Making a positive difference for energy consumers

Interconnector developers and other interested parties

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Dear stakeholders,

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

On 19 June 2017 we published a consultation on our minded-to position on our Initial Project Assessment (IPA) of the GridLink, NeuConnect and NorthConnect interconnector projects.[1] The consultation closed on 14 August 2017. We received 12 responses (one of which was marked confidential). We have carefully considered these responses and this letter sets out our final decision on the IPA for the GridLink, NeuConnect and NorthConnect interconnector projects.

Background

In August 2014 we established our cap and floor assessment process for electricity interconnectors.[2] The cap and floor regime is the regulated route for interconnector investment in Great Britain (GB), which sits alongside the existing exemption route.

Five projects applied for cap and floor regulation in our first application window (Window 1) which closed in September 2014. All five projects were granted a cap and floor regime in principle.[3] In November 2015 we confirmed that we would open a second application window (Window 2), between 31 March and 31 October 2016, for interconnector projects seeking a cap and floor regime.[4]

Three projects applied for cap and floor regulation in Window 2. The three projects are GridLink (to France), NeuConnect (to Germany) and NorthConnect (to Norway). Our Window 2 IPA considered whether each of these three interconnector projects were likely to

[1] Our July 2017 IPA consultation is available at: https://www.ofgem.gov.uk/publications-and-updates/cap-and-floor-regime-initial-project-assessment-gridlink-neuconnect-and-northconnect-interconnectors
[2] August 2014, Decision to roll out a cap and floor regime to near-term electricity interconnectors: https://www.ofgem.gov.uk/publications-and-updates/decision-roll-out-cap-and-floor-regime-near-term-electricity-interconnectors
[3] The NSL, FAB Link, IFA2, Viking Link and Greenlink interconnector projects were all approved at our IPA stage. The NSL project has since progressed through the Final Project Assessment stage.
[4] Our November 2015 decision to open a second cap and floor application window for electricity interconnectors is available at: https://www.ofgem.gov.uk/sites/default/files/docs/decision_to_open_a_second_cap_and_floor_application_window_for_electricity_interconnectors_in_2016.pdf

be beneficial and, in particular, whether they were likely to be in the interest of GB consumers.

This is the first stage of the cap and floor assessment process. The second stage is the Final Project Assessment (FPA), which assesses detailed costs, confirms the regulatory regime and sets the provisional levels of the cap and floor. The cap and floor levels are then confirmed following our post-construction review (PCR) process.

Our decision on the IPA for GridLink, NeuConnect and NorthConnect

We have reviewed the consultation responses and carefully considered the points raised. On balance, we do not consider the points raised to alter our minded-to positions for the three projects as detailed in our June 2017 consultation.[5] We remain of the view that these three interconnector projects are likely to be in the interests of GB consumers.

We have therefore decided to grant the GridLink, NeuConnect and NorthConnect projects a cap and floor regime in principle, subject to the IPA conditions specified in Annex 1.

The three projects that we are awarding a cap and floor regime in principle would represent a 4.2GW increase[6] in GB electricity interconnector capacity. Current total GB electricity interconnector capacity (existing and under construction[7]) stands at 8.4GW. This will increase significantly if the projects approved as part of Window 1 and Window 2 proceed to completion.

Key issues raised in consultation responses

Some respondents raised similar issues as to how we had reached our minded-to position. This section clarifies our thoughts on some of the main themes.

Wider system impacts of increased interconnection

A number of respondents raised concerns that our analysis does not sufficiently take into account the potential 'wider impacts' of increased interconnection on the GB transmission system, as outlined in the System Operability Framework (SOF)[8] published by National Grid Electricity Transmission (NGET) in its role as GB System Operator (the SO). Specifically, concerns were raised about the potential increase in operational risks, including reduced system inertia, falling short circuit levels and issues related to interconnector ramp rates.[9]

One respondent pointed to the 'System Needs and Product Strategy'[10] document published by NGET, which in the respondent's view shows that by the early 2020s, NGET expects electricity interconnectors to be curtailed for up to 50% of the year.

System inertia, short circuit levels and interconnector ramp rates

System inertia is a feature of the electricity system and primarily comes from synchronous generators. Inertia stabilises frequency and reduces the rate at which the system frequency

[5] Consultation on the Initial Project Assessment of the GridLink, NeuConnect and NorthConnect interconnectors: https://www.ofgem.gov.uk/system/files/docs/2017/06/ofgem_window2_ipaconsultation_june_2017.pdf
[6] GridLink, NeuConnect and NorthConnect have a planned capacity of 1.4GW each.
[7] Existing interconnectors - IFA (2GW), BritNed (1GW), EWIC and Moyle (500MW each) - plus the following interconnectors under construction: Nemo Link (1GW), ElecLink (1GW), NSL (1.4GW) and IFA2 (1GW).
[8] The SOF is published by National Grid and takes a holistic view of the changing energy landscape to assess the future operation of GB electricity networks. It can be found here: http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/System-Operability-Framework/
[9] The ramp rate is the maximum rate (measured in MW per minute) at which an interconnector can change its output.
[10] NGET's 'System Needs and Product Strategy' can be found here: http://www2.nationalgrid.com/UK/Services/Balancing-services/Future-of-balancing-services/

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changes (the Rate of Change of Frequency, RoCoF) in response to an imbalance between generation and demand.

As the generation mix changes and non-synchronous generation becomes more prevalent, the level of inertia on the system is expected to decrease. Hence, during periods of low system inertia, system frequency will be subject to more rapid changes (higher RoCoF) in response to a large instantaneous demand or infeed loss on the system.

