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2016 Forecast Update: Weather Normalization, Peak-Shift Analysis, and Future Work

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Peak Weather Normalization

Weather-Normalized Historical Peaks

- Defined as estimate of annual peaks that would have occurred in the last historical year in a typical or “average” weather year
- Serve as starting points for peak forecasts
- Regression analysis to develop weather response
- 30 years of temperature data applied to estimated weather response to develop distribution; median serves as 1 in 2 peak

Weather-Normalized Peaks

- Comparison with weather-normalized peaks estimated by IOUs
  - Relatively small differences in 2016, IOUs are comfortable with our estimates
  - Remaining issue: differences in IOU load data vs. CAISO EMS hourly data
  - RECOMMENDATION: Mechanism in place to allow IOUs use of EMS data

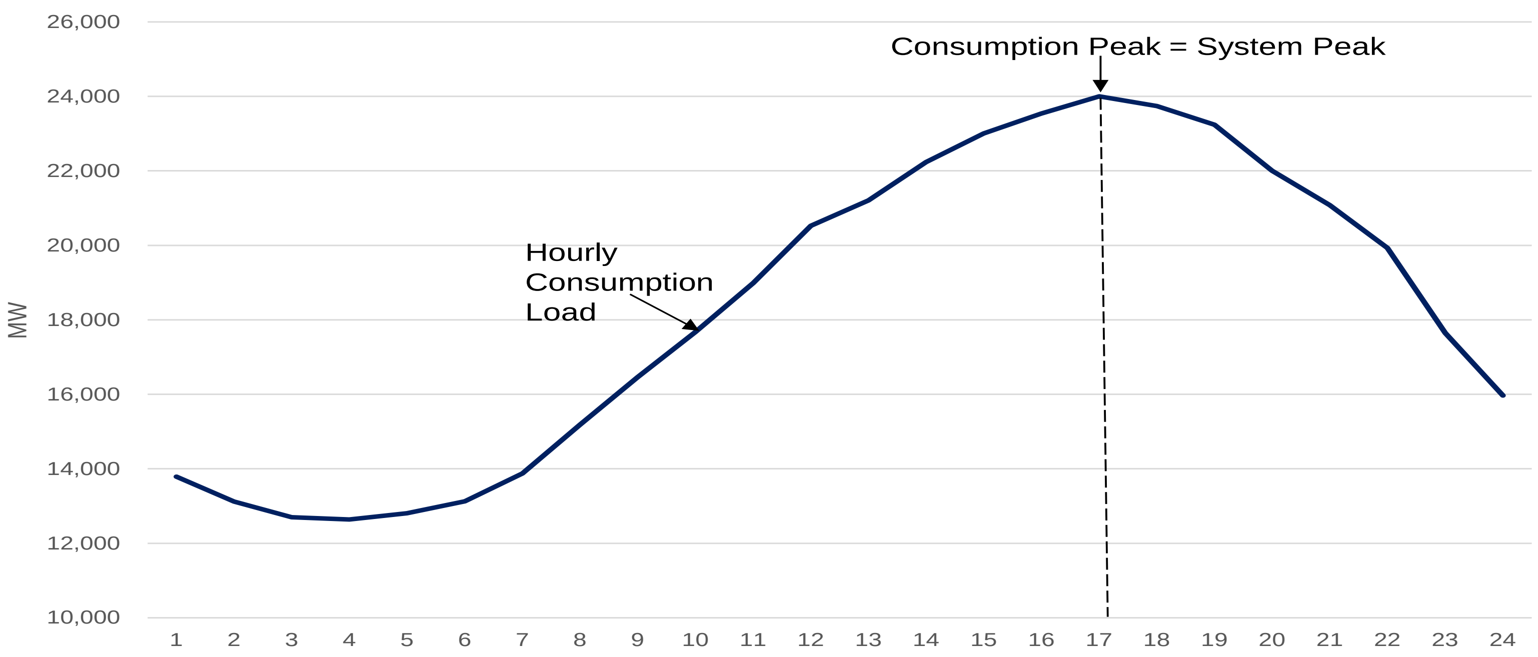
Peak-Shift Analysis

Peak-Shift Issue

- Demand modifiers may affect hourly loads served by LSEs to the extent that LSE-served (system) peak load may shift to later in the day
- Key factor: PV
  - PV generation drops off quickly after conventional peak hour in late afternoon
  - With sufficiently high PV adoption, drop-off can result in system load increasing from late afternoon to evening
- Other factors: AAEE, EVs, TOU

