ENERGY DIVISION- CALIFORNIA PUBLIC UTILITIES COMMISSION

Flexible Resource Adequacy Workshop Report

Workshop Date: April 5th, 2016

R.14-10-010

6/1/2016

Flexible RA Workshop Report

CPUC-Energy Division Staff hosted a workshop on April 4, 2016 on a variety of topics related to flexible RA requirements and designing a "durable" Flexible RA requirement.

The Workshop included presentations and discussion on the following topics:

1) What operational needs should Flexible RA requirements be designed to address?
2) What other operational needs may need to be addressed through capacity products?
3) Unbundling NQC and EFC Requirements
4) How do we know what grid needs will be in 2020, 2022?
5) Proposal for creation of a 2 hour MCC Bucket

Background

In 2014, the CPUC developed interim counting rules, eligibility criteria, and must-offer obligations for Flexible Resource Adequacy with the CAISO. The rules define three different categories of flexible capacity: base flexibility, peak flexibility, and super-peak flexibility.[1] This was done in response to changing grid conditions, i.e., increased variable renewable resources and the increased concern over ramping. The calculation of effective flexible capacity, as laid out in the decision, is based on the ability of a resource to meet and sustain a three-hour ramp, with various other caveats and allowances for non-generating resources such as demand response and storage.[2]

Starting in 2014, LSEs were required to ensure sufficient flexible capacity in these three categories on a monthly and annual basis as part of their RA compliance. The specific amount of flexible capacity need to be allocated among the LSEs is determined through an annual Flexible Capacity Needs Assessment conducted by CAISO. This allocation is currently based on the largest 3-hour ramp predicted for each month of the year. When the CPUC adopted these requirements, it acknowledged these requirements were "interim" and therefore the CPUC is expected to assess, through the RA proceeding, and in coordination with CAISO, whether the requirements should be revised by 2018. This Staff led workshop was an early step in the process of determining whether requirements should be revised.

[1] D.14-06-050. "Base flexibility" is the capacity needed to handle the largest 3-hour secondary ramp that occurs anytime during a one-month period. "Peak flexibility" is the additional capacity needed, in addition to "base flexibility" capacity, to handle the largest 3-hour primary ramp anytime during a one-month period. "Super-peak flexibility" is the additional capacity needed to handle the final 5% of the largest 3-hour primary ramp anytime during a one-month period. Thus, "base flexibility" and "peak flexibility" together allow meeting the largest ramp during the month. Technically speaking, "base flexibility" plus "peak flexibility" are defined as 95% of this largest ramp of the month.

[2] D.14-06-050.

Topic # 1: What operational needs should Flexible RA requirements be designed to address?

The first session of the workshop included presentations from Energy Division Staff, CAISO and SCE. Staff presented on: the method currently used for setting Flexible Requirements, the three "FRAC-MOO" categories, and an alternate approach for setting capacity requirements. CAISO presented on flexible needs and how CAISO is looking at needs going forward. SCE proposed an alternative method for determining how the sufficiency of each LSE's flexible resource procurement could be determined.

Simone Brant presented on behalf of Energy Division, focusing on a problem Staff has identified with the way current flexible capacity requirements are calculated, and potential alternative methods for setting requirements that Staff could explore. In particular, the proportion of flexible need required to be filled by Category 1 (or "Base Flexibility Resources") seems problematic. Category 1 resources are those that are required to have two starts per day available and to bid into the CAISO market 17 hours per day, every day of the week.

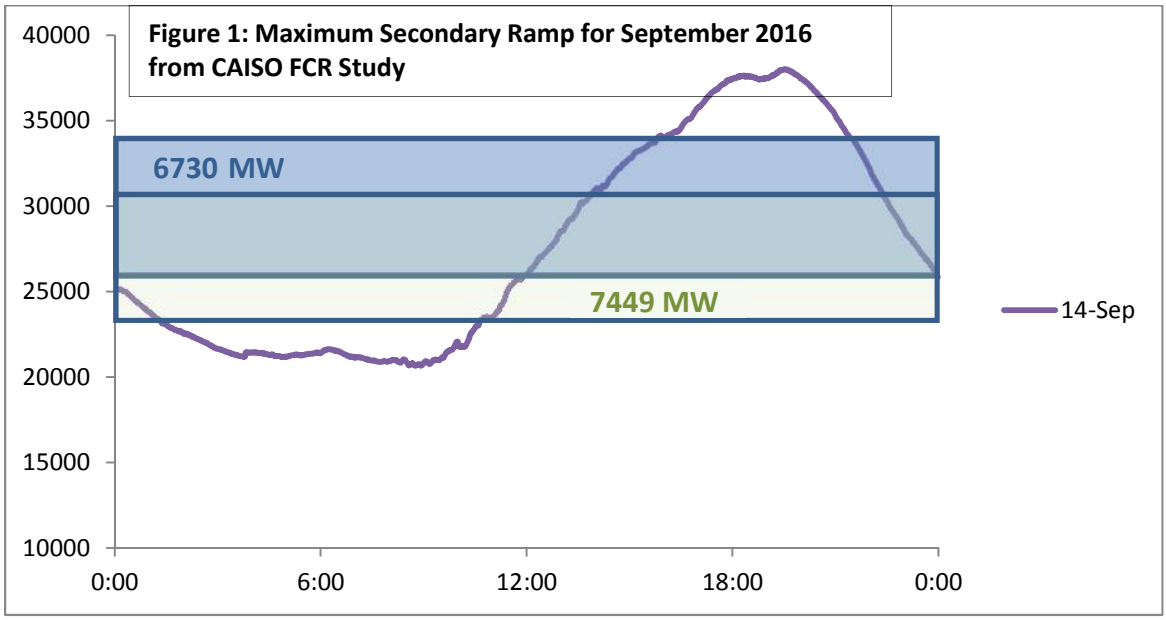
CAISO developed the requirements for this category of flexible RA capacity for 2016 based on its analysis of the largest secondary net-load ramp of the month. CAISO calculated the ramp by identifying the largest net-load ramp beginning in the AM hours and the largest net-load ramp beginning in the PM hours and considering the smaller of the two to be the largest secondary net-load ramp. In practice, this meant that what was designated as the largest secondary net-load ramp during summer months was not a true secondary ramp, but in fact one long continuous ramp that began before 12:00 pm. As seen in Figure 1, for September 2016, what was determined to be the largest secondary net-load ramp of the month (6,730 MW, illustrated in blue), was not only not a true secondary ramp, but in fact overlapped with the hours of the 7,449 MW primary ramp for that day. This situation applied to all summer months for 2016 leading to inflated Category 1 requirements in May-September.

