California ISO
Shaping a Renewed Future

Reliability Services

Working group meeting

April 23, 2014

Karl Meeusen - Market Design and Regulatory Policy Lead
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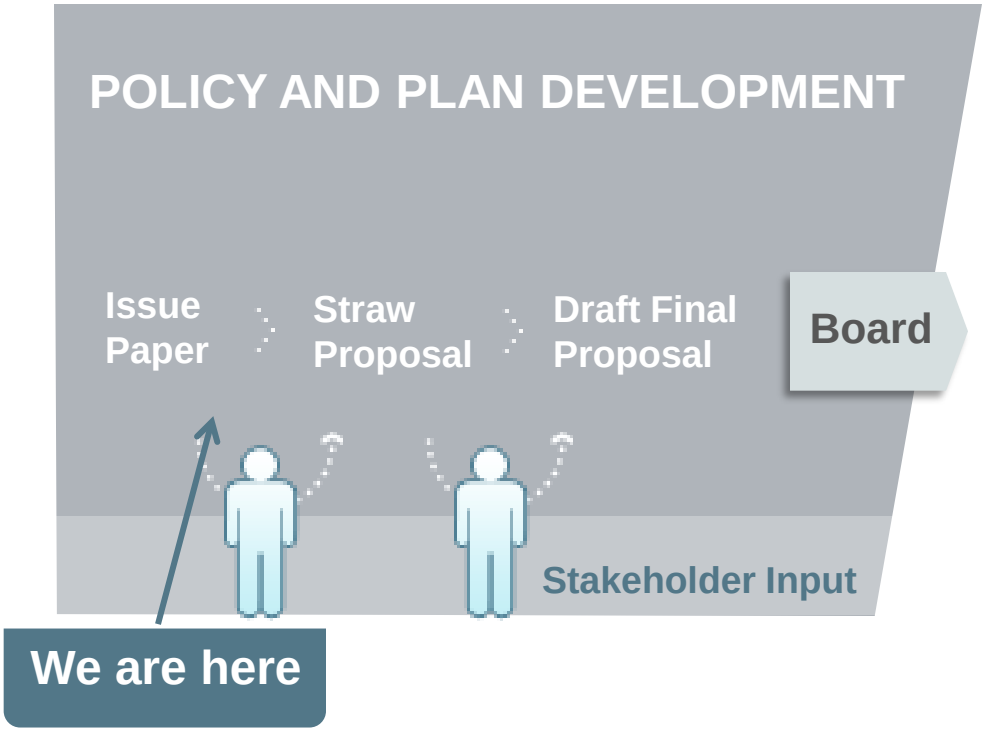
Stakeholder Meeting – Agenda – 1/23/14

Time	Topic	Presenter
10:00 – 10:10	Introduction	Tom Cuccia
10:10 – 10:20	Overview and Update on Reliability Service Initiative Scope and Timing	Carrie Bentley
10:20 – 10:45	Opportunity Cost Bidding of Start-up and Minimum Load Costs	Karl Meeusen
10:45 – 11:15	Ensuring Comparable Must-Offer obligation across resource types	
11:15 – 11:45	Establishing default qualifying capacity criteria for NGR and distributed energy resources	
11:45 – 12:00	Clarifying the process and criteria for determining use-limited status	
12:00 – 1:00	Lunch	
1:00 – 2:30	Availability Incentive Mechanism	Carrie Bentley
2:30 – 2:45	Break	
2:45 – 3:40	Availability Incentive Mechanism (cont.)	Carrie Bentley
3:40 – 3:50	Flexible capacity from interties and non-NGR energy storage resources	Karl Meeusen
3:50 – 4:00	Next steps	Tom Cuccia

ISO Policy Initiative Stakeholder Process



Update on RSI scope and timing

- CPUC has prioritized consideration of a multi-year RA requirement- first CPUC workshop is May 2nd
- A flexible, multi-year forward RA requirement is vital to mitigate the risk of disorderly retirement and reliably integrate renewable resources up to the 33% and beyond in the coming decade
- The ISO will defer the development of a multi-year backstop and voluntary forward auction market design until the CPUC's multi-year RA process is near completion
- The ISO will move forward with developing a market-based price to replace the current CPM upon expiration in 2016

Reliability Services scope

- Phase 1:
  - Create durable CPM pricing mechanism for near term backstop capacity procurement
  - Standardize eligibility criteria and must-offer requirements for local, flexible, and system RA resources as needed
  - Enhance incentive mechanisms for RA resource energy market participation
- Phase 2:
  - Update the CPM to include multi-year backstop procurement authority
  - Develop voluntary residual forward capacity auction for multi-years forward
  - Revaluate need for risk-of-retirement backstop procurement authority

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Standardizing Must-Offer Obligations and Use-Limited Resource Eligibility Criteria

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Overview

- Opportunity cost bidding of start-up and minimum load costs for use-limited dispatchable resources
- Ensure comparable and consistent must-offer obligation across resource types
  - Generic Capacity
  - Flexible Capacity
- Clarify treatment of Use-Limited Resources
  - Clarify the process and criteria that ensure reliable system operations

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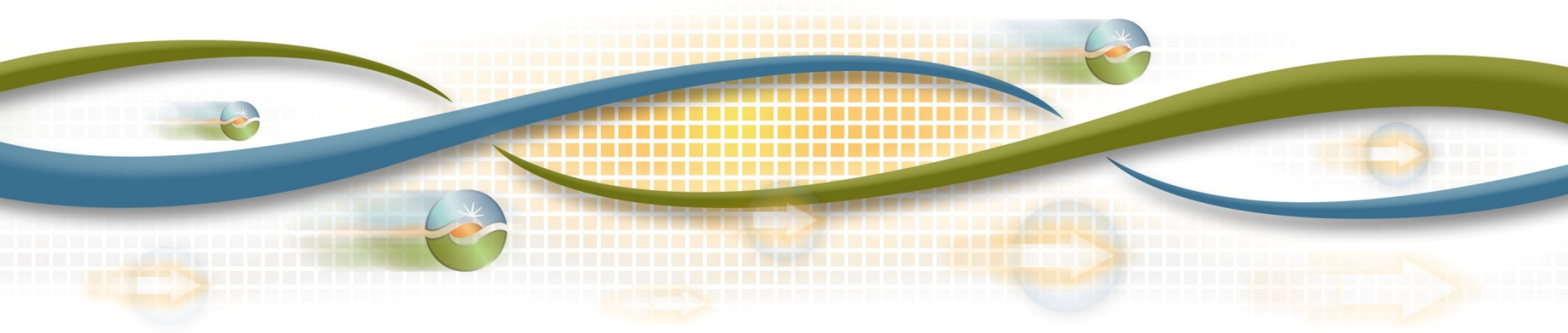
Opportunity cost bidding of start-up and minimum-load costs for flexible resource adequacy use-limited dispatchable gas-fired resources



Description: Use-limited, dispatchable, gas-fired resources

- Resources with monthly or annual physical limitations for environmental reasons
  - Applies to all use-limited, dispatchable, gas-fired resources, not just RA or Flexible resources
- Have a verifiable use-plan filed with the ISO
- Monthly and annual limitations can be translated into daily limitations in the master file
  - Start, run-time, energy limits
  - Cannot be more restrictive than monthly or annual limit

Allowing use-limited, dispatchable, gas-fired resources to bid opportunity cost provides an additional tool to manage potential risks

- Allow resources to incorporate an opportunity cost into their start-up, minimum load, and energy bid
  - Allow daily bidding of start-up and minimum load costs up to this amount
  - Allow a monthly registered cost of up to 150% of this amount
- An opportunity cost will be calculated each month
  - Opportunity costs will be updated, at a minimum, monthly
  - More frequent updates may occur if gas prices or energy prices vary significantly from estimated prices
- Goal is to optimize resource availability over the month or year

Opportunity cost methodology: Optimization model

- The ISO will develop a unit commitment and dispatch optimization model
  - Respect Master File and use-limitation constraints
  - Maximize gross margin (total revenues – total costs)
- Optimally commit and dispatch each resource against forecasted real time energy prices over a month
- Annual limitations will need to be converted into monthly
  - SCs provide the ISO monthly limits only for the purpose of calculating the opportunity cost
  - Do not have to be the same limit each month, but the sum of all monthly limits has to equal the annual

Opportunity cost methodology: Optimization model

- Start and run hour limitations will require the model to be run twice for each limitation
  - Once with all starts or run hours and the second with one less start or run hour
- Maximum Starts
  - The opportunity cost will be the difference between the maximized gross margin from having all starts and having one less start
  - Will be added to the resource's start-up cost for the corresponding month