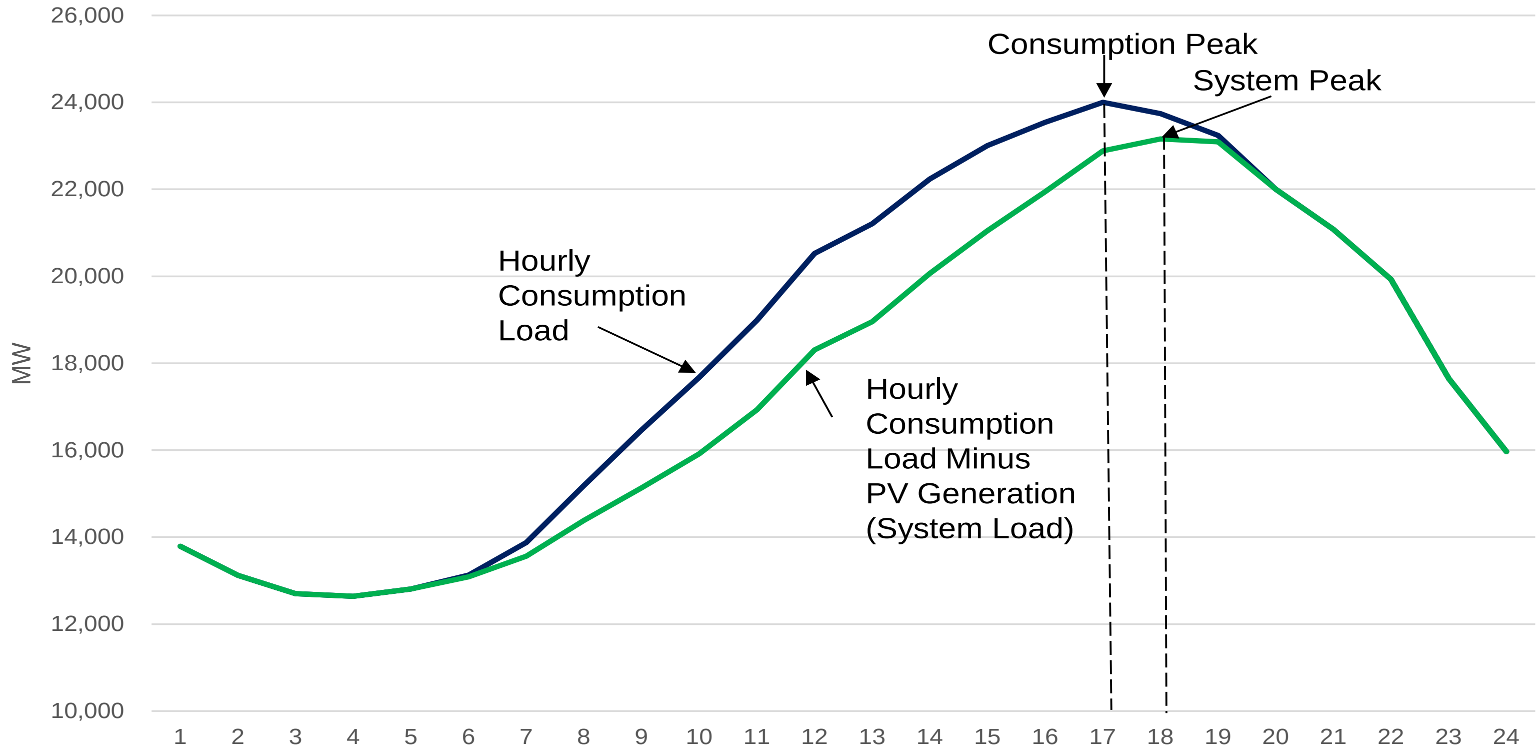
Peak-Shift Illustration

Hourly Loads: first, with no PV or AAEE
Assume zero non-PV self-gen for this example