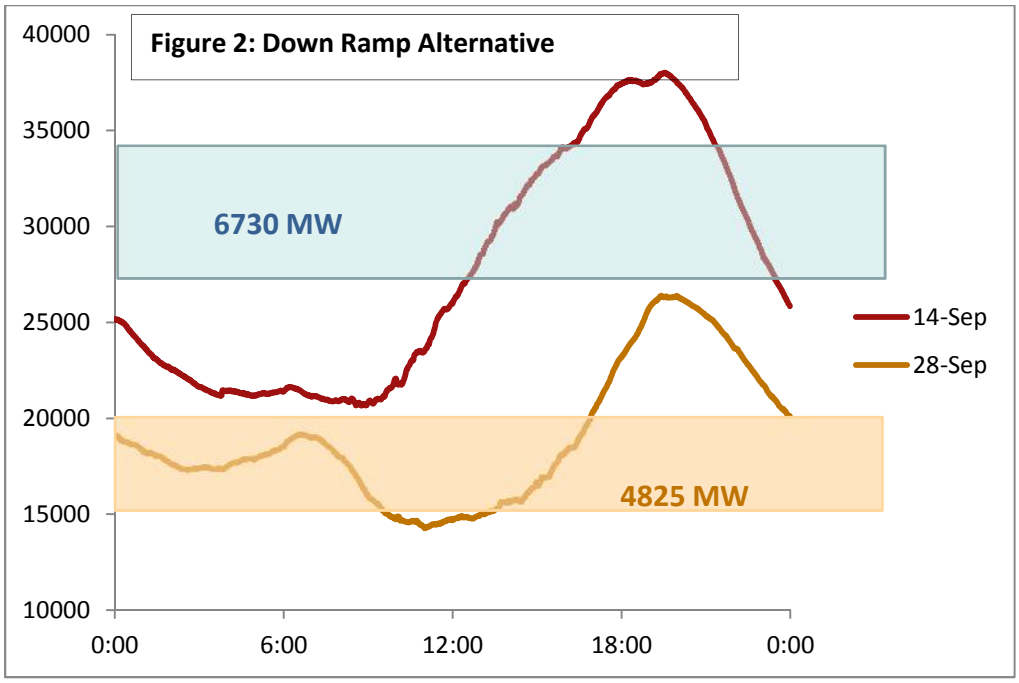
Simone's presentation offered several options for improving this calculation. Option 1 is simply to devise rules for what constitutes a secondary ramp so that the "secondary" ramp could not occur on a day that does not have two distinct ramps. A similar alternative is to use the largest mid-day "down ramp" of the month to determine the need for base flexibility with the assumption that the absolute maximum number of resources that could be required to have two starts per day are the ones that would have to be turned off during the middle of the day. Of course, this is an overstatement given that many resources can be ramped up and down during the day without restarting and separate resources may be used at different times. Additionally, as seen in Figure 2, on some days the "down ramp" can exceed the magnitude of the morning ramp. However, even with this likely overstatement of the need, this "down ramp" method of calculating requirements results in lower requirements for Category 1 Base Flexibility, particularly in the summer months (Figure 3).

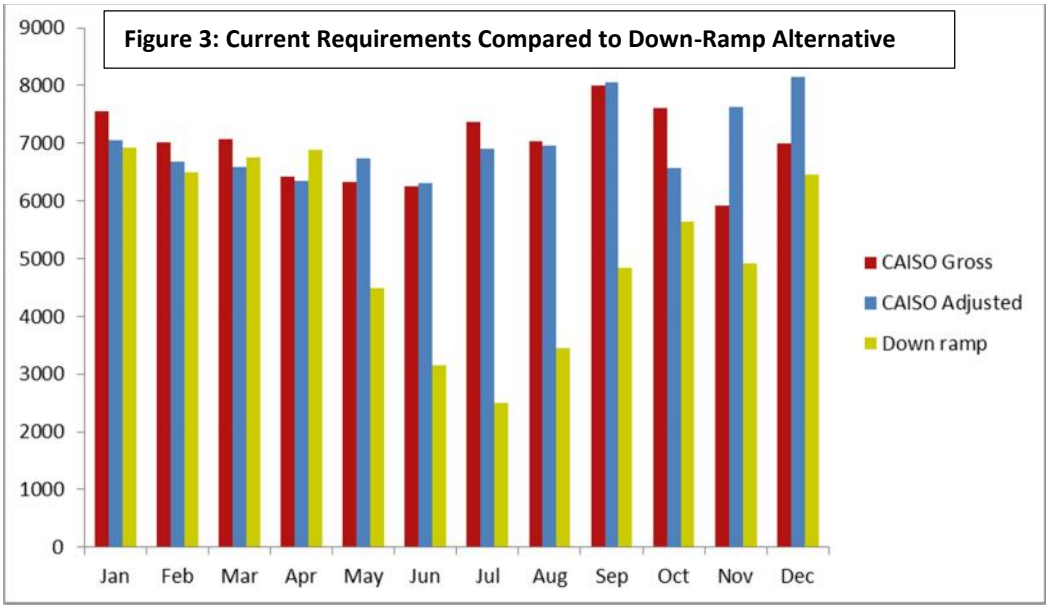
As a potential third alternative, Simone presented preliminary thoughts on a new way of determining overall system and flexible resource adequacy needs. Here, four types of overall resource adequacy needs were identified, with three being different "types" of flexible capacity and the last being a variation of the "non-flexible" system RA capacity needs. As illustrated in Figure 4, they are:

1. Base Load – resources needed throughout the day that do not need to be flexible or rampable;
2. Long Duration One Start – resources that can be turned on in the morning and stay on all day;
3. Two Start – resources needed for both the morning and evening ramps; and
4. Short Duration One Start – resources needed to meet the peak load.

By looking at the distribution of these types of resources for each month, it would be possible to begin to build out an RA framework based on meeting the needs for the four categories (Figure 5). Figure 5 is meant to represent what the monthly relative ratios of these categories could be, and hence does not include a scale (in MW). This chart also captures the fact that in summer months there is only one net-load ramp with a broad peak so the need for all one start resources is combined. Many elements would have to be explored by Staff and parties further if this idea were to be pursued including how to cap the monthly needs at the system need and requirements for bidding and/or self-scheduling.







In its flexible capacity study, CAISO first calculates a need for each month shown here as CAISO Gross. An average of the percentage of Base Capacity is then calculated for both winter and summer and that percentage is applied to the total monthly flexible need to determine the final Base Capacity requirement for the month. The adjusted value is shown as CAISO Adjusted.

