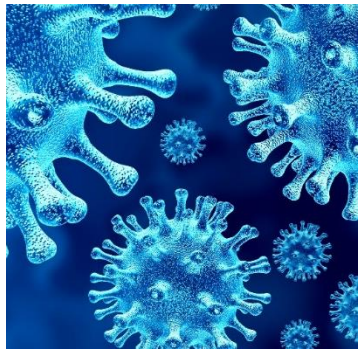
California ISO



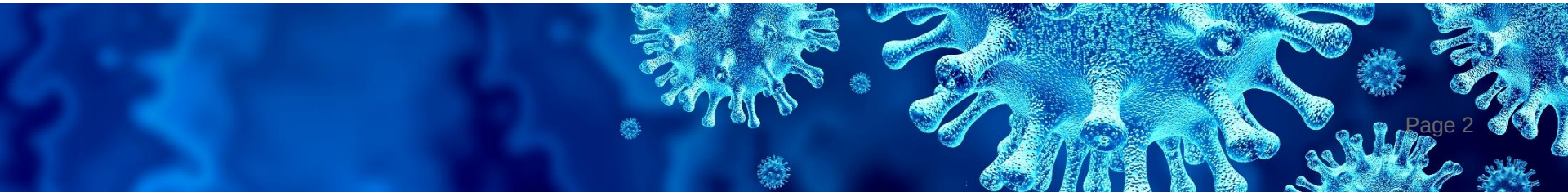
COVID-19 Impacts to California ISO Load & Markets: **March 17 – July 26, 2020**

Market Analysis and Forecasting

July 31, 2020

Background

- Between March 17-19, various California counties started requiring non-essential businesses to close or limit activity, including restaurants and some commercial stores, and directed companies to have their employees work from home if possible.
- On March 20, the state ordered all individuals living in California to stay home except for critical infrastructure sectors, and to get essential goods and services.
- On May 9, the state launched its Pandemic Roadmap, which allowed for counties to submit plans for phased reopening of businesses, schools, and public spaces. The majority of California counties have applied for gradual and modified re-openings.
- Following a significant statewide increase in coronavirus cases, the state again modified restrictions on July 13, requiring closure of some commercial venues, including restaurants, wineries, and certain entertainment venues.



Summary

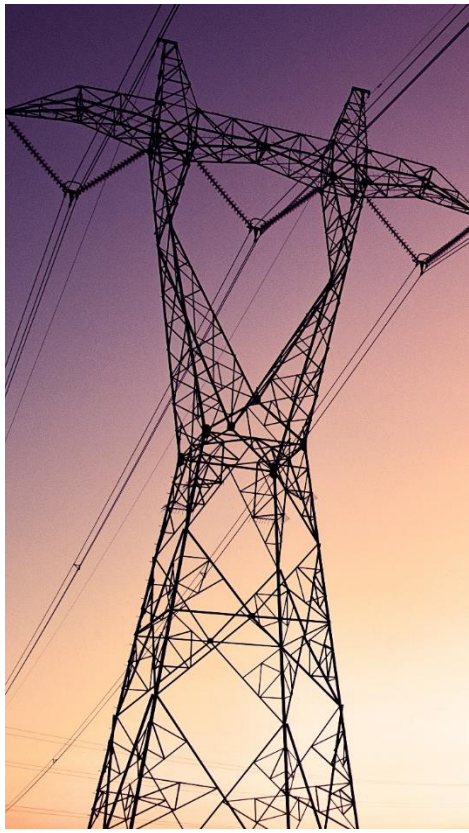
- Since the first full week of the statewide stay-at-home order, the ISO has observed:
  - **Weekday** average load reductions of **2.4%**, and up to **5.0%** reductions during peak hours.
    - hourly average expected load differences for the month of July range from -**3.5% to +2.0%**, with the highest percent reductions observed during Hour Ending (HE) 7 through HE 12
  - **Weekend** average load reductions of **1.1%,** and up to **1.9%** reductions during peak hours.
- Because ISO's forecasting process allows us to perform a backcast analysis given the underlying weather conditions and type of day, these reductions compare actual load to expected loads if no order were in place.
- While the sophisticated load forecast models could not have anticipated the stay-at-home order, the ISO continues to fine-tune its models to improve forecast accuracy in day-ahead and real-time markets as conditions evolve.
- Energy prices declined by about $10/MWh in the day-ahead and real-time markets. With higher loads since the end of May, prices increased to pre-provision levels.
- There have been no impacts to grid reliability from the stay-at-home order.

