CRA Insights

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The impact of COVID-19 reactions on electric load: An update after six months

This *Insights* follows up on two prior analyses, conducted **one** and **two** months into the COVID-19 crisis, in which we reviewed data illustrating the impact of COVID-19 on electric demand across different market regions. Here, we refresh our analysis to include data through September 2020 and, using the same high-level analytical approach, review how electric load patterns have evolved six months into the coronavirus pandemic. Examining trends from New York, California, and England and Wales, we observe lingering demand destruction caused by pandemic response efforts, though the severity of load reductions seems to have abated since the early months of the pandemic. In some geographies, we observe that electric load appears to have recovered to the degree that a more sophisticated analysis would be required to determine whether observed year-over-year variation is a result of COVID-19 or other factors. We close by highlighting several areas that we expect to affect stakeholders in the electric utility space, particularly in light of the ongoing nature of the pandemic.

Electric demand after six months of COVID-19

In this *Insights*, we focus on the continuing impact of the COVID-19 pandemic and how that impact varies by jurisdiction. In the US, by September, economic activity had increased from its early nadir. While lockdowns have eased, there had been no return to normal and the country remains in an economic recession. Alternatively, the UK was more successful at managing the pandemic during this six-month period and was able to more widely relax lockdown restrictions.[1] This has led to a widely varying set of circumstances in terms of business openings, industrial operations, prevalence of work-from-home, and general economic conditions. Nonetheless, millions remain out of work, public gatherings are still constrained, and many types of businesses remain closed or severely limited.

We examine the ongoing impact on load in the same jurisdictions as our initial papers (New York City, NYISO outside of NYC, Los Angeles, CAISO, England and Wales). These regions are reasonably geographically defined and allow for consistency across our analyses. We also select markets where we can potentially isolate cities from more rural areas. In each market region we provide two analyses.

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[1] Here, we focus on pandemic status and data through late September, and do not comment on any pandemic statistics (e.g., rising case counts) or potential electric load impacts between that time and the publication of this *Insights*. We recognize that the situation is dynamic and circumstances may have changed since the six-month milestone in September. For example, England and Wales have moved to a tiered approach as of October (https://www.bbc.com/news/uk-54654138).

First, we compare current electric demand to demand from spring 2020, early in the pandemic. This allows us to observe how current electric market conditions compare to those from early in the COVID-19 response. Second, we compare the two datasets from the pandemic period with electric load from a weather-similar week from before the pandemic, either from 2018 or 2019 depending on which offered the best historical analog.[2]

For New York, we again evaluate the impacts separately for New York City (defined as the New York Independent System Operator – or NYISO – Zone J) and the rest of the NYISO system (excluding NYC). We selected the second week of September (starting September 7) as our most recent sample. To investigate changes in load from earlier in the pandemic period, we chose weather similar weeks from May and June 2020.[3] As a weather-similar week for comparison with prior years, the week of September 9, 2019, is a good fit (see **Figure** 1).[4]

Table 1: Load change from "normal" during weather-similar weeks in NYISO and NYC

	Analysis of March data	Analysis of April data	Analysis of Sept. data
NYISO (ex. NYC)	- 9%	- 5%	+ 3%
NYC	- 15%	- 11%	- 3%

We observe different trends in terms of the ongoing impact of COVID-19 response measures in the rest of New York State as compared with the experience in New York City. After qualitatively controlling for weather, electric demand outside of New York City appears to have largely recovered since the early months of the pandemic, even potentially showing some growth relative to prior years.[5] On the other hand, electric loads in New York City in September 2020 remain diminished relative to weather-similar periods from 2019, though they have recovered considerably as compared to our observations from March and April. This likely stems from ongoing business closures and limitations as well as continuing expectations for teleworking. Consistent with the shift of activities into the home, we observe declines in daytime load but increases in evening loads relative to the pre-pandemic proxy. Declines in consumption patterns in New York City are most pronounced during weekday on-peak hours as well as during all weekend hours, likely because of shifts in consumer behavior and commercial loads. As indoor dining services in New York City have resumed at 25% capacity starting on September 30 following an order from Governor Cuomo, and demand for heaters is increasing for continued outdoor dining throughout the approaching winter, it will be interesting to observe if electricity consumption in New York City further recovers in the next few months.

