



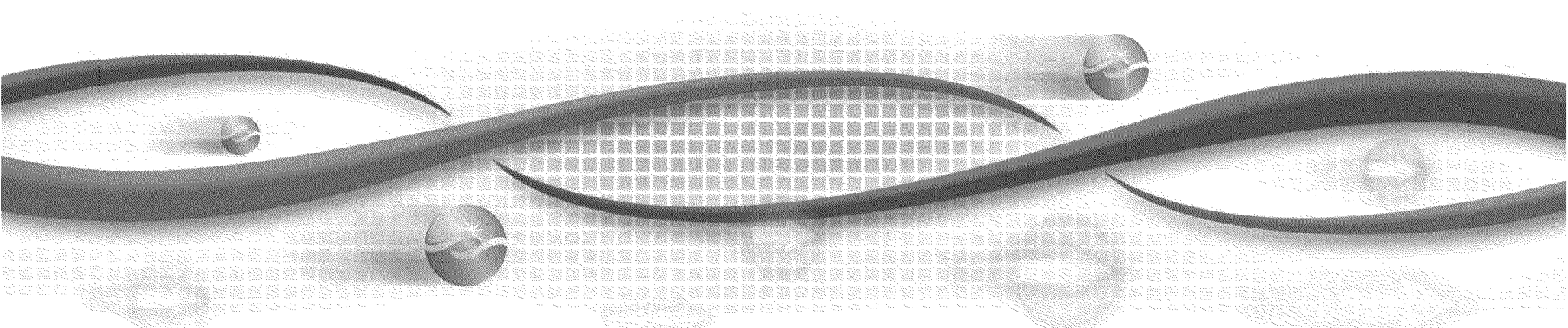
California ISO  
Shaping a Renewed Future

# Use-limited Resources and Flexible Capacity

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# Overview

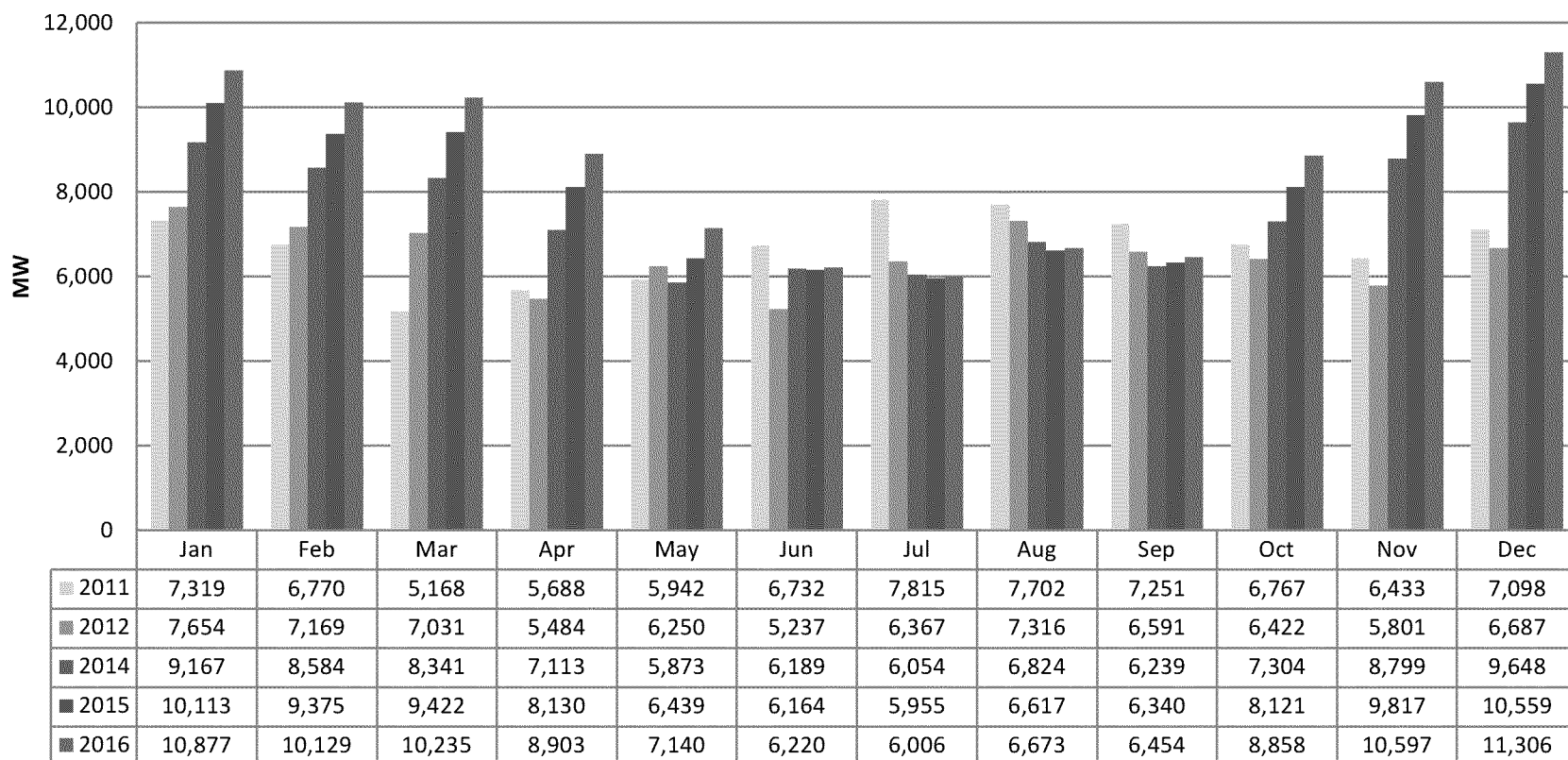
- Review of 2014 Flexible Capacity Requirements Assessment
- Use-limited resources and flexible capacity
- Parameter design options for procuring flexible capacity

