New York ISO Climate Load Impact Study Preliminary Forecasts

Presented to Load Forecasting Task Force

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AGENDA

- » Weather Trends
 - Monthly Cooling Degree Days (CDD) and Heating Degree Days (HDD)
 - Peak-day weather variable using a three-day heat index of temperature and humidity (peak-day CTHI)
- » Review Modeling Approach
- » Preliminary Baseline Results



WEATHER TRENDS



TEMPERATURE TRENDS

- » Average temperature in New York has been increasing since the early 90's.
 - On average, average annual daily temperatures have been increasing 0.7 degrees per decade
 - The coldest day temperatures have been increasing *faster* than average daily temperature
 - Temperatures on the hottest days have been increasing slower than the average daily temperature
- The number of CDD in the shoulder months are increasing faster than in the peak months
- The exception is on Long Island where temperatures on the hottest days are increasing faster than on the average day



WEATHER TREND ANALYSIS

- Trend analysis on six weather concepts:
 - Average annual temperature (avg)
 - Average annual temperature for the coldest day (min)
 - Average annual temperature for the hottest day (max)
 - Annual cumulative temperature humidity index (CTHI) for the hottest day
 - Heating degree days
 - Cooling degree days
- Processed weather data by weather station:
 - 21 weather stations
 - Trends developed for each Transmission Operator (TO) based on weather station weighting.
- Daily & hourly temperature data back to 1950
- Increasing temperature trend beginning in 1992
 - Strong statistical support with trend highly significant
- Trend analysis also provides uncertainty bandwidths
- In addition to the trend temperature forecast, a more extreme weather scenario will also be constructed



TREND MODELS



Actual

— Predicted

Estimated from 1950 through 2018

20!



ALBANY AVERAGE DAILY TEMPERATURE TREND





ALBANY MAX AND MIN TEMPERATURE TRENDS







ALBANY HOT-DAY CUMULATIVE TEMPERATURE HUMIDITY INDEX (CTHI)



Cumulative THI drives summer peak demand. Cumulative THI increases 0.63 degrees per decade.



NYC AVERAGE DAILY TEMPERATURE TREND



Note: Average daily temperature does not account for humidity or for heat that accumulates over several days in a row.



NYC MAXIMUM AND MINIMUM TEMPERATURE TREND





Climate Study Overview 11

NYC HOT-DAY CUMULATIVE THI



Average peak-producing weather variables increase 0.5 degrees per decade. 10% probability peak-producing weather increases 0.7 degrees per decade.



WEATHER TREND COEFFICIENTS

- » Average, Max, Min, and CTHI trends estimated for each weather station
 - 21 weather stations
- » Station trends weighted to TO based on NYISO station weights

то	AvgTemp	MaxTemp	MinTemp	СТНІ
NIMO	0.71	0.52	1.07	0.64
ConEd	0.69	0.56	0.86	0.59
Cen Hudson	0.90	0.78	1.78	0.80
LIPA	0.85	0.93	0.79	0.75
NYSEG	0.60	0.44	1.07	0.55
0 & R	0.59	0.41	0.99	0.64
RG&E	0.78	0.45	1.12	0.68
NYCA	0.71	0.58	0.98	0.63

- » State average temperature trend is 0.71 degrees per decade
- » Cumulative hot-day CTHI trend is 0.63 degrees per decade



THE CHALLENGE

- » Developing a forecasted weather series that reflects historical weather trends
 - Minimum increasing faster than average temperature
 - Maximum increasing slower than average temperature
- » Faster increase in CDD in the shoulder months
 - Summer is coming earlier and staying around longer



START OFF WITH A DAILY WEATHER PATTERN

- 1. For AvgDB and CTHI, calculate average by date from 1/1/1999 to 12/31/2018
 - a) Average all January 1st
 - b) Average all January 2nd
 - c) ... (all other days in the year)
 - d) Average all December 31st
- 2. Assign the values to a realistic pattern that assures that the peak-producing weather conditions occur on a weekday



Calculate Starting Annual Temperature Duration Curve (TDC)

- » Sort from high to low temperature and average by season (1999 2018)
- » Adjust starting temperature duration curve to 2019 start-year
 - Already 20 years out from the starting point
- » This is the base. The duration curve adjusted going forward by trend parameters. Similar curve constructed for CTHI.