Some generators have protection relays[11] fitted that disconnect or 'trip' the generator off the system if a high RoCoF is detected. The SO must therefore manage the RoCoF below the level that would activate these relays to avoid multiple generation plant being disconnected or 'tripping' off the system. It currently achieves this during periods of low inertia by constraining the largest single infeed loss (ie curtailing interconnector flows) or by taking actions to increase system inertia. Unless this issue is resolved, the frequency of such actions and the associated costs will increase.

The strength of the system is an indication of its inherent robustness and in a particular region, in response to a disturbance, short circuit levels are a measure[12] of that system strength. The main contributor to short circuit levels are large synchronous generators. A decline in such generation may therefore lead to reduced system strength, affecting the dynamic performance of the system during a fault and increasing challenges in operating protection systems.

Power flows across an interconnector change in response to the relative price of electricity between the two markets coupled by the interconnector. The change in interconnector flow is referred to as 'ramping'. Ramp rates of up to 100MW a minute are currently permitted, which is accommodated by the amount of reserve held on the system by the SO. In future, it may not be possible for multiple interconnectors to ramp at this rate without increasing the level of reserve held by the SO. Alternatively, ramp rates could be restricted to avoid the need for the SO to hold additional reserves.

Our view

We acknowledge that the changing energy landscape presents a number of system operability challenges for the SO. The increased penetration of wind and solar energy to meet the UK's decarbonisation targets is expected to significantly change the generation mix in GB. The proportion of energy supplied to the GB system from non-synchronous[13] sources (from wind, solar and interconnectors) rather than conventional synchronous generation sources (such as thermal plants) is also increasing. This changing generation mix and the increasing prevalence of non-synchronous generation presents a number of technical challenges for the GB System Operator.

However, we note that these changes to the technical characteristics of the GB system are not solely attributable to increased levels of interconnection, but to the changing energy landscape more generally.

We have raised these wider system impact issues with NGET. Its response to the inertia issue is attached at Annex 3. We note from NGET's response that a number of initiatives are currently either underway or under consideration to help meet these operability challenges, including ongoing and planned work to desensitise Loss of Mains Protection

[11] NGET notes in its 2017 System Needs and Product Strategy document that the settings for these relays are widely accepted to be too sensitive for the GB system.
[12] The Short Circuit Level measure is highly dependent on the locations of generators.
[13] Generation which is decoupled from the GB system via a converter or control system and that does not contribute to system inertia.

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(RoCoF) settings, procurement of Enhanced Frequency Response and a Network Innovation Competition (NIC) project aimed at addressing some of these challenges.[14]

Falling short-circuit levels will require the SO to review its approach to ensuring that the system remains resilient to disturbances and that protection systems operate correctly during times of low system strength. In terms of interconnector ramp rates, the SO considers revising these, rather than increasing the amount of reserve held on the system, to be the more efficient way of dealing with this issue[15]. We note that this issue is currently being discussed with industry participants.

We further note that NGET expects that timely resolution of the Loss of Mains Protection (RoCoF) issue coupled with the other initiatives mentioned in its response will mean that the Window 2 interconnector projects will not be unduly constrained. We are confident that NGET is taking reasonable actions to address these wider system challenges. We will continue to monitor developments and, where appropriate, ensure appropriate regulatory arrangements are in place to facilitate mitigation of these wider system issues.

Interactions with network charges and the carbon price floor

A number of respondents suggested there is an uneven playing field between GB-based generators and those in other countries that may not pay the same level or structure of network charges as GB-based generators. Some respondents also commented that interconnectors being exempt from having to pay network charges results in market distortions and gives an unfair competitive advantage to flows over an interconnector. Some concerns were also raised about how the GB carbon price floor may affect the needs case for further interconnection.

Network charges for GB generators are composed of both Transmission Network Use of System (TNUoS) charges, which recover the costs that NGET incurs in providing and maintaining the GB transmission system, and Balancing Services Use of System (BSUoS) charges, which recover the cost of day-to-day operation of the transmission network.[16] Changes to these arrangements are made via industry-led processes set out in the Connection and Use of System Code (CUSC) and Balancing and Settlement Code (BSC).

Currently, average transmission charges for GB generation are subject to a charge range of €0-2.5/MWh[17] as defined by European Commission Regulation 838/2010 (the Regulation).[18] The total revenues that transmission network owners are allowed to recover via TNUoS charges each year are set by Ofgem using the price control process. The proportion of these costs recovered from generation (G) and demand (D) network users is determined by the 'G:D split', which is now set to ensure average generator charges do not exceed the €2.5/MWh limit set by the Regulation.[19] As such, we note that in charging year 2017/18 the proportion of allowed TNUoS revenue paid by GB generators was 14.8%, and is forecast to

[14] Project Phoenix – submission by SP Transmission (partnered with NGET) on routes to market for synchronous compensators that provides the system with inertia and could potentially allow for a further reduction in synchronous generation while maintaining inertia levels https://www.ofgem.gov.uk/publications-and-updates/electricity-nic-submission-scottish-power-transmission-phoenix
[15] Increasing the amount of reserve held on the system may lead to increasing balancing costs.
[16] Neither of these sets of charges are levied on interconnectors.
[17] The Regulation exempts transmission charges for ancillary services, as such, BSUoS charges are not subject to the charge range.
[18] Regulation (EU) No 838/2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:250:0005:0011:EN:PDF
[19] Based on the methodology set in place via CMP224 (cap on the total TNUoS target revenue to be recovered from Generation Users), the G:D split is required to be the lower of 27% of allowed TNUoS revenue or the maximum upper limit of the charge range set by Regulation.

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continue to shift in favour of generation, to a split of around 10% for generators and 90% for demand users (e.g. suppliers) by 2021.[20]

BSUoS charges recover the costs of System Operator balancing activities and are exempt from the charge range set by the Regulation. The charges are calculated ex-post, based on the volume of energy a user takes from, or supplies to, the transmission system on a half-hourly basis. In GB, BSUoS charges are levied 50:50 between generation and suppliers. We previously rejected a modification to remove BSUoS charges from GB generators[21] on the grounds that the potential benefits this change would bring would not be material enough to offset the potential costs to consumers.

