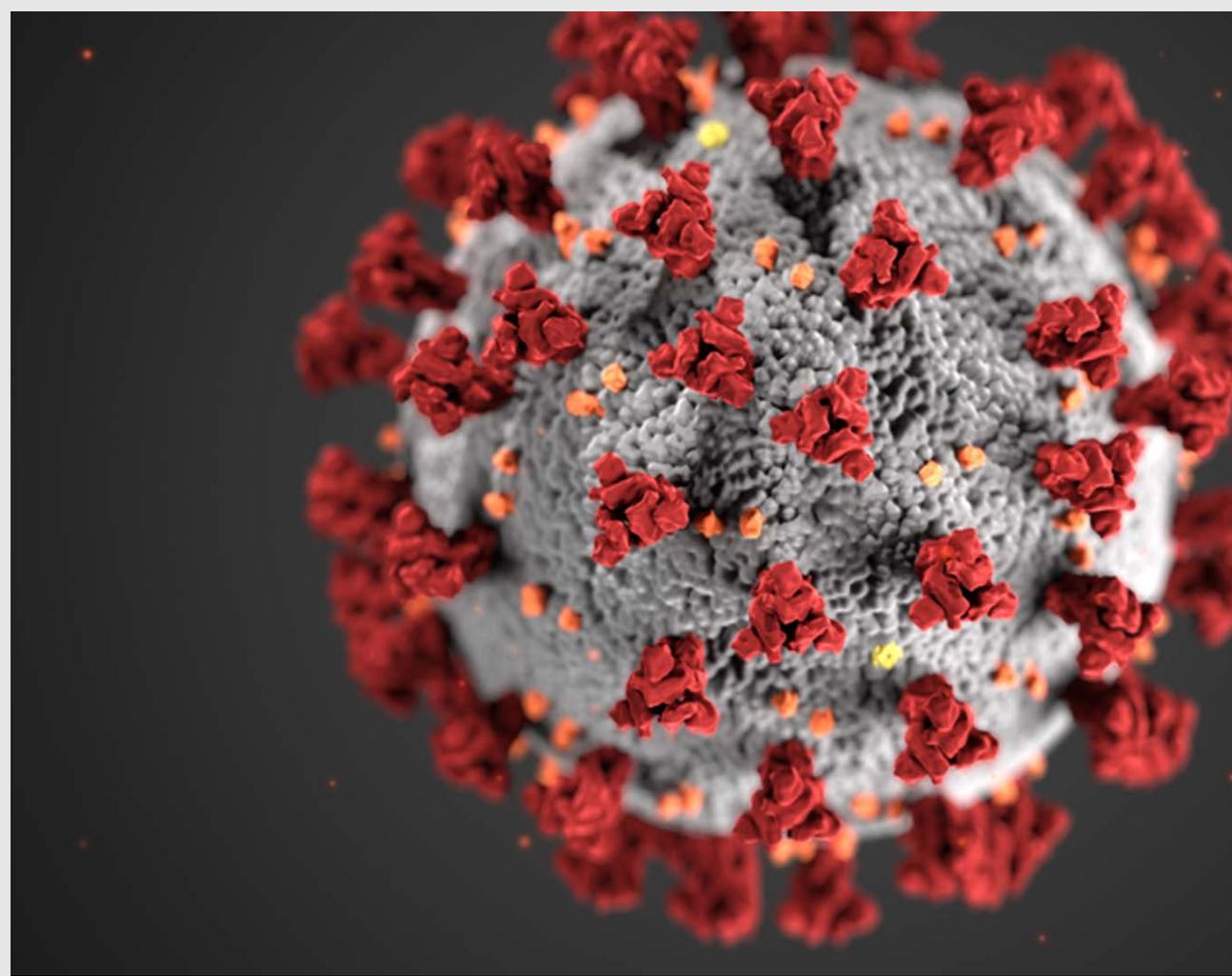


Evaluating Impacts of Covid- 19 on Electricity Demand for Humboldt County

Erick Eschker, Will Fisher and Liam
O'Brien

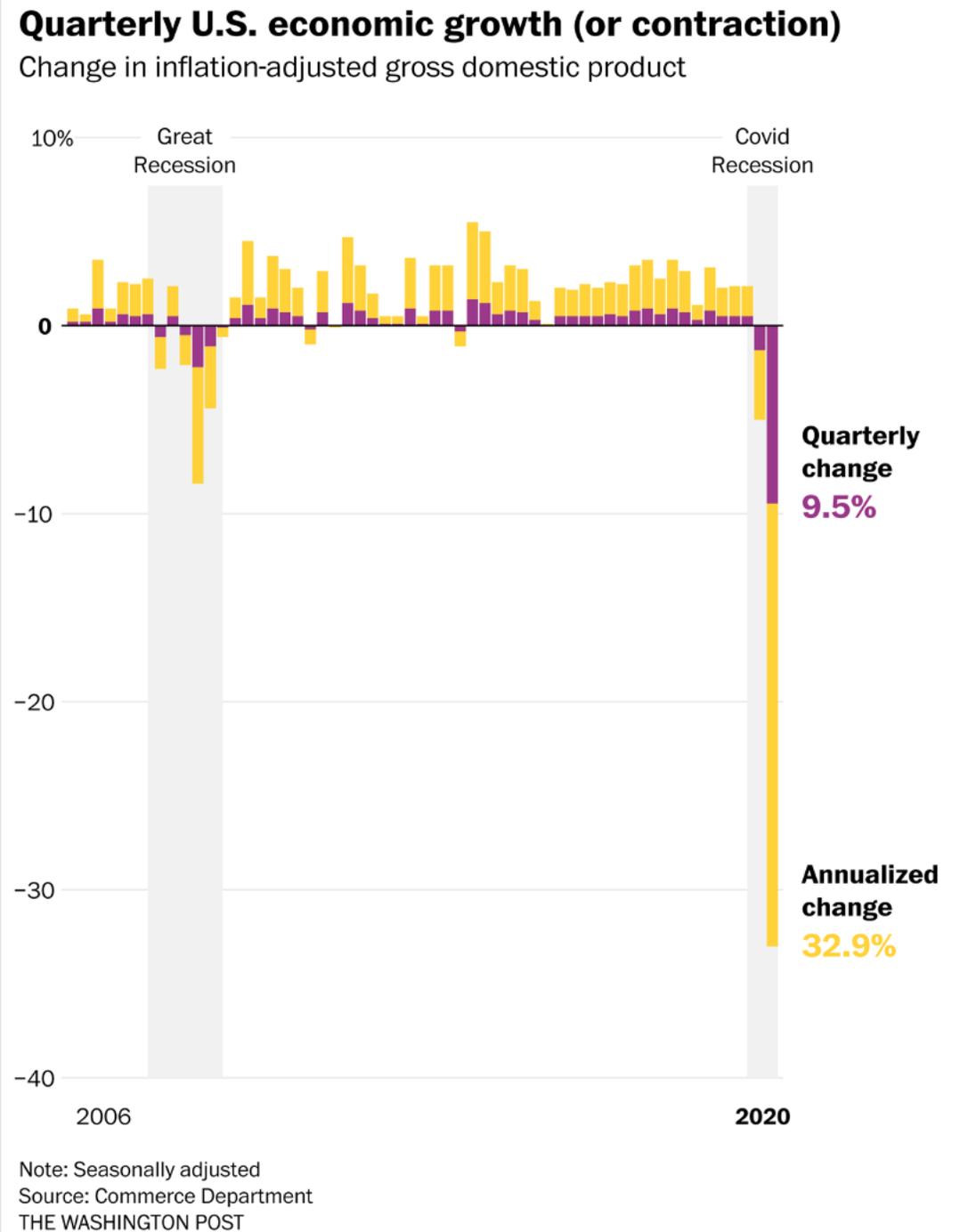
**Department of Economics
Humboldt State University**



October 20, 2020

Major Economic Impacts

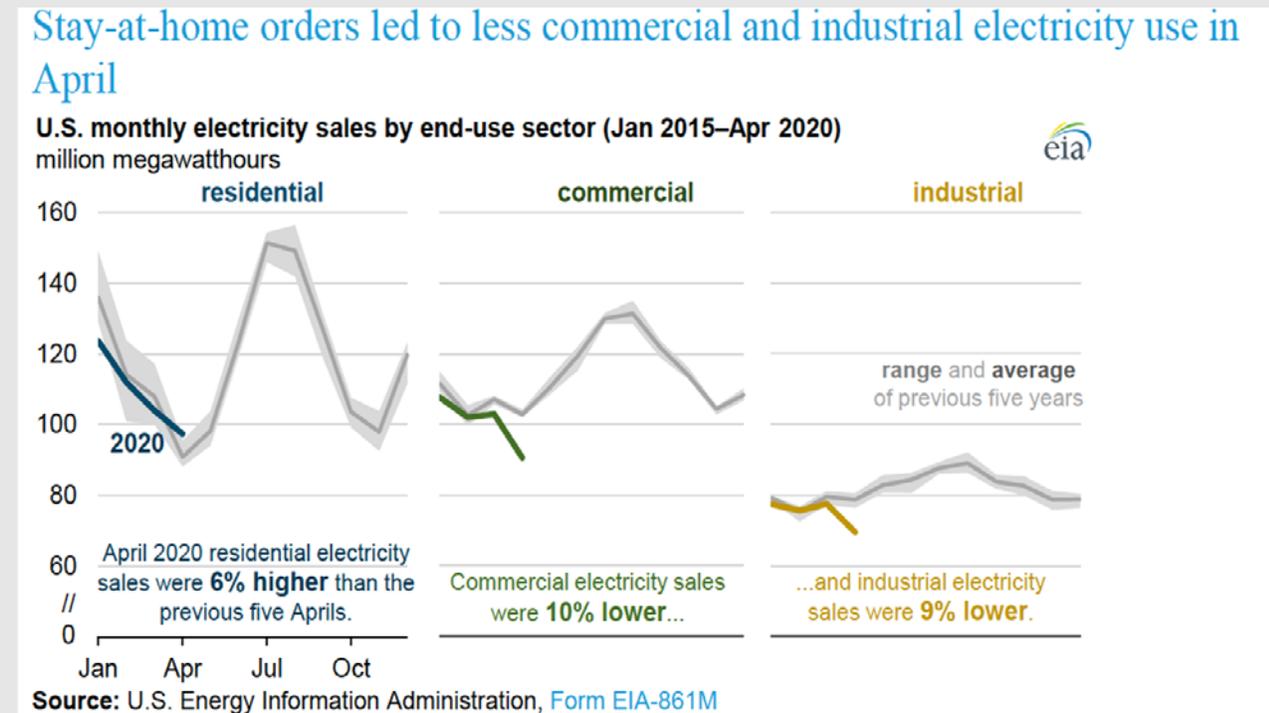
- Shutdown Orders forced non-essential businesses to close
 - Unemployment rate increase to 14.7% in April
- GDP contracted by 9.5% in Q2 and annualized 32.9%
- Different industries were impacted more than others



Impacts on Load In the U.S.

