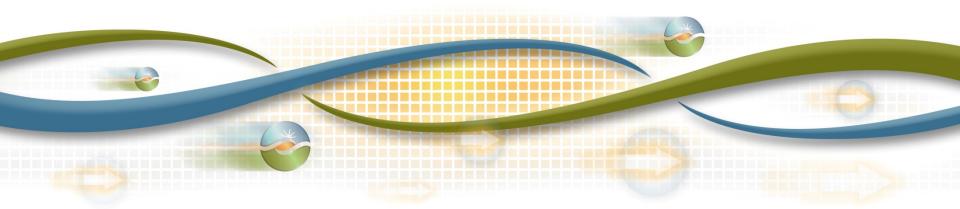# Flexible Resource Adequacy Criteria and Must-Offer Obligation

June 19, 2013

Karl Meeusen, Ph.D.

Market Design and Regulatory Policy Lead
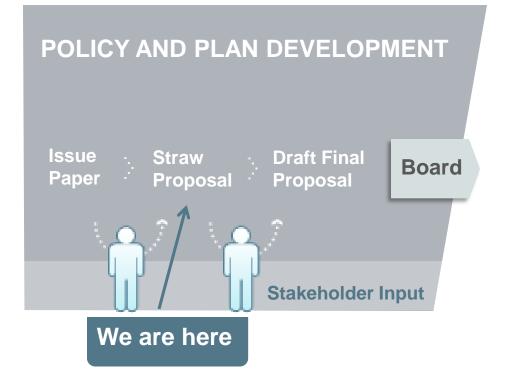
Stakeholder Meeting – Agenda - 06/19/13

Time	Topic	Presenter
10:00 – 10:15	Introduction	Chris Kirsten
10:15 – 10:45	Overview and Meeting Objective	Karl Meeusen
10:45 – 12:00	Process and Study Methodology for Determining Flexible Capacity Procurement Requirements	
12:00 – 1:00	Lunch	
1:00 – 2:00	Proposal for Allocating Flexible Capacity Requirements	Karl Meeusen
2:00 – 2:30	Flexible Capacity Must-Offer Obligation (Availability Requirements)	
2:30 – 2:45	Break	
2:45 – 3:15	Flexible Capacity Must-Offer Obligation (Availability Requirements) Cont.	
3:15 – 3:45	Proposed Flexible Capacity Backstop Procurement Authority	
3:45 – 4:00	Next Steps	Chris Kirsten

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ISO Policy Initiative Stakeholder Process

POLICY AND PLAN DEVELOPMENT

Issue Paper → Straw Proposal → Draft Final Proposal → Board

Stakeholder Input

We are here

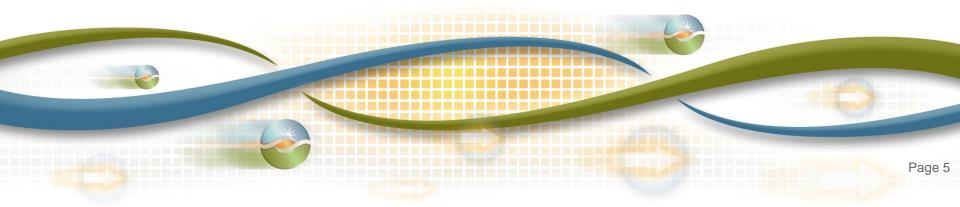California ISO
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Flexible Resource Adequacy Criteria and Must-Offer Obligation: Revised Straw Proposal

Karl Meeusen, Ph.D.

Market Design and Regulatory Policy Lead

Overview and Meeting Objectives

The ISO will ensure it has sufficient tariff authority to manage Flexible Capacity RA Resources

- ISO has combined the two phases of the initiative
- Stakeholder process will be completed by December 2013 for 2015 RA Compliance
- This initiative will cover:
  - The ISO study process and methodology to determine flexible capacity requirements
  - Allocation of flexible capacity requirements
  - RA showings of flexible capacity
  - Flexible capacity must-offer obligation (availability requirements)
  - Backstop procurement for flexible capacity