Removing weather errors to isolate stay-at-home order’s impact

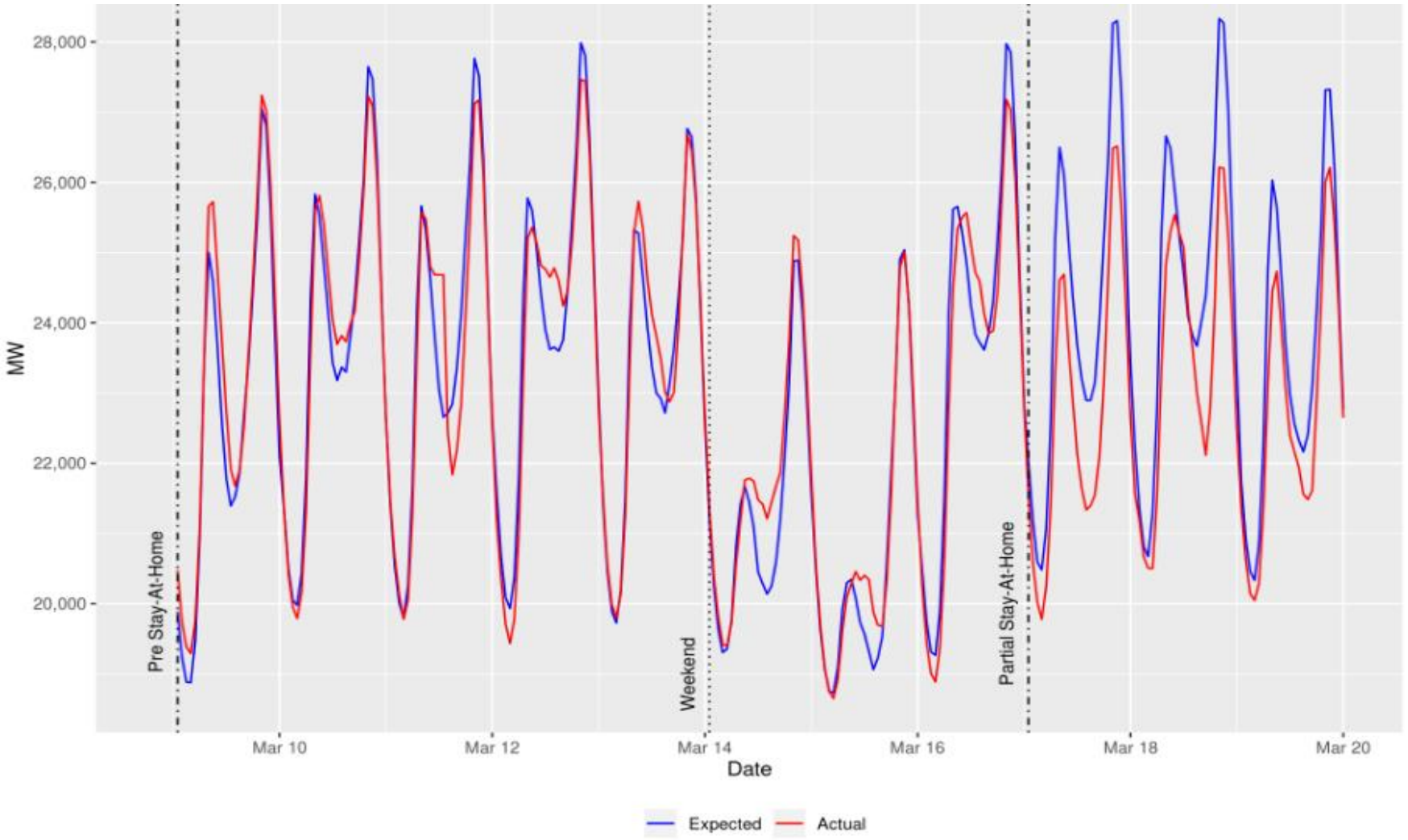
Backcast Analysis

Methodology for removing weather errors to isolate stay-at-home order's impact

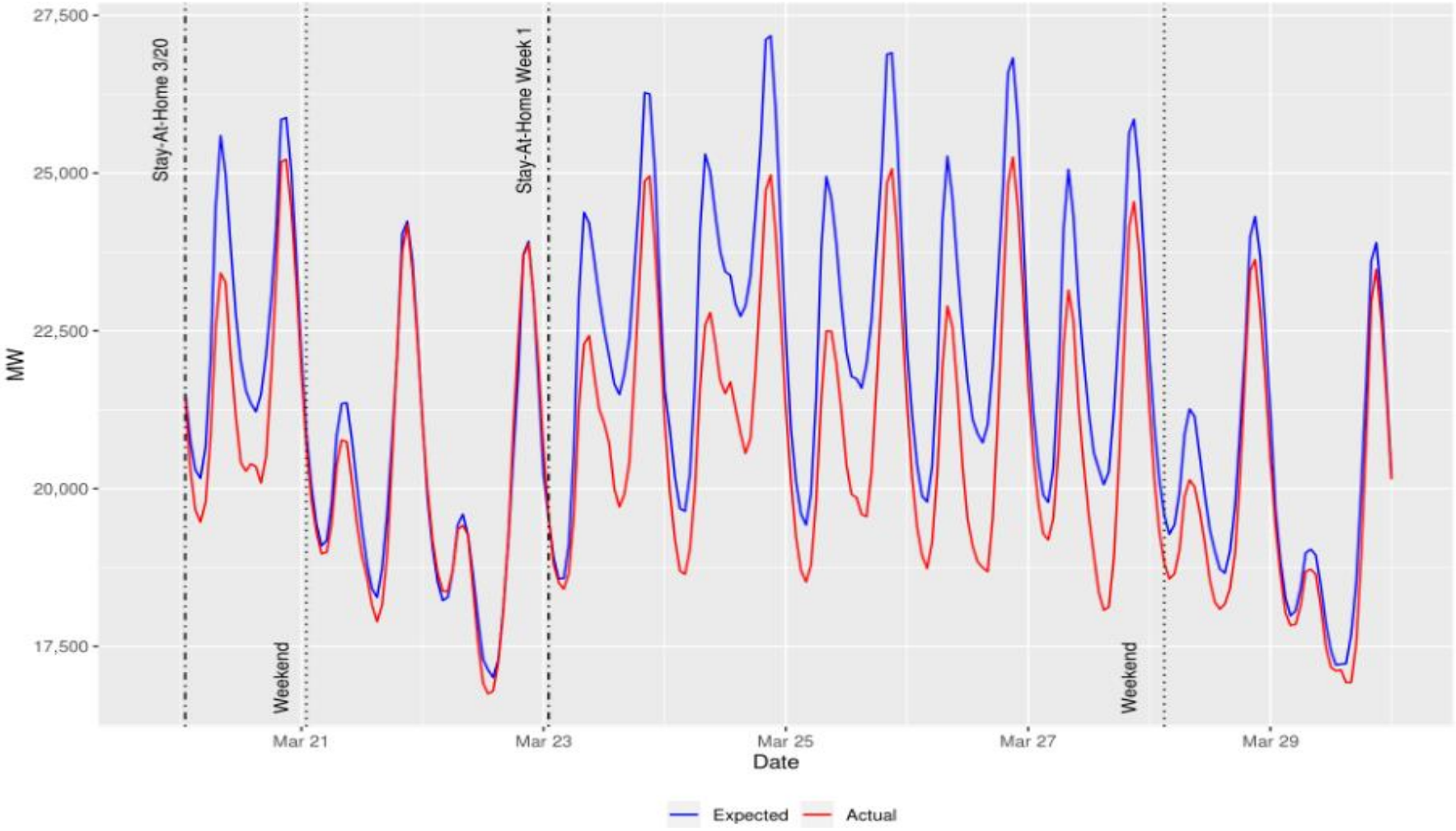
- CAISO is using a backcast model, which removes the largest known sources of weather error to isolate the stay-at-home order's impact.
- The difference between the expected load model and what actually occurred is referred to as model error.
  - COVID-19 is a component of model error. There is a normal range for model errors and what is seen in this analysis is outside the normal range, allowing the ability to isolate the COVID-19 Impact.



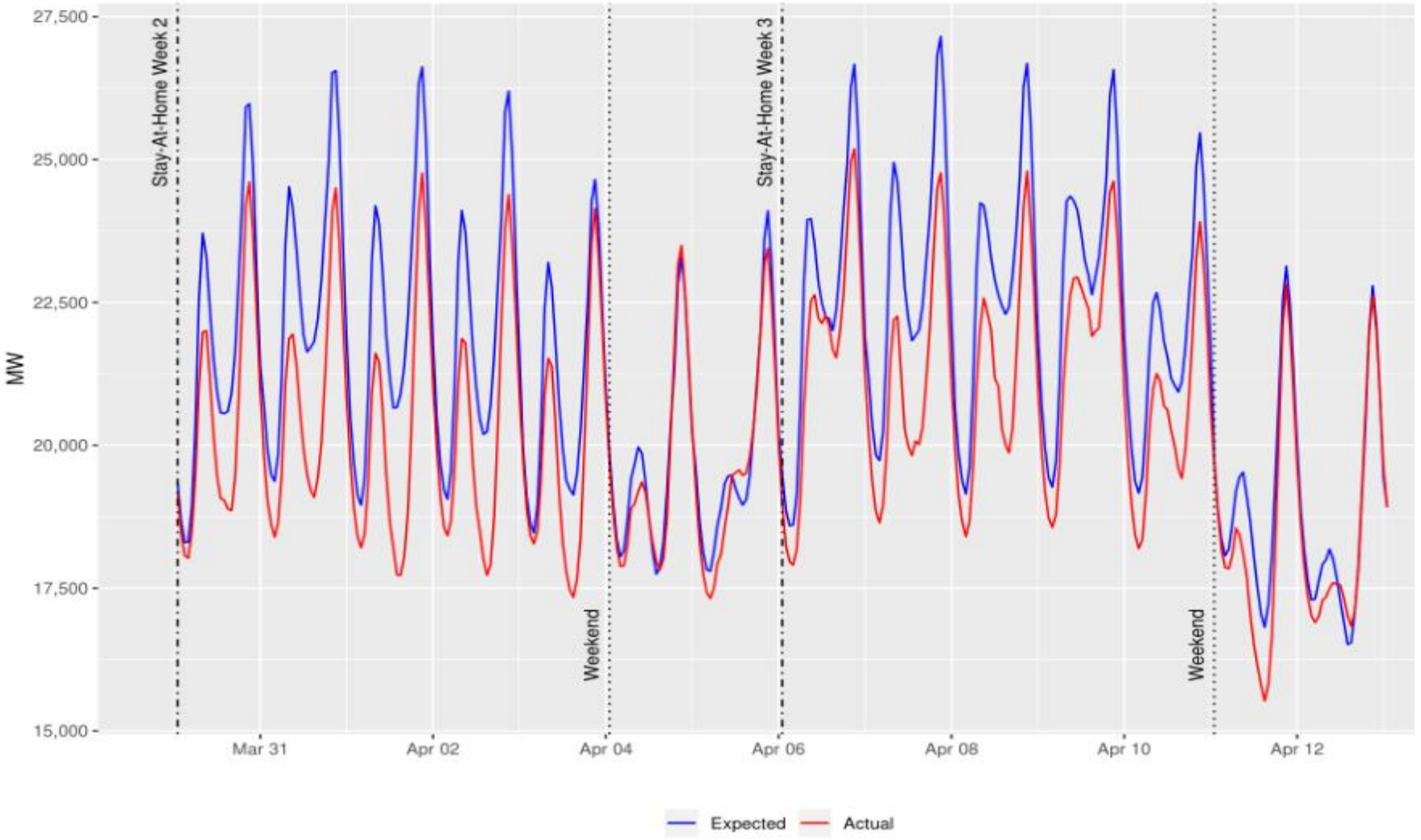
Weather Adjusted: System impact March 9 - March 19



