Assessing the Flexible Capacity Requirements for 2018 through 2020

Clyde Loutan

Senior Advisor, Renewable Energy Integration

Stakeholder Conference Call

January 31, 2017

What's the purpose of this call?

To discuss the criteria, methodology, and assumptions for calculating monthly flexible capacity requirement

Specifically

Calculating requirements for all LRAs within the ISO footprint for RA compliance year 2018 and advisory flexible capacity requirements for compliance years 2019 and 2020

Agenda/Overview

- Background
- Process review
  - Expected build out from all LSEs (CPUC jurisdictional and non-Jurisdictional)
  - Load wind and solar profiles
  - Calculate 3-hour net-load ramps
  - Calculate monthly Flexible Capacity requirement
  - Add contingency reserves
  - Next steps

Each LSE's SC shall make a year-ahead and month-ahead showing of flexible capacity for each month of the compliance year

Resource Adequacy (RA)

- Ensure LSEs contract for adequate capacity to meet expected flexible needs
- Year ahead timeframe: LSEs need to secure a minimum of 90% of the next years monthly needs
- Month ahead timeframe: LSEs need to secure adequate net qualified capacity to serve their peak load including a planning reserve margin and flexible capacity to address largest three hour net load ramps plus contingency reserves
- All resources participating in the ISO markets under an RA contract will have an RA must-offer-obligation
- Required to submit economic bids into the ISO's real-time market consistent with the category of flexible capacity

The ISO flexibility capacity assessment is based on current LSE's RPS build-out data

- Uses most current data available for renewable build-out obtained from all LSE's SC
- For new renewable installation simply scale CREZs based on actual 1-minute production from the previous year
- Solar profiles account for technology type and location:
  - Solar thermal; solar thermal with storage; solar PV tracking & non-tracking and distributed Rooftop Solar PV
- Generate net-load profiles for 2018 through 2020
  - Generate load profiles for 2018 through 2020
  - Generate solar profiles for 2018 through 2020
  - Generate wind profiles for 2018 through 2020

The ISO will use the CEC's 2017 IEPR 1-in-2 monthly peak load forecast to develop the load forecast

- Used 2016 actual 1-minute load data to build 1-minute load profiles for subsequent years
- Scaled the actual 1-minute load of each month of 2016 using a load growth factor for a subsequent year's monthly peak forecast divided by actual 2016 monthly peak

2017 Load Growth Assumptions

- Scale the actual 1-minute load value of each month of 2017 by the fraction $(Monthly_{2017\_Peak\_Load\_Forecast}/Monthly_{2016\_Actual\_Peak\_Load})$

2018 Load Growth Assumptions

- Scale each 1-minute load data point of 2018 by the fraction $(Monthly_{2018\_Peak\_Load\_Forecast}/Monthly_{2017\_Peak\_Load})$

2019 Load Growth Assumptions

- Scale each 1-minute load data point of 2019 by the fraction $(Monthly_{2019\_Peak\_Load\_Forecast}/Monthly_{2018\_Peak\_Load})$

1-minute wind and solar data for all new CREZs may or may not be developed using the methodology outlined below

TRACK I DIRECT TESTIMONY OF MARK ROTHLEDER ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION (Rulemaking 10-05-006)

Located at:

http://www.cpuc.ca.gov/NR/rdonlyres/1DE789A2-29EB-4E95-9284-9E680C0113E6/0/CAISOTestimony70111_FINAL.pdf

Wind growth assumptions

- Use actual 1-minute wind production data for the most recent year e.g. 2017 wind forecast uses actual production data from 2016
- Projects installed in 2016 would be modeled in 2017 for the months the projects were not yet in-service (e.g. projects installed in May 2016 would be included in January through April of 2016
- Repeat the above steps for 2017

$$\text{2017 } W_{\text{Monthly\_Simulated\_1-min}} = \text{2016}W_{\text{Actual\_1-min}} * \text{2017}W_{\text{Monthly Capacity}} / \text{2016}W_{\text{Monthly Capacity}}$$

$$\text{2018 } W_{\text{Monthly\_Simulated\_1-min}} = \text{2017}W_{\text{Actual\_1-min}} * \text{2018}W_{\text{Monthly Capacity}} / \text{2017}W_{\text{Monthly Capacity}}$$

Solar growth assumptions

Existing solar

- Use the actual solar 1-minute production data for the most recent year

  e.g. 2017 forecast uses 2016 actual 1-minute data (**$2016_{Act\_1\text{-}min}$**)

New solar installation within the ISO's footprint

- $Future_{Year\text{-}Solar}$ --- Scale the actual 1-minute solar production data by the factor (Solar Monthly $Capacity_{Future\_Year}$ /Solar Monthly $Capacity_{Current\_Year}$)
- Projects installed in 2016 would be modeled in 2017 for the months the projects were not yet in-service

