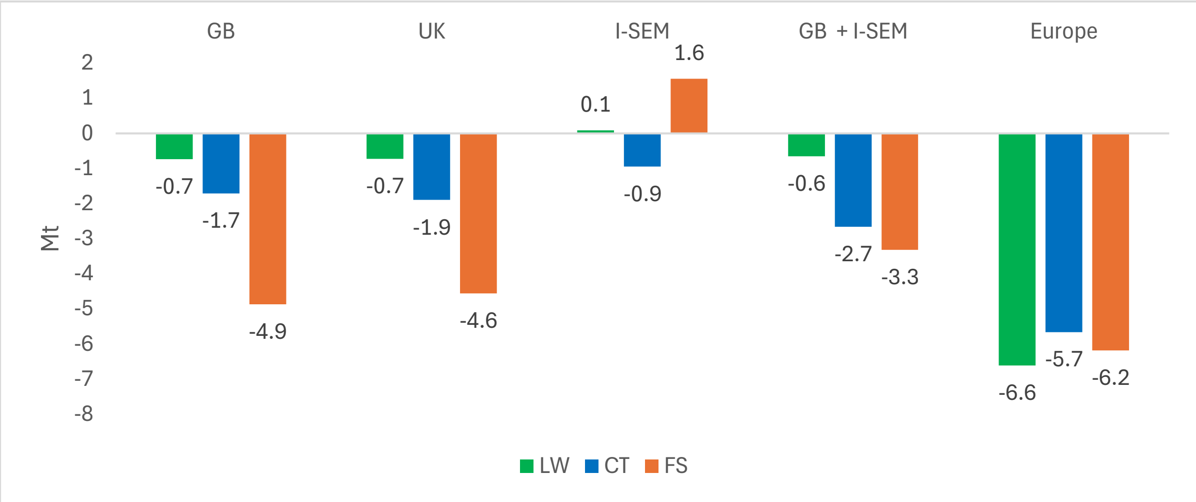
Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2030 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

LirIC is forecast to earn most of its revenue through imports to GB from I-SEM in all scenarios.

LirIC's revenues are likely to fall below the floor in the early years in LW and CT. The project is likely to make cap payments to consumers from 2040 in LW, 2041 in CT, and 2044 in FS. LW is the scenario where the project reaches the highest revenues due to the high price differentials that are predicted to occur between the two countries after 2040.

Decarbonisation impacts

Figure 4.5 – Decarbonisation impact in GB, island of Ireland and Europe



Column chart representing the impact of LirIC on CO_2 emissions in GB, I-SEM and Europe.

The introduction of the LirIC project is likely to reduce CO_2 emissions in GB and across Europe. In the island of Ireland, the project reduces emissions in CT but increases them in LW and FS.

In GB, LirIC is largely used to import electricity from the island of Ireland, leading to lower GB wholesale prices compared to the counterfactual in all scenarios. The decrease in prices displaces expensive thermal generation from the dispatch order in GB, leading to less emissions.

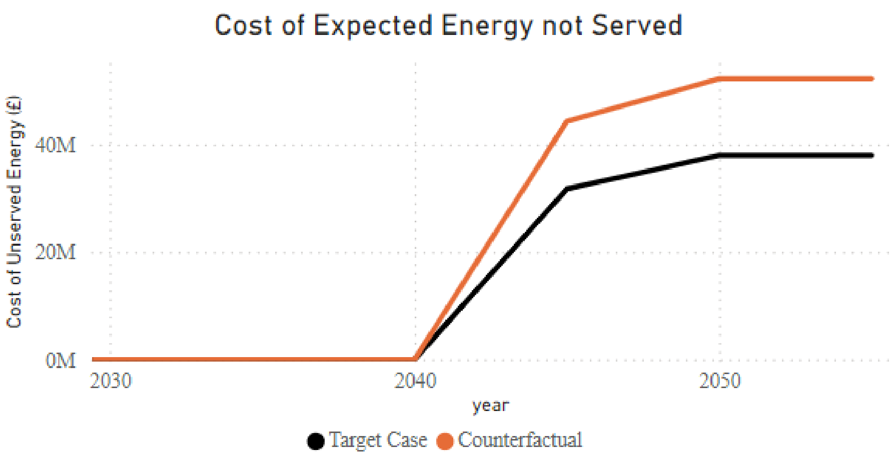
Table 4.1 – Decarbonisation indicators for LirIC

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	-77.5	-139.3	-355.1
CO_2 reduction (societal value)	GB	£m real 2022 NPV	-251.5	-374.5	-512.8
Overall decarbonisation	Europe	Mt	-6.6	-5.7	-6.2

As shown in Table 4.1 above, the decrease in CO_2 emissions in GB leads to energy consumers paying electricity at a lower cost compared to the counterfactual. Lower emission levels also lead to lower societal costs in GB.

Security of supply impact

Figure 4.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of LirIC's introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of LirIC leads to a reduction in the number of USE hours in GB compared to the counterfactual. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £162.7m.

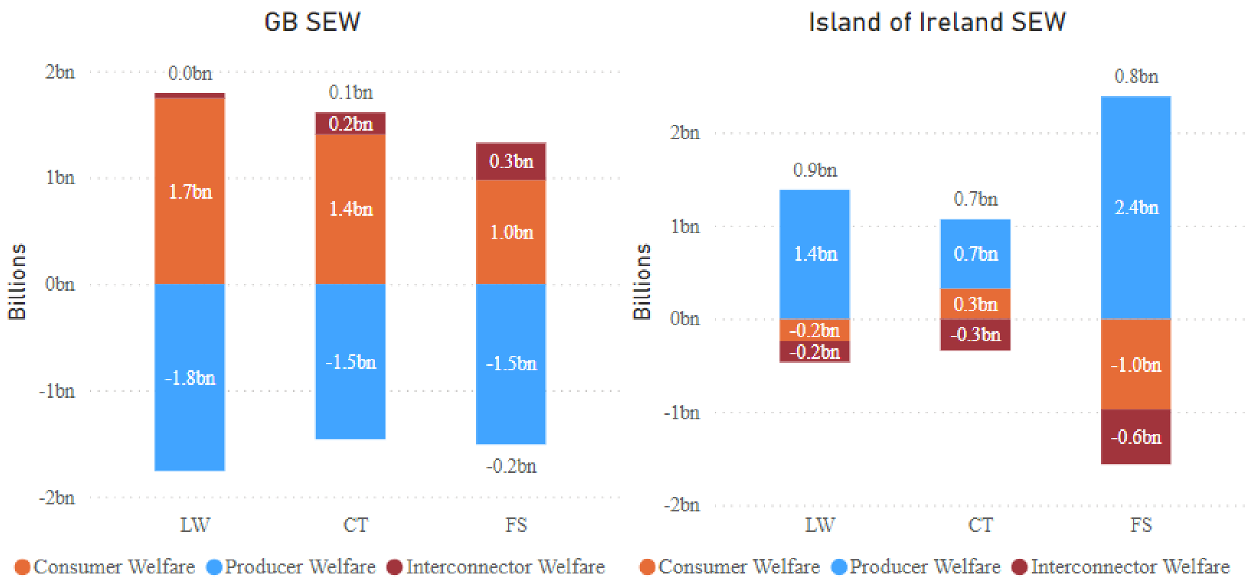
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that LirIC does not have positive nor negative impacts on SoS in GB.

MaresConnect

Overview and SEW impacts

The MaresConnect project has been modelled as a 750MW interconnector, connecting GB and the island of Ireland in 2030.

Figure 5.1 – SEW impacts of MaresConnect in GB and the island of Ireland (£bn, real 2022, NPV)



Stacked column charts representing the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and I-SEM.