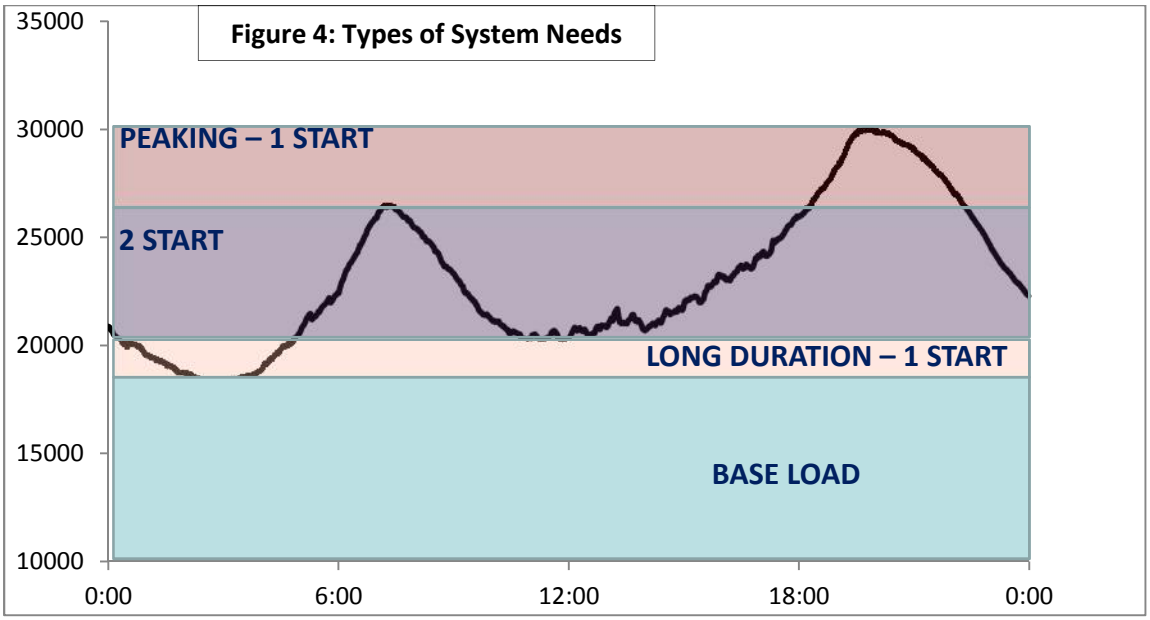


Figure 4: Types of System Needs
35000
30000
25000
20000
15000
10000
PEAKING – 1 START
2 START
LONG DURATION – 1 START
BASE LOAD
0:00
6:00
12:00
18:00
0:00

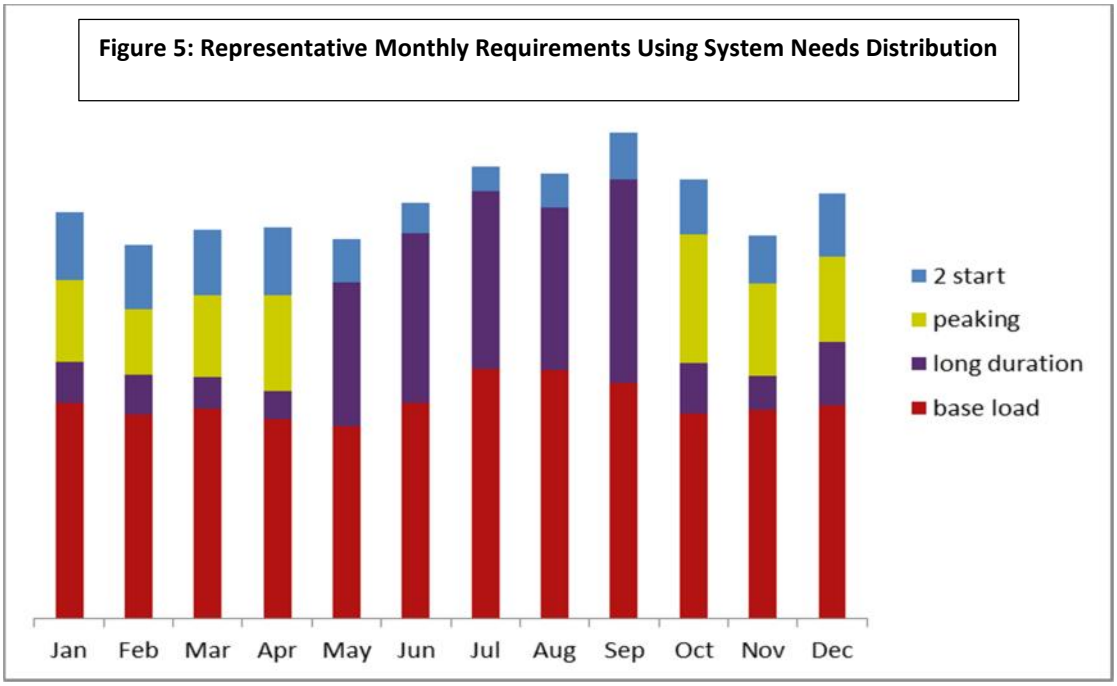
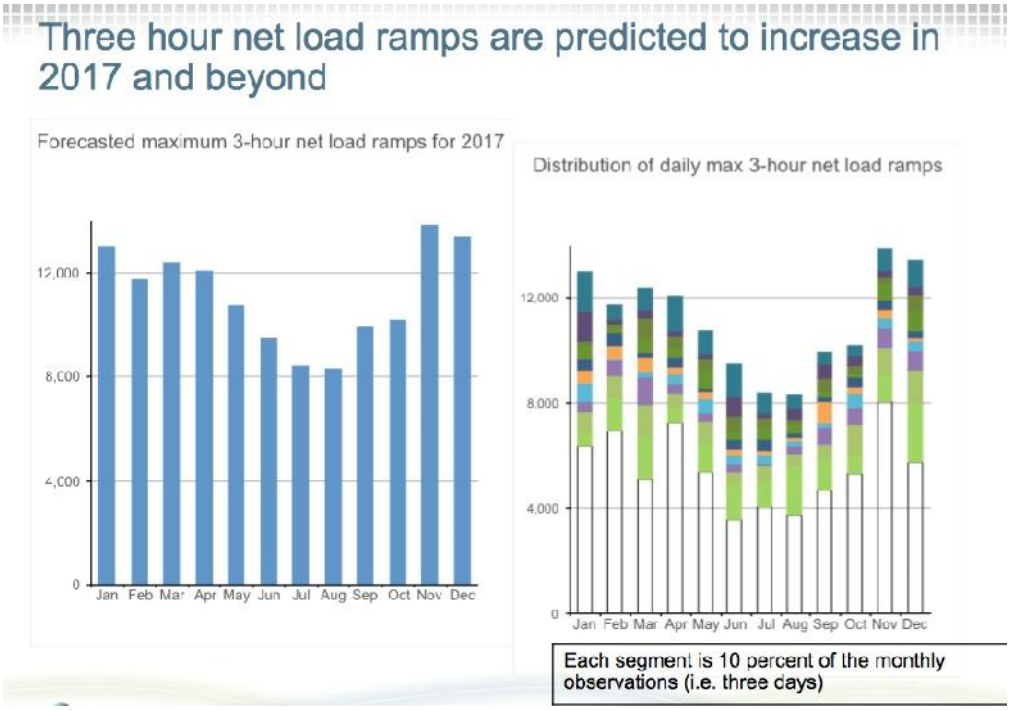


Figure 5: Representative Monthly Requirements Using System Needs Distribution
2 start
peaking
long duration
base load
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