New DER solar installation and solar installation outside the ISO's footprint

- Develop 1-minute solar production profiles for each CREZ based on their geographic location and technology type (i.e. Solar Thermal, Solar PV etc.)
- Aggregate all new solar 1-minute production data (**$2017_{Sim\_1\text{-}min}$**)
- Sum the actual 1-minute existing solar production data with the aggregated simulated solar data for new installation

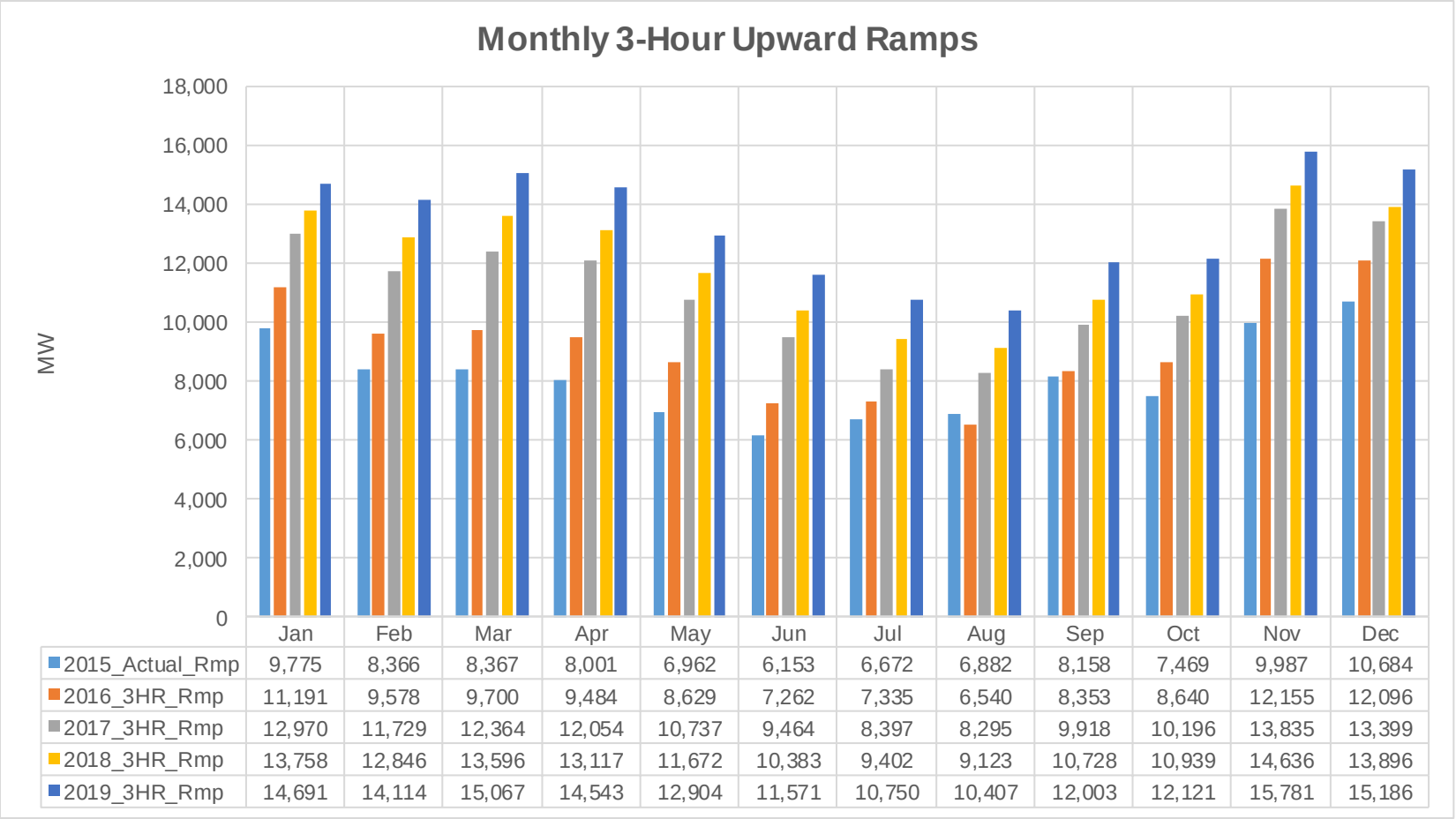
Total solar $2018_{1\text{-}min} = 2016_{Act\_1\text{-}min} + 2017_{Sim\_1\text{-}min} + 2018_{Sim\_1\text{-}min}$