- Total load decreased
 - Projected to be 4.2% lower than 2019
 - Lowest since 2009

- CAISO March 23rd to May 11th
 - 4.7% weekday reduction
 - 1.7% weekend reduction



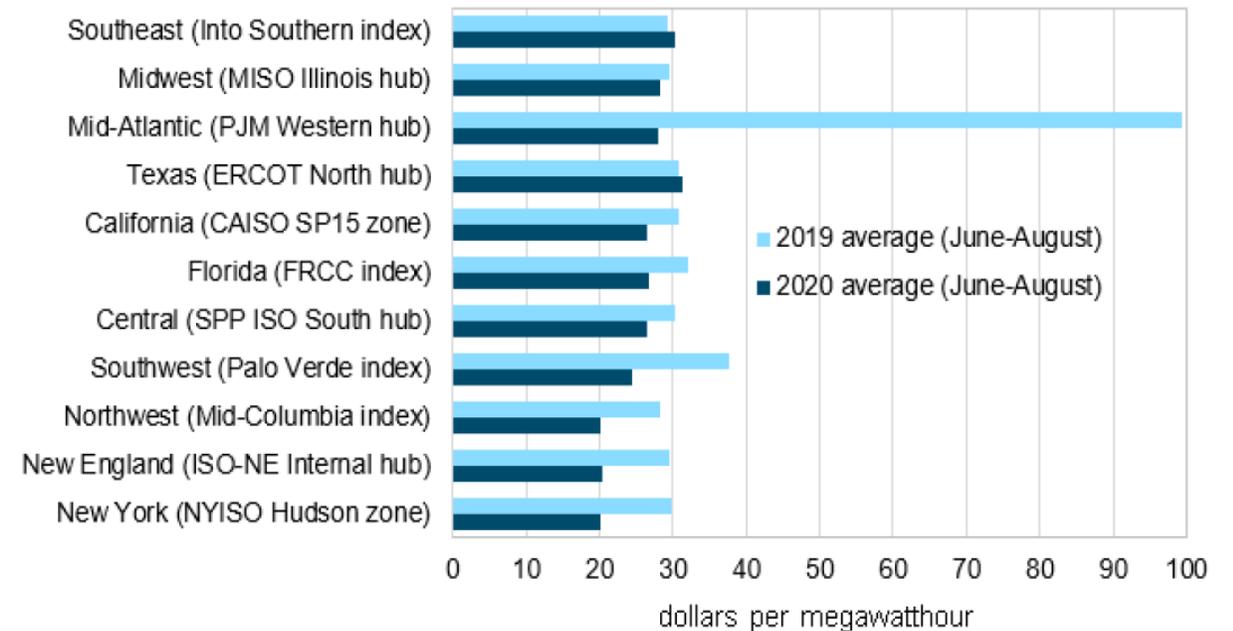
- Residential Load Increased during April
 - 6% from EIA

- Industrial Load (9%) and Commercial Load (10%) were down substantially

Impacts on Prices

- Nationally wholesale prices were down from 2019 following the shutdown
 - Still down from June-August
- CAISO saw \$9-\$10/ MWh reduction during shutdown in day-ahead and real-time markets

Figure 4. Average peak-hour wholesale electricity prices, summer (June–August) 2019–2020



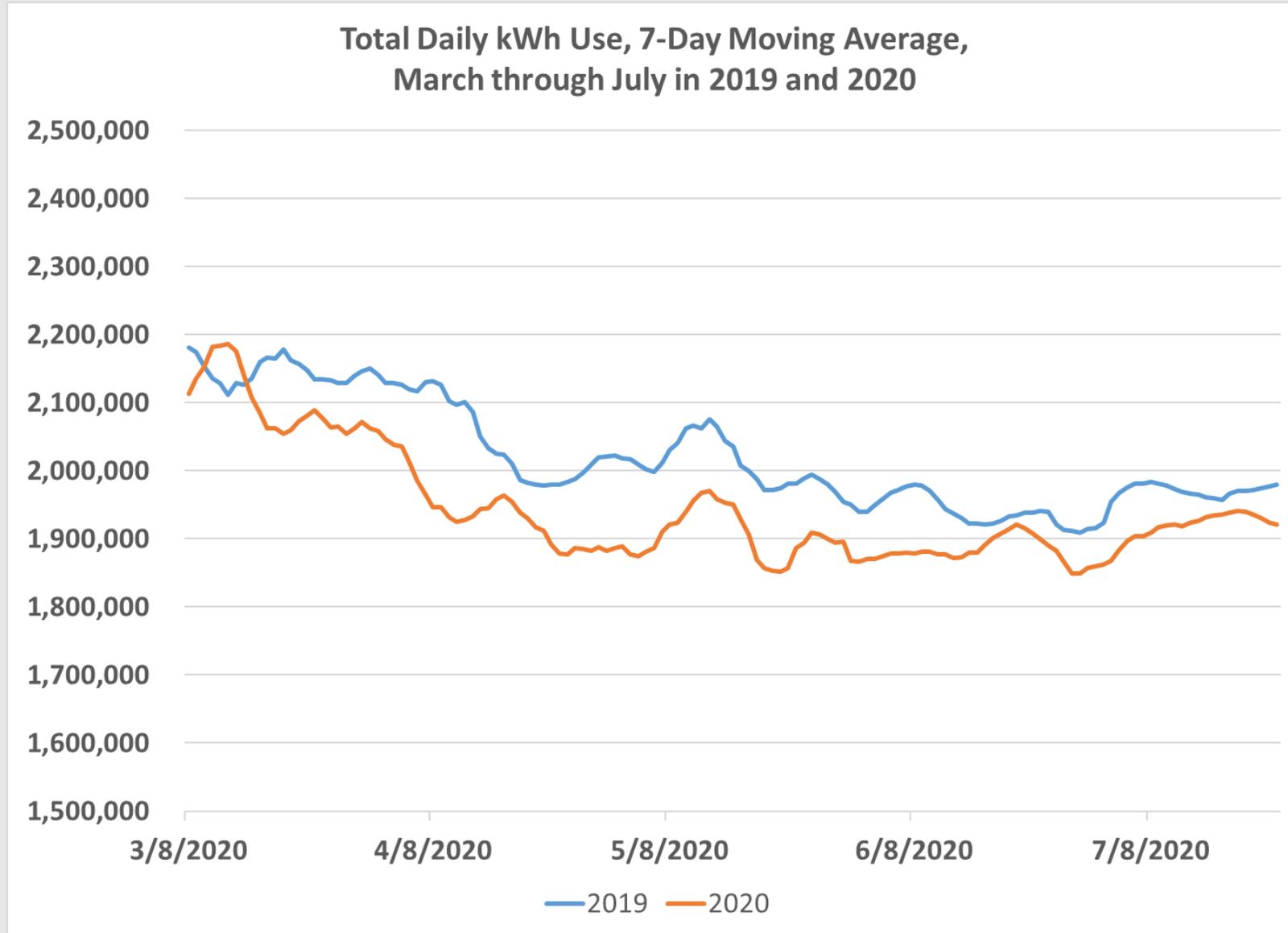
Source: U.S. Energy Information Administration, June 2020 *Short-Term Energy Outlook*

Key Dates in Our Analysis

- March 19th State -Wide Shelter-in -Place order issued by the Governor
 - Only essential businesses are allowed to remain open
- May 8th Some businesses in Humboldt County begin to reopen
- May 28th - June 4th More businesses open
- Analysis of data will see if there is significant change in load resulting from these key dates

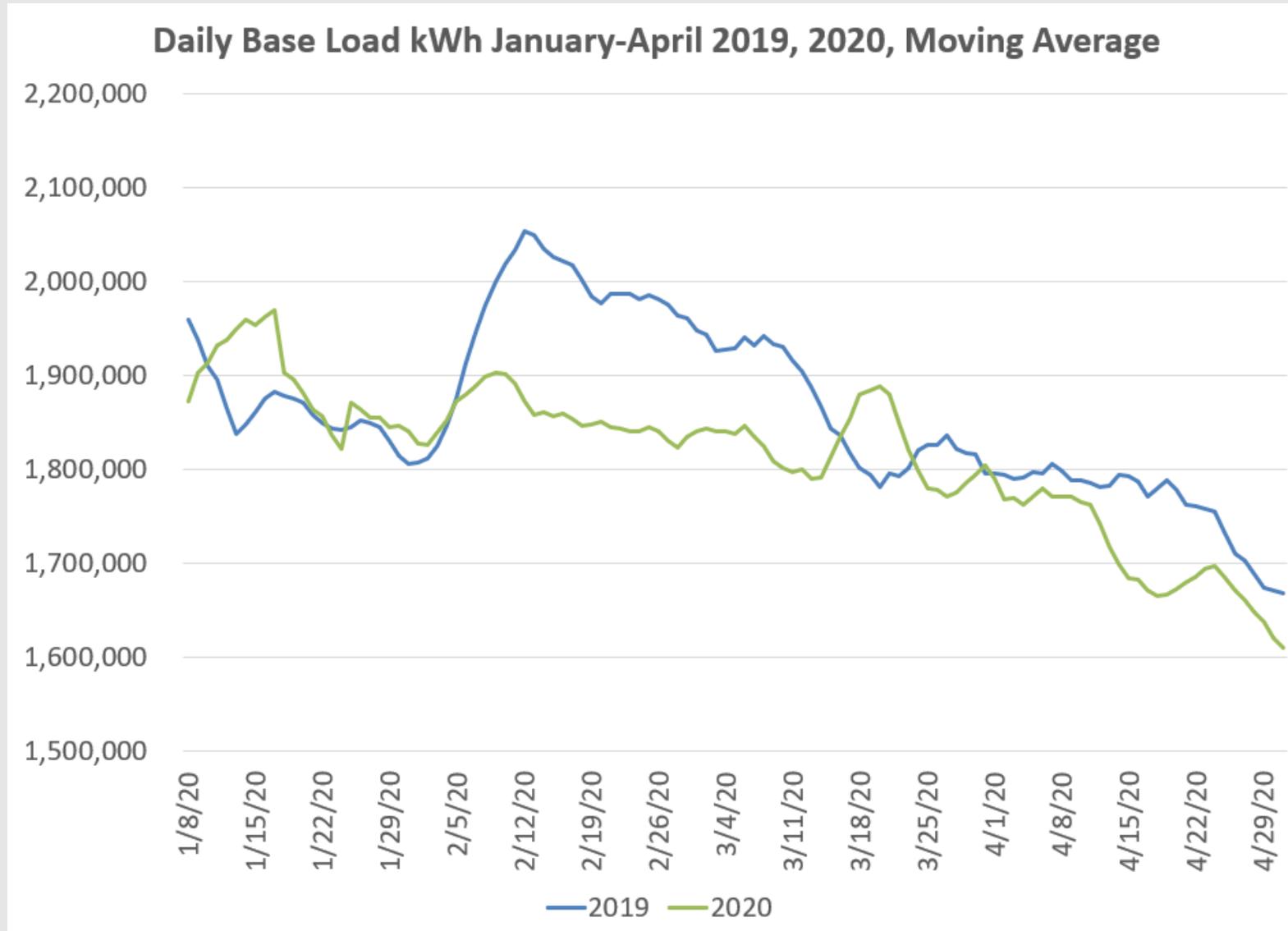
Humboldt County Total Electricity use down during Coronavirus shutdowns

Note: days adjusted to show same day of week



But Humboldt County Total Electricity use down even more in February!