We removed[22] GB network tariffs for interconnectors in order to comply with EU legislation, which defines an interconnector as a transmission line.[23] Consequently, interconnector flows are neither classed as production (generation) nor consumption (demand), but part of the overall transmission infrastructure facilitating the wider market, and therefore not an entity that can be subject to network charges.

While network charges are structured and levied differently in other markets, work has been undertaken to promote the harmonisation of network tariffs across Europe. In 2015, ACER concluded that existing policies are sufficient to prevent potential negative effects from any lack of harmonisation in transmission tariff structures. However, ACER also concluded it would continue work to establish a common set of transmission tariff principles.[24]

We have committed to review existing network charging arrangements, including how charges are levied on different network users, through both the Targeted Charging Review (a Significant Code Review launched in July 2017[25]) and as part of our 'Strategy for Regulating the Future Energy System'[26] which includes potential reforms to electricity network access arrangements and forward-looking charges. We published working papers[27] providing further details on both of these reviews in November 2017 and have established the 'Charging Futures Forum' to bring together both the Ofgem-led and industry-led electricity network charging review activities into a joined-up work programme, in which stakeholders can engage with efficiently and effectively. We consider this to be an appropriate forum to further consider issues relating to the current charging arrangements.

We agree with respondents that policy differences in carbon pricing and network charges affect price differentials between markets, and that our IPA conclusions on the potential welfare impacts are sensitive to these differences.

This is why we asked Pöyry to include a 'Policy' sensitivity in its analysis. This sensitivity assumes there is no carbon price differential between GB and Europe and removes BSUoS charges in the base scenario. It is designed to test our IPA conclusions against a possible

[20] Based on National Grid's 2017 5-year TNUoS forecast : http://www2.nationalgrid.com/uk/Industry-information/System-charges/Electricity-transmission/Approval-conditions/Condition-5/
[21] Ofgem decision CMP201: Removal of Balancing Services Use of System (BSUoS) charges from generation.
[22] See October 2010 Modification Proposal GB ECM-26 removing TNUoS charges: https://www.ofgem.gov.uk/sites/default/files/docs/2010/10/ecm-26-decision-letter-published-041010.pdf; May 2012 decision on BSC Modification Proposal P278, and CMP202 that removed BSUoS charges: https://www.ofgem.gov.uk/ofgem-publications/62082/cmp202-decision-letter-pdf and https://www.ofgem.gov.uk/sites/default/files/docs/2012/05/p278d_0.pdf
[23] Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0015:0035:EN:PDF
[24] http://www.acer.europa.eu/en/Electricity/FG_and_network_codes/Documents/Scoping%20conclusions%20for%20harmonised%20Transmission%20Tariff%20Structures%20in%20Electricity.pdf
[25] https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-significant-code-review-launch
[26] https://www.ofgem.gov.uk/publications-and-updates/our-strategy-regulating-future-energy-system
[27] https://www.ofgem.gov.uk/system/files/docs/2017/11/tcr_working_paper_nov17_final.pdf and https://www.ofgem.gov.uk/publications-and-updates/reform-electricity-network-access-and-forward-looking-charges-working-paper

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future where there is no carbon price differential and BSUoS charges are removed. The sensitivity effectively eliminates the value of interconnector arbitrage opportunities based on policy differences in carbon pricing and balancing charges and assesses a project's resilience to policy risk. Although the results of this analysis show that the projects are less beneficial overall, they continue to offer benefit to GB consumers.

Inclusion of 'Policy' and 'Capacity Reduction' sensitivities in the base case

Some respondents suggested that the 'Policy' and 'Capacity Reduction' sensitivities, which we used to test project resilience to policy normalisation and reduced GB generation, should have been included in the base case rather than considered as sensitivities.

Capacity reduction sensitivity: Generators in GB potentially investing less in future generation or cutting back on existing generation capacity is one of the possible dynamic effects that may be caused by an interconnector. There are several other possible dynamic effects which dynamic modelling could potentially include. For example, another possible dynamic effect may be that generators in the connecting country react to the interconnector by increasing their capacity due to potentially higher export opportunities leading to potentially additional benefits for GB consumers. Most of these possible effects can influence each other, resulting in feedback loops, which are very difficult to reflect in the analysis. This makes it complex to choose where to draw the line in our consideration of the ripple-effects caused by the interconnector.

Our base case considers the electricity system with and without the interconnector project in question and compares metrics between the two cases (all other things, including generation capacity, being kept equal). The interconnector projects' resilience to competing domestic generators coming offline or developing less future generation is then tested as a sensitivity.

In our view this static approach and use of sensitivities is fit for purpose, and preferable to the added complexities that would be introduced by adopting a dynamic approach as our base case. We also note that the static approach is widely used and consistent with our approach to the analysis for Window 1 and ENTSO-E's CBA guidelines.[28]

Policy sensitivity: Our base case reflects a best view of the future based on known market and policy trends and assesses projects on that basis. We do not consider it appropriate to include policy variables in the base case that do not reflect current market conditions and which may or may not materialise in future.

A number of other points raised in the consultation responses are discussed in Annex 2 to this decision.

