

Extreme Demand Disruptions

A review of U.S. refined fuels demand developments amid COVID-19

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Over the past 12 months, the U.S. oil market has weathered one of the greatest storms in commodity market history. No end of the industry was spared, with the upstream, midstream, and downstream sectors all suffering from the largest collapse of demand on record amid the COVID-19 pandemic and accompanying government social and economic restrictions. During the pandemic, the industry also faced the most active Atlantic hurricane season on record, which shut in both crude production and refining across the Gulf Coast on six different occasions. Across industries, 2020 was fraught with extreme disruptions that emphasized the need for more timely, accurate, and geographically precise data to better respond to unforeseen changes in both supply and demand.

When it comes to demand for refined fuels, many factors determine relative demand trends between countries, states, and cities. These underlying distinguishing economic characteristics are always illuminated during an economic downturn, as some industries and local economies inevitably fare better than others. Some cities and states are more exposed to heavy industry. Others are more exposed to tourism. Some rely more on public transport than private vehicles. The list goes on and on. Even a population's tendency to voluntarily choose to avoid a risk like COVID-19 is not uniform across a geography the size of the United States or even across a state the size of California.

In the end, a multitude of variables determine the relative refined fuels demand between geographies, as each is unique in its own way. Government policy responses – as we have seen across the country during the pandemic - are also unique to specific geographies and help shape demand. Government restrictions on social and economic activity amid COVID-19 have undoubtedly played a significant role in the demand weakness witnessed over the past year. With government interventions to restrict social and economic behavior varying widely across the country, both in scope and timing, and the virus itself spreading across the nation in an ununiform fashion, this past year provides a unique opportunity to study how these various factors shaped demand in specific geographies throughout 2020.

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Cycles & substitution: the evolving narrative of refined fuels demand amid COVID-19

Amid the initial U.S. outbreak of COVID-19 and government lockdowns last March, both demand and refining margins for diesel held up relatively well compared to demand and refining margins for gasoline, which plummeted in line with government lockdowns and the initial outbreaks in the most populous U.S. cities. As we moved through the spring, the tables turned as the global economic contraction and breakdown of industrial supply chains caused diesel demand to turn lower once more while passenger vehicle driving activity recovered from the initial lockdowns, pushing demand and refining margins for gasoline higher. But as we moved through the summer and toward the fall, it was clear that demand for diesel was once again pushing higher while gasoline demand was slowing faster than seasonal norms.



Refined fuels crack spreads showing the effects of COVID-19, from the start of the pandemic through 2020.

Over the second and third quarters of 2020, a seemingly cyclical relationship developed between refined fuels demand, the spread of the virus, and subsequent government restrictions. Recovering social and economic activity initially led to stronger gasoline demand, followed by stronger diesel demand. However, this rise in social activity ultimately foreshadowed the next wave of COVID-19 cases, government restrictions, and the next downturn in demand. Refined fuels demand seemed doomed to repeat this cycle — what we termed the "COVID-19 demand cycle" — until a vaccine was widely distributed and/or herd immunity was reached. The downturn in gasoline demand in the United States, much like in Europe, was already beginning as case counts and hospitalizations rose in November, prior to new lockdown announcements. The question moving into November was if diesel demand would ultimately follow gasoline lower, completing the aforementioned cycle.





NATIONWIDE COVID-19 METRICS SINCE APRIL 1. 7-DAY AVERAGE LINES

Nationwide COVID-19 metrics from April 1 through October 1, 2020, showing testing and surges in cases, hospitalizations, and deaths.

