Deloitte.

The impact of COVID-19 on European power markets

Special viewpoint

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Contents

1. Introduction

The lockdowns to contain the COVID-19 outbreak in Europe have a profound impact on European power markets

The introduction of lockdown measures has had a profound impact on economic activities, which can be reflected by the current dynamics in power markets.

Here we examine the immediate impact of the outbreak on power markets across affected European markets – including France, Germany, Belgium, Italy, Spain, and Great Britain (GB)*. In particular, we analyse the impact so far on:

- **Electricity demand**
- **Electricity wholesale prices**
- **Electricity demand profile**
- **Residual demand**
- **Thermal generation**

We offer analysis of the **observed changes and expected impacts** on market participants and the Power & Utilities sector across Europe and have **modelled various economic recovery scenarios**.

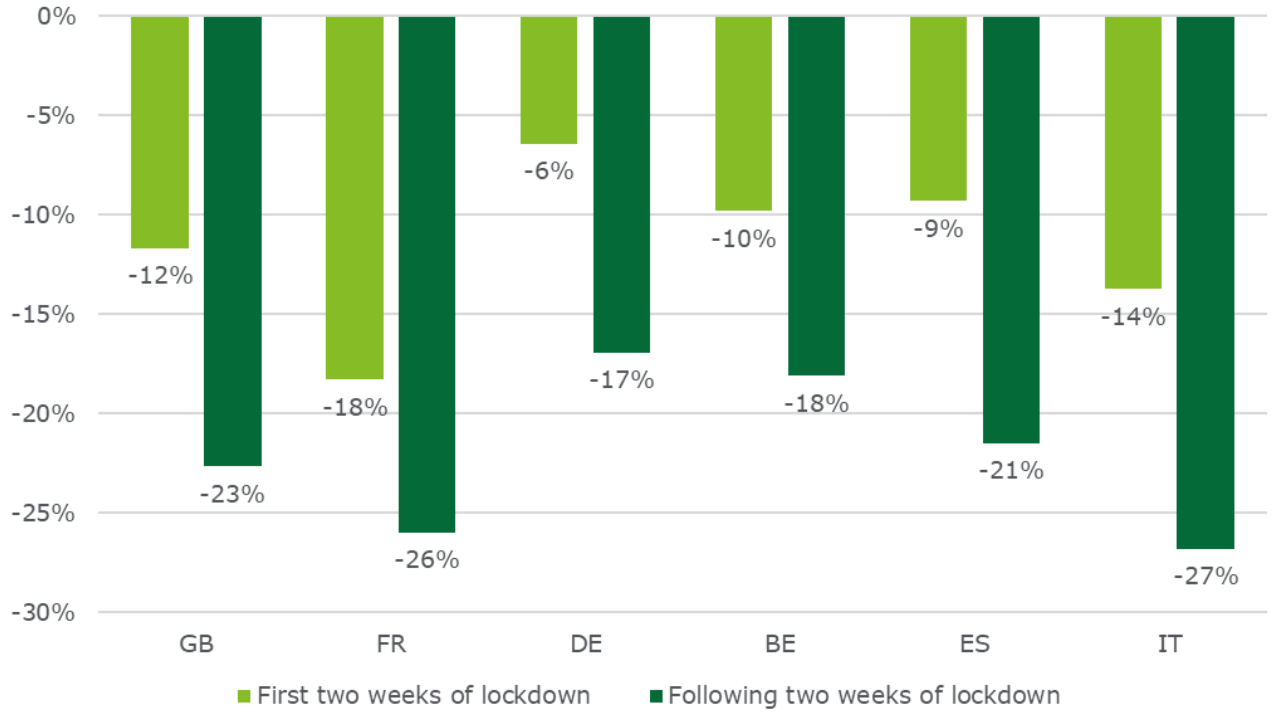
*Our analysis does not include Northern Ireland

2. Impact on Electricity Demand in Major European Markets

Across European markets, electricity demand has plunged due to lockdown measures

Impact on Electricity Demand across European Countries

Electricity demand reduction in several European countries
after two and four weeks of COVID-19 lockdowns



Note: The lockdown dates are 23/03/2020 in the UK (GB), 17/03/2020 in France (FR), 22/03/2020 in Germany (DE), 18/03/2020 in Belgium (BE). 15/03/2020 in Spain (ES), and 09/03/2020 in Italy (IT).

Source: ENTSO-E. Deloitte analysis.

Comments

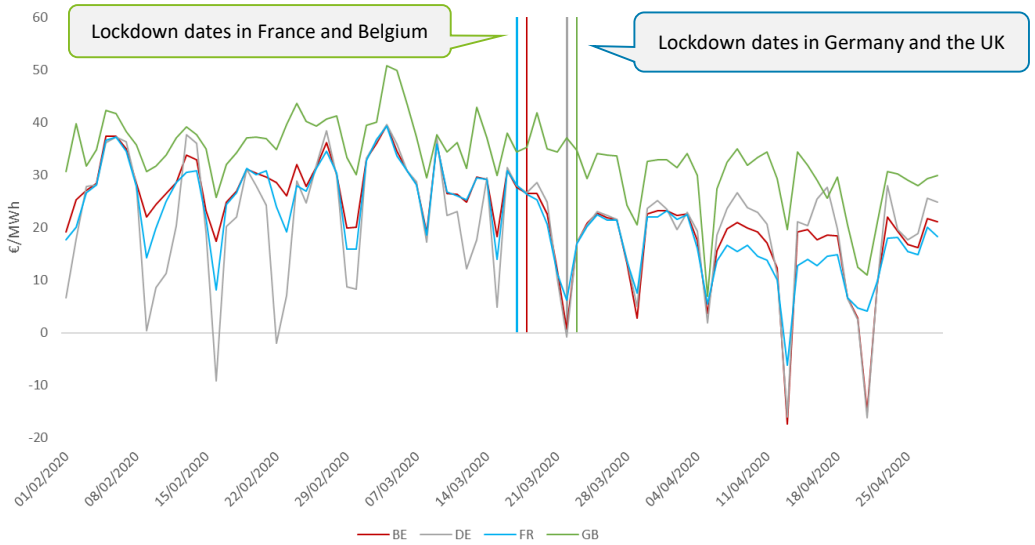
- The first two weeks following lockdowns saw a reduction in electricity demand between 6-17 per cent in major European markets, but with lockdowns in place longer, electricity demand stabilised at a level between 17-27 per cent lower than the level before.
- Electricity demand was down 20-27 per cent in some countries, such as the Italy, Spain, France and the UK, following a considerable decline in economic activity.
- Belgium has a relatively small, less electricity-intensive economy. Therefore its electricity demand decline was less pronounced.
- The impact in Germany was the smallest – a reduction of 17 per cent. According to independent sources, this fact can be explained by a high industrial share of electricity demand in Germany, including an important share from chemicals/medical supplies industry, which is central to efforts to contain COVID-19 (industrial electricity share is 45 per cent vs 29 per cent in France).

