PÖYRY

AN UPDATE OF HISTORICAL DE-RATING FACTORS FOR GB INTERCONNECTORS

Gareth Davies, Director, Pöyry Management Consulting
Florent Deledalle, Analyst, Pöyry Management Consulting

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SUMMARY OF APPLIED APPROACH AND UPDATED DE-RATING FACTORS

	Relevant periods	Applied metrics	Applied metrics
Applied approach	• Highest 50% of GB peak demand periods during winter quarter • Time series of last 7 years	**Existing interconnectors:** Contribution to de-rating factor only when day-ahead price differentials are positive and GB is importing electricity	**New interconnectors:** Contribution to de-rating factor when day-ahead price differentials are positive

Historical de-rating factors of existing and new interconnectors

Highest 50% of peak demand periods during winter quarter (7am-7pm business days, Dec 2011- Feb 2018, 2678 total relevant period)

DRF calculations based on:	Interconnector between GB and:						
	France	Ireland	Netherlands	Belgium	Norway (NO2/NO5)	Denmark	Germany
Price differential (+ve i.e. GB price > price in France)				67%	96%	93%	82%
Price differential (+ve) & GB imports	55%	5%	70%				

- In line with the requirements of the Capacity Market (amendments) Rules (2015), interconnectors to Belgium, Norway, Denmark and Germany are treated as new interconnectors as they do not yet have seven complete years of operational data. Their de-rating factors are based on only price differentials during the relevant periods.
- The de-rating factors of new interconnectors are before any adjustments for technical reliability and losses. As proposed in the original study and in the 2017 Update, these de-rating factors will need adjustment for technical reliability (including ramping) and a minimum positive price differential threshold to compensate transmission losses.

KEY FINDINGS

- In general, the historical de-rating factors for interconnectors have increased when based on the latest seven years time series i.e. 2011-2017.

DRF based on:	Interconnector between GB and:						
	France	Ireland	Netherlands	Belgium[2]	Norway[2]	Denmark[2]	Germany[2]
Feb. 2015 Study (time series: **2008-2013**)	29%	2%	62%	58%	74%	Not part of the study scope	Not part of the study scope
May 2016 Update (time series: **2009-2015**)	45%	2%	70%	65%	76%		
April 2017 Update (time series: **2010-2016**)	48%	4%	75%	65%	85%	87%	
April 2018 Update (time series: **2011-2017**)	55%	5%	70%[1]	67%	96%	93%	82%

– The increase in de-rating factors is mainly driven by the replacement of the 2010 DRFs with 2017 DRFs in the seven-year time series. 2017 DRFs were generally higher than 2010.

– The annual DRF for 2017 for France, the Netherlands and Belgium came back to levels observed in the May 2016 Update after the dip which occurred in the FY16 due to nuclear closures in France leading to lower regional capacity margins and higher prices in the affected markets.

- In the case of GB-Ireland interconnection, there has been no material improvement in the correlation of flows and price differentials between the two markets.

[1] DRF for interconnector to the Netherlands include in the April 2018 Update both price differentials and flows

[2] DRFs for interconnectors to Belgium , Norway, Denmark and Germany are based on price differentials only.

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BACKGROUND

- A GB capacity market was introduced in December 2014. The Capacity Market is designed to ensure that security of electricity supply is maintained for GB consumers, while offering rewards for those capacity providers most economically able to contribute towards security of supply.
- All capacity participating in the auction has a de-rating factor applied.
- New and existing interconnectors were eligible to participate in the December 2015 auction for capacity in 2019/20.
- BEIS (former DECC) commissioned Pöyry in January 2015 to develop an approach based on historical evidence to derive conservative estimates of the de-rating factor of interconnectors applicable to both existing and new interconnectors to GB[1].
- In April 2017, BEIS asked Pöyry to update the historical de-rating factors including the latest 2016 data similar to the May-2016 update, while applying the methodology as set out in the Capacity Market Rules[2].
- In April 2018, BEIS asked Pöyry to update the historical de-rating factors including the latest 2017 data similar to the May-2017 update, while applying the methodology as set out in the Capacity Market Rules[2]
- In accordance with the Capacity Market Rules, the updated de-rating factors presented in this report are based on the average of the latest seven years (2011-2017) annual de-rating factors. However, for new interconnectors no adjustments are made in their de-rating factors for the technical reliability and losses.
- Any revision to, or update of, the methodology proposed in the original study (in January 2015) is outside the scope of this project.