Net-load is a NERC accepted metric[1] for evaluating additional flexibility needs to accommodate VERs

- Net load is the aggregate of customer demand reduced by variable generation power output
- Net-load is more variable than load itself and it increases as VER production increases
- The monthly three-hour flexible capacity need equates to the largest up-ward change in net-load when looking across a rolling three-hour evaluation window
- The ISO dispatches flexible resources to meet net-load

1 NERC Special Report
Flexibility Report Requirements and metrics for Variable Generation: Implications for System Planning Studies, August 2010 . http://www.nerc.com/files/IVGTF_Task_1_4_Final.pdf

Example of maximum monthly three-hour upward net-load ramps



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015_Actual_Rmp	9,775	8,366	8,367	8,001	6,962	6,153	6,672	6,882	8,158	7,469	9,987	10,684
2016_3HR_Rmp	11,191	9,578	9,700	9,484	8,629	7,262	7,335	6,540	8,353	8,640	12,155	12,096
2017_3HR_Rmp	12,970	11,729	12,364	12,054	10,737	9,464	8,397	8,295	9,918	10,196	13,835	13,399
2018_3HR_Rmp	13,758	12,846	13,596	13,117	11,672	10,383	9,402	9,123	10,728	10,939	14,636	13,896
2019_3HR_Rmp	14,691	14,114	15,067	14,543	12,904	11,571	10,750	10,407	12,003	12,121	15,781	15,186

Contingency reserves is a NERC/WECC requirement BAs must have available in real-time

- Each Balancing Authority and each Reserve Sharing Group shall maintain a minimum amount of Contingency Reserve, except within the first sixty minutes following an event requiring the activation of Contingency Reserve
- To meet WECC and NERC reliability criteria, the ISO must have contingency reserves equal to the greater of:

  1) the most severe single contingency ("MSSC")

  2) the sum of 3% of hourly integrated load plus 3% percent of hourly integrated generation

- 50% of the contingency reserve must be spinning reserve
- Contingencies can occur during ramps and the ISO must be prepared to dispatch contingency reserve to recover its Area Control Error (ACE) within 15-minutes following a disturbance
- Contingency reserves are held for contingency events and cannot be dispatched to meet day-to-day net-load ramps

For more information please refer to: WECC Standard BAL-002-WECC-2---Contingency Reserve

The proposed interim flexible capacity methodology should provide the ISO with sufficient flexible capacity

Methodology

Flexible $Req_{MTHy} = Max[(3RR_{HRx})_{MTHy}] + Max(MSSC, 3.5\%*E(PL_{MTHy})) + \varepsilon$

Where:

$Max[(3RR_{HRx})_{MTHy}]$ = Largest three hour contiguous ramp starting in hour x for month y

