What Machine Learning Helps Us Know About Power Demand Destruction During COVID-19

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ENVERUS Trading & Risk

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When the coronavirus power load demand destruction began appearing in Enverus Trading & Risk's daily ISO load forecasts, the Enverus power analytics team had to quickly tackle a new set of realities.

Demand destruction is an unforeseen decline in electricity consumption – the metric Enverus forecasts twice a day to help utilities balance supply and demand of power for their consumers.

Just like businesses all over the world, Enverus was faced with never-before-seen scenarios as a result of the nationwide shutdowns. Enverus machine learning-based forecasting tools have never learned the demand dynamics at play—nor had the power analytics team.

First, how the models normally work: machine learning models look at actual temperature and power demand data from previous days and weeks, learning as it goes. The models were built to respond to load growth or anything that may be happening in the market.

This presented a minor challenge. The model was suddenly forced to predict demand in a scenario where it had no historical data to compute.

The solution: Enverus launched a new model that knows what the temperatures were for the load from February 2019 to February 2020. But it doesn't know anything that's been happening over the last month.

Below are some of the first results from the new forecast model and our analysis of demand destruction based on same/similar temperatures and load pre and post using data back to 2019 and adjusting to load growth when appropriate.

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Summary of report findings:

NEW YORK (The New York Independent System Operator)

-In NYISO, the emerging epicenter of the pandemic, **demand destruction increased from 7-10% or 1,300-2,000 MW to 10%-15% or 1,600-2,400 MW.** Localized pockets around New York City are likely much higher.

TEXAS (Electricity Reliability Council of Texas)

In the Texas power market, demand destruction increased during the last five days of March – from 1-3% or 500-1,500 MW this weekend to 3-5% or 1,000-2,000 MW.

MIDWEST (Midcontinent Independent System Operator)

Load destruction continues to increase and is accelerating at a rapid rate in the MISO region. When analyzing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from earlier in the week at 6-8% or 4,000-6,000 MW to now at 8-12% or 6,000 to 8,000 MW.

Pennsylvania-New Jersey-Maryland Interconnection

Demand destruction has been acceleration in PJM. When comparing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from 4-6% or about 4000-6000 MW to 8-12% or 6,000-10,000 MW.

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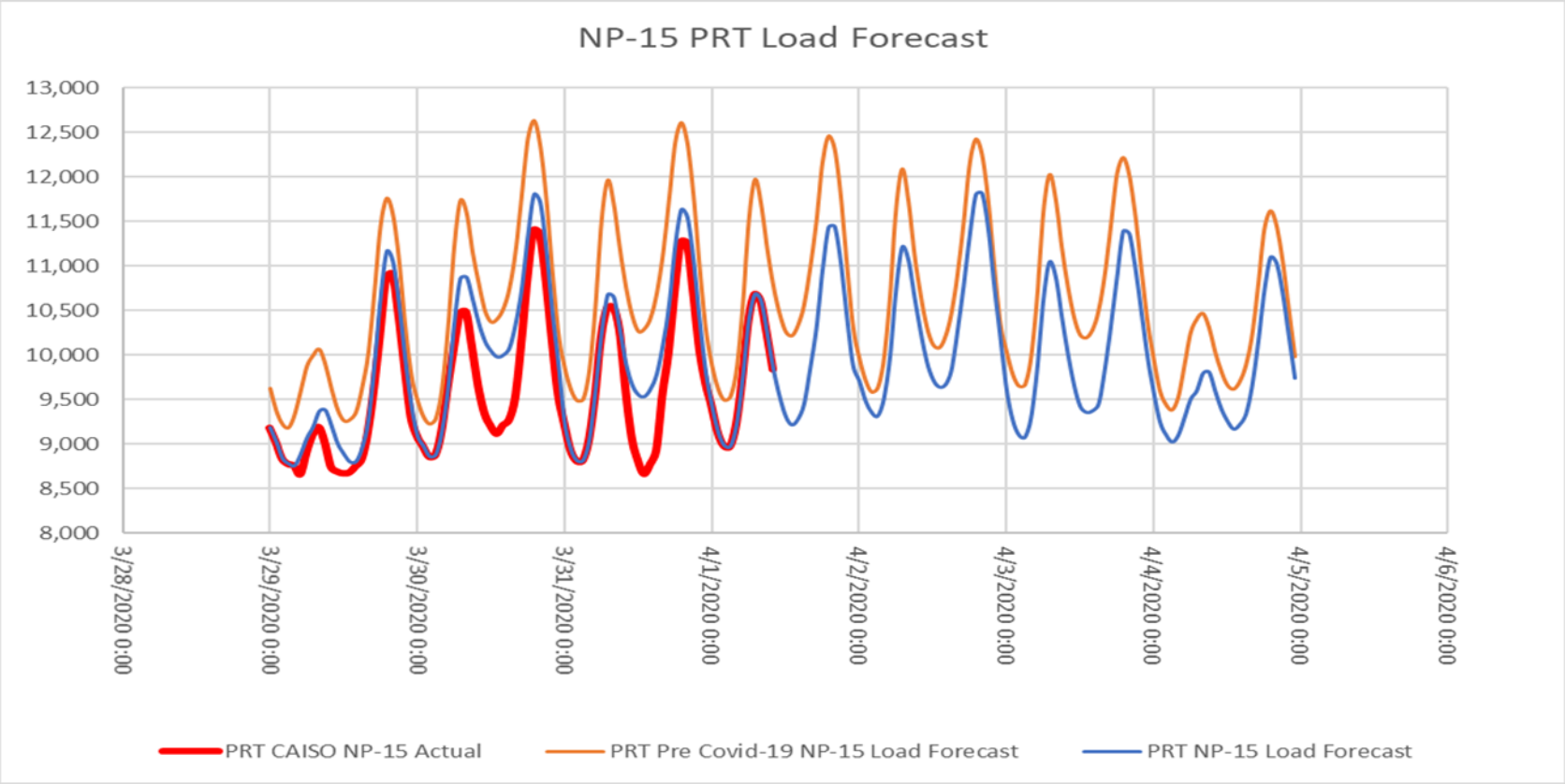
COVID-19 NP-15 Graph

