Brexit: implications for the GB electricity market

June 2016

Despite the UK being part of the EU Single Market, trade in electricity between Great Britain and connected markets is significantly affected by differences in CO_2 taxes, as well as in transmission and balancing charges. Brexit may give the UK the opportunity to adjust for this effect through import tariffs. If this happens, what would be the impact on the GB electricity market and trade in electricity? To answer this question, Oxera has estimated the likely changes using its electricity market dispatch model.

The electricity market in Great Britain is part of the EU Single Market. Great Britain is connected to Continental Europe via interconnectors to France (IFA) and the Netherlands (BritNed) of 2GW and 1GW capacity, respectively. Wholesale power prices in Great Britain are approximately 20% higher than in the Netherlands and almost 40% higher than in France;[1] thus, electricity is mainly imported into Great Britain via these interconnectors and exports are relatively infrequent. Average hourly net imports from France and the Netherlands are 2,240MW.[2] This is equivalent to around 70% of the planned capacity of Hinkley Point C.[3]

Net electricity trade flows between Great Britain and France and between Great Britain and the Netherlands are shown in Figure 1 below.[4]

The prevailing direction of electricity flows suggests that electricity is significantly more expensive to generate in Great Britain than in either the Netherlands or France. However, there is currently no level playing field where GB generators can compete with their counterparts in the rest of the EU. Notably, Great Britain has a higher CO_2 tax than the rest of the EU, as well as higher transmission and balancing charges levied on generators.[5] This gives thermal generators in Continental Europe a competitive advantage over their GB peers. Therefore, the existing arrangements may have a significant impact on prices to GB consumers.

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[1] Average prices over the period from July 2012 to December 2015, based on APX Power UK Reference Price Data (RPD) from http://www.apxgroup.com/market-results/apx-power-uk/ukpx-rpd-historical-data/, accessed 11 May 2016. APX power NL day-ahead hourly electricity spot prices from Bloomberg. Epex spot phelix day-ahead hourly electricity auction prices from Bloomberg.

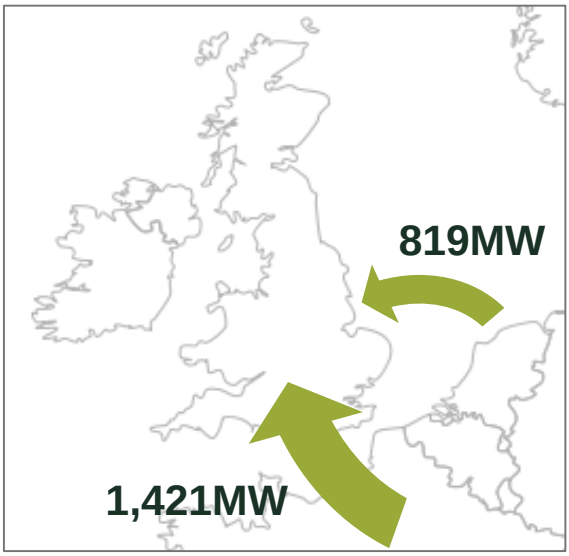
[2] Average over the period from July 2012 to December 2015, based on data from http://www.gridwatch.templar.co.uk/download.php, accessed 26 April 2016.

[3] EDF Energy (2015), 'Hinkley Point C: Building Britain's low-carbon future', September, https://www.edfenergy.com/sites/default/files/edfe_nnb_hpc_-_low_res.pdf, accessed 10 June 2016.

[4] Note that the figure shows only the average balance of electricity trade from July 2012 to December 2015. At any given point in time, electricity flows along the interconnector could be going in either direction.

[5] In most EU markets, the bulk of the transmission and balancing charges are levied on demand rather than generation.

Figure 1 Electricity net imports into Great Britain from France and the Netherlands



Source: Oxera analysis.

Oxera has estimated additional variable costs for GB combined-cycle gas turbine (CCGT) stations at £8.35/MWh and £8.44/MWh when compared with equivalent generators in France and the Netherlands, respectively.[6] Around 25% of these cost differences relate to differences in balancing tariffs and transmission loss levies, with the remaining 75% due to the cost of Carbon Price Support, which is additional to the cost of EU allowances.