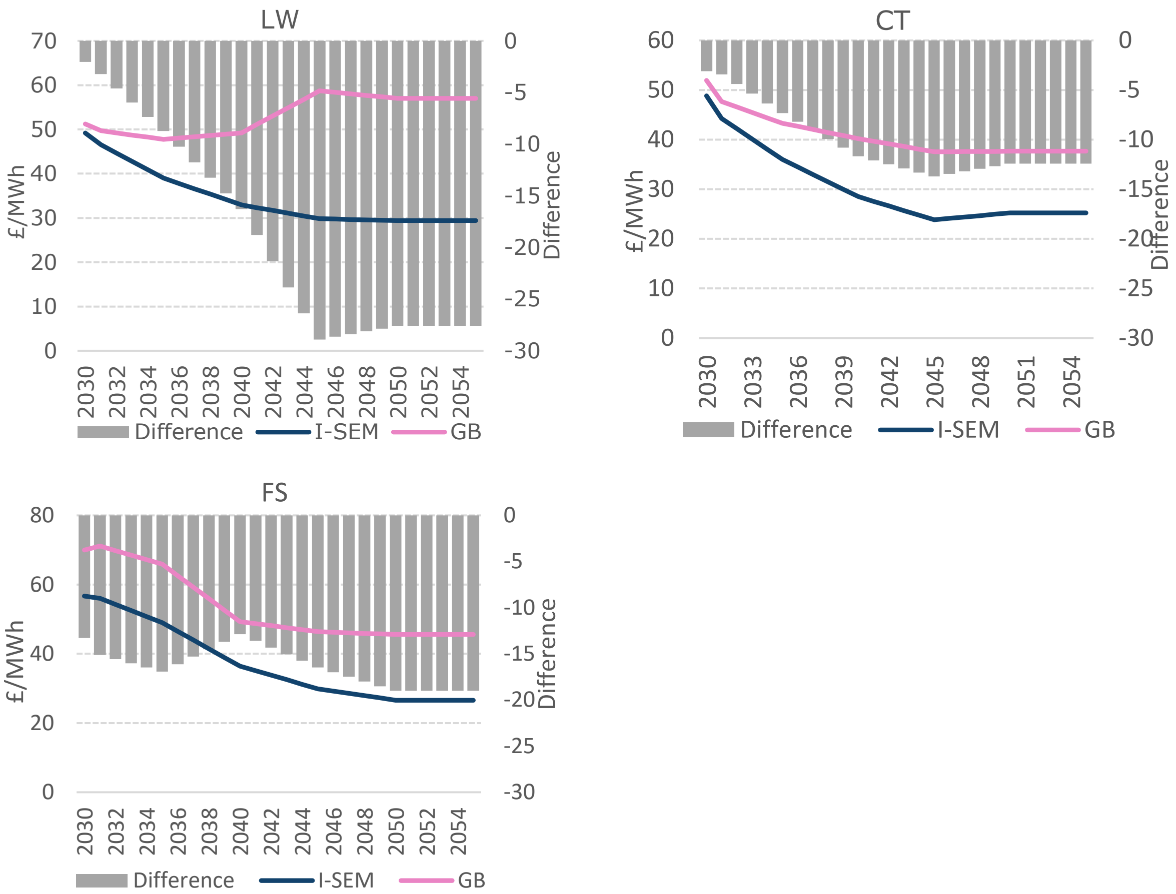
In GB, the total SEW impact is marginally positive in LW and CT, and marginally negative in FS. MaresConnect delivers positive Consumer and Interconnector SEW. Producer SEW is negative in all scenarios.

MaresConnect is predominantly used to import electricity to GB across the three scenarios. This decreases wholesale prices in GB compared to the counterfactual. This in turn decreases producer SEW and increases consumer welfare.

In the island of Ireland, MaresConnect delivers positive total SEW in all scenarios, largely driven by positive producer welfare. The interconnector is negatively impacted in all scenarios. The impact on consumers is negative in LW and FS, and positive in CT.

Price differentials and flows

Figure 5.2 – Price differentials between GB and I-SEM (£/MWh)

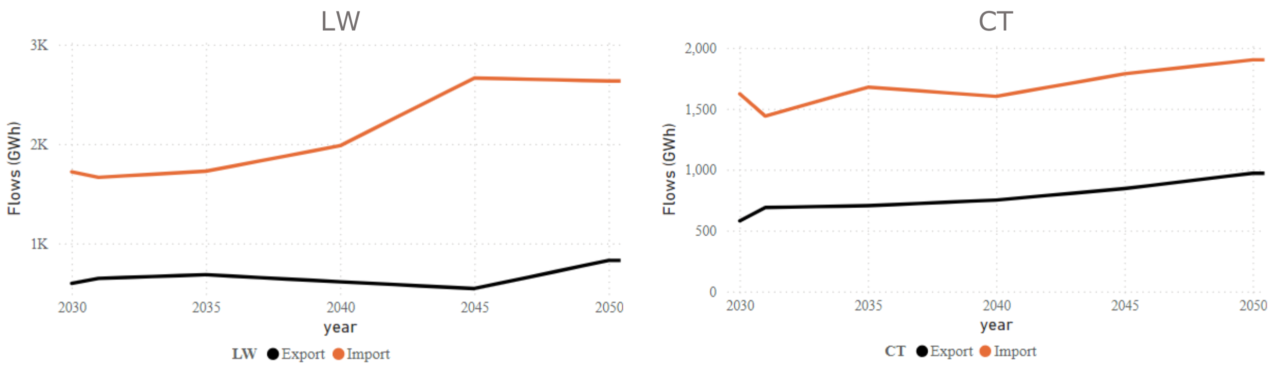


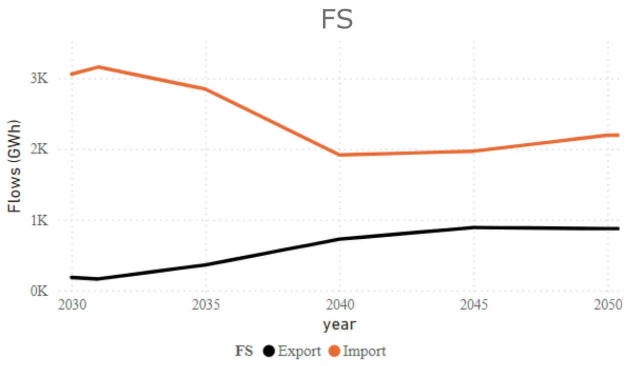
Combined column and line chart comparing the annual wholesale prices in GB and I-SEM from 2030 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in the I-SEM are constantly lower than prices in GB, except in the early years in LW and CT. In LW, there is a large increase in price differentials from 2040.

The price differentials largely determine the direction of the electricity flows across the project. As the below line charts show, the project is mostly used for importing electricity from GB.

Figure 5.3 – Electricity flows across MaresConnect (black line: exports from GB, orange line: imports from I-SEM) (GWh)

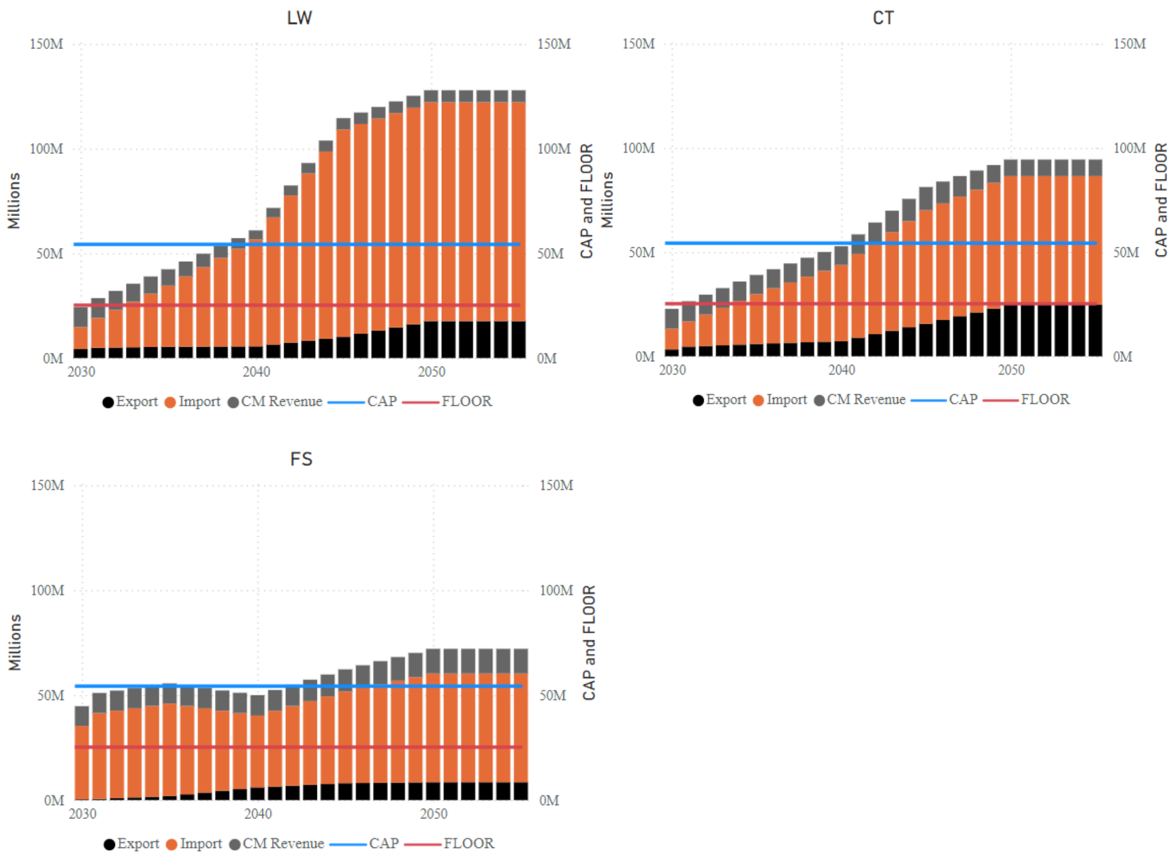




Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 5.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)