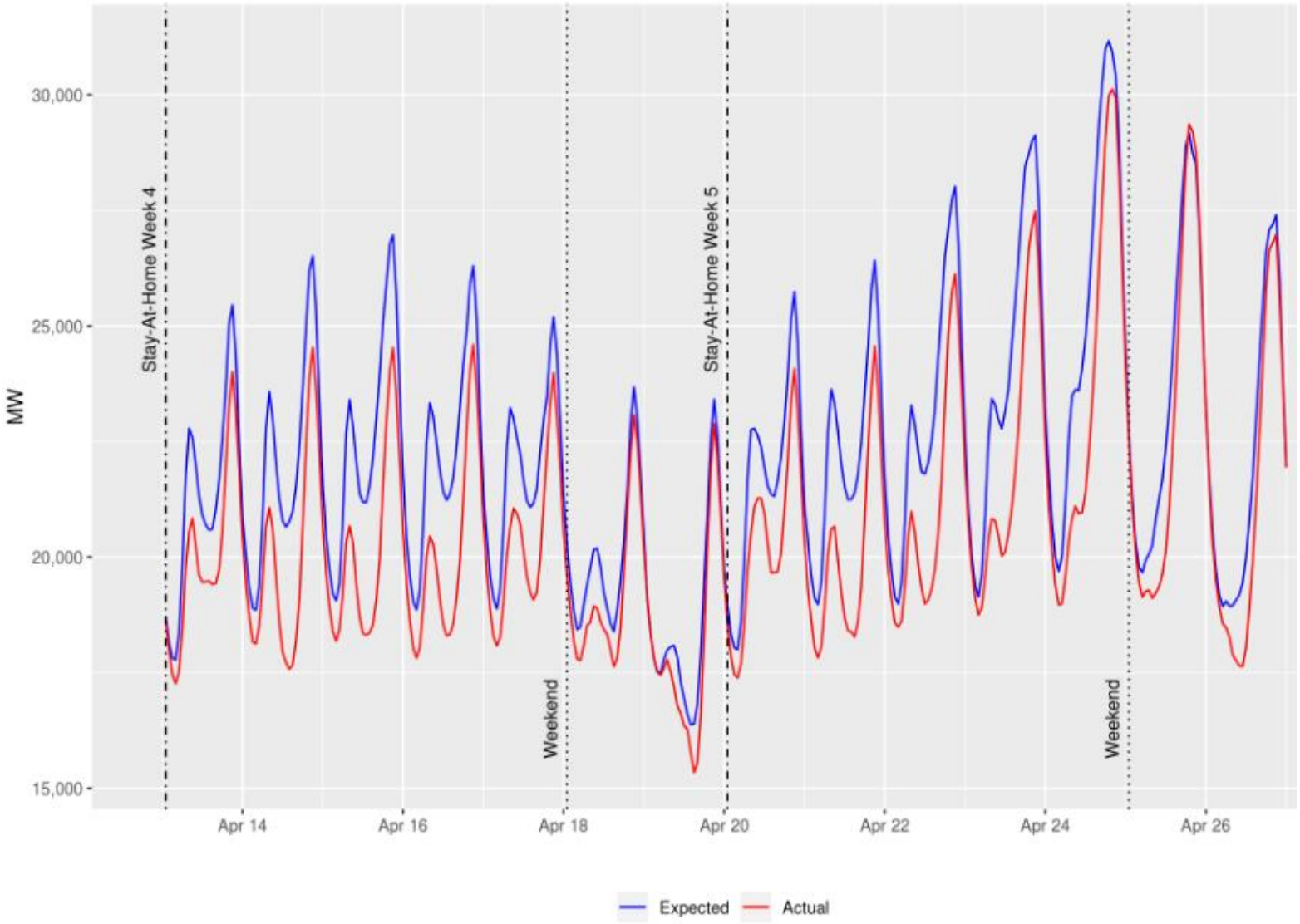
Weather Adjusted: System impact March 20 - March 29



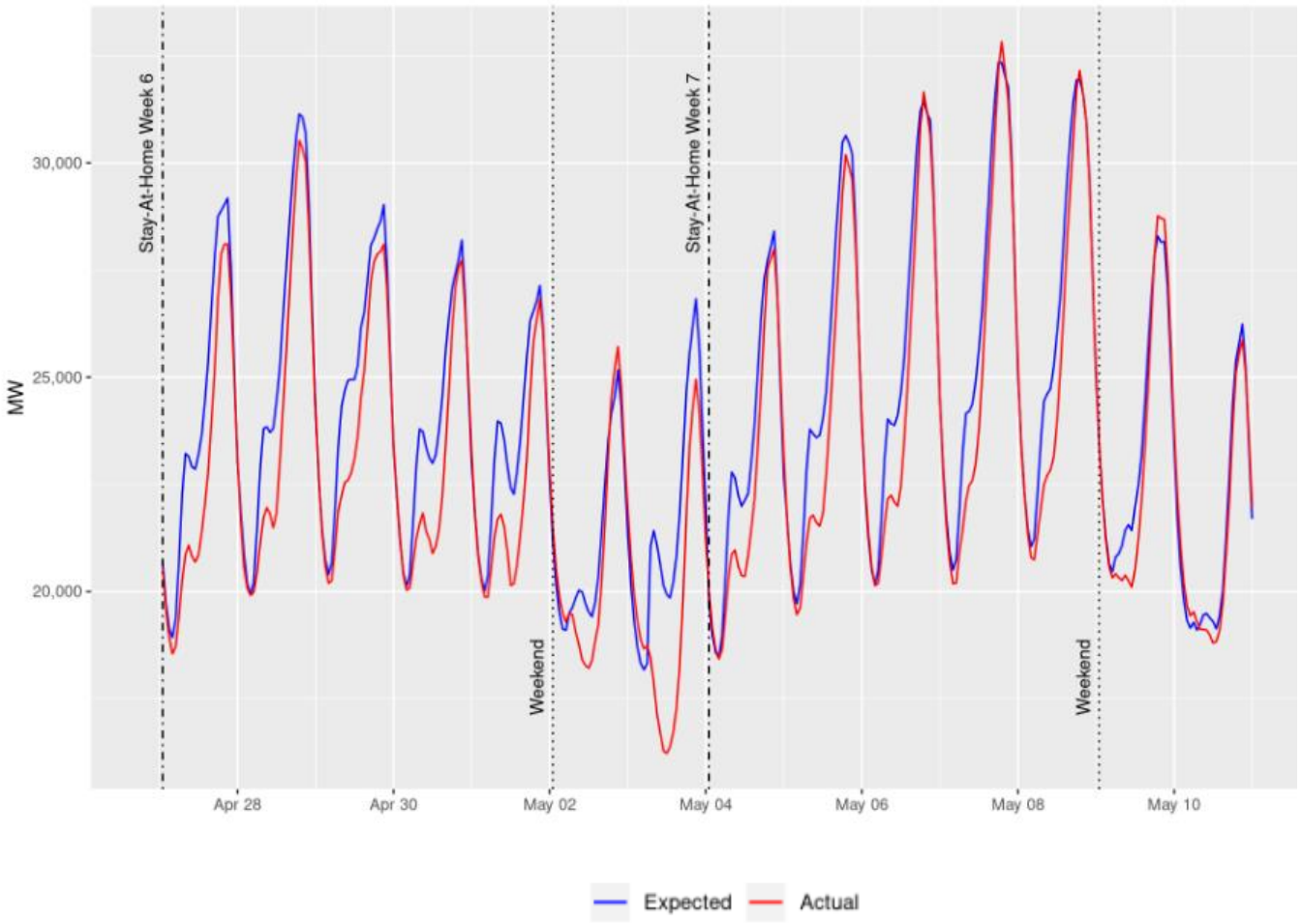
Weather Adjusted: System impact March 30 – April 12



Weather Adjusted: System impact April 13 – April 26



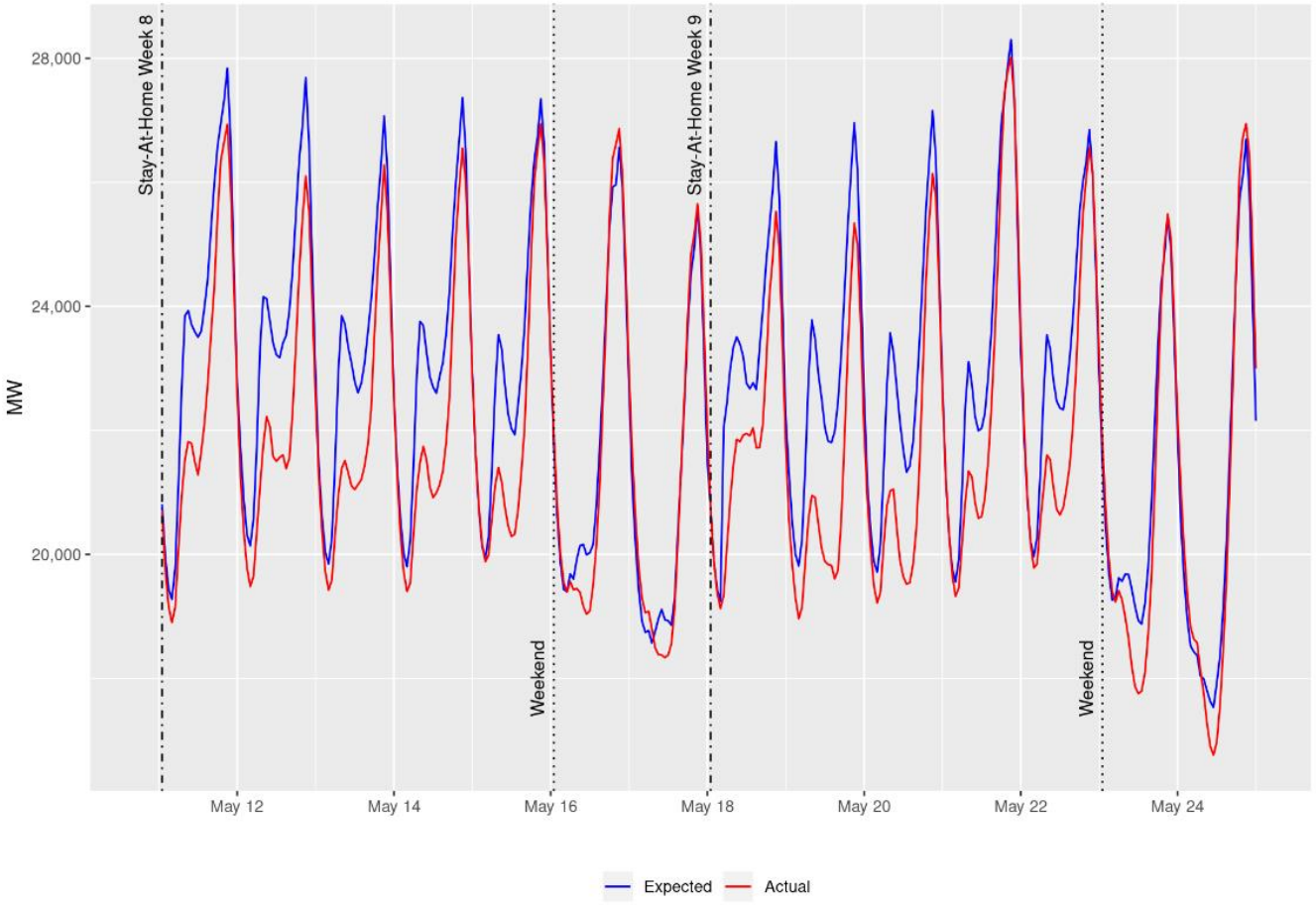
Weather Adjusted: System impact April 27 – May 10



