

How is COVID 19 impacting the UK electricity system?



The measures taken by the UK government to control the spread of COVID-19 are having an impact on the country's electricity system. A group of data scientists and energy nerds at Frontier Economics have been diligently scraping through electricity market data to understand how the system is being affected by the reduction in economic activity and the upheaval in day-to-day routines brought about by the nationwide lockdown.

Below we have set up a few interactive graphics (alongside some observations of our own) to allow you to play around and observe the week-over-week changes in GB electricity transmission level demand and generation.

Mid-March saw a rapid escalation in measures designed to curb the spread of COVID-19. On Monday, March 16th, the government advised people to avoid social contact, work from home where possible and stop going to pubs, restaurants and theatres. Stricter measures followed in the evening of Monday, 23 March, when Prime Minister Boris Johnson announced the start of a lockdown throughout the UK, following in the footsteps of Italy and Spain.

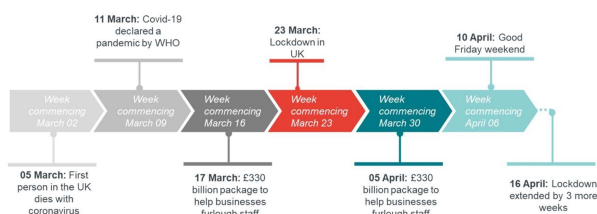
Authors

Abbas Hussain

Manager

Wen Jian

Consultant

Chart 1: Timeline of events in recent weeks

Changes in electricity consumption levels and patterns

With most shops, factories, schools and offices closed, the electricity demand on the GB transmission system has declined over the lockdown period. Reduced demand from commercial and industrial businesses scaling back their activities is the main reason for the drop, slightly offset by an increase in domestic demand due to people spending more time at home. It is interesting to see that the total electricity demand remained relatively stable between the weeks of March 9th and March 16th, despite the government urging people to stay home. This drastically changed in the weeks following the imposition of a lockdown. Compared to the week of March 9th, total electricity demand fell by 13% in the week of March 23rd, by 14% in the week of March 30th, and by 24% in the week starting April 6th.

Chart 2: Comparison of half-hourly GB transmission level electricity demand by week – March 2, 2020 to April 5, 2020

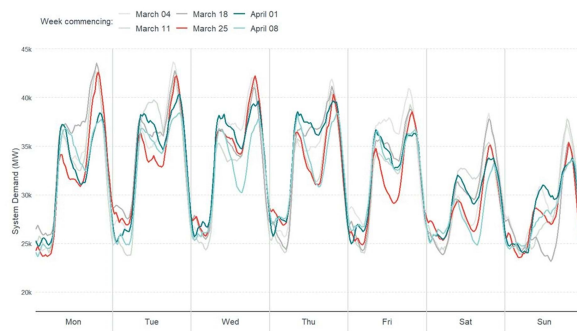
Click on any week to add/remove lines. Hover over the lines to see key events and details.

afternoon (11 am – 5 pm). This is largely due to increased levels of embedded solar generation that lowers transmission system demand and is more pronounced when it is sunnier than usual (see chart below). While the evening peak is also lower (and flatter) than usual given that pubs, shops, restaurants and theatres have been shut, the evening consumption pattern appears to be relatively less affected likely because domestic activities like cooking, heating and hot water use, have not changed as much.

It is interesting to look at the evolution of demand over the same weeks in 2019 to gain a sense of what “normal” would have looked like. The absence of significant

changes in demand levels and profile, so clearly visible this year, is striking. Over the same period, the maximum weekly drop in demand relative to mid March 2019 was less than 5%.

Chart 4: Comparison of half-hourly GB transmission level electricity demand by week – March 4, 2019 to April 8, 2019



Changes in generation mix

Lower electricity demand has meant fossil fuel generators like coal and some gas power plants are needed less, and a greater proportion of the demand can be met with lower marginal cost, low-carbon generation like solar and wind when weather conditions are favourable.

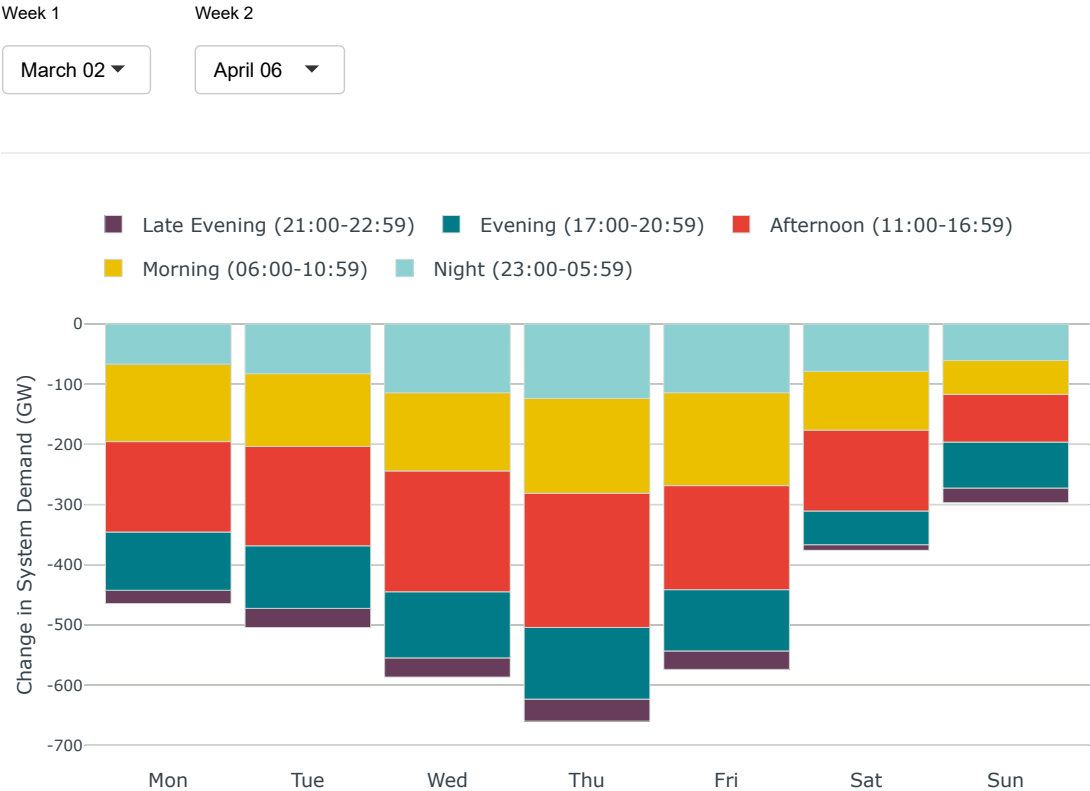
Chart 5: Changes in GB electricity generation mix by week – March 2, 2020 to April 5, 2020