Note: data are not strictly comparable with last slide

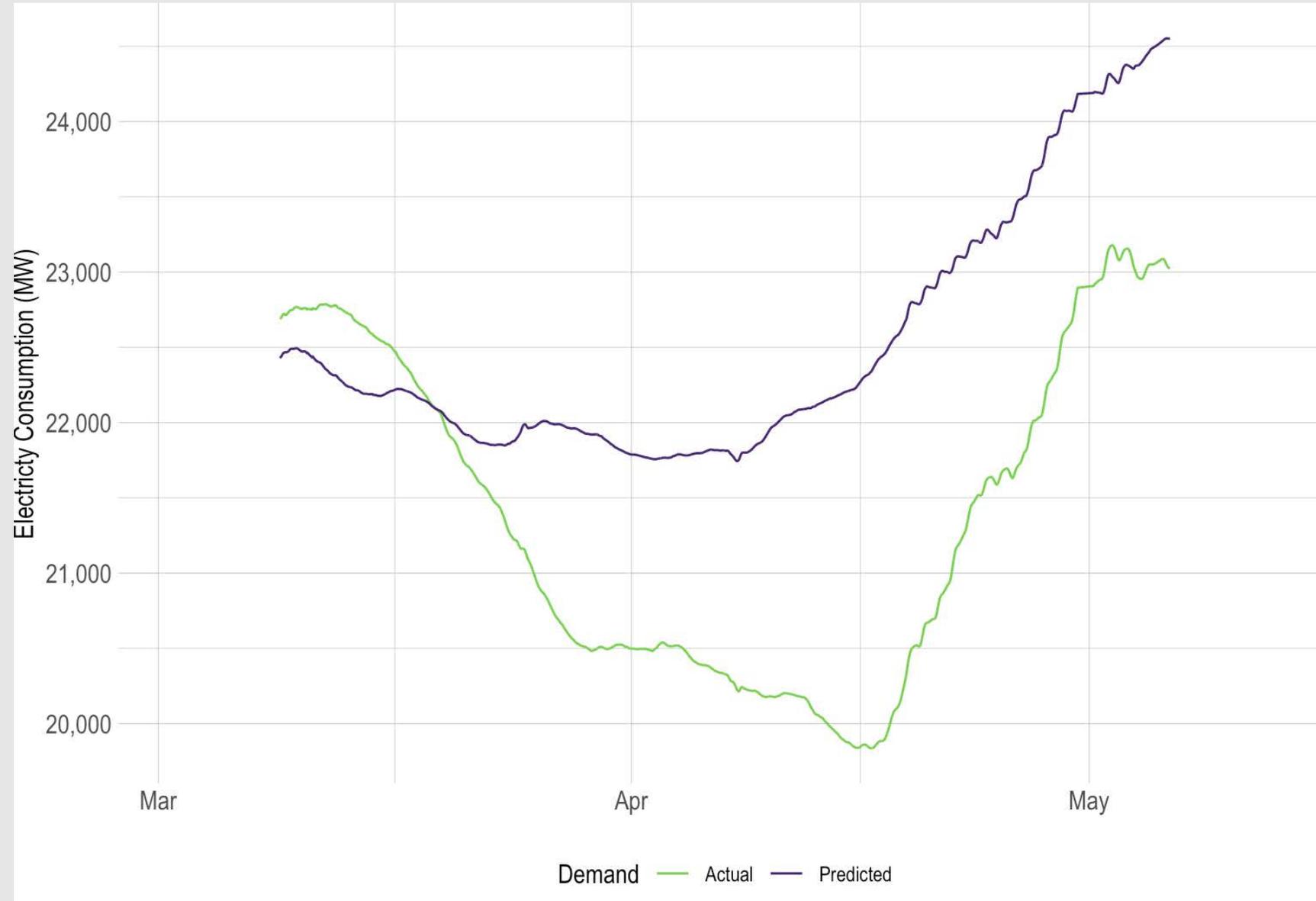


This suggests that we must control for other factors, such as temperature.

From Cal-cca.org

- Electricity demand Predictions in California:
- Highly temperature dependent
- Daily patterns
- Seasonal patterns
- Behind the meter solar is increasing year-on-year

Predicted Demand Versus Actual



Rolling seven-day average

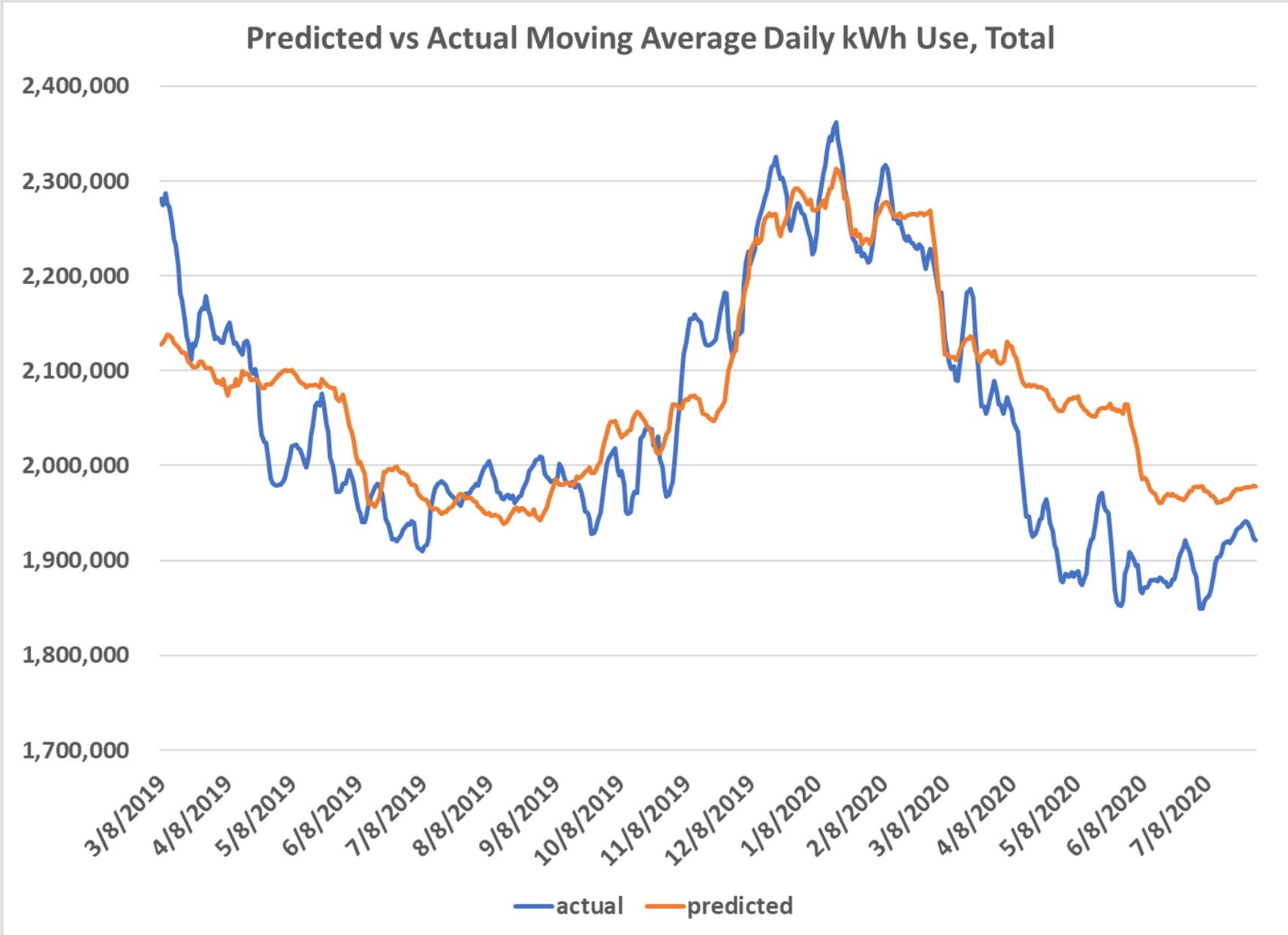
Forecasting Electricity Use in Humboldt County

- Weather
 - Obtained historical weather data 2019, 2020 from NOAA
 - Eureka Woodley Island Station
 - This was more correlated with electricity than Arcata Airport or inland stations
 - Includes daily maximum temp, minimum temp, and whether daily precipitation was 0.5 inches or greater.
- Day of Week
- Season
- Trend
 - This may pick up effect of more solar panels

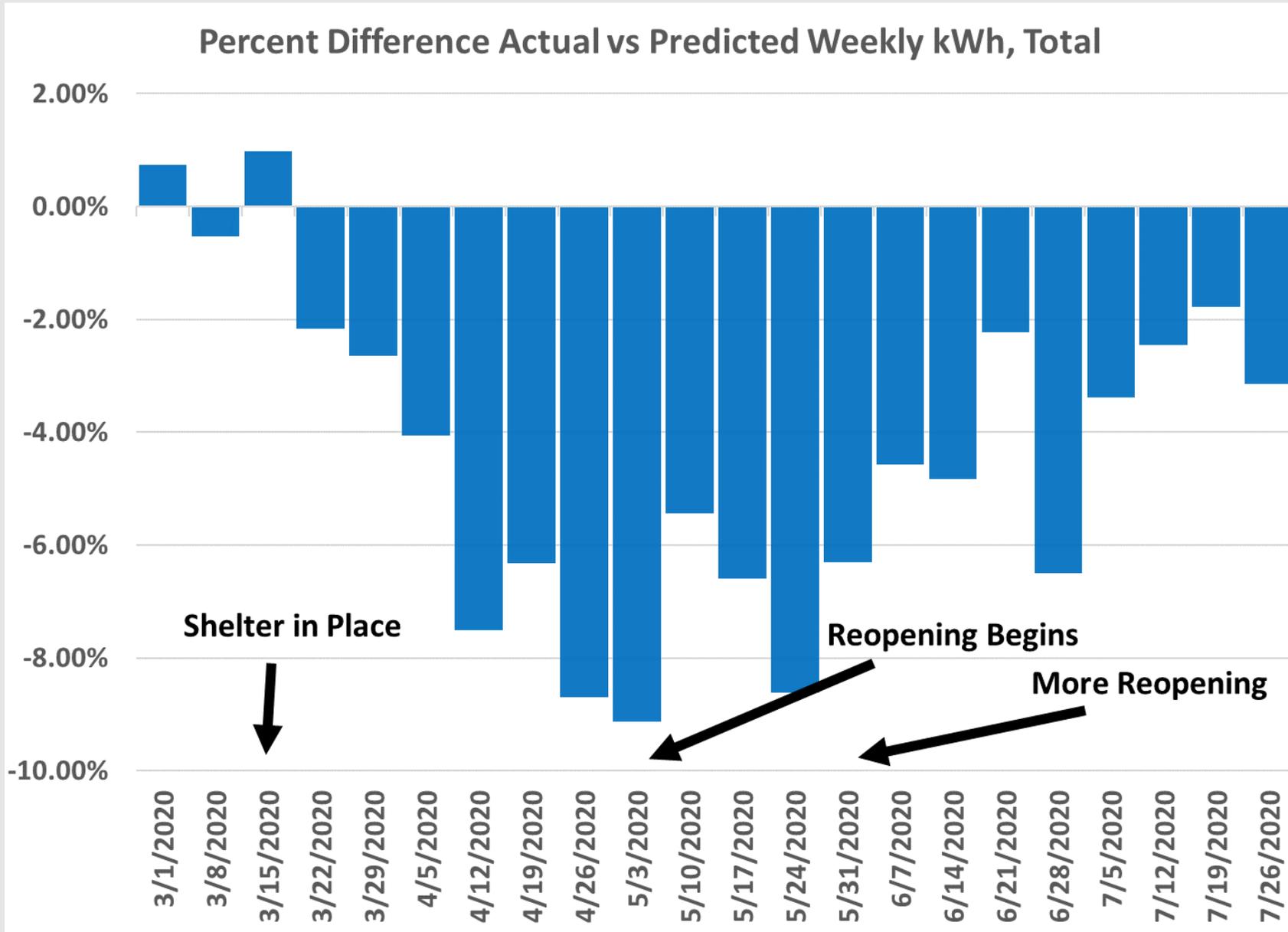
Forecasting Electricity Use in Humboldt County

- The Model was estimated using data from March 2019 to March 2020 to determine “normal” electricity use.
- Predicted electricity use was then calculated during the lockdown March 16, 2020-July 31.