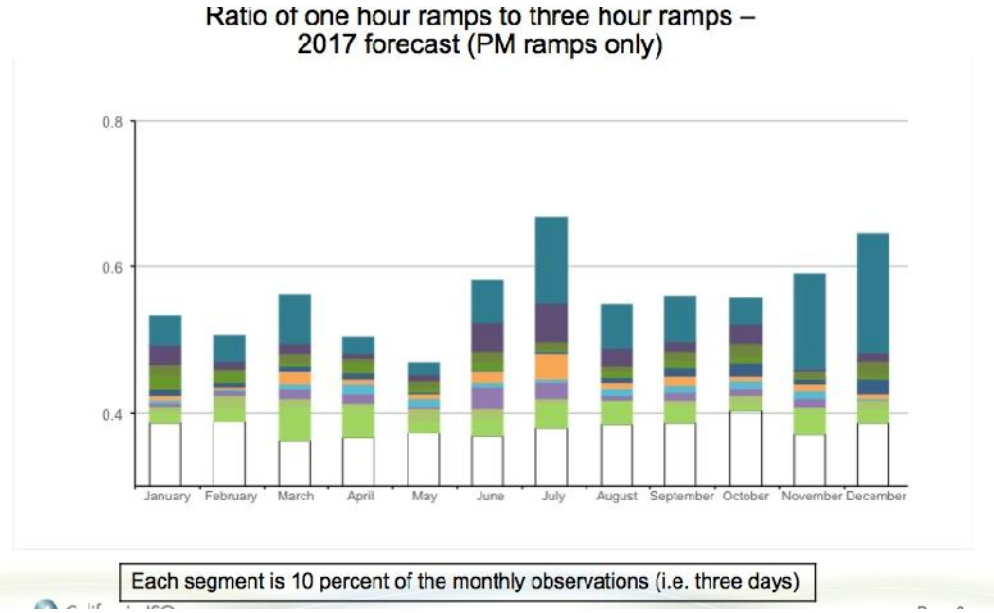
The second presentation was given by Karl Meeusen on behalf of CAISO. Karl's presentation identified four flexible capacity needs that address the following issues:

1) Three hour net-load ramps
2) Single-hour net-load ramps
3) Upward and downward dispatchable range during low net-load periods and the transition between low net-load periods and three-hour ramps and
4) Five-minute upward and downward deviations during the three-hour net-load ramps

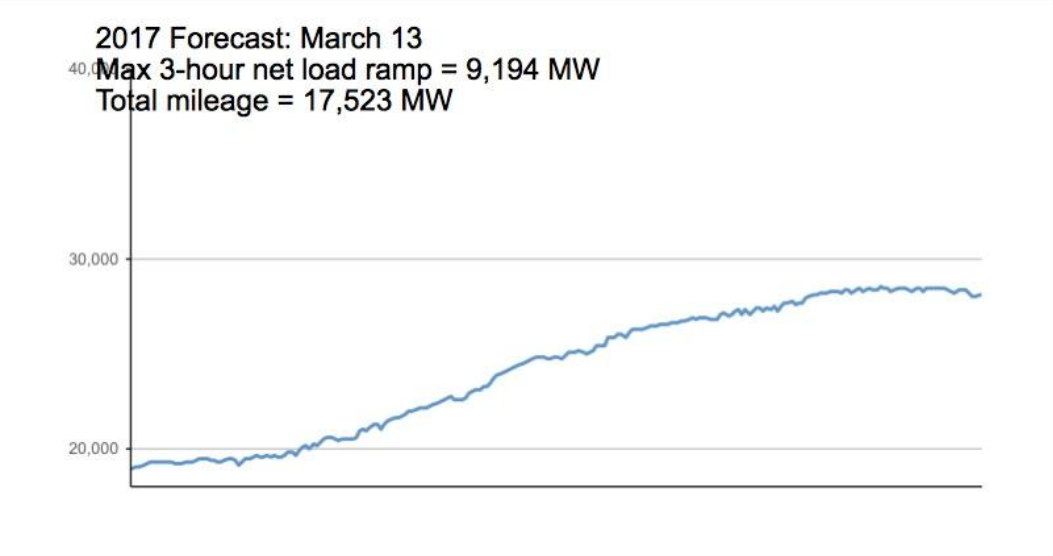
Karl stated that the existing flexible product (FRAC-MOO) adequately addresses the first item only and then presented more detail on each of these topics. He stated that rapid expansion of behind-the-meter solar is increasing the size of the three-hour net-load ramp (as illustrated in the following images). He emphasized that different studies are reaching very different estimates of behind-the-meter solar growth: the base behind-the-meter solar differs widely between them. The 2016 Flexible Capacity Technical Needs Assessment estimates total behind the meter solar for 2017 to be 1,740 MW, whereas CAISO has updated that value to be 5,975 MW.



Next, Karl shared his analysis that the magnitude of the secondary net-load ramps are decreasing, meaning that the Base Flexible capacity needed has decreased compared to the prior year's study of need. In contrast, the "three hour ramping" need is now mostly made up of large one-hour ramps, according to Karl's analysis of the 2017 forecast. Karl then discussed the need for fast-ramping resources to be on-line to meet afternoon ramps.



Finally, Karl discussed the concept of "total mileage" needed over a three hour period, driven by the variability of wind and solar resource generation patterns, represented with this image.

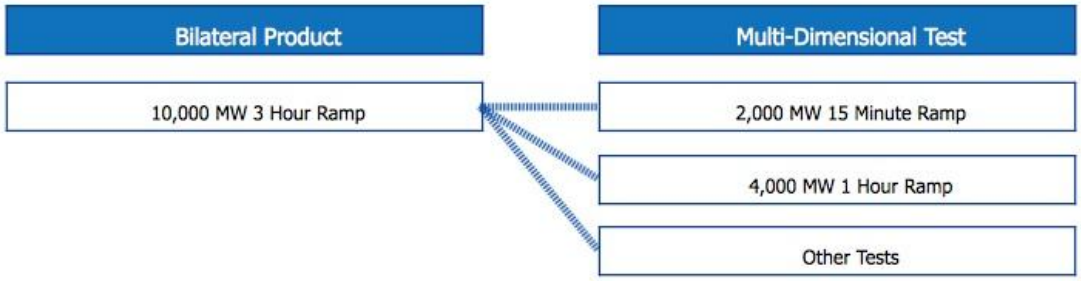


Martin Blagaich from SCE was the final presenter in this session. The topic of Martin's presentation was a Durable Flexible RA proposal. The main components of the proposal are:

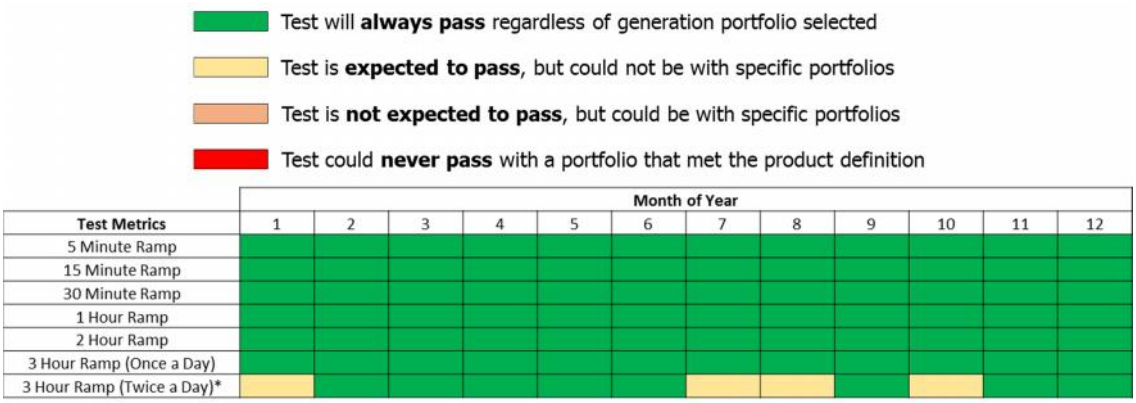
1) Keep the interim solution product definition
   - LSE's procure a single 3 hour product to meet a single flexibility requirement
2) Perform a Multi-Dimension Test to Ensure Reliability
   - Once resources are shown by LSEs, CAISO can validate the shown portfolio using multiple flexibility criteria
   - Tests will be predefined and well understood by all parties
   - Conceptually similar to the current process for Local RA

Martin proposed that such a framework would result in a product that will meet CAISO's flexibility needs with only minimal changes to the interim product. Martin provided this example: LSEs will procure and show a single portfolio that meets a 10,000 MW of 3 hour ramp EFC requirement. CAISO will test the shown portfolio to see if it has the capability to meet 2,000 MW of 15-minute ramp, 4,000 MW of 1 hour ramp, etc. Deficiencies are cured by additional LSE showing/procurement and/or ISO backstop procurement. Details of cure process are TBD, but, conceptually similar to the cure process for Local RA effectiveness deficiencies. SCE designed an analysis to test this approach and verify that such a requirement would pass a multi-dimensional test. To do this they:

1) Created generation portfolios that satisfy the 3 hour ramping product
2) Tested the generation portfolios against the multi-dimensional requirements
   "Does the flexible RA portfolio meet the largest 15-minute ramp, 1 hour ramp, etc."
3) Determined how often a portfolio that satisfies the 3 hour ramping requirement will pass the multi-dimensional test.



Martin asserted that the results of SCE's analysis show that the simplified requirement would meet all of the needs of the grid 100% of the time regardless of generation portfolio, with the exception of a 3 hour ramp twice a day. For this parameter, it would make a difference what portfolio of resources was procured by each LSE.

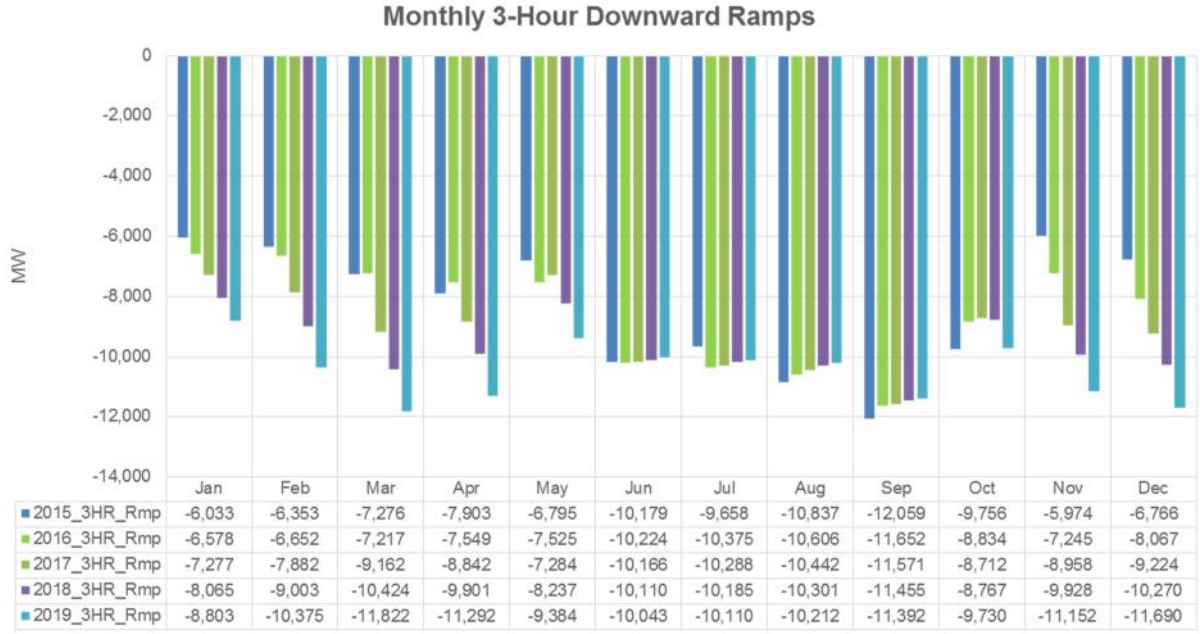


Topic 2: What other operational needs may need to be addressed through capacity products?

The second session of the workshop included presentations from the CA Energy Storage Alliance (CESA), given by Alex Morris, and a presentation by Karl Meeusen from CAISO.

CESA's presentation mainly advocated for the RA proceeding to consider creating a new "downward flexibility" product or requirement. Alex stated that changing net-load shapes and ramping needs drive flexibility – up and down and went on to propose that although "Flex down" may be supplied competitively/liquidly through the market, categorizing flex-down as "only an operational/spot-market issue" underutilizes our planning capacity frameworks.

CAISO's presentation focused on identifying downward flexible capacity needs. CAISO proposed that downward ramps are increasing and the ability to address these ramps may be affected by minimum operating level constraints, as illustrated by this graphic.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015_3HR_Rmp	-6,033	-6,353	-7,276	-7,903	-6,795	-10,179	-9,658	-10,837	-12,059	-9,756	-5,974	-6,766
2016_3HR_Rmp	-6,578	-6,652	-7,217	-7,549	-7,525	-10,224	-10,375	-10,606	-11,652	-8,834	-7,245	-8,067
2017_3HR_Rmp	-7,277	-7,882	-9,162	-8,842	-7,284	-10,166	-10,288	-10,442	-11,571	-8,712	-8,958	-9,224
2018_3HR_Rmp	-8,065	-9,003	-10,424	-9,901	-8,237	-10,110	-10,185	-10,301	-11,455	-8,767	-9,928	-10,270
2019_3HR_Rmp	-8,803	-10,375	-11,822	-11,292	-9,384	-10,043	-10,110	-10,212	-11,392	-9,730	-11,152	-11,690

Topic 3: Unbundling NQC and EFC Requirements

The Joint Demand Response parties made the first presentation on this topic. They proposed that Flexible RA Attributes and requirements should be unbundled from the underlying system RA and Local RA attributes for Demand Response and Storage resources. They stated that this would allow a resource to have an EFC (Effective Flexible Capacity) value without having an NQC (Net Qualifying Capacity) value. They proposed that the goal of such a rule change would be to allow these resources to achieve their best and highest grid functions as we move to a grid needing more flexibility for intermittent resource integration. Further reasons given for this proposal were:

- Mismatch of MOO hours can limit participation
  - Past RA cycles would have created 10+ hour daily MOO for flexible resources
  - DR Resources can be designed for peak needs for ramping
- EFC is capped at a resource's NQC
  - Limits bidirectional resources like DR and storage from providing full flexibility
  - EFC is usually higher for storage and DR resources than NQC

The DR parties also advanced that this change could be accommodated in current RA compliance system, by updating EFC and NQC lists to utilize the unbundled and uncapped EFCs.