This is a new forecast that PRT created that is not learning about demand destruction due to Covid-19. Temperatures errors will cause variations in these forecasts.

Demand destruction in NP-15 continues to be stable over the last 7-10 days. When comparing similar temperatures hours to pre-covid-19 load it appears demand destruction is around 10-15% or 1,000-1,500.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 3.51% while the ISO is 3.80%.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-975	-895	-875	-877	-897	-1,096	-1,220	-890
3/30/2020	-1,156	-1,276	-1,118	-1,078	-1,661	-1,684	-1,582	-1,238
3/31/2020	-1,316	-1,440	-1,154	-908	-1,588	-1,722	-1,668	-1,344
4/1/2020	-1,133	-1,295	-1,089	-953				

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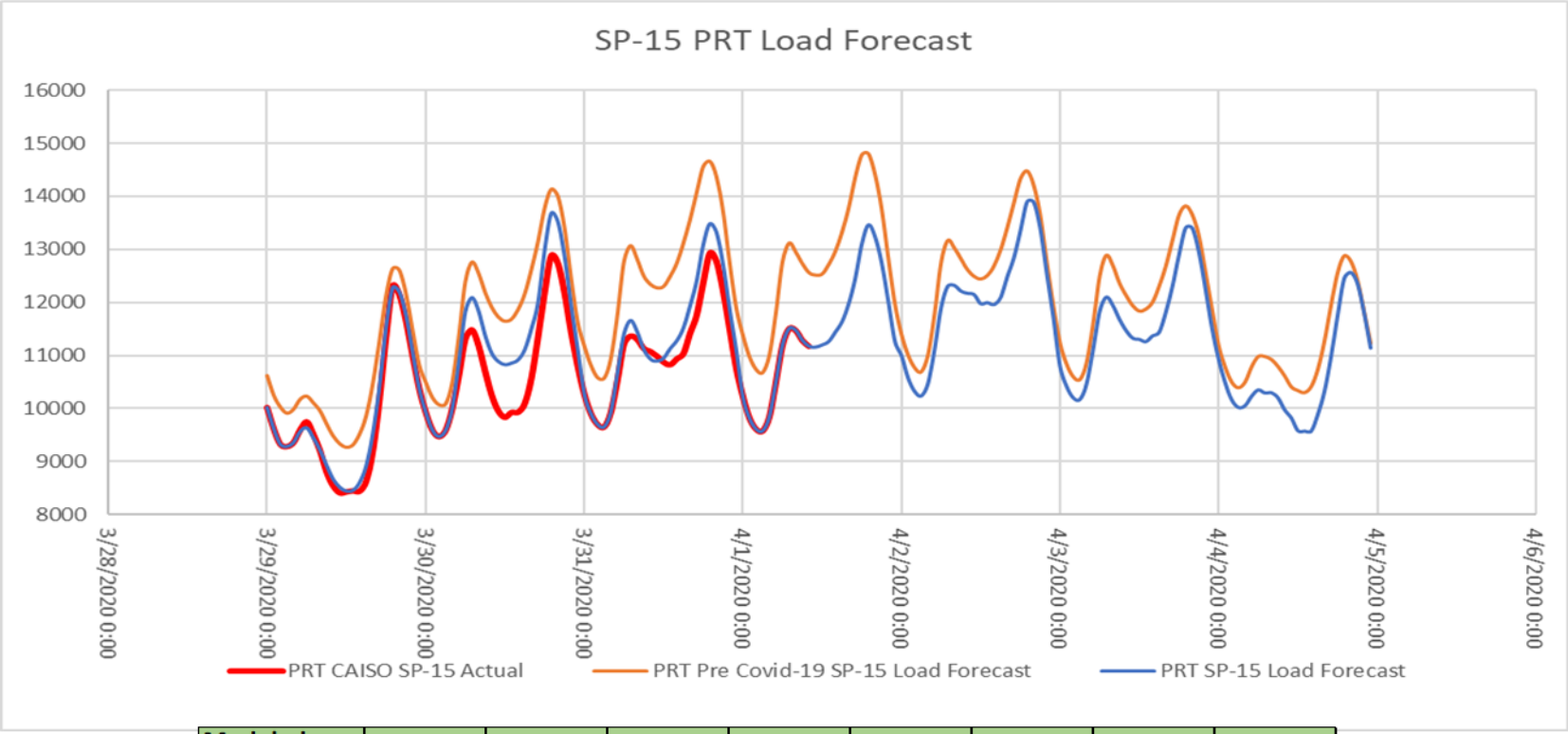
COVID-19 SP-15 Graph