1 The details of the developed methodology and implied de-rating factors of interconnectors are available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404337/Final_historical_derating_of_IC_poyry_report.pdf

2 Consolidated version of the capacity market rules (July 2016), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/538235/Informal_consolidation_of_Capacity_Market_Rules_July_2016.pdf

DEFINITIONS

- **De-rating factor (DRF)**: The de-rating factor is the percentage of time when GB is expected to be importing electricity from an interconnector during identified system stress periods.
  - DRF represents the capacity credit of an interconnector. For example, a 90% de-rating factor of an interconnector will mean that 90% of the time it is available to provide electricity imports to GB from the connected market during GB system stress periods.
  - High DRF of an interconnector means that it can provide more of its capacity to support GB security of supply during system stress periods.

– **Relevant periods**: These are the chosen periods within a year when the behaviour of an interconnector is examined for assessing its de-rating factor – i.e. highest 50% of GB peak demand periods during the winter quarter (7am-7pm business days, Dec-Feb).

– **Existing interconnectors**: Interconnectors to France, Ireland and the Netherlands are described as existing interconnectors as they have operational data covering the seven years for which the relevant periods are defined.

– **New interconnectors**: Interconnectors which have less than seven years operational data or are not currently operational, but may be within the timescale of the Capacity Market auction – i.e. interconnectors to Belgium, Denmark, Norway and Germany are described as new.

– **Yearly data**: One year represents the 12 months period from 1 April to 31 March in order to include one complete winter season – e.g. 2017 data will include 1 April 2017 to 31 March 2018 period.

DATA SOURCES

Historical demand and interconnector flows

Data	Period	Source
Electricity demand	Apr 2008 – March 2018	National Grid UK
Interconnector flows	Apr 2008 – March 2018	National Grid UK

Historical electricity price data sources

Market	Period	Source (power exchange)
Great Britain	Apr 2008 – Oct 2011	APX UK for within day prices and Heren day-ahead price index
Great Britain	Nov 2011 – March 2018	N2EX for day-ahead prices
France	Apr 2008 – March 2018	EPEX (former Powernext) for day-ahead prices
Netherlands	Apr 2008 – March 2018	APX Netherlands for day-ahead prices
Ireland	Apr 2008 – March 2018	SEMO Ireland for day-ahead prices
Belgium	Apr 2008 – March 2018	Belpex for day-ahead prices
Norway and Denmark	Apr 2008 – March 2018	Nordpool for day-ahead prices

Other assumptions

- The currency conversion rates (for each day) are adopted from OANDA (http://www.oanda.com/currency/historical-rates/)

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APPLIED METHODOLOGY

We have applied the methodology for estimating conservative estimates of de-rating factors as proposed in the original study for BEIS (former DECC) conducted in Jan-Feb 2015[1] and adopted in the Capacity Market rules. This methodology determines the extent to which an existing interconnector has (or a future interconnector would have potentially) contributed to GB security.

