

Assessing the Long-Term Impacts of COVID-19 on Electricity Consumption

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On March 11, 2020, the World Health Organization declared the COVID-19 outbreak a global pandemic, sending the United States economy reeling. In 11 months, the virus has spread to every corner of the country. Public safety guidelines from the Centers for Disease Control and Prevention, interstate and international travel bans, and local restrictions on public gatherings have fundamentally changed the daily lives of Americans, reshaping the way we use energy. As the U.S. recovers from the pandemic, it remains to be seen which changes rebound and which leave permanent marks on the energy landscape.

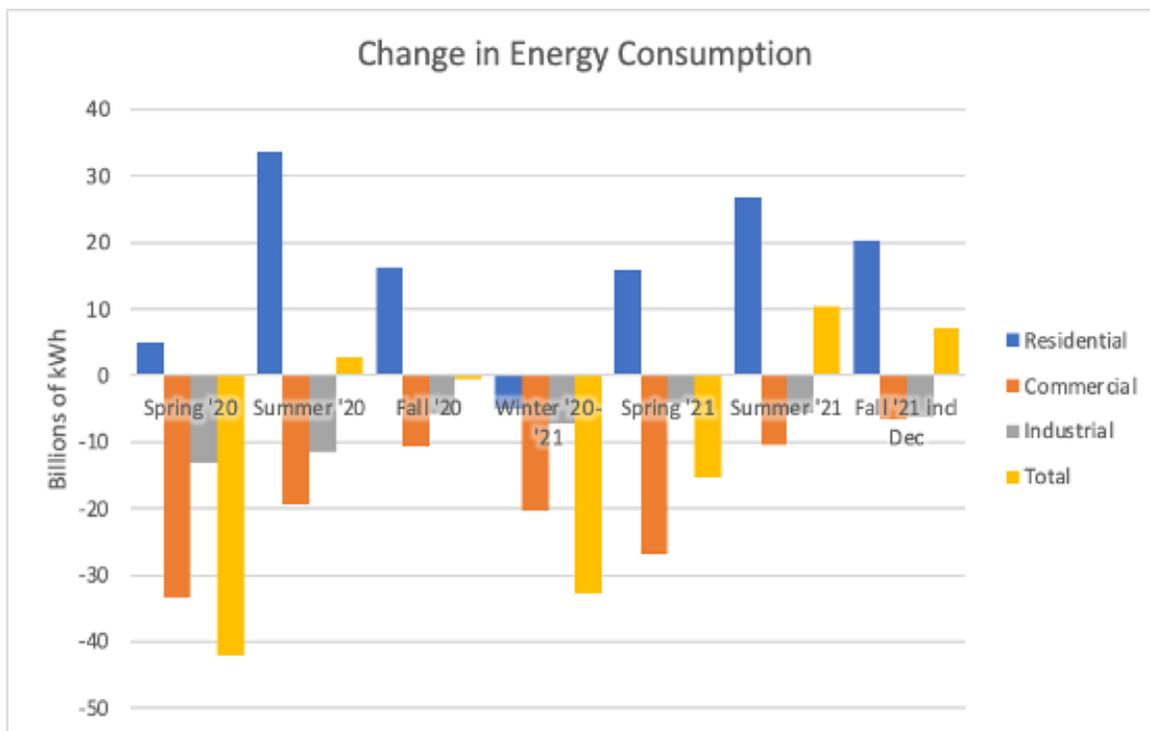
REDISTRIBUTION OF ELECTRICAL CONSUMPTION

To observe the changes underway, we compared regional- and sector-level pre-COVID electrical consumption projections to actual usage in 2020 and post-outbreak projections for 2021 from the Energy Information Administration's (EIA) February and December Short-Term Energy Outlook reports.*

*. The EIA uses gross domestic product and employment forecasts from third party macroeconomic analyses as the main inputs for the energy consumption projections used in the Short-Term Energy Outlook reports.

As shown in Figure 1, nationwide electrical consumption dropped immediately at the onset of the pandemic and related lockdowns. In the spring, total electrical consumption fell by 42.0 billion kWh—approximately 4.9% of the projected consumption. Most of this reduction—33.4 billion kWh—came from plummeting demand in the commercial sector. Industrial sector consumption also decreased by a more modest 13.2 billion kWh. The residential sector, meanwhile, saw a slight increase of 5.0 billion kWh. Through the summer and fall, much larger increases in residential sector consumption offset slowing losses from the commercial and industrial sectors. By the end of the year, cumulative change in electrical consumption had only decreased by about 5.2 billion kWh more than it already had in the spring for a total reduction of 47.2 billion kWh—about 1.52% under projections—since the onset of COVID-19.^{1,2}

Figure 1. Seasonal comparisons of pre-COVID projections for 2020 and 2021 electrical consumption to actual consumption in 2020 and shifted projections for 2021.