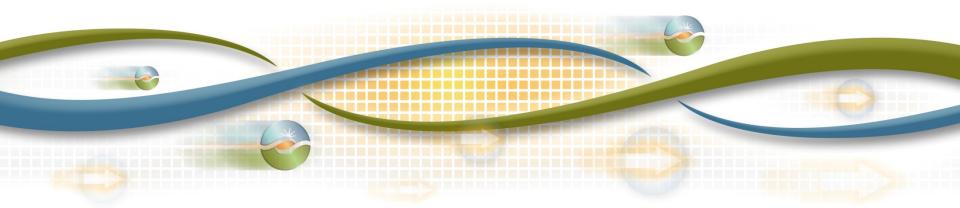California ISO
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Availability incentive mechanism for flexible capacity will be addressed in a separate stakeholder initiative

- A flexible capacity availability incentive mechanism should consider bidding behavior and forced outage rates
  - The ISO will revisit this issue after market participants have more experience with the new bidding rules
- The ISO will commence a stakeholder initiative that will address:
  - Modifications to the must-offer obligation for all use-limited resources
  - The standard capacity product for demand response resources for system and local capacity

Process and Study Methodology for Determining Flexible Capacity Procurement Requirements

The ISO's Flexible Capacity Requirement process

January
- Receive CEC load forecast used for TPP expansion plan
- Receive updated RPS build-out data from the IOUs
- Publish annual FCR assumptions paper

February
- ISO stakeholder meeting to discuss assumptions Stakeholder comments, and posting of comments with ISO response

March
- Draft LCR and FCR study completed (including EFC list of eligible flexible capacity resources) followed by Local & flexible capacity needs stakeholder meeting
- Publish draft final LCR & FCR needs study

April
- ISO stakeholder meeting to discuss LCR / FCR results followed by stakeholders comments

May/June
- Final 2014 LCR & FCR study posted
- CPUC proposed and final annual RA decision incorporating LCR and FCR procurement obligations

July
- LSEs receive Year-Ahead obligation

August
- Revised load forecasts for following RA compliance year

September
- LSEs receive revised RA obligation

October
- Year-ahead showing of system, local, and flexible capacity (show 100% local and 90% system and flexible)

Monthly Showings
- T-45 days: Month-ahead showings, including local and flexible true-up
- T-25 days: ISO notifies LSEs and suppliers of any deficiencies of system, local, and or flexible capacity
- T-11 days: Final opportunity for LSEs to demonstrate to the ISO that any identified deficiencies have been cured

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LSEs will have annual and monthly Flexible Capacity Procurement demonstrations

- LSEs required to demonstrate
  - 90 percent monthly flexibility procurement obligations year-ahead
    - Future needs may require LSEs demonstrate that 100 percent of their flexible capacity has been procured.
  - 100 percent of flexibility procurement obligation in monthly showing
- The ISO is not proposing changes to existing resource adequacy replacement requirement for planned generator outages at this time

Expected IOU RPS portfolio build-out has been updated

- The three IOUs provided their latest RPS data
  - Data based on IOU 2012 RPS Compliance Reports
  - The ISO obtained public version of contracted MW of RPS plans
- Information collected on resources included:
  - Location
  - Contracted capacity
  - On-line date
  - Technology

Using LTPP Base Case Assumption, Updated System-wide RPS Build-Out Shows 11,000 MW New Intermittent resources by 2017
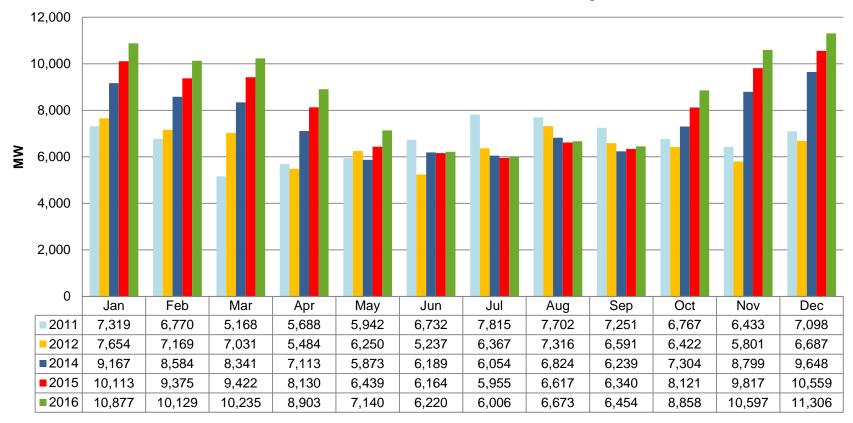
- **Relies on the same methodology and renewable profiles used in R.12-03-014**

- **Modified Assumptions:**
  - Updated RPS data as previously defined*
  - Total Small PV figures are based on 2010 LTPP Assumptions