Steps involved	Metrics for computing historical DRF	Rationale
1 Choice of criteria that represents GB system tightness	**GB electricity demand**	GB demand level has strong correlation with GB system stress conditions and demand data is readily available to apply this criteria in identifying stress periods.
2 Define threshold for metric to identify periods when GB system was stressed	**Time series:** 2011-2017 **Within year window:** winter quarter (December to February) **Ranking characteristic:** GB peak demand periods i.e. 7am to 7pm GMT during business days **Relevant periods:** highest 50 % of GB peak demand periods	Historically system stress periods have mainly occurred during winter peak demand conditions. Use of a larger number of periods in a year generally provides more conservative and more significant statistical estimates of DRFs.
3 Choice of metric for IC de-rating calculation	**IC flows**: The direction of IC flows during system stress periods define if an interconnector was contributing to GB system **Price differentials**: Lower prices in neighbouring countries than GB favour GB – presumption is that IC flows would follow price differentials	A tighter (stressed) system would expect relatively high prices hence imports from connected countries. There is good data availability of both interconnector flow data and day-ahead electricity prices to apply this metric.
4 Calculating DRFs	**Existing IC:** Divide the number of periods when price differentials were positive (i.e. GB prices > prices in other markets) and GB was importing during the relevant periods by the total number of relevant periods **New IC:** Divide the number of periods when price differentials were positive during the relevant periods by the total number of relevant periods	The DRF is based on 'efficient behaviour' of interconnectors when imports coincide with a positive price differential (i.e. GB electricity price > price in the connected market). Only price differentials are available for new interconnectors.

The use of highest 50% peak demand periods in winter quarter and 7 years time series is consistent with the Capacity Market Rules (2015).

1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404337/Final_historical_derating_of_IC_poyry_report.pdf

PROS AND CONS OF APPLIED APPROACH FOR EXISTING ICs

Using highest 50% peak demand periods in winter quarter (for the latest 7 years time series) and applying imports and price differentials to determine the DRF of existing interconnectors has the following advantages:

- it provides consistency with the timeframe for DRF assessment of conventional generation in the Capacity Market auction;
- for existing interconnectors, it represents those periods when the interconnectors were operating efficiently (i.e. the flow direction was following the price differentials between the connected markets) and actually contributing to GB security rather than relying on an assumption of how we expect them to operate (i.e. considering price differentials only);
- it incorporates technical availability for existing interconnectors; and
- it captures the interactions between different interconnectors (i.e. if the interconnectors are competing at the margin to supply GB) and of system tightness conditions in GB and the connected markets.

Some issues related to the applied approach include:

- annual historical DRFs may rise over time as efficiency of interconnectors improves, however basing on a long historical time series means that the DRF is likely to be affected by the earlier years when markets operated less efficiently and therefore the DRF could be biased; and
- it can provide less conservative estimates of DRFs when the interconnector capacity to the connected market increases.

PROS AND CONS OF APPLIED APPROACH FOR NEW ICs

Using highest 50% peak demand periods in winter quarter (for recent 7 years of time series) and applying price differentials to determine the DRF of new interconnectors has the following advantages:

- it provides consistency with the timeframe for DRF assessment of conventional generation in the Capacity Market auction; and
- it reflects the expectation that market coupling will be more embedded and efficient by the time these come into operation.

Some issues related to the applied approach include:

- future policy or regulatory changes affecting market behaviour will not be captured as the DRFs are based on 'historical' price trends in connected markets though these can be captured in the rest of the de-rating process;
- it can not capture the interactions between interconnectors and of system tightness conditions in GB and the future connected markets – the physical existence of new interconnectors can alter pricing dynamics and historical price differential based DRFs may overstate contribution of interconnectors at times of system stress;
- it does not incorporate the technical availability and ramping of new interconnectors (post commissioning date) requiring adjustment to DRFs; and
- DRFs will also need adjustment – i.e. a minimum positive price differential threshold to reflect transmission losses across the interconnector.

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DRFS FOR GB-FRANCE INTERCONNECTION

In 2017, DRF back to levels observed in 2013 after substantial dip for 2016; due to low nuclear generation availability in France during the winter quarter, electricity prices were higher relative to GB during most of the relevant periods resulting in a very low DRF of 25% in 2016

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in France)	14%	55%	57%	79%	80%	70%	79%	28%	71%	66%
GB Imports	1%	29%	32%	59%	76%	97%	91%	30%	72%	65%
Price differential (+ve) & GB Imports	1%	20%	26%	50%	68%	69%	79%	25%	70%	**55%**

Convergence between only price differential based DRF and only IC flow (i.e. imports) based DRF shows improvement in efficient behaviour of interconnector in 2017

DRF for 2016 was significantly low however, the substitution of 2010 annual DRF (20%) by 2017 DRF (70%) results in an increase in the average DRF of the latest 7 years time series.

Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	10%	25%	50%
	274	540	1347	2678
Price differential (+ve)	77%	75%	68%	66%
GB imports	63%	66%	64%	65%
Price differential (+ve) & GB Imports	59%	62%	55%	**55%**

Using a larger number of periods in a year generally reduces DRFs.

The choice of number of 'relevant periods' in a year involves a trade-off between statistical significance and capturing representative interconnector behaviour under system stress conditions (as larger data set captures 'normal' or 'slack' conditions).

Notes: In late November 2016, 4 out of 8 cables of the GB-France interconnector were damaged during storm Angus and the interconnector capacity was reduced by 50% for most of the winter period. However, this would not affect the calculated historical DRFs as the absolute volume or level of flow through the interconnector is not part of the DRF calculation methodology. The NTC was reduced on 10&11 Dec 2017

DRFS FOR GB-IRELAND INTERCONNECTION

There is an increase in the number of positive price differential periods during the relevant periods. However, the continued inefficiency of flows to price results in a low DRF.

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Ireland)	*9%*	*29%*	12%	14%	17%	34%	47%	37%	43%	29%
GB Imports	*0%*	*0%*	4%	6%	17%	0%	16%	32%	12%	11%
Price differential (+ve) & GB Imports	*0%*	*0%*	2%	0%	3%	0%	12%	13%	9%	**5%**

In 2017, GB prices were higher than prices in Ireland (SEM) for 43% of the relevant periods. However, the DRF of GB-Ireland interconnector remained low at 9% indicating an ongoing inefficient behaviour of this interconnector.

Average annual DRF based on different number of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	**10%**	**25%**	**50%**
	274	540	1347	2678
Price differential (+ve)	32%	30%	28%	29%
GB imports	6%	6%	9%	11%
Price differential (+ve) & GB Imports	4%	4%	4%	**5%**

Notes: The East-West interconnector was offline between early September and late December 2016 due to a technical fault at the converter station in Meath.
Moyle interconnector NTC was reduced at 250MW from mid February 2017 to the end of August 2017
The East-West interconnector was offline between the end of February and the end of March 2018 due to a system trip

DRFS FOR GB-NETHERLANDS INTERCONNECTION

2017 is the first year there is a complete 7 years of operational data for the GB-Netherlands interconnector. DRF back to levels observed in 2015

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Ireland)	*31%*	*58%*	68%	78%	84%	83%	89%	64%	93%	80%
GB Imports	*n/a*	*n/a*	37%	71%	87%	99%	97%	70%	92%	79%
Price differential (+ve) & GB Imports	*n/a*	*n/a*	31%	57%	75%	83%	90%	63%	91%	**70%**

In 2016, the reduced regional capacity margins (due to lower availability of the French Nuclear fleet) has also affected the electricity prices in the Dutch electricity market. However, this effect was lesser than in countries directly connected to France.

In 2017, the DRF calculated as an "existing" interconnector is lower than when considered "new", but mostly due to the first couple of years (2011-2012)

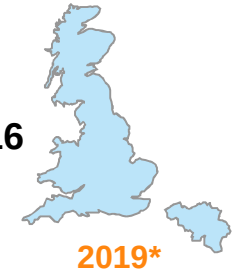
Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	**10%**	**25%**	**50%**
	274	540	1347	2678
Price differential (+ve)	98%	91%	83%	80%
GB imports	78%	82%	81%	79%
Price differential (+ve) & GB Imports	74%	78%	73%	**70%**

Notes: GB-Netherlands interconnector had reduced NTC over most of the end of November 2017 (no influence on current estimates)

DRFS FOR GB-BELGIUM INTERCONNECTION

The DRF of GB- Belgium interconnection in 2017 back to levels observed prior to 2016



2019*

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Belgium)	*27%*	*59%*	63%	64%	75%	79%	87%	31%	70%	**67%**
GB Imports	n/a									
Price differential (+ve) & GB Imports										

In 2016, the number of positive price differential periods between the GB and Belgium markets significantly decreased. This was mainly due to the dependence of the Belgian market on the French market – their interconnector has a net transfer capacity of 1850MW from France to Belgium.