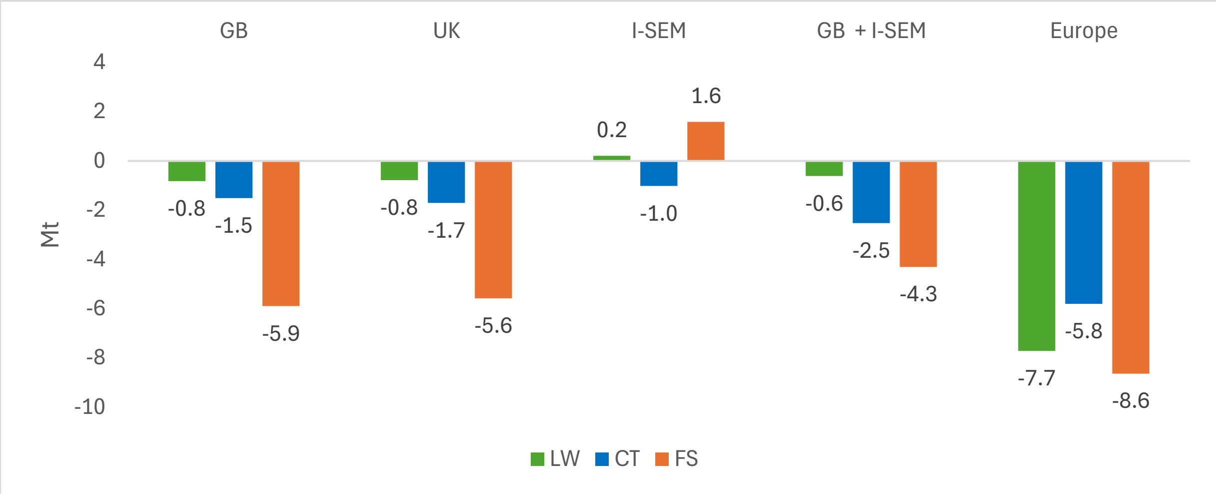
Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2030 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

MaresConnect is forecast to earn most of its revenue through imports to GB from I-SEM in every scenario.

MaresConnect's revenues are likely to fall below the floor in the early years in LW and CT. The project is likely to make cap payments to consumers from 2039 in LW and 2041 in CT. In FS, some cap payments are expected to arise around mid-2030s and from 2042. LW is the scenario where the project reaches the highest revenues due to the high price differentials that are predicted to occur between the two countries after 2040.

Decarbonisation impacts

Figure 5.5 – Decarbonisation impact in GB, island of Ireland and Europe



Column chart representing the impact of MaresConnect on CO_2 emissions in GB, I-SEM and Europe.

The introduction of the MaresConnect project is likely to reduce CO_2 emissions in GB and across Europe. In the island of Ireland, the project reduces emissions in CT but increases them in LW and FS.

In GB, MaresConnect is largely used to import electricity from the island of Ireland, leading to lower GB wholesale prices compared to the counterfactual in all scenarios. The decrease in prices displaces expensive thermal generation from the dispatch order in GB, leading to less emissions.

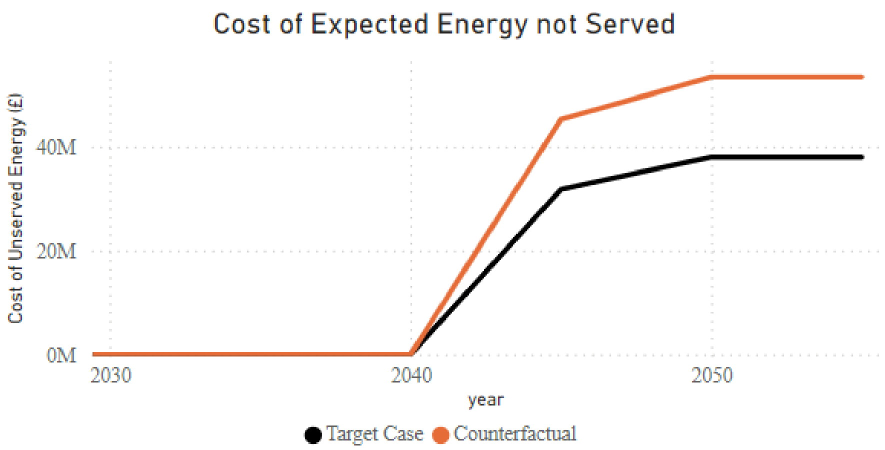
Table 5.1 – Decarbonisation indicators for MaresConnect

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	-83.2	-130.8	-419.2
CO_2 reduction (societal value)	GB	£m real 2022 NPV	-280.8	-329.9	-615.6
Overall decarbonisation	Europe	Mt	-7.7	-5.8	-8.6

As shown in Table 5.1 above, the decrease in CO_2 emissions in GB leads to energy consumers paying electricity at a lower cost compared to the counterfactual. Lower emission levels also lead to lower societal costs in GB.

Security of supply impact

Figure 5.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of MaresConnect's introduction (target case) on the cost of expected energy not served against the counterfactual (project not being introduced).

The introduction of MaresConnect leads to a reduction in the number of USE hours in GB compared to the counterfactual. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £175.2m.

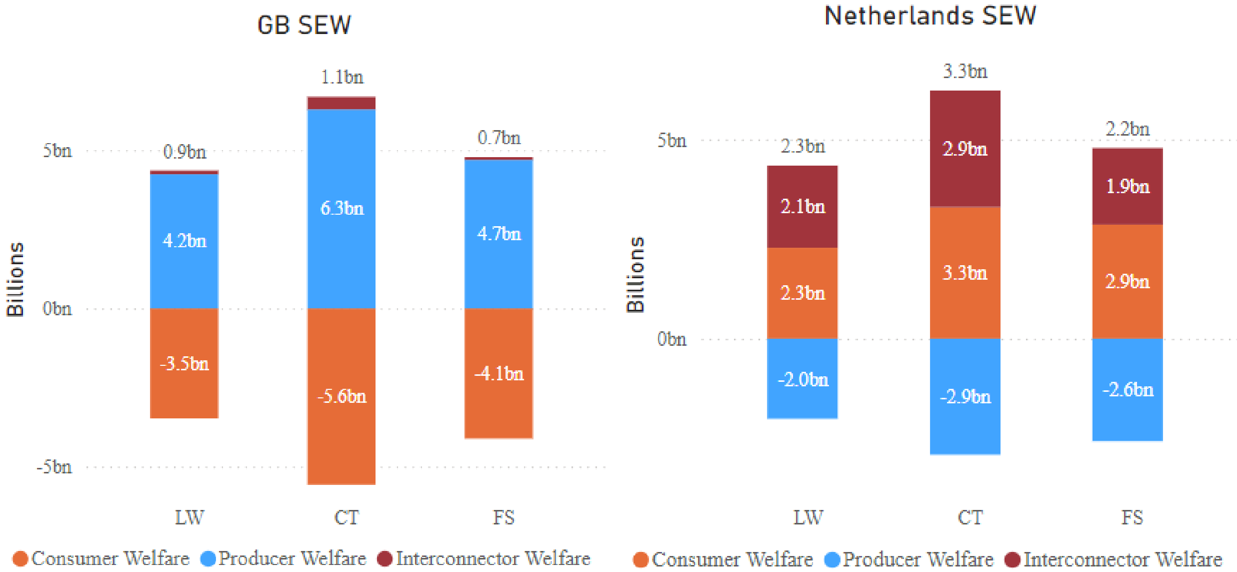
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that MaresConnect does not have positive nor negative impacts on SoS in GB.