As we progressed through the fourth quarter, it became clear that this demand cycle was short-lived and diesel demand would not follow gasoline demand lower as it did amid the initial outbreak and lockdowns in the spring. We had reached a new stage in the recovery of the industrial and manufacturing sectors, which brought with it a new trend in refined fuels demand. Even with COVID-19 cases, hospitalizations, and deaths surging higher, and cities and states announcing new economic and social restrictions, national diesel demand continued to push higher through the fourth quarter as gasoline demand slumped. The recovery in the industrial economy, which further supported diesel demand through Q4, also emphasized a relationship that had emerged between gasoline and diesel earlier in the year — one in which diesel largely served as a substitute for gasoline. As U.S. consumers continued to avoid brick-and-mortar storefronts in exchange for online shopping and at-home delivery, diesel demand proved resilient. The combined impact of the strength in e-commerce purchases and the recovery in the industrial economy was highlighted over the holiday shopping season, which saw record volumes of online shoppers and national diesel demand moving above 2019 levels during the period.





National refined fuels demand by the numbers

U.S. gasoline demand

In the depths of the initial wave of COVID-19 and government lockdowns over the March-April 2020 period, gasoline demand plummeted nearly 50% year-on-year. This coincided with the U.S. unemployment rate surging from just 3.5% in February to a record-high 14.8% in April. But even with unemployment still holding at a staggering 11.1% in June, gasoline demand in the U.S. had rebounded to just 10% below year-ago levels as the initial virus outbreak along the coasts, government restrictions, and compliance with the restrictions eased. Gasoline demand then plateaued and – outside of holiday weekends - held near this 10% year-on-year deficit consistently throughout the second half of the year, regardless of the gradual recovery in employment. Gasoline demand in the United States averaged 14% below 2019 levels in the March-December 2020 period amid the pandemic and accompanying government restrictions.

Record hospitalizations and deaths due to a resurgent virus prompted renewed government restrictions on social and economic activity in several states in December. This was met with the usual Christmas and New Year's holiday demand seasonality, leading to significant gasoline demand volatility throughout the month. At a national level, gasoline demand weakness accelerated heading into December as COVID-19 cases and hospitalizations rose. But this gave way by Christmas, as it became increasingly clear that government restrictions were not, in fact, locking people down as intended.



U.S. year-over-year gasoline demand showing seven-day moving averages; note the sharp dip related to initial COVID-19 shutdowns and restrictions.

Despite renewed government restrictions and a resurgent virus in many states in December, seasonal weakness in U.S. gasoline demand narrowed sharply moving into the Christmas holiday. This largely reflects two trends that we had already begun to witness develop through the summer: First, it became clear that a significant number of Americans were largely "over" the virus. That is to say, a segment of the population grew tired of social distancing restrictions and began to ignore them when possible. Based on gasoline demand, clearly many Americans were unwilling to stay at home and social distance through the holidays in the second half of the year.



Second is the trend of substituting driving for flying. Over the Christmas and New Year's holidays, gasoline consumption appears to have been buoyed by those who were concerned enough about the virus to avoid airports but not enough to avoid travel altogether. Transportation Security Administration (TSA) data show passenger flights on the rise over the Christmas holiday, but still down 50-60% year-on-year. As some travelers turned to driving rather than flying to make their holiday visits, gasoline demand was pulled higher through the final month of the year. Gasoline demand in the United States rose to just 4% below year-ago levels in the final week of December on a sevenday moving average basis – up from a 15% year-on-year deficit earlier in the month. This marked the narrowest year-on-year demand deficit for gasoline since early March when the pandemic had just begun to hit U.S. demand.



TSA data showing the impact of COVID-19, government restrictions, and consumer behavior on air travel, from early March through December 2020.

U.S. diesel demand

As previously noted, national diesel demand was relatively resilient compared to gasoline demand in the early days of the pandemic and amid the initial lockdowns. While gasoline demand bottomed at the end of March, many sources of diesel demand were seen as "essential work," needed to keep the country moving. Diesel demand did not find its ultimate bottom for the year until late May, as supply chains began to break down and the economic fallout of the initial lockdowns and joblessness took hold moving into the Memorial Day holiday.