Through party discussion and questions from Staff, the DR parties clarified that they are not advancing a proposal for a "complete" unbundling of system RA attributes from Flexible RA attributes (such that the same resource could sell the system and flexible attributes of that resource separately). Rather, they are proposing that certain resources (DR and Storage) that may not be able to qualify for a system RA attribute, be allowed to qualify as a Flexible RA resource only. This could allow LSEs to contract with that resource to fulfill their Flexible RA obligation (but not their system RA obligation.)

PG&E, represented by Peter Griffes, presented next on the topic of unbundling, beginning by summarizing comments PG&E previously made into the RA proceeding. PG&E previously agreed that DR resources should not need an NQC to receive an EFC (February 2014 Comments). PG&E also asked for the CPUC to allow an EFC greater than NQC in its March 2014 Comments. In 2015, PG&E supported the SCE proposal to allow EFC-only and NQC-only resources and opposed SDG&E's proposal for complete unbundling. PG&E previously indicated support for all resource types to be able to provide EFC-only and NQC-only. Concerns raised by PG&E about the DR parties' proposal include:

- Supplier Market Power
- Administrative Burden and Complexity
- Implications on Existing Contracts need to be considered.
- CAM Implications are not clear.
- No Clear Need
- Methods to balance portfolios already exist.

PG&E thinks an important primary question to answer is: would unbundling reduce complexity or increase complexity? PG&E recommended that an initial area of complexity to target is the CPUC's resource counting rules.

NRG provided brief remarks on the topic, focused on their opinion that it is not yet clear that unbundling attributes is valuable at this time. However, NRG would support providing the EFC value of resources without first requiring an NQC.

CESA presented briefly as well, mainly echoing their members' support for the Joint DR parties' proposal on unbundling. CESA commented specifically that the point of the CPUC's storage procurement orders was not to provide peak deliverability, so, the value of these resources to serve RA needs shouldn't only be based on peak.

A variety of parties participated in a discussion after the presentations. Olivine commented that it is hard to manage capacity value for DR and Storage when the study window changes both by year and during the year. Having different notice periods is problematic. CESA commented that similarly, for storage, the NQC methodology increases costs and limits what the resources can actually do. CAISO commented that they would need a new deliverability study to determine capacity value during non-peak hours, but that they are willing to study this.

Topic 4: How do we know what grid needs will be in 2020, 2022?

Wellhead, which is not a party to the RA proceeding, was represented by Doug Davie who presented on modeling efforts they have undertaken to understand flexible needs in the 2020-2024 timeframe. Doug began by presenting the main issues that they have identified, and which their modeling was focused on:

- Increasingly steep, volatile, and uncertain ramps correlated with renewables penetration
- The over-generation problems the CAISO has identified will likely occur well before 2024
- The system is operated on an intra-hourly basis and no analysis has looked at this level of granularity
- If not managed, over-generation is a reliability problem
- This changed planning paradigm has not been evaluated for the years between 2016 and 2024

Doug explained Wellhead's modeling methodology as follows:

- Analyzed the system in a way that closely represents how the CAISO operates the markets and the system
    - Sequential operating decisions are made based on generator characteristics starting with day-ahead forecasts and ending with real-time system operation which includes dealing with forecast uncertainty
- Used data that had 5-minute granularity (this required using data for 2019)
- Used NREL renewable profiles of historical day-ahead and real-time generation to account for forecast error
- Energy Exemplar used PLEXOS in a sequential simulation approach to reflect generator characteristics and forecast error as you go from the day ahead to real time
    - Started with hourly simulation then did a 5-minute simulation that only allowed commitment changes to fast start units

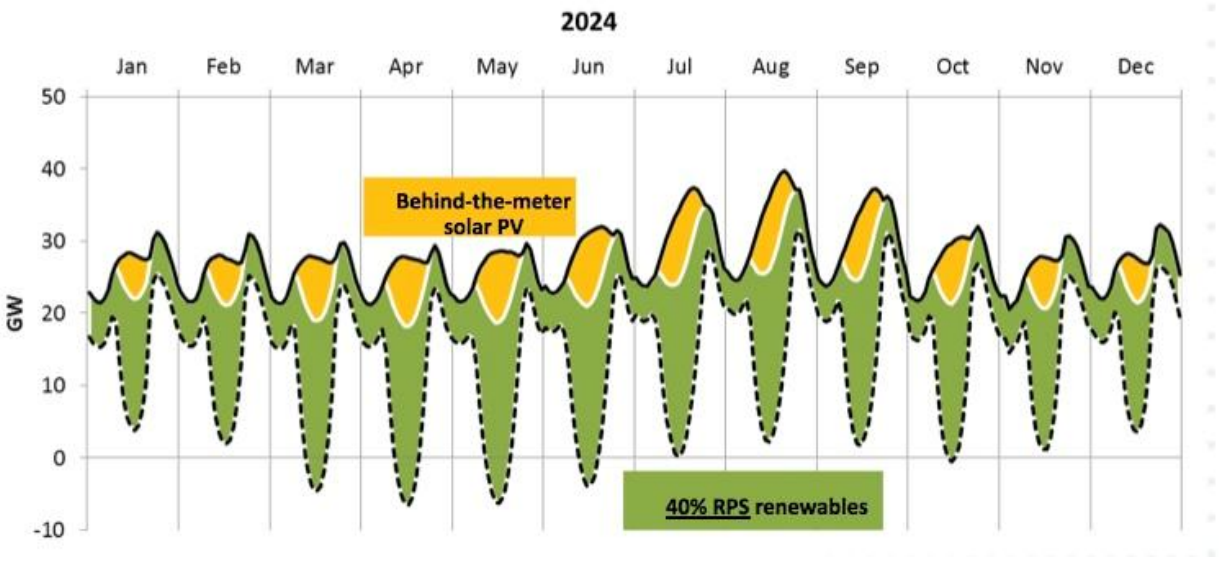
Their modeling produced the following results for the hourly simulations, comparing the quantities of over-generation in CAISO with and without an Energy Imbalance Market (EIM):