Depiction of Adjustment Process – Trend 2050





TRENDED TEMPERATURE PROJECTIONS

- » Map duration curves to the normal temperature pattern
 - Rotate by day always put the hottest on a specified weekday
 - Rotate by calendar always start on January 1st





CALCULATE DAILY DEGREE-DAYS





AGGREGATE TO MONTHLY DEGREE DAYS SALES/ENERGY WEATHER DRIVERS

» State level

Itron

- Average daily temperature increases 0.71 degrees per decade
- Highest daily average temperature increases 0.58 degrees per decade
- Lowest daily average temperature increase 0.91 degrees per decade



PEAK WEATHER DRIVERS

» CTHI increases 0.63 degrees per decade



Peak TDD (CTHI based degree days) increases 0.3% degrees per year

Peak-day HDD decreases 0.3% degrees per year



WEATHER TRENDS BY TO

Year	CenHud	ConEd	LIPA	NIMO	NYPA	NYSEG	OR	RGE	NYCA
2020	14.2	16.8	15.8	11.9	12.0	11.5	13.9	12.5	13.9
2030	14.8	17.3	16.8	12.2	12.4	11.8	14.4	12.9	14.5
2040	15.5	17.9	17.7	12.6	12.8	12.1	14.9	13.3	15.0
2050	16.1	18.4	18.7	13.0	13.2	12.5	15.4	13.7	15.5
Avg Change	0.44%	0.32%	0.56%	0.32%	0.31%	0.26%	0.35%	0.30%	0.37%

Peak-Day TDD65

* Derived from trended cumulative peak-day THI

Year	CenHud	ConEd	LIPA	NIMO	NYPA	NYSEG	OR	RGE	NYCA
2020	839.9	1,185.2	1,009.6	613.0	471.8	571.6	778.4	644.0	850.6
2030	925.9	1,263.2	1,125.7	669.1	497.1	616.4	827.0	700.7	919.6
2040	1,020.9	1,349.9	1,253.3	731.8	526.4	666.9	882.0	765.2	995.9
2050	1,114.2	1,432.0	1,378.6	792.7	552.9	714.8	933.7	827.6	1,069.5
Avg Change	0.95%	0.63%	1.04%	0.86%	0.53%	0.75%	0.61%	0.84%	0.77%

CDD65

* Derived from trended temperatures



MODELING APPROACH



ENERGY & PEAK MODELING APPROACH

- Models
 - Bottom-up for the state starting with customer class sales
 - Top-level for the Transmission Owners directly modeling system energy and peak demand
- Weather
 - Actual daily temperature combined with trended daily temperature
 - Actual daily CTHI combined with trended CTHI
 - Weather data use to generate monthly CDD, HDD, and peak-day CTHI
- Economic Index
 - TO Models: GDP and Households (equally weighted)
 - Residential: Households, household income
 - Commercial: GDP and nonmanufacturing employment
 - Industrial: Industrial output
- Energy Intensity Indices Heating, Cooling, Base or Non-Weather Sensitive
 - Derived from the AEO 2019 end-use forecast for mid-Atlantic
 - Weighted to reflect residential, nonresidential sales mix
 - For ConEd, modified to reflect higher multi-family mix



TOP-LEVEL ENERGY MODEL VARIABLES CONEDISON





ENERGY MODEL – CONEDISON

ESTIMATED JAN 2009 TO DEC 2018

Variable	Coefficient	StdErr	T-Stat	P-Value
mEnergyVars.XOther	5191408.895	21655.977	239.722	0.00%
mEnergyVars.XCool	7485462.138	107387.356	69.705	0.00%
mEnergyVars.XHeat	2007348.232	107838.143	18.614	0.00%
AR(1)	0.449	0.084	5.349	0.00%