Unless the UK leaves the EU, no tariffs on the trade between Great Britain and Continental Europe will be allowed. Moreover, even if the UK does leave, if it negotiates a free trade agreement with the EU then, after the agreement is in place, the GB market would be part of the European Single Market.

However, if a free trade agreement is not reached and trade is regulated by World Trade Organization rules, tariffs between the UK and the EU may be allowed. In this case, the UK government could, in theory, level the playing field by imposing a tariff on electricity imports, making it more expensive for EU generators to export electricity to the UK.

Oxera has investigated how putting GB generators on a level playing field with their EU counterparts through import tariffs would affect GB power prices, interconnector flows and security of supply, as explained below.

[6] Based on data from National Grid (2015), 'Forecast TNUoS tariffs from 2016/17 to 2019/20', 28 January; National Grid (2015), 'Monthly Balancing Services, Summary 2015/16', September; National Grid (2014), 'Special Condition 2K.4 – Transmission Losses Report – Reporting Period 1 April 2013 to 31 March 2014'; ENTSO-E (2014), 'Overview of transmission tariffs in Europe: Synthesis 2014', June, charts 6.1 and 7.2; and Oxera calculations.

Methodology

Oxera used its wholesale electricity market model to undertake the analysis.

Overview of Oxera's wholesale electricity market model

Oxera's GB wholesale electricity market model is based around an optimisation framework that mimics a competitive market bidding framework by optimising generation plant dispatch.

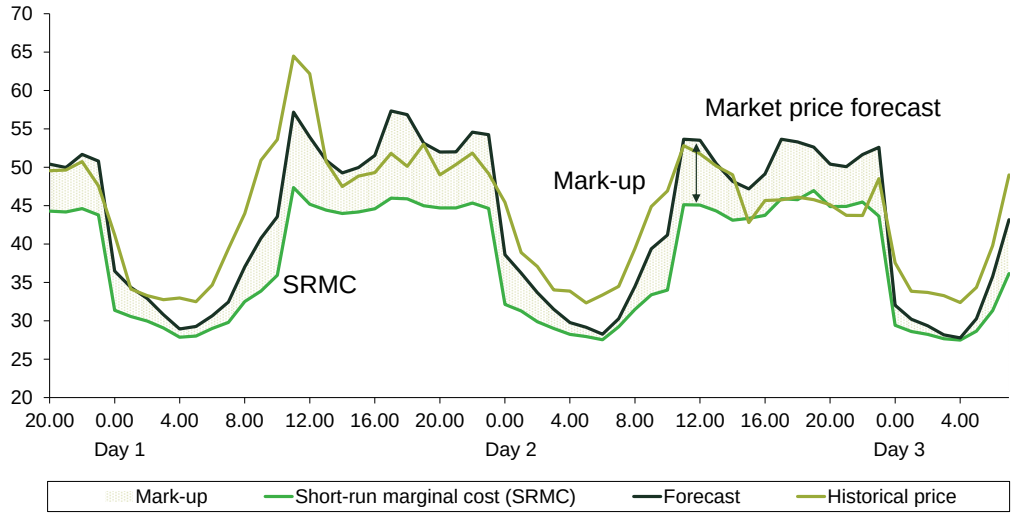
The model is backed up by a detailed database of electricity demand and supply by generation plants. For thermal plants, the database includes parameters such as capacity and efficiency, but also dynamic constraints such as start-up costs. This ensures that the modelled behaviour of generators is realistic and reflects phenomena such as generators continuing to operate in periods when the market price is below the short-run marginal cost (SRMC) to avoid incurring start-up costs when prices subsequently increase.

The model is calibrated by backcasting over a number of years using actual data on factors such as demand, fuel prices and output of non-controllable generation to ensure that the prices it produces for those years are consistent with actual observed prices for the corresponding period.

The price produced by the model is made up of two components: system SRMC and a mark-up (see Figure 2). The system SRMC, the main component of the market price, is estimated by solving an economic dispatch problem. In particular, the model finds the lowest-cost way to satisfy total demand, taking into account all the parameters and constraints present in the model.