Above-normal temperatures were experienced system-wide May 4 – 10. During the heat, minimal to no load reductions were observed for the evening peak, compared to pre-COVID-19 orders.

The ISO continues to see the most significant reductions to load during the morning and mid-day hours.

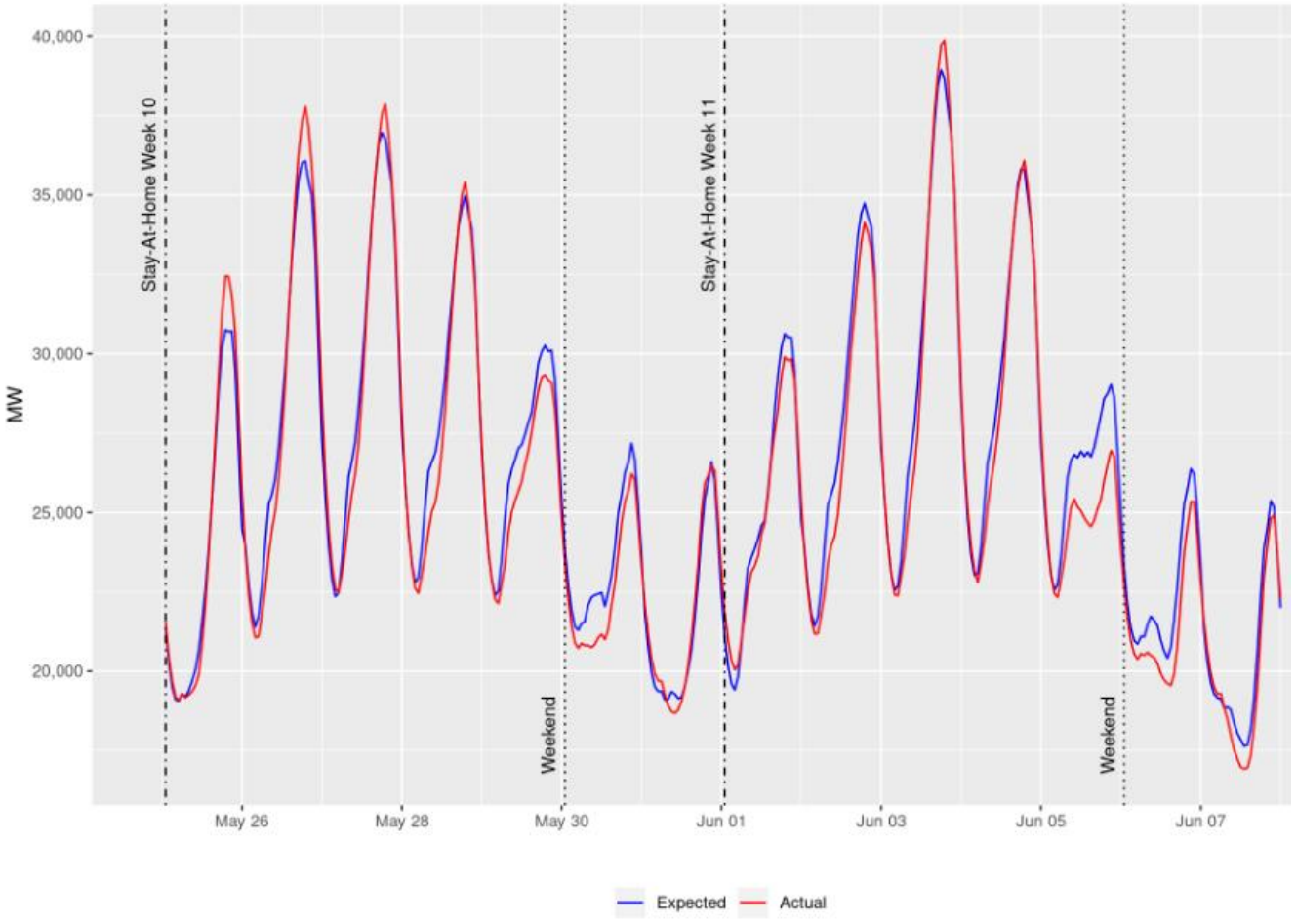
Weather Adjusted: System impact May 11 – May 24



The ISO continues to observe that during days with warmer temperatures, minimal to no load reductions were observed for the evening peak, compared to pre-COVID-19 orders.

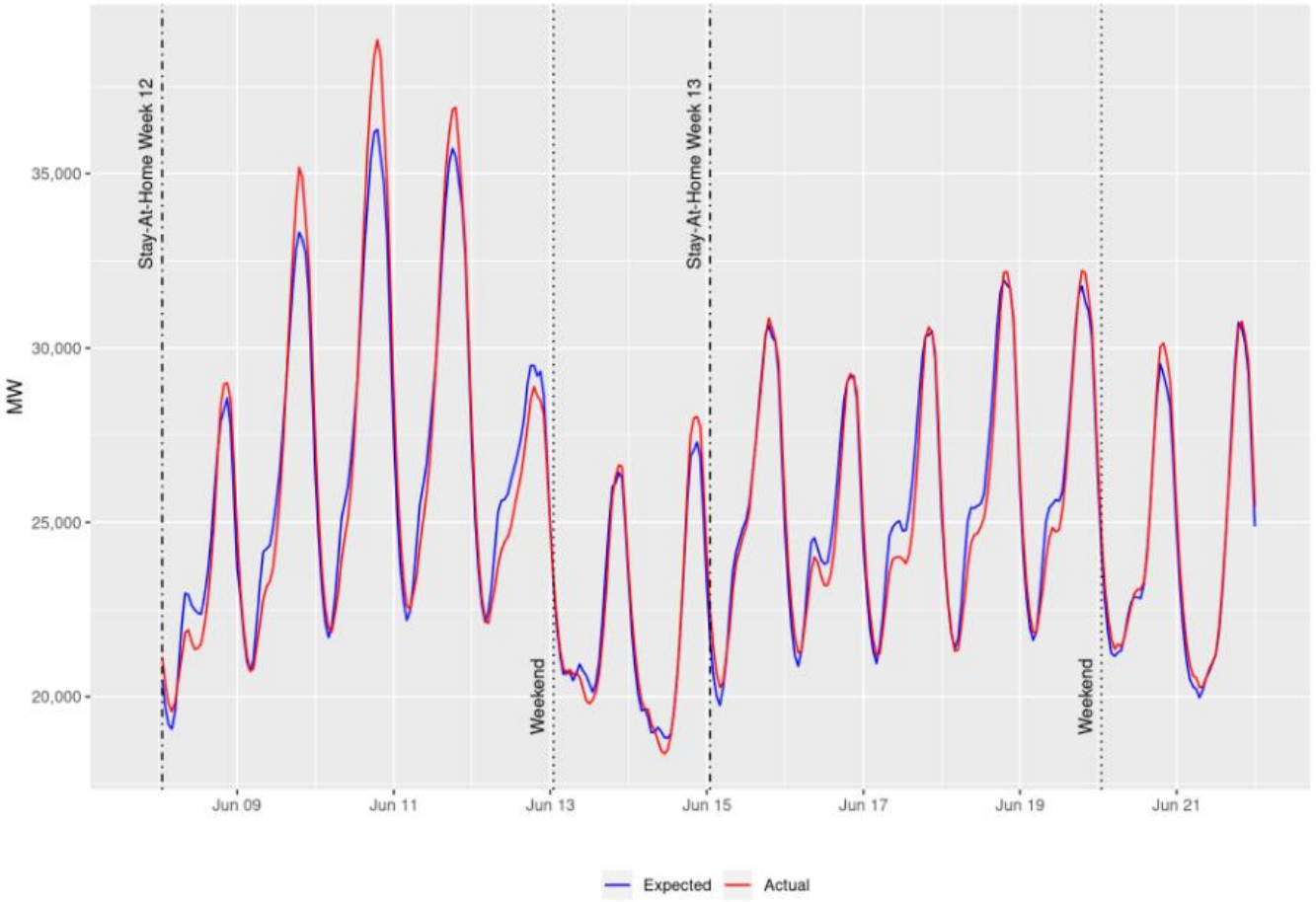
During the month of May, the ISO continues to see the most significant percent reductions to load during the morning and mid-day hours.