2. Impact on Electricity Price in Major European Markets

Following lower demand, falling commodity prices coinciding with high renewable generation, electricity prices across major European markets have slumped in March and April 2020

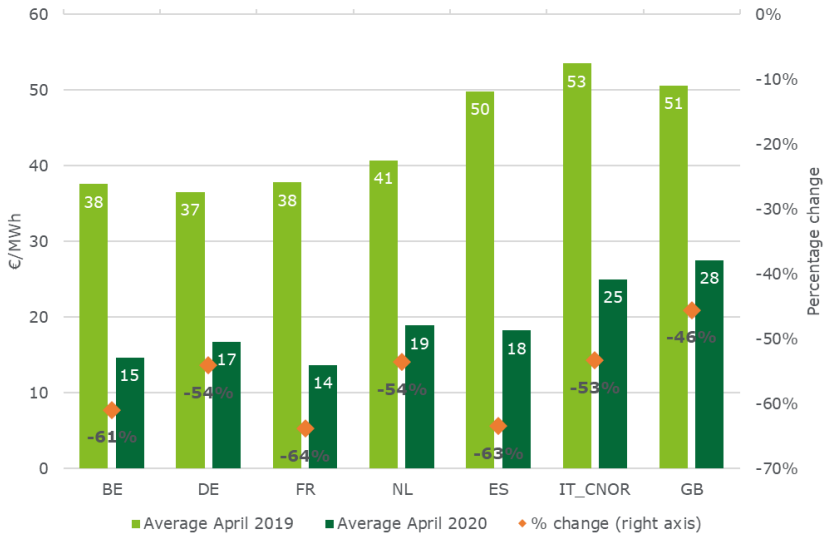
Impact on Electricity Demand across European Countries

Electricity demand reduction in several European countries after two and four weeks of COVID-19 lockdowns



Wholesale Electricity prices compared to the previous year

Average electricity prices in April 2020 compared to April 2019



Note: The lockdown dates are 23/03/2020 in the UK (GB), 17/03/2020 in France (FR), 22/03/2020 in Germany (DE), 18/03/2020 in Belgium (BE), 09/03/2020 in Italy (IT CNOR Central North regional price), and 15/03/2020 in Spain (ES). The Netherlands (NL) has not implemented lockdown measures.

Source: ENTSO-E. Deloitte analysis.

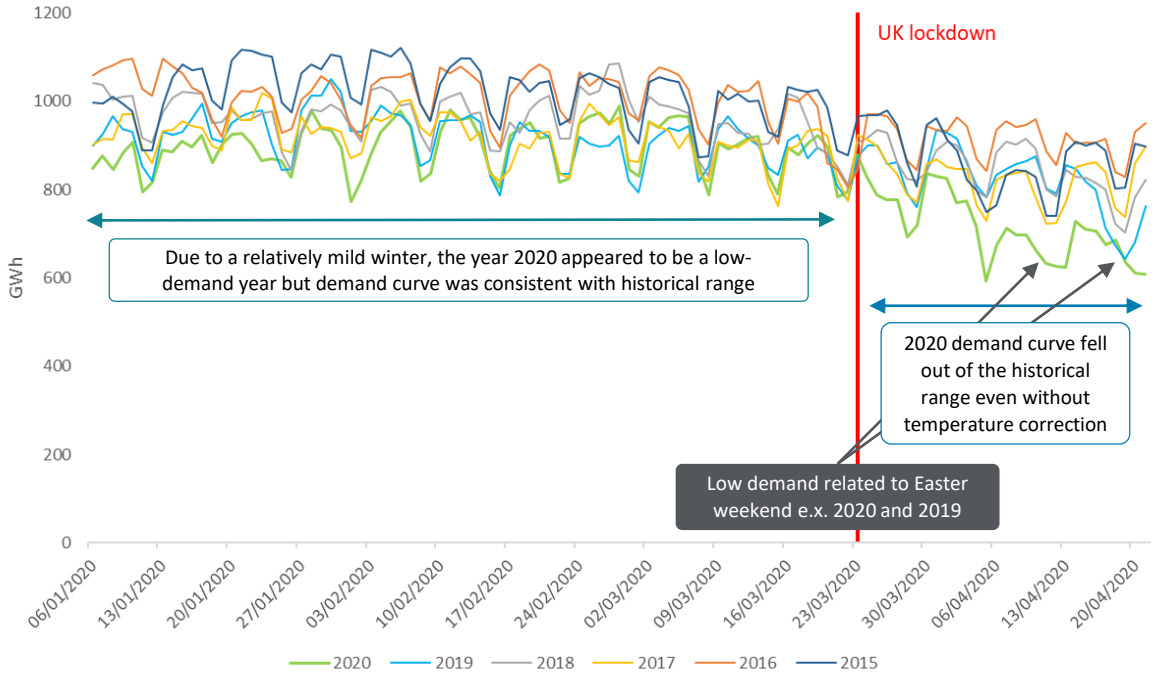
- As electricity demand across major European countries dropped by about 20 per cent after imposed lockdown measures came into effect, the decline in electricity demand led to a fall in wholesale electricity prices across several European power markets.
- Due to low demand and increasing renewable generation in the mix, wholesale prices have fallen between 46-64 per cent across major European markets in April 2020 compared to April 2019. More negative prices in Germany and Belgium have been observed.

3. Impact on Overall Load in the British market

The UK lockdown has resulted in a deviation from “normal” weekly electricity consumption patterns. The 2020 demand curve remained within the historical range until the lockdown came into force, but fell out of it afterwards

Impact on Electricity Demand in GB

GB daily electricity consumption



Note: The series depict daily total demand in GWh. To compare weekly profiles of electricity demand, weekdays and weekends are aligned among different years. X-axis only show dates in 2020 between 06/01/2020-21/04/2020. The corresponding periods in previous years are 07/01/2019-23/04/2019, 08/01/2018-24/04/2018, 09/01/2017-25/04/2017, and 11/01/2016-26/04/2016, and 05/01/2015-21/04/2020. ENTSO-E uses demand definition as sum of power generated by plants on both TSO/DSO networks, from which net exchange balance and power absorbed by energy storage resources is deducted.

Source: ENTSO-E. Deloitte analysis.

Comments

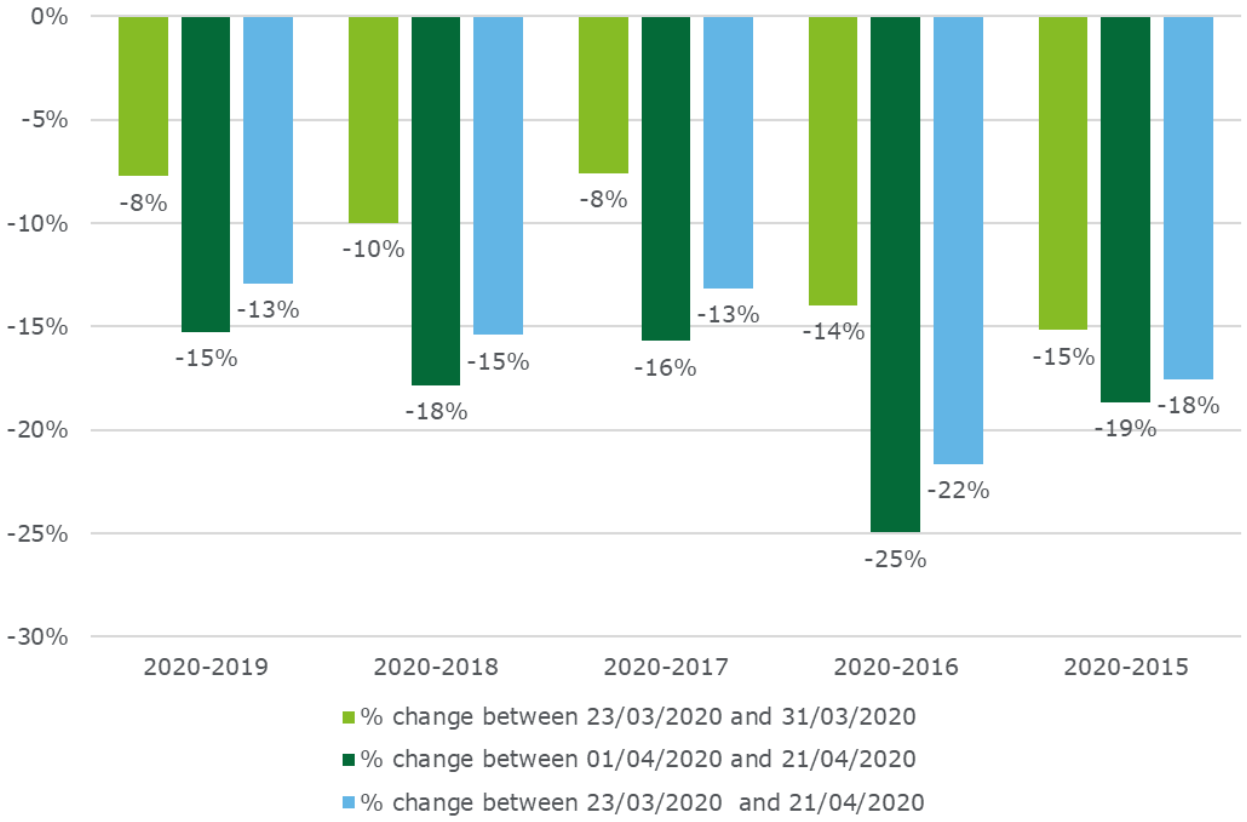
- In the first week of lockdown, electricity demand fell by 10 per cent, dropping further over the following weeks to more than 20 per cent.
- Compared with the demand curves in previous years, 2020 shows a clear weekly cycle similar to that of previous years until the lockdown came into place. Since, the weekly demand curve was flattened with fewer differences between weekdays and weekends.
- Had a lockdown occurred at a later date, it is likely that electricity demand would have increased after Monday 23 March 2020, rather than remain at a similar level as the previous weekend.