Opportunity cost methodology: Optimization model

- Maximum run hours
  - The opportunity cost will be the difference between the maximized gross margin from having all run hours and having one less run hour
  - Will be added to the resource's minimum load cost for the corresponding time period
- Generation
  - The opportunity cost will be the shadow price on the generation constraint
  - Will be included in the resource's default energy bid curve as the opportunity cost portion

Estimating real time prices: Overview

- Estimated real time energy prices will be used in the model
  - Resources are dispatched and settled on real time energy prices
  - MOO requires real time economic bids
- A set of estimated prices will be generated for each pricing node associated with a dispatchable gas-fired use-limited resource
- For computational purposes, 5 minute estimated real time prices will be aggregated up to 15 minute prices

Estimating real time prices: Preliminary comparisons

- ISO estimated April and September 2013 LMPs
  - Two pricing nodes, one in the north one in the south
  - Two different seasons
- Estimated 5 minute real time LMPs and then aggregated up to 15 minute prices
- Compared percentage of estimated LMPs to percentage of actual LMPs within a given price range
- Initial proof of concept indicates the model can reasonably estimate start-up and minimum load opportunity costs

Ensuring Comparable Must-Offer Obligation across resource types

Guiding Design Principles

- Resources able to meet the requirements of standardized products can be used interchangeably with other resources providing the same product

- Standardized products designed to address a specific ISO need

The ISO is reviewing all existing must-offer obligations and default qualifying capacity criteria

- Reviewing existing must-offer obligations to determine:
  - Are there resource types without a clearly defined must-offer obligation

- Reviewing default qualifying capacity criteria
  - Are there resources types without defined minimum eligibility criteria
    - Non-generator resources
    - Distributed energy resource

Must-offer obligation should be independent of resource's interconnection point within the ISO's BAA

- Supply-side resource adequacy resources of a given resource type should be subject to the same must-offer obligation regardless of the point of interconnection:
  - Grid level or
  - Distribution level

Most resources' system/local must-offer obligations are well defined and the ISO is not proposing changes at this time

- The system/local must-offer obligation for following resource types will not be changed
  - Non-Use Limited Generators
    - Includes dynamic schedules and pseudo ties
  - Use-Limited Generators (non-hydro and dispatchable)
  - Hydro, Pumping Load, and Non-Dispatchable Use-Limited Resources
  - Non-Dynamic, Resource-Specific System Resources
- The system/local must-offer obligation for following resource types will be enhanced or developed
  - Proxy Demand Resource
  - Non-generator resources
  - Distributed energy resources

Example: Non-Use Limited Generators System/Local Capacity RA Must-Offer Obligations

- IFM: Self-schedule or economic bid for all energy and economic bid or self-schedule of all certified ancillary services for all RA capacity
- RTM: Self-schedule or economic bid for all energy and economic bid or self-schedule of all certified ancillary services for all RA capacity any remaining RA Capacity from resources scheduled in IFM or RUC and all RA Capacity from Short-Start Units not scheduled in IFM
- Other:
  - Bid insertion applies

System/Local Capacity RA Must-Offer Obligations: Use-Limited Generators (non-hydro and dispatchable)

- IFM: Economic Bids or Self-Schedules for all RA Capacity for all hours unit is capable of operating consistent unit's Use-Plan.
- RTM: Economic Bids or Self-Schedules for any remaining RA Capacity from resources scheduled in IFM or RUC, Energy Bids or Self-Schedules all RA Capacity from Short-Start Units not scheduled in IFM consistent with the use-limitations described in unit's Use-Plan.
- Other
  - No bid insertion
  - Must submit use-plan

The ISO proposes to enhance the system must-offer obligation for proxy demand resources

- IFM: Economic Bids or Self-Schedules for all RA Capacity for all non-holiday weekday during peak hours of the month
- RTM: Economic Bids or Self-Schedules for any remaining RA Capacity from resources scheduled in IFM or RUC Capacity for all non-holiday weekday during peak hours of the month for all resources that require less than one day notice
- Other:
  - Must be available for at least 5 days per month
  - Peak hours defined:
    - April – October HE 14:00-18:00
    - All other months HE 17:00-21:00

Non-Generator Resources should have a must-offer obligation comparable to a non-use limited resource

- IFM: Self-schedule or economic bid for all energy and economic bid or self-schedule of all certified ancillary services for all RA capacity
  RTM: Self-schedule or economic bid for all energy and economic bid or self-schedule of all certified ancillary services for all RA capacity
  Economic Bids or Self-Schedules for any remaining RA Capacity from resources scheduled in IFM or RUC
- Other:
  - The ISO will optimize the dispatch of the resource charge and discharge capabilities
  - REM resources must be registered in master file and may only provide regulation to the ISO market, cannot submit commitment costs
  - Bid insertion will apply
    - Must determine methodology to calculate default energy bid
    - Ancillary Services bid at $0

Aggregated distributed energy resources will be defined as use-limited resources

- Aggregates distributed energy resources encompass numerous technologies/resource types
  - Roof top solar
  - Demand response
  - Behind the meter storage
- The availability of the resource is a function of the component parts
- Aggregated distributed energy resources should have a must-offer obligation that mirrors that of a non-dispatchable use-limited resource

The ISO is not proposing any new flexible capacity must offer obligations at this time

- In FRAC-MOO, the ISO committed to re-examaning the flexible capacity categories and must offer obligations starting in Q1 2016

The ISO may consider additional enhancements to bid insertion rules in subsequent phases of this initiative

- Is bid insertion needed for non-use limited resources or could the same result be achieved by another means
- Can/should bid insertion apply when allowed opportunity cost bidding of start-up and minimum load cost

Establishing default qualifying capacity criteria for NGR and distributed energy resources

Non-generator resources must meet certain minimum provision to be eligible for default qualifying capacity calculations

- NGR resources must meet provisions of section 40.4.3 of the ISO tariff
  - Available for qualifying capacity testing
  - Provide any requested performance information
  - Submit bids as required by tariff
  - Be subject to non-performance charges
  - For resources with RA obligation below Pmin, bid in up to Pmin

The ISO must establish default qualifying capacity provisions for non-generator resources*

- Currently no default provisions for non-generator resources section 40.8 of the ISO tariff
- ISO must establish criteria for default provisions that may include:
  - Charge/discharge volume
  - Charge/discharge duration
  - Performance
  - Minimum size requirements
- Qualifying capacity provisions need not connect directly with the EFC provisions developed in FRAC-MOO

*The ISO is addressing deliverability studies for non-generator resources in a separate stakeholder initiative

The ISO is working to develop a methodology for determining how intertie resources can provide flexible capacity

- In the FRAC-MOO stakeholder initiative committed to additional review of the flexible capacity that can be provided from intertie resources
  - "The ISO continues to assess the reliability impact of allowing 15 minute interties to meet flexible capacity needs designed to simultaneously address five minute load-following needs and longer steep ramps. The ISO will provide this assessment in phase one of the recently opened Reliability Services initiative."
- This assessment must determine:
  - Minimum eligibility criteria and
  - Maximum quantity of EFC that that does not have 5-minute dispatchablity that can count while ensuring a single product can simultaneously address five minute load-following needs and longer steep ramps

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Clarifying the Process and Criteria for Determining Use-Limited Status

Definition: Use-Limited Resource

- Use-Limited Resource – A resource that due to design considerations, environmental restrictions on operations, cyclical requirements, such as the need to charge or refill, or other non-economic reasons, is unable to operate continuously on a daily basis, but is able to operate for a minimum set of consecutive Trading Hours each trading day

Use-limited resources must submitting use-plans to the ISO

- Section 40.6.4.2 of the ISO tariff states:
  - The Scheduling Coordinator shall provide for the following Resource Adequacy Compliance Year a proposed annual use plan for each Use-Limited Resource that is a Resource Adequacy Resource

As the quantity of use limited resources on the system increase, it becomes increasingly important to have clear ULR rules and criteria

- There are a growing number of use-limited resources on the ISO system
  - Increased wind and solar
  - More environmental regulations
  - Goals for additional DG, DR, and storage
- The ISO will clarify the process, rules, and criteria for approving use-limited resource applications
  - See section 40.6.4

The ISO tariff does not have defined criteria for determining if a resource qualifies as a use-limited resource

- Section 40.6.4.1 requires an application that includes
  1) a detailed explanation of why the resource is subject to operating limitations;
  2) historical data to show attainable MWhs for each 24-hour period during the preceding year, including, as applicable, environmental restrictions for NOx, SOx, or other factors; and
  3) further data or other information as may be requested by the CAISO to understand the operating characteristics of the unit.
- Section 40.6.4.3.2 states:
  - The CAISO will retain discretion as to whether a particular resource should be considered a Non-Dispatchable Use-Limited Resource, and this decision will be made in accordance with the provisions of Section 40.6.4.1.