NU-Link

Overview and SEW impacts

The NU-Link project has been modelled as a 1.2GW interconnector, connecting GB and the Netherlands in 2031.

Figure 6.1 – SEW impacts of NU-Link in GB and the Netherlands (£bn, real 2022, NPV)



Stacked column charts representing the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and the Netherlands.

In GB, the total SEW impact is positive in all scenarios. NU-Link delivers positive Producer and Interconnector SEW, and negative Consumer SEW in all scenarios.

NU-Link is predominantly used to export electricity from GB across the three scenarios. This increases wholesale prices in GB compared to the counterfactual. This in turn increases producer SEW and reduces consumer welfare.

In the Netherlands, NU-Link delivers positive total SEW in all scenarios. Producers are negatively impacted in all scenarios as NU-Link reduces wholesale prices in the Netherlands. The impact on consumer and interconnector SEW is positive.

Price differentials and flows

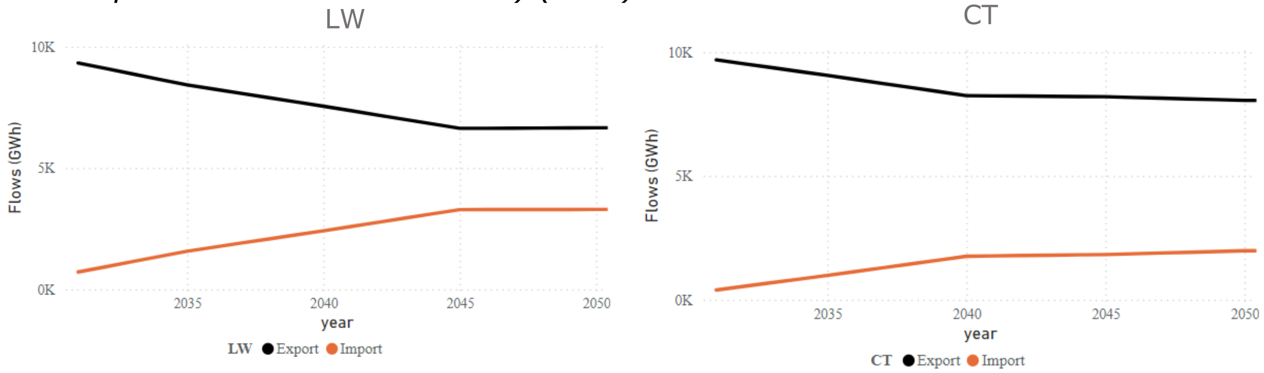
Figure 6.2 – Price differentials between GB and the Netherlands (£/MWh)

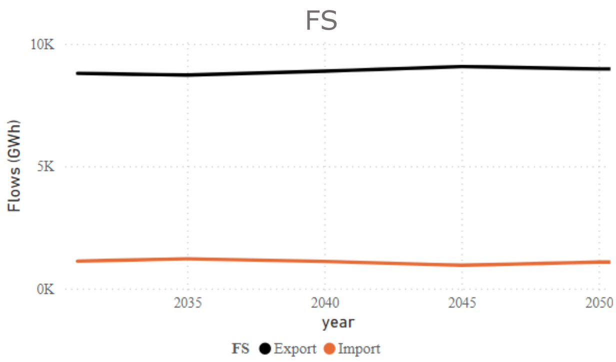
Combined column and line chart comparing the annual wholesale prices in GB and the Netherlands from 2031 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in the Netherlands are constantly higher than prices in GB. In LW, the difference in prices between both countries reduces from 2040.

The price differentials largely determine the direction of the electricity flows across the project. As the below line charts show, the project is mostly used for exporting electricity from GB.

Figure 6.3 – Electricity flows across NU-Link (black line: exports from GB, orange line: imports from the Netherlands) (GWh)

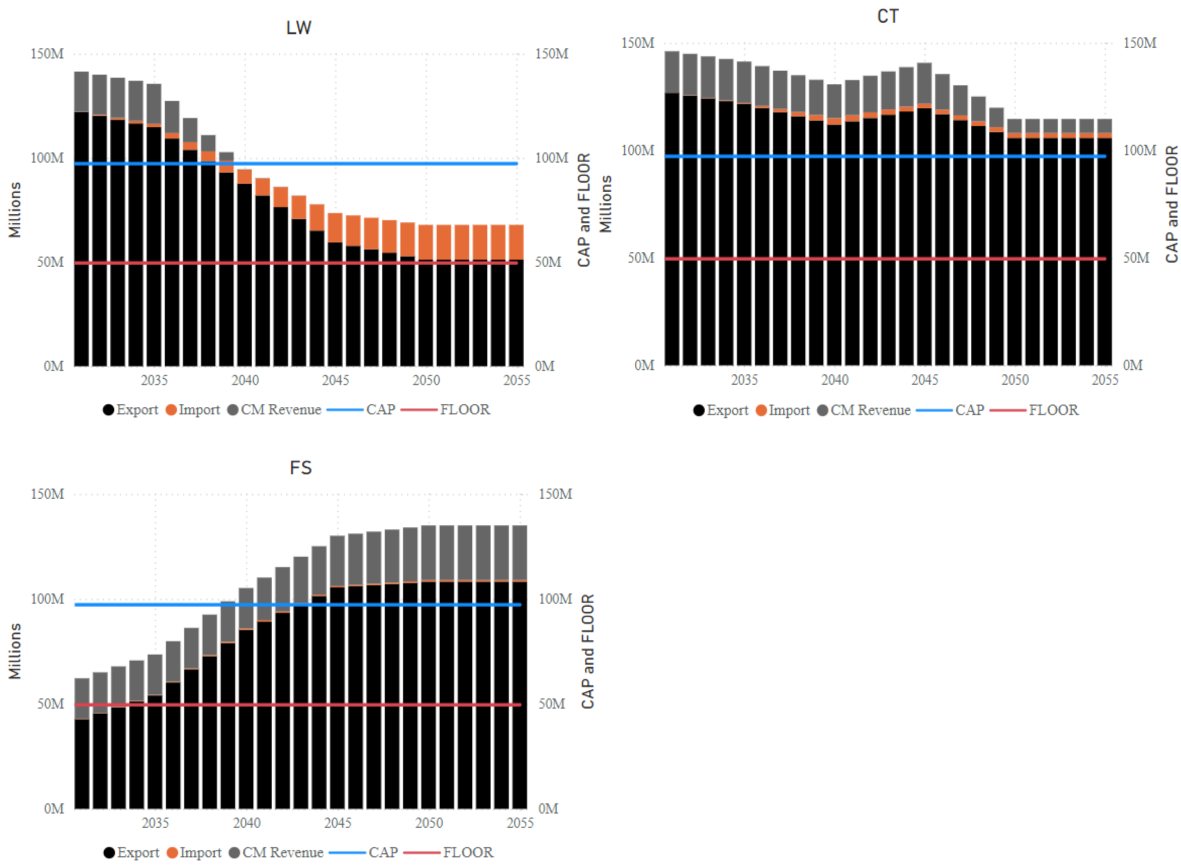




Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 6.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)

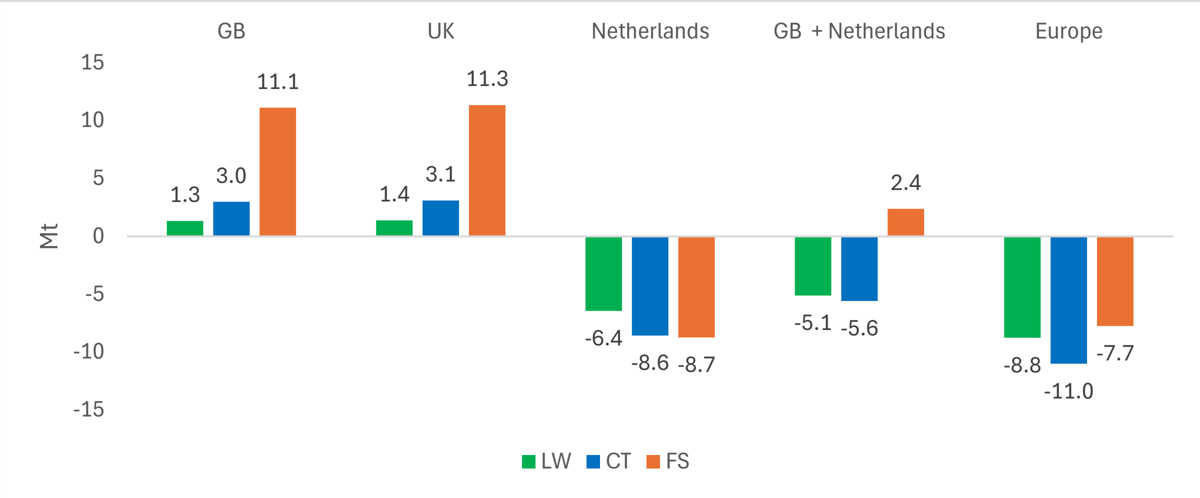


Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2031 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

NU-Link is forecast to earn most of its revenue through exports from GB to the Netherlands in every scenario. In LW, the share of revenue captured through imports is larger compared to the other scenarios. In CT, revenues earned by NU-Link are likely to be constantly above the cap level. In LW, the project earns revenues above the cap in the early years and then revenues fall between the cap and floor levels from 2040. The opposite trend can be observed in FS.