Demand destruction in SP-15 has been accelerating over the last 5 days. When comparing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from 5-7% or 700-1,000 MW to 10-13% or 1,200-1,600 MW.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 5.83% while the ISO is 6.48%.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-975	-895	-875	-877	-897	-1,096	-1,220	-890
3/30/2020	-1,156	-1,276	-1,118	-1,078	-1,661	-1,684	-1,582	-1,238
3/31/2020	-1,316	-1,440	-1,154	-908	-1,588	-1,722	-1,668	-1,344
4/1/2020	-1,133	-1,295	-1,089	-953				

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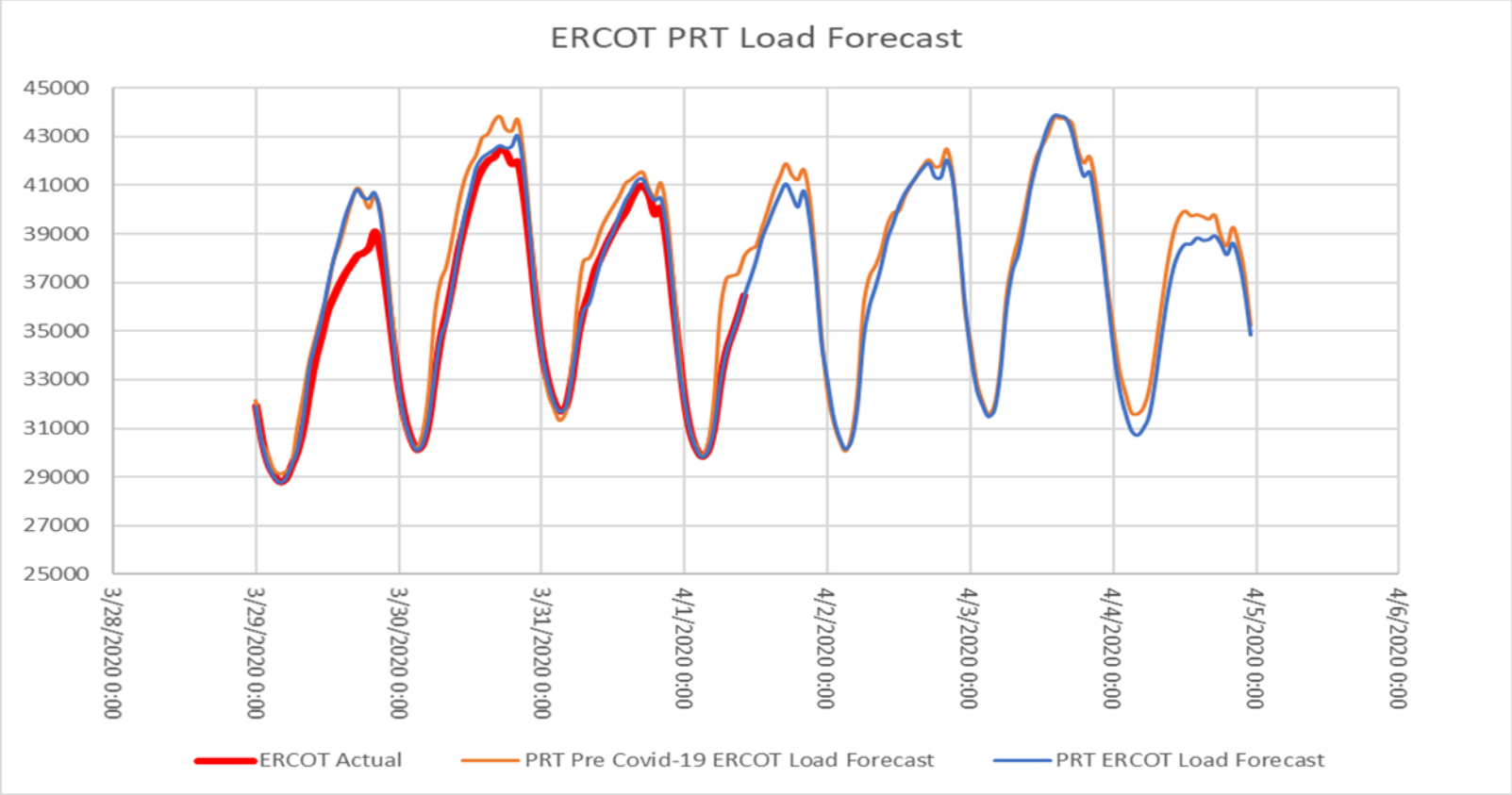
COVID-19 ERCOT Graph

Demand destruction has been increasing again in ERCOT over the last 5 days. When comparing similar temperatures hours to pre-Covid-19 load, demand destruction went from 1-3% or 500-1,500 MW this weekend to 3-5% or 1,000-2,000 MW the last five days.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 2.19% while the ISO is 2.16%.