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Availability Incentive Mechanism

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Availability Incentive Mechanism in scope items

"Enhance incentive mechanisms for RA resource energy market participation"

1. Create flexible incentive mechanism and price
2. Reevaluate system incentive price due to CPM expiration
3. Standardize resources' exposure to incentive mechanism
4. Create an availability price that accounts for market conditions

AVAILABILITY STANDARDS PROGRAM: CURRENT DESIGN REVIEW

Current incentive mechanism (SCP)

- Resource availability is measured based on forced outages during peak hours
  - *April - October*: 2:00pm – 6:00pm
  - *January - March, November, December*: 5:00pm – 9:00pm
- Availability compared to historic availability percentages during peak hours
  - Resources more than 2.5% above/below historic availability metric receive availability credit/charge
- Availability charge tied to CPM rate
- Availability payments are funded only by charges

Why do we have availability standards program?

Reliability

- Planning reserve margin accounts for expected forced outage rates
- If more than this percentage go on outage at once, could cause reliability concern
- Increases incentive for RA resources to be available where and when needed

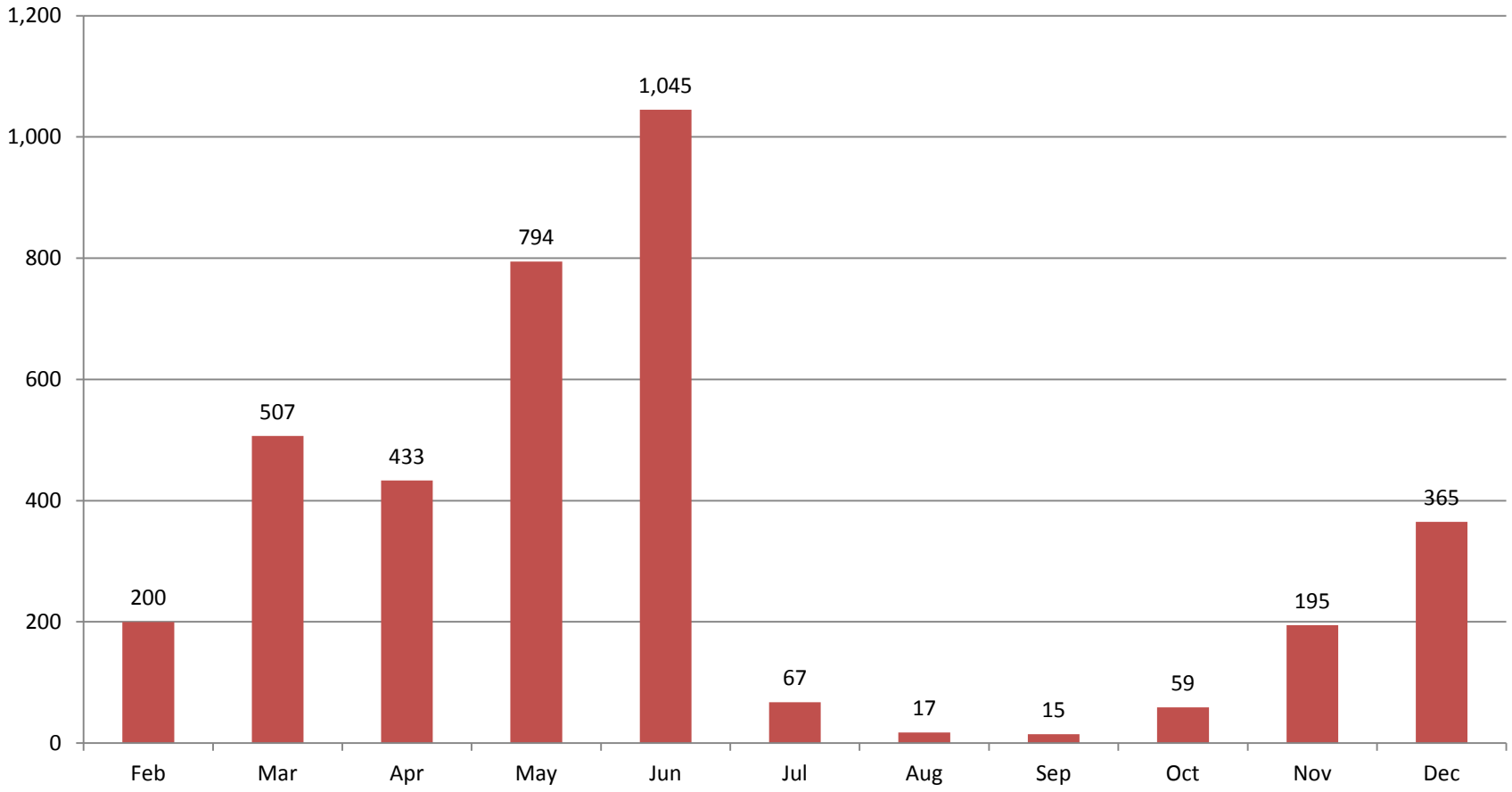
Reduces potential gaming

- Decreases ability of resources to profit from physical withholding

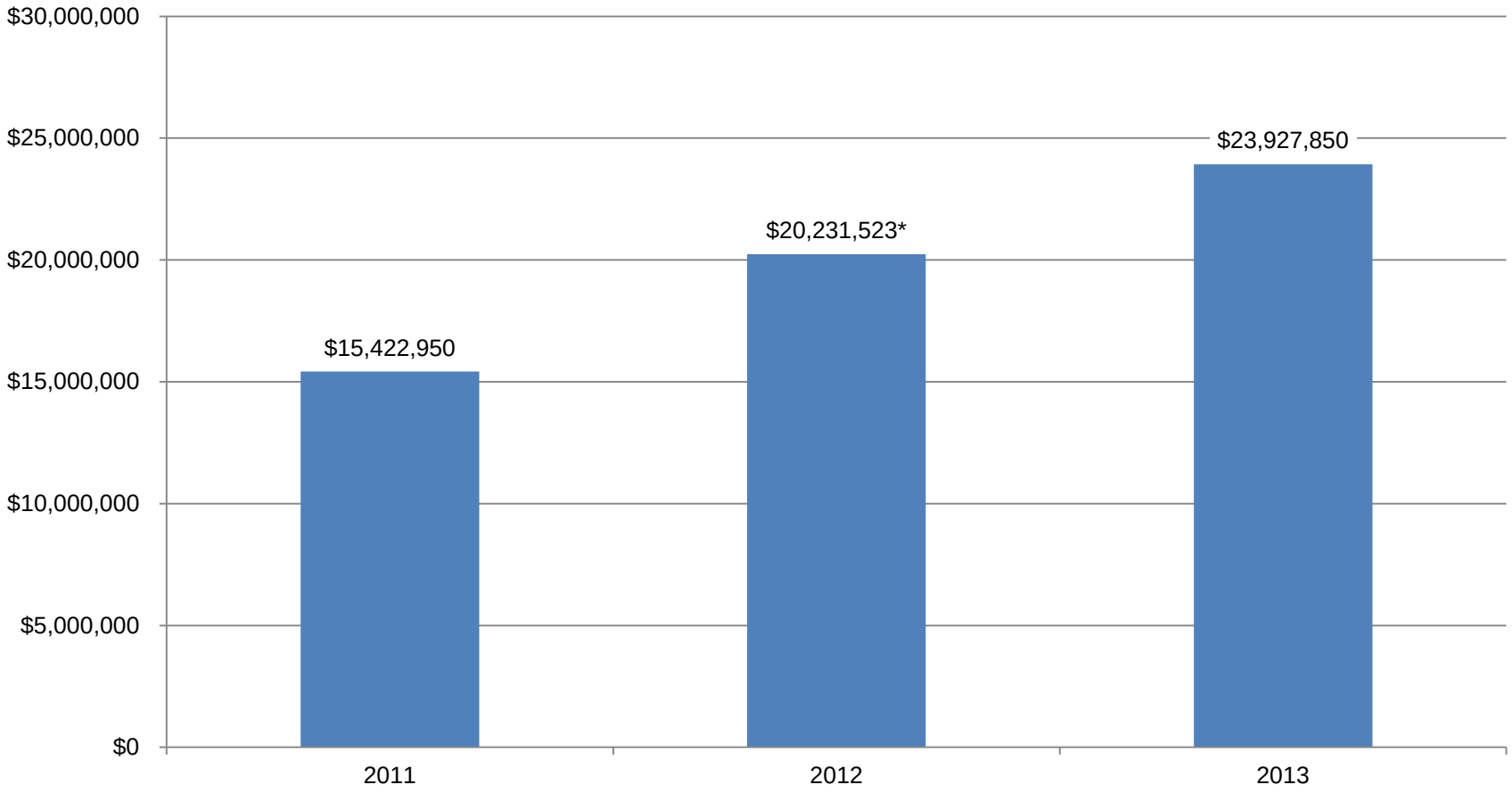
Standardization

- An availability metric in the ISO tariff rather than in each contracts increases standardization between RA resources