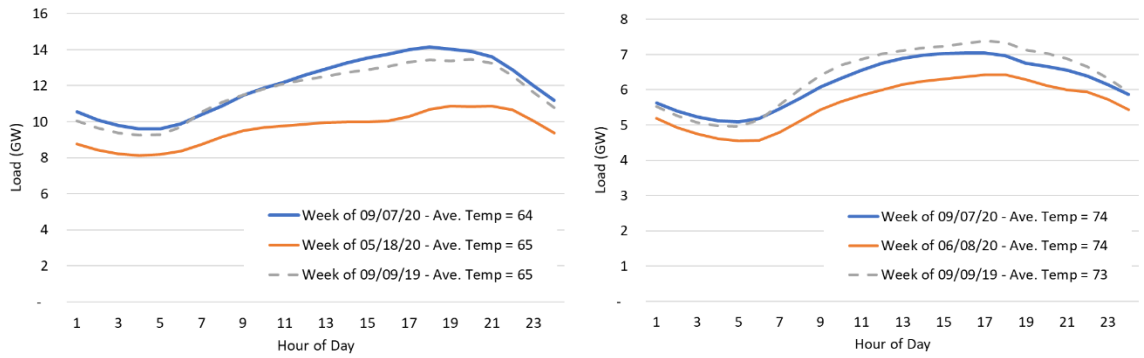
2 We again note that numerous factors affect daily demand patterns, including time of year and various elements of weather. To keep things simple, we only attempted to subjectively control for weather, using average weekly temperature as an imprecise proxy.

3 The week of May 18 and the week of June 8 are good weather-similar proxies from spring 2020 for NYISO non-NYC and NYC, respectively.

4 All of these weekly observations are within 1 °F as measured at Albany and LaGuardia airports.

5 We would not draw any conclusions about overall load growth from this analysis. A 3% increase relative to the prior year proxy may be indicative of such an outcome, but this is probably a sufficiently small change that it is within the inherent "margin of error" of this rough analysis approach. Likewise, the 3% decline, relative to "normal," observed in New York City should also be viewed as being accompanied by some error due to the imprecision of this approach.

Figure 1: NYISO non-NYC load (left, excluding zone J) and NYC load (right, zone J only)



Source: CRA analysis, Energy Velocity

Turning to California, we compare the impacts in the California Independent System Operator (CAISO) footprint to those in the Los Angeles Department of Water & Power (LADWP) balancing area. Slightly different date samples were used in these cases to ensure a good weather fit across data sets. [6] For CAISO, which does not include Los Angeles, we selected the first full week of September (starting September 7) as our most recent sample. And for Los Angeles, we selected the second full week of September (starting September 14). To investigate changes in load from earlier in the pandemic period, we chose weather-similar weeks from May and June 2020.[7] To compare with demand in prior years, we selected weeks from September 2019 (see **Figure 2**).[8]

Table 2: Load change from "normal" during weather-similar weeks in CAISO and LADWP

	Analysis of March data	Analysis of April data	Analysis of Sept. data
CAISO	- 9–11%	- 9%	- 11%
LADWP	-11–13%	- 5%	- 1%

Across California, it appears that load destruction driven by the pandemic response persists at levels similar to those observed early in the pandemic, particularly during the working hours of the day. As with the analysis structure used throughout this *Insights*, this effect is observed comparing current demand to weather-similar periods from prior years. The impacts are less pronounced in Los Angeles,[9] potentially indicating recovery of economic activity, where we again – as with prior analyses – observe that peak loads appear largely undiminished during the pandemic though average and off-peak demand have fallen. We speculate that this may be a result of steady heating and air conditioning during daytime, while off-peak demand is diminished as a result of reduced discretionary activities. We also note that the impact of forest fires in California, paired with the widespread deployment of solar photovoltaic

6 As measured at Sacramento Executive Airport and at Los Angeles International Airport, the CAISO and LADWP weather-similar weeks averaged within 1 °F.

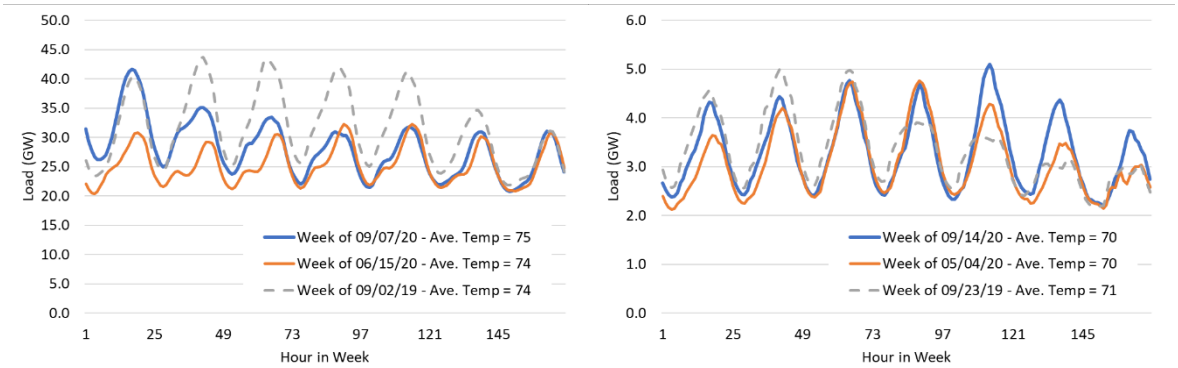
7 We selected the week of June 15, 2020 for CAISO and May 4, 2020 for Los Angeles. Each represented a good weather-similar proxy from early in the pandemic.