The basis of our decisions and project progression

Our decisions are based on the analysis of welfare impacts from 2022 onwards, and on information provided as part of each project's IPA submission and contingent upon the IPA conditions set out in Annex 1. We recognise that as these projects are developed, it may be optimal for the developers to alter details of the projects in the light of further analysis or engagement with partners or suppliers. Whilst we are generally supportive of ongoing project optimisation, we also need to ensure that this does not undermine the basis of our decisions. We note in particular that the decisions we have made today are contingent on

[28] ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects', February 2015: https://www.entsoe.eu/Documents/SDC%20documents/TYNDP/ENTSO-E%20cost%20benefit%20analysis%20approved%20by%20the%20European%20Commission%20on%204%20February%202015.pdf

progress generally in line with the timelines, cost estimates and commercial arrangements provided in the project submissions.[29]

Regime parameters - IDC and regime variation requests

As part of our ongoing studies into the cost of capital for all network assets, we are reviewing our approach to the calculation of Interest During Construction (IDC) applicable to interconnectors. This is with a view to moving towards a more consistent framework for the application of IDC to discrete new projects such as interconnectors, OFTOs and onshore transmission assets subject to competition. This aligns with the position we set out on the application of IDC for Window 2 projects in our minded-to consultation.[30] We would anticipate that, as signalled in our minded-to consultation, a specific development/construction risk premium will not be applied to the IDC for Window 2 projects, as these risks will be taken into account within the proposed modified methodology.

We intend to issue a consultation on the application of IDC shortly and would expect the eventual revised approach to IDC to apply to these three Window 2 interconnector projects. This consultation will also set out proposals for modifications to the calculation of the cost of capital for the operational stage of cap & floor interconnectors. If adopted, this modified approach would be applied to interconnector projects in any future cap and floor application windows.[31] For the avoidance of doubt, the modified approach to calculation of the operational stage cost of capital would not apply to the Window 1 or Window 2 cap and floor interconnector projects.

We note that the developers of all three projects have indicated that they intend to seek regime variations. We will consider any such requests on a project-specific basis. Project developers are reminded of the need to demonstrate that any regime variations are in the interests of GB consumers and ensure that any variations are requested as a single package. In making our determination of the impacts on consumers, we will include the impact of any regime variations on consumer welfare and liability (ie the floor). When assessing variations, we will base our decision on their cumulative impact.

Regulatory arrangements in connecting countries

Our decision to grant a cap and floor regime in principle to these three interconnector projects only covers regulatory arrangements for the GB portion (50%) of the interconnector costs and revenues. Regulatory arrangements for the remaining 50% of the interconnector are subject to agreement with relevant National Regulatory Authorities (NRAs) in the connecting countries.

We note that, for all three projects, the regulatory arrangements in the connecting countries are currently either unclear or still being developed.

In particular, we note that the French NRA, the Commission de régulation de l'énergie (CRE), recently confirmed that it is not in a position to determine the need for further interconnection between GB and France until the UK's future relationship with the EU is clarified.[32] Whilst we continue to consider the GridLink project to likely be in the interests of

[29] Condition 3 of the IPA conditions.
[30] Appendix 6 – Regime Parameters of our consultation on the Initial Project Assessment of the GridLink, NeuConnect and NorthConnect interconnectors: https://www.ofgem.gov.uk/system/files/docs/2017/06/ofgem_window2_ipaconsultation_june_2017.pdf
[31] As noted in our minded-to consultation, in 2018/19 we expect to conduct a review of the need for, and timing of, any future cap and floor application windows.
[32] http://www.cre.fr/en/documents/deliberations/orientation/interconnector-projects-with-the-united-kingdom

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GB consumers and the EU as a whole, we recognise that this development may make it increasingly challenging for the GridLink project to be delivered to time.

However, we do not consider the CRE's current position to necessarily present a barrier to the GridLink project proceeding, particularly if the uncertainties are resolved in a timely manner. We have taken this into consideration when confirming our decision to grant a cap and floor regime in principle to the project, subject to the IPA conditions.

We would stress that our decision to grant a cap and floor regime to these three projects should not be construed as being indicative of an Ofgem view on the likelihood of project developers reaching agreement with relevant NRAs on the regulatory treatment for the non-GB portion of the interconnector. We would also remind developers that any development costs incurred before such arrangements are agreed are entirely at the developers' own risk.

For further details on this decision please contact Ikbal Hussain at cap.floor@ofgem.gov.uk or on 0207 901 7049.

Yours faithfully,

Akshay Kaul
Partner, Networks

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Annex 1 – The IPA conditions

Our decision to award a cap and floor regime in principle is contingent upon the following conditions:

1. **If any information given to us before making our Final Project Assessment (FPA) decision leads us to consider that the basis of our IPA decision has materially changed, then we may choose to require a new IPA stage.** Material changes would include any prospective delays in project delivery of more than 3 years.

2. **We will also reconfirm at the FPA stage that the assumptions regarding connected country energy market access and electricity trading rules on which the IPA decision was based remain broadly correct at the time of the FPA.** Should this position change, Ofgem reserves the right to revisit the needs case in order to confirm whether or not the project continues to be in consumers' interests and should continue to be granted a cap and floor arrangement.

3. **Project progress is generally in line with the timelines, cost estimates and commercial arrangements provided in the project IPA submissions**. For cost estimates, the condition is that the costs submitted by the project developers do not materially rise.[33] For the avoidance of doubt, this condition also includes developers reaching agreement with the relevant NRA in the connecting country, on the regulatory treatment for the non-GB portion of its interconnector, by the FPA submission date.

4. **Developers must also:**

   (a) Submit sufficiently detailed information 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 to support cost estimates;

   (b) 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 our IPA welfare assessment;

   (c) Confirm the timing of FPA submission in writing to Ofgem at least two months before the expected submission date; and

   (d) Give formal written notice of any material changes to the project's design, such as changes in capacity, connection location or connection date. Following any such change, developers must explain the rationale for the change and the implications for project costs and delivery timescales.

It should be noted that, in reaching our decision, we have assumed project costs will be shared on a 50:50 basis as per the default cap and floor regime.[34]

[33] We will consider the threshold for materiality of any cost escalation against the potential impact on the needs case and consumer benefits, the original estimates provided, and comparable costs for similar projects.
[34] Subject to any variation request that is approved and specifies otherwise.