Model Statistics	
Iterations	8
Adjusted Observations	119
Deg. of Freedom for Error	115
R-Squared	0.987
Adjusted R-Squared	0.986
AIC	22.625
BIC	22.718
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-1,511.04
Model Sum of Squares	54,769,366,150,695.20
Sum of Squared Errors	745,179,363,979.33
Mean Squared Error	6,479,820,556.34
Std. Error of Regression	80,497.33
Mean Abs. Dev. (MAD)	60,644.01
Mean Abs. % Err. (MAPE)	1.18%
Durbin-Watson Statistic	1.991



PEAK MODEL VARIABLES – CONEDISON





PEAK MODEL CONEDISON ESTIMATED JAN 2009 TO DEC 2018

Variable	Coefficient	StdErr	T-Stat	P-Value
mPeakVars.HeatVar	33.211	2.427	13.683	0.00%
mPeakVars.CoolVar	256.994	10.445	24.604	0.00%
mPeakVars.BaseMW	1.265	0.009	141.703	0.00%
mPeakVars.MarBase	-0.037	0.014	-2.616	1.02%
mPeakVars.MayBase	0.114	0.018	6.363	0.00%
mPeakVars.JunBase	0.176	0.023	7.727	0.00%
mPeakVars.JulBase	0.151	0.028	5.436	0.00%
mPeakVars.AugBase	0.143	0.025	5.798	0.00%
mPeakVars.SepBase	0.179	0.024	7.468	0.00%



Model Statistics	
Iterations	1
Adjusted Observations	120
Deg. of Freedom for Error	108
R-Squared	0.984
Adjusted R-Squared	0.982
AIC	11.075
BIC	11.354
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-822.79
Model Sum of Squares	379,927,998.69
Sum of Squared Errors	6,342,246.24
Mean Squared Error	58,724.50
Std. Error of Regression	242.33
Mean Abs. Dev. (MAD)	182.02
Mean Abs. % Err. (MAPE)	1.86%
Durbin-Watson Statistic	2.049