8 For CAISO, the best weather-similar fit was the week of September 2, 2019. For Los Angeles, the week of September 23, 2019 offers a good point of comparison.

9 Notably, the NYISO vs. NYC and CAISO vs. LADWP comparisons show different trends between the areas representing major cities and the broader markets. Further analysis would be required to determine which specific factors are driving observed differences in consumption levels across urban and market-wide geographies.

generators likely confounds our ability to draw clear conclusions about load impacts in California. Forest fires lead to atmospheric conditions (i.e., smoky skies) that block solar radiation and reduce solar panel output. In turn, such conditions would lead to higher observed system loads as customers with rooftop solar panels turn to the grid to serve their electrical loads.[10]

Figure 2: CAISO load (left, excluding LADWP) and LADWP load (right)



Source: CRA analysis, Energy Velocity

In the last section, we review the effects of COVID-19 on electric demand in England and Wales. For these regions we compare the weeks of September 14 and May 18 in 2020, and the week of September 23 from 2019 (see **Figure 3**). The weather-similar weeks are within 1 °F of one another on a daily basis. Weather data is the same as that used by the UK's National Grid.

Table 3: Load change from "normal" during weather-similar weeks in England and Wales

	Analysis of March data	Analysis of April data	Analysis of Sept. data
England and Wales	- 17–18%	- 15%	- 6%

Loads in September of 2020 appear to have recovered from the early months of the pandemic. While average load in September 2020 remains about 6% below weather-similar periods in 2019, this is still a considerable improvement from March and April, where load destruction exceeded 15% relative to prior years. This makes sense in the context of the UK's pandemic response. In March, full lockdown was in effect, meaning the closure of schools and all non-essential face-to-face business. As of early October 2020, the response measures are limited to local lockdowns in smaller and less populous regions, while big cities remain fairly open.[11] It is also likely that the prevalence of office workers substituting efficient office lighting and heating for less efficient household equivalents is causing the load rebound in the daytime hours, despite the fact that normal working behavioral patterns are still largely unrecognizable from last year.

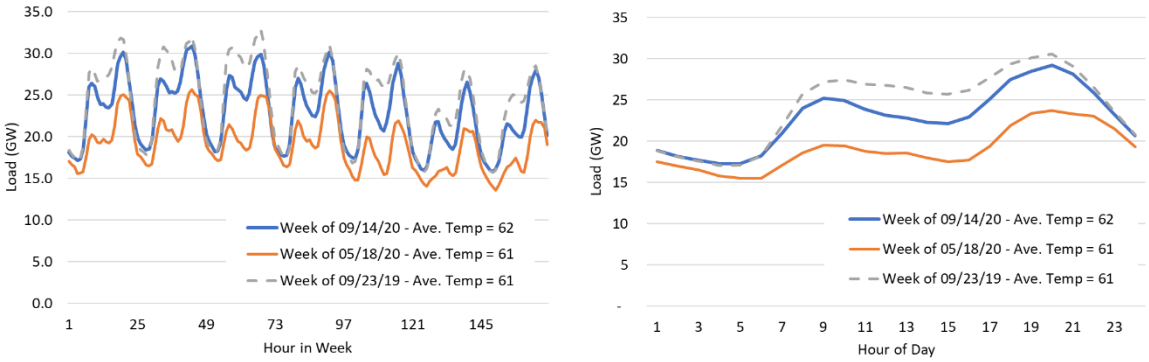
It is also notable that, while early pandemic load declines were observable around-the-clock – which was unique to England and Wales – by September 2020 load reductions appear largely confined to waking hours (7:00 am –11:00 pm). This is likely a symptom of the UK's current curfew, which

10 A more sophisticated analysis could be performed to control for this and other weather conditions (e.g., cloud cover), as well as for the considerable geographic expanse of California.

