# Flexible Capacity Requirements for 2019 through 2021

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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 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 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 $(Monthly_{2018\_Peak\_Load\_Forecast}/Monthly_{2017\_Actual\_Peak\_Load})$

***2019 Load Growth Assumptions***

- Scale the actual 1-minute load value of each month of 2017 by the fraction $(Monthly_{2019\_Peak\_Load\_Forecast}/Monthly_{2018\_Peak\_Load\_Forecast})$

*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:**

http://www.caiso.com/Documents/2011-08-10_ErrataLTPPTestimony_R10-05-006.pdf

# 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

**$2018\ W_{Mth\_Sim\_1\text{-}min} = 2017W_{Act\_1\text{-}min} * 2018W_{Mth\ Capacity} / 2017W_{Mth\ Capacity}$**

**$2019\ W_{Mth\_Sim\_1\text{-}min} = 2017W_{Act\_1\text{-}min} * 2019W_{Mth\ Capacity} / 2017W_{Mth\ Capacity}$**

*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 (**$2017_{Act\_1\text{-}min}$**)

***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

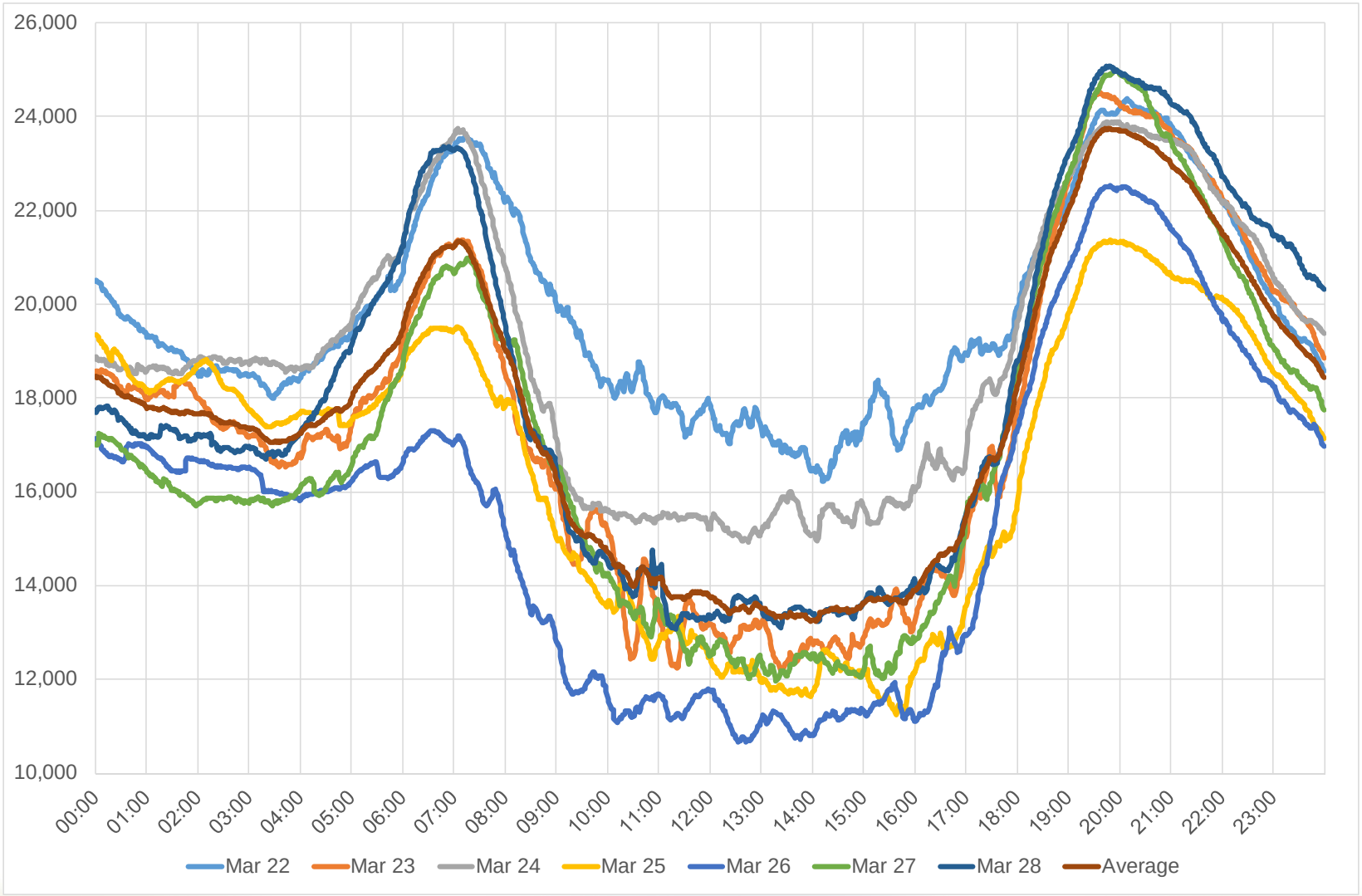
**$Total\ solar\ 2018_{1\text{-}min} = 2017_{Act\_1\text{-}min} * 2018_{Monthly\_Cap} / 2017_{Installed\_Capacity}$**