Weather Adjusted: System impact May 25 – June 7



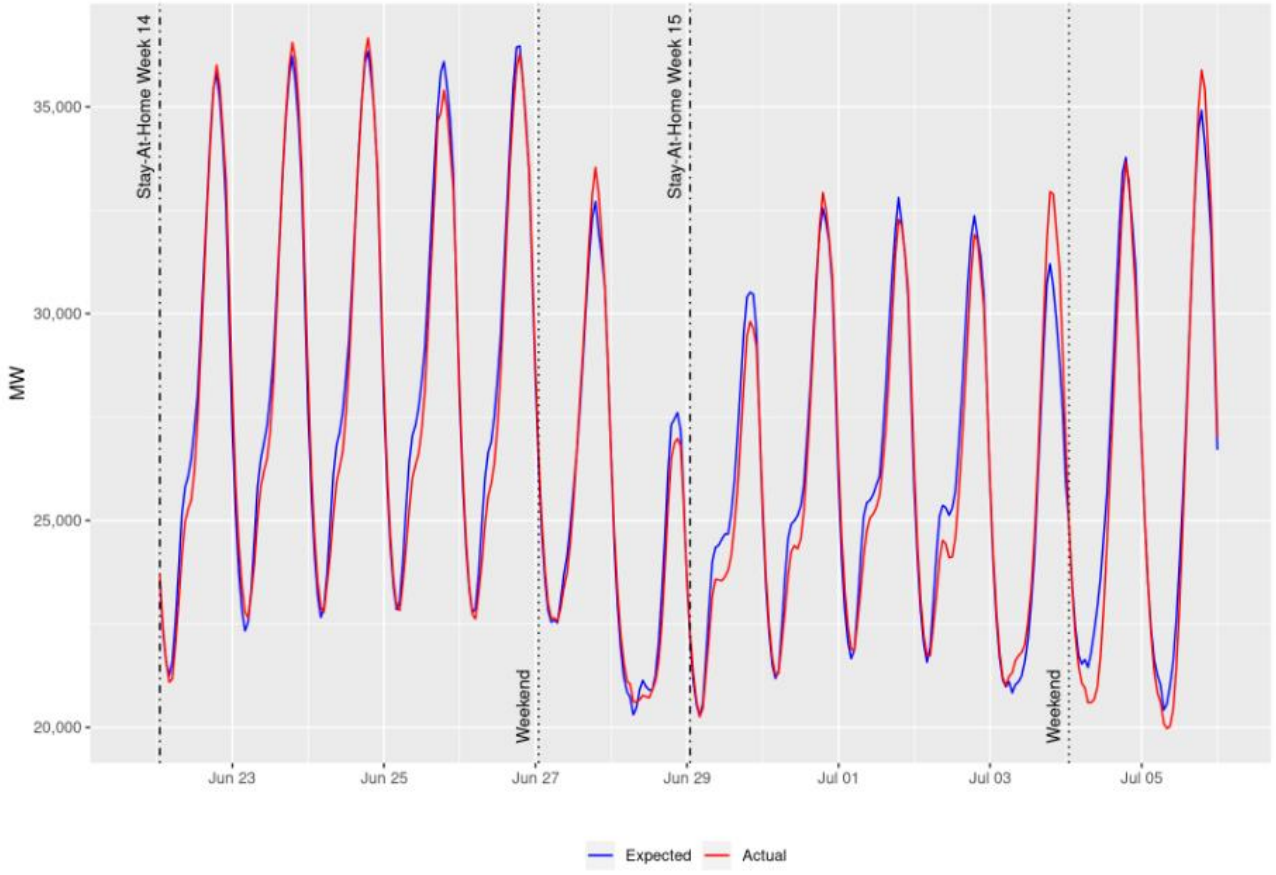
The ISO continues to observe that during days with warmer temperatures, minimal to no load reductions were observed for the evening ramp and peak, compared to pre-COVID-19 orders.

Weather Adjusted: System impact June 8 – June 21



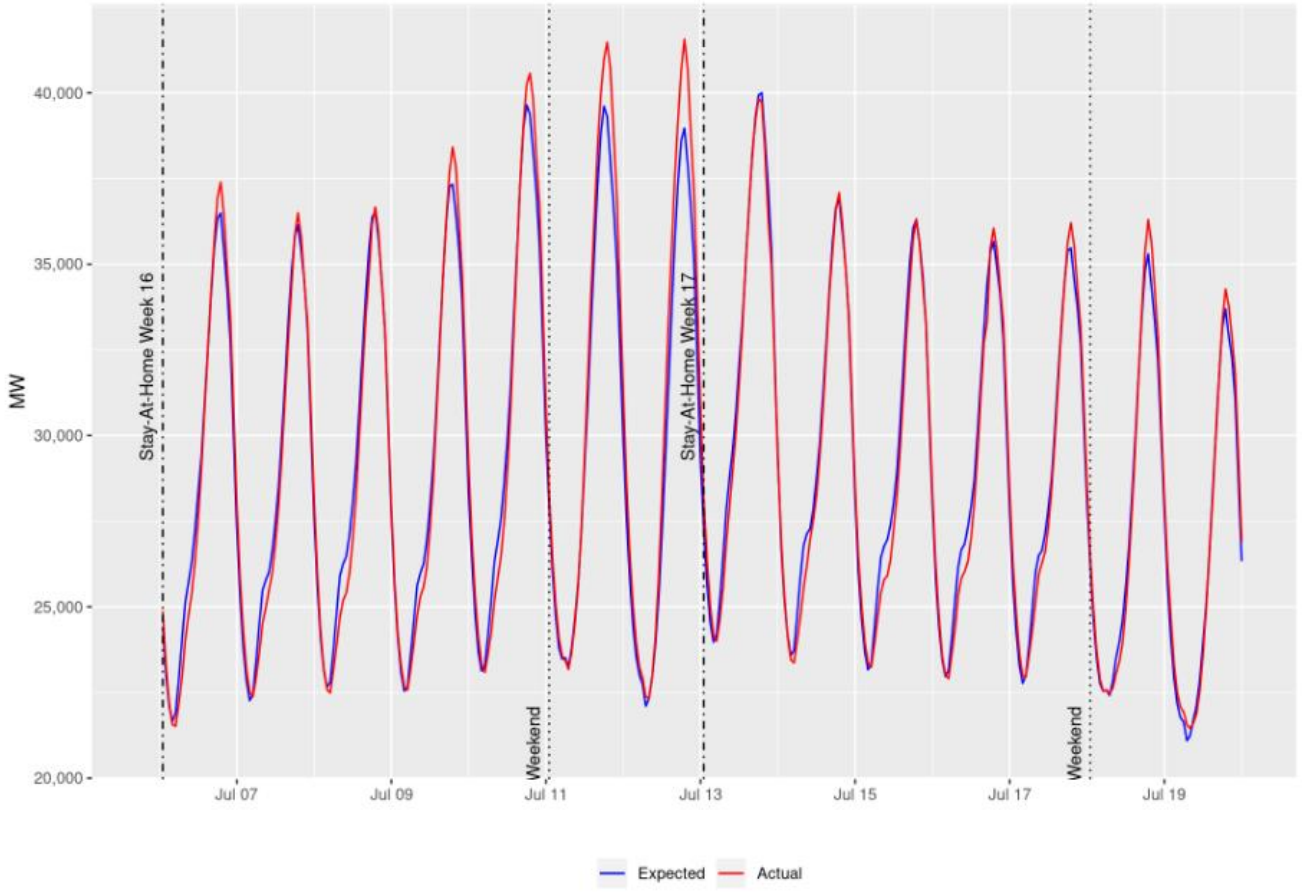
The ISO continues to observe that during days with warmer temperatures, minimal to no load reductions were observed for the evening ramp and peak, compared to pre-COVID-19 orders.