Average annual DRF based on different number of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	**10%**	**25%**	**50%**
	274	540	1347	2678
Price differential (+ve)	79%	80%	70%	**67%**
GB imports	n/a			
Price differential (+ve) & GB Imports				

In line with the requirements of the Capacity Market (amendments) Rules (2015), the existing interconnector to Belgium is treated as a new interconnector because it does not have complete seven years of operational data. Therefore, its DRF is based on only positive price differentials during the relevant periods.

* According to Ofgem

DRFS FOR GB-NORWAY2 INTERCONNECTION

DRF of GB-Norway interconnection remains very high as hydro based historical electricity prices in Norway during the relevant system stress periods in GB remain lower than the GB prices.

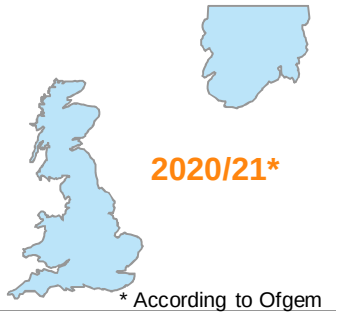
Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Norway)	*38%*	*51%*	91%	94%	99%	99%	93%	100%	99%	**96%**
GB Imports	n/a									
Price differential (+ve) & GB Imports										

After a drop in DRF in 2015 driven by several unusual cold spells in Norway, the DRF in 2016 increased again as electricity prices in Norway were predominantly lower than in GB due to warmer winter conditions (average winter temperature in Norway was higher than the seasonal norm during 2016/17 winter).

Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	**10%**	**25%**	**50%**
	274	540	1347	2678
Price differential (+ve)	97%	96%	95%	**96%**
GB imports	n/a			
Price differential (+ve) & GB Imports				



* According to Ofgem

DRFS FOR GB-NORWAY5 INTERCONNECTION

DRF of GB-Norway interconnection remains very high as hydro based historical electricity prices in Norway during the relevant system stress periods in GB remain lower than the GB prices.

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Norway)	*n/a*	*35%*	89%	92%	100%	99%	93%	100%	99%	**96%**
GB Imports	n/a									
Price differential (+ve) & GB Imports										

After a drop in DRF in 2015 driven by several unusual cold spells in Norway, the DRF in 2016 increased again as electricity prices in Norway were predominantly lower than in GB due to warmer winter conditions (average winter temperature in Norway was higher than the seasonal norm during 2016/17 winter).

Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	10%	25%	50%
	274	540	1347	2678
Price differential (+ve)	97%	96%	95%	**96%**
GB imports	n/a			
Price differential (+ve) & GB Imports				

DRFS FOR GB-DENMARK INTERCONNECTION

Price differential based DRF of Danish interconnection is very high as electricity prices in Denmark are influenced by low prices in Norway.

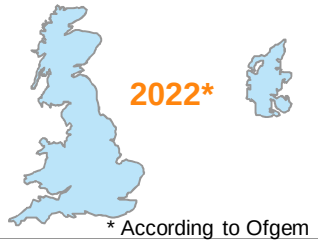
Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Norway)	*43%*	*58%*	84%	88%	97%	94%	92%	97%	99%	**93%**
GB Imports	n/a									
Price differential (+ve) & GB Imports										

The substitution of 2010 annual DRF (58%) by 2017 DRF (99%) results in an increase in the average DRF of the latest 7 years time series.

Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	10%	25%	50%
	274	540	1347	2678
Price differential (+ve)	95%	95%	92%	**93%**
GB imports	n/a			
Price differential (+ve) & GB Imports				



* According to Ofgem

DRFS FOR GB-GERMANY INTERCONNECTION

Price differential based DRF of German interconnection is overall increasing as electricity prices in Germany are increasingly influenced by wind generation.