Modeled Demand Destruction	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
3/29/2020	-1,454	-1,604	-1,999	-2,502	-2,785	-2,387	-1,618	-1,481
3/30/2020	-1,094	-1,271	-1,101	-1,456	-1,330	-970	-1,366	-1,740
3/31/2020	-1,005	-1,166	-835	-565	-563	-281	-705	-1,048

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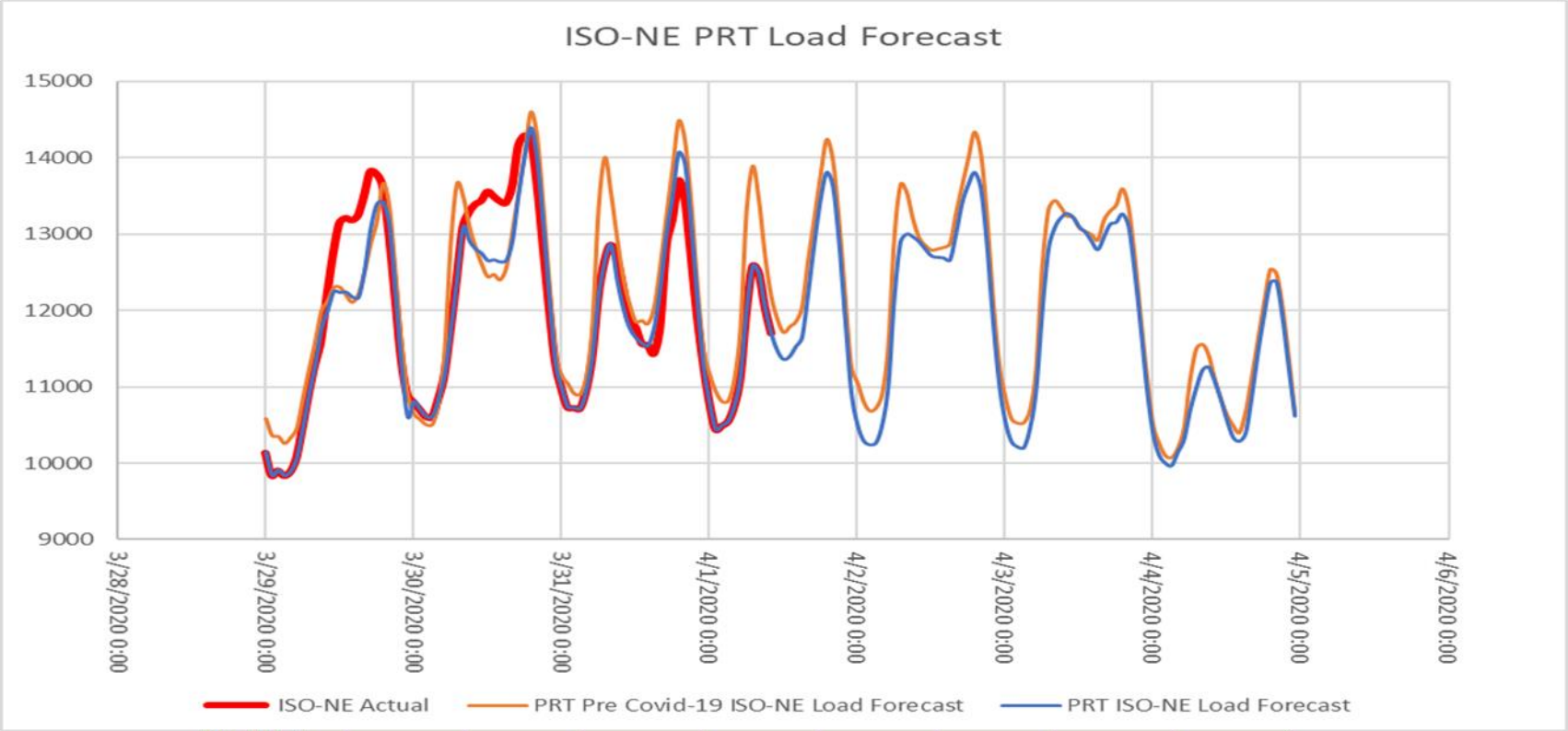
COVID-19 Graph ISO-NE

Load destruction in ISO-NE has increased over the last three days. When analyzing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from 3-5% or 500-700 MW to 7-10% or 800-1,200 MW.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 2.31% while the ISO is 2.71%.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-399	-341	-316	-400	992	941	619	-35
3/30/2020	-1,157	-1,259	-407	177	594	610	231	-348
3/31/2020	-1,164	-1,358	-670	-270	-802	-408	-678	-784
4/1/2020	-1,321	-1,313	-957	-684				

