COVID-19 Load Impacts Update and Forecasting Discussion

Analysis through 10/10/2020

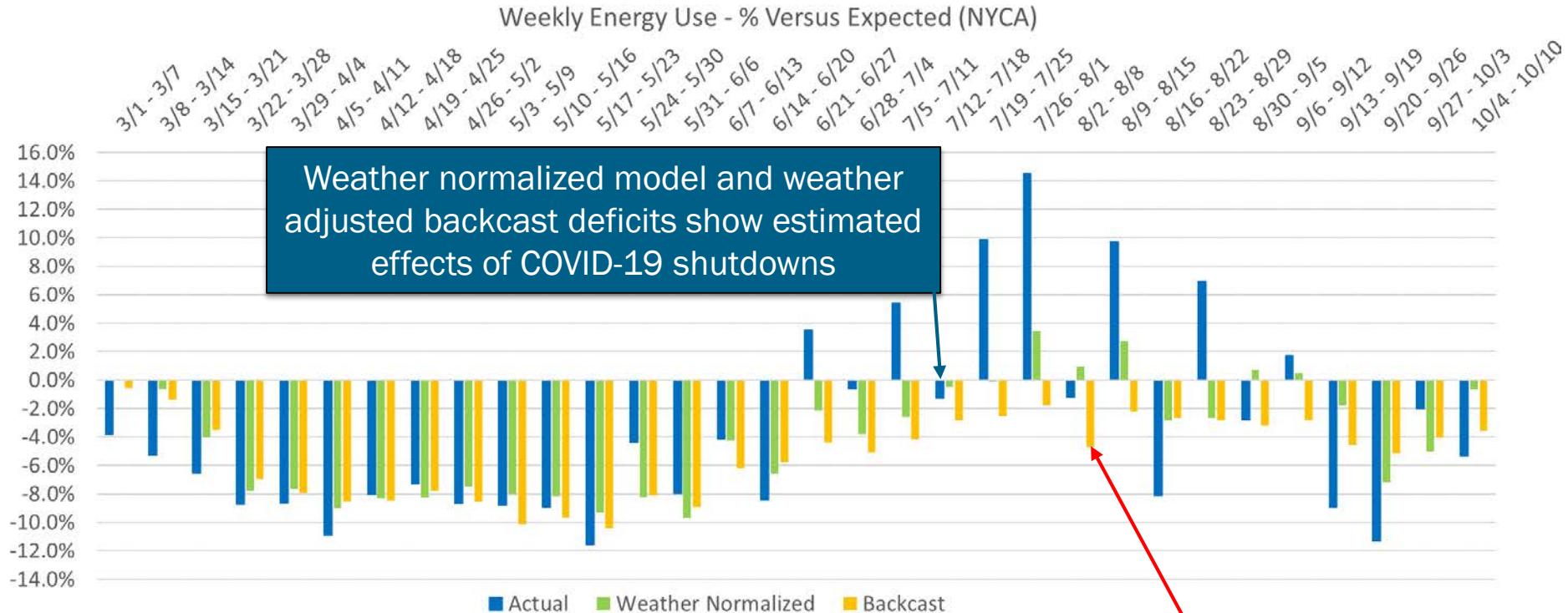Chuck Alonge and Maxim Schuler

Demand Forecasting and Analysis

Load Forecasting Task Force

October 21, 2020

COVID-19 Estimated Impacts on Load

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Recent Impacts on Daily Energy by Week

Weekly Energy Use - % Versus Expected (NYCA)

Weather normalized model and weather adjusted backcast deficits show estimated effects of COVID-19 shutdowns