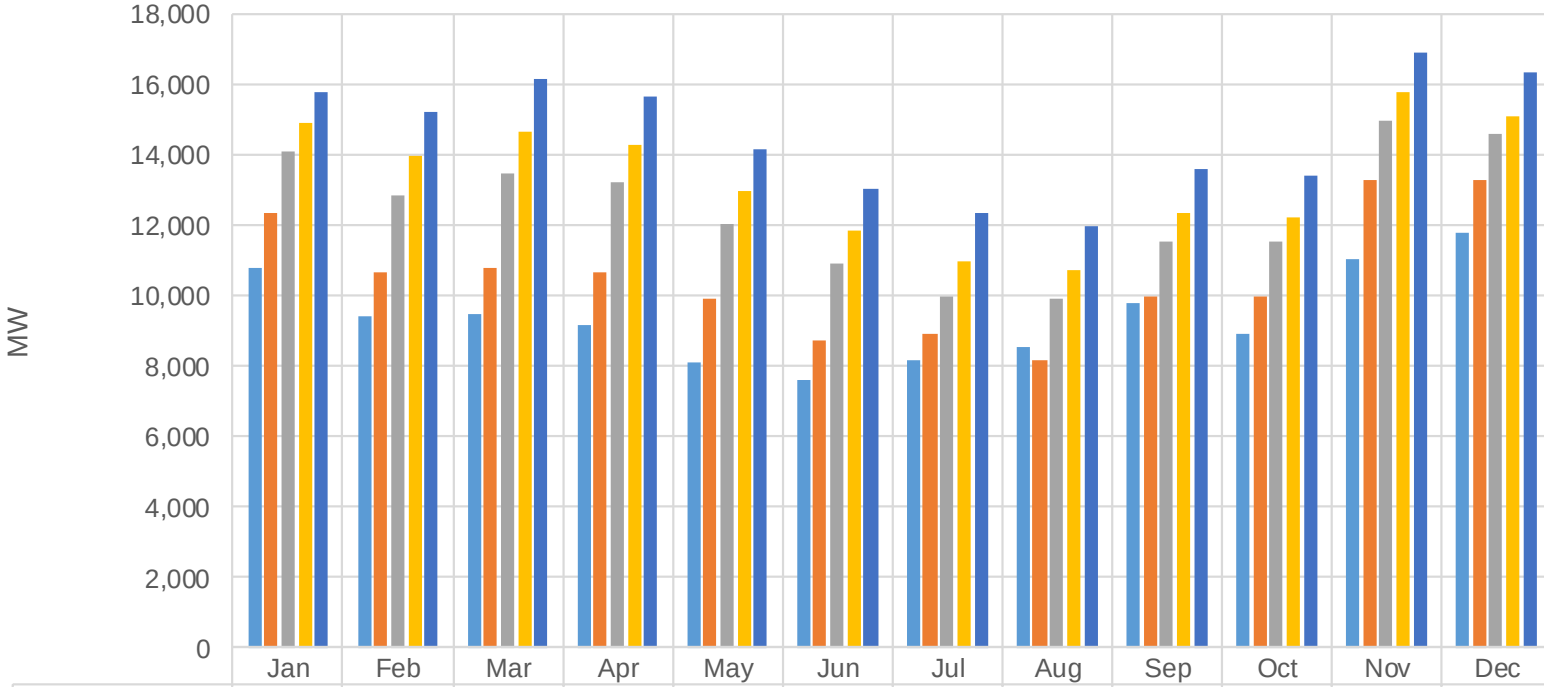
E(PL) = Expected peak load

MTH_y = Month $_y$

MSSC = Most Severe Single Contingency

ε = Annually adjustable error term to account for load forecast errors and variability. ε is currently set at zero

Monthly 2017 flexible capacity procurement target for CPUC's jurisdictional LSEs



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015_Act_Flex	10,818	9,422	9,473	9,196	8,128	7,625	8,159	8,533	9,815	8,929	11,062	11,796
2016_Flex_Cap	12,330	10,687	10,792	10,652	9,933	8,737	8,930	8,161	9,957	9,959	13,295	13,283
2017_Flex_Cap	14,110	12,840	13,456	13,220	12,044	10,939	9,994	9,918	11,525	11,514	14,977	14,588
2018_Flex_Cap	14,890	13,949	14,680	14,273	12,968	11,846	10,989	10,735	12,325	12,247	15,770	15,077
2019_Flex_Cap	15,816	15,211	16,145	15,688	14,191	13,023	12,324	12,007	13,588	13,418	16,907	16,361

What data does the ISO need?

- CEC's monthly demand forecast (e.g. 2017-2020 demand forecast) by January 31, 2017
- LSE's SC to update renewable build-out for 2017 through 2020 by CREZ by January 15, 2017 (Beyond 2020 if data is available)
- The data should include:
  - Installed capacity by technology and expected operating date (e.g. Solar thermal, solar PV tracking, solar PV non-tracking, estimate of behind-the-meter solar PV etc.) for all variable energy resources under contract
  - Operational date or expected on-line date
  - Location of CREZ preferably latitude and longitude coordinates
  - Interconnecting substation or closes substation or switching station
  - Resources located outside ISO's BAA must indicate if the resources are dynamically scheduled or not
- Almost all LSE's SC have already provided this data
  - LSE's SC must submit data for all LSE for which they are the SC

The ISO will modify the calculation of average contribution

- Current methodology calculates percent contribution on a day then averages percentages
  - Factors with small overall change on one or two days can result in an LRA receiving a large contribution because of a large percent of a small change
- ISO will change calculations to first calculate the weighted average change then determine the percent contribution of each LRA
  - Days where a given factors has a small change will have less impact on the allocation of a given factor than days when that factor had a large change

Next steps

- CPUC and the ISO would determine the overall timeline
- ISO published a market notice for data December, 2016
- Complete data collection from LSE SC's and CEC by January 15, 2015
- Stakeholder comments on ISO study assumptions February 10, 2015
- Finalize methodology, criteria, and assumptions for 2018 flexible requirements by February 15, 2017
- Publish preliminary flexible capacity requirement for 2018, 2019 & 2020 by April 3, 2017
- Stakeholder call on April 6, 2017
- Stakeholder comments on requirements due on April 19, 2017
- Issue final Flexible Capacity requirement for 2018, 2019 & 2020 by May 1, 2017
- CPUC proposed and final annual RA decision incorporating FCR obligations May 2017

Questions?

Please submit comments on the assumptions to

initiativecomments@caiso.com

by February 10, 2017

Thank you for your participation!