Average annual DRF based on 50% of peak demand periods during winter quarter
(7am-7pm business days, Dec-Feb)

DRF calculations based on:	Annual									Average of recent 7 years
	2009	*2010*	2011	2012	2013	2014	2015	2016	2017	2011-2017
Price differential (+ve i.e. GB price > price in Norway)	*38%*	*63%*	68%	85%	89%	87%	91%	64%	94%	**82%**
GB Imports	n/a									
Price differential (+ve) & GB Imports										

Monthly average day-ahead prices in Germany surged in Q4 2016 following rising coal/gas prices and lower nuclear availability in France

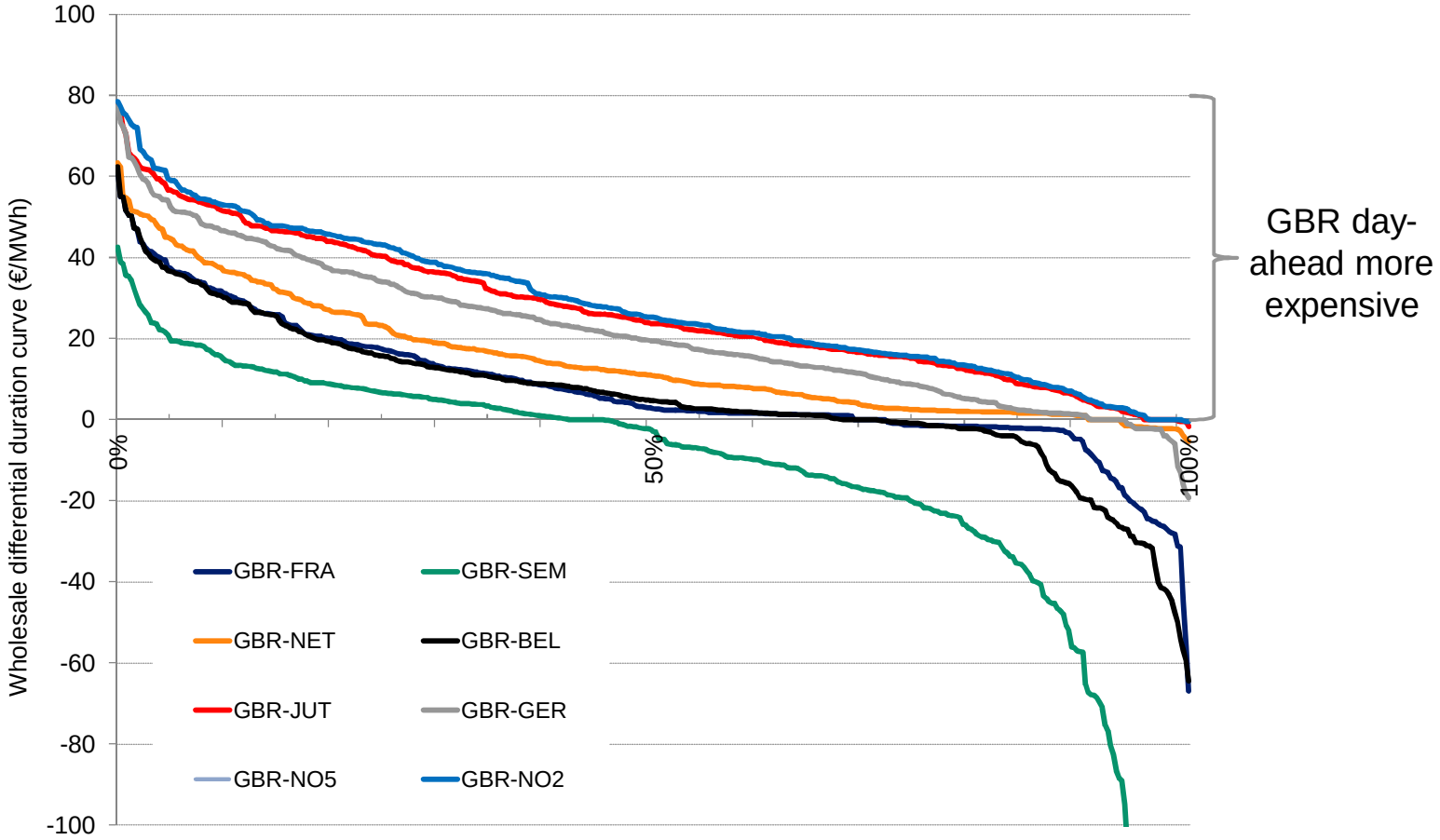
Average annual DRF based on different number of peak demand periods during winter quarter (7am-7pm business days, Dec-Feb, April 2011 to March 2018)