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Annex 2 – Summary of consultation responses

The consultation on our minded-to position on the Initial Project Assessment (IPA) of the GridLink, NeuConnect and NorthConnect interconnectors ran from 19 June 2017 to 14 August 2017. We received 12 responses, one of which was marked confidential. Responses were received from interconnector developers, generators, and the GB System Operator (SO). The non-confidential responses have been published on our website and copies are also available from our library. Below we provide our view on the responses to the questions asked in the consultation. We also address other points raised in the consultation.

	Question 1: Do you agree with our minded-to positions on the three projects considered in this consultation?	
	Points raised:	**Our view:**
1	• No economic case is made for the projects, the evidence presented shows that total GB welfare is negative in all but a small number of scenarios • Further work is needed to be confident that underwriting of the three projects with consumers' money is appropriate.	• We take the financial risks to GB consumers into account when we undertake our assessments. We expect net floor payments for these projects (i.e. financial risk to consumers) over the 25-year span of the regime to be significantly lower than the total positive consumer impact (as a result of lower wholesale prices). Our analysis shows that the overall domestic bill impact (wholesale price savings minus any floor contributions) is expected to be a saving of approx. £2.10 to £2.60 per project, per year. We note that 2 of the 3 projects have a total impact on GB that we expect to be negative in the base case. However, the positive consumer impact significantly outweighs the negative GB impact (which is driven by lower GB generator revenues).
2	• Interconnectors displace firm domestic capacity which does not rely on generating margins in connected markets and therefore increase GB dependence on marginal carbon plant. Consequently these interconnectors will not provide additional security of supply and are likely to result in increased carbon emissions.	• There is a range of factors driving where the marginal output will come from, which will vary over time and across connecting markets. For example, interconnection offers an export route for (low marginal cost) wind and solar from markets where – for either demand or network configuration reasons – these would need to be curtailed. In addition, some markets are likely to have renewable surplus capacity, such as Norway. • Pöyry's modelling considered total carbon emissions at a system level and the high-level conclusion is that carbons emissions are likely to be reduced overall, based on the expected dispatch profile across 25 years.
3	• Ofgem should explain the consequences to the broader GB policy objectives.	• We consider interconnectors to be able to contribute towards all three policy objectives of the energy trilemma. In addition we note that further interconnection is a policy objective for the sector. • The cap and floor regime is a revenue regulation tool rather than a specific subsidy mechanism. We take into account overlaps with other policy interventions to ensure that consumers are not double funding the same outcome, for example by taking balancing services, capacity market and any additional sources of revenue into account in our assessment of interconnector revenue relative to the cap and floor levels.

4	• The assumptions made for GridLink are heavily weighted to the availability and reliability of the ageing nuclear fleet in France. The nuclear assets in France are nearing their end of life and the French Government has recently announced that the fleet should be reduced to 50% of the electricity fuel mix by 2025. It is likely that the resulting supply gap would be satisfied by thermal generation. This does not appear to have been included in the supporting analysis. This raises the question whether the UK would be comfortable in importing fossil fuel based generation while obliging domestic thermal plant to pay the Carbon Price Support (CPS).	• We agree that the dominance of nuclear generation in France will likely reduce over the coming years as France transitions away from its reliance on nuclear. • We note that ENTSO-E's TYNDP 2030 scenario projects an increase in generation from renewable energy sources in France's electricity mix.[35] We further note that an International Energy Agency[36] review estimates the role of renewable energy in the French power mix to increase to 40% by 2030 (from its current share of 16.5%).
5	• The assessment of GB welfare versus EU (excluding GB) welfare is heavily weighted towards the EU. This translates as net outgoing of value from the GB economy to that of the concerned EU states which would be deemed to be against national interest within the context of the current climate of Brexit. Whilst the GB consumer may be the recipient of any welfare benefit, the movement of value away from the UK is borne by producers and suppliers of balancing services whose revenue is required for continued investment in the maintenance of the domestic infrastructure.	• We note that overseas generator welfare in connecting countries is likely to be positive. However, we would note that this is because those generators are providing power at a lower price than GB generators, and this is the same reason that GB consumers benefit from lower wholesale prices. GB consumer gains are tied to overseas generator gains, where power generated overseas is imported. Equally, GB generators would benefit from the interconnector in a situation where the interconnector exported from GB, but this would increase costs to GB consumers. In addition, we don't take a view on the revenue benefit to interconnectors from providing any balancing and ancillary services.
	Question 2: Is there any additional information that you think we should take into account when reaching our decision on the IPA of the projects?	
	Points raised:	**Our view:**
6	• Some respondents queried whether it was appropriate for the potential SEW benefits from the provision of ancillary services to be attributed to interconnectors (rather than generators). One respondent also noted that "balancing service provider" is defined in the Electricity Balancing Guidelines as a "market participant with reserve-providing units or reserve providing groups able to provide balancing services to TSOs"	• Ancillary services were traditionally provided by generators. However, it is a matter for NGET and its contracting strategy as to whom such services should be procured from in future, and we do not consider this has a direct bearing on the decision at hand. • Whilst potential SEW benefits of interconnectors providing ancillary services is a factor in the IPA, potential revenue derived from the ancillary services is not taken into account as we do not have visibility on what revenues might ultimately be earned by the interconnectors. • We are aware of the draft guidelines and the envisaged definitions. However, we remain of the view that interconnectors play a pivotal role in enabling these services. As such, we continue to consider it appropriate to attribute benefits arising from such