Though changes in total electrical consumption since the spring have been modest, the EIA projects considerable deviations from its pre-COVID sectoral consumption projections through 2021. Seasonal changes in consumption due to COVID-19 from spring 2020 through 2021 have created an undulating pattern whereby total electrical consumption compared to previous projections is reduced in the colder months of winter and spring and increased in the warmer months of summer and fall.

Figure 2. Seasonal comparisons of pre-COVID projections for 2020 and 2021 electrical consumption to actual consumption in 2020 and shifted projections for 2021.

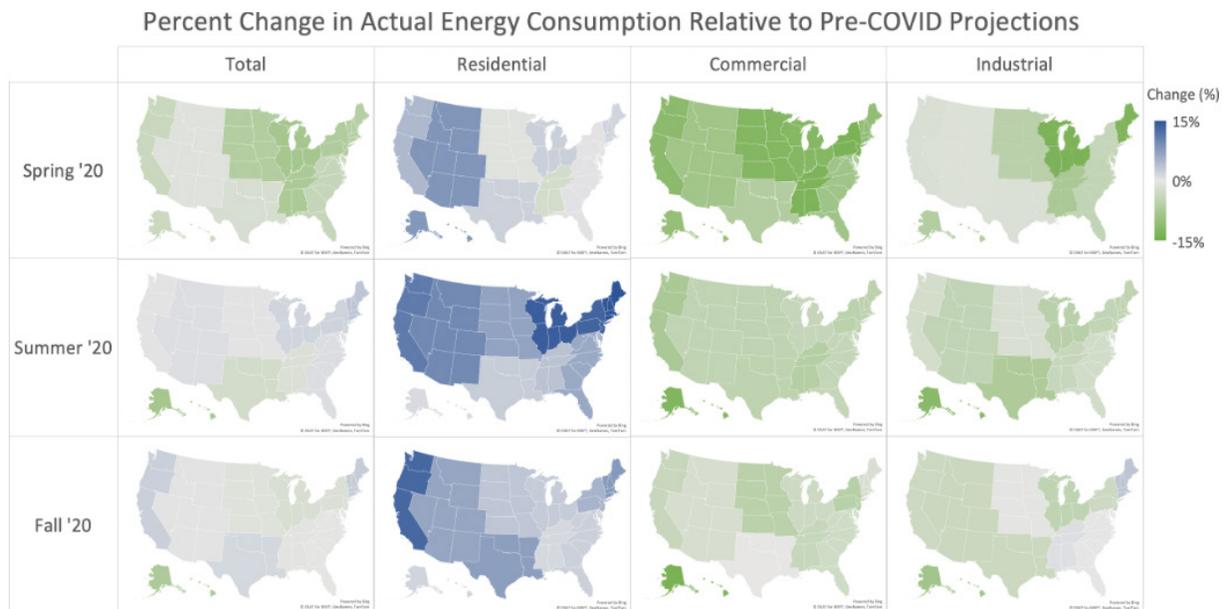
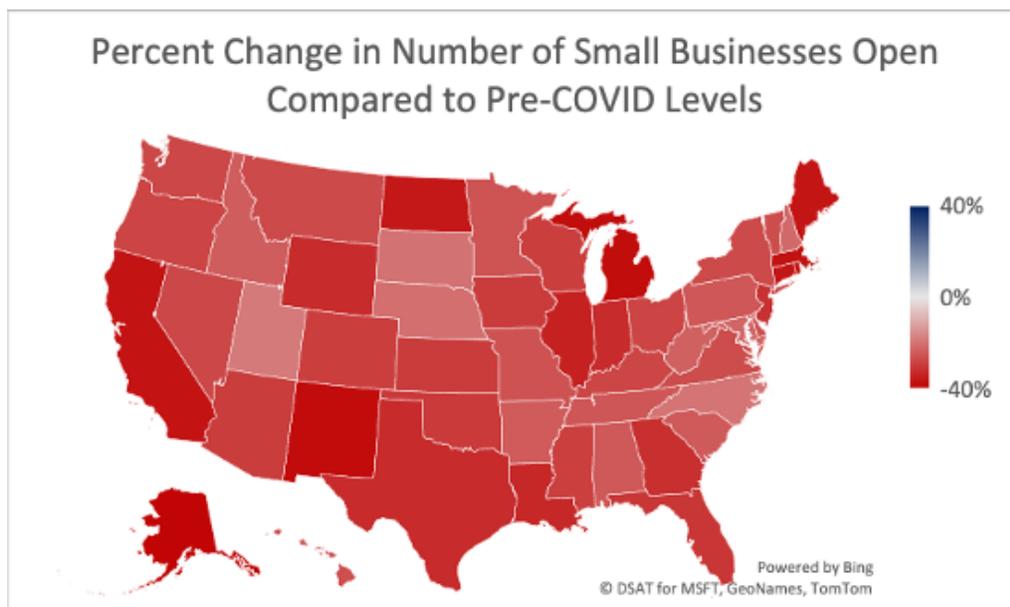