Peak-Shift Illustration

Now, include PV generation: 1 hour peak-shift



Peak-Shift Illustration

Finally, include AAEE Savings: 2 hour peak-shift

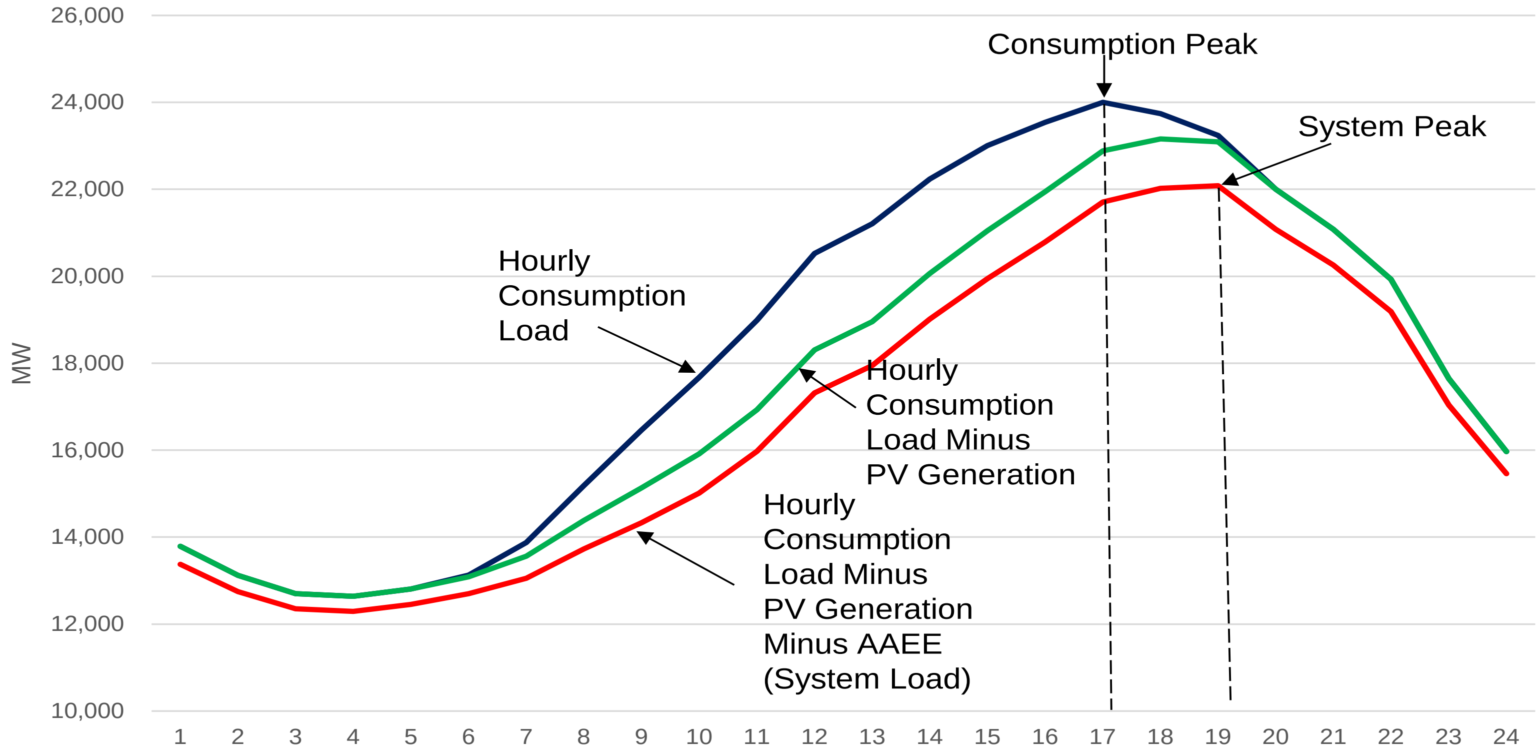
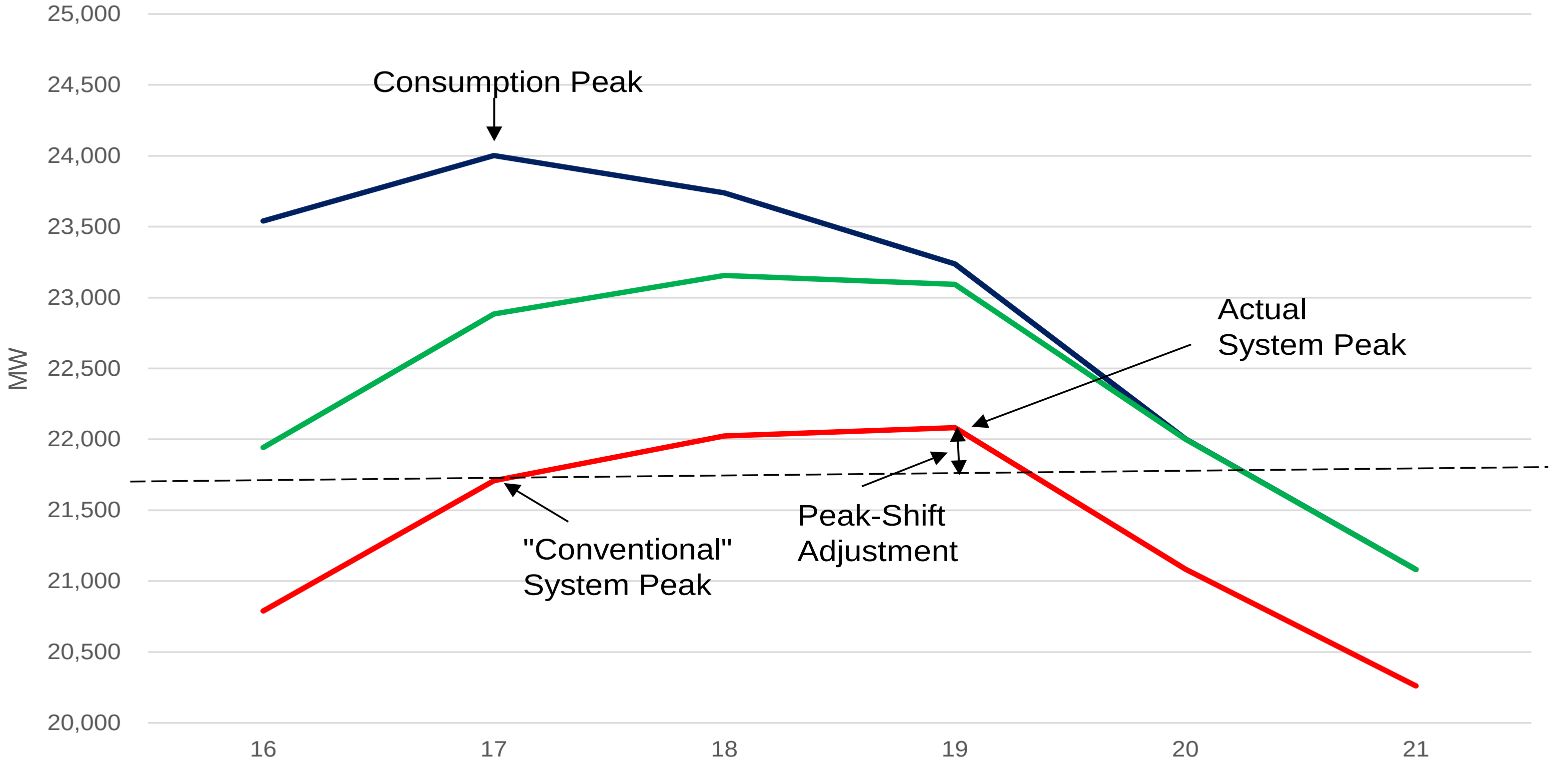