Humboldt County Electricity Use



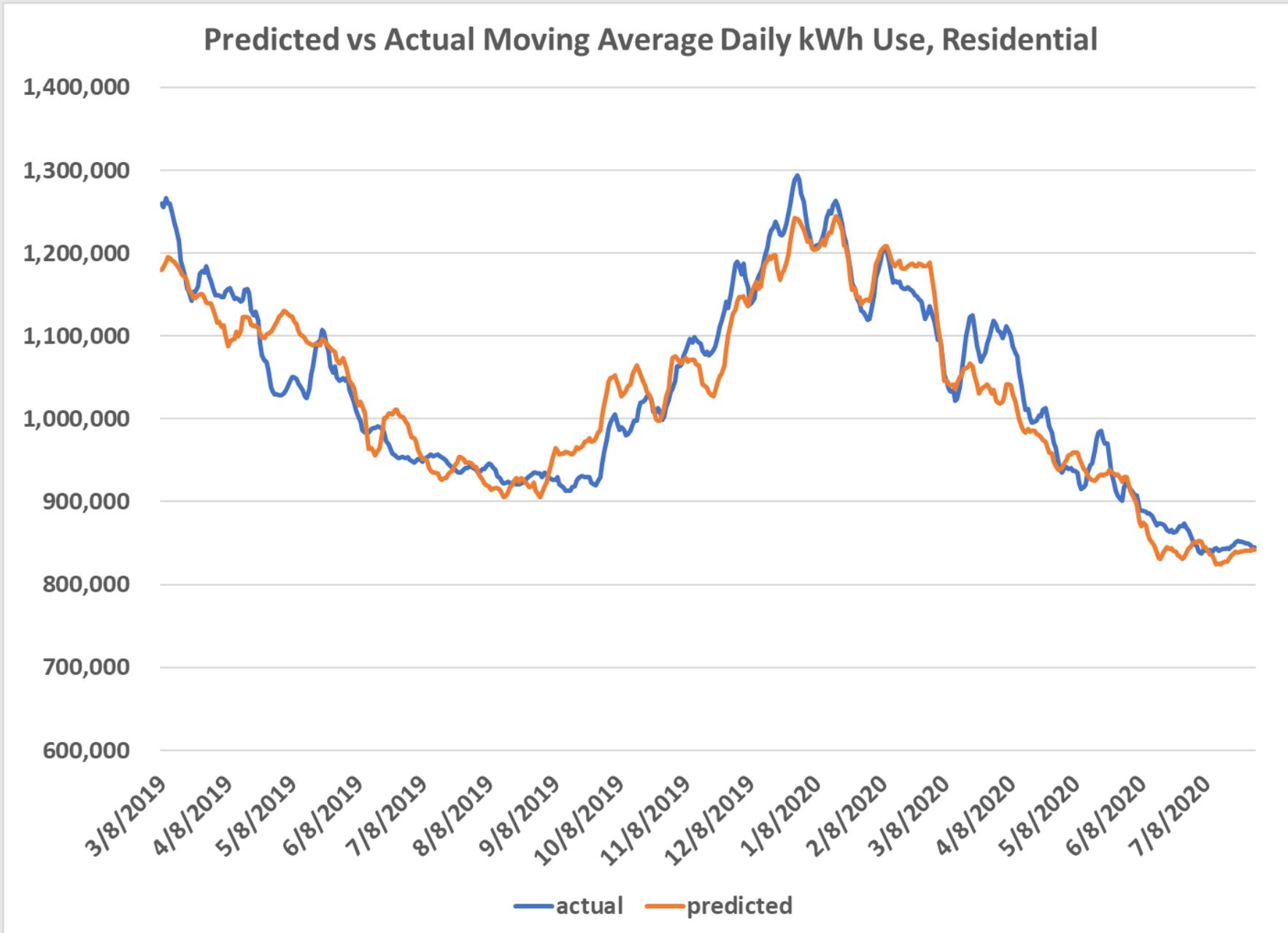
Humboldt County Electricity Use



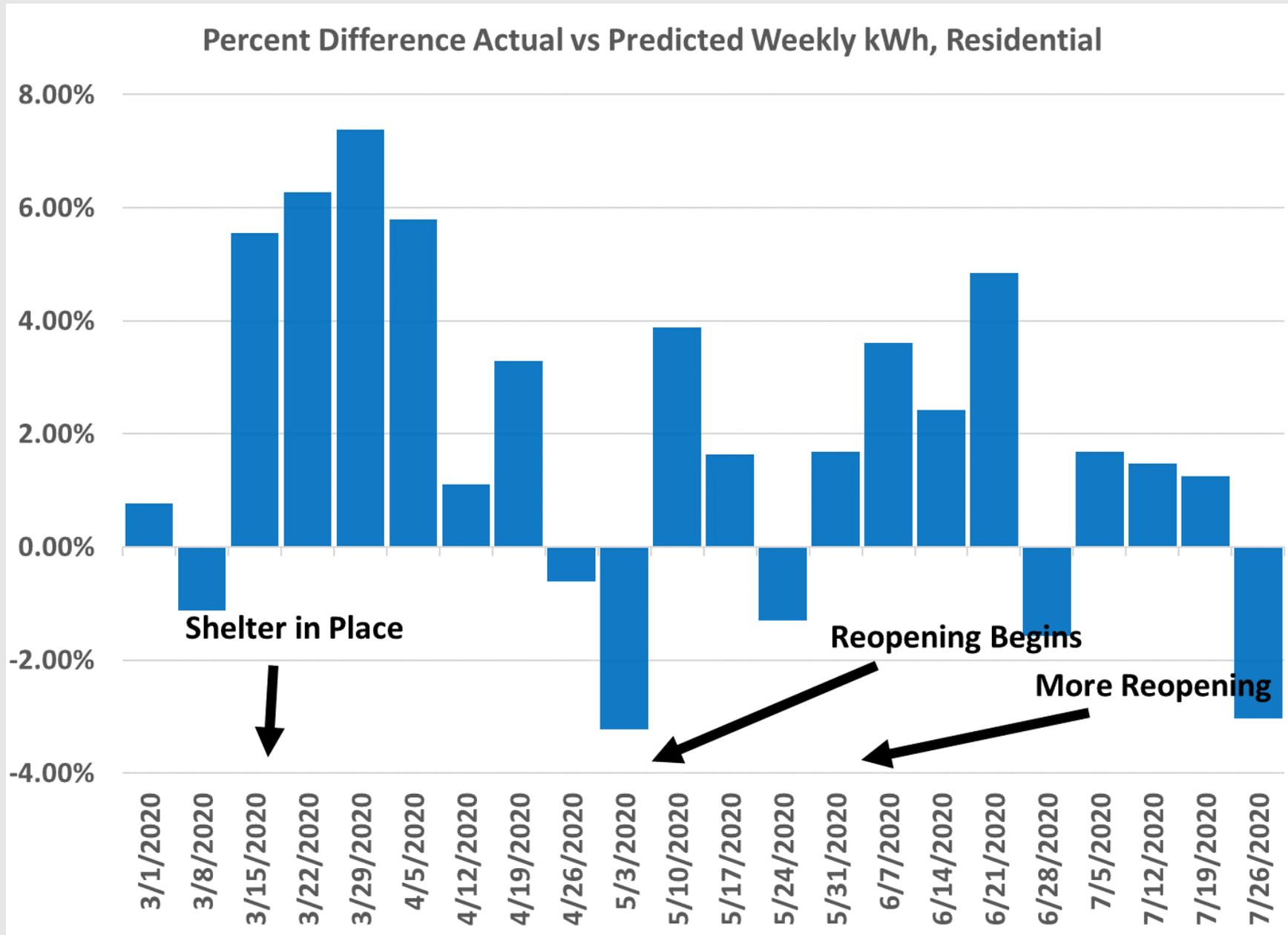
Forecasting Electricity Use in Humboldt County

- In addition to overall total electricity use, predicted use was calculated in the largest and some interesting sectors:
 - Residential (51.2% of use pre-covid)
 - Public Administration (5.8%)
 - Agriculture, Forestry and Fishing (5.0%)
 - Group 1 Hardware/Garden centers and Grocery Stores (3.3%)
 - Group 2 Department Store Retailers (0.8%)
 - Group 3 Real Estate Lessors and Self Storage (1.6%)
 - Group 4 Hotels and Motels (1.2%)
 - All Remaining Users (31.1%)