# 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

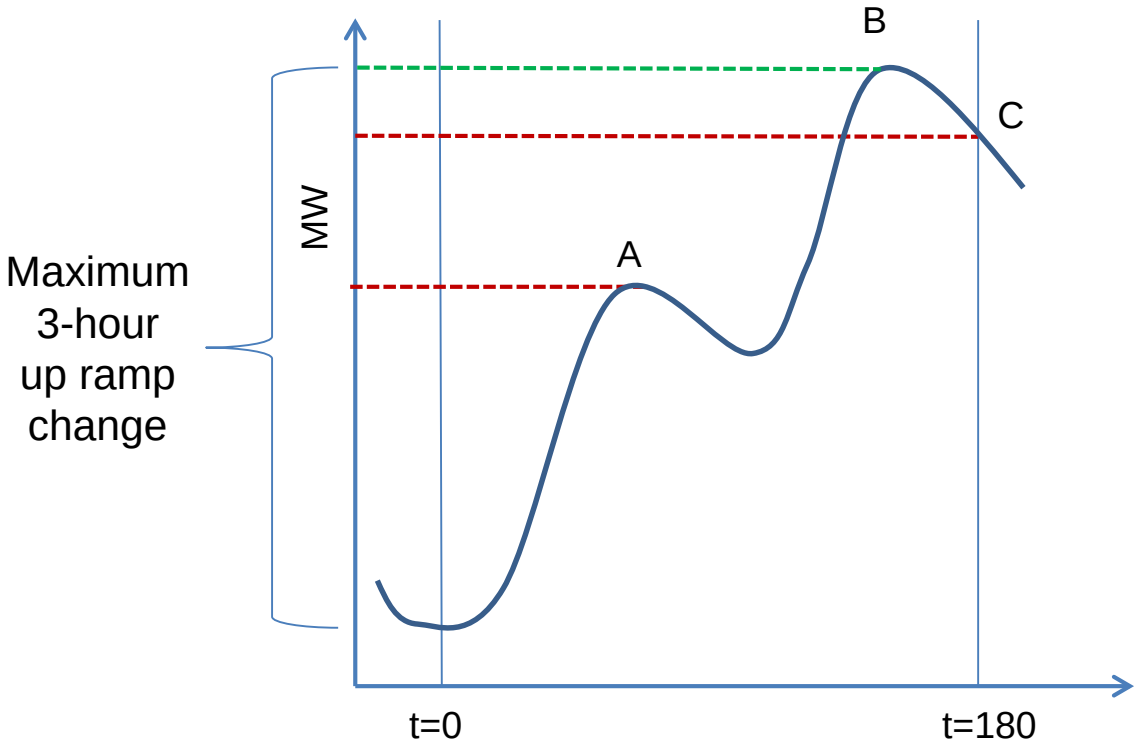
1 NERC Special Report
Flexibility Report Requirements and metrics for Variable Generation: Implications for System Planning Studies, August 2010 . http://www.nerc.com/files/IVGTF_Task_1_4_Final.pdf