Contains impacts from Tropical Storm Isaias

Includes Weekend Days

Regional Impacts on Daily Energy Patterns

2020 WN (Backcast) Load to Expected (Actual) Load, 7-Day Moving Average (Daily Energy)

Regional Impacts on Daily Energy Patterns

2020 WN (Backcast) Load to Expected (Actual) Load, 7-Day Moving Average (Daily Energy)

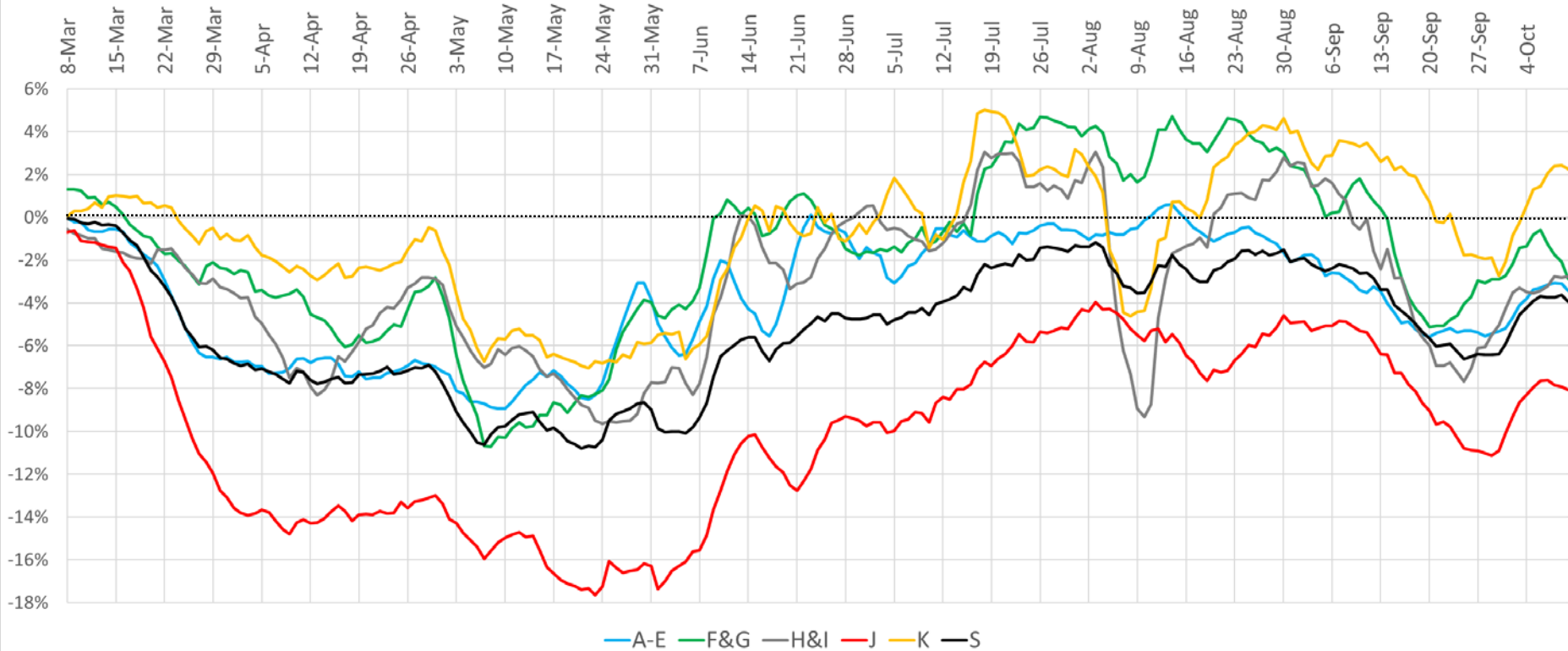Legend: --- H&I (Backcast) --- K (Backcast) --- NYCA (Backcast) — H&I — K — NYCA
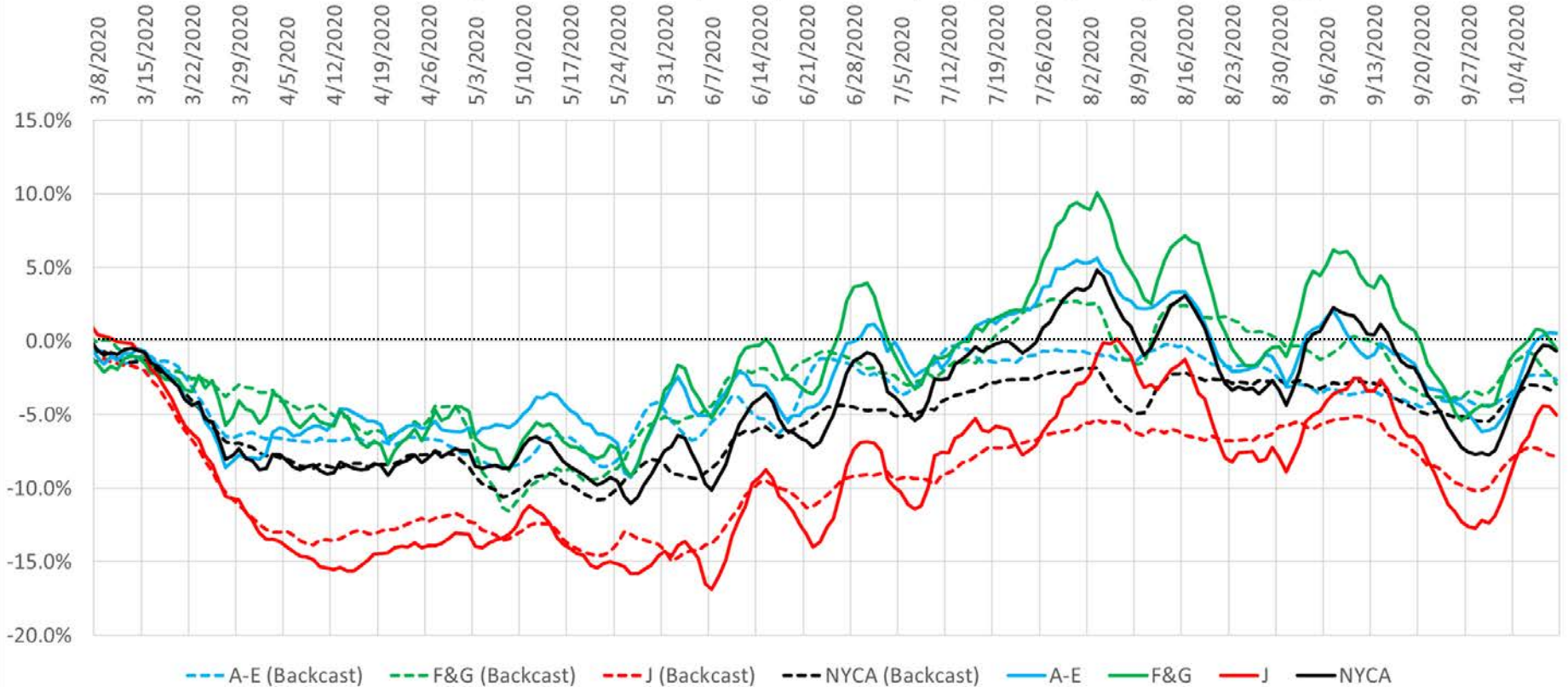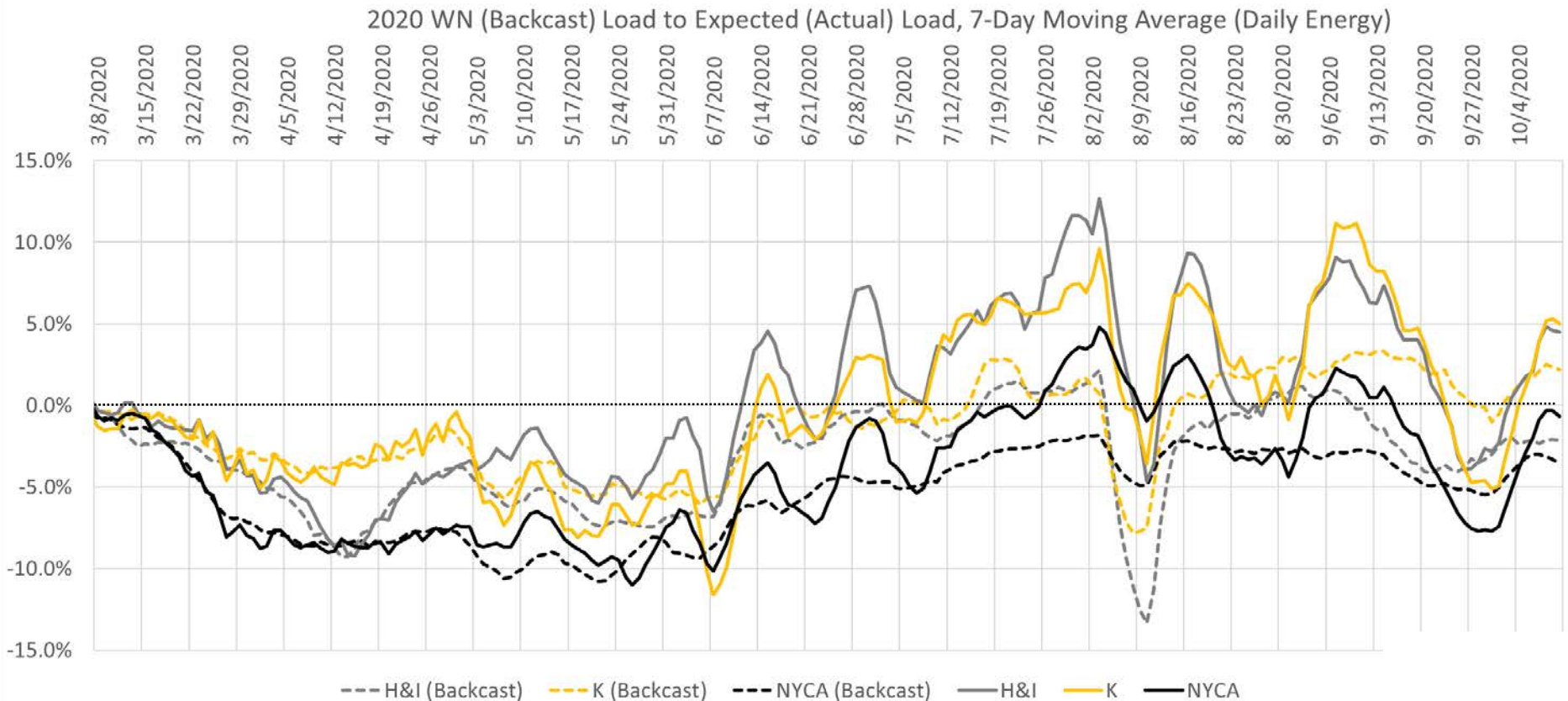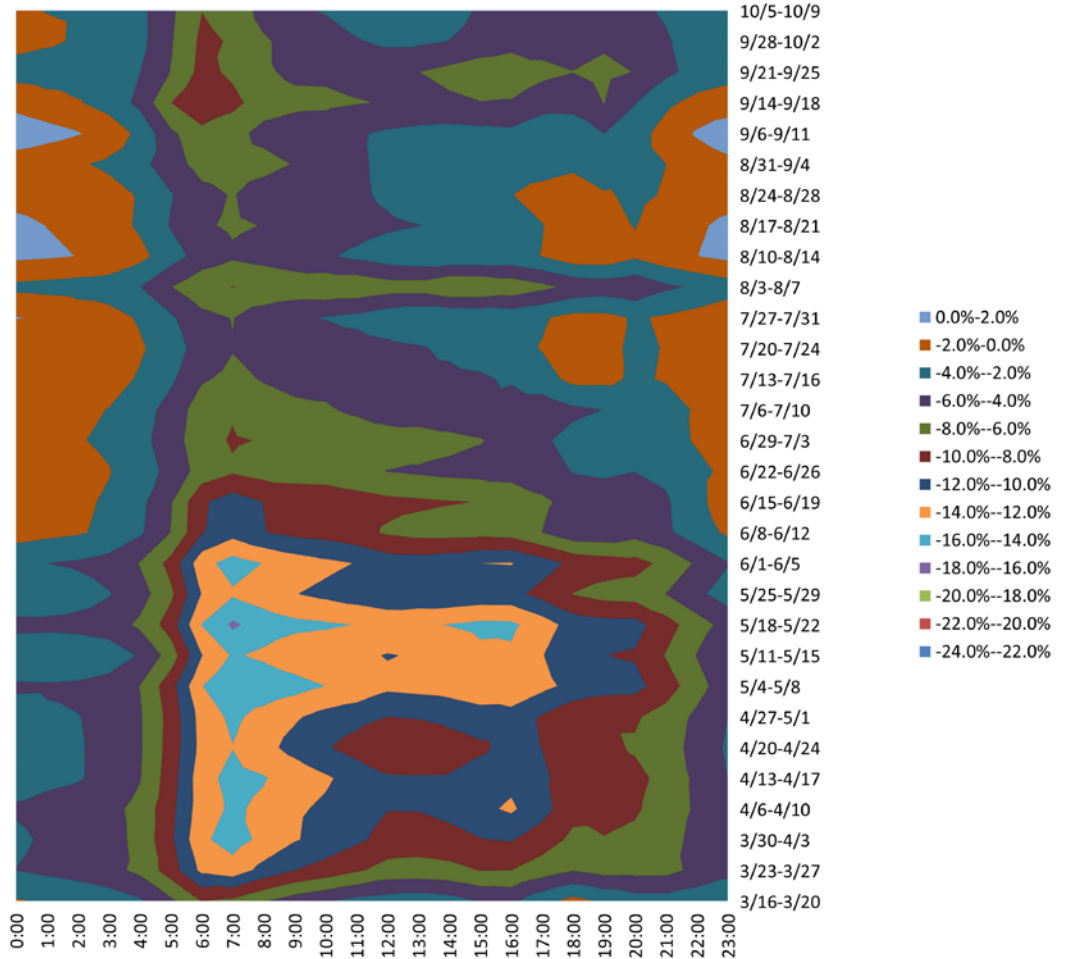
Regional Impacts on Peak Demand