		Existing 2012	2013	2014	2015	2016	2017
Total Small PV (Demand Side) 2010 LTPP Assumptions		367	733	1100	1467	1833	2200
ISO	Solar PV	1,345	1,645	3,193	3,727	4,205	5,076
ISO	Solar Thermal	419	373	748	968	1,718	1,918
ISO	Wind	5,800	1,224	1,402	1,685	1,695	1,695
Sub Total of Intermitant Resources		*7,931*	*11,906*	*14,374*	*15,779*	*17,382*	*18,821*
Incremental New Additions in Each Year			3975	2,468	1,405	1,603	1,439

* Additional detail regarding individual IOU build out is provided in the Appendix

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

Maximum 3-hour net load ramp

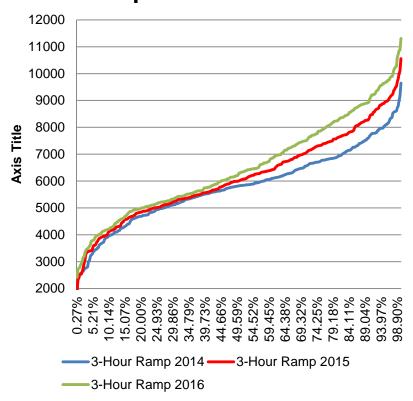|	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	7,319	6,770	5,168	5,688	5,942	6,732	7,815	7,702	7,251	6,767	6,433	7,098
2012	7,654	7,169	7,031	5,484	6,250	5,237	6,367	7,316	6,591	6,422	5,801	6,687
2014	9,167	8,584	8,341	7,113	5,873	6,189	6,054	6,824	6,239	7,304	8,799	9,648
2015	10,113	9,375	9,422	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

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There are opportunities for use-limited and DR resources to address "super-ramps"

Disrtribution of 2014 Daily Maximum 3-Hour Net Load Ramps by Month

Legend:
- Top 5 Percent
- 95th Percent
- Q3
- Q2
- Q1

3-hour Net Load Ramp Duration Curve

- 3-Hour Ramp 2014
- 3-Hour Ramp 2015
- 3-Hour Ramp 2016

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The proposed interim flexible capacity methodology should provide the ISO with sufficient flexible capacity

- ## Methodology

    Flexibility Requirement$_{MTHy}$ = Max[(3RR$_{HRx}$)$_{MTHy}$] + Max(MSSC, 3.5%*E(PL$_{MTHy}$)) + ε

    Where:

    Max[(3RR$_{HRx}$)$_{MTHy}$] = Largest three hour contiguous ramp starting in hour x for month y

    E(PL) = Expected peak load

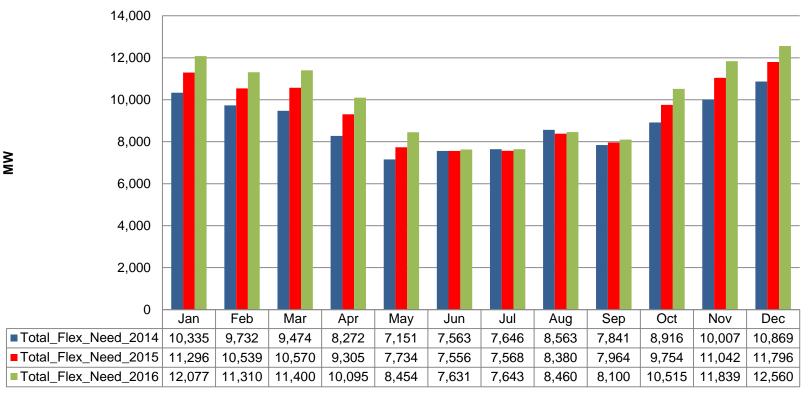   MTHy = Month y

    MSSC = Most Severe Single Contingency

    ε = Annually adjustable error term to account for load forecast errors and variability

The forecasted peak ramping needs are greatest in the shoulder months and growing over time

Calculated Flexible Capacity Requirement

	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

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

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

The flexible capacity counting rules

Start-up time greater than 90 minutes

$$EFC = \text{Minimum of } (NQC\text{-}Pmin) \text{ or } (180 \text{ min} * RRavg)$$

Start-up time less than 90 minutes

$$EFC = \text{Minimum of } (NQC) \text{ or } (Pmin + (180 \text{ min} - SUT) * RRavg)$$