DRF calculations based on:	Relevant peak demand periods			
	5%	**10%**	**25%**	**50%**
	274	540	1347	2678
Price differential (+ve)	90%	90%	85%	**82%**
GB imports	n/a			
Price differential (+ve) & GB Imports				

* Initial criteria for eligibility to progress to IPA

PRICE DIFFERENTIAL DISTRIBUTION DURING GB STRESS TIMES

For more than 50% of the relevant stress periods in GB, the Irish price zone is more expensive than the British one in FY2017

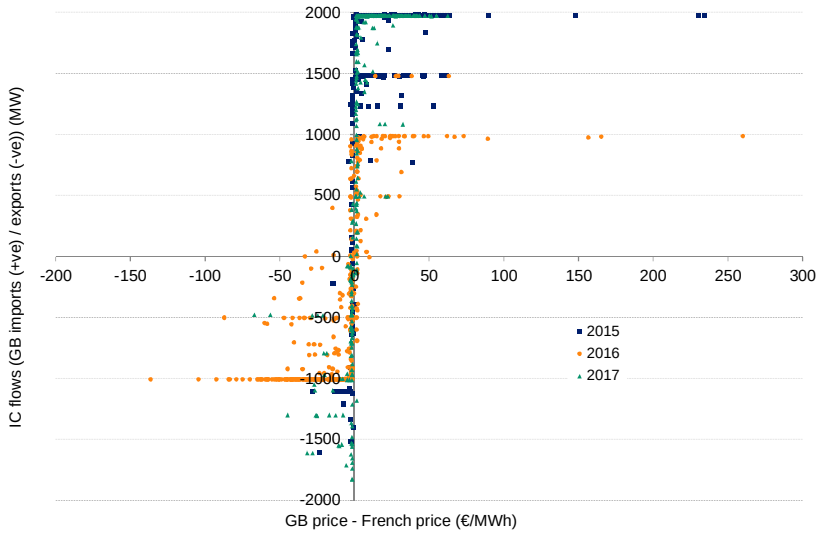


Note: If the equivalent of a carbon price floor is decided on one of the foreign price zones, the percentage of tight time the differential would be in favour of GB might decrease to some extent.

RESPONSE OF FLOWS TO DAY-AHEAD DIFFERENTIALS

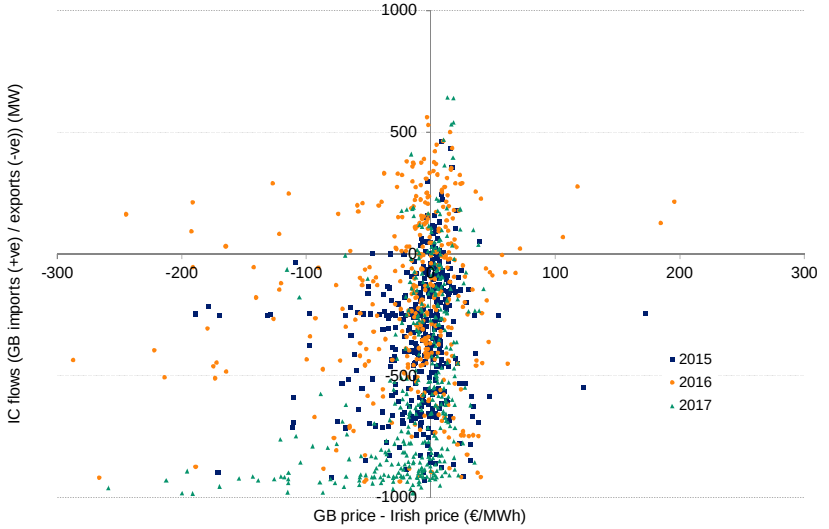
Some interconnectors respond more to differences in the day-ahead price than others