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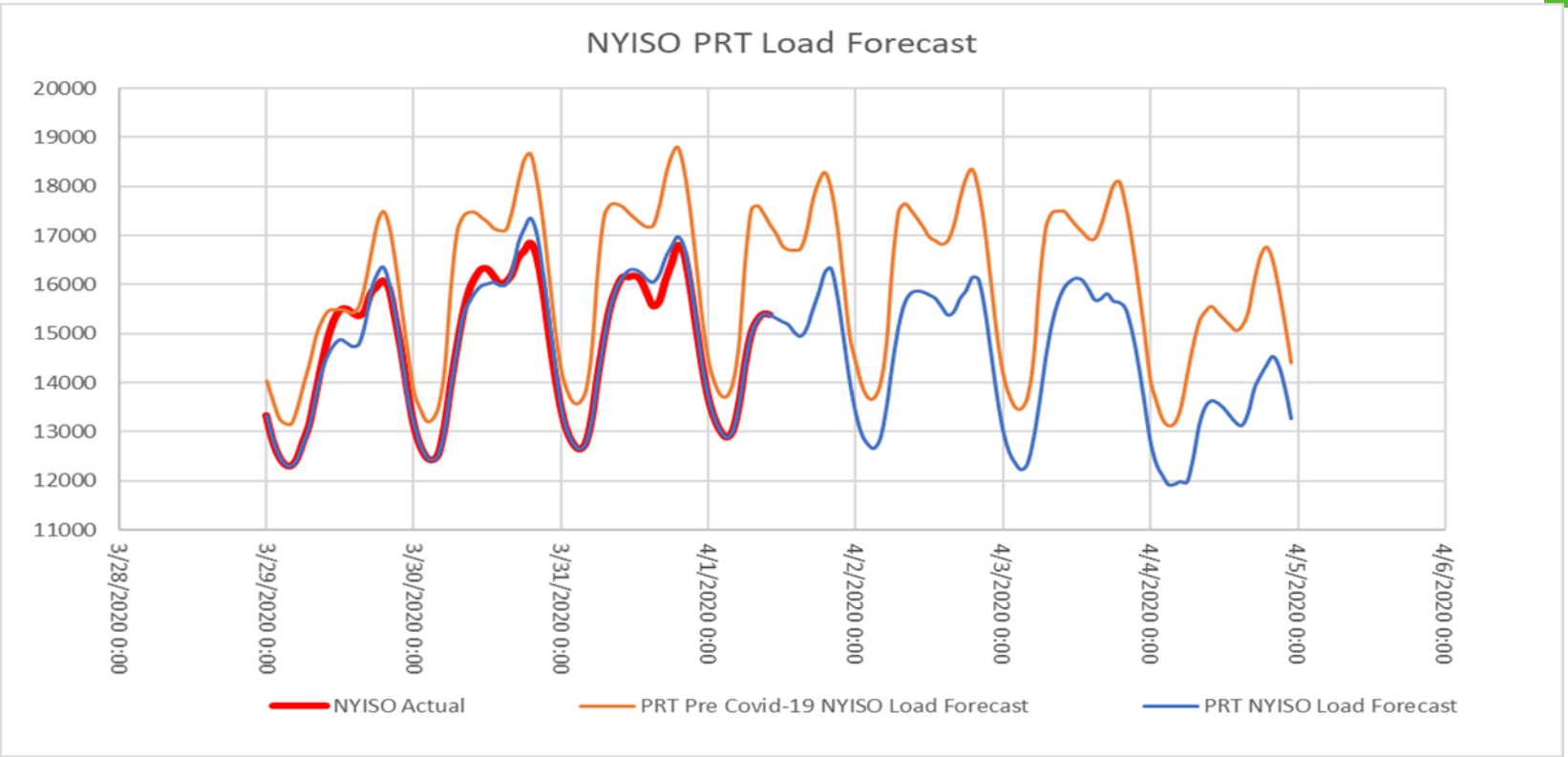
Load destruction in NYISO has been increasing again over the last three days. When analyzing similar temperatures hours to pre-Covid-19 load, demand destruction increased from 7-10% or 1,300-2,000 MW to 10%-15% or 1,600-2,400 MW. Localized pockets around New York City are likely much higher.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 2.31% while the ISO is 2.71%.

COVID-19 Graph NYISO



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-1,176	-1,268	-1,202	-914	-555	-830	-1,299	-1,418
3/30/2020	-2,023	-2,383	-2,019	-1,617	-1,305	-1,560	-1,881	-1,820
3/31/2020	-2,221	-2,498	-2,092	-1,736	-1,962	-2,136	-2,209	-2,002
4/1/2020	-2,102	-2,529	-2,330	-2,050				

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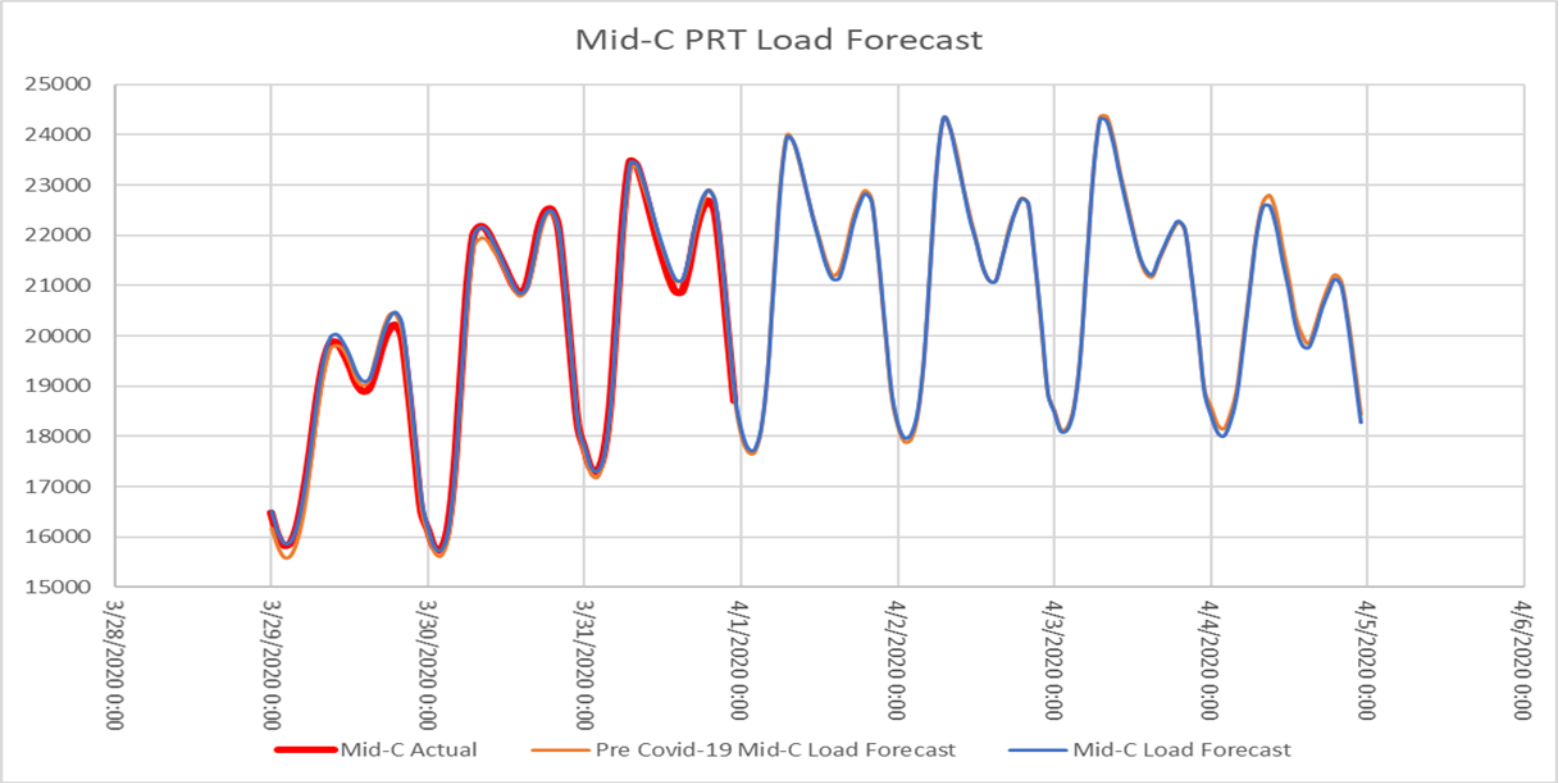
COVID-19 Mid-C Graph