2020 Actual Load Relative to Backcast Load, 7-Day Moving Average (Daily Peak)

Legend: —A-E —F&G —H&I —J —K —S

Impacts on Hourly Load Patterns

NYCA Load Profile - Weekday Diurnal Load Changes

Legend:
- 0.0%-2.0%
- -2.0%-0.0%
- -4.0%--2.0%
- -6.0%--4.0%
- -8.0%--6.0%
- -10.0%--8.0%
- -12.0%--10.0%
- -14.0%--12.0%
- -16.0%--14.0%
- -18.0%--16.0%
- -20.0%--18.0%
- -22.0%--20.0%
- -24.0%--22.0%

Impacts on Hourly Load Patterns

Zone J (NYC) Load Profile - Weekday Diurnal Load Changes

Legend:
- 0.0%-2.0%
- -2.0%-0.0%
- -4.0%--2.0%
- -6.0%--4.0%
- -8.0%--6.0%
- -10.0%--8.0%
- -12.0%--10.0%
- -14.0%--12.0%
- -16.0%--14.0%
- -18.0%--16.0%
- -20.0%--18.0%
- -22.0%--20.0%
- -24.0%--22.0%
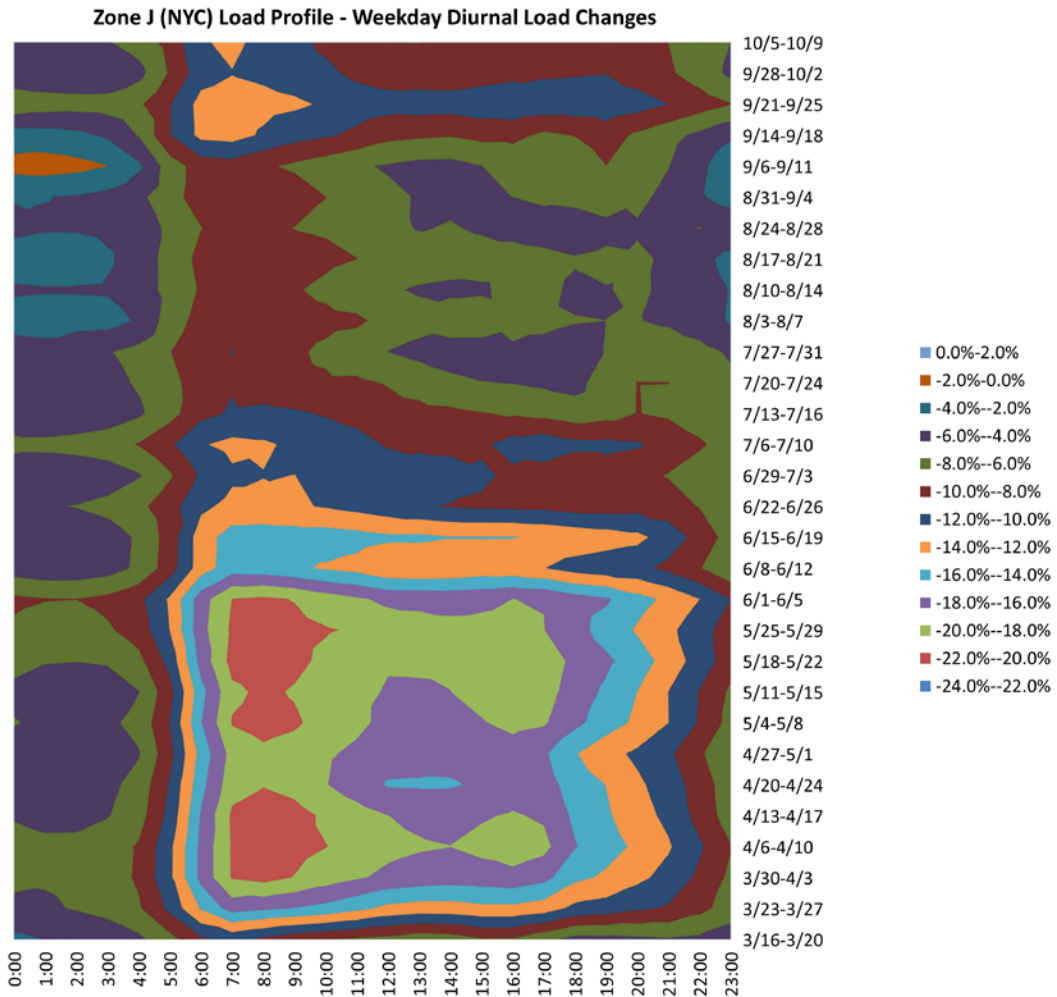
Impacts on Hourly Load Patterns (Area)