Weather Adjusted: System impact June 22 – July 5



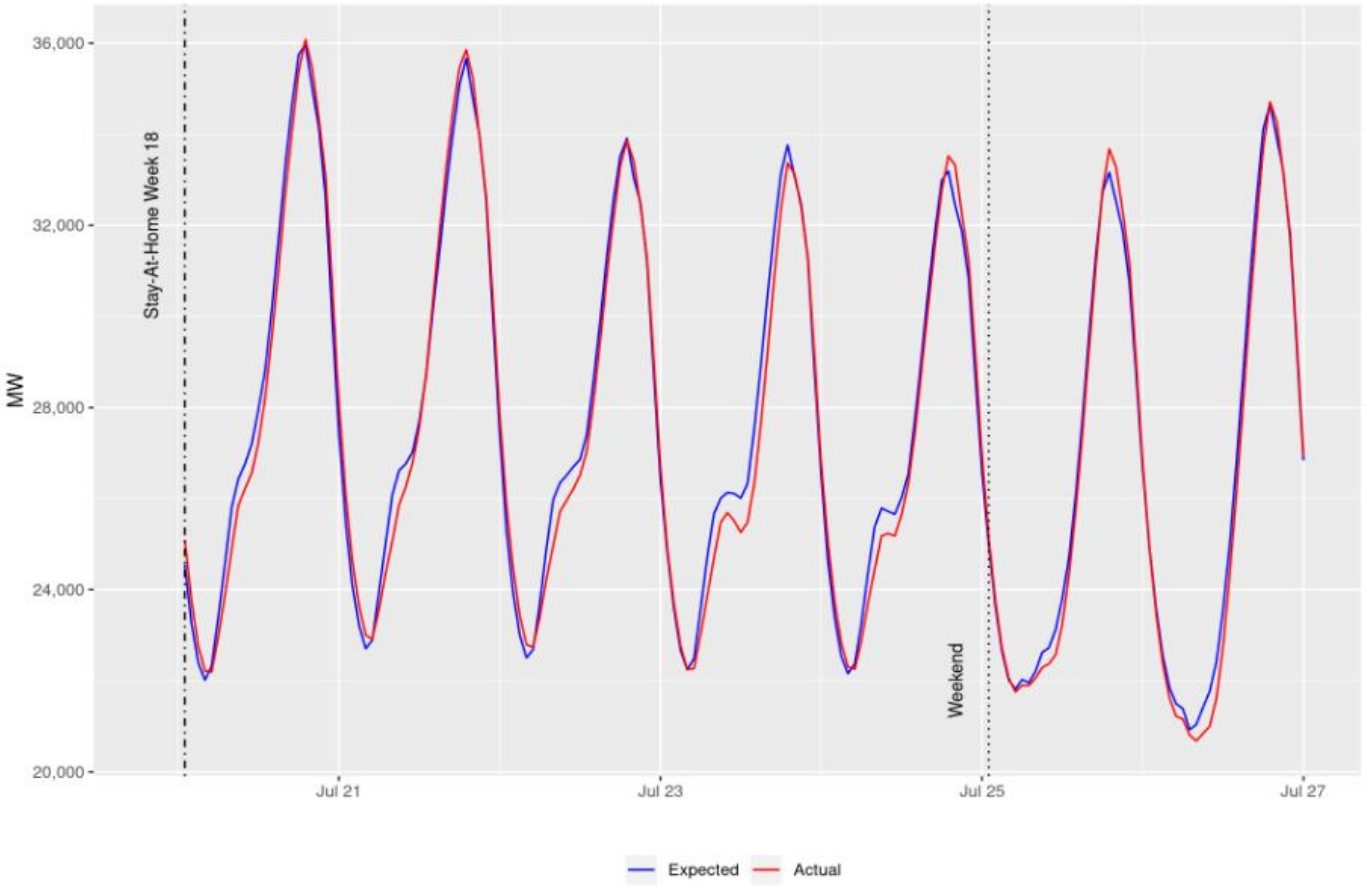
Thus far, during the month of July, the ISO observes minimal to no load reductions compared to pre-COVID-19 orders.

Weather Adjusted: System impact July 6– July 19



During the month of July, the ISO observes minimal to no load reductions compared to pre-COVID-19 orders.

Weather Adjusted: System impact July 20– July 26



During the month of July, the ISO observes minimal to no load reductions compared to pre-COVID-19 orders.

Summary of system impact: March 23 – July 26

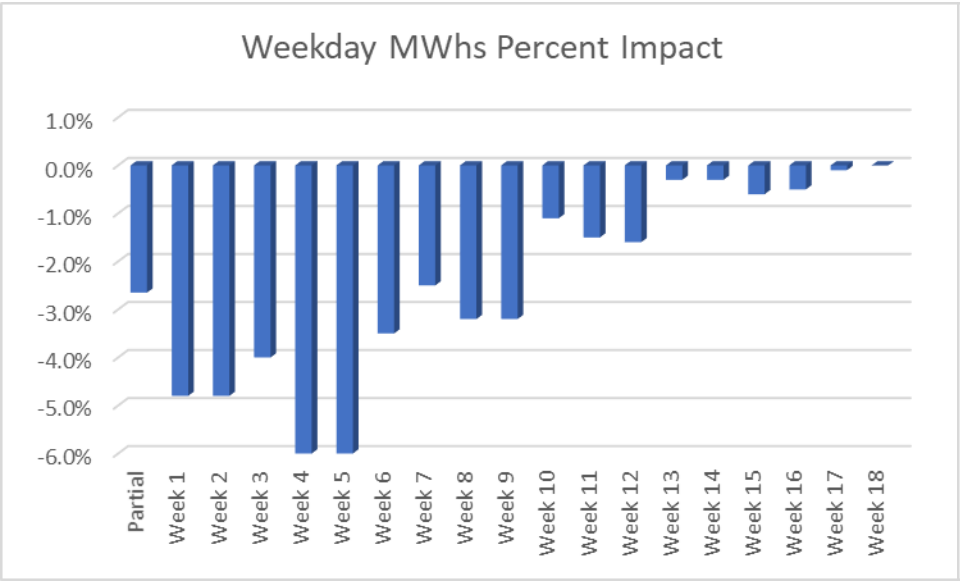
Day Type	Peak	MW Impact	MW Percent Impact
Weekday	Morning	-1,254	-5%
Weekday	Evening	-704	-2.9%
Weekend	Morning	-395	-1.9%
Weekend	Evening	-238	-1.1%

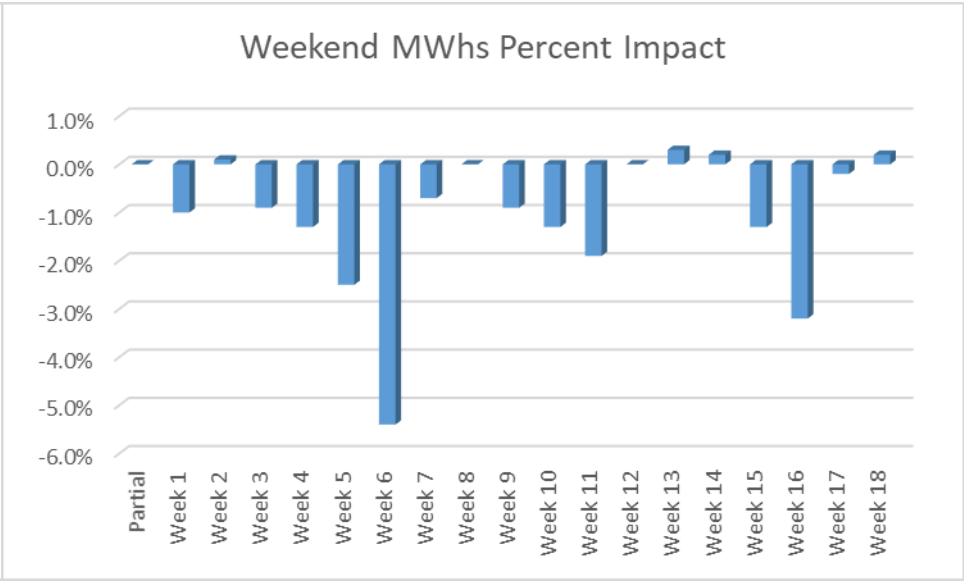
Day Type	MWhs Impact	MWhs Percent Impact
Weekday	-13,783	-2.4%
Weekend	-5,612	-1.1%

Numbers Show an Overall Reduction

The stay-at-home order began on Friday, March 20; our summary begins at the first full week beginning Monday, March 23. For details of impact during the partial stay-at-home orders, see next slide.