	Market Simulations of Over-Generation for 2019 With 37% RPS, $150 dump energy price, and PNNL load shape *except as noted*												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Hourly Simulations													
hourly EIM area results	Hourly simulation; May 2015 LTPP Case 4													
	Renewable Generation (GWh)	8,159	7,503	8,271	7,938	8,084	7,681	7,486	7,347	7,084	7,472	7,382	7,309	91,717
	Over-generation Renewables only (GWh)	129	200	183	61	68	4	5	-	30	64	31	88	863
	Over-generation Renewables (% of Renewables	1.58%	2.67%	2.21%	0.77%	0.84%	0.05%	0.06%	0.00%	0.42%	0.86%	0.42%	1.20%	0.94%
	Dispatchable Hydro Generation (GWh)	986	920	1,243	1,340	1,795	1,728	1,677	1,493	1,155	940	837	1,179	15,292
	Spilled Hydro Generation (GWh)	-	-	-	-	-	-	-	-	-	-	-	-	-
	Over-generation Renewables + Hydro Spill (GWh	129	200	183	61	68	4	5	-	30	64	31	88	863
	Over-generation Renewable + Hydro Spill (% of	1.58%	2.67%	2.21%	0.77%	0.84%	0.05%	0.06%	0.00%	0.42%	0.86%	0.42%	1.20%	0.9%
	Max of Over-generation (MW)	8,075	7,022	8,976	3,238	4,926	1,335	2,325	-	4,101	4,096	4,141	4,609	8,976
	Hours of Over-generation	64	92	83	47	37	6	5	-	22	49	25	49	479
	Hours of Over-generation (%)	8.6%	13.7%	11.2%	6.5%	5.0%	0.8%	0.7%	0.0%	3.1%	6.6%	3.5%	6.6%	5.5%
	5-Minute Sequential Simulations WITHOUT EIM													
5-min no EIM EIM area results	5-minute Sequential Simulation; no EIM; line flows between balancing areas from hourly simulation frozen													
	Renewable Generation (GWh)	8,245	7,546	8,279	7,957	8,146	7,744	7,562	7,436	7,157	7,561	7,485	7,386	92,504
	Over-generation (GWh)	223	267	233	99	98	14	10	3	42	92	81	135	1,298
	Over-generation (%)	3%	4%	3%	1%	1%	0%	0%	0%	1%	1%	1%	2%	1.40%
	Dispatchable Hydro Generation (GWh)	980	906	1,214	1,319	1,759	1,713	1,671	1,490	1,152	938	834	1,174	15,149
	Spilled Hydro Generation (GWh)	6	14	29	21	36	15	6	3	3	3	3	6	143
	Over-generation Renewables + Hydro Spill (GWh	229	282	262	120	135	29	15	6	45	95	84	141	1,442
	Over-generation Renewable + Hydro Spill (% of	2.77%	3.73%	3.16%	1.50%	1.66%	0.38%	0.20%	0.08%	0.63%	1.25%	1.12%	1.90%	1.56%
	Max of Over-generation (MW)	9,356	7,859	9,189	4,777	6,312	2,395	2,088	1,047	3,804	3,944	4,632	5,094	9,356
	Hours of Over-generation	279	276	317	217	183	106	45	28	61	145	152	185	1,993
	Hours of Over-generation (%)	37.49%	41.11%	42.60%	30.13%	24.55%	14.78%	6.03%	3.79%	8.46%	19.48%	21.08%	24.81%	22.75%
	5-Minute Sequential Simulations WITH EIM (CAISO, PAC & NVE)													
5-min w/ EIM EIM area results	5-minute Sequential Simulation; EIM full operation with CAISO PAC NVE; line flows between non EIM area from hourly simulations frozen; BA transactions between EIM participants constrained to hourly simulation +/- contract rights (400 for PAC and 1,500 for NVE)													
	Renewable Generation (GWh)	8,245	7,546	8,279	7,957	8,146	7,744	7,562	7,436	7,157	7,561	7,485	7,386	92,504
	Over-generation (GWh)	172	218	176	65	68	6	2	1	18	50	47	99	924
	Over-generation (%)	2%	3%	2%	1%	1%	0%	0%	0%	0%	1%	1%	1%	1.00%
	Dispatchable Hydro Generation (GWh)	983	915	1,227	1,336	1,790	1,729	1,677	1,490	1,153	939	835	1,174	15,248
	Spilled Hydro Generation (GWh)	3	5	15	3	5	(1)	0	3	2	2	2	5	44
	Over-generation Renewables + Hydro Spill (GWh	175	223	191	69	73	5	3	4	20	52	49	104	968
	Over-generation Renewable + Hydro Spill (% of	2%	3%	2%	1%	1%	0%	0%	0%	0%	1%	1%	1%	1.05%
	Max of Over-generation (MW)	8,956	7,779	9,057	4,369	5,758	1,936	1,043	1,612	2,848	3,654	4,041	4,831	9,057
	Hours of Over-generation	142	144	155	93	59	28	10	6	22	58	57	97	871
	Hours of Over-generation (%)	19.06%	21.43%	20.77%	12.96%	7.87%	3.95%	1.36%	0.77%	3.07%	7.83%	7.94%	13.00%	9.94%

Doug proposed that their modeling results suggest the following:

- Significant over-generation problems are coming sooner than previously projected.
- Uncertainty in forecasts between day ahead and real time can be significant and intra-hour volatility adds to the need for flexible resources.
- Ordering renewables curtailment, the only option the CAISO has after-market options, is i) contrary to CA policy, ii) will require higher effective-cost renewables to be procured, iii) may be administratively impossible, and iv) may lead to significant hardship/disruption to CA's renewable development programs.

The next presentation was given by Nick Schlag, representing E3. E3 is the CPUC's main contractor for the RPS Calculator v6. E3 is also a consultant for CAISO on their regionalization studies. E3 is not under contract to the CPUC to assist with Flexible RA issues specifically. The main purpose of E3's presentation was to provide information about how the RPS calculator is analyzing the evolution of net-loads under different RPS penetrations. Nick explained that the RPS calculator creates "average" net-load shapes for each month of the year in each year that it studies. Load shapes are then adjusted in each year to capture growing penetration of behind-the-meter solar PV. Then, average renewable production shapes are subtracted from load, net of BTM solar PV, which yields a net-load shape. The calculator is designed to fill in the RPS "net short" for a target year, so, the shape of net-load adjusts as RPS Calculator adds resources to the portfolio to meet policy goals (like a 33, 40 or 50% RPS).



Topic 5: Revision of MCC "Buckets", Proposals for a 2 hour MCC "Bucket"

Donald Brooks, Energy Division Staff, provided and overview of the current RA program's MCC Buckets, and expanded upon Simone Brant's presentation on Flexible RA requirements. Donald first suggested that several current features of the RA program can be simplified or removed. They include: the current need to allocate and track flexible RA MW requirements to LSEs, the current MCC bucket concepts, and the current flexible RA categories. In the future, Donald suggested, even more simplifications may be made. Donald presented this background on the MCC buckets:

Current Requirements • 5 Buckets of Resources – differentiated by contracted limits • Same percentages apply each month, all maximum portfolio limits
Procedural History • Attempt to reorganize in 2012, result in recalculation but maintaining same structure • Added DR Bucket in 2012
Potential Realignment that combines Flexible Categories with limit on Base load (inflexible) generators

Next Donald contrasted the original categorization system for RA with more recent changes.