Illustration of Peak-Shift Adjustment

Blow-up of Previous Graph



Overview of Method

- Develop 8760 generation for PV
- Develop 8760 load impacts for AAEE
- Develop weather-normalized 8760 loads for consumption peak (hourly load model)
- Calibrate to CEDU 2016 consumption peak and annual consumption load for each year
- Adjusting for PV and AAEE, calculate system peak
- Compare CEDU 2016 1 in 2 managed peak with calculated system peaks for each year
- Calculate peak-shift incremental to 2016

Hourly Load Model Estimation

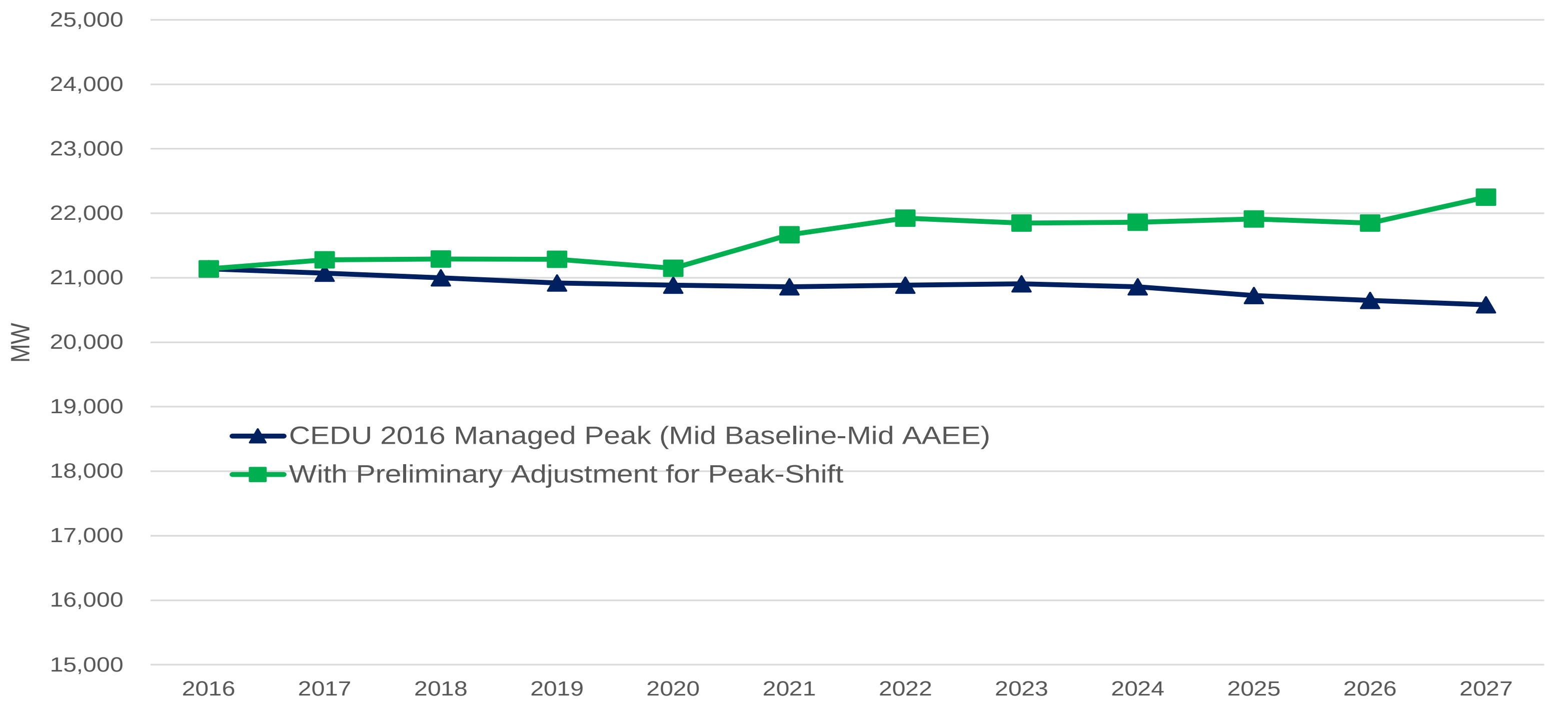
Estimate ratio of hourly load to annual average load for each hour (24 regressions for each TAC) as a function of temperatures, day of the week, weekend/holiday, and month using hourly data by TAC for 2006-2012