Figure 2 is a geographical representation of the changes observed in the EIA reports through fall 2020. Green represents states where electrical consumption decreased, and blue represents increases. The darker the color, the greater the change (up to 15% of pre-COVID projections). The undulating pattern in seasonal variation from the EIA's pre-COVID baseline consumption projections is most noticeable across the Northeast and Midwest residential sectors. These are cooler regions that perhaps experienced an outsized increase in the number of residential air conditioning units running during the summer to meet the shift in people staying home through hotter working hours.

Compared to the residential and industrial sectors, the change in commercial electrical consumption is more geographically uniform regardless of climate or population size. This may simply have to do with the fact that the commercial sector has been hit hard across the country as evidenced by the relatively even reduction in operational small businesses depicted in Figure 3.³

Figure 3. State-by-state change in open small businesses as defined by having financial transaction shows uniform distribution of closures.



Source: Opportunity Insights Economic Tracker.

While electrical consumption data clearly depict significant changes in consumption since the first wave of COVID-related shutdowns, they fail to capture the economic undercurrents that have driven these changes, let alone what dynamics may outlast the pandemic. Review of other data sets suggests some of the changes may persist. Here are just a few of the trends to watch.

Reimagining the 9–5 Workweek

COVID-19 has shifted the way Americans work. Before the pandemic, only 12% of American workers spent at least one day a week working from home. Since COVID-19, over half of the active workforce has been working remotely.⁴

Work-from-home policies have sunk demand for workspace.⁵ Figure 4 shows quarterly losses in leased office space in the main U.S. metro areas outpacing losses during the great recession in the late 2000s. Following the great recession, vacancy rates took nearly a decade to recover back to the previous levels.⁶

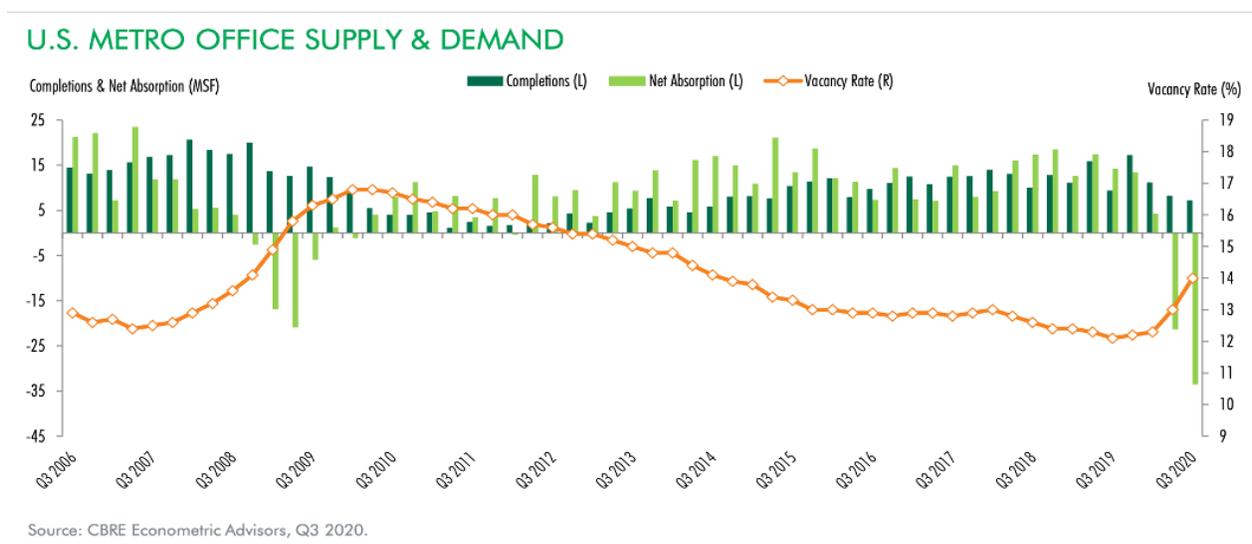
We may see an even sharper spike and slower recovery in office vacancy rates than in the great recession as the shift to remote work looks to outlast the pandemic. In May, Twitter was the first major U.S. company to announce permanent work-from-home plans.⁷ In June, the S&P Global reported that 67% of companies expect work-from-home policies to be permanent or at least long-term.⁸