Load destruction is occurring in Mid-C but temperatures have also been dropping (increasing load) masking some of these drops. When analyzing similar temperatures hours to pre-Covid-19 load, demand destruction has increased slightly this week from 3-5% or 500-1,000 MW to 5-7% to 700 to1,200 MW. Localized areas in Washington State are much higher in the Puget Sound Area.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	270	244	188	107	-292	-306	-308	-199
3/30/2020	232	230	254	212	164	193	110	81
3/31/2020	163	126	64	49	-192	-141	-122	-211
4/1/2020	-96	-35	19	32				

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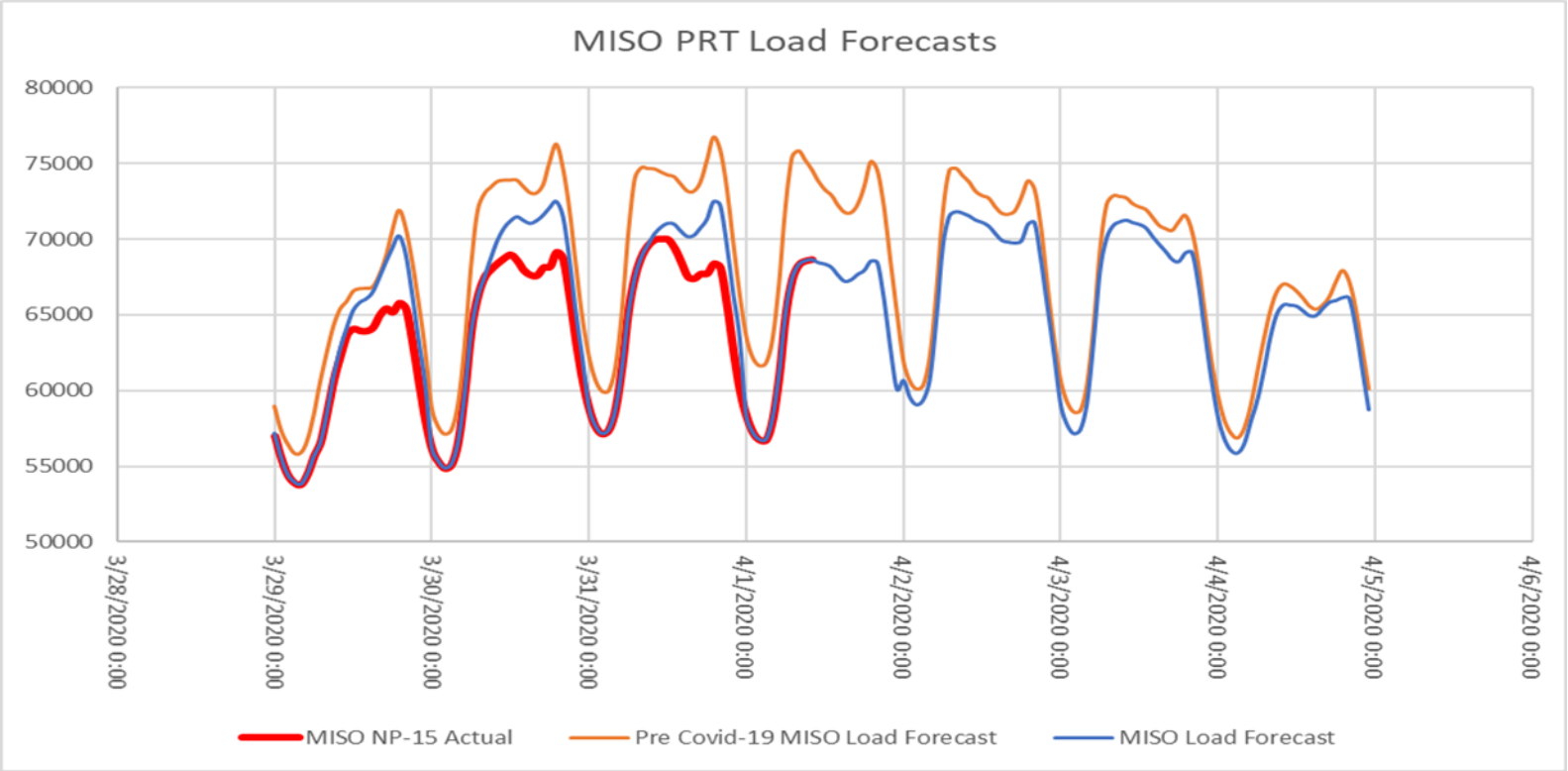
COVID-19 MISO Graph