$L_{i,d} / L_y = f(g(t), dow_d, wkhol_d, month_d, constant_i)$

i=1,24 d=1,365, y=1,7, g(t)=temperature formulation

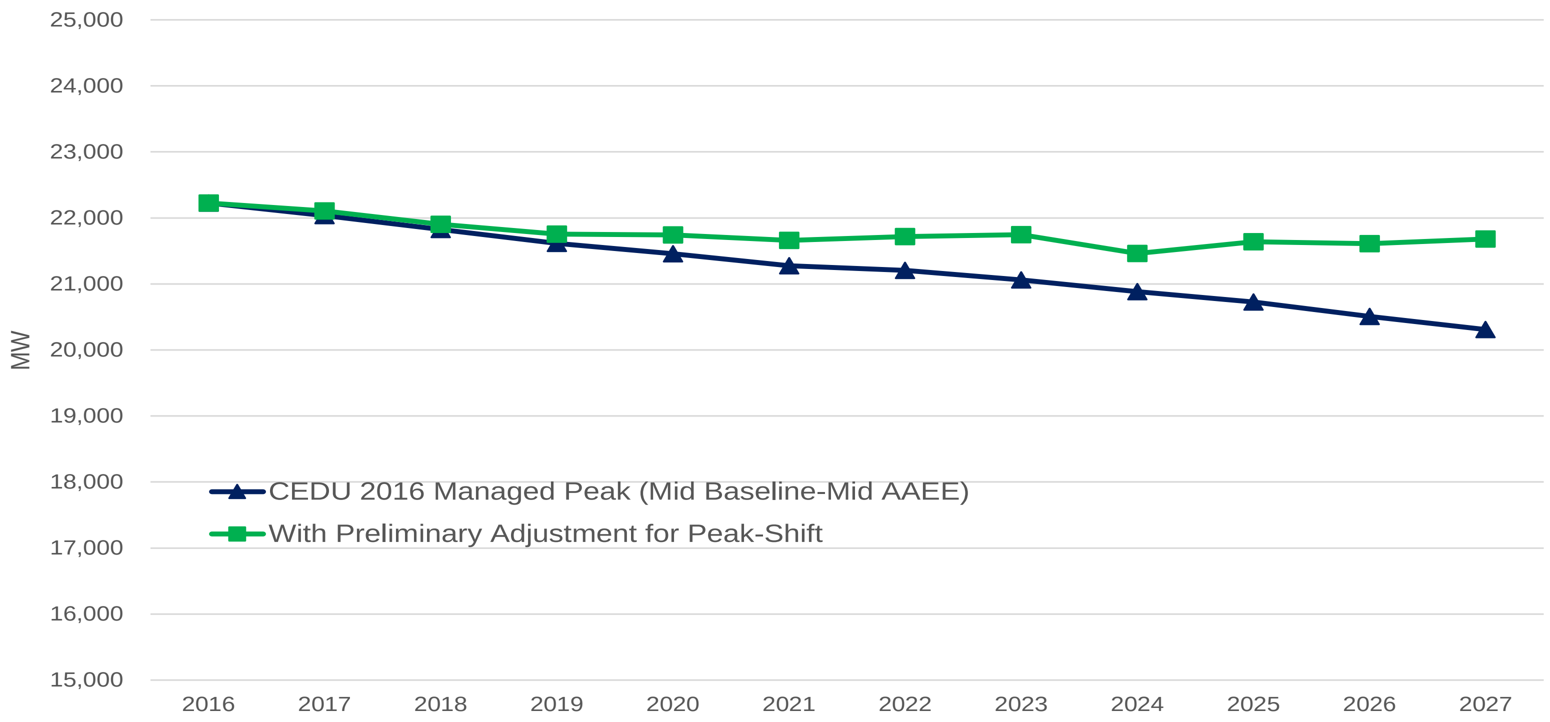
Preliminary 1 in 2 Peak-Shift Adjustment: PG&E Planning Area (TAC)