Old definitions:

- Broad methodology adopted in D.05-10-042, further analysis conducted and implemented by Energy Division in 2005;

- Based on load duration curve made up of average ranked month specific loads from last three years;
- Need to accommodate existing energy contracts.

Possibilities for revisions within current methodology:

- Standard energy contracts outdated and phased out;
- Hours of availability do not adequately characterize dispatchability or other technical operating limits;
- Portfolios have become more complicated since the Flexible RA requirements were adopted.

Donald suggested that the RA program—specifically the categories of RA resources—could be revised by removing: the MCC Bucket structure, the MW based Flexible RA obligation, and the 3 Flexible RA Categories. If these changes were made, the CPUC could also design new program elements, such as: portfolio limits for non-flexible resources, portfolio minimums for flexible RA categories, and minimums and limits that change from month-to-month. However, RA Capacity procured would still need to total the overall System RA obligation.

Donald expanded upon the concept for new and simplified RA categories by explaining that such categories would either reflect a limit on non-flexible resources or a flexible requirement. There would be a minimum level of: "one start" (long-running) resources, two-start (short running) resources, and peaking (one start) resources. Portfolio requirements would be monthly and dependent on net-load curves. This could be accomplished by ED staff analyzing the previous five years of net-load curves, and scaling them up to reflect the next year's wind/solar installation and peak load levels. ED staff could also analyze requirements given production of non-dispatchable baseload resources. Staff would calculate distribution of monthly category limits, rank category limits from highest to lowest, and set category maximums and minimums at some point on a curve that this proceeding could determine (95%? 75%? etc.) Loads and wind/solar production curves could be derived from either CAISO analysis or production/load profiles developed for the ELCC analysis using SERVM.

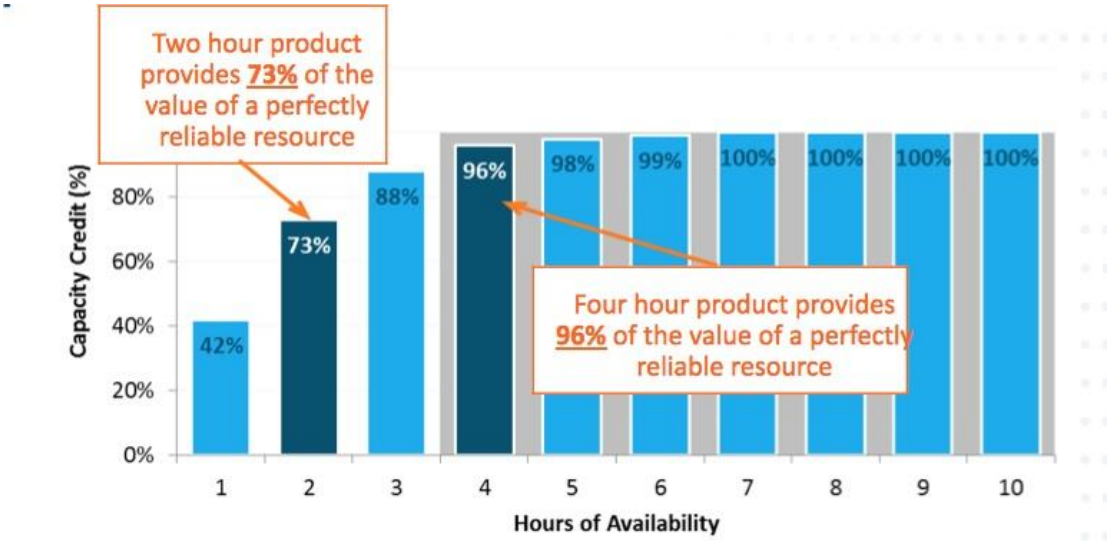
Donald concluded by explaining that Staff does not have a proposal now – more analysis is needed before proposal is complete. Therefore, Staff seeks party feedback on these concepts so that Staff could develop a complete proposal over the summer, and issue a proposal for consideration in the RA proceeding by the end of 2016.

Following Donald's presentation, Nick Schlag of E3 presented some preliminary results of modeling being done in the DR proceeding that is related to the valuation of a potential short-duration capacity product. This modeling is being done for the purpose of quantifying the "avoided cost of capacity" value used in the cost effectiveness evaluation for demand-side programs; it is not being done for the purpose of analyzing potential RA products. Nick started off by explaining that many factors impact the efficacy of demand response as a capacity resource:

- DR programs are commonly available only certain months, hours, and day-types (weekend/weekday)

- DR programs are also subject to additional uncertainty such as forecast error, uncertainty availability, and variable response rate

One of the conclusions of E3's modeling is that a two-hour capacity product would provide a significant share of the capacity value provided by the current standard capacity product. The second conclusion is that Capacity value is not limited to discrete intervals; the value provided by resources with short durations of availability can be measured through ELCC techniques.



E3 then moved on to explaining their analysis that many resource characteristics can support the flexible needs of the system. E3 also posits that there is no single metric that can be used to measure the adequacy of the flexibility of an electric system, (ie, ramping capability) because there are too many "flavors" of flexibility that the system needs to be able to measure those needs with just one metric (like ramping needs).

Characteristic	How it helps with system flexibility
Upward ramping capability on multiple time scales: • 1 minute, 5 minutes, 20 minutes, 1 hour, 3 hours, 5 hours	Helps meet upward ramping demands
Downward ramping capability on multiple time scales: • 1 minute, 5 minutes, 20 minutes, 1 hour, 3 hours, 5 hours	Helps meet downward ramping demands
Minimum generation levels	Lower minimum generation levels can help meet upward ramping needs while avoiding overgeneration
Start time	Faster start times help meet upward ramping demands
Shut-down time	Faster shut-down times help avoid overgeneration
Minimum run times	Shorter minimum run times help avoid overgeneration
Minimum down times	Shorter minimum down times can help meet upward ramping needs
Number of starts	If starts are limited under air permits, units are less available to meet ramping needs

Next, Brian Theaker presented NRG's position on a 2 hour capacity product. The major point that Brian emphasized was that the duration of energy resources is less important now than it was a few years ago, because of the flexible needs that have emerged recently. Brian also noted that during the summer months on weekdays, a longer duration product is still likely what is needed. Weekends provide a contrasting point.

Finally, the Joint DR Parties, represented by Jennifer Chamberlin, presented next in support of the proposal they made into the RA proceeding to establish a 2 hour capacity product. Jennifer suggested that resources should be able to aggregate together and that this would provide value from a two-hour product. Most DR resources are currently only dispatched for 1-2 hours, suggesting that they are meeting a shorter duration need. The opportunity to link DR with Storage may further improve the value of these resources.

Staff pointed out that there used to be a 2 hour capacity product for use-limited peaking resources. Staff also suggested that to design a program that includes 2 hour resources would likely require setting a maximum percentage of the portfolio that could be met with such short-duration resources. CAISO commented that they have not looked into the planning value of short duration resources. SCE commented that product diversity is a positive benefit and minimizes ratepayer costs.