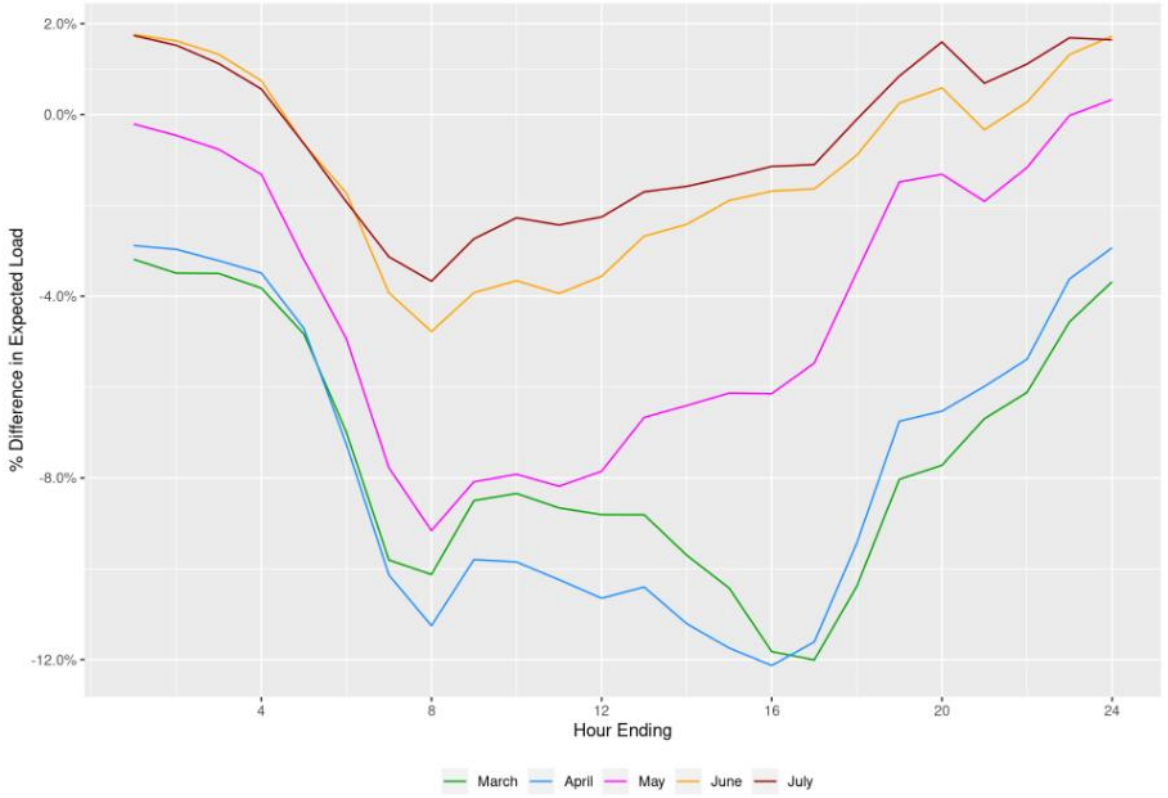
Average daily energy system impact due to COVID-19





The stay-at-home order began on Friday, March 20; our summary begins at the first full week beginning Monday, March 23.

Average weekday hourly percent difference in expected load due to COVID-19



Numbers Show an Overall Reduction

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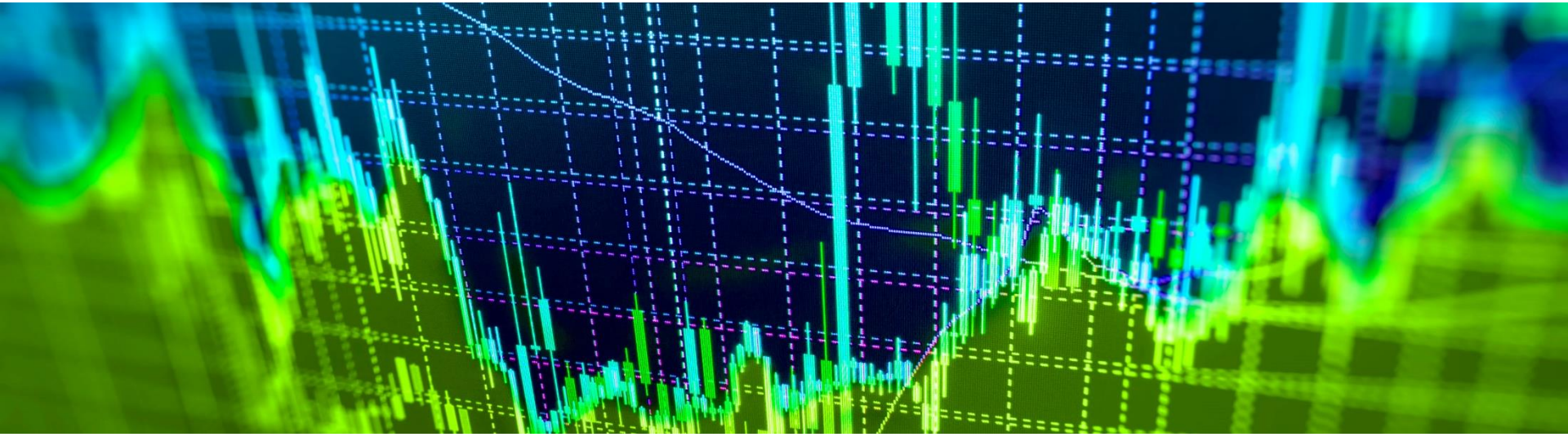
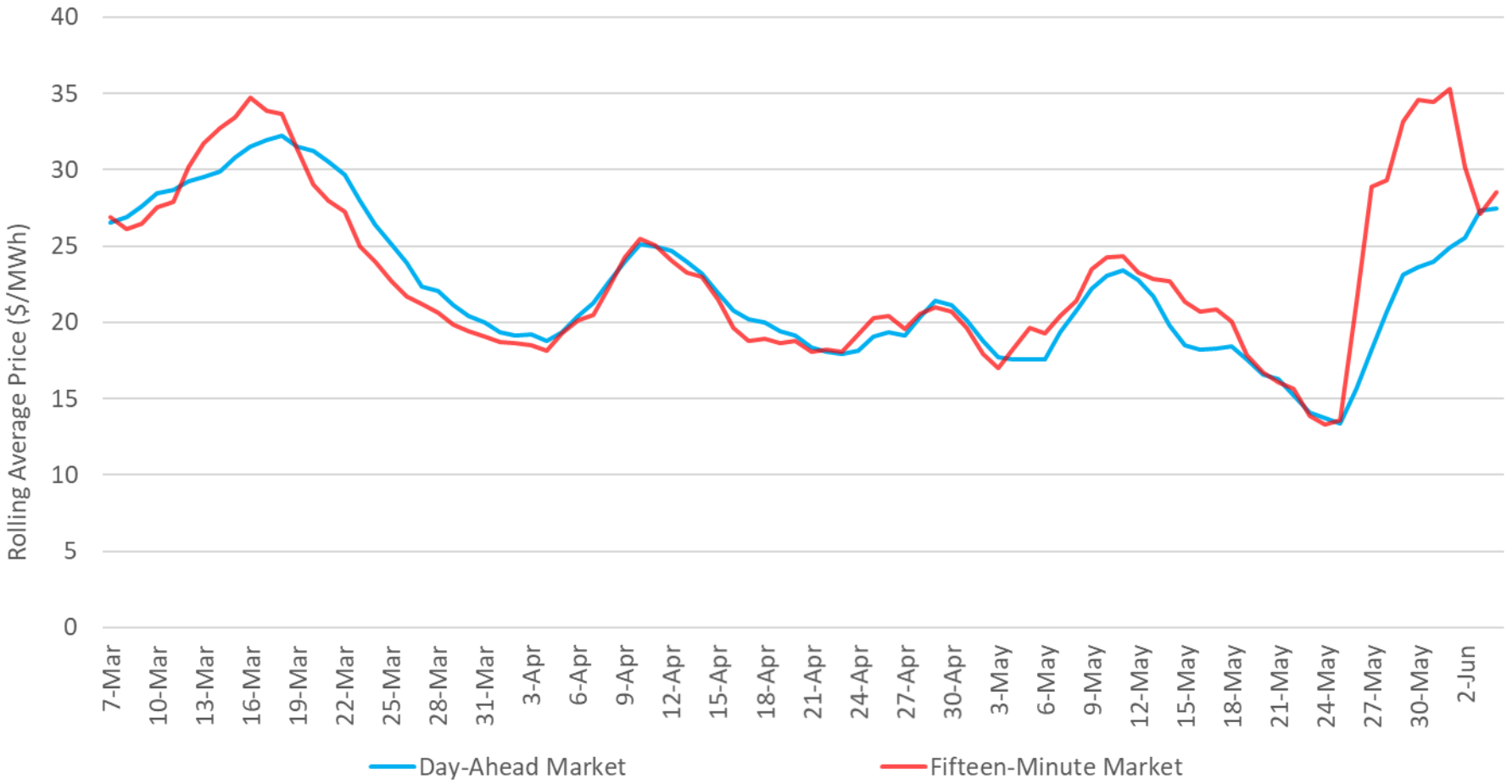