Decarbonisation impacts

Figure 6.5 – Decarbonisation impact in GB, the Netherlands and Europe



Column chart representing the impact of NU-Link on CO_2 emissions in GB, Netherlands and Europe.

The introduction of the NU-Link project is likely to increase CO_2 emissions in GB across all scenarios. This is because the project increases the dispatch of thermal generation in GB by increasing GB wholesale prices. The project is likely to reduce emissions in the Netherlands and across Europe in all scenarios.

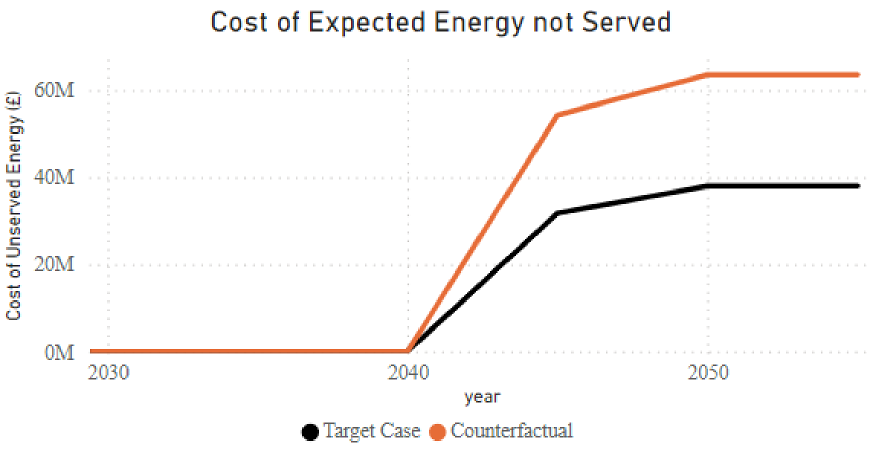
Table 6.1 – Decarbonisation indicators NU-Link

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	101.2	236.5	733.4
CO_2 reduction (societal value)	GB	£m real 2022 NPV	449.2	655.0	1,122.4
Overall decarbonisation	Europe	Mt	-8.8	-11.0	-7.7

As shown in Table 6.1 above, the increase in CO_2 emissions in GB leads to energy consumers paying electricity at a higher cost compared to the counterfactual. The additional CO_2 also leads to higher societal costs in GB.

Security of supply impact

Figure 6.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of NU-Link's introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of NU-Link leads to a reduction in the number of USE hours in GB compared to the counterfactual. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £317.1m.

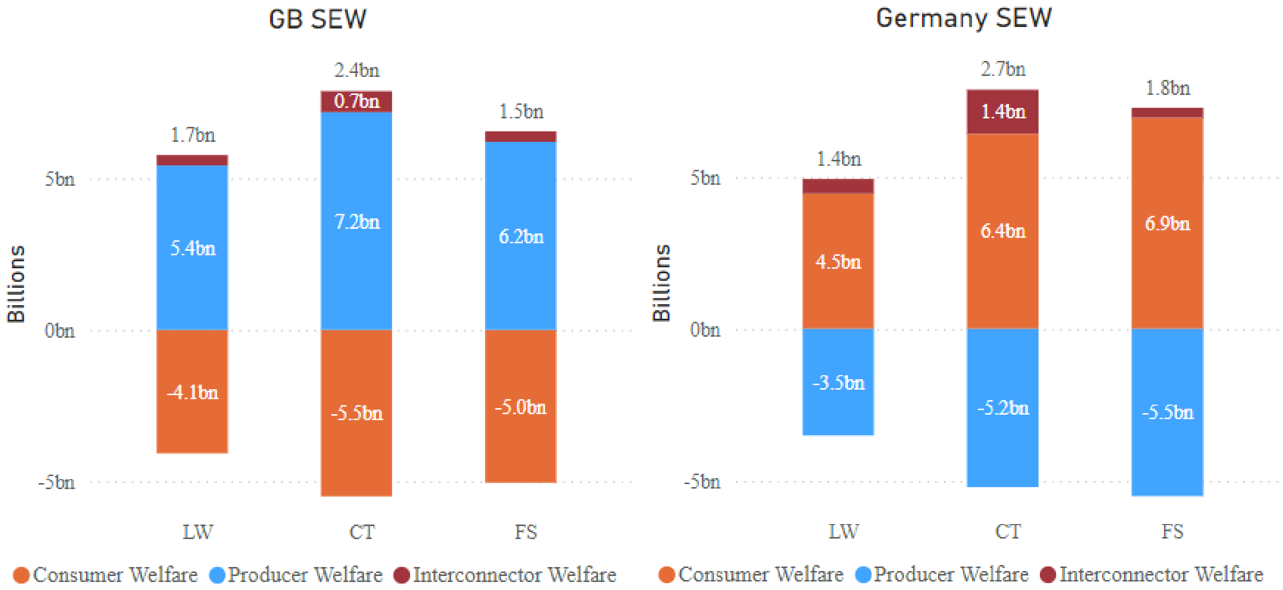
In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that NU-Link does not have positive nor negative impacts on SoS in GB.

Tarchon

Overview and SEW impacts

The Tarchon project has been modelled as a 1.4GW interconnector, connecting GB and Germany in 2030.

Figure 7.1 – SEW impacts of Tarchon in GB and Germany (£bn, real 2022, NPV)



Stacked column charts representing the total SEW figures and breakdown by Consumer, Producer and Interconnector welfare, for GB and Germany.

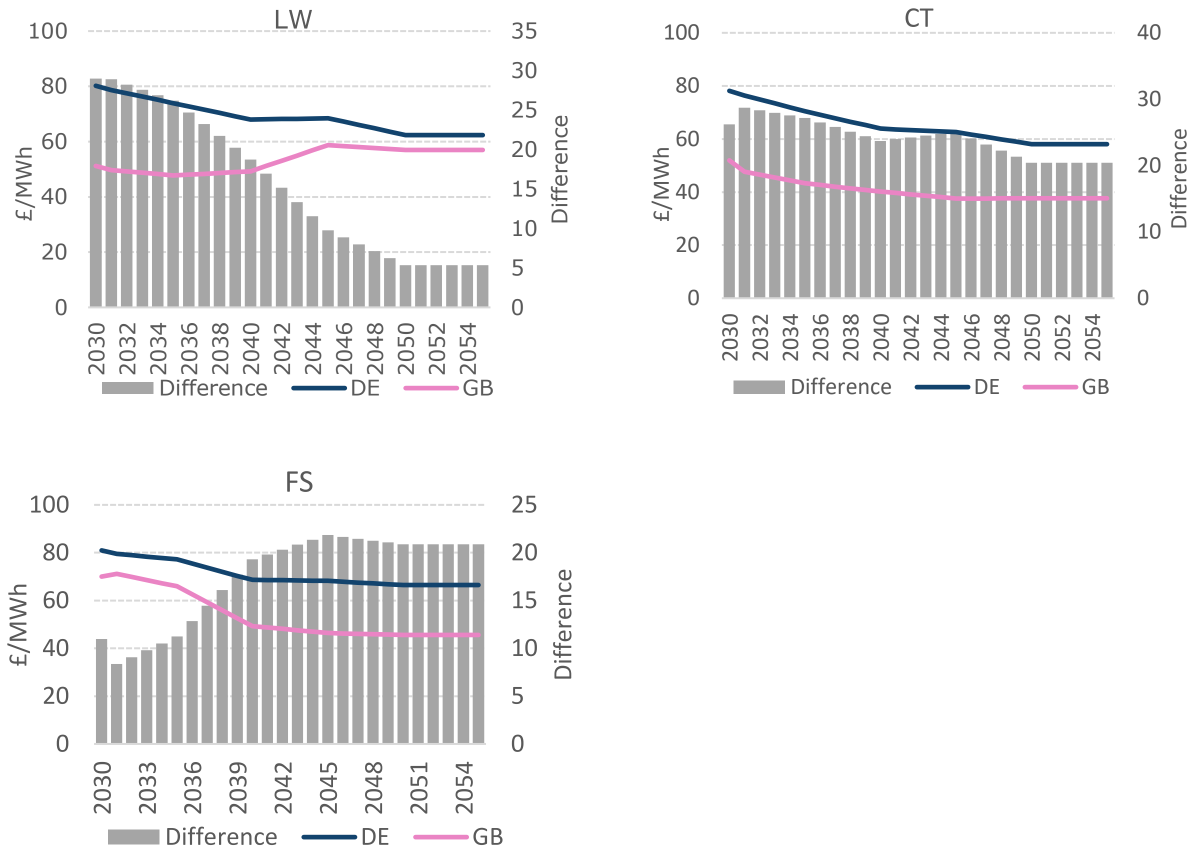
In GB, the total SEW impact is positive in all scenarios. Tarchon delivers strong positive producer SEW and positive interconnector SEW. Consumer SEW is negative in all scenarios.