Since the wholesale power price must also remunerate the fixed and investment costs of high marginal cost plants, wholesale prices modelled by Oxera include a mark-up on the system SRMC, which is calibrated statistically using historical data on prices and model backcast results.

Figure 2 Model price outputs



Note: Illustrative only; does not reflect the data used in the analysis.

Source: Oxera.

The model is used to quantify the impact of tariffs on the GB electricity market and net imports into Great Britain, based on a calibration to the period between

mid-2012 and 2015 for factors such as generation capacity mix and fuel prices.[7] When the import tariff is imposed, the model checks whether the new price differential between connected markets justifies a change in interconnector flows in every modelled hour. If it does, dispatch of the GB electricity system and interconnectors is re-optimised, with a corresponding change in the GB market price, until the interconnector flows and prices balance out.

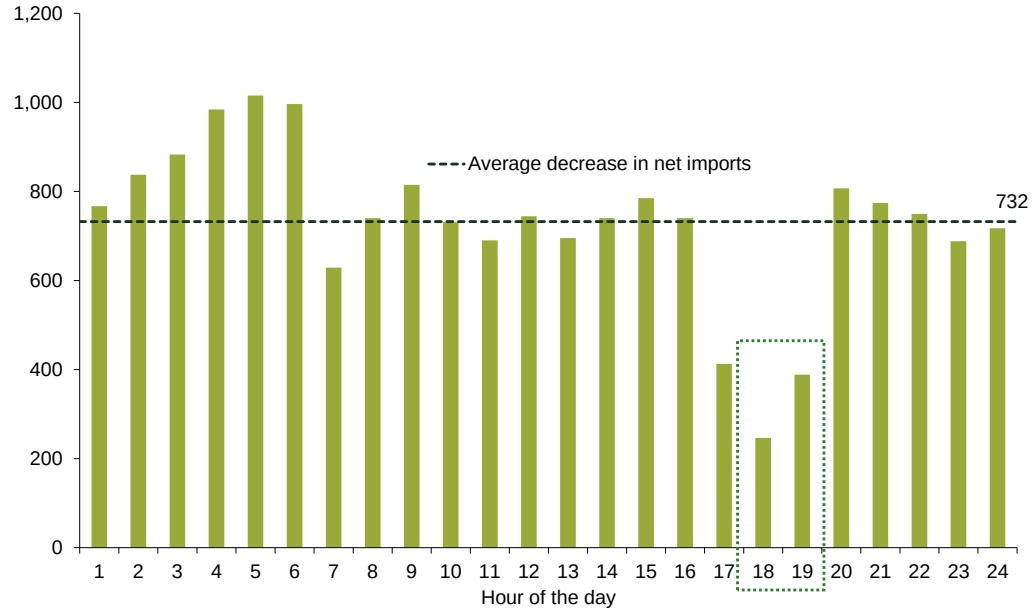
As a simplifying assumption, French and Dutch wholesale power prices are assumed to be unaffected by the imposition of the tariffs. These markets are represented in the model as the spot price series that prevailed between mid-2012 and 2015. Since the capacity of GB interconnectors is currently small in comparison to the large and well-interconnected markets of Continental Europe, Oxera considers that this assumption does not have a significant effect on our results.

Among other results, the model produces GB power prices and interconnector flows both with and without import tariffs.

What is the impact of tariffs?

The modelling undertaken by Oxera shows that import tariffs which put GB and other EU gas generators on a level playing field would reduce average hourly net imports of electricity into the GB market by over 700MW. This is 33% of the current average net imports and 24% of the total interconnection capacity with France and the Netherlands.

Figure 3 Expected decrease in net imports due to imposition of the tariff (MW)



Source: Oxera analysis.