Humboldt County Electricity Use

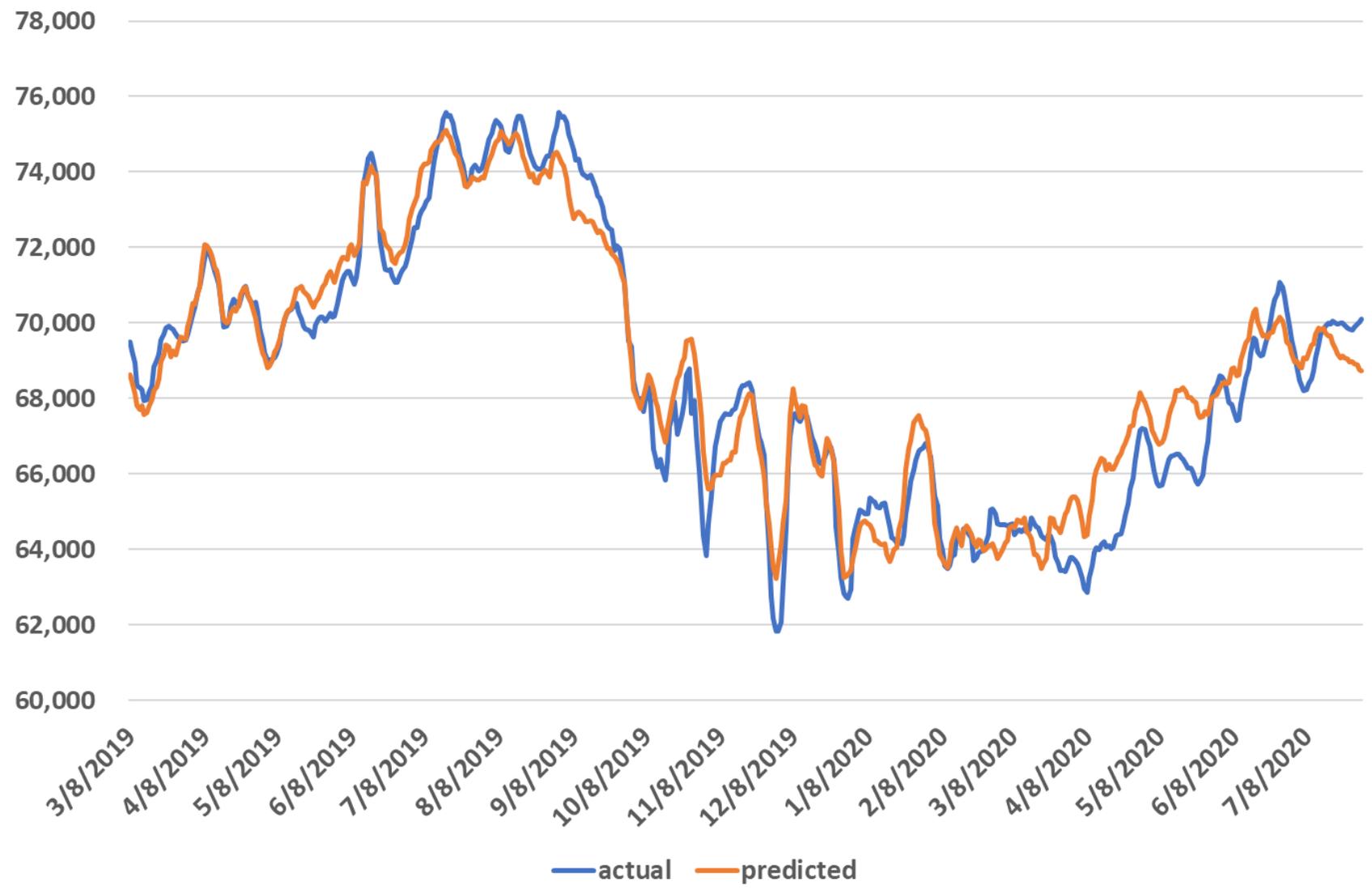


Humboldt County Electricity Use



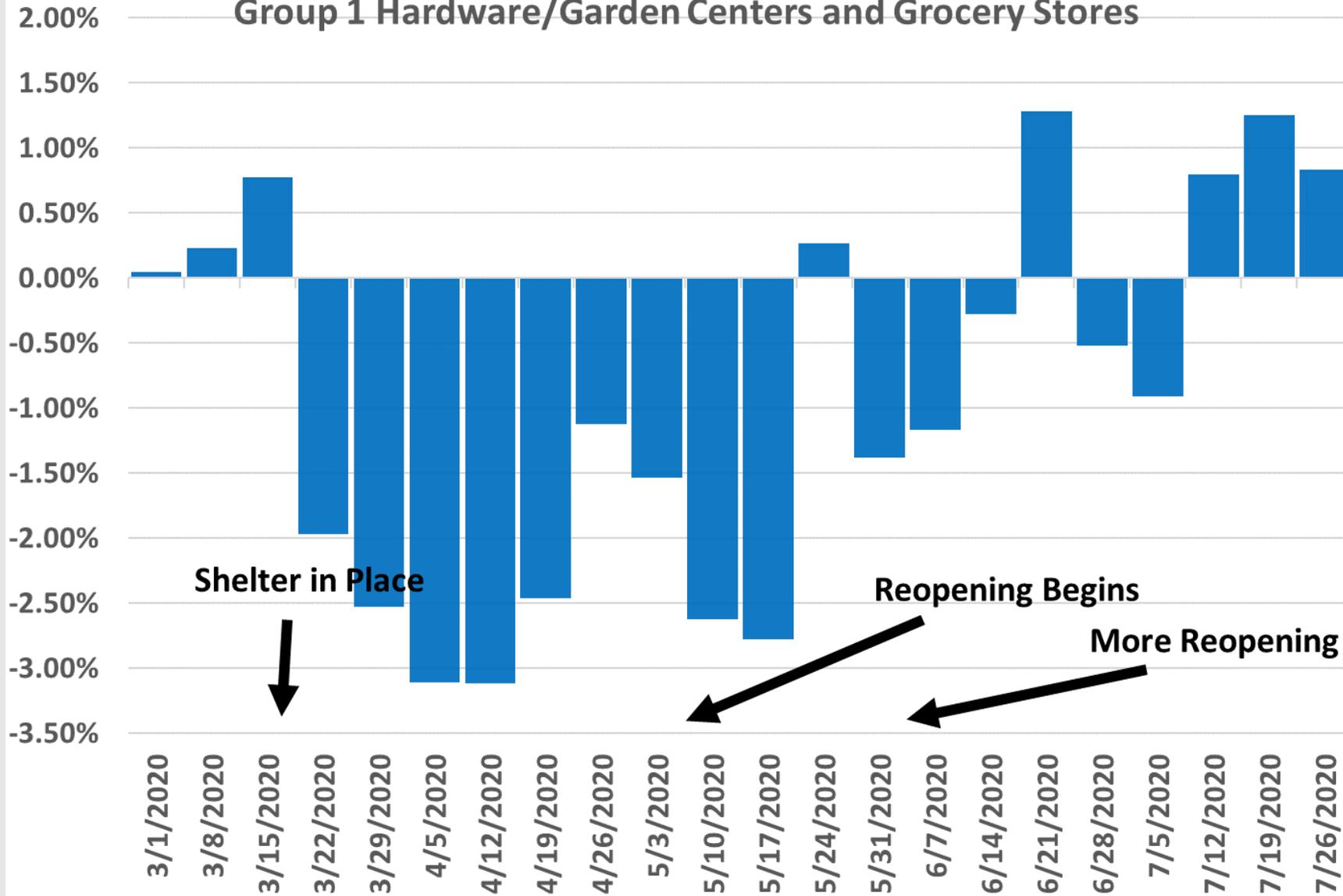
Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 1 Hardware/Garden Centers and Grocery Stores



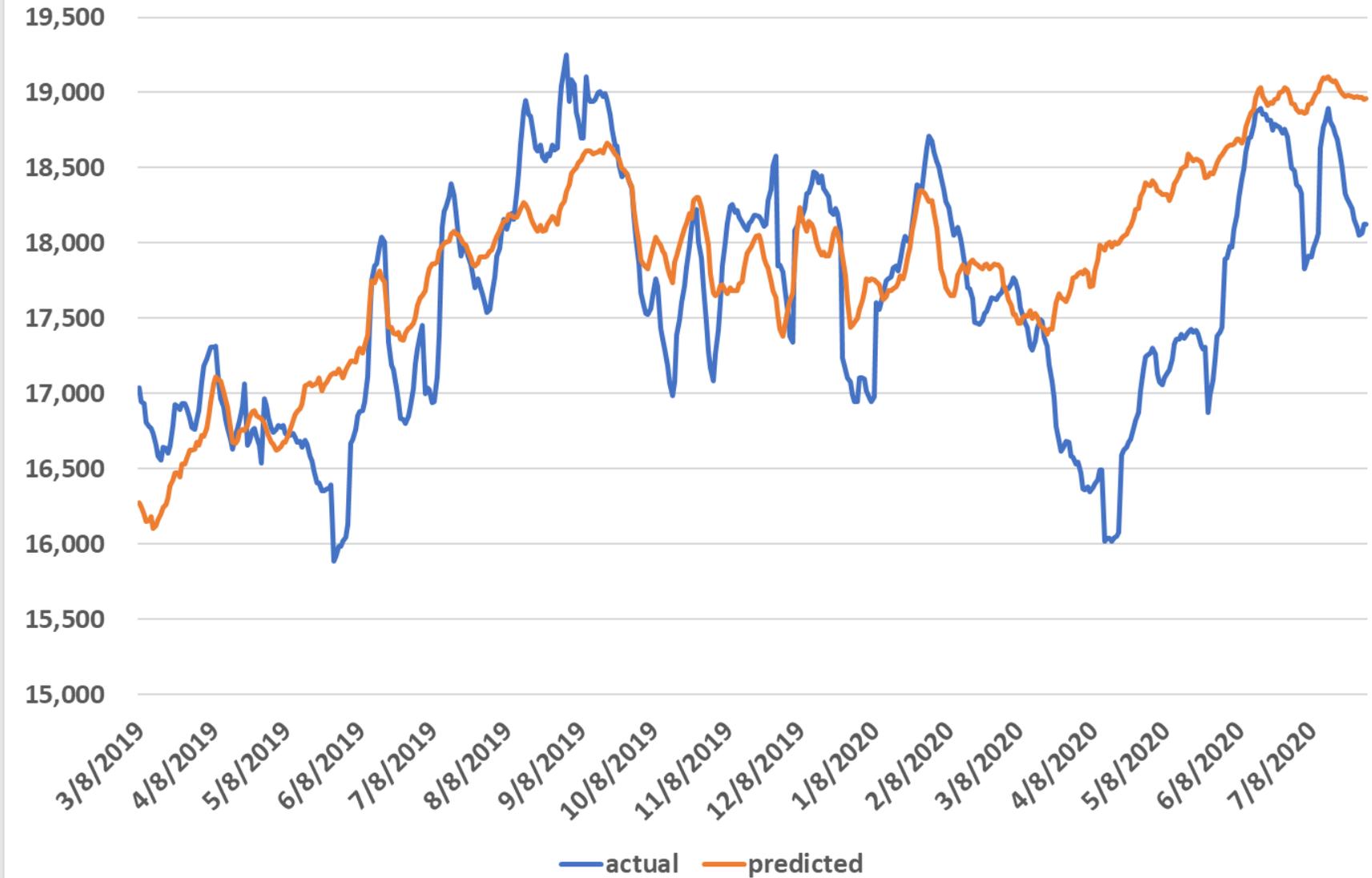
Humboldt County Electricity Use

Percent Difference Actual vs Predicted Weekly kWh,
Group 1 Hardware/Garden Centers and Grocery Stores

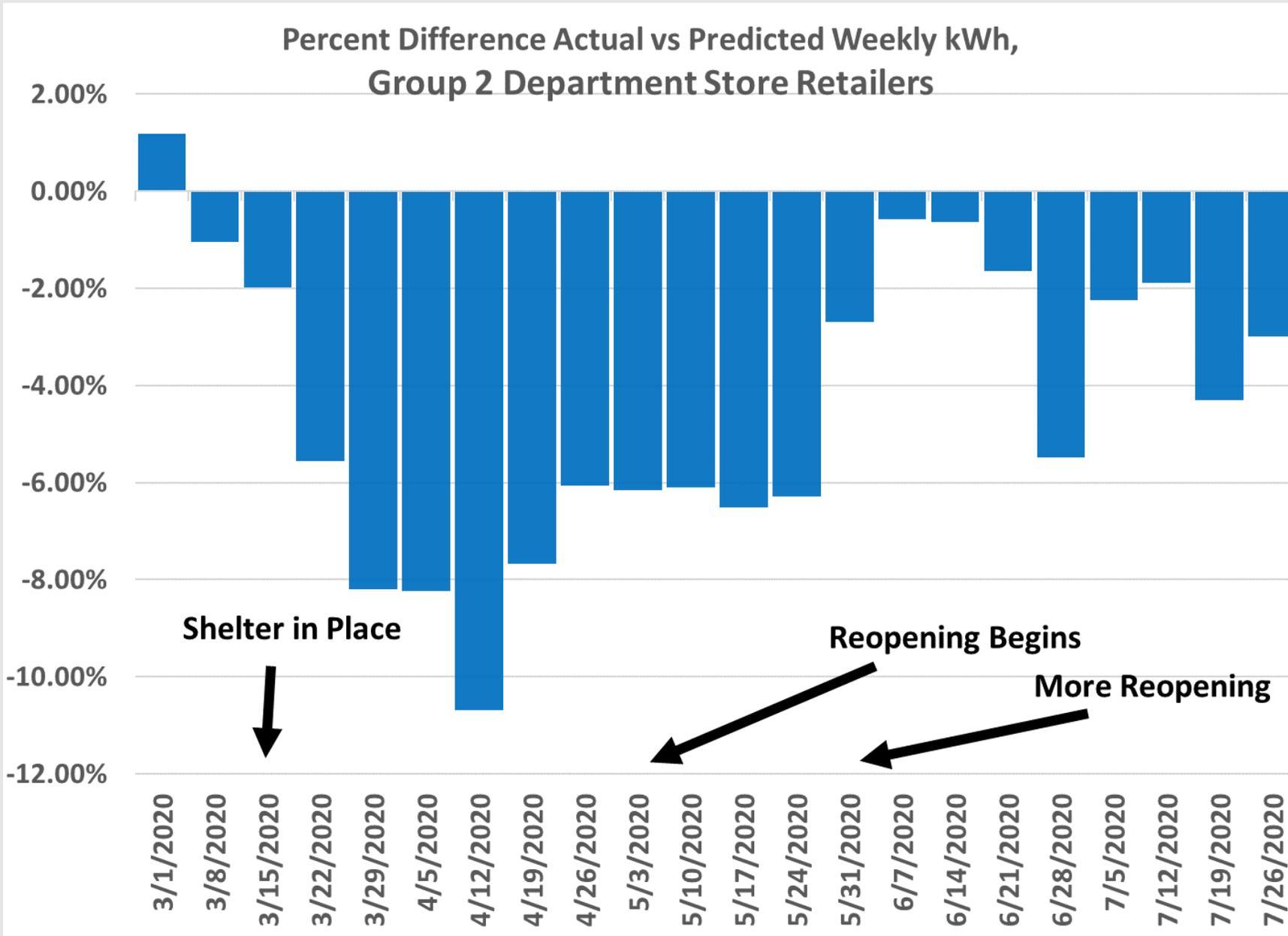


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 2 Department Store Retailers