Tarchon is predominantly used to export electricity from GB across the three scenarios. This increases wholesale prices in GB compared to the counterfactual. This in turn increases producer SEW and reduces consumer Welfare.

In Germany, Tarchon delivers positive total SEW in all scenarios, driven by strong positive consumer SEW and positive interconnector SEW. Producers are negatively impacted in all scenarios.

Price differentials and flows

Figure 7.2 – Price differentials between GB and Tarchon (£/MWh)

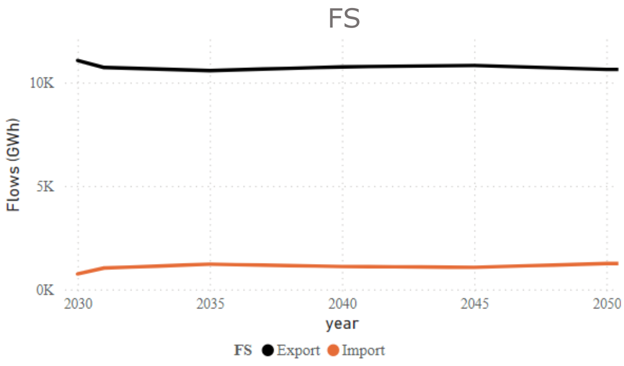


Combined column and line chart comparing the annual wholesale prices in GB and Germany from 2030 to 2055. Lines represent the prices for each country. Columns show the difference between the two.

Prices in Germany are constantly higher than prices in GB. In LW, the difference in prices between both countries reduces from 2040.

The price differentials largely determine the direction of the electricity flows across the project. As the below line charts show, the project is mostly used for exporting electricity from GB.

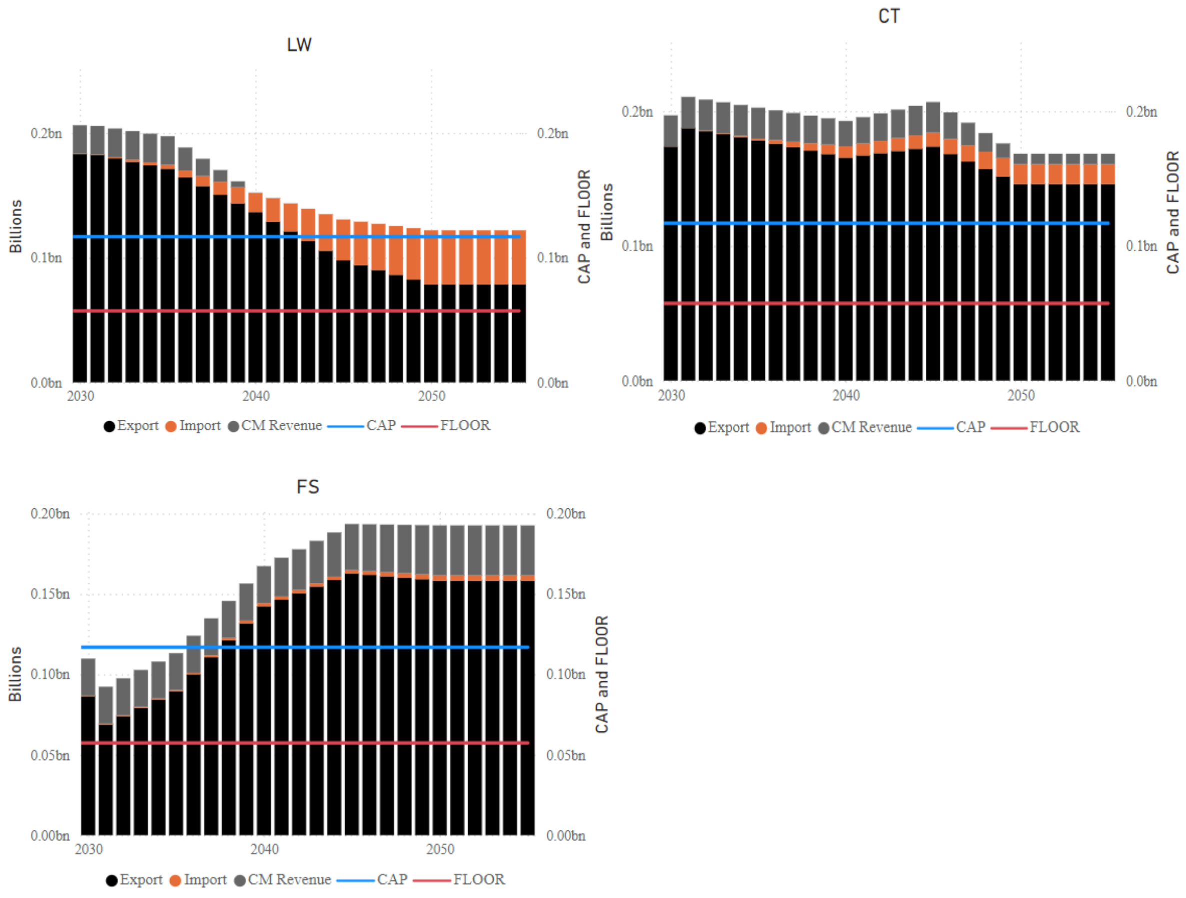
Figure 7.3 – Electricity flows across Tarchon (black line: exports from GB, orange line: imports from Germany) (GWh)



Line charts presenting the electricity flows (export/import) across the interconnector (black line - export, orange line - import).

Revenues and impacts on consumers

Figure 7.4 – GB portion of revenues, based on a 50:50 split with the connecting country (£m, real 2022)



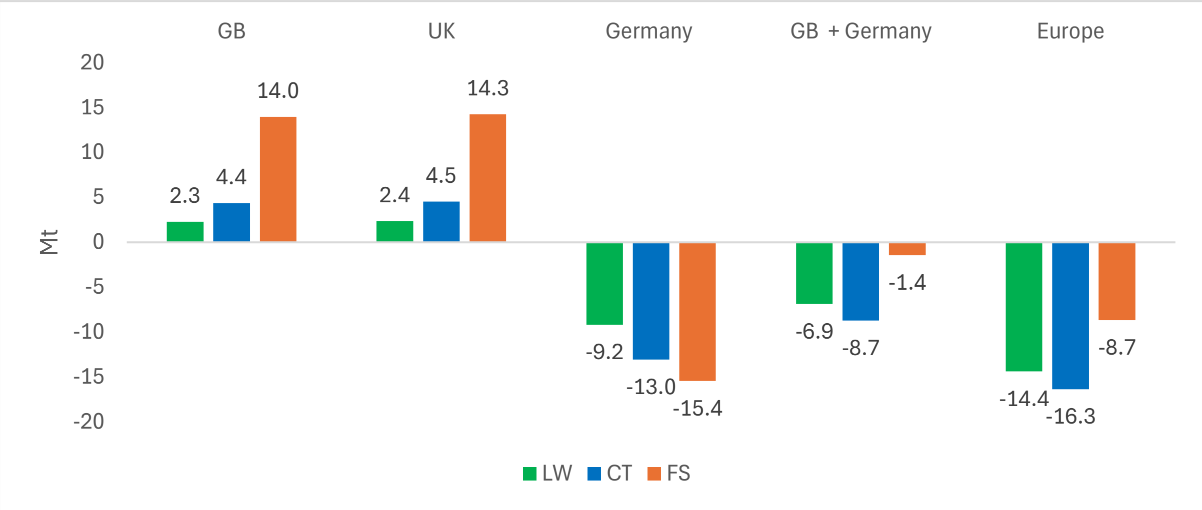
Combined stacked column and line charts comparing revenue sources against the cap and floor levels from 2030 to 2055. Stacked columns represent revenues from export, import and CM. Lines show cap and floor levels

Tarchon is forecast to earn most of its revenues through exports from GB to Germany in every scenario. In LW, the share of revenue captured through imports is larger compared to the other scenarios. Revenues are likely to exceed the cap level in LW and

CT in all modelled years. In FS, all revenues are likely to fall above the floor and exceed the cap from 2036.