Where:

EFC: Effective Flexible Capacity

NQC: Net Qualifying Capacity

SUT: Start up Time

RRavg: Average Ramp Rate
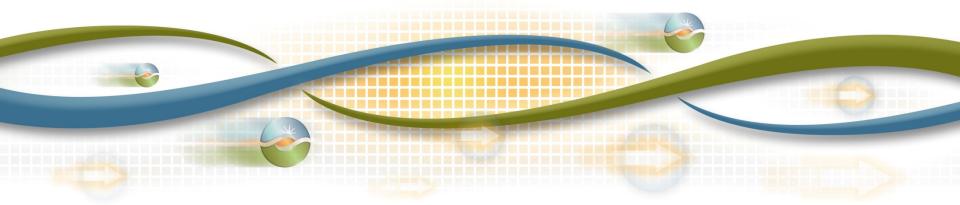
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Additional flexible capacity counting rules

- MSG resources measured based on 1x1 configuration
- Hydro resources qualify if physical storage capacity to provide energy equivalent to output at Pmax for 6 hours
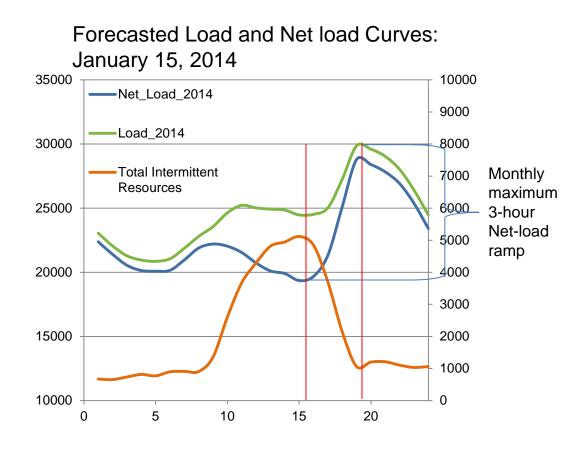
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Proposal for Allocating Flexible Capacity Requirements

Allocating flexible is based on contribution to system's monthly maximum 3-hour net-load ramp

- 3-maximum ramp used is the coincident 3-hour maximum ramp
  - Not each individual LSE's maximum 3-hour ramp
- ISO must assess the proper level of granularity to use when determining the allocation to each LSE
  - Reach an equitable allocation at a reasonable cost

Forecasted Load and Net load Curves: January 15, 2014

Legend:
- Net_Load_2014
- Load_2014
- Total Intermittent Resources

Monthly maximum 3-hour Net-load ramp

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The flexible capacity is split into its two component parts to determine the allocation

- Maximum of the Most Severe Single Contingency or 3.5 percent of forecasted coincident peak
  - Allocated to LSE SC based on peak-load ratio share
- The maximum 3-hour net load ramp using changes in
  - Load
  - Wind output
  - Solar PV
  - Solar thermal
  - Distributed energy resources

The ISO will decompose the largest 3-hour net load ramp into five components to determine the LSE's final allocation

- Δ Load – Peak load ratio share x total change in load
- Δ Wind Output – Percent of total wind contracted x total change in wind output
- Δ Solar PV – Percent of total solar PV contracted x total change in solar PV output
- Δ Solar Thermal – Percent of total solar thermal contracted x total change in solar thermal output
- Δ Distributed Energy Resources – Peak load ratio share x total change in DG output

Allocation = Δ Load – Δ Wind Output – Δ Solar PV – Δ Solar Thermal – Δ Distributed Energy Resources

Example of Allocated 3-hour net load ramp: Evening Ramp

ISO flexible capacity needs assessment	
Δ load	4000
Δ wind	-2000
Δ solar PV	-2500
Δ solar thermal	-1000
Δ DG output	-500
Total flexible capacity need	10000

	LSE 1	LSE 2	LSE 3	LSE 4
Percent of total wind contracted	40%	20%	25%	15%
Percent of total Solar PV contracted	30%	35%	15%	20%
Percent of total Solar Thermal contracted	70%	20%	0%	10%
Peak Load Ratio Share	35%	30%	20%	15%