# Net Load varies from one day to the next --- One week in March 2017



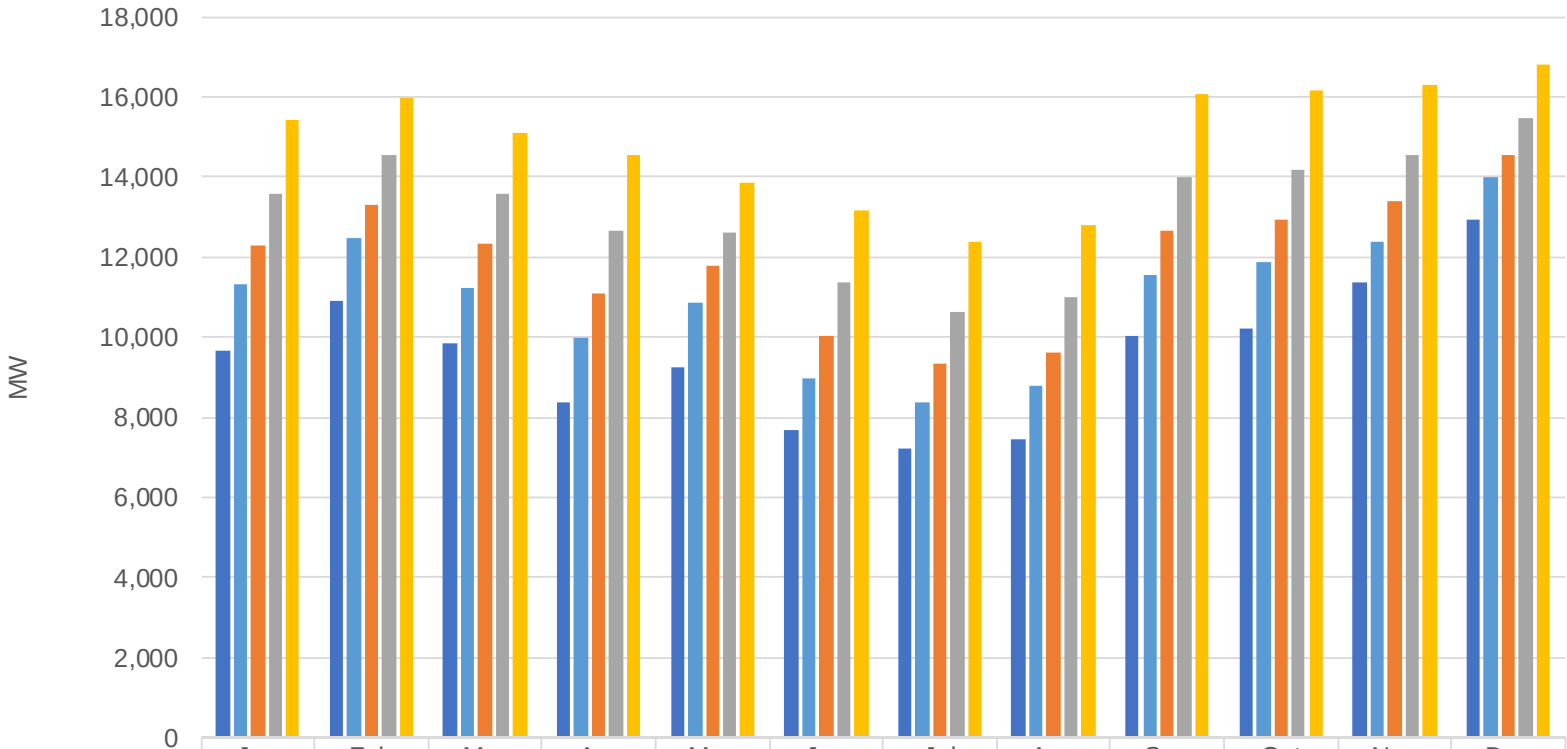
# The monthly 3-hour ramping need is calculated using the largest ramp in each 180 minute period

- 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 = Average(t+4 min) ≥ Average(t-4min)
Down Ramp = Average(t+4min) < Average(t-4min)

# Expected 3-hour ramps increase through 2020 with build out of renewables and addition of behind-the-meter resources




| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 (Actual) | 9,687 | 10,891 | 9,828 | 8,397 | 9,263 | 7,669 | 7,214 | 7,463 | 10,030 | 10,228 | 11,375 | 12,960 |
| 2017 | 11,342 | 12,465 | 11,253 | 9,973 | 10,878 | 8,996 | 8,379 | 8,768 | 11,575 | 11,900 | 12,391 | 14,004 |
| 2018 | 12,282 | 13,313 | 12,352 | 11,111 | 11,803 | 10,039 | 9,326 | 9,617 | 12,660 | 12,954 | 13,376 | 14,567 |
| 2019 | 13,595 | 14,543 | 13,574 | 12,672 | 12,631 | 11,350 | 10,616 | 10,982 | 13,981 | 14,199 | 14,553 | 15,495 |
| 2020 | 15,439 | 15,984 | 15,089 | 14,572 | 13,859 | 13,181 | 12,391 | 12,821 | 16,061 | 16,169 | 16,293 | 16,817 |

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

**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

# 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!

# Questions