Decarbonisation impacts

Figure 7.5 – Decarbonisation impact in GB, Germany and Europe



Column chart representing the impact of Tarchon on CO_2 emissions in GB, Germany and Europe.

The introduction of the Tarchon project is likely to increase CO_2 emissions in GB across all scenarios. This is because the project increases the dispatch of thermal generation in GB by increasing GB wholesale prices. The project is likely to reduce emissions in Germany and across Europe in all scenarios.

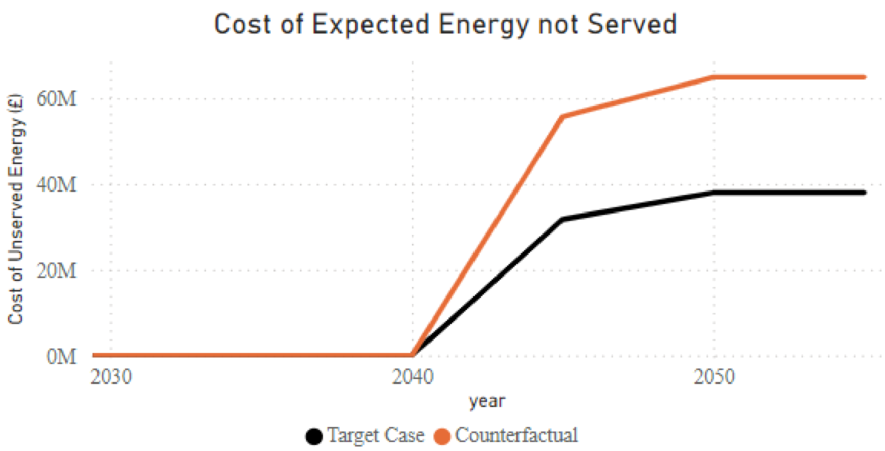
Table 7.1 – Decarbonisation indicators for Tarchon

Indicator	Applies to	Unit	LW	CT	FS
CO_2 reduction (SEW)	GB	£m real 2022 NPV	154.7	313.4	940.8
CO_2 reduction (societal value)	GB	£m real 2022 NPV	796.2	984.2	1,451.9
Overall decarbonisation	Europe	Mt	-14.4	-16.3	-8.7

As shown in Table 7.1 above, the increase in CO_2 emissions in GB leads to energy consumers paying electricity at a higher cost compared to the counterfactual. The additional CO_2 also leads to higher societal costs in GB.

Security of supply impact

Figure 7.6 – Cost of EENS in the counterfactual and target case in LW (£, real 2022)



Line chart comparing the impact of Tarchon's introduction (target case) on the cost of expected energy not served (EENS) against the counterfactual (project not being introduced).

The introduction of Tarchon leads to a reduction in the number of USE hours in GB compared to the counterfactual. The project helps to reduce the costs of EENS by importing electricity in periods of system stress. The reduction is predicted to be £308m.

In CT and FS, no USE hours are observed before and after the introduction of the project, meaning that Tarchon does not have positive nor negative impacts on SoS in GB.

Multi-Criteria Assessment framework tables

For all projects:

'System operability' indicators were not re-run with the updates to modelling since consultation. Results displayed are those published in our March 2024 consultation.

We have changed the way we RAG rate the 'Security of Supply' indicator. This indicator is now being rated green whenever there is at least a positive impact in any of the modelled scenarios and there are no positive nor negative impacts on the other two scenarios.

There was no need to re-assess hard to monetise indicators. The RAG rating results here reflect those published in our March 2024 consultation.

The RAG rating for the balancing market (constraint costs) impact presents the same rating principle we used in our March 2024 consultation. Green means the project reduces constraint cost in all scenarios, amber means the project increases constraint costs in any scenario to a proportionate level and red means the project disproportionately increases constraint costs in any scenario. This reflects our level of concern regarding the projects' constraint cost impact on the system

Aminth

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	49.8	(1.7)	(2.5)	=	(0.7)	(3.3)	(2.0)	↓
SEW	Producers SEW	£bn real 2022, NPV	(37.9)	1.9	2.7	=	1.0	3.3	2.1	=
SEW	Interconnectors SEW	£bn real 2022, NPV	(1.4)	0.6	0.6	=	0.2	0.7	0.4	=
SEW	Total SEW	£bn real 2022, NPV	10.6	0.9	0.7	=	0.5	0.7	0.4	=
Network costs	Onshore works	£m, real 2022	-	-	-		[redacted]	[redacted]	[redacted]	
System operability	Frequency stability	Average TWh/y	0.61	0.66	0.58	=	0.67	0.77	0.67	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.08	0.10	0.09	=	0.11	0.10	0.10	=
System operability	Voltage stability	Average TVar/y	3.47	3.47	3.47	=	3.47	3.47	3.47	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.11	0.11	0.11	=	0.11	0.11	0.11	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.04	=	0.04	0.04	0.04	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(1.5)	(1.6)	(0.4)		(0.5)	(0.5)	(0.1)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	(0.0)	0.0	0.4	=	0.0	0.1	0.4	↑
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	(0.1)	0.1	0.5	=	0.0	0.2	0.5	↑
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	2.6	4.0	2.2	=	0.8	1.2	1.2	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation (Europe)	Mt	(8.3)	(12.5)	(14.1)		(9.5)	(10.0)	(11.6)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	4.1	0.1	-		0.2	-	-	
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

AQUIND

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	36.0	(2.2)	(3.9)	=	0.0	(3.2)	(2.9)	=
SEW	Producers SEW	£bn real 2022, NPV	(23.8)	5.1	6.0	=	3.0	5.7	4.8	↑
SEW	Interconnectors SEW	£bn real 2022, NPV	(1.7)	(0.1)	(0.3)	=	(0.3)	(0.0)	(0.3)	=
SEW	Total SEW	£bn real 2022, NPV	10.6	2.8	1.9	=	2.7	2.5	1.5	=
Network costs	Onshore works	£m, real 2022	-	-	-					
System operability	Frequency stability	Average TWh/y	0.96	1.02	0.79	=	0.77	0.91	0.73	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.14	0.17	0.16	=	0.16	0.13	0.13	=
System operability	Voltage stability	Average TVar/y	3.70	3.95	3.72	=	3.70	3.95	3.72	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.14	0.13	0.13	=	0.14	0.13	0.13	=
System operability	Black start	£bn, NPV, real 2022	0.05	0.04	0.05	=	0.04	0.05	0.05	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(4.6)	(3.6)	(1.0)		(3.0)	(2.3)	(0.4)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	0.2	0.2	0.0	=	0.2	0.3	0.2	=
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	0.8	0.8	0.0	=	0.8	0.8	0.2	=
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	2.4	3.9	2.0	=	1.4	2.1	1.6	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation (Europe)	Mt	(21.9)	(30.6)	(20.9)		(23.2)	(26.8)	(18.1)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	4.5	0.1	-	=	0.2	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