[35] See TYNDP 2016 Scenario Development Report: https://www.entsoe.eu/Documents/TYNDP%20documents/TYNDP%202016/150521_TYNDP2016_Scenario_Development_Report_for_consultationv2.pdf
[36] See IEA 2016, Energy Policies of IEA Countries: France: https://www.iea.org/publications/freepublications/publication/Energy_Policies_of_IEA_Countries_France_2016_Review.pdf

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		services that are enabled by interconnectors to interconnectors. Based on information provided by NGET, we expect interconnectors to be able to provide such services in future.
7	• European welfare - the Network Options Assessment (NOA) for Interconnectors is based on impact of the interconnection on the welfare across Europe and the UK. At times when the interconnectors flow from GB to Europe, there is also a net benefit (and therefore an increase in total welfare across all parties however this has not been considered in the analysis. This would make the interconnectors appear more beneficial. For projects which create net benefit, however a dis-benefit to GB consumers, a mechanism for reallocation of welfare could be created.	• Our analysis considers flows in both directions over the regime period. This therefore captures welfare transfers in both directions over that period. We do not consider non-GB European welfare specifically in our consultation but this is taken into account in Pöyry's economic analysis and in our decision making.
	Question 3: What are your views on the approach Pöyry has taken to modelling the impact of cross-border interconnector flows?	
	Points raised:	**Our view:**
8	• Further work is required to consider the impact of policy differences between connected markets and the potential impact of these on incentives to construct interconnectors.	• We consider the impact of policy normalisation between connected markets through our "Policy" sensitivity. This eliminates value from interconnector arbitrage based on policy differences on carbon pricing and balancing charges and assesses a projects' resilience to policy risk. The results indicate that whilst the projects are less beneficial overall, they continue to provide benefits to GB consumers.
9	• Any assumptions regarding income streams from the Capacity Market (CM) are unsafe since the current arrangements whereby the interconnector owner is the holder of capacity arrangements are only intended to be temporary.	• As noted in our consultation, we did not include Capacity Market revenues with the socio-economic welfare (SEW) figures used to inform our decision as it is unclear how long the capacity market will be in place or if a project would win a contract.
10	• It is not appropriate to assume that new plant will come on-line as required to provide for security of supply. This could distort the modelling outputs and would benefit from further analysis.	• Pöyry's economic analysis assumes that supply meets demand and assumes new investment in line with standard modelling practice. However, we recognise the individual nature of investment decisions.
11	• Pöyry should include the impact of new interconnectors being built or being considered across Europe to ensure a consistent approach with the capacity mix assumptions for smaller markets.	• We assessed a range of scenarios and sensitivities which assume varying levels of interconnection, based on Pöyry's view of future interconnector development between connecting markets. • Given that the Low scenario is designed to result in circumstances that would be

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		unfavourable to the development of interconnectors, and the High scenario in favourable circumstances, a higher level of interconnection is assumed in the Low scenario than in High scenario.
12	• Pöyry's main conclusions state that "capacity market revenues represent a significant share of overall revenues for NorthConnect and GridLink. For both projects, capacity market revenues are required to reach the floor in the Base Case and the Policy normalisation sensitivity." If Pöyry is correct in saying that, significant CM revenues are required to reach the floor in the Base Case and the Policy normalisation sensitivity. It is unclear how the projects will be financed given the expectation that their revenues will be sat at the floor for prolonged periods.	• We note that in the Marginal Additional (MA) case, without Capacity Market or additional revenue, floor payments may be required for the GridLink and NorthConnect projects. However, the three projects are still expected to generate significant consumer benefits as the benefits of lower wholesale prices significantly outweigh the cost of any floor payments, which are already factored into the results of our analysis.
13	• The 60% utilisation factor for NorthConnect interconnector that has been derived by the Pöyry modelling in its Base Case suggests that the modelling and/or input assumptions may have been very conservative. A higher utilisation factor for the cable would, other things being equal, increase GB consumer benefits (by further reducing average electricity prices and/or by increasing the amount of above cap payments).	• The utilisation factor used in Pöyry's modelling is driven by supply and demand patterns and wholesale electricity prices. The base case is a central view of the future, which we note is not intended to be overly optimistic or unduly conservative, and is based on assumptions described in Pöyry's report.
14	• The thermal loss factor assumption of 7.5% [for NorthConnect] is too high. More generally, the BID3 model used by Pöyry – although suitable for Ofgem's needs - is unlikely to capture the full nuances of the Norway's hydro system.	• Pöyry applied the same principle to calculate the thermal loss factor for all three projects – this is based on a standard AC/DC conversion loss factor plus losses due to the distance of the cable. • We understand from Pöyry that the BID3 Model has been designed to take full account of the hydro-dominated electricity systems in the Nordics.
	Question 4: Do you have any additional evidence in this area that we should take into account?	
	Points raised:	**Our view:**
15	• The generating margins in neighbouring countries are expected to reduce significantly over the next several years – each market will become dependent on wind and interconnection. However, in the event of coincident system stress events, interconnectors will not be able to provide the security of supply that is anticipated.	• We disagree that increased interconnection is a risk to security of supply. Given the fall in GB capacity margins, there's an equal case to be made that interconnection increases supply security by connecting GB to a larger market and to increased diversity of supply sources. We would expect market prices to respond to tightness of supply in GB (or in other markets) and to provide a signal for imports. • Interconnectors that participate in the Capacity Market are de-rated (ie the capacity contribution is reduced) to ensure that the likelihood of flow into GB is properly reflected. This accounts for technical and market characteristics of the interconnector, including the likelihood of coincident stress events. • We also note that interconnection is a requirement for cross-border sharing of balancing and ancillary services – providing our System Operator with more options to maintain system security than would otherwise be the case (via cooperation with