Average daily substitute MWs by month in 2013



Availability funds (charges/payments) 2011 - 2013

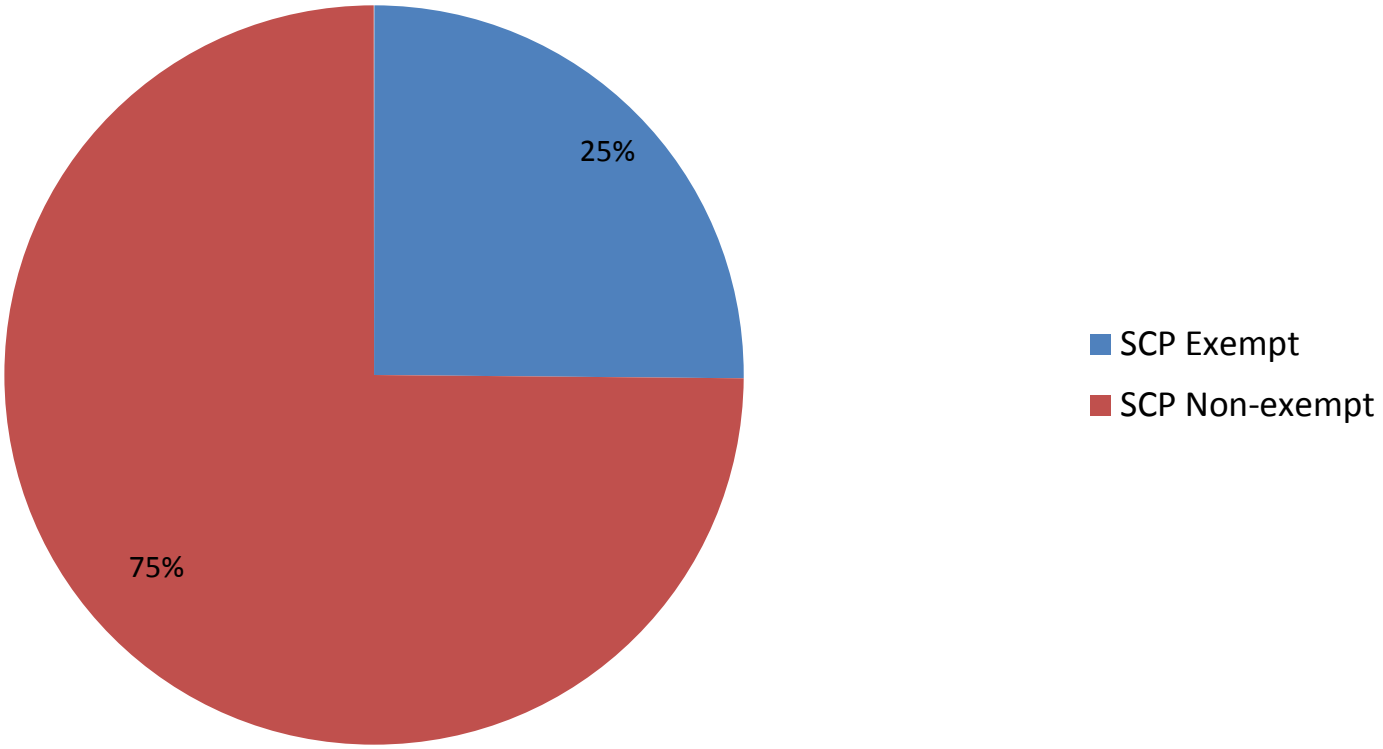


*Outliers removed

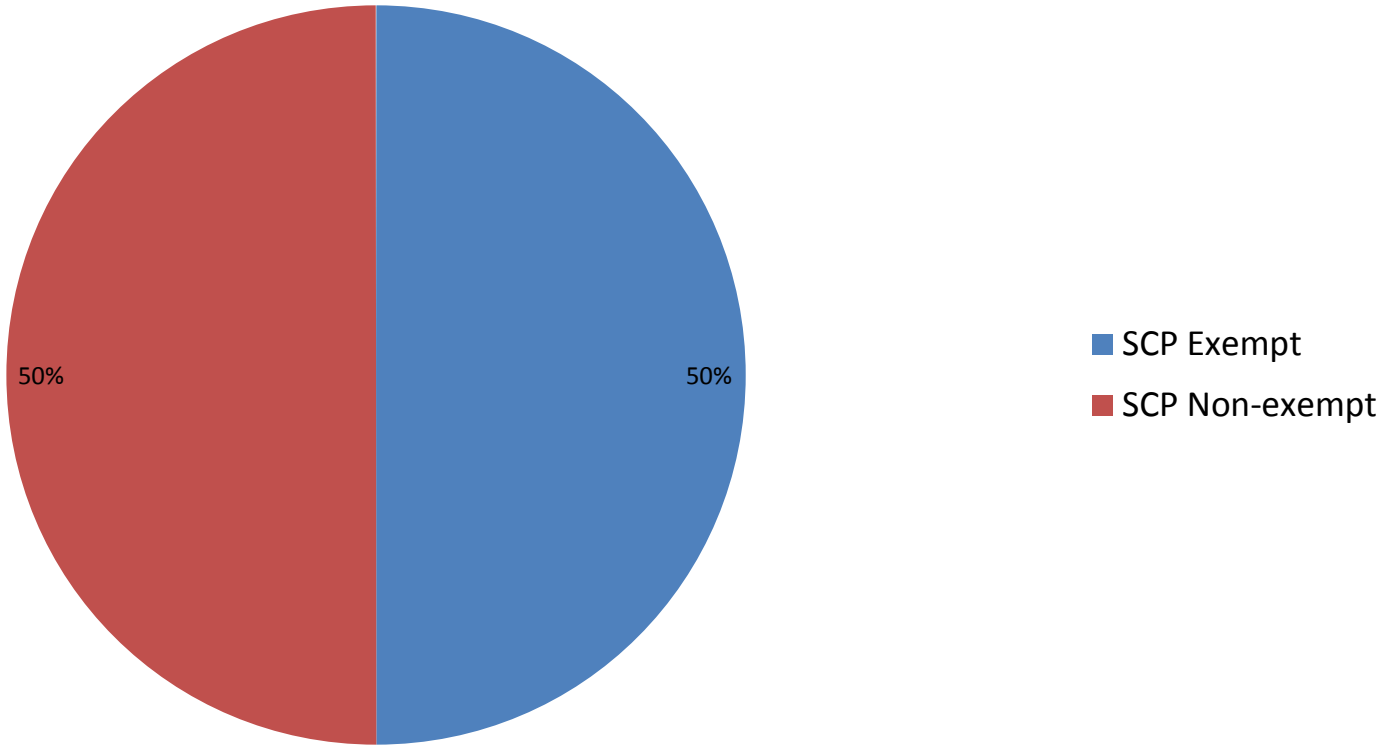
Resources exempt from current Availability Standards program (tariff 40.9.2)

- Pmax < 1.0 MW
- Capacity under a resource specific power supply contract that existed and was approved prior to June 28, 2009 and was not renegotiated after this point
- Demand response
- Contracts for Energy from non-specified resources
- Modified Reserve Sharing LSE and Load following MSS resources
- Most Qualified Facilities (QFs)