PRELIMINARY TO DEMAND FORECAST COINCIDENT PEAK UNADJUSTED FOR NEW TECHNOLOGIES

2019 1,146 12,938 5,288 6,975 398 3,153 1,093 1,526 33,2 2020 1,146 0.0% 12,910 -0.2% 5,290 0.0% 6,953 -0.3% 394 -0.9% 3,143 -0.3% 1,102 0.8% 1,528 0.1% 33,2 2021 1,145 -0.1% 12,853 -0.4% 5,283 -0.1% 6,918 -0.5% 387 -1.8% 3,124 -0.6% 1,108 0.5% 1,525 -0.2% 33,2 2022 1,153 0.7% 12,887 0.3% 5,314 0.6% 6,939 0.3% 384 -0.9% 3,129 0.2% 1,121 1.2% 1,535 0.6% 33,33 2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 383 -0.2% 3,133 0.1% 1,133 1.1% 1,543 0.5% 33,4 2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 383 -0.2% 3,133<	03 82 0.2% 28 -0.2% 85 0.5% 94 0.3% 95 0.3% 89 0.3% 62 0.2%
2020 1,146 0.0% 12,910 -0.2% 5,290 0.0% 6,953 -0.3% 394 -0.9% 3,143 -0.3% 1,102 0.8% 1,528 0.1% 33,2 2021 1,145 -0.1% 12,853 -0.4% 5,283 -0.1% 6,918 -0.5% 387 -1.8% 3,124 -0.6% 1,108 0.5% 1,525 -0.2% 33,2 2022 1,153 0.7% 12,887 0.3% 5,314 0.6% 6,939 0.3% 384 -0.9% 3,129 0.2% 1,121 1.2% 1,535 0.6% 3,32 2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 3,133 0.1% 1,133 1.1% 1,543 0.5% 3,43	82 0.2% 28 -0.2% 85 0.5% 94 0.3% 95 0.3% 89 0.3% 62 0.2%
2021 1,145 -0.1% 12,853 -0.4% 5,283 -0.1% 6,918 -0.5% 387 -1.8% 3,124 -0.6% 1,108 0.5% 1,525 -0.2% 33,22 2022 1,153 0.7% 12,887 0.3% 5,314 0.6% 6,939 0.3% 384 -0.9% 3,129 0.2% 1,121 1.2% 1,535 0.6% 33,32 2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 383 -0.2% 3,133 0.1% 1,133 1.1% 1,543 0.5% 33,4	-0.2% 85 0.5% 94 0.3% 95 0.3% 89 0.3% 62 0.2%
2022 1,153 0.7% 12,887 0.3% 5,314 0.6% 6,939 0.3% 384 -0.9% 3,129 0.2% 1,121 1.2% 1,535 0.6% 33,23 2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 383 -0.2% 3,133 0.1% 1,133 1.1% 1,543 0.5% 33,4	85 0.5% 94 0.3% 95 0.3% 89 0.3% 62 0.2%
2023 1,159 0.5% 12,931 0.3% 5,339 0.5% 6,953 0.2% 383 -0.2% 3,133 0.1% 1,133 1.1% 1,543 0.5% 33,4	94 0.3% 95 0.3% 89 0.3% 62 0.2%
	95 0.3% 89 0.3% 62 0.2%
2024 1,164 0.4% 12,968 0.3% 5,364 0.5% 6,960 0.1% 380 -0.6% 3,133 0.0% 1,146 1.1% 1,549 0.4% 33,5	89 0.3% 62 0.2%
2025 1,169 0.4% 13,007 0.3% 5,389 0.5% 6,966 0.1% 378 -0.6% 3,132 0.0% 1,157 1.0% 1,554 0.3% 33,6	62 0.2%
2026 1,172 0.3% 13,024 0.1% 5,411 0.4% 6,961 -0.1% 375 -0.9% 3,126 -0.2% 1,167 0.8% 1,558 0.2% 33,7	
2027 1,175 0.3% 13,053 0.2% 5,436 0.5% 6,963 0.0% 372 -0.8% 3,123 -0.1% 1,178 0.9% 1,562 0.3% 33,8	61 0.3%
2028 1,181 0.5% 13,105 0.4% 5,470 0.6% 6,977 0.2% 370 -0.5% 3,126 0.1% 1,191 1.1% 1,569 0.4% 34,0	06 0.4%
2029 1,187 0.5% 13,169 0.5% 5,508 0.7% 6,997 0.3% 369 -0.2% 3,131 0.2% 1,205 1.2% 1,576 0.5% 34,1	73 0.5%