Load destruction continues to increase and is accelerating at a rapid rate in the MISO region. When analyzing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from earlier in the week at 6-8% or 4,000-6,000 MW to now at 8-12% or 6,000 to 8,000 MW.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 2.76% while the ISO is 3.14%.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-2,732	-3,990	-3,929	-3,522	-2,650	-3,408	-5,397	-6,114
3/30/2020	-4,144	-5,592	-5,469	-5,398	-5,436	-5,440	-6,892	-7,097
3/31/2020	-4,998	-6,397	-5,801	-5,019	-5,751	-6,022	-7,436	-8,335
4/1/2020	-7,049	-8,009	-7,500	-6,636				

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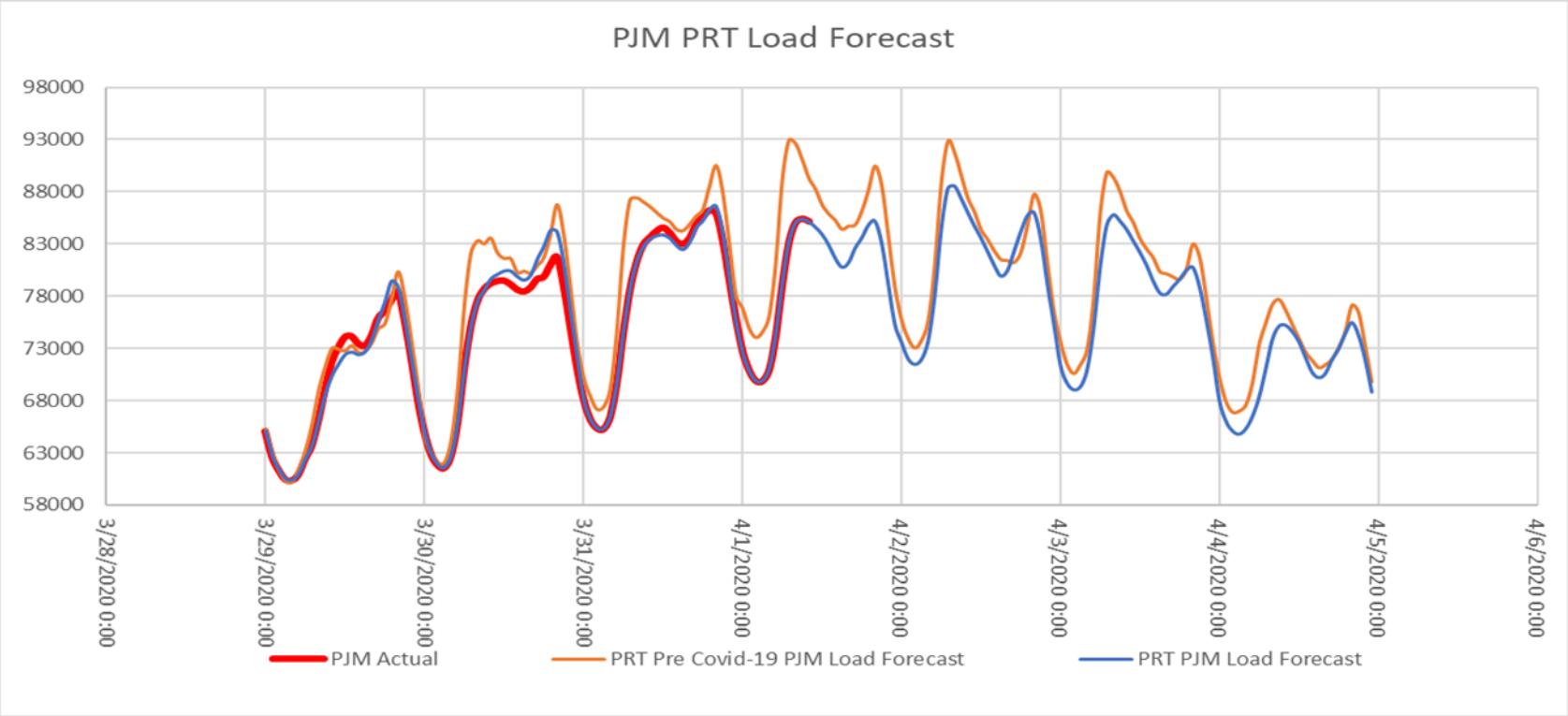
Demand destruction has been acceleration in PJM over the last three days. When comparing similar temperatures hours to pre-Covid-19 load, demand destruction has increased from 4-6% or about 4000-6000 MW to 8-12% or 6,000-10,000 MW.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 3.27% while the ISO is 3.80%.