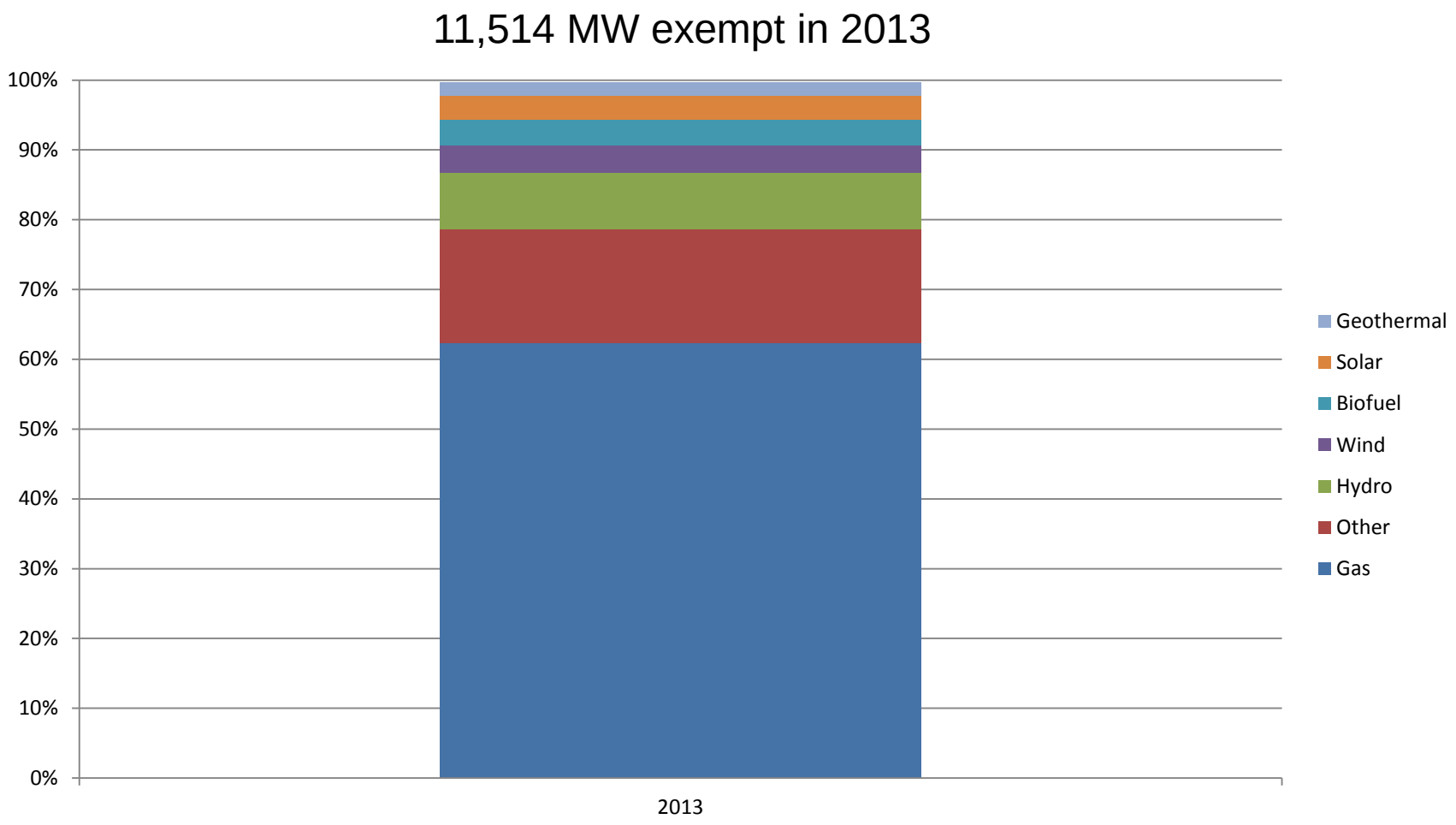
Percent of resource adequacy August 2013 *capacity* (MW) by exemption from Availability Standards program



Percent of resource adequacy August 2013 *resources* (#) by exemption from Availability Standards program



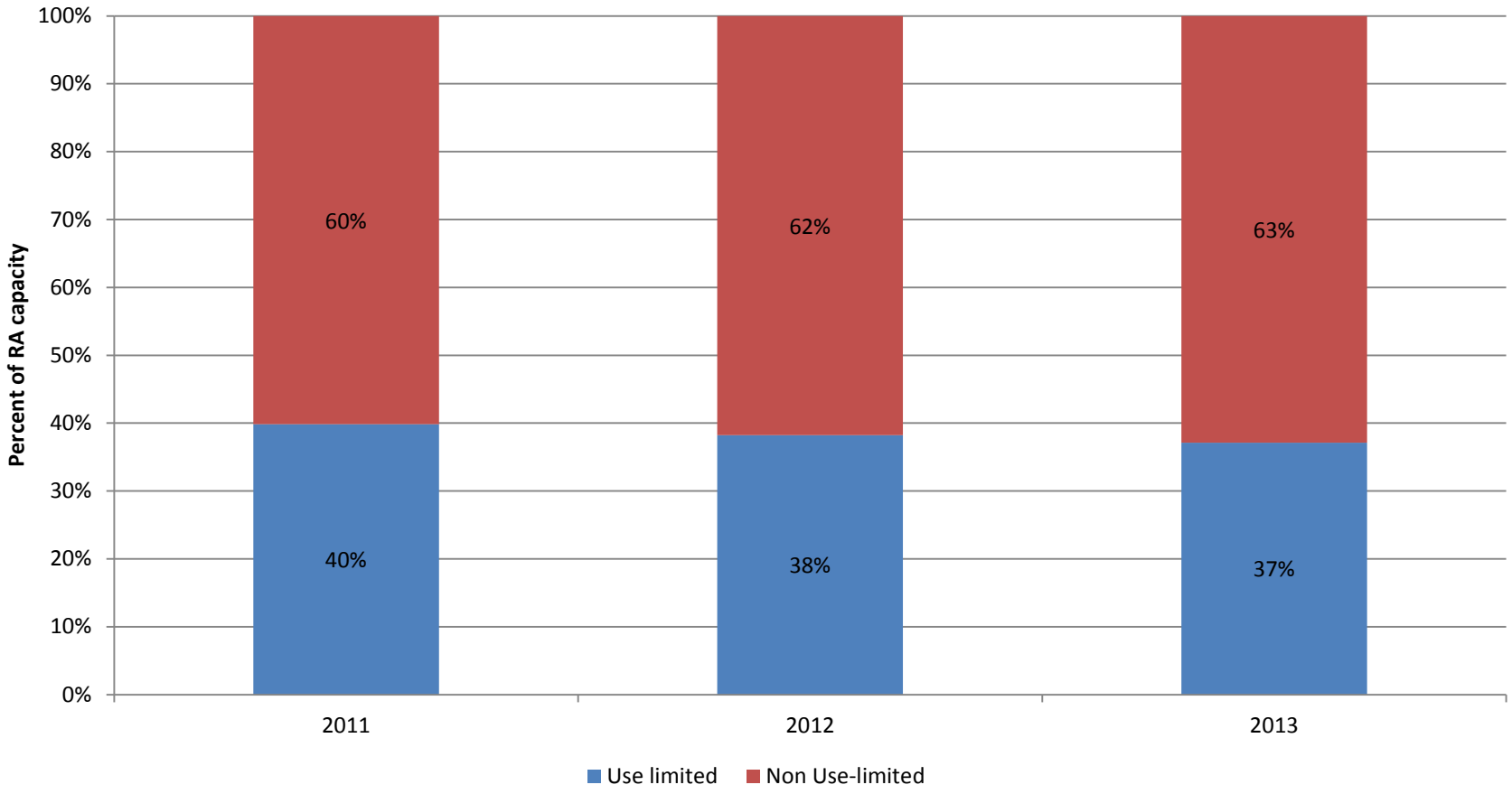
Percentage of exempt capacity by fuel type in 2013