In late May, at the depths of the economic fallout and supply chain breakdowns, our data showed U.S. diesel demand hitting its ultimate bottom of a 20% year-onyear deficit. But by early July, following unprecedented fiscal and monetary stimulus, and with manufacturers scrambling to get operations back on track, the year-on-year shortfall in diesel demand had already narrowed to just 3%. In early September, diesel demand moved above year-ago levels for the first time since early March. Over the second half of 2020, our data show diesel demand averaging in line with 2019 levels for the period, bringing the March-December 2020 average to just 5% below 2019 levels. Given the size and scope of the economic catastrophe that had followed from the pandemic, this recovery in demand was remarkably impressive.



U.S. year-over-year diesel demand showing seven-day moving averages; note the movements around the initial COVID-19 related shutdowns, as well as economic and supply chain breakdowns, and the surge in online purchases.

Diesel demand was initially pulled higher by a major shift in consumer behavior toward making purchases online that need to be shipped to the home. Americans spent nearly \$792 billion on e-commerce during 2020, marking a 32.4% increase year-onyear from 2019. This behavioral change led e-commerce sales to account for 14% of total retail sales on the year, up from 11% in 2019. E-commerce sales as a percent of total sales peaked at 16.1% in Q2 2020, but even with gasoline demand showing mobility increasing sharply from Q2 in the second half of the year, e-commerce sales as a percent of total sales were still at 14% in Q4, up from 11.3% in Q4 2019.





E-commerce retail sales as a percent of total sales, starting in Q1 2017 through Q3 2020; note the sharp increase at the start of the pandemic.

During the second half of 2020, recovery in diesel demand was seen in rail traffic, as well as ocean-bound and over-the-road freight. This strength across all modes of transport reflects the scramble to manufacture and restock inventories throughout the economy. Industrial production in the United States rose in each consecutive month throughout the fourth quarter, hitting its highest output rate since February — before the pandemic began — in December. The final manufacturing purchasing managers' index (PMI) for 2020 was the highest since September 2014, rising from 56.7 in November to 57.1 in December. December's reading marked eight consecutive months of improvement for the sector. The persistent strength in e-commerce sales amid the holiday shopping season, combined with the rebounding industrial and manufacturing sectors, explains why our Refined Fuels Demand data for December 2020 shows diesel demand rising to average 2% higher than December 2019 levels. This is despite the lingering economic weakness, a resurgent virus, and renewed government restrictions.



Total index industrial production from January 2012 through January 2021; note the plummet related to COVID-19 supply chain issues and the quick rebound.





From macro to micro — policy and behavior shaping demand

While a national examination of demand is both necessary and interesting when reviewing an event as far reaching as COVID-19, for those active in physical oil markets, even real-time, national-level refined fuels demand data is insufficient for making business decisions that apply to specific cities or states. The examples below highlight the lack of uniformity in refined fuels demand developments across various U.S. cities during COVID-19. These small case studies serve to remind us of the value of real-time measures of demand in specific geographies, accessible through the Refined Fuels Demand database from DTN.

Los Angeles, California

Our Refined Fuels Demand data for Los Angeles show a city hard-hit by the virus. With one of the most stringent and long-lasting government policy responses, unsurprisingly, it had disappointing gasoline demand compared to most of the country throughout 2020. Gasoline demand in the city was down 25% year-on-year in the March-December period, compared to a 14% deficit for the country at large.

Gasoline demand in Los Angeles rose to its narrowest year-on-year deficit in the postpandemic period in early September. This period of strengthening gasoline demand followed the late-summer decline in COVID-19 cases and hospitalizations in California that began in the second half of August, and also reflected holiday travel for Labor Day. However, this strength was short-lived. As California COVID-19 cases began to surge once more, by early November, gasoline demand in L.A. sank back to a 25% year-on-year deficit.

For diesel, it was a much different story. While diesel demand in L.A. was down 14% yearon-year in the first half of 2020, demand for the shipping and industrial fuel only averaged 7% below year-ago levels in the second half of the year. This gradual strengthening trend continued as the year progressed, with diesel demand in L.A. averaging just 2% below yearago levels during Q4.