Peak-shift adjustment reaches 1,675 MW by 2027



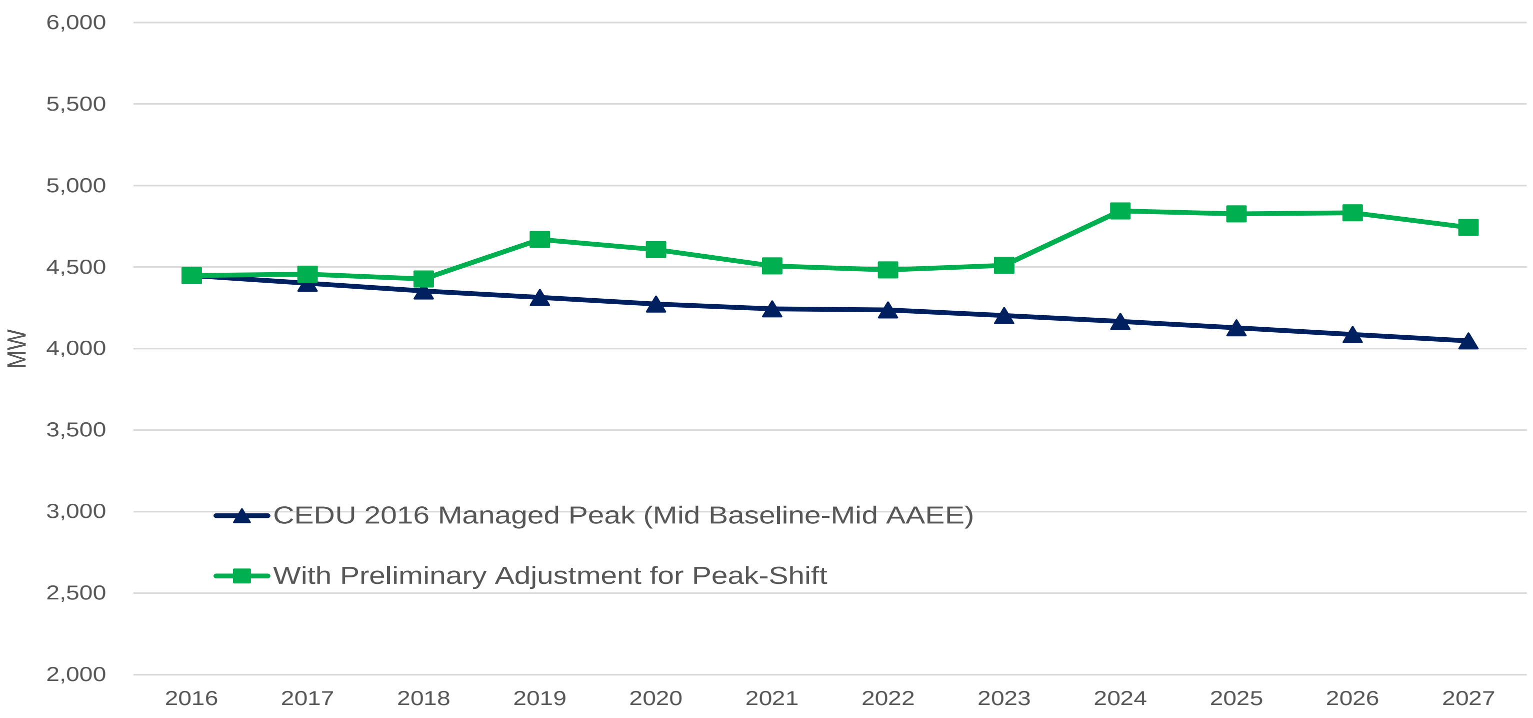
Preliminary 1 in 2 Peak-Shift Adjustment: SCE Planning Area (TAC)

Peak-shift adjustment reaches 1,375 MW by 2027



Preliminary 1 in 2 Peak-Shift Adjustment: SDG&E Planning Area (TAC)