LSE	Load contribution	Wind contribution	Solar PV contribution	Solar Thermal contribution	DG contribution	Total contribution
LSE 1	.35 x 4,000 = 1,400 MW	.40 x -2,000 = -800 MW	.30 x -2,500 = -750 MW	.70 x -1,000 = -700 MW	.35 x -500 = -175 MW	3,825
LSE 2	.30 x 4,000 = 1,200 MW	.20 x -2,000 = -400 MW	.35 x -2,500 = -875 MW	.20 x -1,000 = -200 MW	.30 x -500 = -150 MW	2,825
LSE 3	.20 x 4,000 = 800 MW	.25 x -2,000 = -500 MW	.15 x -2,500 = -375 MW	.00 x -1,000 = 0 MW	.20 x -500 = -100 MW	1,775
LSE 4	.15 x 4,000 = 600 MW	.15 x -2,000 = -300 MW	.20 x -2,500 = -500 MW	.10 x -1,000 = -100 MW	.15 x -500 = -75 MW	1,575
Total	4,000	-2,000	-2,500	-1,000	-500	10,000

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Example of Allocated 3-hour net load ramp: Morning Ramp

ISO flexible capacity needs assessment	
Δ load	8,000
Δ wind	-2,000
Δ solar PV	2,500
Δ solar thermal	1,000
Δ DG output	500
Total flexible capacity need	6,000

	LSE 1	LSE 2	LSE 3	LSE 4
Percent of total wind contracted	40%	20%	25%	15%
Percent of total Solar PV contracted	30%	35%	15%	20%
Percent of total Solar Thermal contracted	70%	20%	0%	10%
Peak Load Ratio Share	35%	30%	20%	15%

LSE	Load contribution	Wind contribution	Solar PV contribution	Solar Thermal contribution	DG contribution	Total contribution
LSE 1	.35 x 4,000 = **1,400 MW**	.40 x -2,000 = **-800 MW**	.30 x 2,500 = **750 MW**	.70 x 1,000 = **700 MW**	.35 x 500 = **175 MW**	**3,825**
LSE 2	.30 x 4,000 = **1,200 MW**	.20 x -2,000 = **-400 MW**	.35 x 2,500 = **875 MW**	.20 x 1,000 = **200 MW**	.30 x 500 = **150 MW**	**2,825**
LSE 3	.20 x 4,000 = **800 MW**	.25 x -2,000 = **-500 MW**	.15 x 2,500 = **375 MW**	.00 x 1,000 = **0 MW**	.20 x 500 = **100 MW**	**1,775**
LSE 4	.15 x 4,000 = **600 MW**	.15 x -2,000 = **-300 MW**	.20 x 2,500 = **500 MW**	.10 x -1,000 = **100 MW**	.15 x -500 = **75 MW**	**1,575**
Total	4,000	-2,000	2,500	1,000	500	6,000

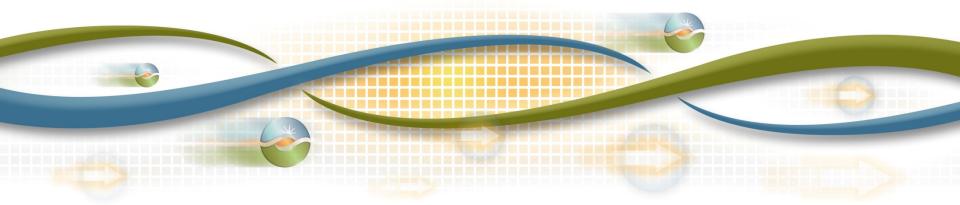California ISO
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The ISO may consider other allocation options

- Allocate based on LSE resource portfolio
  - Reduces flexible capacity requirements for LSEs that minimize total within-day variability, may also provide signals for future RPS development
  - Requires additional data disaggregation and detail, may not result in significantly different allocation
- Allocate based on a single measurement
  - Allocation calculation significantly simplified
  - There may not be a single measurement that equitably allocate requirements
- Select a different allocation factors
  - Load factors or average load instead of peak load ratio share
  - Alternatives to percent of contracted capacity

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Flexible Capacity Must-Offer Obligation (Availability Requirements)

The ISO is considering bid validation rules

- Must determine how bid validation rules would apply
- Example 1: A 150 MW RA resource, 50 MW of flexible capacity. Submit self-schedule for 125 MW and an economic bid for 25 MW

    - Should the ISO reject both the self-schedule and economic bid?