3. Impact on Overall Load in the British market

Electricity demand fell 15-25 per cent once lockdown measures were stabilised, compared to the same period in previous years

Impact on Electricity Demand in GB

Percentage change in average load against previous years (not weatherised)



Source: ENTSO-E. Deloitte analysis.

Comments

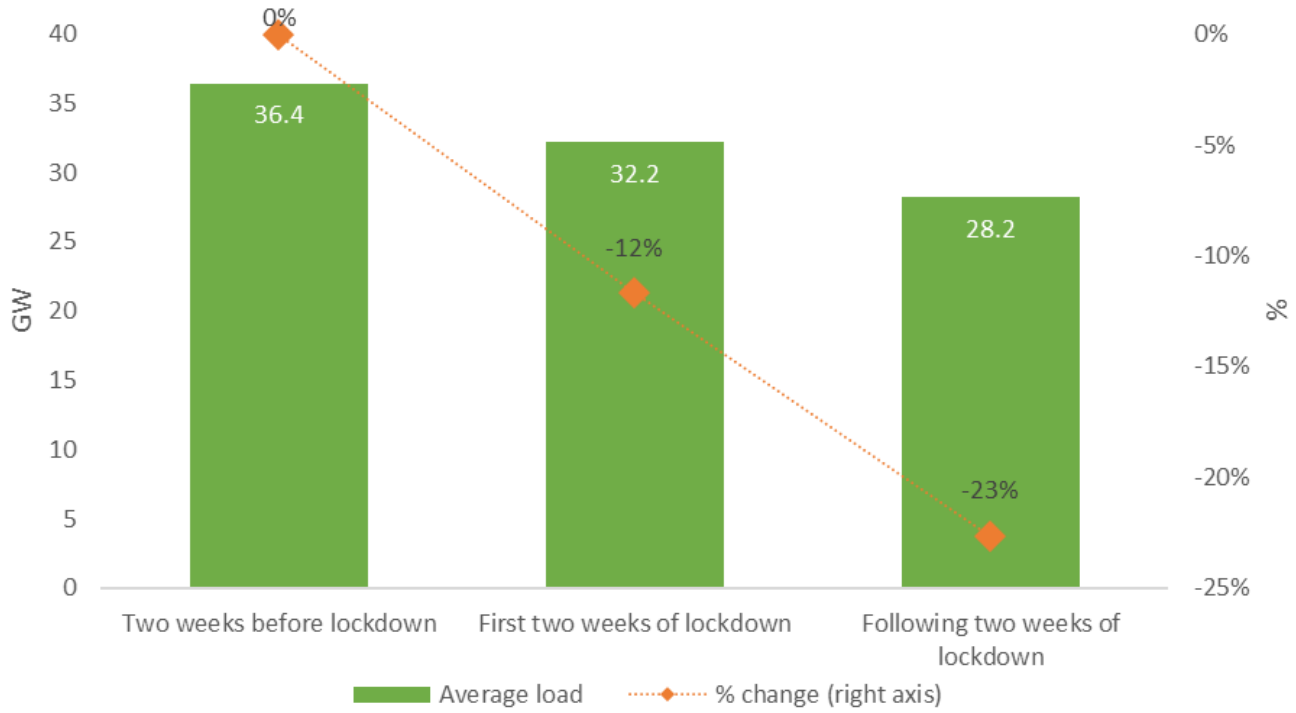
- The lockdown announced by the UK government led to a 13-22 per cent drop in electricity demand between 23 March 2020-21 April 2020, compared to the average demand load in previous years.
- During the first days of lockdown, the impact was smaller, an 8-15 per cent decrease between 23 March 2020-31 March 2020, as businesses were closing gradually and people were adapting to the lockdown.
- Once reduction in economic activities was stabilised, the reduction in electricity demand reached 15-25 per cent in April compared to the same period in previous years.

3. Impact on Overall Load in the British market

Compared to the demand level before the lockdown, the GB average load went down by 12 per cent and 23 per cent during the first and following two weeks of lockdown, mainly driven by a drop in industrial and commercial demand

Impact on Electricity Demand in GB

GB average load before and during lockdown



Source: ENTSO-E. Deloitte analysis.