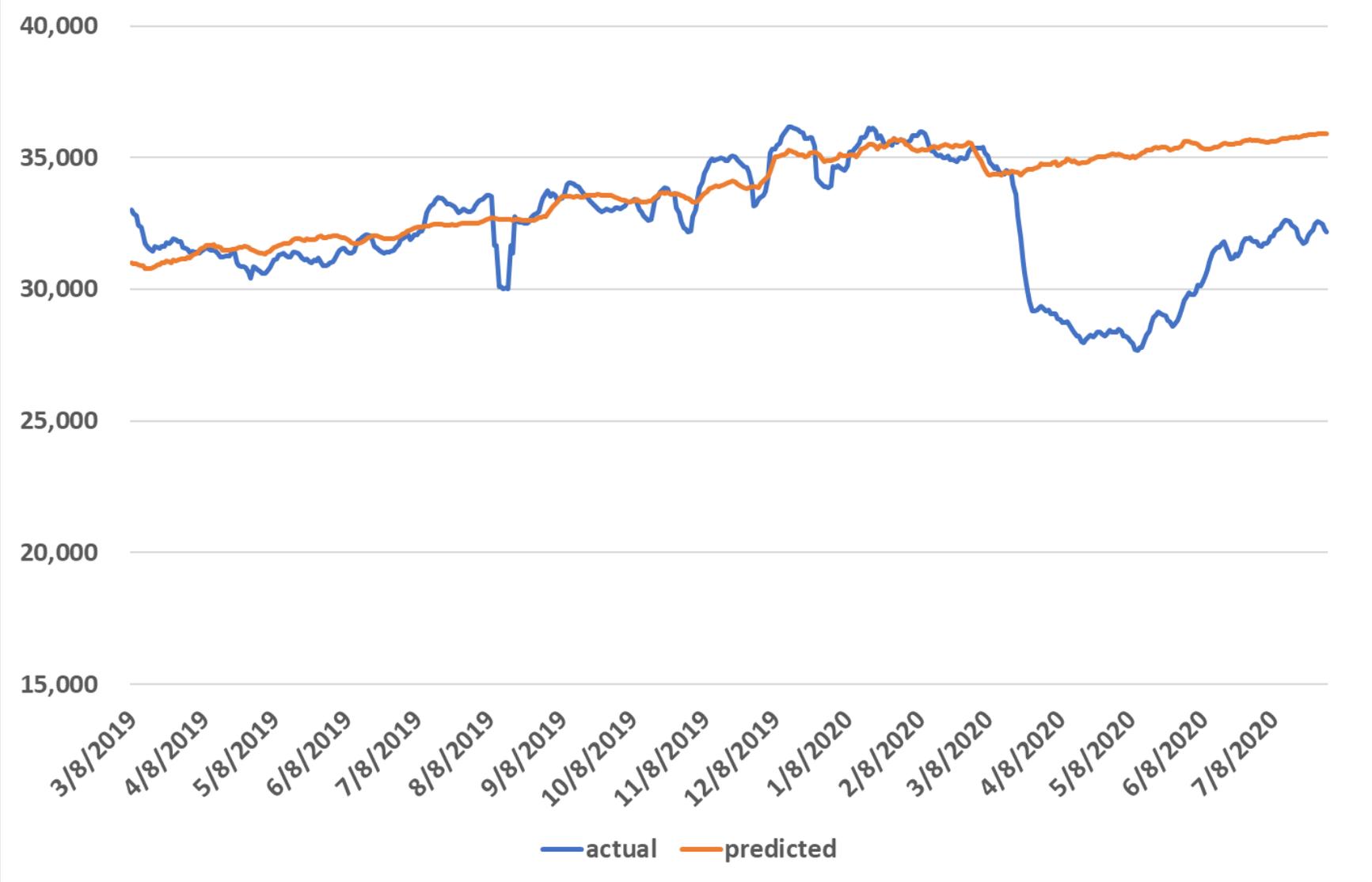


Humboldt County Electricity Use

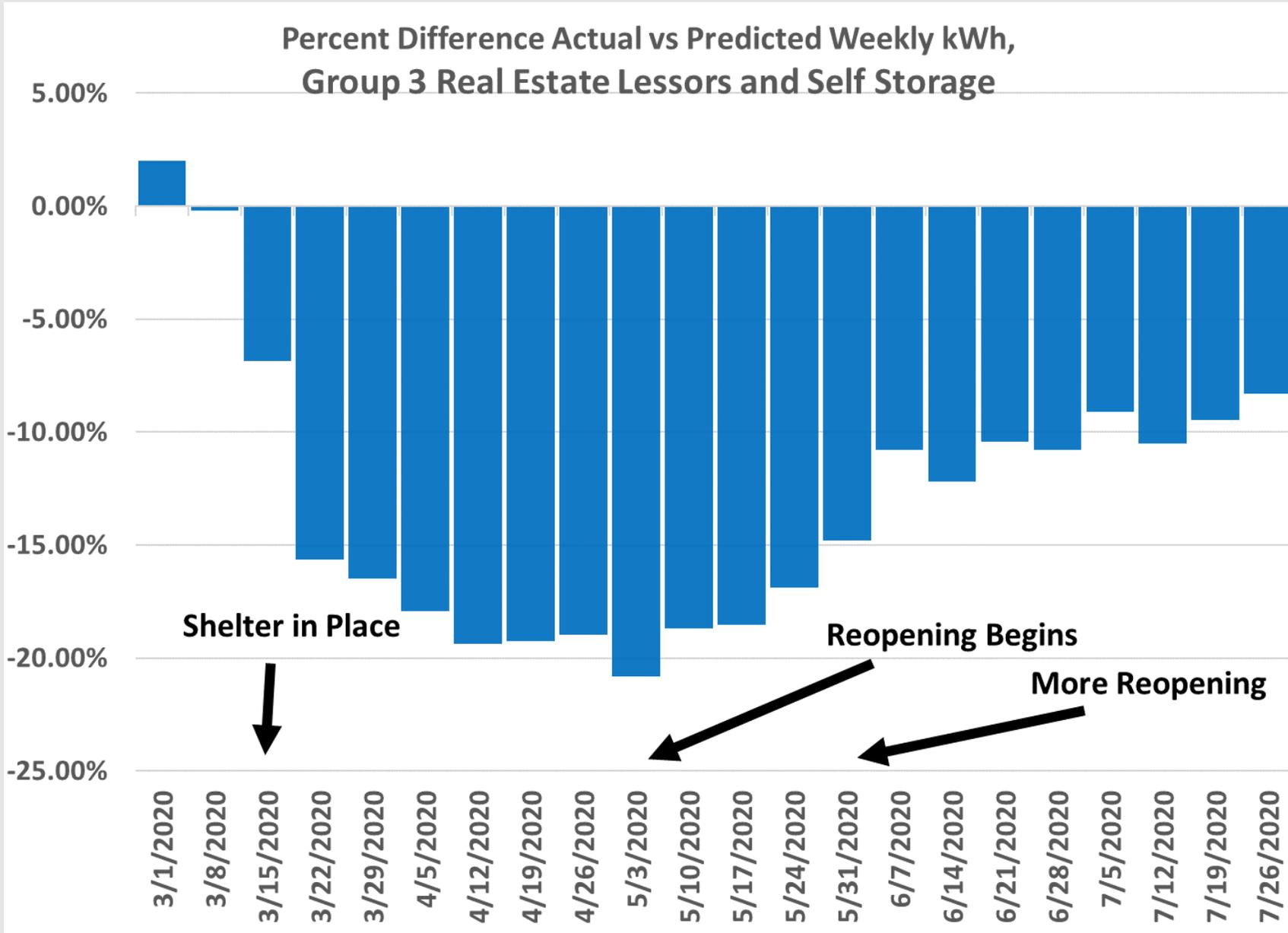


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 3 Real Estate Lessors and Self Storage

