BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Assess Peak Electricity Usage Patterns and Consider Appropriate Time Periods for Future Time-of-Use Rates and Energy Resource Contract Payments.	Rulemaking 15-12-012

COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR

On August 20, 2016, Administrative Law Judge (ALJ) McKinney issued an email ruling (Ruling) inviting the California Independent System Operation Corporation (CAISO) to serve and file additional comments in this proceeding. Generally, the Ruling requested that the CAISO provide comments regarding (1) the information needed in future rate proceedings to re-produce the CAISO's time-of-use (TOU) period report (TOU Report) and (2) instructions that would enable other entities to use the methodology used by CAISO for its TOU Report in this proceeding. The CAISO responds to these questions below.

I. Introduction

The TOU Report filed by the CAISO on January 22, 2016 can be prepared by other parties (referred to as "modelers" in this response) using publicly available and vetted data. The resulting analysis can be compared against wholesale market prices and marginal generation cost data to set TOU time periods that would be most helpful from a grid perspective for customers to beneficially modify their energy use. The CAISO analysis is based on net load, which is defined as the system load less electricity production from variable wind and solar resources. The net load assumes that the contribution from low production cost intermittent renewable resources is maximized while higher variable production cost resources that burn fuel must be turned down given the system's limited ability to store significant amounts of energy for later use. The net load curve is calculated using historical or forecasted energy production and load data. The CAISO presents the specific process through which it developed the TOU Report below.

II. Discussion

The CAISO developed its TOU period proposal through a six step process. The steps were:

Step 1: Choose a load data source;
Step 2: Establish hourly load data – calculate hourly load for the study year of interest;
Step 3: Source wind and solar installed capacity data;
Step 4: Source and apply wind and solar generation profiles;
Step 5: Perform net load calculation;
Step 6: Develop TOU rate periods, validating against CAISO operational needs.

These steps are described in more detail below.

Step 1: Choosing a load data source

Projected load data is obtained consistent with the Long-Term Procurement Plan (LTPP) process and as described in the Planning Assumptions and Scenarios (A&S) document.

The LTPP A&S document uses the California's Energy Commission's (CEC's) Integrated Energy Policy Report (IEPR) as its source for load projections. The IEPR consists of 10-year forecasts of electricity consumption and peak electricity demand for California and for individual utility planning areas and forecast zones within the state.[1] The IEPR brings together two sources: (1) the CEC-adopted California Energy Demand (CED) Forecast and (2) additional achievable energy efficiency (AAEE).

The CED is the baseline forecast which includes economic and demographic growth, conservation and efficiency impacts, self-generation (including behind-the-meter PV), rate structures, electric vehicle fuel consumption, demand response, and additional electrification. The CED forecasts include three cases for "Low," "Mid," and "High" load growth. AAEE reflects future expected energy and capacity savings from energy efficiency programs not yet established or funded. Together, they are referred to as the "managed demand forecasts." A full IEPR is produced by the CEC in every odd-numbered year and updates are provided in even numbered years.

[1] http://www.energy.ca.gov/energypolicy/.

The 2016 LTPP A&S document relied on the CED 2015 Adopted "Mid" Demand case[2] (for forecasted years 2016 through 2026) paired with AAEE as reflected in the 2015 IEPR.[3]

Step 2: Establish hourly load data – calculate hourly load for the study year of interest

The IEPR has historically provided both monthly MW peak and MWh energy data for the utility planning areas under the Commission's jurisdiction. In future, the CEC expects to provide hourly MW load data.[4] When this occurs, Step 2 as described in this document will no longer be necessary.

Because the IEPR provides monthly MW peak data, an hourly load shape should be developed based on normalized demand. In the CAISO's TOU Report, the IEPR peak load data were used as a starting point and normalized based on historical 2005 load shapes.[5] Modelers may want to use a historical year with weather normalized demand or similar load patterns. Because the CAISO's TOU Report focused on 2021 as the year of interest, the 2024 load data was scaled down to 2021 based on the fixed monthly ratio of 2021 to 2024 peak demand. For example, if the January peak is 30,000 MW in 2021 and 32,000 MW in 2024, then the fixed ratio for the month is 0.94 (30,000 MW divided by 32,000 MW). The CAISO then applied this ratio to every minute of the 2024 January data to create a scaled 2021 load profile. The CAISO calculated a ratio for every month and applied it to each minute within the month.[6] For the CAISO's TOU Report, minute-by-minute data was available but was not necessary. Hourly granularity will suffice.