Cronos

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	40.3	(4.8)	(5.3)	=	(3.8)	(5.8)	(4.5)	=
SEW	Producers SEW	£bn real 2022, NPV	(28.2)	7.0	7.0	=	5.3	7.4	5.8	=
SEW	Interconnectors SEW	£bn real 2022, NPV	(1.5)	0.3	0.1	=	0.0	0.3	(0.0)	=
SEW	Total SEW	£bn real 2022, NPV	10.7	2.4	1.8	=	1.5	1.9	1.3	=
Network costs	Onshore works	£m, real 2022	-	-	-		[redacted]			
System operability	Frequency stability	Average TWh/y	0.47	0.62	0.56	=	0.63	0.75	0.71	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.08	0.10	0.07	=	0.12	0.11	0.10	=
System operability	Voltage stability	Average TVar/y	3.47	3.47	3.47	=	3.47	3.47	3.47	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.11	0.11	0.11	=	0.11	0.11	0.11	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.04	=	0.04	0.05	0.05	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(3.5)	(3.2)	(1.5)		(2.3)	(2.1)	(0.6)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	(0.2)	(0.4)	(1.1)	=	(0.2)	(0.4)	(1.0)	=
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	(0.9)	(1.1)	(1.6)	=	(0.9)	(1.0)	(1.5)	=
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	2.0	2.1	1.2	=	0.7	0.5	1.0	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation	Mt	(13.7)	(21.0)	(14.6)		(12.2)	(15.9)	(8.4)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	3.8	0.1	-	=	0.1	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

LirIC

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	26.6	1.8	1.0	↑	1.8	1.3	1.0	↑
SEW	Producers SEW	£bn real 2022, NPV	(21.4)	(1.7)	(1.3)	↓	(1.8)	(1.5)	(1.5)	↓
SEW	Interconnectors SEW	£bn real 2022, NPV	(0.7)	0.2	0.4	↑	0.0	0.1	0.3	↑
SEW	Total SEW	£bn real 2022, NPV	4.5	0.3	0.1	↑	0.0	(0.1)	(0.2)	↑
Network costs	Onshore works	£m, real 2022	-	-	-					
System operability	Frequency stability	Average TWh/y	0.17	0.24	0.1	=	0.27	0.31	0.23	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.02	0.04	0.0	=	0.05	0.04	0.04	=
System operability	Voltage stability	Average TVar/y	1.74	1.74	1.7	=	1.74	1.74	1.74	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.05	0.05	0.1	=	0.05	0.05	0.05	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.0	=	0.04	0.04	0.04	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(0.1)	(0.2)	(0.2)		(0.3)	(0.2)	(0.3)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	0.1	0.1	0.4	↑	0.1	0.1	0.4	↑
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	0.3	0.3	0.6	↑	0.3	0.4	0.5	↑
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	(0.1)	0.7	0.1	↓	(0.3)	(0.1)	(0.3)	↓
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation	Mt	(5.3)	(5.9)	(8.7)		(6.6)	(5.7)	(6.2)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	2.3	0.1	-	=	0.1	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

MaresConnect

Impact category	Indicator	Unit	FA LW	FA CT	FA FS	FA RAG	MA LW	MA CT	MA FS	MA RAG
SEW	Consumers SEW	£bn real 2022, NPV	19.7	2.0	1.0	↑	1.7	1.4	1.0	↑
SEW	Producers SEW	£bn real 2022, NPV	(15.4)	(1.8)	(1.2)	↓	(1.8)	(1.5)	(1.5)	↓
SEW	Interconnectors SEW	£bn real 2022, NPV	(0.4)	0.2	0.4	↑	0.1	0.2	0.3	↑
SEW	Total SEW	£bn real 2022, NPV	3.9	0.5	0.2	↑	0.0	0.1	(0.2)	↑
Network costs	Onshore works	£m, real 2022	-	-	-					
System operability	Frequency stability	Average TWh/y	0.11	0.13	0.08	=	0.15	0.15	0.10	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.01	0.02	0.02	=	0.02	0.02	0.02	=
System operability	Voltage stability	Average TVar/y	1.89	1.89	1.89	=	1.89	1.89	1.89	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.06	0.06	0.06	=	0.06	0.06	0.06	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.04	=	0.04	0.04	0.05	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(0.2)	(0.2)	(0.3)		(0.3)	(0.3)	(0.2)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	0.1	0.1	0.4	↑	0.1	0.1	0.4	↑
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	0.3	0.4	0.6	↑	0.3	0.3	0.6	↑
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	0.8	2.0	1.1	=	0.4	0.8	0.5	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation	Mt	(5.5)	(6.7)	(10.6)		(7.7)	(5.8)	(8.6)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	2.2	0.1	-	=	0.1	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

NU-Link

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	44.0	(4.5)	(4.8)	=	(3.5)	(5.6)	(4.1)	=
SEW	Producers SEW	£bn real 2022, NPV	(32.4)	5.7	5.7	=	4.2	6.3	4.7	=
SEW	Interconnectors SEW	£bn real 2022, NPV	(1.5)	0.4	0.3	=	0.1	0.4	0.1	=
SEW	Total SEW	£bn real 2022, NPV	10.1	1.6	1.2	=	0.9	1.1	0.7	=
Network costs	Onshore works	£m, real 2022	-	-	-		[redacted]			
System operability	Frequency stability	Average TWh/y	0.17	0.32	0.19	=	0.28	0.44	0.29	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.03	0.05	0.02	=	0.07	0.04	0.04	=
System operability	Voltage stability	Average TVar/y	3.02	3.02	3.02	=	3.02	3.02	3.02	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.09	0.09	0.09	=	0.09	0.09	0.09	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.04	=	0.04	0.04	0.04	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(1.3)	(1.5)	(0.3)		(0.6)	(0.6)	0.0	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	(0.1)	(0.3)	(0.8)	=	(0.1)	(0.3)	(0.8)	=
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	(0.4)	(0.7)	(1.2)	=	(0.5)	(0.7)	(1.1)	=
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	2.2	3.6	1.8	=	1.2	1.6	1.1	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation	Mt	(10.0)	(15.0)	(14.2)		(8.8)	(11.0)	(7.7)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	3.6	0.1	-	=	0.1	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=

Tarchon

Impact category	Indicator	Unit	FA				MA			
			LW	CT	FS	RAG	LW	CT	FS	RAG
SEW	Consumers SEW	£bn real 2022, NPV	34.6	(5.1)	(5.8)	=	(4.1)	(5.5)	(5.0)	=
SEW	Producers SEW	£bn real 2022, NPV	(23.5)	7.0	7.2	=	5.4	7.2	6.2	=
SEW	Interconnectors SEW	£bn real 2022, NPV	(1.0)	0.6	0.5	=	0.3	0.7	0.3	=
SEW	Total SEW	£bn real 2022, NPV	10.2	2.5	1.9	=	1.7	2.4	1.5	=
Network costs	Onshore works	£m, real 2022	-	-	-		[redacted]			
System operability	Frequency stability	Average TWh/y	0.24	0.41	0.24	=	0.44	0.57	0.42	=
System operability	Frequency response savings	£bn, NPV, real 2022	0.04	0.06	0.04	=	0.09	0.07	0.07	=
System operability	Voltage stability	Average TVar/y	3.45	3.45	3.45	=	3.45	3.45	3.45	=
System operability	Reactive response savings	£bn, NPV, real 2022	0.11	0.11	0.11	=	0.11	0.11	0.11	=
System operability	Black start	£bn, NPV, real 2022	0.04	0.03	0.04	=	0.04	0.05	0.05	=
Flexibility	Balancing Market impacts	£bn, NPV, real 2022	(1.6)	(1.2)	(0.1)		(1.3)	(0.8)	(0.0)	
Decarbonisation	CO_2 reduction (SEW)	£bn real 2022, NPV	(0.2)	(0.4)	(1.0)	=	(0.2)	(0.4)	(1.0)	=
Decarbonisation	CO_2 reduction (Societal value)	£bn real 2022, NPV	(0.8)	(1.0)	(1.5)	=	(0.8)	(1.0)	(1.5)	=
Decarbonisation	RES integration (avoided RES spillage)	Average TWh/y	3.1	6.7	3.4	=	1.9	4.2	2.5	=
Decarbonisation	RES integration (additional RES capacity)	MW	n/a	n/a	n/a		n/a	n/a	n/a	
Decarbonisation	Overall decarbonisation	Mt	(14.8)	(21.8)	(17.1)		(14.4)	(16.3)	(8.7)	
Security of Supply	Cost of EENS	£bn real 2022, NPV	3.9	0.1	-	=	0.1	-	-	=
Hard to monetise impacts	Environmental impact, local community impacts, noise/disturbance, landscape and other.	qualitative	-	-	-		-	-	-	=