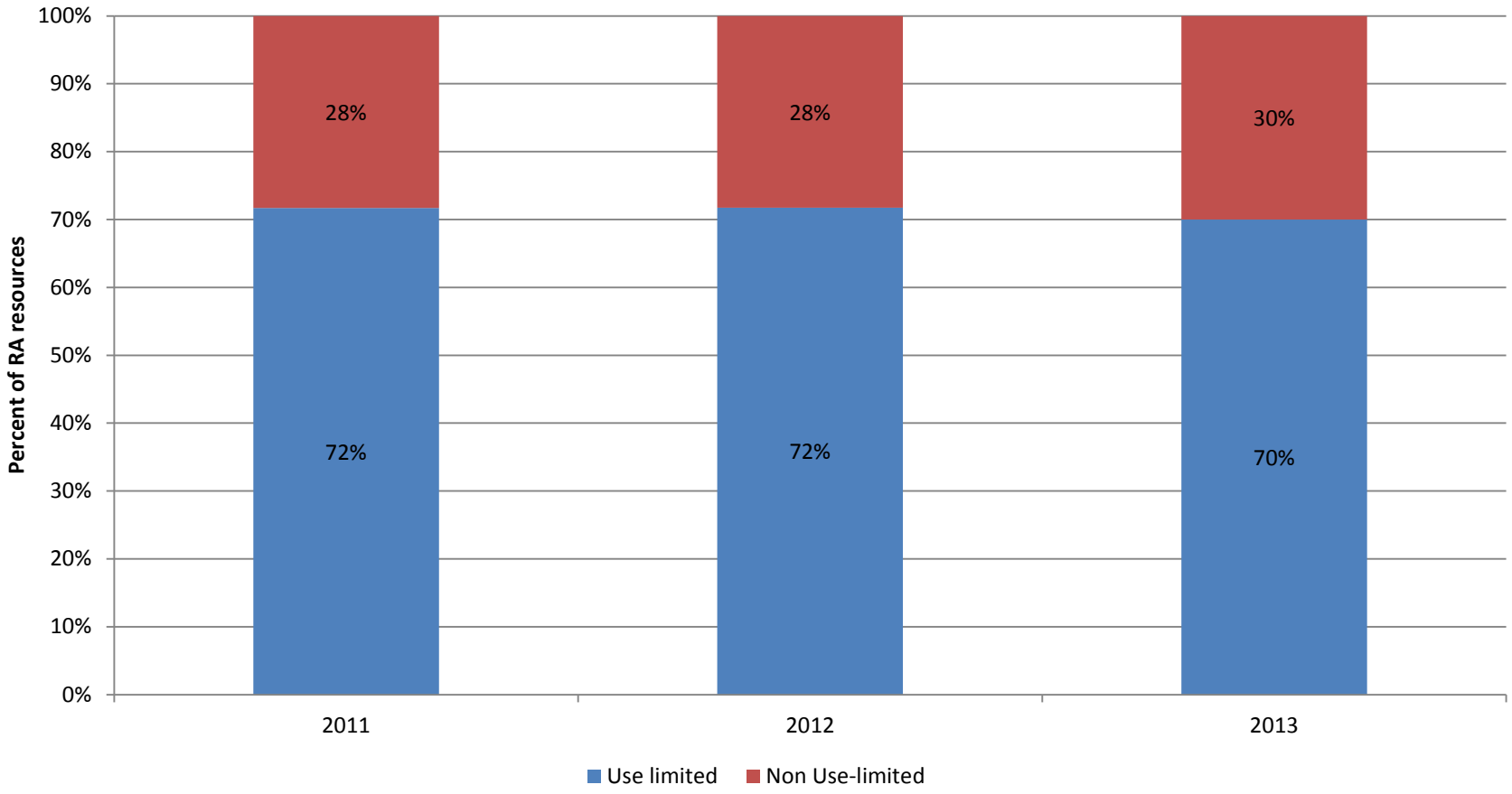
Use-limited resources

- Use-limited resources are not exempt from the current SCP availability incentive; however:
  - There is no bid insertion for use-limited resources
  - Use-limited resources only have to bid when available according to the tariff
  - They do not have to go on forced outage during typical periods of unavailability (e.g. solar does not take a forced outage before sunrise)
  - Forced outages vs. typical unavailability is difficult to verify
- Therefore, a forced outage metric for use-limited resources is not equivalent to how the metric works for non-use-limited resources

Resource adequacy capacity (MW) in August by use limitation status



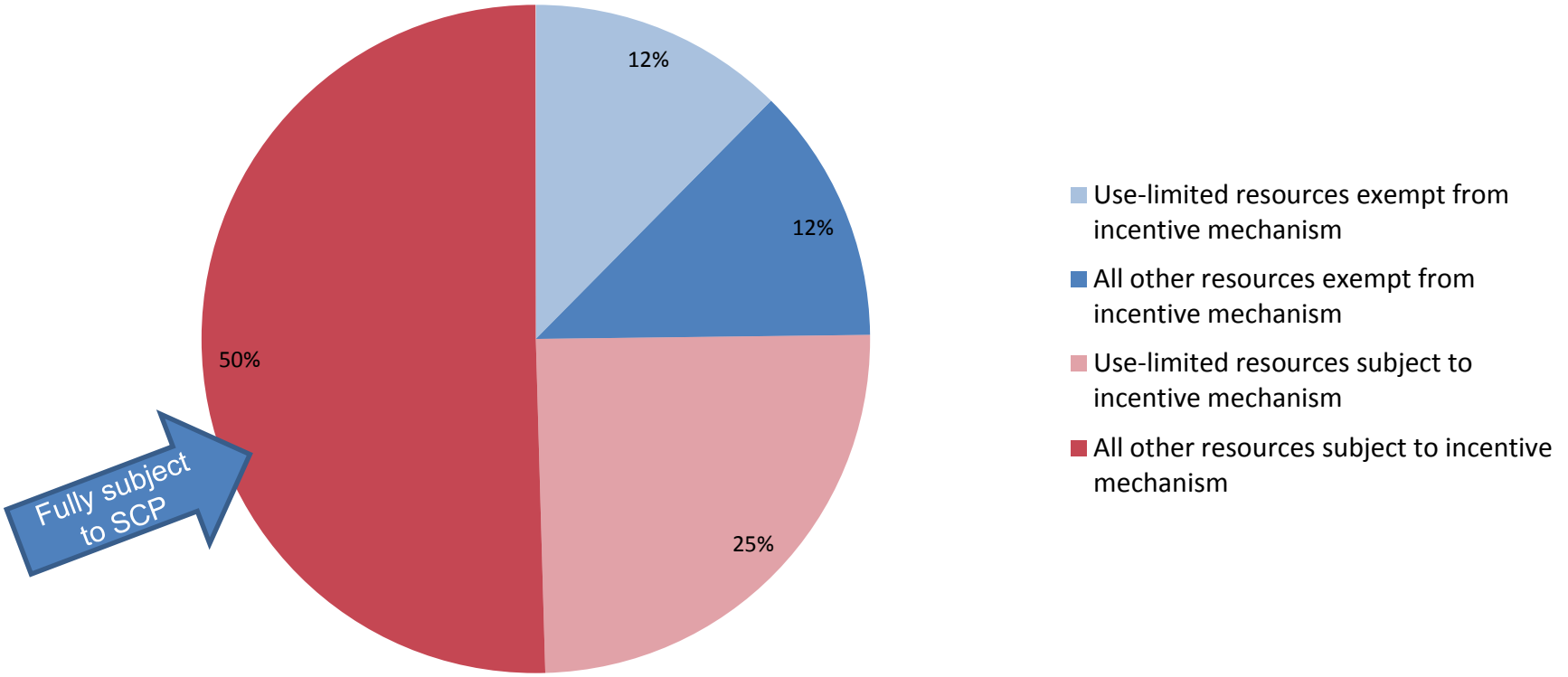
Resource adequacy resources (#) in August by use limitation status



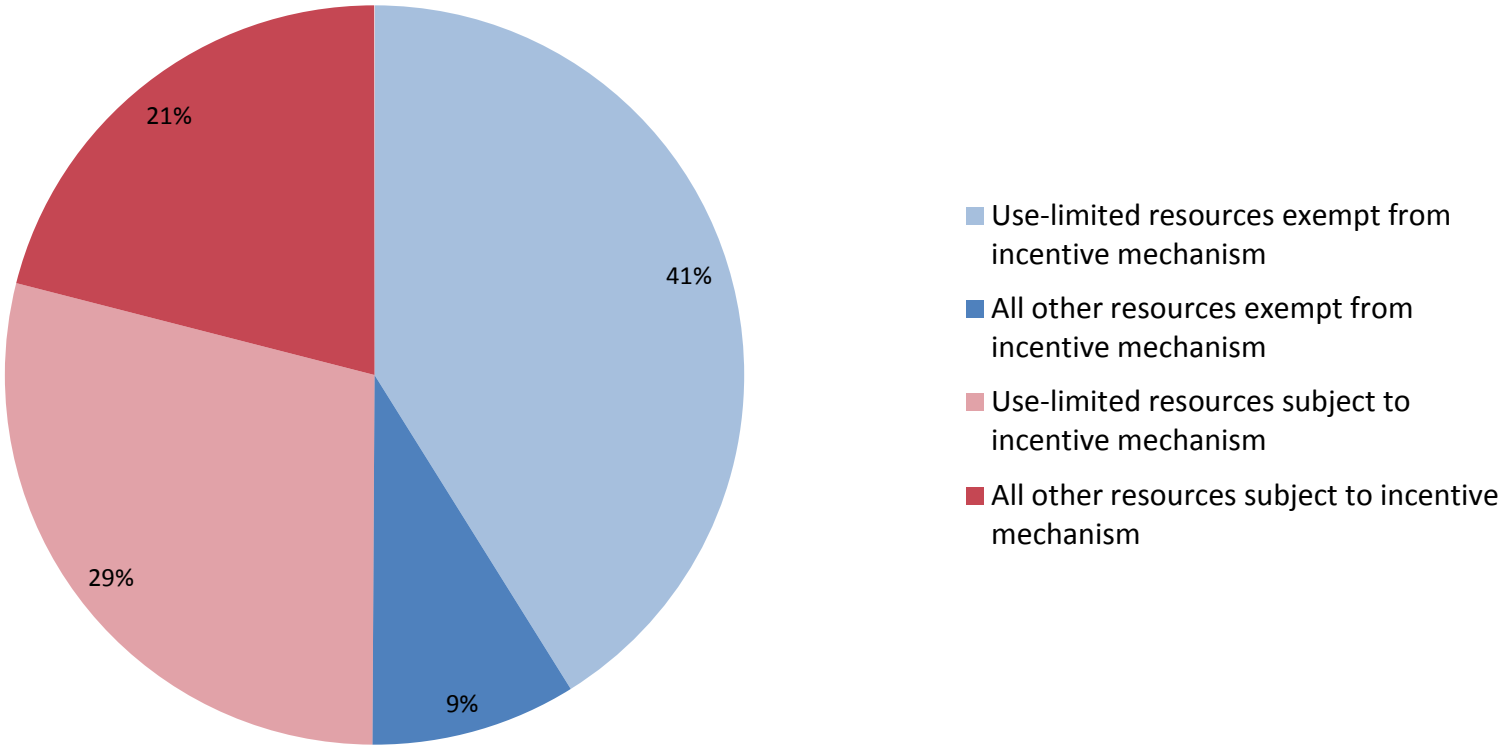
Combining use limitations and exemptions

