Use-limited Resources and Flexible Capacity

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Overview

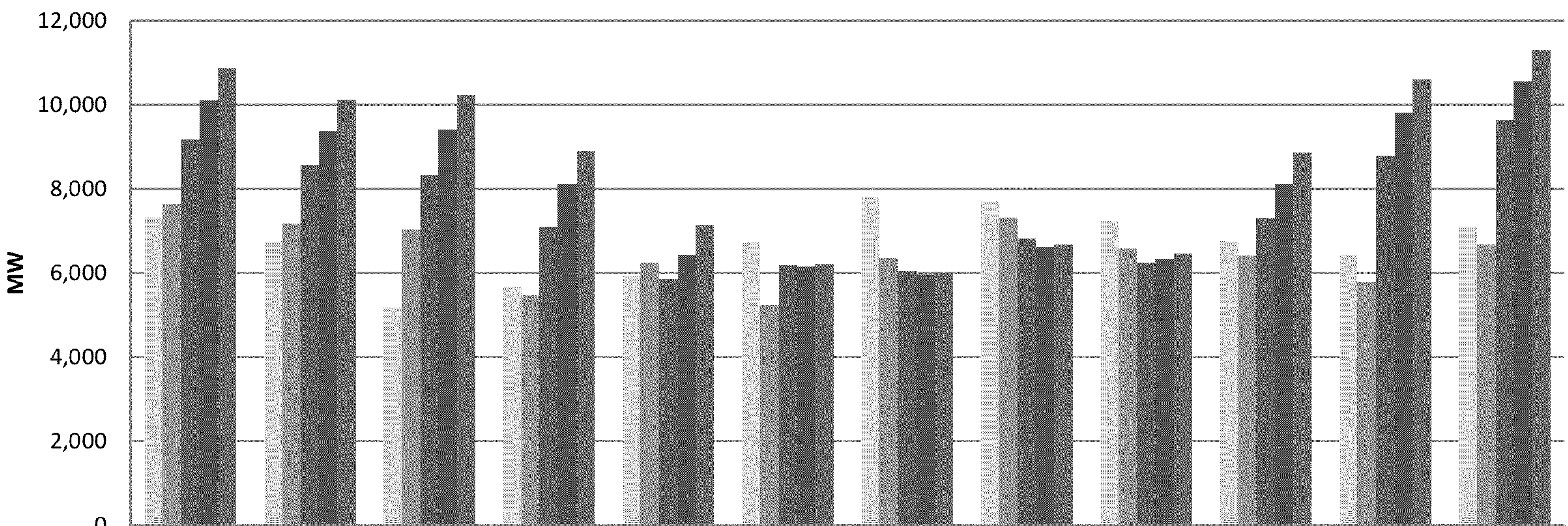
- Review of 2014 Flexible Capacity Requirements Assessment
- Use-limited resources and flexible capacity
- Parameter design options for procuring flexible capacity