Peak-shift adjustment reaches 700 MW by 2027

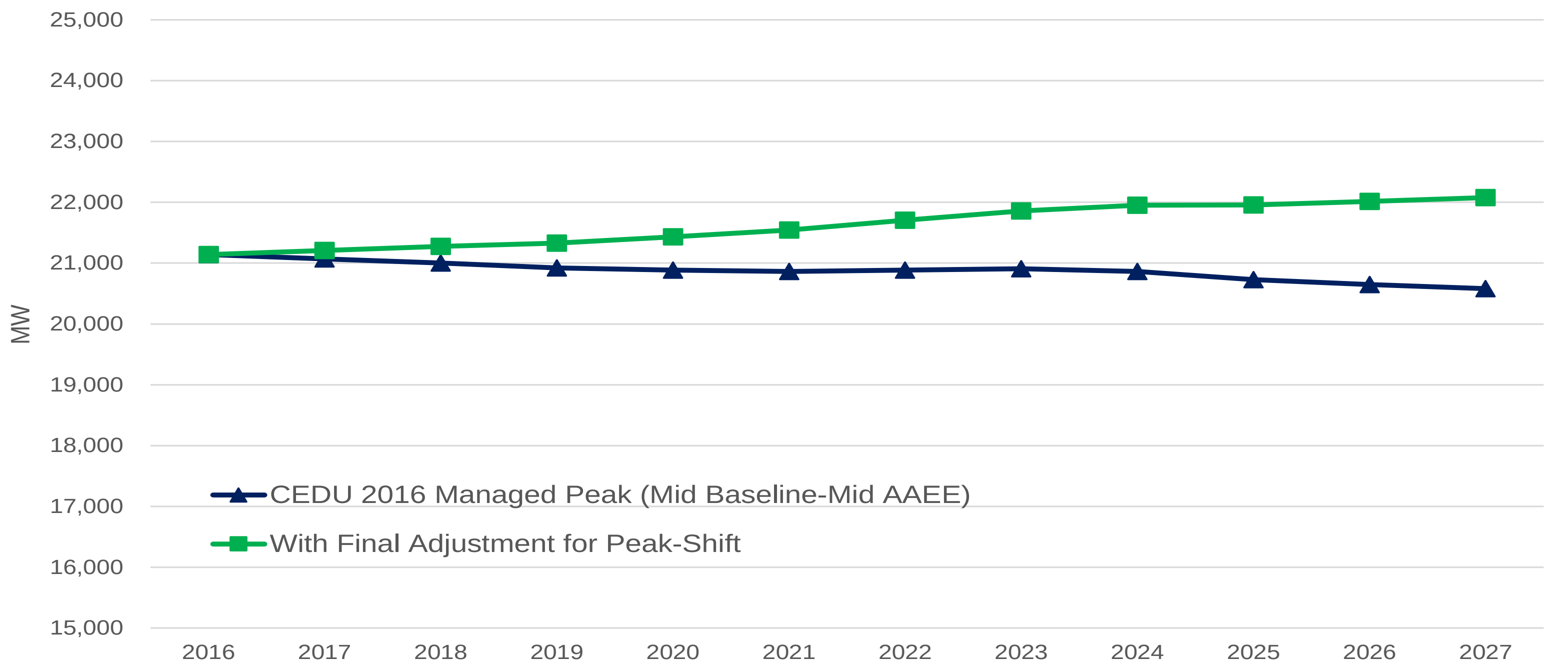


Final Peak-Shift Adjustment

- Previous figures show abrupt year-to-year changes in peak-shift adjustment.
- These year-to-year changes reflect the assumptions for average weather year for hourly temperatures and requirement of hourly analysis.
- Choice of different assumptions for average weather year would yield different year-to-year changes but similar upward trend.
- Therefore, staff recommends “smoothing” of peak-shift adjustment to reflect upward trend.

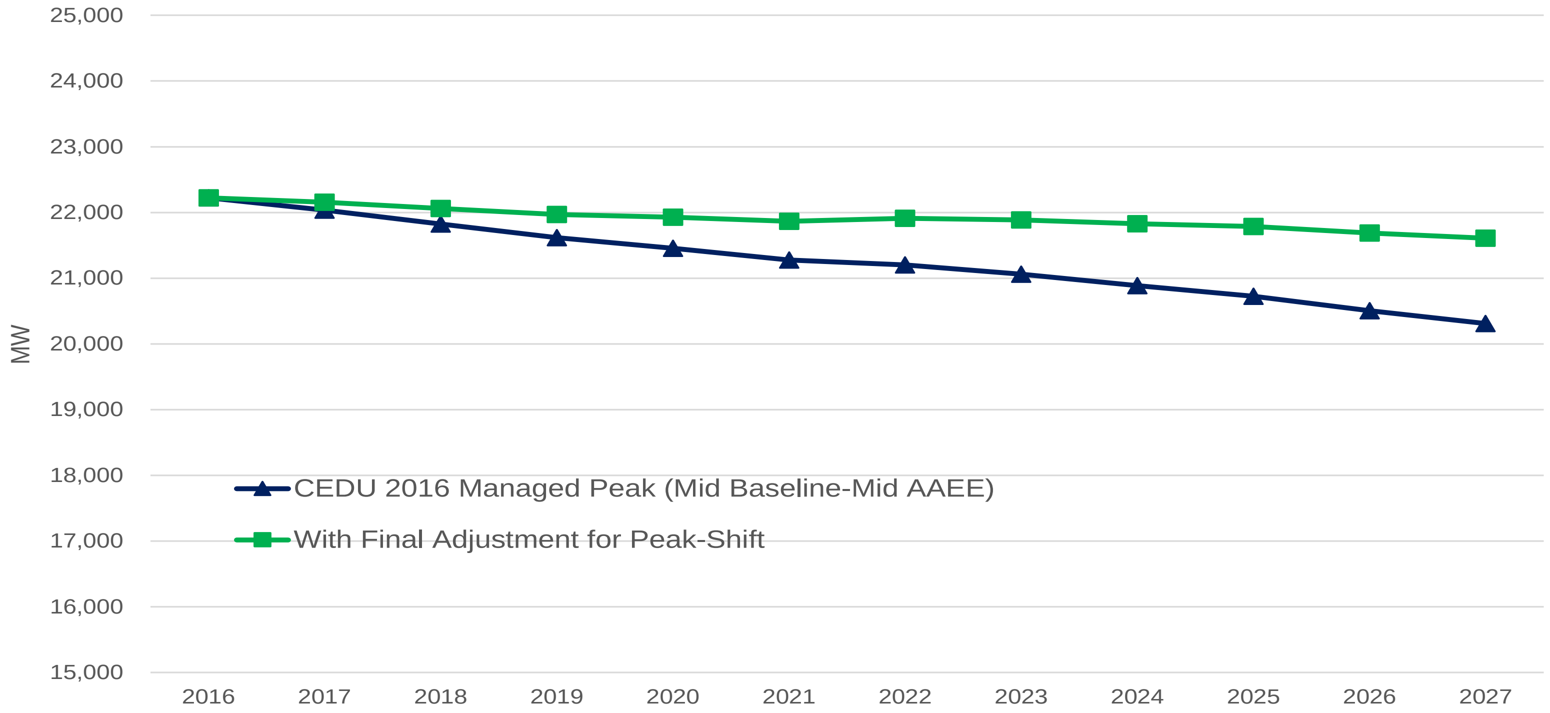
Final 1 in 2 Peak-Shift Adjustment: PG&E Planning Area (TAC)