- Example 2: A 150 MW, 100 MW of RA, 25 MW flexible capacity. Submit a self-schedule for 80 MW and an economic bid for 20 MW
- Should the ISO
    - Reject the both the self-schedule and economic bid
    - Reject the economic bid only because it does not comply with the flexible capacity availability requirements, or
    - Reject neither bid, but automatically generate an economic bid for an additional 5 MW

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Most flexible capacity will be required to submit economic bids into the day-ahead and real-time markets

- Availability requirements (or must-offer obligation) will:
  - Require submit economic energy bids day-ahead and real-time markets from 5:00 AM through 10:00 PM
  - Will also be applied to use-limited resources
    - The majority of use-limitations can be managed, through constraints modeled in the ISO market or appropriate default energy bids or start-up costs that reflect these constraints
- Flexible Capacity resources would still be subject to standard RA must-offer obligation from 10:00 PM through 5:00 AM

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Daily use limits are already respected by the ISO markets

- ISO markets already ensures resources daily operational limits are respected
  - Will not dispatch a resource with a maximum run-time of six hours beyond that time
  - Will not look to start a resource twice in a day if it is limited to a single start
- Consistent with the treatment of hydro resources
  - Must demonstrate the capability of producing a six hour energy equivalent and submit economic bids from 5:00 AM through 10:00 PM

Annual run limitations can be managed through negotiated default energy bids

- ISO allows a resource to establish a default energy bid that reflects the resources opportunity cost of for run resources

  - reflects potential earnings in the hours with the highest prices

- Allows the SC comply with the flexible capacity must-offer obligation

  - The ISO markets would dispatch the hours with the greatest need as reflected in the LMP

- Can be applied to resources with annual energy or environmental resources

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The ISO may develop a methodology for including opportunity cost into start-up cost for start limited resources

- Similar to the method used for addressing run limitations
    - Assess and determine the opportunity cost of starting a resource
    - The opportunity cost of limited starts per year can be incorporated into resource start-up costs used by the ISO market
    - The resource would then be able to account for this opportunity cost in its registered start-up cost

There are two potential options for managing the flexible capacity must offer obligation for long-start resources

- Impose a start time cap for flexible capacity resources
  - If a resource cannot within a specified time, then it is not eligible to provide flexible capacity
- Consider a resource's availability requirement fulfilled if it not scheduled in the IFM
  - If the resource is not scheduled in the IFM, then it has fulfilled its must-offer obligation and need not bid into the real-time market
- ISO proposes a must-offer obligation applies until the ISO's dispatch instructions cannot place the resource at Pmin
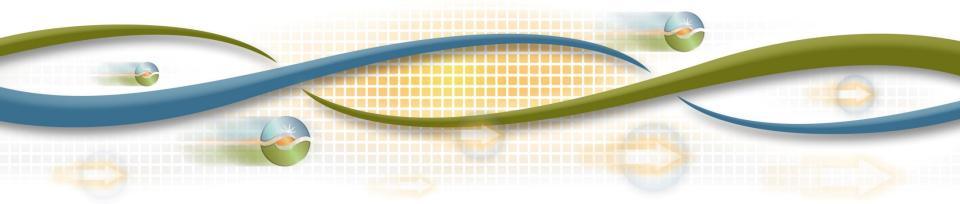
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Demand response resources may have use-limitations that require additional tools to manage

- Participating load and Proxy Demand Resources may be use-limited based
  - On the hours in which they can be called
    - Cannot be called before or after a given time
  - Quantity they can provide in each hour
    - Able to drop 5 MW when the underlying demand is operating at baseload but 10 MW when the underlying demand has increased
  - Other resource specific limitations
- Requires additional consideration to allow the ISO manage use-limitations
- Reliability Demand Response Resources is best suited for emergency dispatch rather than meeting day-to-day flexibility needs

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Proposed Flexible Capacity Backstop Procurement Authority

New backstop procurement authority to address deficiencies in an LSE's flexible capacity requirement

- ISO proposes backstop procurement authority that allows for backstop designations when:

  – An LSE has insufficient flexible capacity in either its annual or monthly Resource Adequacy Plan and

  – There is an overall net deficiency in meeting the <u>total</u> annual or monthly flexibility requirements

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Backstop procurement compensation and cost allocation will mirror the Capacity Procurement Mechanism

- Compensation will be at the existing CPM rate
  - Any incremental costs from economic bidding requirement should be included in energy bids
- Costs of backstop procurement will be allocated to all deficient LSEs

Next Steps

- Comments on straw proposal
  - Comments Template posted June 20, 2013
  - Due June 26, 2013
  - Submit comments to fcp@caiso.com

- Board of Governors
  - December 2013