Average Hourly Deficit by Area, 9/28 through 10/9 (Weekdays)

Legend: A-E, F&G, H&I, J, K, SENY (G-K), NYCA
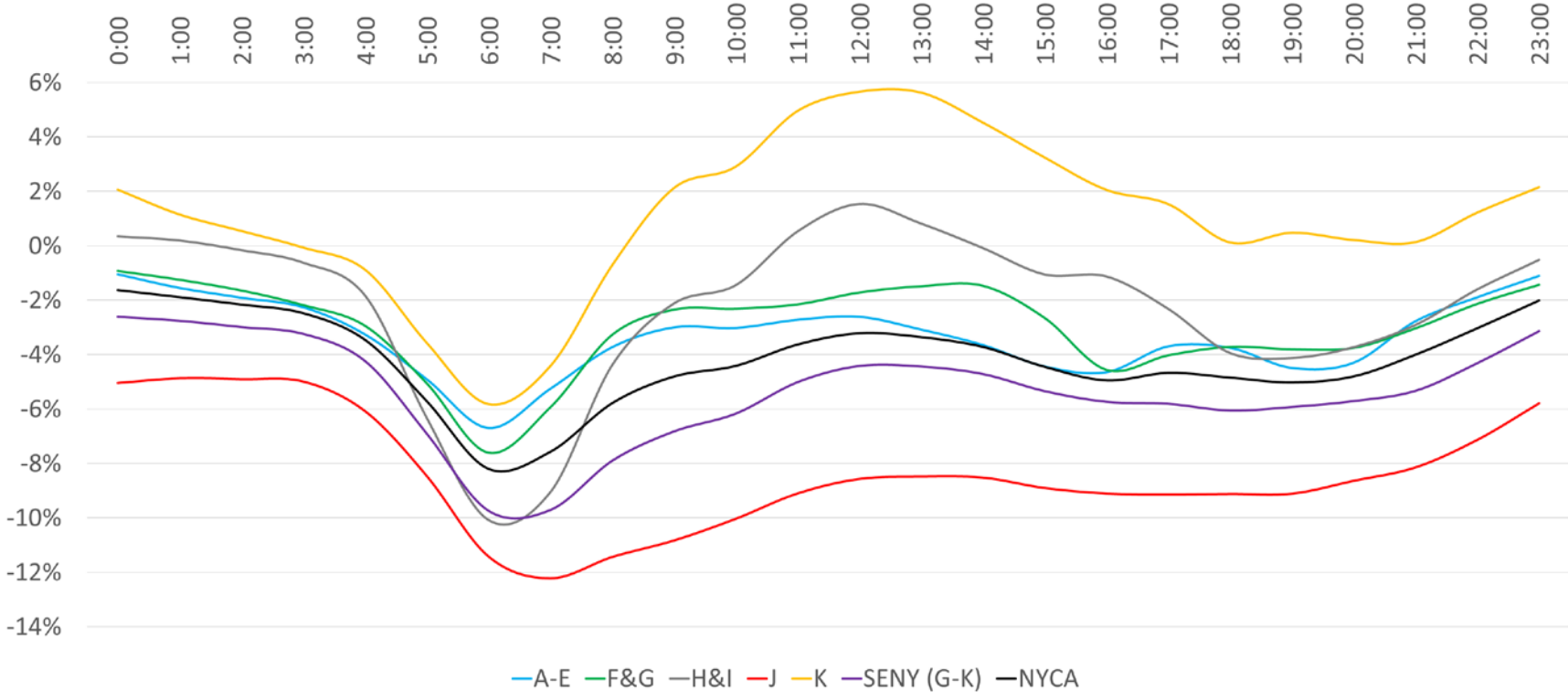
COVID-19 Load Forecasting Discussion

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Hourly Load Pattern Evolution