Comments

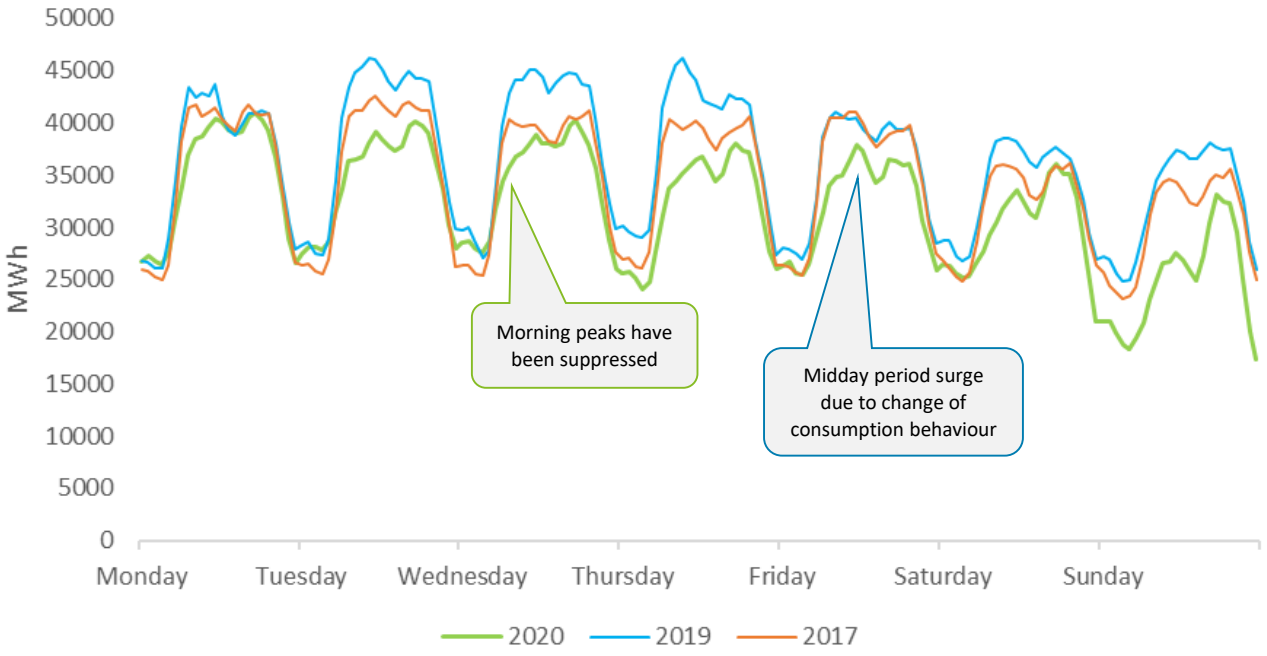
- The GB average load went down from 36.4 GW to 32.2 GW during the first two weeks of lockdown, and then further to 28.2 GW during the following two weeks of lockdown, representing a 12 per cent and 23 per cent decrease compared with the level before.
- The overall decrease was mostly driven by a drop in industrial and commercial electricity consumption, counting for 45 per cent of UK demand, as offices and factories remain closed. Until lockdown measures begin to ease, the impact on electricity consumption is set to continue.
- Meanwhile, residential demand experienced a slight increase as households spend more time at home and the lockdown has changed individual consumption behaviours.
- Some utility companies indicated that residential electricity weekend use remained mostly the same while the overall residential demand saw a 2-6 per cent rise between Monday and Friday.

3. Impact on Demand Profile in the British market

COVID-19 lockdown measures have changed the shape of daily demand profile in Britain, revealing some changes in individual consumption behaviours and habits

Impact on Electricity Demand profile

GB hourly load



Note: The figure shows hourly load in MWh. The corresponding weeks are between 30/03/2020 – 05/04/2020, 01/04/2019 – 07/04-2019, and 03/04/2017 – 09/04/2017. Easter weekends did not occur over these periods.

Source: ENTSO-E. Deloitte analysis.

Comments

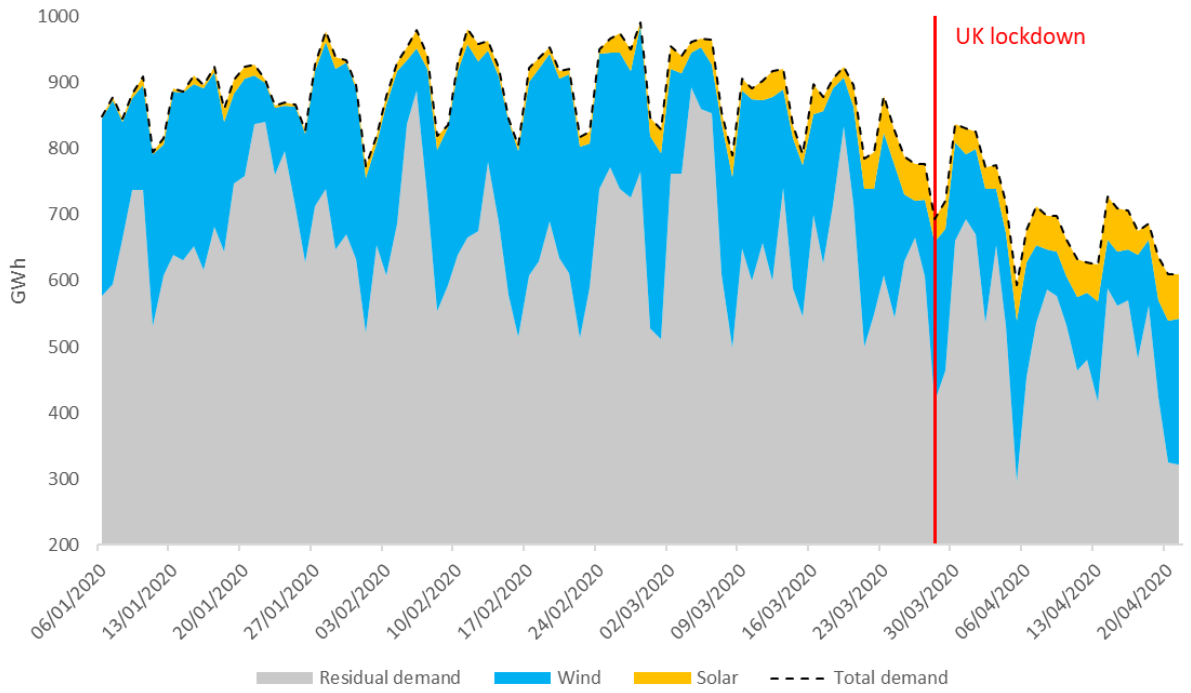
- Historical patterns show electricity consumption typically peaks in the morning between 7.00am-10.00am and in the evening between 6.00pm-9.00pm.
- The 2020 curve shows that after the UK lockdown:
  - suppressed morning peak as businesses remain closed and people no longer need to prepare to go to work, resulting in a smooth morning consumption pattern.
  - a midday surge in electricity use following an increase in residential use as people prepare lunch and take midday breaks. Some utility companies reported up to a 20-30 per cent increase of electricity use in the midday hours.
- Moving forwards, it is likely that this shift in electricity demand profile will remain at least for the period of the lockdown. Beyond that, it will depend on the measures that remain in place to slow the pandemic in the future, and the gradual lifting of restrictions.

3. Impact on Residual Demand in the British market

Warmer weather in March and April 2020, combined with lockdown measures has reduced overall residual demand to a new low

Impact on residual demand

GB daily residual demand



Note: The figure shows daily total demand/generation in GWh. Residual demand is defined as total demand minus wind generation and minus solar generation.

Source: ENTSO-E. Deloitte analysis.