# Key principles for expanded flexible capacity accounting design

- Resource adequacy is one dimensional product while actual flexibility challenges are multi-dimensional
- Some flexibility is expected to be used on daily basis while others will be used less frequently
- Over-reliance of one type of resource for flexibility could put reliability at risk
- Parties were able to design a solution for hydro resources and should leverage such work to apply to other resource types
- Operational parameters and incentive options can provide opportunities that allow use-limited resources to meet flexible capacity needs and ensure a reliable electric system

The maximum 3-hour net load ramp need in shoulder months increases by about 800-1000 MW year over year

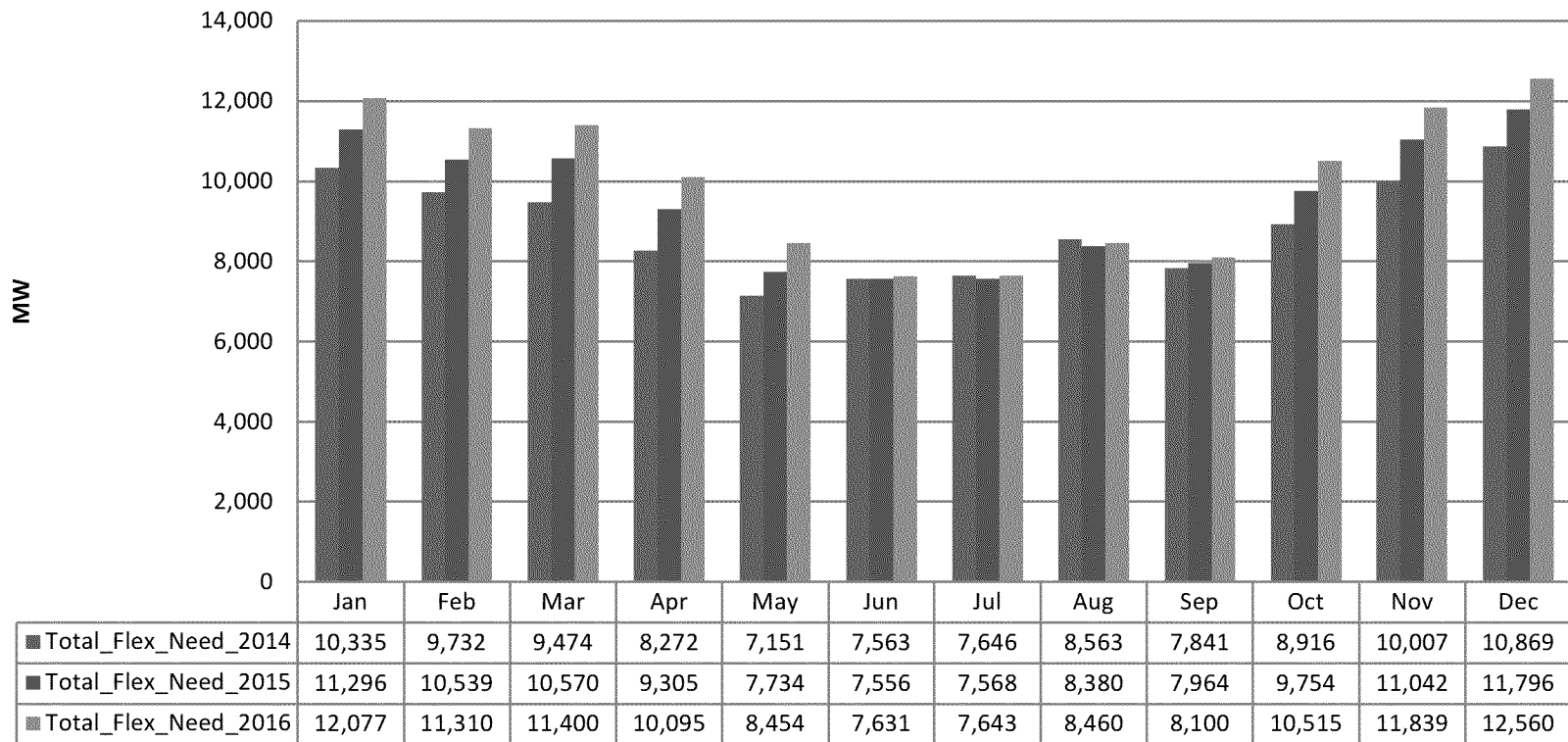
### Maximum 3-hour net load ramp



\* 2011 and 2012 use actual ramp data, while 2014-2016 use minute-by-minute forecasted ramp data

The forecasted flexible capacity requirements are greatest in the shoulder months and growing over time