Monthly Mean Net Load Profile (Actual vs. Backcast)
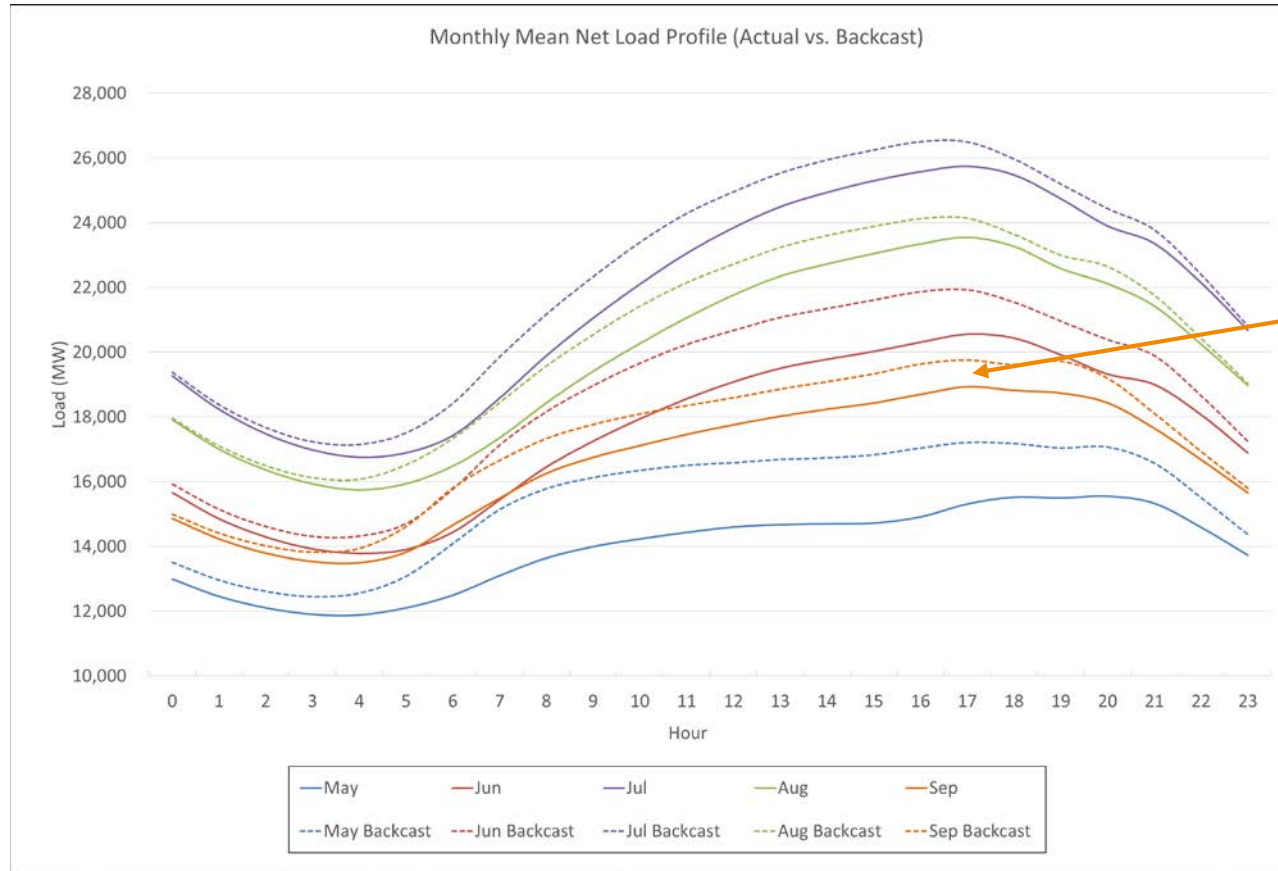
Modeling the evolution of "The Wedge"

Short-term Forecasting Considerations

- Continue to track regional changes in base loads and profiles

- Learn from weather/load sensitivity changes throughout the spring, summer, and fall

- Daily energy calibration normally produces slightly better peak forecasts; COVID-19 forecasts benefit from using interval based calibration methods

- Shorten the length of the model calibration period (i.e. rolling bias corrections)

- Add COVID binaries to the forecast model and consider the benefit of weather interaction terms (e.g. COVID binary and CDD/HDD)

NY State 30-Minute Forecast Errors

COVID Variable Example
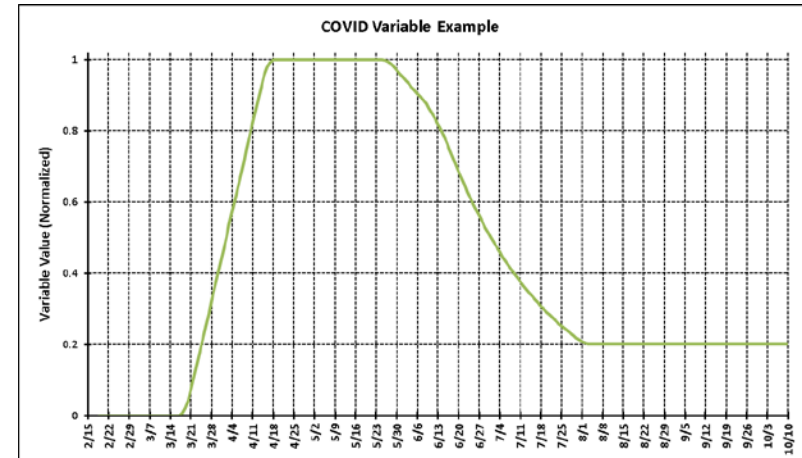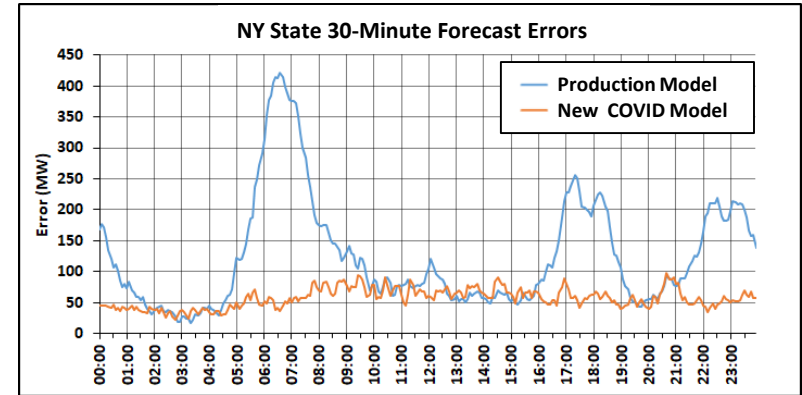
Near-term Forecasting Considerations