The electricity demand shown here is the transmission system demand which is net of distributed generation (solar and wind). Increased generation from embedded solar PV and wind reduces transmission system demands.

During the lockdown, people working from home are less governed by school runs, commuting timelines or routines around the start of the day. This has caused the weekday morning peak in demand to flatten out, as the use of electricity (for kettles, stoves, showers, heating, etc) is spread out over a longer period. Power usage on weekday mornings appears similar to that of a “normal” Sunday or holiday: the typical surge in demand as people start their working day is less visible.

Chart 3: Comparison of change in daily transmission level electricity demand by week

Compare the change in electricity demand across two weeks:



Aside from mornings, a significant proportion of the change in demand appears to be occurring during the



Covid-19

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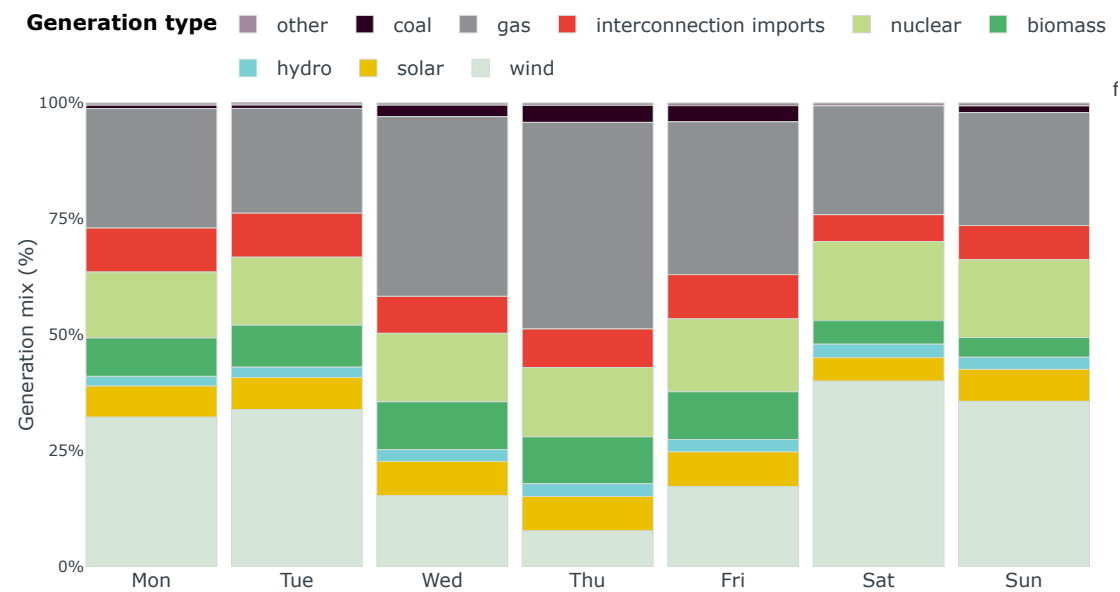
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Choose the week to analyse the UK energy mix.

Week Commencing:

March 23

▼



This pattern was most noticeable on Sunday, April 5th, when renewables comprised more than three-fourths of the generation mix.^[1] Fossil fuels made up less than one-fourth of the total, and less than 1% came from coal plants. The particularly sunny and windy weather brought a surge in renewable generation, which, coupled with lower demand, led to wholesale electricity prices turning negative in Britain for the longest time on record.

During this period, thousands of British homes on time-of-use tariffs were paid to use electricity.

Changes in carbon intensity

The increasing proportion of power being met by low-carbon sources has reduced carbon emissions from electricity generation in the UK. The chart below shows National Grid’s estimate of emissions from all large metered power stations, interconnector imports and transmission and distribution losses. It also takes into account national electricity demand and embedded wind and solar generation.

Chart 6: Changes in GB carbon intensity by week – March 2, 2020 to April 5, 2020

Compared to the week of March 9th, the average carbon intensity of UK electricity generation decreased by 26% in the week commencing March 16th, by 15% in the week commencing March 23rd, by 29% in the week of March 30th and by 25% in the April 6th week.

Looking ahead

When this bulletin went to press, the UK government had just announced the lock-down would be extended by at least three more weeks. The continuation of the lockdown and increase in solar generation alongside the onset of summer will keep a downward pressure on transmission system demand. The industry is looking ahead to how COVID-19 will impact the electricity system with National Grid expecting up to a 20% reduction in electricity demand over summer 2020.

Data analysis for this article was coordinated by analyst, Sumaiya Rahman and junior data scientist, Ivy Kocanova.