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		other system operators). • Interconnection is also widely recognised as an enabling tool for more intermittent generation mixes, providing security and flexibility at system level, as well as providing an export route for surplus generation that would otherwise be curtailed. • Pöyry takes a view on likely supply patterns in connecting countries and the modelling therefore this is to some extent already taken into account.
	Question 5: Do you have any views on the information presented in the chapter?	
	Points raised:	**Our view:**
16	• The potential impact of increased interconnection on the GB transmission system must be considered in detail with respect to the deployment of new large interconnectors. Costs may be incurred in managing the system as a result of increased interconnection through, for example, the fluctuations that occur from the direction of flows and in particular in relation to the RoCoF – the SO may need to intervene to manage flows to ensure system security.	• We discuss the potential wider system impacts of increased interconnection in the main decision letter.
17	• Ofgem should consider operational risks of having more interconnectors as outlined in the SOF.	
18	• The potential impacts on the GB transmission network from increased interconnection have not been fully examined and understood in the IPA.	
	Question 6: Are there any additional factors that you think we should have considered?	
	Points raised:	**Our view:**
19	• New interconnectors may simply displace services currently provided by domestic resources. With increasing penetration of intermittent generation in most European markets it is likely that services across interconnectors become increasingly less reliable and more expensive for the GB market.	• As noted above, interconnection is widely recognised as an enabling tool for more intermittent generation mixes, providing security and flexibility at system level, as well as providing an export route for surplus generation that would otherwise be curtailed. • We also note that interconnection is a requirement for cross-border sharing of balancing and ancillary services – providing the GB System Operator with more options to maintain system security than would otherwise be the case (via cooperation with other System Operators).
20	• It is important that the GB SO does not have any conflicts of interests regarding its relationship with the relevant TSOs in relation to incentives to promote interconnector investment.	• National Grid's interconnector arm (National Grid Ventures) is a legally separate and ring-fenced division of National Grid plc. This, coupled with licence conditions that prohibit discriminatory or preferential treatment gives us confidence that the analysis provided was a neutral and transparent assessment. Further, we believe NGET SO is

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		also best placed to provide analysis of SO impacts. We also note the ongoing work on future arrangements for the system operator[37] which aims to address any actual or perceived conflicts of interest between National Grid's SO functions and other business interests, such as the electricity TO and the electricity interconnectors.
21	• If interconnectors are able to compete for and displace domestic GB ancillary services, this will likely force closure of current GB service providers and displace new build assets, adversely impacting security of supply or requiring higher revenues from other resources.	• We place responsibilities on the System Operator to ensure that a range of economic and efficient tools are available for effective operation of the system. • We would not expect ancillary services that may be provided by interconnectors (as opposed to more conventional sources) to detrimentally affect security of supply.
	Question 7: Have we appropriately assessed the hard-to-monetise impacts of the interconnectors?	
	Points raised:	**Our view:**
22	• If system stress events are coincident on both sides of an interconnector, exporting flows from GB may exacerbate a system stress event or imports to GB may be curtailed by the exporting System Operator in order to maintain their own levels of capacity and would thus reduce system security further. • Ofgem should also consider effects on security of supply should interconnectors be unavailable.	• As noted above, the technical and market characteristics of an interconnector, including the likelihood of coincident stress events is taken into account in the de-rating factors attributed to that interconnector. Interconnectors that participate in the Capacity Market are de-rated to ensure that the likelihood of imports into GB is properly reflected.
23	• With coal still a significant part of the generation mix in Germany, it is unclear from the analysis how NeuConnect would support the decarbonisation of energy supplies.	• We note that the electricity generation mix in Germany is similar to GB. However, Germany has higher shares of generation from renewables which is expected to continue to increase in all TYNDP 2030 scenarios. NeuConnect is also expected to maximise the value of GB and German renewables through efficient dispatch across the two markets, particularly wind. The flow of weather patterns, as well as time and daylight differentials, contributes to this.
24	• One respondent commented that whilst it was broadly satisfied with the hard-to-monetise impacts of the interconnectors. It considered our assessment to be one sided and suggested that we should also consider the potential negative impacts of interconnectors.	• We expect net positive impacts on the hard-to-monetise areas as set out in Chapter 6 of our consultation. We welcome further dialogue from stakeholders on any potential negative hard-to-monetise impacts. Our view continues to be that any potential negative hard-to-monetise impacts would be significantly outweighed by the potential benefits.

[37]Future arrangements for the GB electricity System Operator https://www.ofgem.gov.uk/publications-and-updates/future-arrangements-electricity-system-operator-its-role-and-structure

25	• Ofgem should consider the effects on the generation mix from displaced GB generation capacity. As renewables penetration increases across Europe flexible generation will become increasingly important. Increased interconnector penetration, when not competing on a level playing field, will displace existing and in addition will disincentives investment in new GB generation capacity. • Increased interconnection may displace activity in the GB electricity market to deliver innovative new solutions and increase reliance on marginal carbon plant. • Increased investment in interconnectors increases the risk of plant closures in GB, the potential unavailability of interconnectors will impact of security of supply and market conditions in other market restrict access to interconnector flows (e.g. coincident periods of low wind or cold spells).	• We address concerns over policy differentials in the main decision letter. • We expect interconnectors to positively contribute to security of supply by connecting GB to a larger market and to increased diversity of supply sources. • In our view Pöyry's analysis provides a reasonable view of future generation dispatch and new investment. This analysis recognises the extent to which some GB generation will be displaced in the wholesale market. This results in a lower wholesale price overall which benefits consumers.
	Question 9: Do you have any views on the information presented in this chapter?	
	Points raised:	**Our view:**
26	• One respondent assumes that the GB SO has determined the economic and efficient connections arrangements for the new interconnectors, but remains concerned about the potential for conflict of interest between the GB SO and the GB Transmission Owner (TO) in which it has an interest.	• We consider the GB System Operator to be best to determine the most economic and efficient connection location utilising the CION process. We also note the ongoing work on future arrangements for the system operator[38]which aims to address any actual or perceived conflicts of interest between National Grid's GB System Operator functions and other business interests, such as the electricity Transmission Owner (TO) and the electricity interconnectors.
	Question 10: Do you have any comments on our assessment of the project plans?	
	Points raised:	**Our View:**
27	• One respondent notes that third party delays in approvals and consents may add additional delays to the start of operation. The respondent suggests a greater recognition to external factors beyond the reasonable control of the developer.	• We understand that developers may face a number of challenges in delivering these complex infrastructure projects. In recognition of such challenges, and in line with our decision to update the IPA conditions for Window 1 projects[39], we have extended the Final Project Assessment (FPA) deadline for Window 2 projects from 2 years to 3 years. We also expect licence conditions implementing the cap and floor regime for successful Window 2 projects to provide for the duration of any delays caused by force majeure events to be taken into account.