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

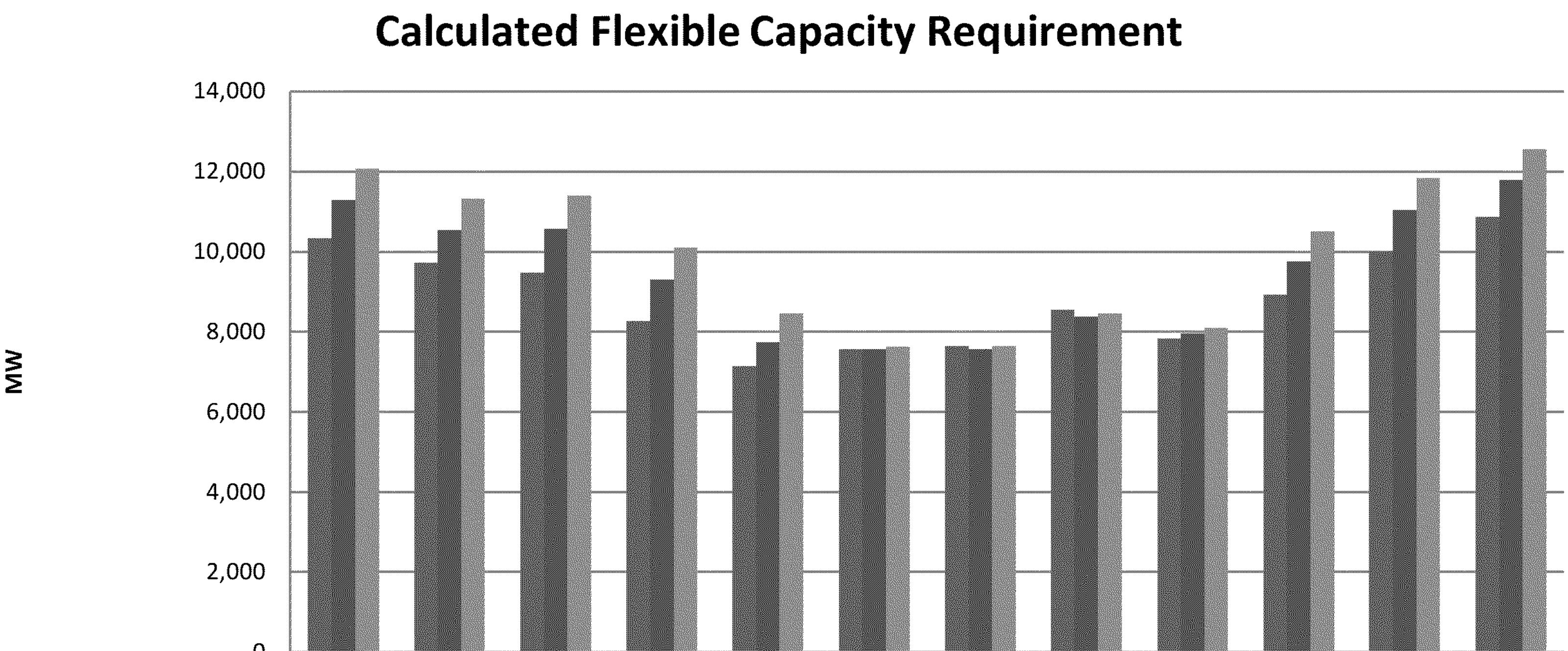
Maximum 3-hour net load ramp



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	7,319	6,770	5,168	5,688	5,942	6,732	7,815	7,702	7,251	6,767	6,433	7,098
2012	7,654	7,169	7,031	5,484	6,250	5,237	6,367	7,316	6,591	6,422	5,801	6,687
2014	9,167	8,584	8,341	7,113	5,873	6,189	6,054	6,824	6,239	7,304	8,799	9,648
2015	10,113	9,375	9,422	8,130	6,439	6,164	5,955	6,617	6,340	8,121	9,817	10,559
2016	10,877	10,129	10,235	8,903	7,140	6,220	6,006	6,673	6,454	8,858	10,597	11,306