Example 1: GBR-FRA



- Large price differentials tend to drive flows across the two price zones in Great Britian and France through IFA.
- FY2016 data show that this can be observed in both directions.
- In late November 2016, 4 out of 8 cables of the GB-France interconnector were damaged during storm Angus and the interconnector capacity was reduced by 50% for most of the winter period

Example 2: GBR-SEM



- It is much harder to observe a pattern in the data relative to Great Britain and the Island of Ireland through Moyle and East/West interconnectors.
- Although in FY2017 flows seemed more responsive to higher Irish prices.

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Historical de-rating factors of existing and new interconnectors

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- The de-rating factors of new interconnectors are before any adjustments for technical reliability and losses. As proposed in the original study and in the 2017 Update, these de-rating factors will need adjustment for technical reliability (including ramping) and a minimum positive price differential threshold to compensate transmission losses.

KEY FINDINGS

- In general, the historical de-rating factors for interconnectors have increased when based on the latest seven years time series i.e. 2011-2017.

DRF based on:	Interconnector between GB and:						
	France	Ireland	Netherlands	Belgium[2]	Norway[2]	Denmark[2]	Germany[2]
Feb. 2015 Study (time series: **2008-2013**)	29%	2%	62%	58%	74%	Not part of the study scope	Not part of the study scope
May 2016 Update (time series: **2009-2015**)	45%	2%	70%	65%	76%		
April 2017 Update (time series: **2010-2016**)	48%	4%	75%	65%	85%	87%	
April 2018 Update (time series: **2011-2017**)	55%	5%	70%[1]	67%	96%	93%	82%

– The increase in de-rating factors is mainly driven by the replacement of the 2010 DRFs with 2017 DRFs in the seven-year time series. 2017 DRFs were generally higher than 2010.

– The annual DRF for 2017 for France, the Netherlands and Belgium came back to levels observed in the May 2016 Update after the dip which occurred in the FY16 due to nuclear closures in France leading to lower regional capacity margins and higher prices in the affected markets.

- In the case of GB-Ireland interconnection, there has been no material improvement in the correlation of flows and price differentials between the two markets.

1 DRF for interconnector to the Netherlands include in the April 2018 Update both price differentials and flows

2 DRFs for interconnectors to Belgium , Norway, Denmark and Germany are based on price differentials only.

CONSIDERATIONS FOR UPDATING THE METHODOLOGY

The following areas for potential revision to the methodology have been identified:

- Thresholds for price differentials and import (i.e. flow) levels:
  - Should there be a minimum threshold for positive price differentials and/or for import levels in calculating the de-rating factors?
  - What will be the basis for setting minimum thresholds for price differentials and for import level?
- Technical reliability:
  - Are the reliability factors (as proposed in the SKM analysis[1]) reflective of the future availability of interconnectors?
  - How to determine the reliability of new interconnector during the ramping period?
- Future response of interconnector flows to dynamic pricing (e.g. intraday prices):
  - How to capture the inconsistency between the intra-day market and day-ahead market prices in calculating historical DRFs?
- How the de-rating factors should be calculated for new interconnectors to already connected markets (i.e. Ireland, France and the Netherlands)?
  - Should interconnector de-rating factors be asset or market specific?
- Review of the robustness of conservative estimates of historical de-rating factors considering major market or policy developments (e.g. doubling of interconnector capacity to a currently connected market, etc.)

1 Calculating Target Availability figures for HVDC interconnectors, SKM report to Ofgem, December 2012

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