Flexible Capacity Requirements for 2019 through 2021

Clyde Loutan - Principal, Renewable energy Integration
Amber Motley - Manager, Short Term Forecasting

Stakeholder Conference Call

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What’s the purpose of this call?

• Discuss the criteria, methodology, and assumptions used in calculating monthly flexible capacity requirement.

• Calculate system requirements within the ISO footprint for RA compliance year 2019 and advisory flexible capacity requirements for compliance years 2020 and 2021.

• Discuss the input assumptions and methodology of the annual CAISO’s Availability Assessment Hour (AAH).
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
Flexible capacity requirements

**CPUC decision on flexible capacity**

2015 – The flexible capacity framework became mandatory starting with RA compliance year 2015. The adopted framework will be in effect through RA compliance year 2017

The CPUC’s Decision (13-06-024 June 27, 2013) defines “Flexible capacity need” as the quantity of resources needed by the California ISO to manage grid reliability during the greatest three-hour continuous ramp in each month.
Each LSE 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 year's 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 for which it is shown
The ISO flexibility capacity assessment is based on current LSE’s RPS build-out data

- Uses the most current data available for renewable build-out obtained from all LSE SCs
- For new renewable installation scale 2017 actual production data based on installed capacity in subsequent years
- For new BTM use NEXANT production data located in close geographic proximity
- Generate net-load profiles for 2019 through 2021
  - Generate load profiles for 2019 through 2021
  - Generate solar profiles for 2019 through 2021
  - Generate wind profiles for 2019 through 2021
The ISO will use the CEC’s 1-in-2 monthly peak load forecast to develop the load forecast

- Used 2017 actual 1-minute load data to build 1-minute load profiles for subsequent years
- Scaled the actual 1-minute load value of each month of 2017 using a load growth factor of monthly peak forecast divided by actual 2017 monthly peak

**2018 Load Growth Assumptions**

- Scale each 1-minute load data point of 2018 by the fraction \( \frac{\text{Monthly}_{2018}\_\text{Peak}\_\text{Load}\_\text{Forecast}}{\text{Monthly}_{2017}\_\text{Actual}\_\text{Peak}\_\text{Load}} \)

**2019 Load Growth Assumptions**

- Scale the actual 1-minute load value of each month of 2017 by the fraction \( \frac{\text{Monthly}_{2019}\_\text{Peak}\_\text{Load}\_\text{Forecast}}{\text{Monthly}_{2018}\_\text{Peak}\_\text{Load}\_\text{Forecast}} \)

*If provided by CEC; apply hourly AAEE to load growth*
1-minute wind and solar data for all new CREZs would 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:

Wind growth assumptions

- Use actual 1-minute wind production data for the most recent year
  e.g. 2018 wind forecast uses actual production data from 2017
- Projects installed in 2017 would be modeled in 2018 for the months
  the projects were not yet in-service (e.g. projects installed in May
  2017 would be included in January through April of 2017)
- Scale 1-minute data using expected capacity for the new plants
  scheduled to be operational in 2018
- Repeat the above steps for 2016

\[
2018 \ W_{\text{Mth\_Sim\_1-min}} = 2017\ W_{\text{Act\_1-min}} \ast \frac{2018\ W_{\text{Mth\ Capacity}}}{2017\ W_{\text{Mth\ Capacity}}}
\]

\[
2019 \ W_{\text{Mth\_Sim\_1-min}} = 2017\ W_{\text{Act\_1-min}} \ast \frac{2019\ W_{\text{Mth\ Capacity}}}{2017\ W_{\text{Mth\ Capacity}}}
\]

*Note: Maintain the load/wind correlation*
Solar growth assumptions

**Existing solar**
- Use the actual solar 1-minute production data for the most recent year
  e.g. 2018 forecast uses 2017 actual 1-minute data \( (2017_{\text{Act\_1-min}}) \)

**New solar installation**
- Develop 1-minute solar production profiles by scaling actual 2017 1-minute data by the expected monthly installed capacity in 2018 divided by the monthly installed capacity in 2017
- Projects installed in 2017 will be modeled in 2018 for the months the projects were not yet in-service in 2017

\[
\text{Total solar 2018}_{\text{1-min}} = 2017_{\text{Act\_1-min}} \times \frac{2018_{\text{Monthly\_Cap}}}{2017_{\text{Installed\_Capacity}}}
\]
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

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\(^1\) NERC Special Report
Net Load varies from one day to the next --- One week in March 2017
The monthly 3-hour ramping need is calculated using the largest ramp in each 180 minute period.

- The maximum monthly three-hour net load ramp within a three-hour period is the highest MW value reached within any three-hour moving window.
- The maximum net-load change in three-hours can occur in less than three hours.

Upward Ramp = $\text{Average}(t+4 \text{ min}) \geq \text{Average}(t-4\text{min})$

Down Ramp = $\text{Average}(t+4\text{min}) < \text{Average}(t-4\text{min})$
Expected 3-hour ramps increase through 2020 with build out of renewables and addition of behind-the-meter resources

Note: 2017 actuals are still being analyzed, final number will be based on 2017 actuals.
Contingency reserves is a NERC/WECC requirement all 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 the three hour 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**

\[
\text{Flexible Req}_{MTHy} = \text{Max}[(3RR_{HRx})_{MTHy}] + \text{Max}(\text{MSSC}, 3.5\% \times E(PL_{MTHy})) + \epsilon
\]

Where:

- \(\text{Max}[(3RR_{HRx})_{MTHy}]\) = Largest three hour contiguous ramp starting in hour \(x\) for month \(y\)
- \(E(PL)\) = Expected peak load
- \(MT_{Hy}\) = Month \(y\)
- \(\text{MSSC}\) = Most Severe Single Contingency
- \(\epsilon\) = Annually adjustable error term to account for load forecast errors and variability. \(\epsilon\) is currently set at zero
What data does the ISO need?

- CEC’s monthly demand forecast (e.g. 2018 – 2021 demand forecast by Feb 19, 2018)
- LSE SCs to update renewable build-out for 2017 through 2022 by CREZ by February 19, 2018 (Beyond 2022 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
- All LSE SCs have already provided this data
  - LSE SCs must submit data for all LSE for which they are the SC
  - ISO is in the process of reviewing the submittal
ANNUAL REVIEW OF AVAILABILITY ASSESSMENT HOURS
Methodology Overview of System/Local Availability Assessment Hours

• Used data described in previous slides to obtain:
  – Hourly Average Load
    • By Hour
    • By Month
    • Years 2017-2021
• Calculated:
  – Top 5% of Load Hours within each month using an hourly load distribution
  – Years 2017 through 2021
Next steps

- ISO published a market notice for data December, 2017
- ISO assumptions phone call by January 29th, 2018
- Stakeholder comments on ISO study assumptions due by February 9th, 2018
- Finalize methodology, criteria, and assumptions for 2019 flexible requirements by February 15th, 2018
- Complete data collection from LSE SC’s and CEC by March 15th, 2018
- Publish draft flexible capacity requirement for 2019, 2020 & 2021 by April 13th, 2018
- Stakeholder comments on draft flexible capacity requirements due by April 19th, 2018
- Issue final Flexible Capacity requirement for 2019, 2020 & 2021 by approximately May 15th, 2018
- CPUC proposed and final annual RA decision incorporating FCR obligations June 2018

Note: Dates in red approximate due to ISO receiving load data from CEC no later than March 15th, 2018.
Questions?
Please submit comments on the assumptions to initiativecomments@caiso.com by February 9th, 2018
Thank you for your participation!