Comments

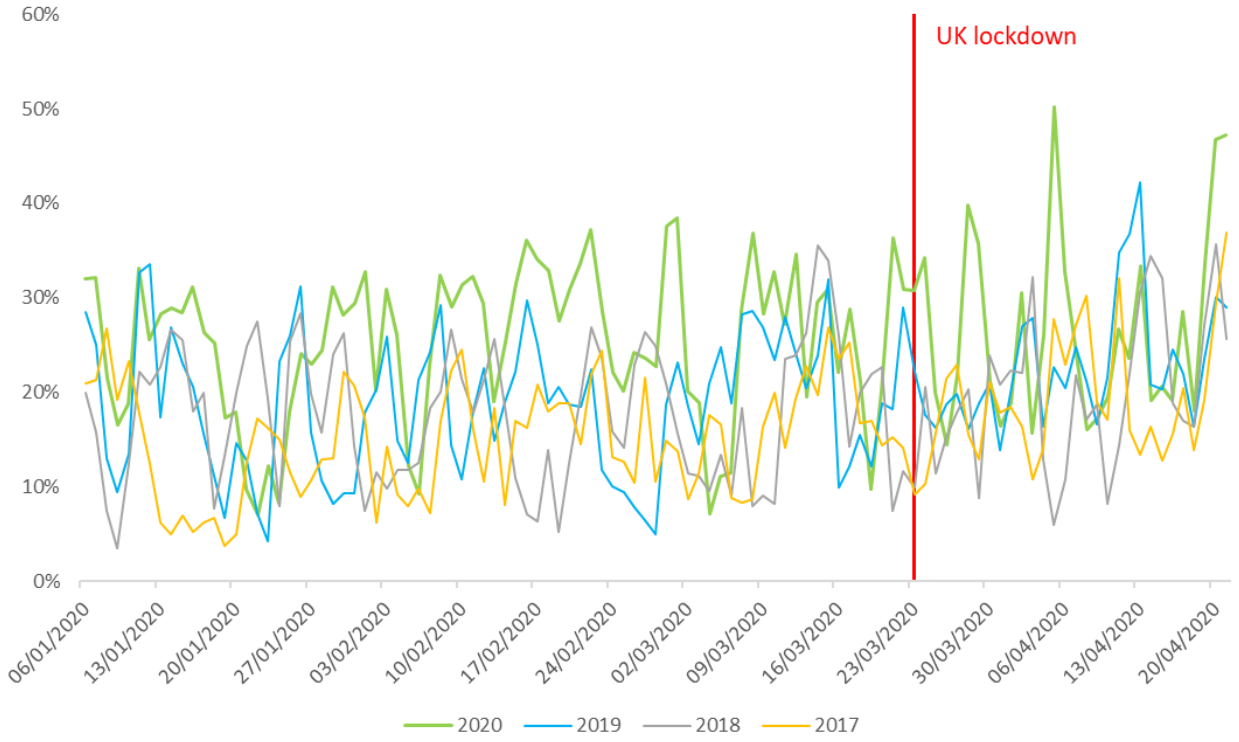
- The outbreak of COVID-19 and subsequent lockdown has put downward pressure on residual demand in the GB wholesale electricity market.
- Residual demand or load is an indicator showing how much capacity is left for conventional power plants to operate.
- A higher “must-run” generation and a lower residual demand mean larger downward pressure on wholesale electricity price, especially as conventional power plants need to shut down.
- Since the UK lockdown, daily residual demand has fell to a new low level given:
  - a significantly lower total demand
  - a higher renewable generation, especially a surge in solar generation due to sunny weather in March and April.

3. Impact on Residual Demand in the British market

The fall of total demand and rise of solar generation have created more pronounced peaks of renewable generation shares, reaching 50 per cent for some days in April

Impact on residual demand

GB daily intermittent renewable generation share of serving total demand



Source: ENTSO-E. Deloitte analysis.zxs1

Comments

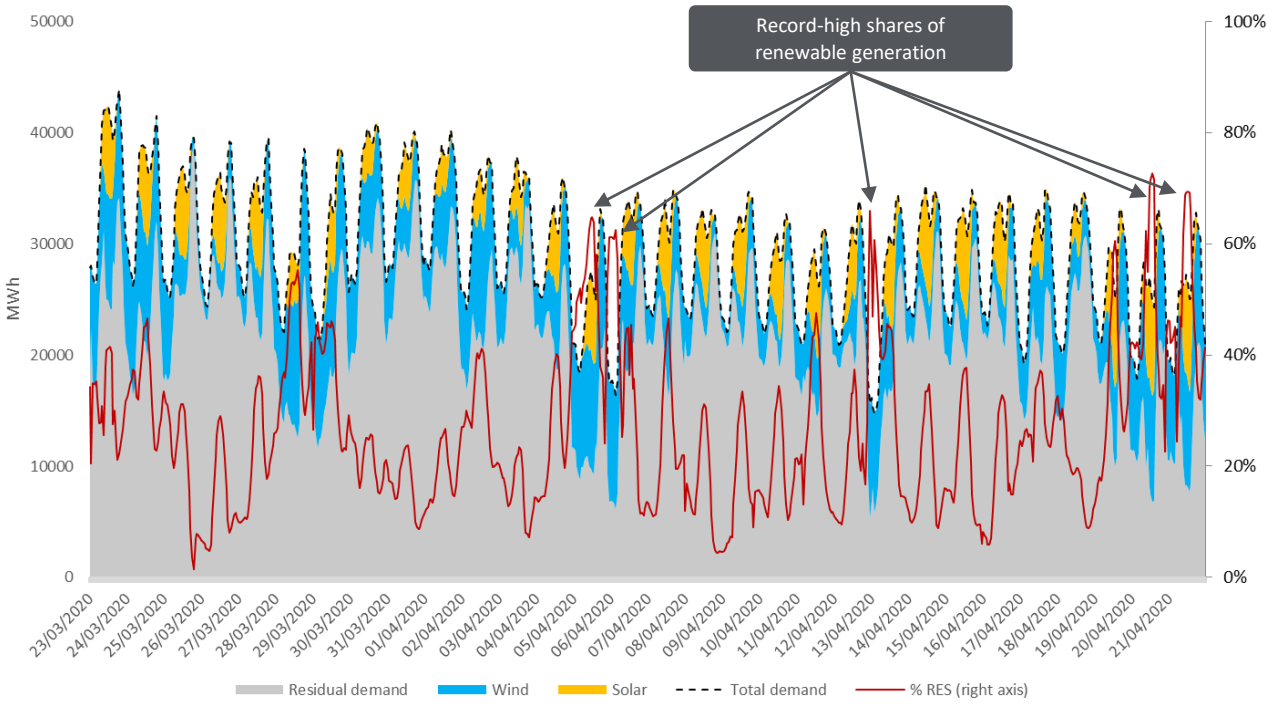
- New intermittent renewable capacity hit record high in 2018 and 2019 in the UK, taking up to 75 per cent new electricity generation capacity that came online.
- As wind and solar capacity increases every year, the share of renewable generation in the system mix rises significantly between 2017-2020.
- The first quarter of 2020 saw several days with renewable generation meeting more than 30 per cent of total demand (higher if we include biomass).
- Renewable generation shares reached about 50 per cent of total demand in April 2020 over the Easter weekend and between 19-21 April.

3. Impact on Residual Demand in the British market

The impact of intraday variation of intermittent renewable generation on residual demand is more pronounced when looking at hourly profile. Hourly renewable generation share reached around 70 per cent

Impact on residual demand

GB Hourly residual demand profile and intermittent Renewable Energy Sources (RES) share of total demand



Note: The figure shows hourly demand and generation in MWh. Coordinated Universal Time (UTC) is used.

Source: ENTSO-E. Deloitte analysis.