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[2] http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212018_20160629T154356_2015_Integrated_Energy_Policy_Report_Full_File_Size.pdf

[3] The 2016 LTPP A&S document is available at: http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M162/K005/162005377.PDF
For AAEE, see Supplement to California Energy Demand 2016-2026 Forecast, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=15-IEPR-05

[4] See discussion on the 2016 IEPR Update at: http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212018_20160629T154356_2015_Integrated_Energy_Policy_Report_Full_File_Size.pdf

[5] For more details on this analysis, please see the Phase 1.A Direct Testimony of Dr. Shucheng Liu in Rulemaking 13-12-10, p. 5. (http://www.caiso.com/Documents/Aug13_2014_InitialTestimony_ShuchengLiu_Phase1A_LTPP_R13-12-010.pdf.); See also CAISO TOU Report, pp. 18-19.

[6] CAISO TOU Report, p. 19.

Step 3: Source wind and solar installed capacity data

Wind and solar generation capacity comes from the Commission's renewable portfolio standard (RPS) Calculator, which has the quantity and capacity factor information for each new RPS project by year and location.[7] Depending on what year's data is available and the study year of interest, the wind and solar generation may need to be scaled down. Continuing with the TOU Report example, 2021 is the study year of interest and wind and solar installed capacity was available for 2024. The CAISO first subtracted from the 2024 total installed capacity of wind and solar generation the incremental capacity with in-service dates after 2021. This yielded the total installed capacities of each resource in 2021 (*i.e.*, 2024 total installed capacity minus new builds in-service after 2021 through 2024). The CAISO scaled down the 2024 data to 2021 based on the fixed monthly ratio of 2021 to 2024 installed capacity by resource. For example, if the January solar installed capacity is 12,000 MW in 2021 and 15,000 MW in 2024, then the fixed ratio for the month is 0.80 (12,000 MW divided by 15,000 MW). The CAISO then calculated and applied a ratio for every month. Monthly granularity for installed capacity may suffice. Modelers may use more granular information if available or necessary.

Step 4: Source and apply wind and solar generation profiles

To develop annual solar generation profiles (*i.e.*, modeling 8,760 hours) for the installed capacity calculated in Step 3, modelers can download solar irradiance data from public sources such as the National Renewable Energy Laboratory's (NREL's) National Solar Radiation Database (NSRDB).[8] The NSRDB provides 8,760 hour solar irradiance profiles by location, which can be matched to the approximate locations of the installed solar capacity from the RPS Calculator. The modeler can further differentiate between the physical configuration of the solar PV projects such as their mounting-types (*i.e.*,

[7] http://www.cpuc.ca.gov/RPS_Calculator/ Specific information for the 2016 LTPP is available in the 2016 LTPP A&S document.
[8] https://nsrdb.nrel.gov/.

fixed-tilt, single or dual tracking axis). The LTPP has provided guidance on these assumptions.[9]

Annual wind generation profiles can be developed in a similar manner with public information such as NREL's Wind Prospector, which provides modeled wind power data at 10-minute granularity at various locations.[10] Data can be aggregated up to the hour to create an 8,760 hour generation profile and mapped to the locations of wind generation from the RPS Calculator.

Step 5: Perform net load calculation

The hourly load data provided from Step 2 net of the generation profiles developed in Step 4 will result in net load curves for the study year of interest.

Step 6: Develop TOU rates rate periods, validating against CAISO operational needs

The CAISO TOU Report separates the 8,760 hours of net load curves by season, month, and weekday versus weekend/holidays to reflect the different operational needs and challenges across these time horizons. The resulting TOU analysis considers these operational needs while minimizing the complexity and time period variations when evaluating potential TOU periods and structures. One way to validate the TOU periods is to compare them against the historical wholesale prices (locational marginal prices) produced by CAISO's day-ahead market. The hourly day-ahead prices may be a better comparison than real-time because real-time events (congestion, outages, etc.) may distort the comparison.

The CAISO's day-ahead prices are publicly available for download from the Open Access Same-time Information System (OASIS) website.[11] Under 'Prices' in the heading, select from the drop-down menu 'Locational Marginal Prices.' The modeler should enter the start and end dates of interest, select 'DAM' for the market type for day-ahead market, and select 'All' under SELECT_NODE. If the modeler is interested in selecting the price for PG&E, SCE, and SDG&E, the node names are DLAP_PGAE-

[9] The 2016 LTPP A&S discusses this in Section 4.2.8. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M162/K005/162005377.PDF.
[10] https://maps.nrel.gov/wind-prospector/.
[11] http://oasis.caiso.com/mrioasis.

APND, DLAP_SCE-APND, and DLAP_SDGE-APND, respectively. After selecting 'Apply," the modeler can download the information in XML or CSV format.

III. Conclusion

The CAISO appreciates this opportunity to provide additional information regarding its TOU period analysis. With the information provided above, other modelers should be able to recreate the CAISO's TOU period analysis now and in future proceedings.

Respectfully submitted
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