The estimated effect is lower during peak hours. From 17.00 to 19.00 on weekdays, when GB demand is at its highest, estimated hourly net imports are around 300MW lower after the introduction of tariffs. This is mainly because a

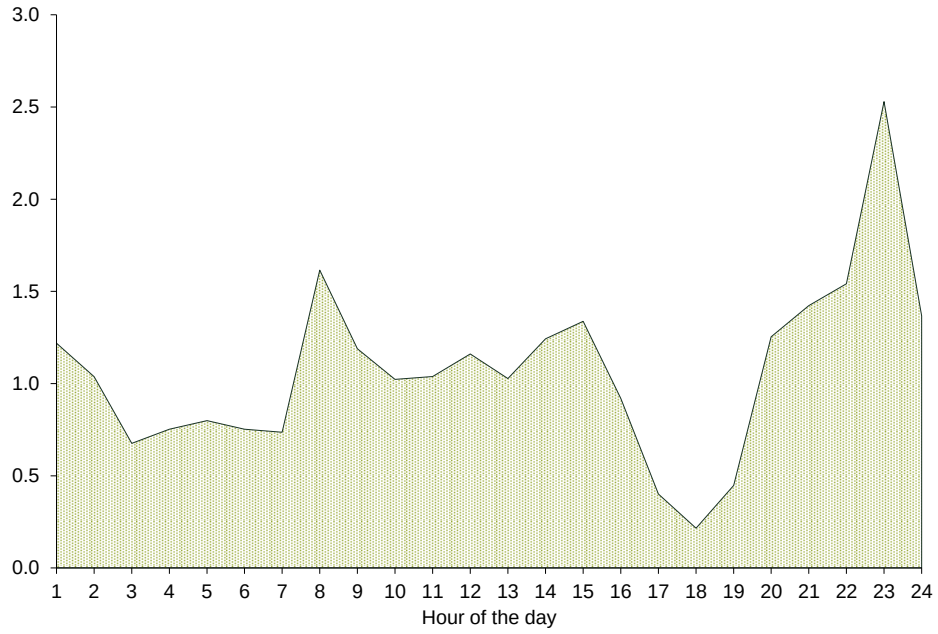
[7] Based on data from the Balancing Mechanism Reporting System (BRMS), http://www.bmreports, assessed 11 May 2016; National Grid, www2.nationalgrid.com/UK/Industry-information/Electricity-transmission-operational-data/Data-Explorer/, accessed 26 January 2016; and Bloomberg.

larger price difference between connected markets prevails during peak hours. The greater the price difference, the less likely it is that the imposition of tariffs would make it uneconomic to import electricity into Great Britain and reverse the direction of interconnector flows. Figure 3 shows the estimated change in GB electricity imports across different times of the day as a result of tariffs being introduced.

Lower and more expensive imports would result in more GB generation and slightly higher prices for GB consumers. The average annual electricity bill is estimated to rise by around £2 per household. This is equivalent to an increase in the total annual cost of electricity of just over £140m. Figure 4 demonstrates the estimated increase in GB electricity price for each hour of the day.

A higher electricity price represents a loss for GB consumers and a corresponding gain for GB producers, which would supply more electricity at a marginally higher price. The estimated value of tariff revenue for the UK government is £136m per year.

Figure 4 Percentage increase in GB electricity prices due to imposition of the tariff



Source: Oxera analysis.

An indirect effect of imposing import tariffs would be greater security of electricity supply in Great Britain. The reduction in imports would need to be substituted by domestic generation, allowing room for new capacity investment or delayed retirement of old capacity. Lower imports would also increase the availability of interconnectors for electricity transmission from the Continental Europe. Hence, by using the levy to reduce reliance on imported energy, the UK government would be ensuring greater security of supply through additional flexibility to increase imports if a supply crunch arose.

Any measure to increase security of supply would be helpful at a time when security margins in generation have been falling rapidly, but this would not be without cost. In the first instance, as set out above, import tariffs would increase the cost of electricity to GB consumers by more than £140m per year in total.

A potentially more significant concern is that any introduction of import tariffs would be likely to cause problems in other areas of negotiation with the EU. Once implemented, this could set a precedent for similar levies across other sectors of the economy. Overall, if the EU judged the UK's policy stance to be deliberately antagonistic, it could make any future trade agreement with the EU much more difficult to achieve.

If the UK chooses to leave the EU, the government may have to decide between enhancing energy security and creating a level playing field in generation on the one hand, and negotiating effective trade agreements that are needed to maintain trade with the EU on the other. The ultimate decision could have substantial implications for the UK's energy sector.