[38]Future arrangements for the electricity system operator: https://www.ofgem.gov.uk/publications-and-updates/future-arrangements-electricity-system-operator-its-role-and-structure
[39] Cap and floor regime: An update on 'Window 1' interconnector projects, June 2017: https://www.ofgem.gov.uk/system/files/docs/2017/06/w1_update_letter_-_19jun2017_-_final.pdf

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Other issues raised

	Points raised:	Our View:
28	• The decision should be based on the total UK social welfare impact of a new project, taking into account the impact on customers, market participants and the UK economy as a whole. This would be consistent with other decisions that regulatory authorities are required to take in a wider European context, such as whether or not to set up different pricing zones.	• Our decision focuses primarily on whether or not projects are in the interests of GB consumers given that our principal objective is to protect the interests of existing and future consumers. • Whilst we recognise projects may have a small negative impact on GB total welfare we note that this is significantly outweighed by the consumer benefit. • We have taken a conservative view throughout and note that there may therefore be additional upsides not reflected in the modelling results. • We have also taken hard-to-monetise benefits into account in our decision making.
29	• One of the key drivers for interconnector flows has been the policy differentials that result in higher prices in GB when compared to the wider European markets, particular in relation to the carbon floor price. However, there is increasing alignment on policy objectives in the European Single Market through greater market coupling, convergence of carbon prices and the implementation of European Network Codes. Consequently, GB cannot rely on policy differentials determining interconnector flows in the future.	• Our analysis takes account of policy differentials between connecting countries and includes a 'Policy' sensitivity. This shows that projects continue to offer significant consumers benefit in the event of policy normalisation (with no carbon price differential and BSUoS charges removed in the base case). These themes are discussed further in the main decision letter.
30	• The cost benefit analysis is underpinned by the current policy arbitrage offered by the carbon price support which has a high level of uncertainty around its future trajectory. The carbon price support is an essential intervention to ensure progression to a low carbon future, however, it is not envisaged to be enduring.	
31	• One respondent sought clarification on why the decision has been taken not to open an application window this year, and what the nature of the review in 2018/19 may be.	• Having now run two cap and floor application windows (in 2014/15 and 2016/17), we expect to conduct a review of the need for, and timing of, any future cap and floor application windows in 2018/19. We consider it sensible to not open a further application window ahead of this review.
32	• One respondent noted that network assets cannot simply be removed should there be a mistake in assessing the benefits of a project or projects and that the risk of such a miscalculation would sit with GB consumers. The respondent suggests Ofgem's approach should be cautious when assessing whether projects should be underwritten by customers through a cap and floor settlement.	• We consider our assessment to take into account a wide range of outcomes to assess the quantifiable economic benefit of new interconnection. The base case assesses projects against known market and policy trends but adopts a conservative bias throughout. • The high and low scenarios further assess projects against a range of potential outcomes from additional interconnection by varying the assumptions that impact upon wholesale price differentials, and therefore interconnector value. • Projects are also assessed against a range of sensitivities, on a project specific basis, to test the robustness of interconnector welfare and value.
33	• One responded stated that it is not clear that the analysis takes into	• We consider interconnectors to increase security of supply by connecting GB to a

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	account any security of supply issues associated with capacity closures within GB as a result of increased interconnection. The respondent further commented that: ○ it would be reasonable to expect that new cap and floor funded interconnector projects would be successful in securing UK Capacity Market agreements, given that the developer is protected from revenue cost risks. ○ Interconnectors would therefore be expected to displace other indigenous sources of capacity such as storage and generation technologies. ○ It is unclear from the analysis on what basis that it has been established that sufficient overseas capacity will remain available to fulfil this demand.	larger market and to increased diversity of supply sources. • We did not include capacity market revenues with the SEW figures used to inform our decision as it is unclear how long the capacity market will be in place or if a project would win a contract. • Interconnectors that participate in the Capacity Market are de-rated to ensure that the likelihood of imports into GB is properly reflected. • We consider Pöyry takes an appropriate of capacity developments in connecting countries over the 25 years of the regime. Furthermore, Government takes into account the reliability of overseas capacity when setting interconnector de-rating factors.
34	• One responded noted that National Grid's analysis on ancillary services refers to interconnectors' ability to provide balancing services such as frequency response and black start. Whilst the respondent agreed that such ancillary services can be facilitated by interconnection, it considered any commercial arrangements around this "should reward the true providers of these services in the interconnected markets concerned rather than the interconnector owners directly, who should continue to be rewarded through congestion revenue". Further that where the service stems from the interconnector technology, provision of the service should be on a consistent and competitive basis as other types of provider.	• Interconnectors facilitate the sharing of these service. It is for NGET, as the System Operator, to contract with the appropriate commercial party for each service. We would expect the SO to contract in a consistent and transparent manner. • We also note that, whilst we have not included revenue derived from such services in our analysis, such revenue would be taken into account when assessing interconnector revenues against the cap and floor levels.

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