- Some exempt resources also have use limitations
- The following pie charts break out exempt and non-exempt resources by use limitations
- The SCP only works as intended on non-exempt, non-use limited resources
- This is indicated by the dark red on the following pie charts

Percent of Resource Adequacy *capacity* (MW) subject to incentive mechanism by use-limitation class



Percent of Resource Adequacy *resources* (#) subject to incentive mechanism by use-limitation class



AVAILABILITY STANDARDS PROGRAM: FUTURE DESIGN PROPOSAL

Principles for availability incentive design

- The energy market should be the primary incentive mechanism for RA resources to bid when required
- The availability incentive mechanism should protect the ISO to the extent possible from potential deviant behavior and physical withholding
- The mechanism should redistribute RA capacity payments in the circumstance that certain resources are significantly under-preforming and other resources are making up the difference
- The mechanism should provide incentives to invest in proper maintenance of resource
- The mechanism should apply to all resource types

FUTURE DESIGN OBJECTIVES

Availability Incentive Mechanism objectives

- Incent RA capacity to be available during periods when it was committed to be available
- Standardize resources' exposure to availability incentive mechanism
- Create availability incentive mechanism price that accounts for market conditions
- Align availability incentive mechanism design with substitution and replacement rules

Design summary

- Move from a forced outage metric to a bid based metric where a resource's availability is determined by the system and flexible must-offer requirements and hours a resource is committed as RA capacity
- Assess availability payments and charges against a fixed percentage rather than a moving fleet average
- Move from a monthly average to an aggregate hourly evaluation over a month
- Create a single price for flexible and system availability, but assess flexible and system availability separately

Availability Incentive Mechanism Proposal

Availability incentive mechanism objective summary

- Incent RA capacity to be available during periods when it was committed to be available
- Standardize resources' exposure to incentive mechanism
- Create availability incentive mechanism price that accounts for market conditions
- Align availability incentive mechanism design and substitution and replacement rules

Objective: Incent RA capacity to be available during periods when it committed to be available

- Foundation of availability incentive mechanism:
  - Was the RA capacity supposed to be available?
  - Was it actually available?
- Move from forced outage metric to bidding evaluation metric:
  - Allows for easier standardization of rules for use-limited resources
  - Allows for the different must-offer requirements between flexible and system RA resources

Bidding evaluation metric – system/local resources

- Only evaluate hours resource is committed as RA capacity
  - Self-schedule or economic bids
- Most RA resources have a 24 must-offer requirement
- Will respect current rules in tariff on RA resource bidding
  - All RA resources must bid into the DA market
  - If not awarded a dispatch or RUC'ed, only short-start resources have an obligation to bid into the RT market
- Use-limited resources discussed on a later slide

Bidding evaluation hours – system/local resources

- System resources without limitations will be evaluated 24 hours a day or over subset of hours contract hours
  - The intent is to evaluate resources only during hours they are contracted as RA resources
- The ISO currently does not evaluate whether an RA resource is available outside the peak and relies on bid insertion for conventional generation
- The ISO relies on the CPUC MCC buckets to ensure both daily and monthly RA is sufficient

Bidding evaluation metric – flexible resources

- Only evaluate category bidding requirement hours
  - Economic bids
- Categories were developed in FRAC MOO
- Will respect rules in tariff on RA resource bidding
  - All flexible RA resources must bid into the DA market
  - If not awarded a dispatch or committed in RUC, only short-start resources have an obligation to bid into the RT market
- Flexible RA resources must rebid into RT market any DA energy awards and any additional energy that must be bid in under proposed tariff rules

Bidding evaluation hours – flexible resources

- Flexible resources will be evaluated by category
- Category 1 will be evaluated for 17 hours

- Category 2 will be evaluated for 5 hours based on seasonal assessment

- Category 3 will be evaluated for 5 hours based on seasonal assessment and be exempt after req. is met

Objective: Standardize resources' exposure to incentive mechanism

- Two main groups receive different treatment under today's availability incentive mechanism:
- Use-limited resources
  - Resources with significant daily limitations
  - Monthly limitations
- Exempt resources
  - Resource exempt under tariff

Use limited resources

- Daily limitations
  - MWh or other limitations, these can be accounted for in the optimization and should not lead to the need for special treatment under availability incentive mechanism
- Monthly limitations
  - Optimization cannot account for monthly limitations at this time
  - Will allow resources to include opportunity cost in their minimum load and start up (resources can already include OC in default energy bid)
  - Some use-limited resources may be exempt, this will be determined through a review of use plans

Availability incentive mechanism exempt resources

Current design

- Pmax < 1.0 MW
- Grandfathered resources
- Demand response
- Contracts for Energy from non-specified resources
- Modified Reserve Sharing LSE and Load following MSS resources
- Most Qualified Facilities (QFs)

Future design

- Pmax < 1.0 MW
- ~~Grandfathered resources~~
- ~~Demand response~~
- Contracts for Energy from non-specified resources
- Modified Reserve Sharing LSE and Load following MSS resources
- Most Qualified Facilities (QFs)

Objective: Create availability incentive mechanism price that accounts for market conditions

- Two main components of allowing the price to account for market conditions
  - Availability standard percentage and bandwidth
  - Price

Availability standard percentage

- ISO currently calculates monthly availability standard using the historical forced outages of RA resources over the range of assessment hours for each month over the prior three years
- RA resources are therefore assessed against an average and not the forced outage rate in the planning reserve margin
- Propose to continue current mechanism construct of comparing resources to a percentage with a bandwidth

Historical average based standard in a monthly RA construct

- The monthly RA construct implies that resource availability in non-summer months is equally as important to reliability as resource availability in summer months
- The system requirement in non-summer months is already less than summer months so do not need to reflect this in availability standard
- In months with relatively high availability, using a varying monthly standard and a fixed annual price rewards resource availability less and penalizes non-availability more relative to a static availability standard

Historical average bounds and fixed price implications

- December, January, and February have the highest historical availability
- Resource availability is not rewarded in these months
- Resource non-availability is penalized more relative to months with less availability on average

	Average historical lower bound	Average historical upper bound
Jan	***95.1%***	***100.0%***
Feb	***95.1%***	***100.0%***
Mar	93.9%	98.9%
Apr	93.1%	98.1%
May	92.3%	97.3%
Jun	94.1%	99.1%
Jul	93.8%	98.8%
Aug	93.3%	98.3%
Sep	93.3%	98.3%
Oct	94.2%	99.2%
Nov	93.8%	98.8%
Dec	***95.2%***	***100.0%***