- Impacts have varied by area, policy, commercial/residential/industrial mix

- Zonal loads analysis shows overall impact but does not speak to specific deviations

- AMI data can provide insights on the evolving behaviors
  - Residential
  - Education / Government
  - Office Buildings (Reduced Occupancy vs. No Occupancy)
  - Food Service / Assembly / Warehouse
  - Industrial

- Caution: Behavioral variables in modeling can conflict with strong changes in economic indicators

- NYISO is appreciative of the data this group has shared thus far
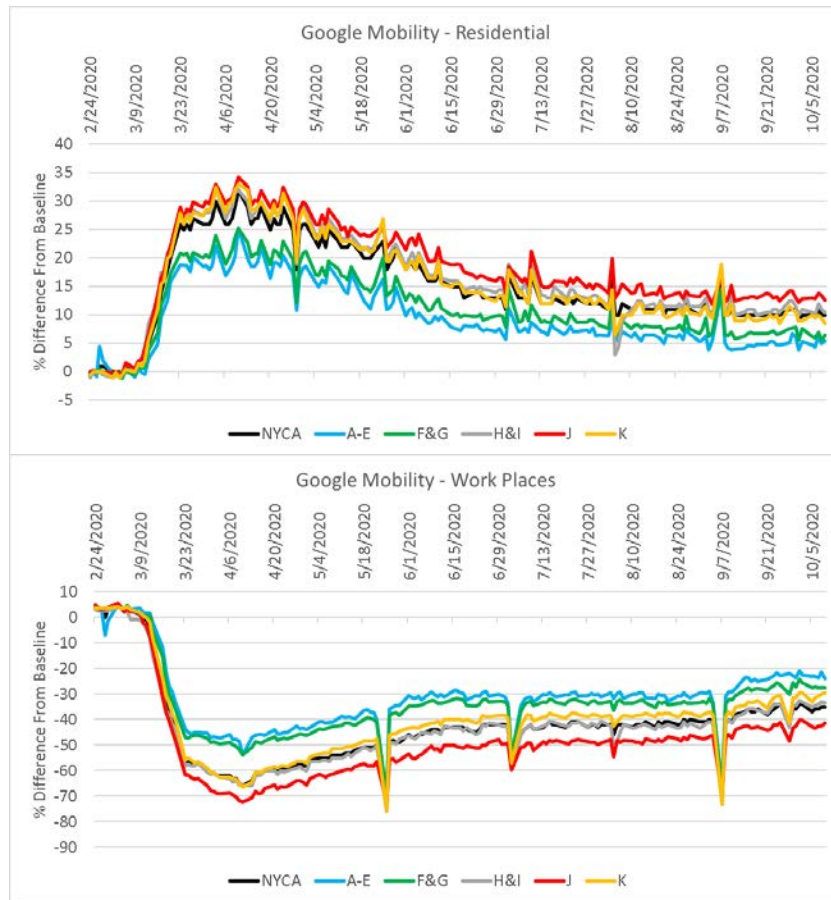
Values relative to a baseline day; a baseline day is the median value from the 5-week period between Jan 3rd and Feb 6th 2020.

Questions/Discussion

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Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability

- Operating open, fair and competitive wholesale electricity markets

- Planning the power system for the future

- Providing factual information to policymakers, stakeholders and investors in the power system

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Reference Material
Zonal/Regional Estimated Impacts (Tables) & Model Definitions

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Model Explanation - Recent Impacts on Daily Energy by Week

Actual Difference

- Equals: Actual Load – Expected Load

- Expected Load is the 2020 pre-COVID baseline annual load forecast, shared out on a daily basis using the 10-year history of daily weather-normalized energy

- This difference reflects the total change in load relative to expected levels, including weather, economic, virus, and any other impacts

Weather Normalized Difference

- Equals: Weather Normalized Load – Expected Load

- Weather Normalized Load is calculated via Zonal models regressing daily energy against daily weather variables and binaries. These models estimate what the load would have been on a given date under normal weather conditions

- These models are fit through the most recent 12 months of data, and have recent weather response signals.