2030 1,191 0.3% 13,163 0.0% 5,520 0.2% 6,996 0.0% 366 -0.8% 3,128 -0.1% 1,216 0.9% 1,580 0.2% 34,2	55 0.2%
2031 1,194 0.3% 13,168 0.0% 5,536 0.3% 7,000 0.1% 364 -0.7% 3,126 0.0% 1,227 0.9% 1,584 0.3% 34,3	54 0.3%
2032 1,199 0.3% 13,178 0.1% 5,556 0.4% 7,007 0.1% 361 -0.6% 3,126 0.0% 1,238 0.9% 1,588 0.3% 34,4	58 0.3%
2033 1,203 0.4% 13,199 0.2% 5,581 0.5% 7,018 0.2% 360 -0.5% 3,128 0.1% 1,250 1.0% 1,593 0.3% 34,5	80 0.4%
2034 1,209 0.4% 13,229 0.2% 5,610 0.5% 7,032 0.2% 358 -0.4% 3,132 0.1% 1,263 1.0% 1,599 0.4% 34,7	17 0.4%
2035 1,214 0.5% 13,269 0.3% 5,643 0.6% 7,050 0.3% 357 -0.4% 3,136 0.2% 1,276 1.1% 1,606 0.4% 34,8	72 0.4%
2036 1,221 0.5% 13,321 0.4% 5,681 0.7% 7,072 0.3% 356 -0.3% 3,142 0.2% 1,290 1.1% 1,614 0.5% 35,0	45 0.5%
2037 1,227 0.5% 13,373 0.4% 5,719 0.7% 7,091 0.3% 354 -0.4% 3,146 0.1% 1,304 1.1% 1,621 0.4% 35,2	14 0.5%
2038 1,233 0.5% 13,429 0.4% 5,757 0.7% 7,111 0.3% 352 -0.5% 3,150 0.1% 1,318 1.1% 1,627 0.4% 35.3	85 0.5%
2039 1,240 0.5% 13,488 0.4% 5,798 0.7% 7,132 0.3% 351 -0.5% 3,154 0.1% 1,332 1.1% 1,634 0.4% 35,5	60 0.5%
2040 1,245 0.4% 13,505 0.1% 5,822 0.4% 7,144 0.2% 348 -0.8% 3,155 0.0% 1,345 0.9% 1,639 0.3% 35,7	01 0.4%
2041 1,250 0.4% 13,531 0.2% 5,850 0.5% 7,156 0.2% 345 -0.8% 3,155 0.0% 1,358 1.0% 1,644 0.3% 35,8	47 0.4%
2042 1,255 0.4% 13,561 0.2% 5,880 0.5% 7,168 0.2% 342 -0.8% 3,155 0.0% 1,371 1.0% 1,649 0.3% 35,5	96 0.4%
2043 1,261 0.5% 13,602 0.3% 5,913 0.6% 7,183 0.2% 339 -0.8% 3,156 0.0% 1,384 1.0% 1,655 0.3% 36,1	.57 0.4%
2044 1,268 0.5% 13,654 0.4% 5,951 0.6% 7,202 0.3% 337 -0.8% 3,158 0.1% 1,398 1.0% 1,661 0.4% 36,3	37 0.5%
2045 1,275 0.6% 13,720 0.5% 5,995 0.7% 7,227 0.3% 335 -0.7% 3,163 0.2% 1,414 1.1% 1,669 0.5% 36,5	43 0.6%
2046 1,284 0.7% 13,803 0.6% 6,046 0.9% 7,259 0.4% 333 -0.5% 3,171 0.3% 1,432 1.2% 1,678 0.6% 36,7	88 0.7%
2047 1,293 0.7% 13,889 0.6% 6,099 0.9% 7,293 0.5% 331 -0.5% 3,180 0.3% 1,449 1.2% 1,688 0.6% 37,0	37 0.7%
2048 1,303 0.8% 13,985 0.7% 6,156 0.9% 7,330 0.5% 330 -0.4% 3,190 0.3% 1,468 1.3% 1,698 0.6% 37,3	08 0.7%
2049 1,313 0.8% 14,086 0.7% 6,216 1.0% 7,370 0.5% 328 -0.4% 3,201 0.4% 1,487 1.3% 1,709 0.7% 37,5	92 0.8%
2050 1,324 0.8% 14,194 0.8% 6,279 1.0% 7,413 0.6% 327 -0.3% 3,214 0.4% 1,507 1.3% 1,721 0.7% 37,8	91 0.8%
2020 - 30 0.4% 0.2% 0.4% 0.1% -0.7% 0.0% 1.0% 0.3%	0.29%
2030 - 40 0.4% 0.3% 0.5% 0.2% -0.5% 0.1% 1.0% 0.4%	0.41%
2040 - 50 0.6% 0.5% 0.8% 0.4% -0.6% 0.2% 1.1% 0.5%	0.60%
2020 - 40 0.5% 0.3% 0.6% 0.2% -0.6% 0.1% 1.0% 0.4%	0.4%