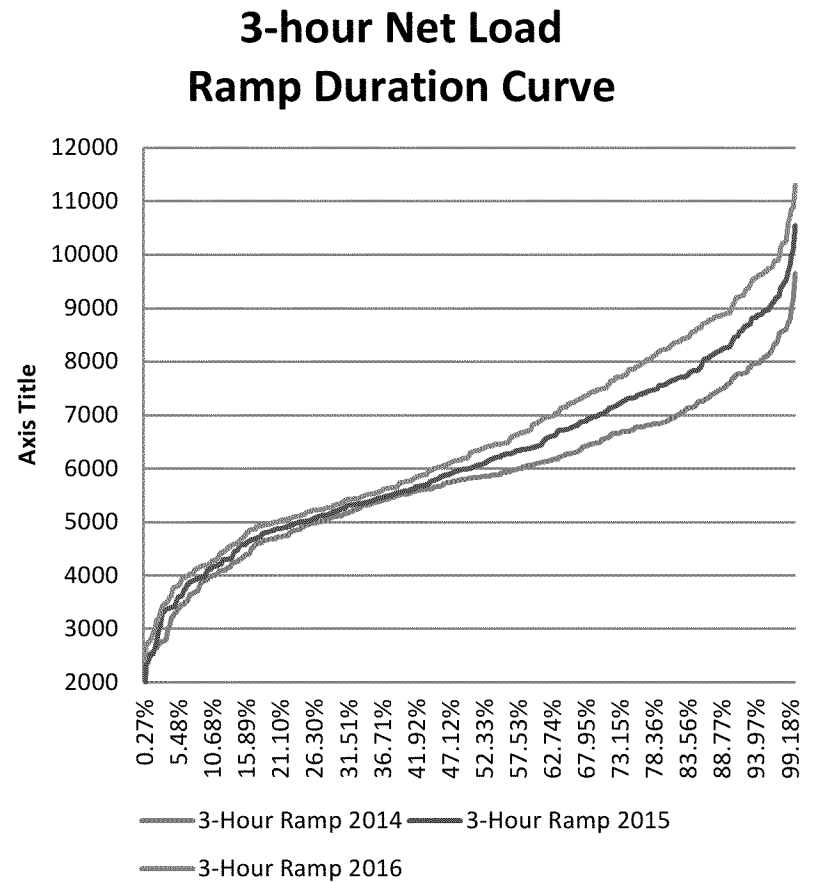
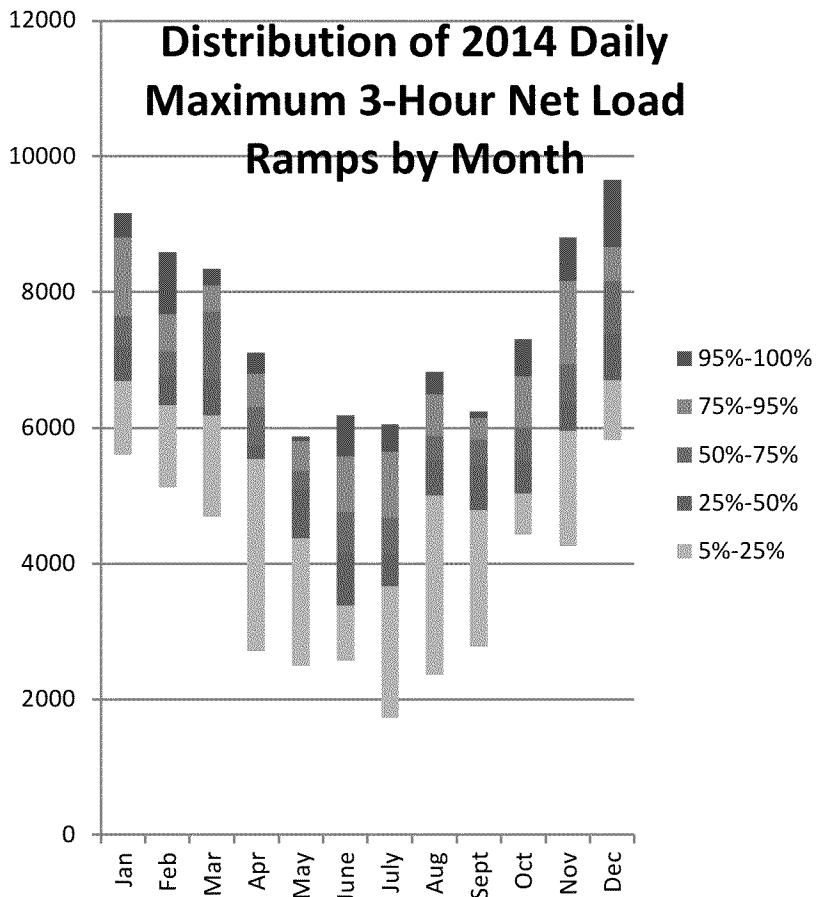
### Calculated Flexible Capacity Requirement



$$\text{Flexibility Requirement}_{MTHy} = \text{Max}[(3RR_{HRx})_{MTHy}] + \text{Max}(\text{MSSC}, 3.5\% * E(PL_{MTHy})) + \epsilon$$

Note: In the 2014-2016 assessments, the MSSC is never larger than the 3.5%\*E(PL<sub>MTHy</sub>)

# There are opportunities for use-limited and DR resources to address less frequent “super-ramps”



## Reliable system operations requires four types of flexibility

- Load-following
  - Needed to address five-minute-to-five-minute net-load uncertainty
- Multi-hour net load ramping
  - Net load ramps are getting shorter in time duration, but much steeper in terms of MW/min ramp rates
- Multiple ramps per day
  - Increased solar penetration may require resources to turn on in the morning, off in the middle of the day, and on again for the evening ramp
- Increased quantities of regulation

## Over-reliance on one type of resource for flexibility could put reliability at risk: All resources have some kind of use limitations