- Expected Load is equivalent to that defined in the Actual Difference calculation

- This difference reflects non-weather driven changes in load levels, including economic, virus, and other impacts. The comparison is weather neutral as normal weather is used on both sides of the comparison

Weather Adjusted Backcast Difference

- Equals: Actual Load - Backcast Load

- Backcast Load is the load generated by the Zonal hourly day-ahead models using actual weather, where the model estimation period ends in February. Thus, these backcasts estimate what the load would have been on a given day under pre-COVID conditions

- These models were fit through February, so they do not contain the most recent weather response signals

- This difference reflects non-weather driven changes in load levels, including economic, virus, and other impacts. The comparison is weather neutral as actual weather is used on both sides of the comparison

Impacts on Hourly Load Patterns (Area)

Hour	A-E	F&G	H&I	J	K	SENY (G-K)	NYCA
0:00	-1%	-1%	0%	-5%	2%	-3%	-2%
1:00	-2%	-1%	0%	-5%	1%	-3%	-2%
2:00	-2%	-2%	0%	-5%	1%	-3%	-2%
3:00	-2%	-2%	-1%	-5%	0%	-3%	-2%
4:00	-3%	-3%	-2%	-6%	-1%	-4%	-3%
5:00	-5%	-5%	-6%	-8%	-4%	-7%	-6%
6:00	-7%	-8%	-10%	-11%	-6%	-10%	-8%
7:00	-5%	-6%	-9%	-12%	-4%	-10%	-8%
8:00	-4%	-3%	-4%	-11%	-1%	-8%	-6%
9:00	-3%	-2%	-2%	-11%	2%	-7%	-5%
10:00	-3%	-2%	-1%	-10%	3%	-6%	-4%
11:00	-3%	-2%	1%	-9%	5%	-5%	-4%
12:00	-3%	-2%	2%	-9%	6%	-4%	-3%
13:00	-3%	-1%	1%	-8%	6%	-4%	-3%
14:00	-4%	-1%	0%	-9%	5%	-5%	-4%
15:00	-4%	-3%	-1%	-9%	3%	-5%	-4%
16:00	-5%	-5%	-1%	-9%	2%	-6%	-5%
17:00	-4%	-4%	-2%	-9%	2%	-6%	-5%
18:00	-4%	-4%	-4%	-9%	0%	-6%	-5%
19:00	-4%	-4%	-4%	-9%	0%	-6%	-5%
20:00	-4%	-4%	-4%	-9%	0%	-6%	-5%
21:00	-3%	-3%	-3%	-8%	0%	-5%	-4%
22:00	-2%	-2%	-2%	-7%	1%	-4%	-3%
23:00	-1%	-1%	-1%	-6%	2%	-3%	-2%

Average Hourly Load Deficit By Area 9/28 - 10/9 (Weekdays)

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Impacts on Hourly Load Patterns (Zone)

Hour	A	B	C	D	E	F	G	H	I	J	K
0:00	0%	0%	-1%	-10%	4%	-1%	-1%	-4%	3%	-5%	2%
1:00	0%	0%	-2%	-13%	5%	-1%	-2%	-6%	3%	-5%	1%
2:00	0%	-1%	-2%	-13%	3%	-1%	-2%	-7%	3%	-5%	1%
3:00	0%	-1%	-3%	-13%	3%	-2%	-2%	-8%	3%	-5%	0%
4:00	-1%	-2%	-3%	-15%	1%	-3%	-3%	-9%	2%	-6%	-1%
5:00	-3%	-5%	-4%	-15%	-2%	-4%	-6%	-14%	-2%	-8%	-4%
6:00	-5%	-7%	-5%	-15%	-5%	-7%	-8%	-17%	-7%	-11%	-6%
7:00	-5%	-5%	-3%	-14%	-3%	-5%	-7%	-12%	-7%	-12%	-4%
8:00	-5%	-4%	-2%	-13%	0%	-2%	-5%	-7%	-3%	-11%	-1%
9:00	-3%	-3%	-1%	-11%	0%	0%	-5%	-3%	-2%	-11%	2%
10:00	-4%	-3%	-2%	-10%	1%	0%	-6%	-2%	-1%	-10%	3%
11:00	-3%	-2%	-2%	-9%	1%	0%	-5%	-1%	1%	-9%	5%
12:00	-2%	-2%	-2%	-10%	1%	1%	-5%	1%	2%	-9%	6%
13:00	-2%	-2%	-3%	-10%	-1%	1%	-5%	-1%	1%	-8%	6%
14:00	-3%	-3%	-4%	-11%	-1%	1%	-5%	-2%	1%	-9%	5%
15:00	-4%	-4%	-4%	-11%	-3%	0%	-6%	-3%	0%	-9%	3%
16:00	-4%	-4%	-4%	-13%	-3%	-3%	-7%	-3%	0%	-9%	2%
17:00	-3%	-3%	-3%	-13%	-1%	-3%	-6%	-4%	-1%	-9%	2%
18:00	-3%	-3%	-3%	-13%	-1%	-3%	-5%	-6%	-3%	-9%	0%
19:00	-4%	-4%	-3%	-15%	0%	-3%	-4%	-6%	-3%	-9%	0%
20:00	-4%	-4%	-3%	-15%	1%	-3%	-5%	-8%	-2%	-9%	0%
21:00	-3%	-2%	-2%	-11%	3%	-2%	-4%	-8%	-1%	-8%	0%
22:00	-2%	-1%	-2%	-9%	4%	-1%	-3%	-6%	1%	-7%	1%
23:00	0%	0%	-2%	-9%	5%	-1%	-2%	-6%	2%	-6%	2%

Average Hourly Load Deficit by Zone, 9/28 - 10/9 (Weekdays)

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