ADJUSTING FOR NEW TECHNOLOGIES

- » Calculate Baseline Hourly Load Forecast
 - Combine peak, energy, and hourly load profile (incorporates increasing temperature
- » Generate hourly load forecast for new technologies
 - Solar
 - Electric Vehicles
 - Battery Storage
 - Electrification Heat Pumps, Water Heating, Commercial Cooking, ??
- » Calculated Adjusted Hourly Load Profile
 - Add EVs and Electrification
 - Subtract Solar
- » Sum over hours to obtain monthly and annual energy



LOAD ADJUSTMENT SOLAR, EVS, AND BATTERY







ADJUSTED LOAD FORECAST







PEAK COMPARISON

- » Baseline Peak Higher than Adjusted Demand through 2033
- » Peak demand shifts out two hours by 2022
 - Fairly flat system load profile. Doesn't take much to shift demand timing

Year	Baseline	Time	Adjusted	Time
2020	33,284	7/15/2020 16:00	32,722	7/14/2020 16:00
2030	34,256	7/17/2030 16:00	33,689	7/17/2030 18:00
2040	35,701	7/18/2040 16:00	37,824	7/18/2040 19:00
2050	37,891	7/20/2050 16:00	43,709	7/20/2050 19:00



WEATHER IMPACTS



NYCA COOLING REQUIREMENTS





NYCA HEATING REQUIREMENTS





NYCA ENERGY REQUIREMENTS



In total, there is not much of an impact

- * Increase in cooling load offset by decrease in heating load
- * Heating and cooling are relatively small part of total energy requirements



SYSTEM END-USE DISTRIBUTION



» Heating and cooling requirements are small compared to total non-weather sensitive usage



SYSTEM PEAK IMPACT COMPARISON WITH NORMAL PEAK WEATHER



1,326 to 2,653 MW higher by 2040



SYSTEM PEAK FORECAST WITH 1.4 DEGREE PER DECADE TREND



2,865 to 4,195 MW higher by 2040



SYSTEM HOURLY LOAD PROFILE - 2020





IMPACT IN HOURLY LOADS OVER TIME DAYS OVER 80 DEGREES AND HOURS OVER 32,000 MW

Year	Month	DaysOvr80	Hr10 Plus	Hr11 Plus	Hr12 Plus	Hr13 Plus	Hr14 Plus	Hr15 Plus	Hr16 Plus	Hr17 Plus	Hr18 Plus	Hr19 Plus	Hr20 Plus	Hr21 Plus	Hr22 Plus	Hr23 Plus	Total
2020	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	7	5.00	0.00	0.00	1.00	2.00	3.00	3.00	4.00	3.00	2.00	0.00	0.00	0.00	0.00	0.00	18.00
2020	8	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
2020	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Year	Month	DaysOvr80	Hr10 Plus	Hr11 Plus	Hr12 Plus	Hr13 Plus	Hr14 Plus	Hr15 Plus	Hr16 Plus	Hr17 Plus	Hr18 Plus	Hr19 Plus	Hr20 Plus	Hr21 Plus	Hr22 Plus	Hr23 Plus	Total
2030	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	7	6.00	0.00	1.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	2.00	0.00	0.00	0.00	0.00	31.00
2030	8	1.00	0.00	0.00	0.00	1.00	1.00	1.00	2.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	7.00
2030	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Year	Month	DaysOvr80	Hr10 Plus	Hr11 Plus	Hr12 Plus	Hr13 Plus	Hr14 Plus	Hr15 Plus	Hr16 Plus	Hr17 Plus	Hr18 Plus	Hr19 Plus	Hr20 Plus	Hr21 Plus	Hr22 Plus	Hr23 Plus	Total
2040	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	7	8.00	0.00	3.00	5.00	6.00	7.00	8.00	10.00	8.00	6.00	4.00	3.00	1.00	0.00	0.00	61.00
2040	8	1.00	0.00	0.00	1.00	3.00	3.00	3.00	3.00	3.00	2.00	1.00	0.00	0.00	0.00	0.00	19.00
2040	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Itron

Incidences of loads exceeding 32,000 MW increases from 22 hours to 80 hours by 2040

2020

2030

2040

NEXT STEPS

- » Evaluate 90% weather impacts
- » Evaluate load impact for potentially more extreme climate impacts
- » Develop load scenarios for state public policy goals
 - Solar, Electric Vehicles, Battery Storage, Electrification