Shifting from central office space to remote work redistributes electrical consumption from the commercial sector to the residential; its net effect on total electricity usage in the U.S. economy is less clear. A review of 39 empirical studies measuring this effect found that results varied

depending on assumptions about secondary impacts of working from home including what remote workers do with added free time.⁹ One consistent thread among these studies is that achieving net electricity savings from a shift towards telecommuting requires a reduction in office space. Simply reducing office occupants is not enough to tip the scales.¹⁰

Some companies are shifting to hybrid at-home/in-person work schedules, only requiring that employees come to work at a central location as few as two days a week.¹¹ It remains to be seen if this shift coincides with a proportional reduction in square footage. Alternatively, businesses may choose to hold enough office space to accommodate a scenario in which every employee comes into the office on the same day. If companies opt for the latter, there will be a significant net increase in electrical consumption across home and central offices.

Figure 4. CBRE’s Q3 2020 U.S. Office Figures Report graph shows vacancy rates, and net absorption (change in leased office space in millions of square feet).



Movement from Cities to Suburbs

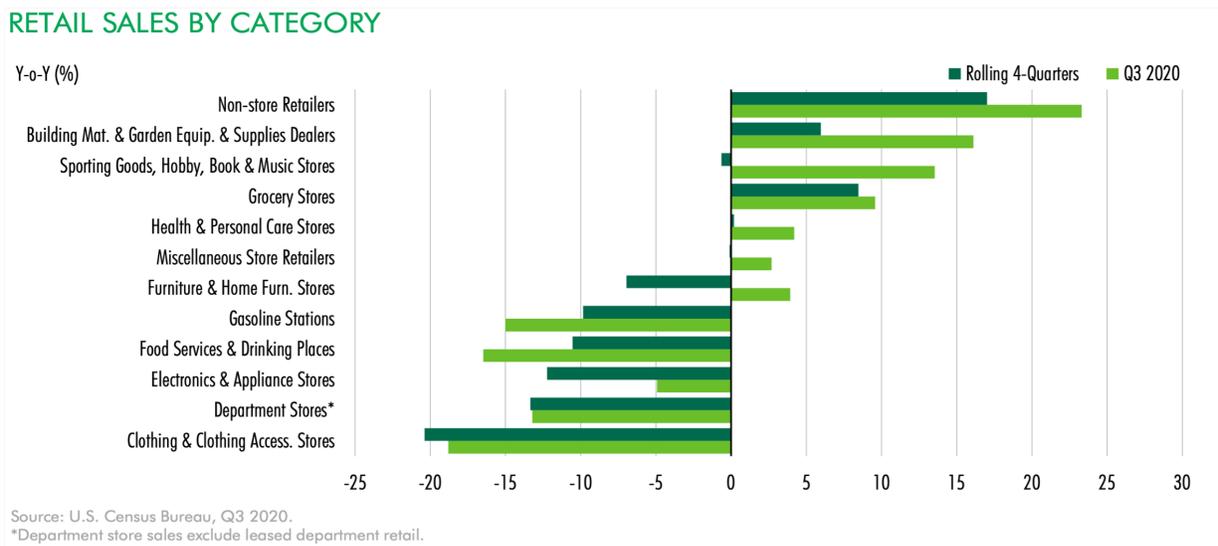
In May, just six weeks into the pandemic, 5% of New York City residents had fled to escape the congested city during lockdowns. In wealthier and denser parts of the city, upwards of 40% of New Yorkers left.¹²

While some residents have returned to New York, home sales suggest a longer-term trend of emigration from the nation’s most densely populated city.¹³ Miller Samuel Real Estate Appraisers & Consultants reported a 44% increase in home sales in the suburban counties surrounding New York with some like Westchester, the suburb just north of the city, as high as 112%. Meanwhile, the number of properties sold in Manhattan plummeted 56%. Miller Samuel posited that the increased flexibility to work from home and the desire for more space, both outdoor and indoor, are driving this shift from cities to suburbs.¹⁴

This trend is not isolated to New York. The real estate listings site, Realtor.com, reported the highest share of searches from urban dwellers for suburban listings in the largest 100 U.S. cities since they began reporting the statistic in 2017.¹⁵

If the movement from cities to suburban homes outlasts the pandemic, we can expect electrical consumption from the residential sector to remain high. According to EIA’s 2015 Residential Energy Consumption Survey, a freestanding single-family home consumes on average 2.77 times more energy than an apartment in a building with over five units.¹⁶

Figure 5. Year-over-year percent changes in retail sales by store type.