Peak-shift adjustment reaches 1,500 MW by 2027



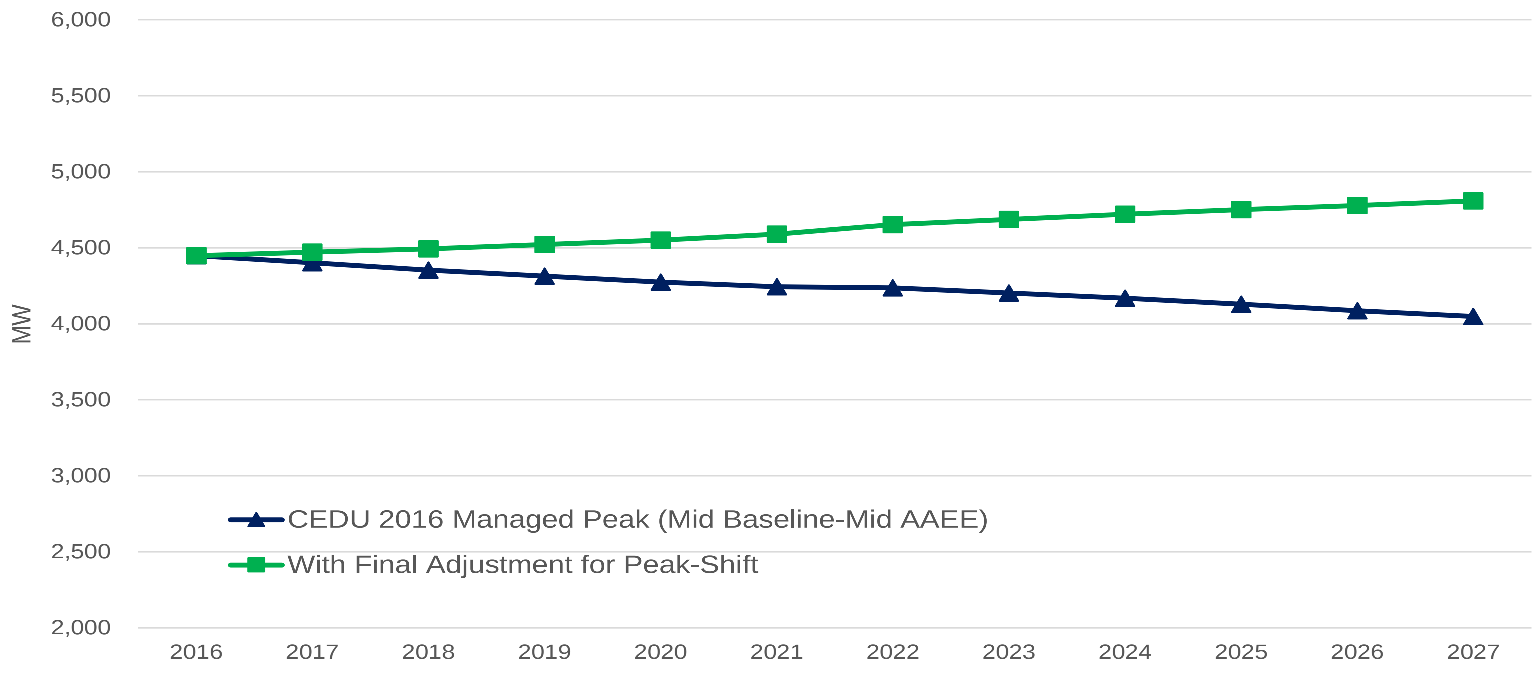
Final 1 in 2 Peak-Shift Adjustment: SCE Planning Area (TAC)

Peak-shift adjustment reaches 1,300 MW by 2027



Final 1 in 2 Peak-Shift Adjustment: SDG&E Planning Area (TAC)

Peak-shift adjustment reaches 750 MW by 2027



1 in 10 vs. 1 in 2 Peak-Shift

- Staff uses multipliers (e.g. 0.1) derived from distribution mentioned in Slide 2 to convert IEPR forecast 1 in 2 peaks to 1 in 10
  - 1 in 2 peak times (1+multiplier) = 1 in 10 peak
- Aside from peak, no specific definition for a 1 in 10 year (as opposed to “average” year)
- So, properly quantifying a 1 in 10 peak-shift would require a full simulation model for hourly loads to develop hourly distributions
  - Also, would require adjustment to AAEE and PV loads

1 in 10 vs. 1 in 2 Peak-Shift

However, with certain simplifying assumptions (e.g. no change in AAEE savings) a relationship can be calculated for the 1 in 10 peak shift vs. the 1 in 2.

Assuming a peak-shift from HR1 to HR 2:

peak-shift adjustment (1 in 10) =

peak-shift adjustment (1 in 2)

minus

(cons. load HR1 1 in 2 – cons. load HR2 1 in 2)

times

1 in 10 multiplier

1 in 10 vs. 1 in 2 Peak-Shift

- The second term in this equation, difference in consumption load times multiplier, tends to be small relative to 1 in 2 peak-shift adjustment
- This means that, under simplifying assumptions, the 1 in 10 peak-shift adjustment will always be slightly below the 1 in 2 adjustment, but relatively close
- Therefore, staff recommends using the same peak-shift adjustment for 1 in 10 as 1 in 2

Moving Forward

Work in Progress for 2017 IEPR Forecast

- Full hourly load model
  - Simulation of numerous weather futures to develop distributions for peaks, more comprehensively capturing peak-shift
  - Incorporation of EV and TOU load impacts
- New AAEE estimates, expanded coverage
- SB 350 and AB 802 scenarios developed through the IOU and POU potential studies
- Continued development of PV modeling

Questions/Comments?