Refined Fuels Demand data from DTN, showing sevenday moving averages for Los Angeles, from January 2020 to January 2021.

Governor Gavin Newsom announced the strictest limits on social and economic activity at the beginning of December amid surging COVID-19 cases, hospitalizations, and deaths across the state. Yet, gasoline demand in L.A. rose 2% from November's pace for the month of December, and diesel demand rose 4% from the prior month. This speaks to many of the trends we discussed above, like populations growing tired of complying with government mandates and the strength in shipping, freight, and manufacturing sectors at year-end.



Milwaukee, Wisconsin

In Wisconsin, Governor Tony Evers' March 23 order to close all nonessential businesses sent gasoline demand plummeting 52% below year-ago levels by late March. Although these orders were extended to be in effect until May 26, it became clear that residents, lawmakers, and law enforcement across the state were pushing back on these orders almost immediately. By mid-April, despite these stay-at-home orders, gasoline demand in Milwaukee had already recovered to just a 12% year-on-year deficit. Following the rebound in mobility in April, as reflected by gasoline demand, COVID-19 cases pushed higher in the state, and gasoline demand once again slumped to a 33% year-on-year deficit by mid-May.

By June, COVID-19 cases in Wisconsin were once again on the decline. With low virus case counts and hospitalizations moving into summer, gasoline demand in Milwaukee recovered through June, ultimately coming back in line with year-ago levels by the first week of July. Once again, following a rise in mobility, as measured by gasoline demand, COVID-19 cases in the state turned higher, and gasoline demand returned to an 18% year-on-year deficit by late July. And as cases, hospitalizations, and deaths surged in the state over the September-November period, year-on-year gasoline demand weakness accelerated.



Refined Fuels Demand data from DTN, showing seven-day moving averages for Milwaukee, from January 2020 to January 2021.

By mid-November, gasoline demand in Milwaukee was back to its lowest point since the initial spring lockdowns at a 28% year-on-year deficit. In November, the peak in cases and hospitalizations coincided exactly with the bottom in Q4 gasoline demand for Milwaukee. As cases and hospitalizations in Wisconsin plummeted throughout December, gasoline demand pushed higher. By the final week of the year, gasoline demand in Milwaukee rose above year-ago levels for the first time since before the initial lockdowns began.

Diesel demand in Milwaukee was far more resilient than gasoline demand amid the initial spread of the virus and lockdown. While gasoline demand in the city was down 10% year-on-year in the first half of 2020, diesel demand was up 4% year-on-year for the period. Diesel demand did rebound temporarily in the summer, briefly breaking above year-ago levels in late August, but this strength did not persist through the second half of the year. Weakness in diesel demand in the city was heavily weighted to the second half of the year, coinciding with the peak in COVID-19 cases and hospitalizations in the state. As the virus spread across the state, diesel demand averaged 9% below 2019 levels in the second half of 2020. With COVID-19 related cases, hospitalizations, and deaths in Wisconsin peaking in November, diesel demand in Wisconsin sank to a 20% year-on-year deficit for the period.

Chicago, Illinois

The second case of COVID-19 identified in the United States was reported in Chicago on January 24, 2020, and the spring spread of the virus in the nation's third-largest city helped create the worst public health situation for any Midwestern state at the time. This meant fuel demand developed differently than in the neighboring and less population-dense Milwaukee to begin the year. There were already more than 2,000 COVID-19 cases being reported per day in Illinois by April – a figure not reached by Wisconsin until September. Lockdown measures first announced by Illinois Governor J.B. Pritzker in mid-March were ultimately extended through the end of May. Gasoline demand in Chicago plummeted to average 20% lower year-on-year in the first half of 2020 compared to the 10% decline seen in Milwaukee for the period.