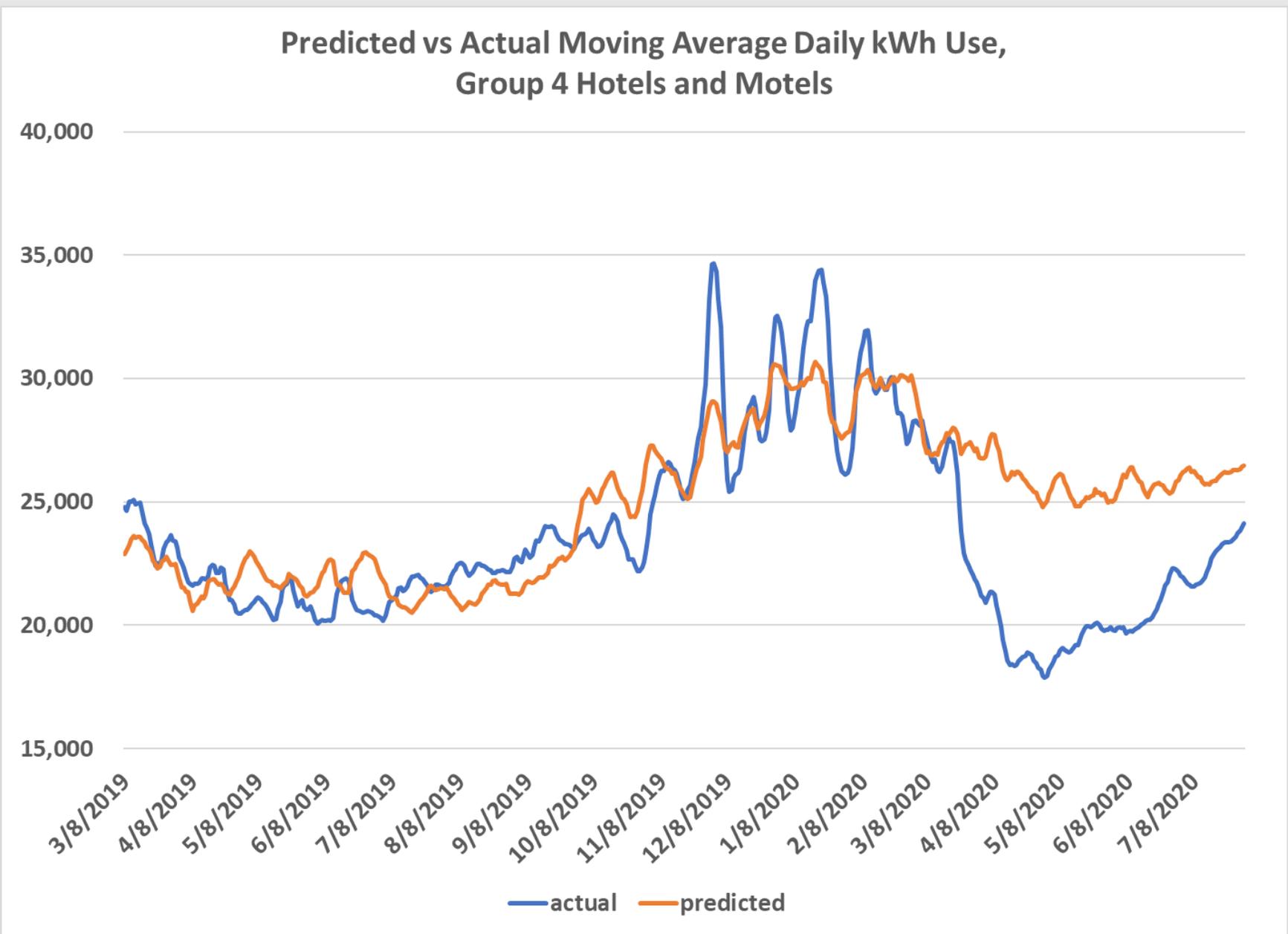


Humboldt County Electricity Use

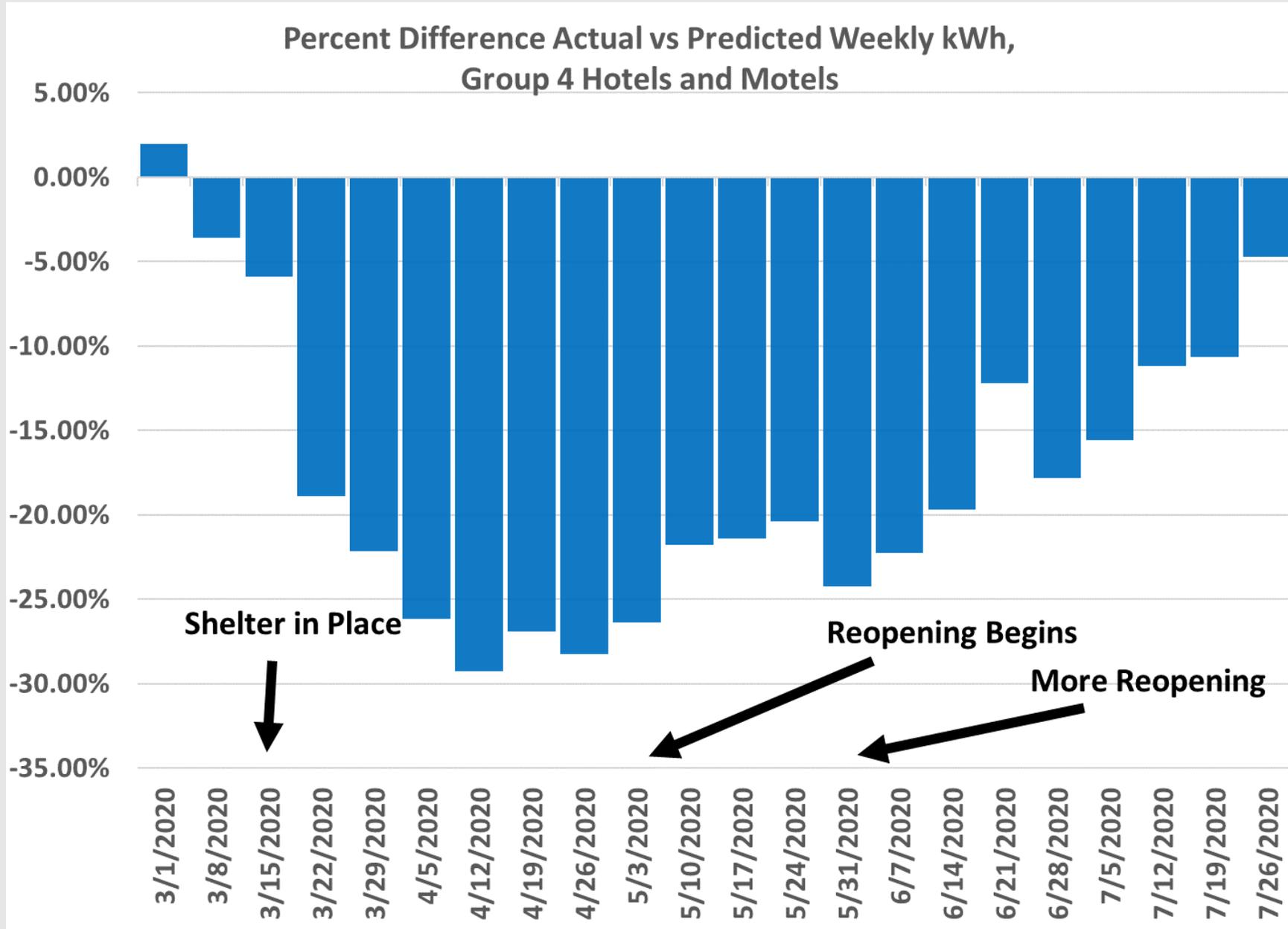


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 4 Hotels and Motels

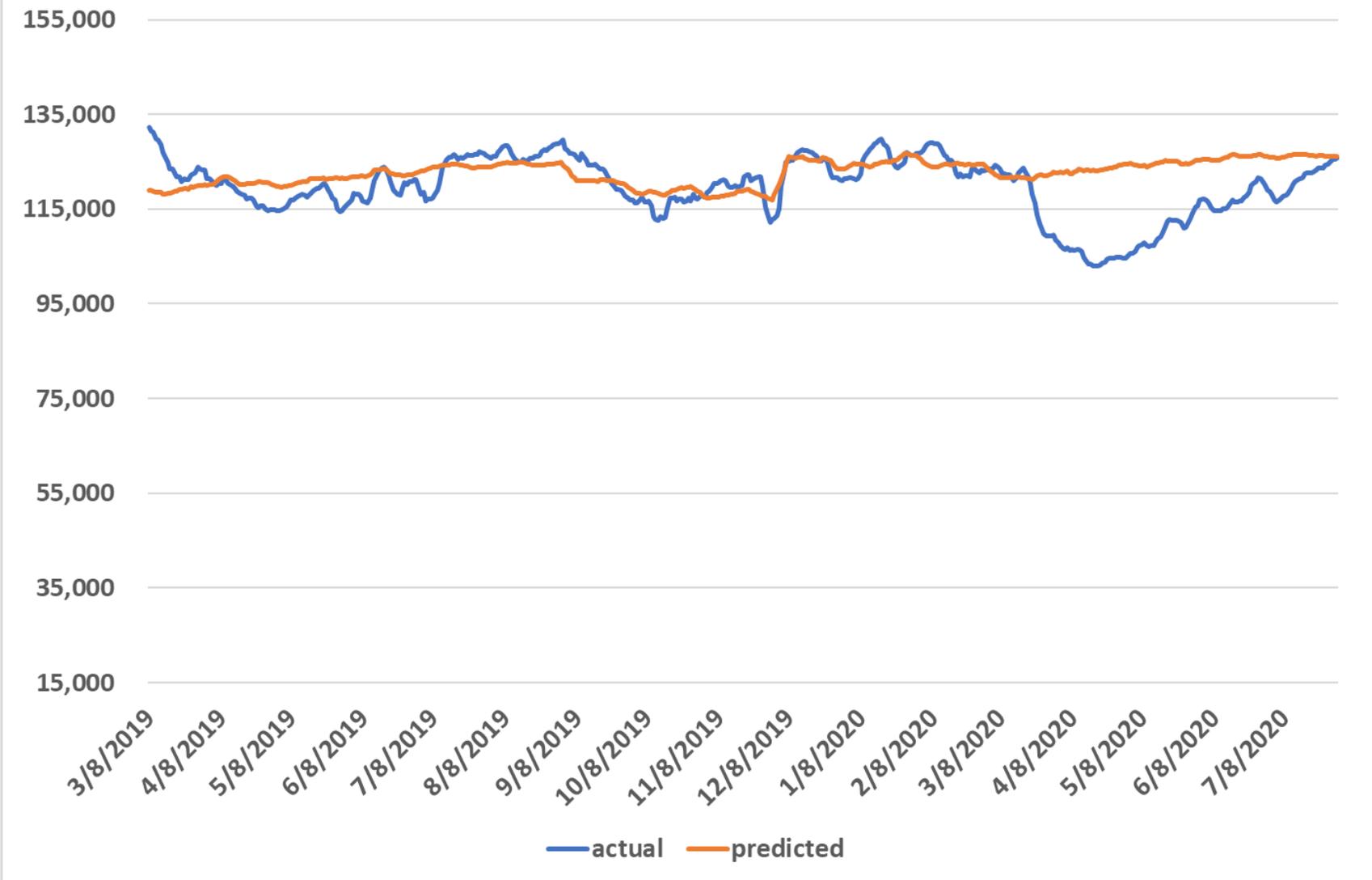


Humboldt County Electricity Use

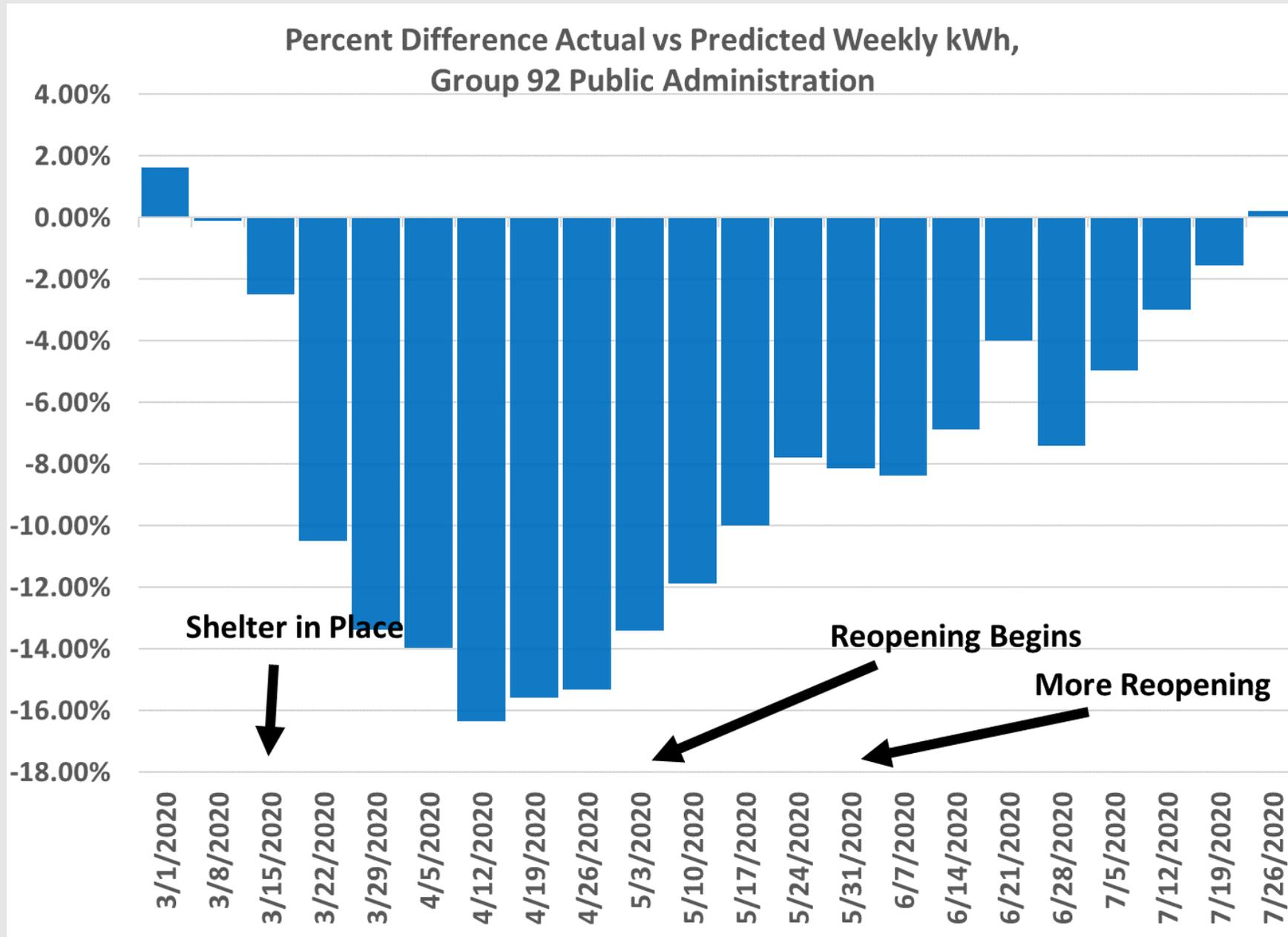


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 92 Public Administration



Humboldt County Electricity Use

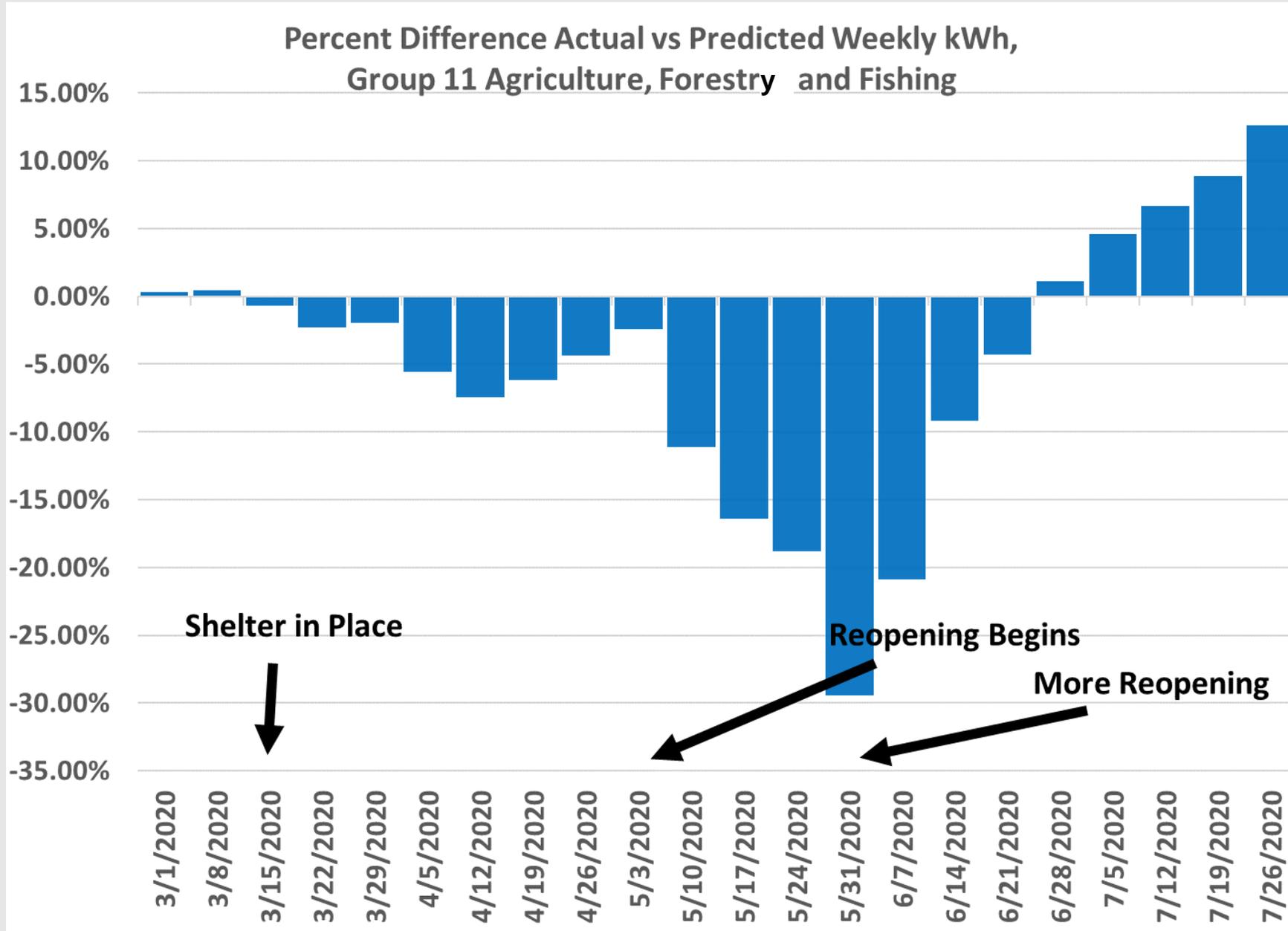


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Group 11 Agriculture, Forestry and Fishing

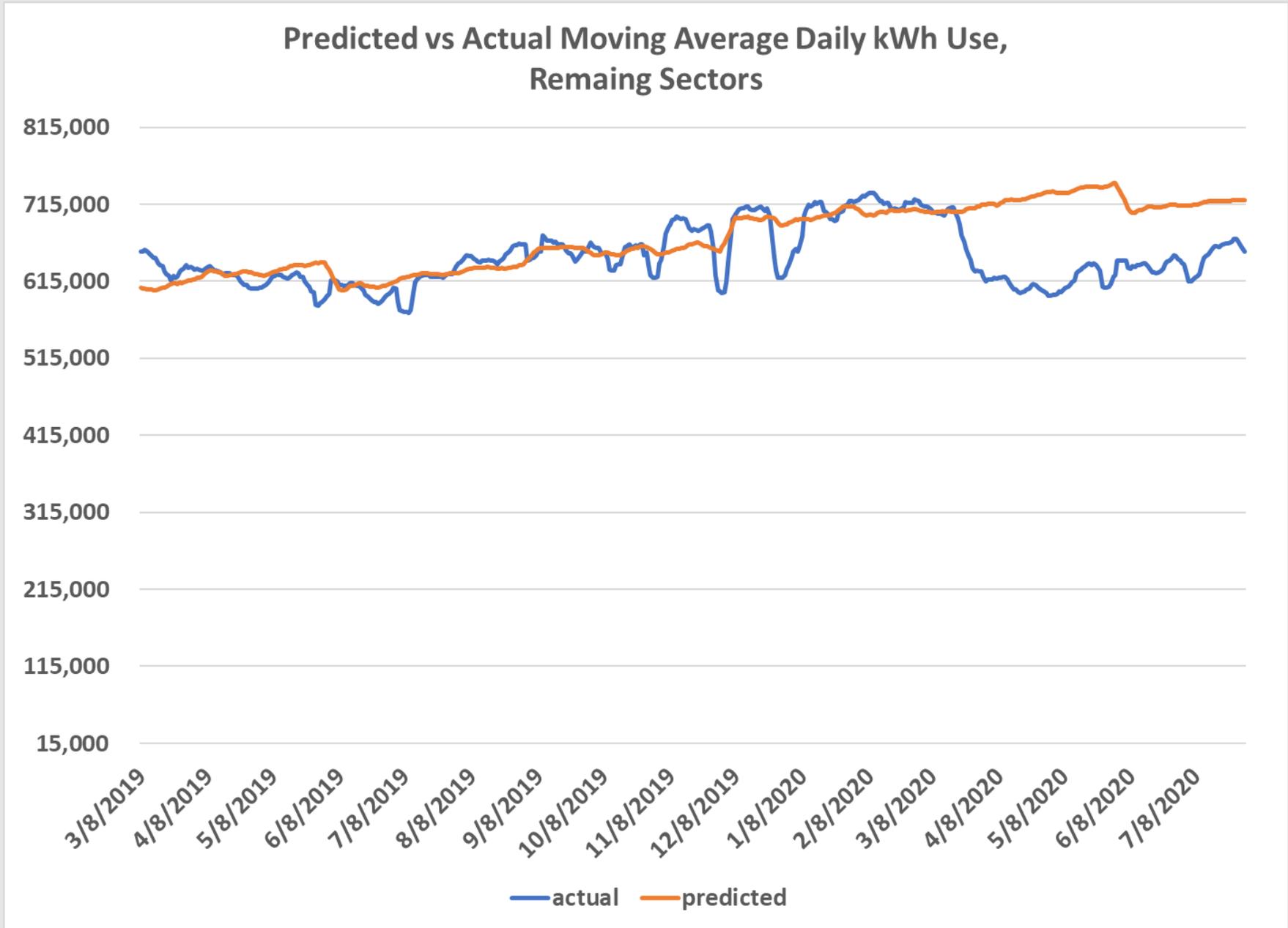


Humboldt County Electricity Use

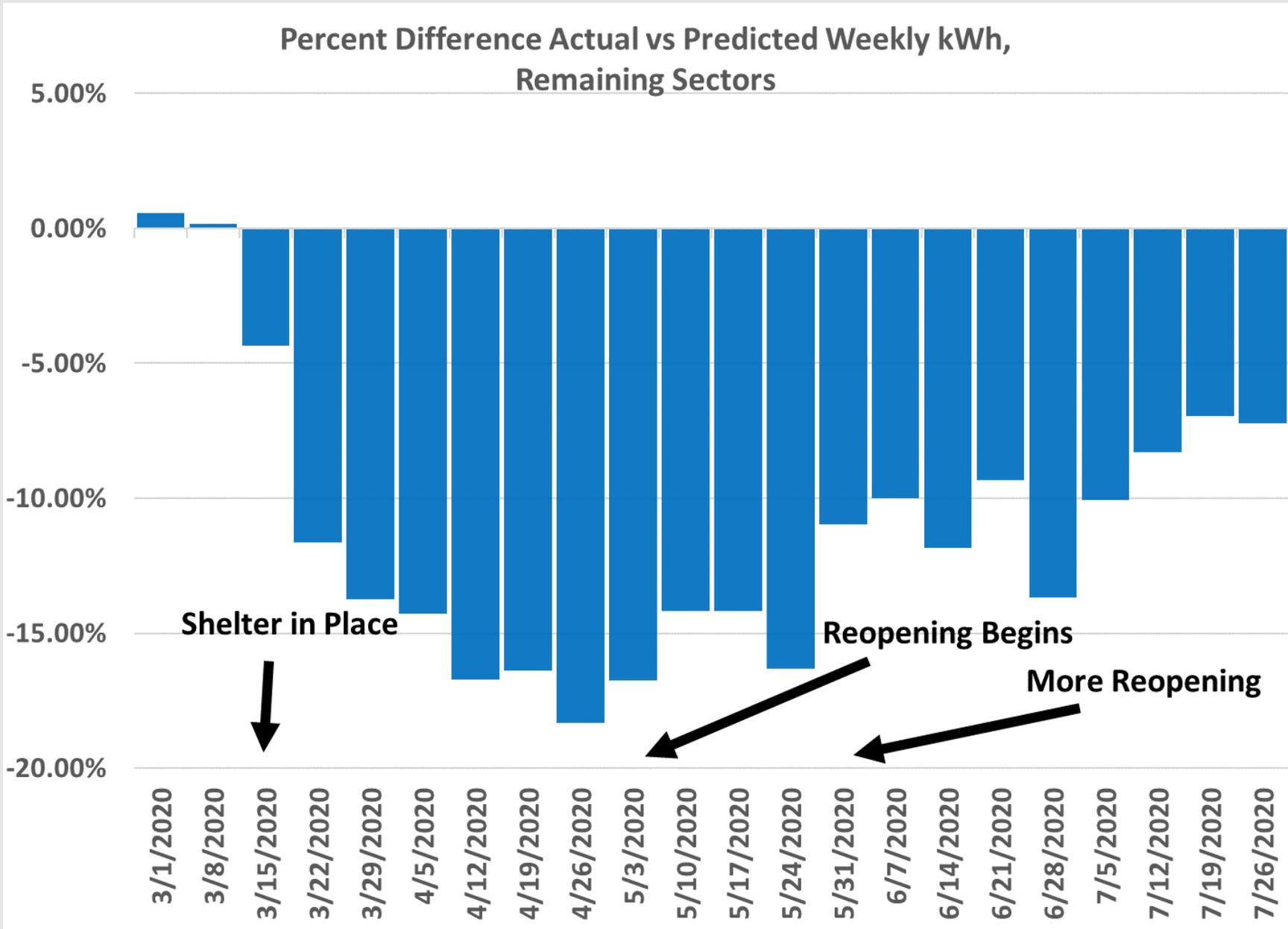


Humboldt County Electricity Use

Predicted vs Actual Moving Average Daily kWh Use,
Remaining Sectors



Humboldt County Electricity Use



Summary--Electricity Use in Humboldt County

March-July, 2020

- We predicted electricity use by estimating a model based on weather, day of week, season, and trend.
- In general, electricity use shifted to residential customers from other users.
- In most sectors and overall, the greatest impact of the shutdowns came in mid-to-late April (one month into shutdowns)
- Most electricity use has been returning to “normal,” but has not fully returned to normal (4.5 months after shutdowns began and after some reopening)

Implications for Future Electricity Shutdowns in Humboldt County

- The degree of shut down (and partial re-opening) is important to energy use.
- Sectors respond differently to shutdown orders and re-openings.
- Need to be careful about forecasting during shutdown, since economy will learn to conduct business around the shutdowns.