- Parameter or “bucket” based mechanism
  - Capacity factors
  - Pmax-to-Pmin Ratio
  - Run hours
  - Starts
- Operational availability
- Incentive based mechanism
  - The ISO’s Standard Flexible Capacity Product (SFCP) proposal in Flexible Resource Adequacy Criteria and Must-Offer obligation (FRAC-MOO) stakeholder initiative



## Many types of resources can contribute to system flexible capacity needs

- Use-limited resources can be classified as:
  - Resources that can run in all (or most) hours, but are limited in the total starts or hours they can run
  - Resources that cannot offer in certain hours
- There must be enough flexible capacity available to meet “everyday” ramping requirements
  - Some flexibility is expected to be used on daily basis while other types may be used less frequently
- Use-limited resources need not be available to meet every single ramp
- Over-reliance on use-limited resources may put grid reliability at risk

## The prior RA proceeding produced a creative model for valuing Hydro as a flexible use-limited resource

- Hydro resources can provide a significant amount of flexible capacity
- Characterizing use-limitations led to creative solutions to define flexibility for hydro resources
- Hydro resources are eligible to provide flexible capacity if the physical storage of the resource/system can provide 6 hours of energy at  $P_{max}$ 
  - Ensures resource is available everyday to meet
    - two 3-hour ramps or
    - one 3-hour ramp and load following as needed
- Proper parameterization of use-limited resources will ensure the system has flexible capacity when and where it is needed

# Thinking about flexibility in terms of operational characteristic buckets

- Run hours
  - Similar to Maximum Cumulative Capacity (MCC) buckets currently used under RA
  - Start limitations may be a more binding constraint
- Pmax-Pmin Ratio
  - Large ratio shows the resource could be flexible over a wide range
  - Does not consider start-up time
  - Many flexible resources have a very low Pmax-Pmin Ratio
- Daily start capabilities
  - Allows the ISO to address bi-modal ramping days
  - Does not consider a resource's range of flexibility
  - May miss flexibility from resources that may run consecutive days

## Thinking about flexibility in terms of operational characteristics and capacity availability

- Resources available more frequently would receive a higher accounting towards meeting an LSE's EFC requirement
- Resources that are available for a limited number of hours would count less towards meeting an LSE's EFC requirement
- For example:\*

  - A 100 MW resource that is available for 75 percent or more of all flexible capacity hours might count for all 100 MW
  - A 100 MW resource that is available for less than 75 percent of all flexible capacity hours might count for some proportion of the 100 MW

\* Numbers are for illustrative purposes only.

The ISO's Standard Flexible Capacity (SFCP) product provides an incentive based method to ensure adequate flexible capacity

- Values resource availability by providing proper incentive
  - Designed to measure resources' compliance with the applicable must offer obligations
  - Considers a self-scheduled resource to be available for generic capacity but not for flexible capacity
  - SFCP appropriately values additional benefit of economic bids over self-schedule
- Reduces implementation challenges to CPUC and LSEs
- Allows for substitute capacity if resource goes on forced outage without penalty

## A methodology to calculate Effective Flexible Capability (EFCs) for Variable energy resources (VERs) should be developed

- The ISO's FRAC-MOO proposal would allow for VERs to provide flexible capacity
  - VERs willing to be scheduled or dispatched at less than its forecast output can provide upward ramping capability
- There is no proposal that would calculate the EFC of a VER differently than a thermal resource
- Additional proposals are needed to allow VERs to provide flexible capacity
  - Also need to consider how VERs would fit into defined parameters or incentives for flexible capacity

## Conclusion – Use limited resources can have a role in meeting flexible capacity needs

- Opportunities exist for use-limited resources to meet flexible capacity challenges that are multi-dimensional
- Some flexibility capacity types are expected to be used on daily basis while others will be used less frequently
- Over-reliance of one type of resource for flexibility could reduce availability or efficacy and put reliability at risk
- Parties were able to design a solution for hydro resources and should leverage such work for other resource types
- Success is establishing the operational parameters and incentives that will provide opportunities for use-limited resources to meet flexible capacity needs of the electric system