Illinois COVID-19 cases and hospitalizations plummeted through June and into early July, leading gasoline demand in Chicago to recover to just 5% below year-ago levels by early July. But as cases — and ultimately hospitalizations and deaths — in the state



began to trend higher moving through late summer, gasoline demand in Chicago pulled back once more to average 13% below yearago levels in the July-August period. With COVID-19 related hospitalizations and deaths surging in November, gasoline demand in Chicago fell back to a 25% year-on-year deficit by the end of the month. Unlike neighboring Milwaukee, which saw gasoline demand rebound in December following the peak of the virus in late November, gasoline demand in Chicago continued to weaken on a year-onyear seasonal basis through December, leaving Q4 gasoline demand in the city to average 17% below 2019 levels for the period.



Refined Fuels Demand data from DTN, showing sevenday moving averages for Chicago, from January 2020 to January 2021.

Diesel demand in Chicago averaged 11% below 2019 levels in the first half of the year — a stark contrast to neighboring Milwaukee, which saw demand average 4% above 2019 levels for the period. But the tables turned as the year progressed. In the second half of the year, Chicago diesel demand averaged just 3% below 2019 levels, while demand in Milwaukee was down 9% year-on-year for the period. In Q4, Chicago diesel demand averaged just 4% below year-ago levels despite the accelerating weakness in gasoline demand in the city, while diesel demand in Milwaukee weakened further to a 10% yearon-year deficit.

Sioux Falls, South Dakota

In South Dakota, where COVID-19 related hospitalizations did not break above the 200-person mark until October, and the governor was adamant about not taking policy measures to limit social and economic activity, demand for refined fuels held up through the first half of the year. In the first half of 2020, diesel demand in the state's most populous city, Sioux Falls, averaged in line with firsthalf 2019 levels for the period. First-half 2020 gasoline demand in Sioux Falls actually averaged 2% higher year-on-year.



Refined Fuels Demand data from DTN, showing seven-day moving averages for Sioux Falls, from January 2020 to January 2021.

In the second half of the year, even with the state not taking lockdown measures seen elsewhere, gasoline demand took a major hit as COVID-19 cases, hospitalizations, and deaths in the state surged. In early October, gasoline demand in Sioux Falls was registering 10% above 2019 levels for the period. But as COVID-19 spread during November, gasoline demand plummeted to a 25% year-on-year deficit by the final week of the month. Gasoline demand in Sioux Falls ultimately averaged 10% below 2019 levels through the second half of the year.

Diesel demand in Sioux Falls averaged 8% below 2019 levels in Q1, well before the virus began to impact South Dakota. Instead of weakening further as the pandemic began to hit the national economy in Q2, Sioux Falls diesel demand pushed higher. Even after a slow start, given the Q2 strength in the first half of 2020, diesel demand in the city averaged in line with 2019 levels for the period. In the second half of the year, Sioux Falls diesel demand rose to average 7% above 2019 levels for the period.

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Conclusion

There may be a tendency to write the pandemic off as a Black Swan event that we need not worry about reoccurring anytime soon. However, for the oil industry, this mindset would risk missing out on valuable lessons learned during this tumultuous time. Admittedly, the past year's events have exaggerated the variance in fuel demand normally seen between cities and states across the country. But in the early months of 2021, we have already been reminded that coping with physical supply and demand disruptions resulting from natural forces is a norm for the oil market rather than an aberration.

While it is unlikely that we will face demand disruptions the size of COVID-19 again in the near future, demand developments over the past year have highlighted the need for timely refined fuels demand data that goes deeper than the national or even regional level. This period has emphasized the need to monitor refined fuels demand at a granular level — even under more normal market conditions — so as to increase efficiency in the downstream sector when times are good and to be as prepared as possible for when the inevitable market disruptions arise, no matter the size or location.

About the author

Troy Vincent is a market analyst for DTN. He's been in the economic research and energy risk management industry for nearly a decade, from large multinationals like Schneider Electric and Ingersoll Rand to innovative technology startups like ClipperData. Vincent specializes in crude oil and refined products and has a thorough understanding of economics and monetary policy, which gives his readers a deeper understanding of market moves and indicators than basic supply and demand levels.