COVID-19 PJM Graph



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-879	-2,140	-2,986	-2,306	644	935	1,167	-165
3/30/2020	-6,157	-7,132	-5,801	-4,375	-1,422	-1,316	-1,884	-2,967
3/31/2020	-8,210	-8,613	-6,174	-4,151	-1,326	-789	-685	-2,319
4/1/2020	-9,874	-9,687	-7,578	-5,725				

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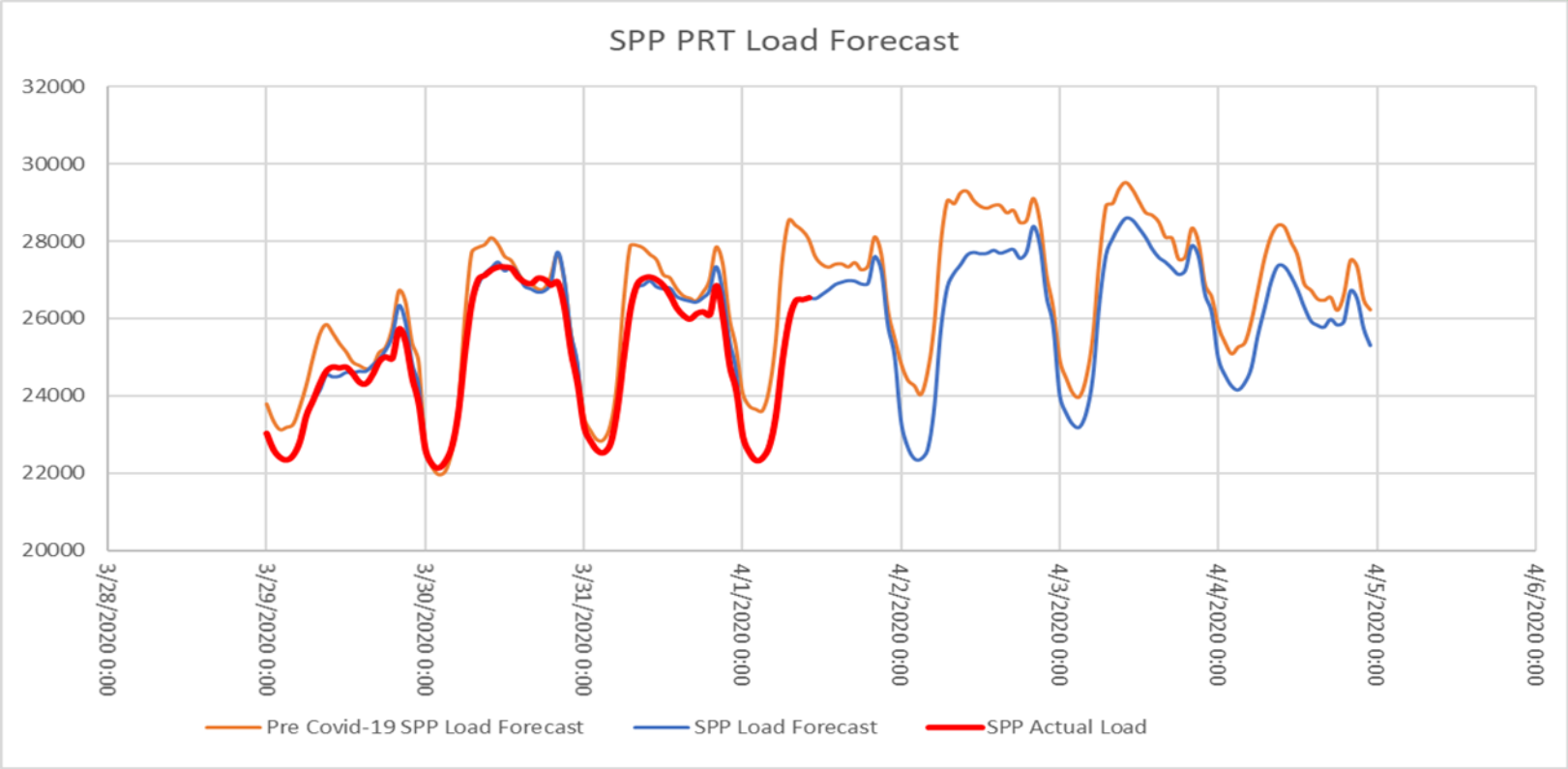
COVID-19 SPP Graph

Demand destruction in SPP has accelerated again over the last three days. When comparing similar temperatures hours to pre-Covid-19 load, demand destruction from 3-6% or 600-1,800 MW since last week and over the weekend to 5-8% or 1,000- 2,200.

PRT Peak Load MAPE (Mean Absolute Percentage Error) from March 16-27th is 1.91% while the ISO is 1.90%.



Modeled Demand Destruction	6:00	7:00	8:00	9:00	16:00	17:00	18:00	19:00
3/29/2020	-808	-1,117	-1,300	-1,222	-211	-237	-260	-793
3/30/2020	-899	-1,305	-828	-792	9	274	231	-244
3/31/2020	-1,422	-1,626	-1,008	-779	-546	-336	-506	-892
4/1/2020	-2524	-2552	-1949	-1796				

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Conclusion

While it is very early in our assessment of the power load demand destruction impacting U.S. ISO markets, it's clear that Covid-19 has had material impacts on electricity consumption.

Enverus power analytics will continue to assess the impacts in twice-daily reports, which are now being offered to utilities free of charge to help weather the storm of lower power trading liquidity.

https://www.enverus.com/power-demand-destruction-prt-enverus-trading-risk/