* 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

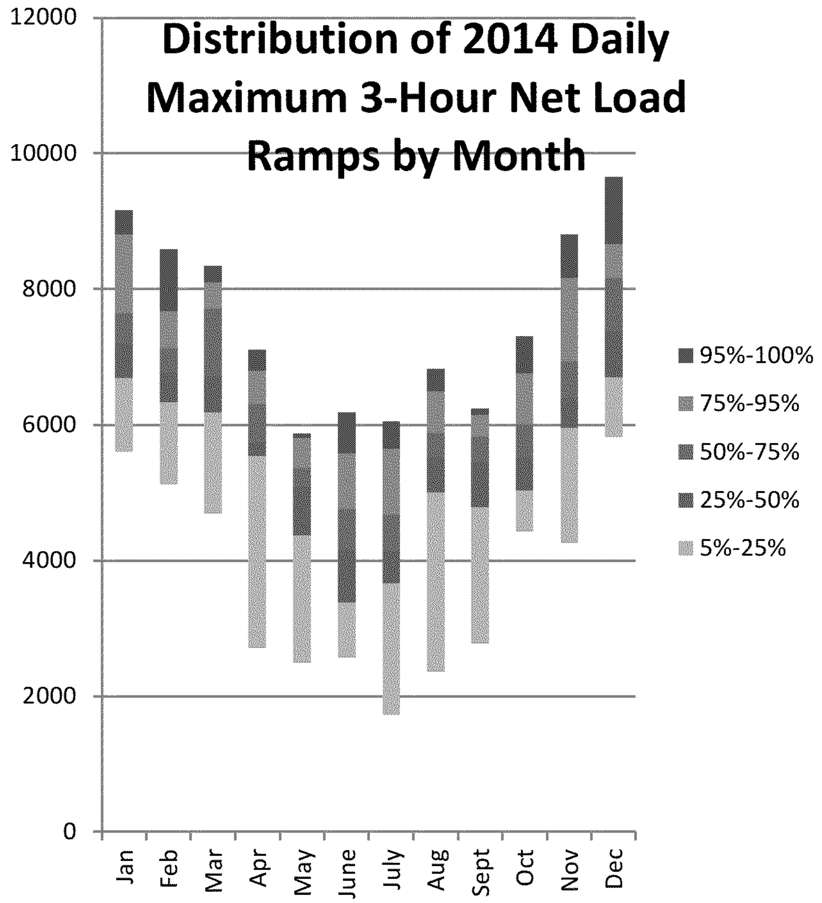


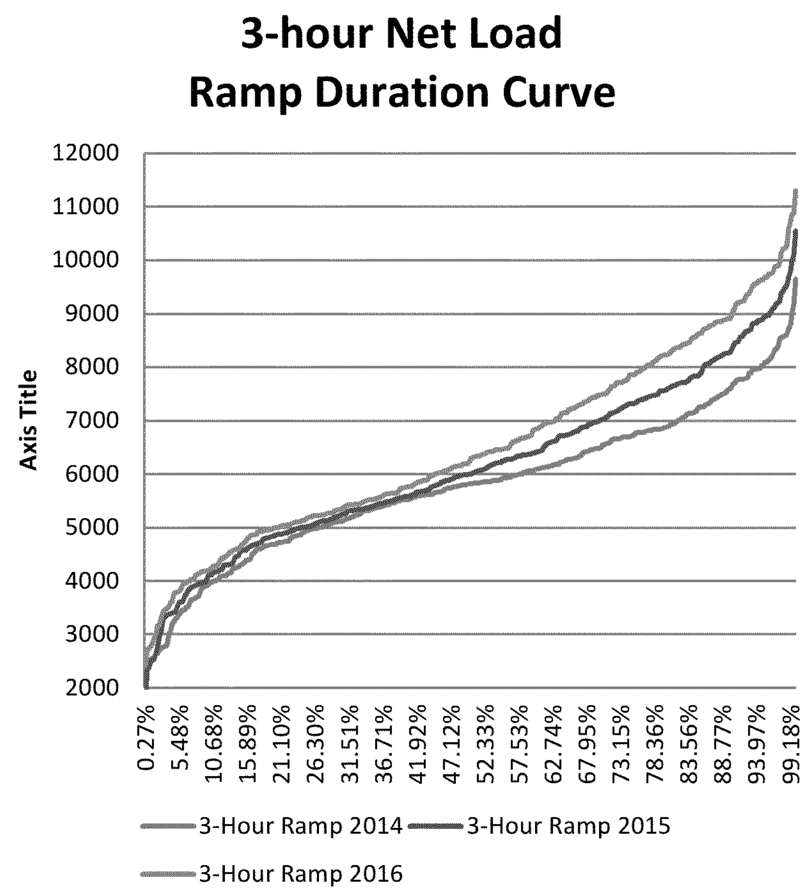
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total_Flex_Need_2014	10,335	9,732	9,474	8,272	7,151	7,563	7,646	8,563	7,841	8,916	10,007	10,869
Total_Flex_Need_2015	11,296	10,539	10,570	9,305	7,734	7,556	7,568	8,380	7,964	9,754	11,042	11,796
Total_Flex_Need_2016	12,077	11,310	11,400	10,095	8,454	7,631	7,643	8,460	8,100	10,515	11,839	12,560

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

Note: In the 2014-2016 assessments, the MSSC is never larger than the $3.5\%*E(PL_{MTHy})$

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 Pmax
  - 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 eceive 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