Comments

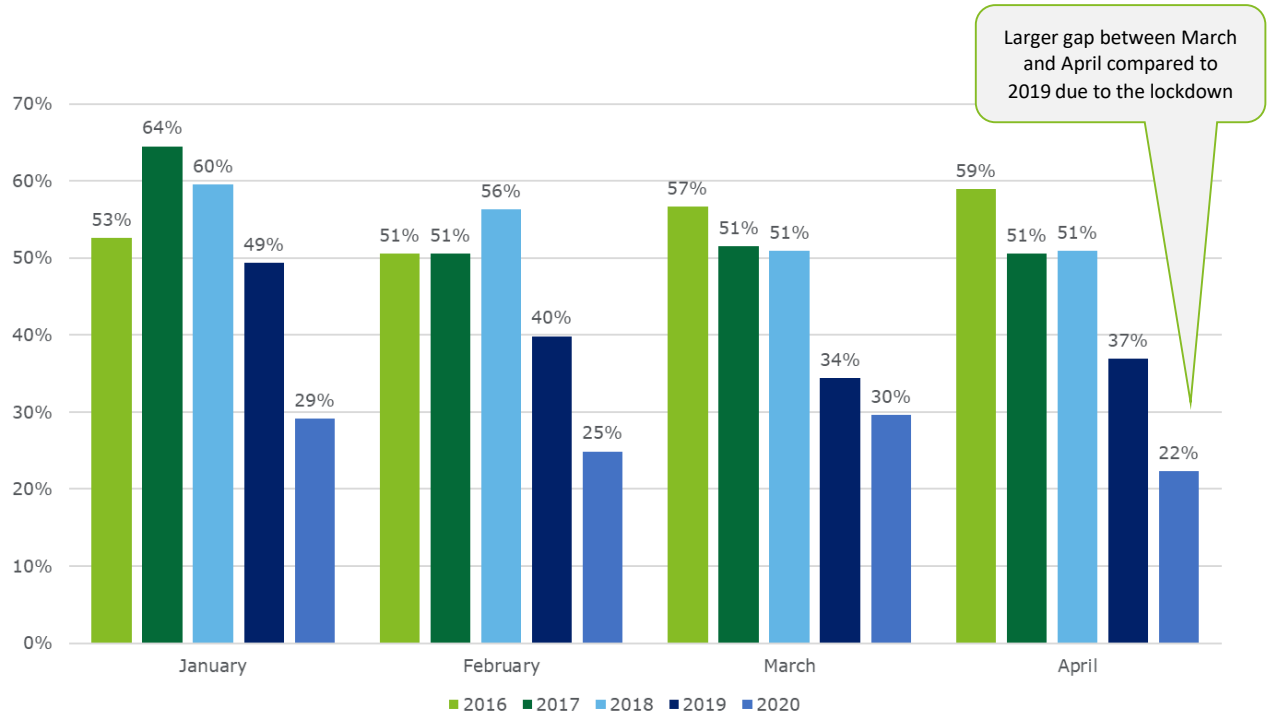
- As solar generation surged, residual demand was squeezed during day time. Over the Easter weekend and between 19-21 April, renewable generation took up about 70 per cent of total demand for certain hours and left only about 30 per cent of total demand for conventional generators in the GB day-ahead market.
- The effect of low demand with particularly good weather has translated into a new record, marking 28 April as the longest period in the GB market (over 18 days) without burning coal.
- System Operators have been facing increasing challenge to ensure sufficient inertia of the system, especially in countries with significant amount of RES capacity, such as Spain, Germany, Italy and the UK. In some cases, RES curtailment is needed.

4. Impact on Thermal Generation in the British market

COVID-19 lockdown measures have exacerbated market position of thermal generation, leading to a further reduction of operating hours and market revenue

Impact on thermal generation

GB monthly average capacity factor of Combined Cycle Gas Turbine (CCGT) plants



Note: The figure shows montly average capacity factors between January and April in 2016 – 2020.

Source: National Grid, ENTSO-E. Deloitte analysis.

Comments

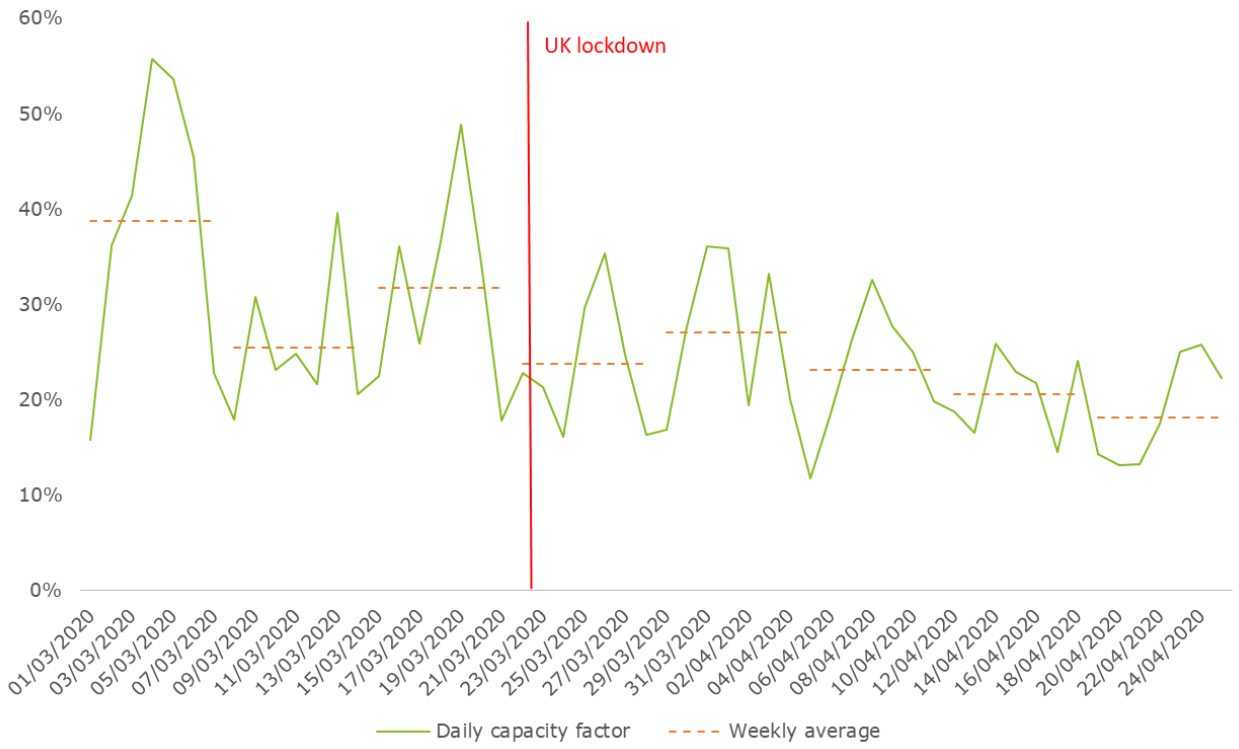
- Because of the residual demand effect, the majority of the impact of lower demand has been concentrated on conventional thermal generators, mostly gas firing CCGTs.
- CCGT generation has been decreasing in recent years given more competition from RES generation and increasing capacity linked to previous investment.
- CCGT generation was significantly lower than previous years due to the mild winter in 2020, but the COVID-19 lockdown has contributed to a larger gap in capacity factors in April between 2019 and 2020, implying a reduced revenue for thermal operators.
- As May and early June usually mark the beginning of planned outage periods for nuclear plants, even if low demand remains, gas plants may be needed to be called in to fill the gap.

4. Impact on Thermal Generation in the British market

Low residual demand has kept the weekly average of CCGT capacity factors below 30 per cent in the GB market since the UK COVID-19 lockdown

Impact on thermal generation

GB daily and weekly capacity factor of CCGT plants



Note: The figure shows montly average capacity factors between January and April in 2016 – 2020.

Source: National Grid, ENTSO-E. Deloitte analysis.