11 This may be subject to change over the coming weeks, but holds true for the week we study in this piece.

mandates the early closure of late night venues, such as pubs.[12] It appears that the "late hours" load rebound may reflect the substitution of late night social venues for more energy intensive at-home activities, such as watching TV with the heating on. We await the latest data on the proportions of electricity consumption by domestic, industrial, and commercial sectors, and are interested to see whether residential electricity consumption remains the largest proportion of final electricity consumption in Q3 of 2020. The Digest of UK Energy Statistics for Q2 2020, published by the government, shows that the domestic share of electricity consumption remained above that of industrial and commercial activities in that quarter – a breakaway from the usual trend wherein commercial and industrial consumption exceeds domestic consumption in the second and third quarters.[13] We surmise that the observations of electric load from England and Wales reflect a general trend of increasing economic activity while idiosyncrasies in the data are explained by the specificities of the Government's COVID-19 policies and their effects on the population's behavioral patterns.

Figure 3: England and Wales load weekly (left) and average hourly by week (right)



Source: CRA analysis, National Grid

Additional observations

This series of *Insights* has now explored the impact on electric load across six months of policy, economic, and social response aimed at addressing and containing the COVID-19 pandemic. As expected, in the limited market areas reviewed here, the effects on electricity demand have evolved alongside changes in economic conditions and personal behavior. Taken together, we observe some strengthening in demand after six months, though the level of recovery is inconsistent. As the pandemic continues to evolve, so too do we expect the response and the impact on energy systems. We also acknowledge the high-level nature of our observations here, and note that additional analysis could more precisely assess the effects of lockdowns, curfews, and business restrictions by jurisdiction.

We will continue to track changing consumption patterns and expect that there will be lasting impacts to electric load even after the recovery and return-to-normal period. As we have stated in prior *Insights,* beyond the expected macroeconomic slowdown and business interruptions, we will be watching commercial loads and their progress recovering to "normal" historical levels. We expect that some demand may never return, as some businesses shutter and are not replaced. A lingering reduction in daytime commercial load may persist as remote working becomes more widespread even

12 As of September, all venues were required to be shut by 10:00 pm under this policy.

13 Note: Q2 was when the UK was in full lockdown and so this may be subject to change now that the tougher restrictions have been eased off in Q3. For further information on UK statistics by sector, see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/920610/Electricity_September_2020.pdf (particularly chart 5.5).

post-pandemic, while nighttime loads may not recover until health risks at social venues abate. Permanent shifts towards e-commerce may also be a factor.

As we have discussed in each prior *Insights*, the COVID-19-driven impacts on load patterns affect a range of stakeholders across the electricity sector. Shifting intraday consumption can impact expected power prices, affecting merchant developers as well as payback periods for distributed solar resources and other third-party energy services. We expect that, after months of diminished demand, utilities will experience cost-recovery shortfalls due to sustained decreased sales, in turn driving increased regulatory activity to reset rates. Disconnection moratoriums during the pandemic may also drive revenue shortfalls that require regulatory treatment to ensure cost recovery.

Looking to potential long-term post-pandemic impacts, extended energy and peak demand declines may expose excess embedded capacity and trigger associated regulatory scrutiny. There may also be strains introduced by rate design for commercial and industrial (C&I) customers, for whom rates have traditionally been weighted towards demand-based charges. Finally, it appears that already-distressed assets (e.g., coal units and inefficient peaking units) are facing accelerated retirement as the fall in demand impacts energy prices. We will continue to offer comment as these processes unfold, as our colleagues have in several other *Insights*,[14] and work with our clients to resolve related problems as they arise.

About CRA's Energy Practice

Charles River Associates is a leading global consulting firm that offers strategic, economic, and financial expertise to major corporations and other businesses around the world. CRA's Energy Practice provides services to a wide range of industry clients, including utilities, ISOs, RTOs, large customers, and investors. The Energy Practice has offices in Boston, New York City, Washington, DC, Toronto, and London. Learn more at **http://www.crai.com/industry/energy**.

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14 See D. Eryilmaz, M. Patria, and C. Heilbrun, "Assessment of the COVID-19 pandemic effect on regional electricity generation mix in NYISO, MISO, and PJM markets," *The Electricity Journal*, August-September 2020, at http://www.crai.com/publication/assessment-covid-19-pandemic-effect-regional-electricity-generation-mix-nyiso-miso-and; Q. Li, J. McMahon, and N. Kissel, "Utilities are not immune this time," *CRA/Marakon white paper*, July 2020, at http://www.crai.com/sites/default/files/publications/Utilities-are-not-immune-this-time-July-2020.pdf; A. Kumar, E. Glotzer, "Capital impact of COVID-19 on electric power sector – Beyond reading tea leaves," *CRA Insights*, September 2020, at http://www.crai.com/publication/capital-impact-covid-19-electric-power-sector-%E2%80%93-beyond-reading-tea-leaves.