Market analysis and forecasting

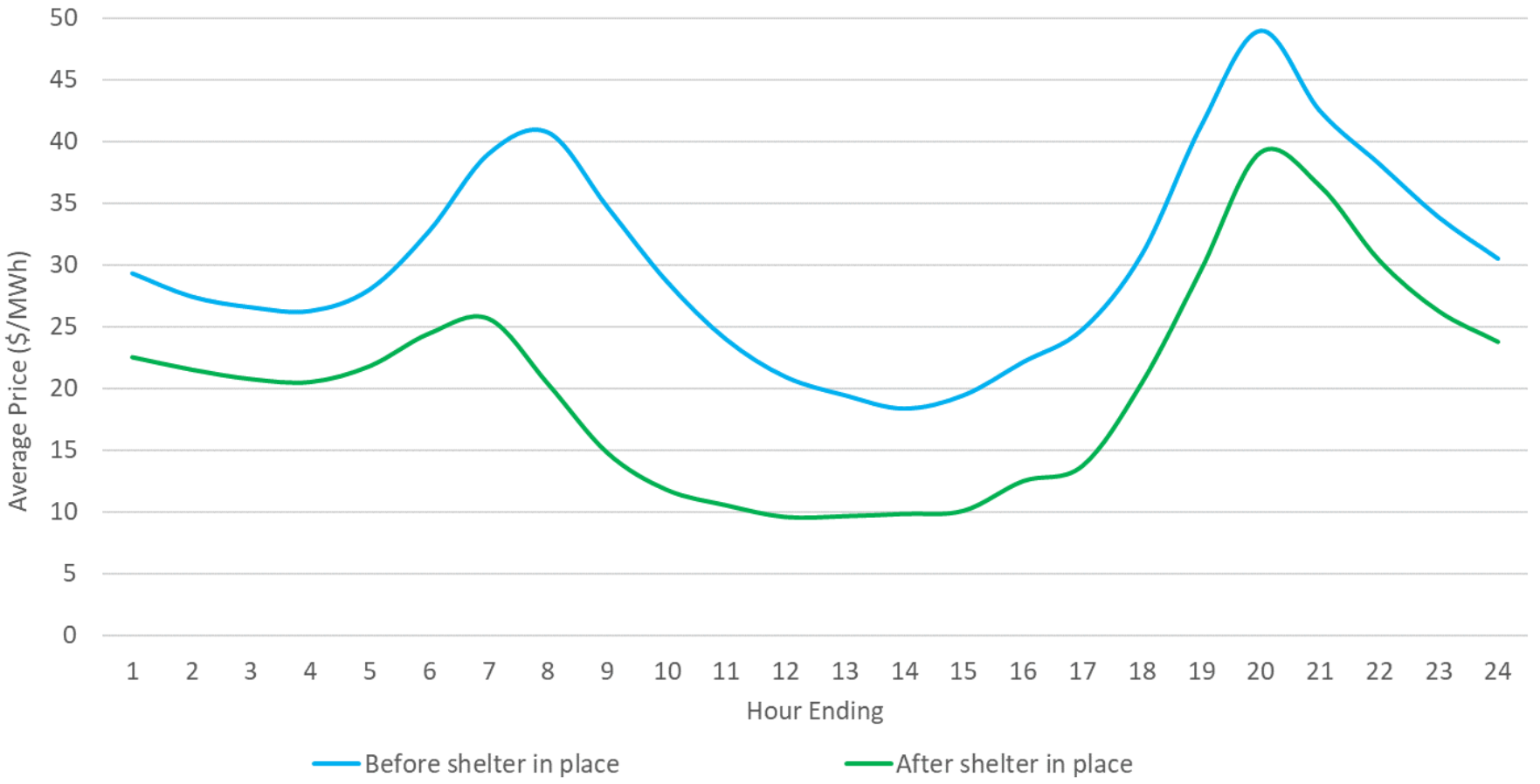
Price impact: COVID-19

March 7 – June 2, 2020

Energy prices trended downward with the shelter-in-place provisions, then increased due to high loads

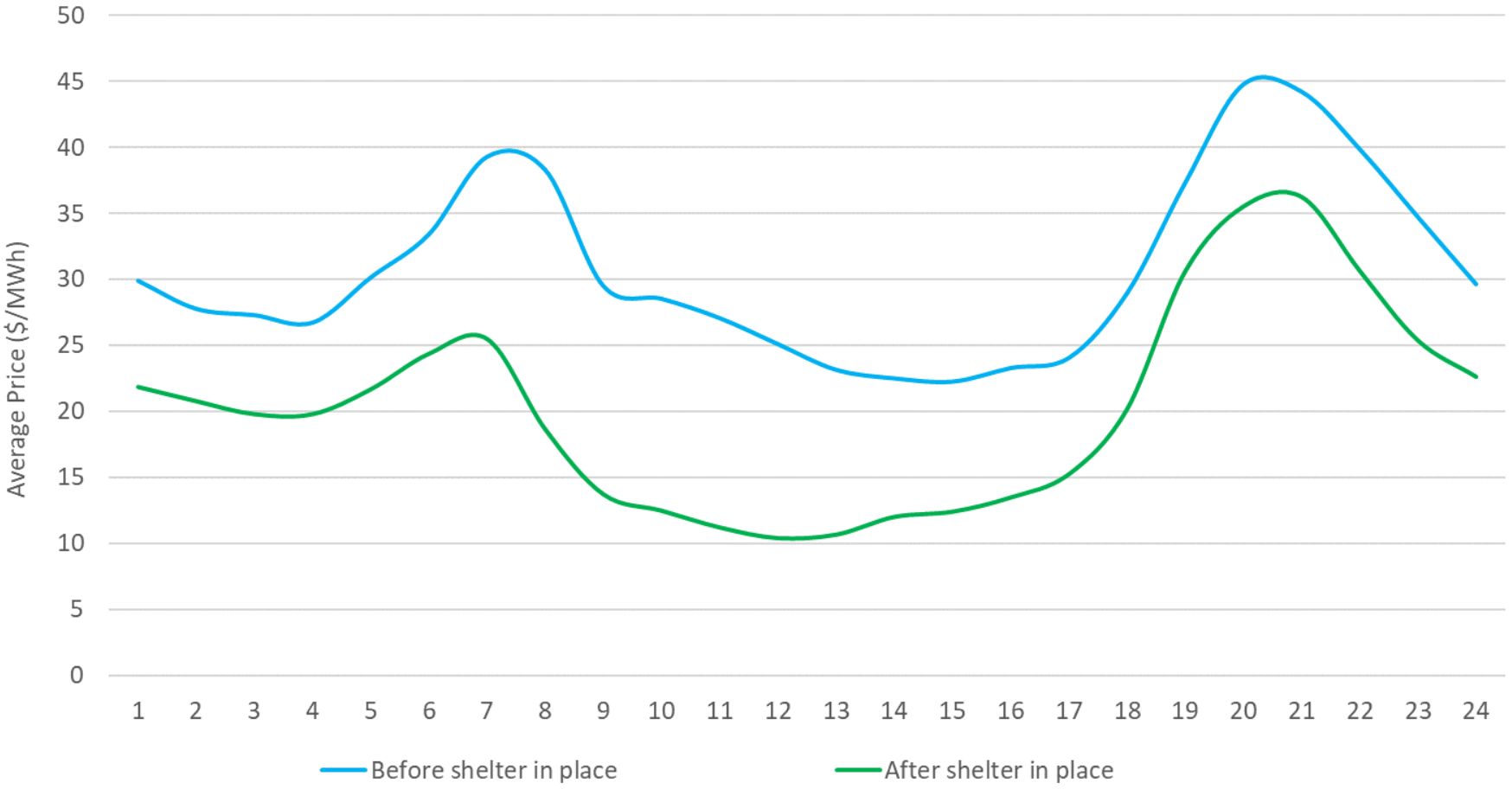


Day-ahead energy prices reduced on average about $10/MWh in the period of the shelter-in-place provisions



Data covers up to May 21. With higher loads since the last two weeks of May, prices have increased accordingly and there is no longer a relative comparison to assess any impacts.

Fifteen-minute energy prices reduced on average about $10/MWh in the period of the shelter-in-place provisions



Data covers up to May 21. With higher loads since the last two weeks of May, prices have increased accordingly and there is no longer a relative comparison to assess any impacts.