Comments

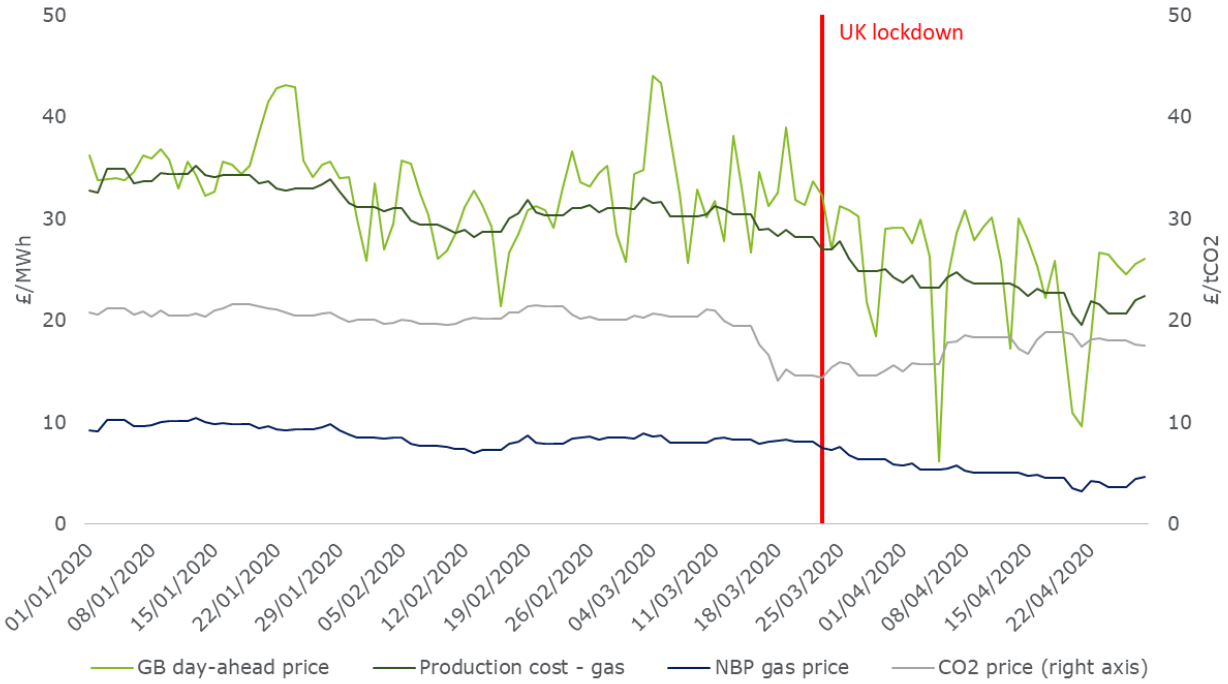
- Looking closer at the daily and weekly running regimes of the CCGT plants in the GB market, the significant reduction in demand with coincidental warm weather has reduced CCGT operating hours from 32 per cent a week before the lockdown to 18-27 per cent.
- We note also that because of the change in demand profile shapes many utilities would have to significantly alter their hedging positions as previous contracted quantities would differ from market outturns.
- For market players with a more merchant approach, the risk profile of the current unpredictable situation can be damaging.

4. Impact on Thermal Generation in the British market

While gas and carbon prices still drive the level of wholesale electricity price in the GB market, intermittent renewable generation and low demand following the lockdown have contributed to large fluctuations around the marginal production cost

Impact on thermal generation

Price drivers of wholesale electricity prices



Note: Production cost is indicative to show the trend of power price and does not represent real estimation of production cost. Production cost for CCGT plants is calculated as Short-Run Marginal Cost (SRMC), assuming average efficiency of 50 per cent, an emission factor of 0.185 and a VO&M of 1.7£/MWh. A Carbon Price Floor of 18£/tCO2 is taken into account.

Source: ENTSO-E, EnergyMarketPrice. Deloitte analysis.

Comments

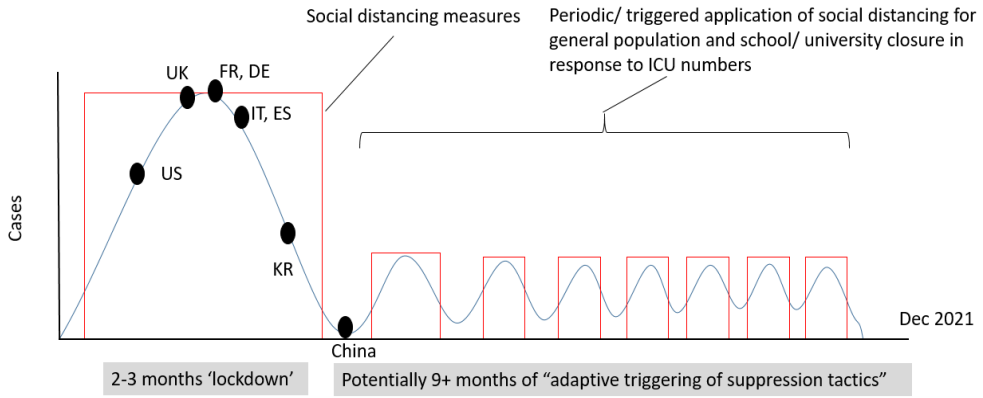
- European hub gas prices have been decreasing since the end of 2018 from around 30 €/MWh to 6 €/MWh as the end of April 2020. The COVID-19 outbreak put additional downward pressure on gas prices.
- The European carbon price has slumped in mid-March from about 25 €/tCO2 to 16 €/tCO2. Since beginning April, the price level has increased and established at around 20 €/tCO2.
- Overall, the wholesale electricity price in the GB market follows the pattern of production cost of CCGTs (being the marginal technology), but intermittent renewable generation and low demand following the lockdown have contributed to large fluctuations around the cost pattern, which introduced higher uncertainty for thermal plants' revenue.

5. Recovery scenarios

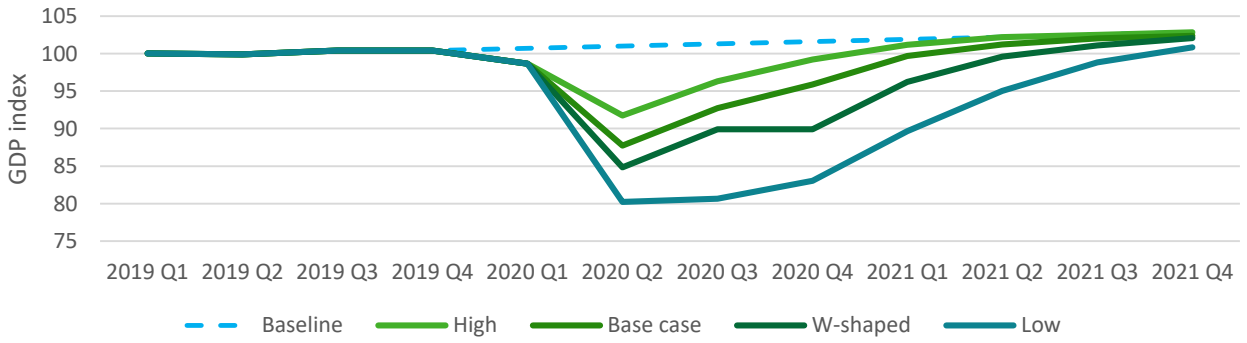
Deloitte has developed sector-by-sector based economic recovery scenarios to forecast short- to medium-term impacts of COVID-19 on the UK economy

UK Economic recovery scenarios

Countries going through massive social and economic disruption



UK GDP scenarios



Comments

We modelled the outlook for the UK lockdown and the effectiveness of public policy under a range of scenarios, for example:

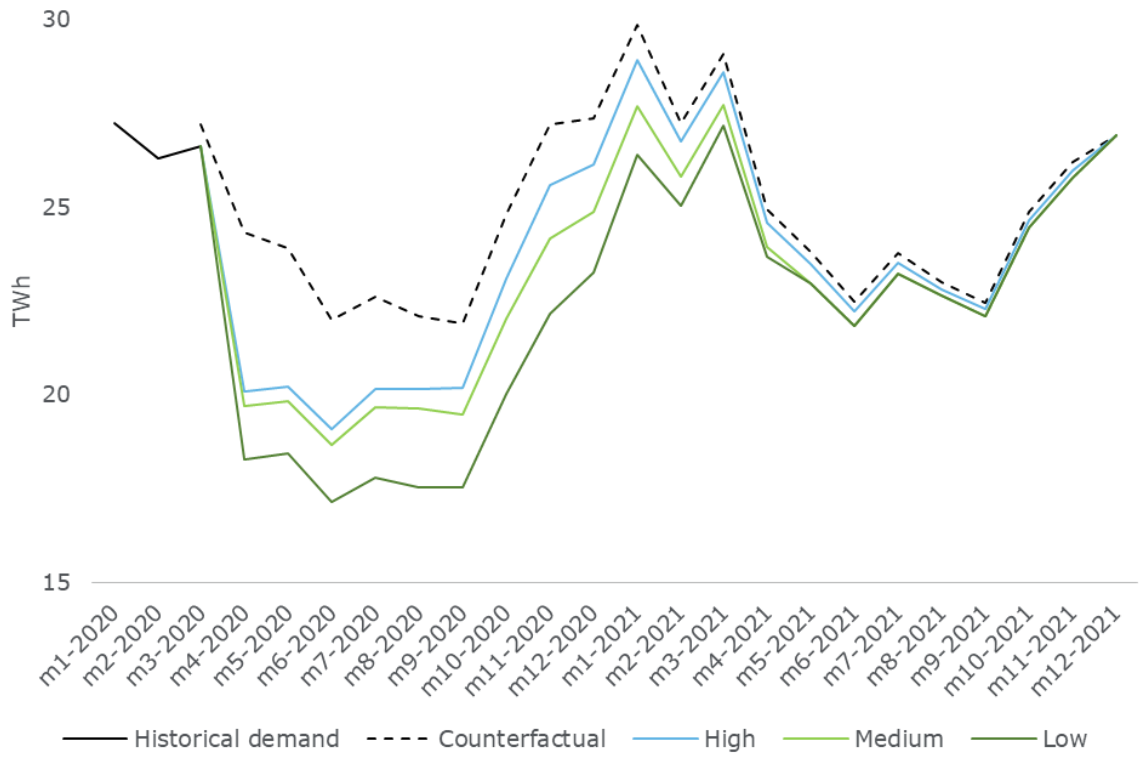
- **High**: lockdown unwound quickly from late Q2; government protects jobs and businesses
- **Base case**: lockdown unwound gradually from June onwards; government largely protects jobs and businesses
- **W-shaped**: lockdown partially returns in Q4, but containing the impact remains successful
- **Low**: lockdown lasts for longer, into Q4, resulting in more unemployment and business failure, hitting the economy in 2021: Risk of high inflation/sterling collapse.

6. How we can help

We provide a demand forecasting service in the UK to help you gain power market insight and adapt business plans, as electricity demand continues to be shaped by the consequences of the pandemic and the process of economic recovery

UK Economic recovery scenarios

Illustrative demand forecasting up to end 2021 under different scenarios



Source: Deloitte analysis.

Comments

We build statistical models to estimate and forecast electricity demand in the UK, accounting for multiple factors:

- Scenarios of the UK economy and electricity sector recovery and their impact on electricity demand
- Metrological factors such as temperature correction on the level of electricity demand
- Specificities of electricity demand profile including:
  - multiple levels of seasonality – monthly, weekly, and daily
  - trend in peak load and changes in shape of consumption profiles
  - modelling of statistical noises.

Our demand forecasting capability includes both short-term and long-term forecast, providing demand outlooks under different time granularity.

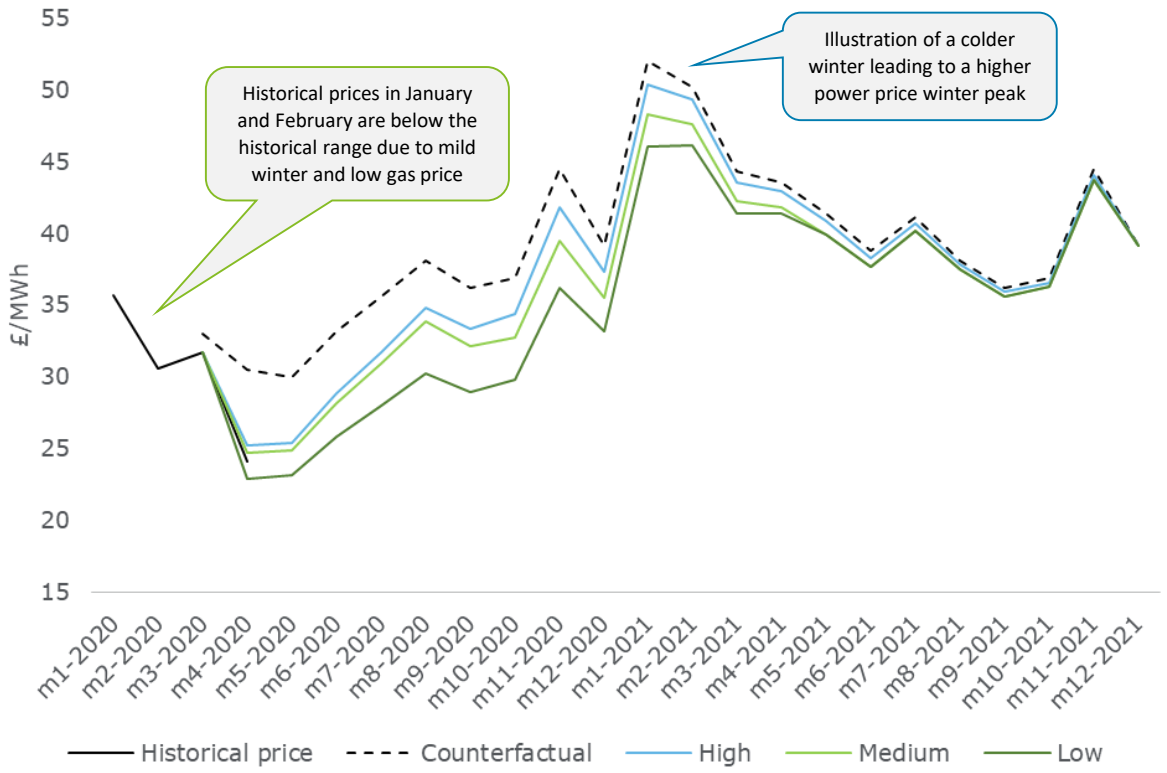
Our model is constantly calibrated on a rolling basis.

6. How we can help

We provide power price forecasts in the UK to help you understand market intelligence and build business strategy, given the uncertain outlook and increasing risks related to rising price volatility

Showcase of power price scenarios

Illustrative price forecasting up to end 2021 under different scenarios



Note: Forecast price range is consistent with the market view of forward prices as of 01 May 2020.

Source: Deloitte analysis.

Comments

We use internal modelling capability, including statistical models and commercial modelling platform PLEXOS, to forecast power prices in the UK under different scenarios. Our price forecasts are based on a full set of assumptions of future energy markets:

- Scenarios of the UK economy and electricity sector recovery and their impact on generation, investment, and electricity markets
- Energy and carbon policies
- Electricity demand outlook
- Generation mix outlook – coal phase-out, evolution of nuclear, gas, and renewable capacity
- Transmission network outlook
- Commodity price outlook.

Our price forecasting capability includes both short-term and long-term forecasts, providing time granularity down to a half-hour or hourly basis.

Our model is constantly backcasted against historical prices.

7. Contacts

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