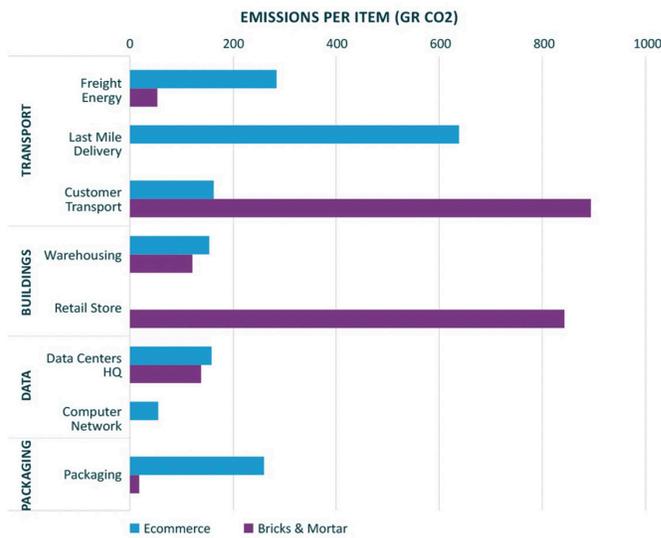
Source: CBRE U.S. Retail Figures Q3 2020.

Service Industries Struggle

Brick-and-mortar retailers were struggling before the pandemic. In 2019, a record high of more than 9,000 retail stores closed in the U.S. Preference for contactless offerings through COVID-19 has only exacerbated this trend. By June 2020, three months into the pandemic, closures had nearly topped the previous high-water mark. Experts predict that the 2020 year-end total for brick-and-mortar retail closures may exceed 20,000.¹⁷ Figure 5 shows the stark contrast in year-over-year percent change in retail sales from brick-and-mortar stores and non-store retailers as ecommerce gains market share.¹⁸

The difference in total greenhouse gas emissions between physical stores and online shopping hinges on variables like transportation methods and product return rates. Nevertheless, the disparity in electricity consumption is stark. Figure 6 compares greenhouse gas emissions from ecommerce and brick-and-mortar retailers at various phases of the supply chain. Oil and gas dominate the emissions contribution from transportation while electricity contributes the greatest to emissions from buildings, data processing, and packaging. The energy intensity of retail stores greatly outweighs the emissions contributions from other electricity-dominant steps in the supply chain.¹⁹

Figure 6. Comparison of greenhouse gas emissions between ecommerce and brick-and-mortar retail.



Source: Generation Investment Management

Lodging and hospitality is another service-based industry seeing a major market shift accelerate through COVID-19. Short-term vacation rental companies like Airbnb have been steadily stealing market share from incumbent hotel chains over the past decade.²⁰ Reduced travel during COVID-19 and the inability to accommodate safety protocols have hurt large hotel companies. As a result, hotel occupancy rates plummeted 32% in 2020.²¹ Meanwhile, Airbnb has actually slightly increased sales through the pandemic, seeing an uptick in more isolated, rural vacation rentals.²²

A study by the Cleantech Group found that Airbnb guests use 63% less energy than hotel guests.²³ These findings signal a significant shift in energy usage from the lodging industry as travelers continue to select short-term rentals over traditional hotel stays.

CONCLUSION

The COVID-19 pandemic has shifted where and how we live, work, shop, and travel. As people move from dense apartment buildings to freestanding suburban houses, work and shop from home, and travel in search of rural open space, our energy consumption patterns change. Consumption flows from urban to suburban and rural, from commercial to residential, and from cooler months to warmer months. As the country vaccinates against the coronavirus, authorities remove restrictions on travel and public gatherings, and the economy begins to recover, we must continue to monitor which of these patterns persist and which return to the pre-pandemic status quo.

Further research could investigate the impact of how the change in energy usage has transformed electrical demand and transportation. Has the shape of regional, seasonal, and daily system peaks changed to become more or less compatible with renewable energy systems like wind and solar? How have short- and long-term transportation trends changed greenhouse gas emissions? How has COVID-19 changed the trajectory of electric vehicles and public transportation?

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