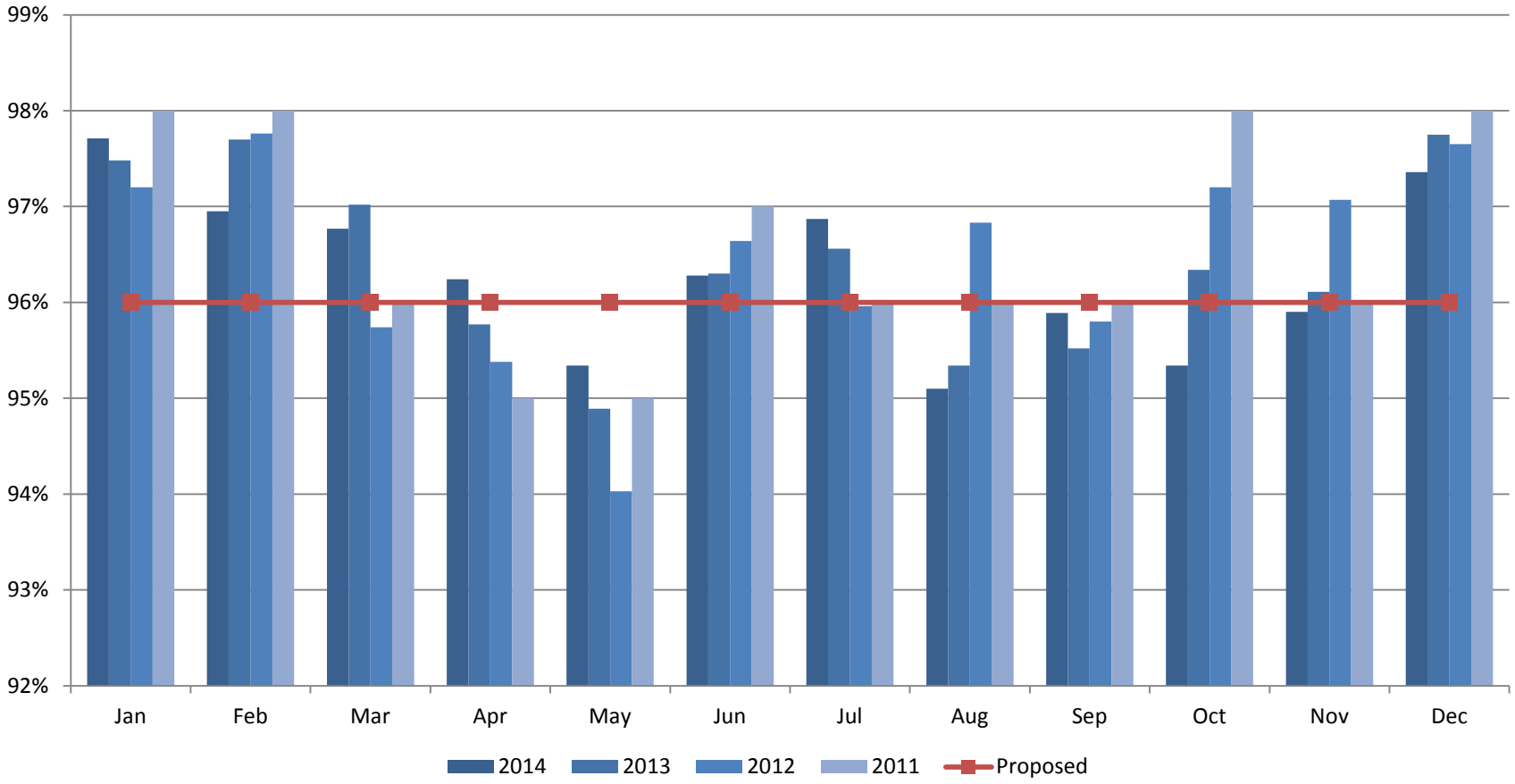
Current and historical availability standards

Trade Month	Availability Standard Percentage				Average
	2014	*2013*	*2012*	*2011*	
Jan	97.7%	97.5%	97.2%	98.0%	**97.6%**
Feb	97.0%	97.7%	97.8%	98.0%	**97.6%**
Mar	96.8%	97.0%	95.7%	96.0%	**96.4%**
Apr	96.2%	95.8%	95.4%	95.0%	**95.6%**
May	95.3%	94.9%	94.0%	95.0%	**94.8%**
Jun	96.3%	96.3%	96.6%	97.0%	**96.6%**
Jul	96.9%	96.6%	96.0%	96.0%	**96.3%**
Aug	95.1%	95.3%	96.8%	96.0%	**95.8%**
Sep	95.9%	95.5%	95.8%	96.0%	**95.8%**
Oct	95.3%	96.3%	97.2%	98.0%	**96.7%**
Nov	95.9%	96.1%	97.1%	96.0%	**96.3%**
Dec	97.4%	97.8%	97.7%	98.0%	**97.7%**
Average	**96.3%**	**96.4%**	**96.4%**	**96.6%**	**96.4%**

Availability standard proposal

- Proposed mechanism will compare all resources to 96% + bandwidth
  - Based on idea that the 115% planning reserve accounts for about 4% forced outage rate
- Will be a 1.5% lower band and 2.5% upper band around 96%, so there will be no charges or payments between 94.5% - 98.5% availability
- Self-funding mechanism will continue where payment for availability are funded through charges from non-availability

Historical and proposed availability standard



Current and proposed range comparison

	Current average bounds		Proposed bounds	
	Lower bound	*Upper bound*	*Lower bound*	*Upper bound*
Jan	95.1%	100.0%	94.5%	98.5%
Feb	95.1%	100.0%	94.5%	98.5%
Mar	93.9%	98.9%	94.5%	98.5%
Apr	93.1%	98.1%	94.5%	98.5%
May	92.3%	97.3%	94.5%	98.5%
Jun	94.1%	99.1%	94.5%	98.5%
Jul	93.8%	98.8%	94.5%	98.5%
Aug	93.3%	98.3%	94.5%	98.5%
Sep	93.3%	98.3%	94.5%	98.5%
Oct	94.2%	99.2%	94.5%	98.5%
Nov	93.8%	98.8%	94.5%	98.5%
Dec	95.2%	100.0%	94.5%	98.5%

Assessment timeframe

- Monthly assessment of availability percentage based on hourly bidding
- Assessment is only done on non-exempt hours
  - Hours that the resource is on exempt outage are pulled out of assessment hours
  - Hours that a resource has a substitute resource in its place are pulled out of assessment hours

Availability incentive mechanism calculation example

Hour	Hour 1	Hour 2	Hour 3	Hour 4
RA value	100 MW	100 MW	100 MW	100 MW
Total hourly bid	80 MW	95 MW	98 MW	97 MW

Subject to incentive?	MW assessment	MW assessment
400 MW	(1) 400 * 94.5%	378 MW
370 MW	(2) Sum of bids	370
92.5%	**(2) – (1)**	**8 MW**

In the monthly evaluation, assuming only 4 hours in a month, then 8 MW would be subject to availability incentive mechanism

Treatment of outages in availability calculation

Resources on the following outages will have their capacity removed from the availability calculation for the hours on outage:

- Planned
- Unit testing
- Unit Cycling
- Unit Supporting Startup
- Transitional Limitation
- Ambient not due to temperature
- Transmission induced outage
- Environmental Restrictions (5 days for flex RA)
- Use Limit Reached (5 days for flex RA)
- Off-peak opportunity
- Short-notice opportunity

Proposed Generation Nature of Work categories in OMS stakeholder initiative

- Environmental Restrictions – replacing current Ambient card
- Use Limit Reached – Potentially limits Pmax, Pmin and/or A/S deliverability due to Use limited resource
- Transmission Induced – Potentially limits Pmax, Pmin and/or A/S deliverability
- Plant Maintenance – Potentially limits Pmax, Pmin and/or A/S deliverability
- Plant Trouble – Potentially limits Pmax, Pmin and/or A/S deliverability
- Unit Cycling – replacing current Normal card
- Unit Supporting Startup – replacing current Normal card
- Transitional Limitation – replacing current Normal card
- Ambient due to temperature – replacing current Ambient card
- Ambient not due to temperature – replacing current Ambient card
- Power System Stabilizer – Primarily a PeakRC reporting requirement
- New Generator Test Energy – Identifies Non-commercial inputs to the grid
- Unit Testing – Potentially limits Pmax, Pmin and/or A/S deliverability

Principles for availability incentive price

- Two ways to allow availability to impact the price paid to capacity
  - Decrease QC based on historic availability
  - Create payment/penalty structure to distribute RA capacity payments after the fact based on actual availability
- No pure theoretical way to come up with availability incentive price similar to other ISOs due to bilateral market construct where capacity is paid different prices per MW
- Goal is to have a price that incents maintenance of fleet and optimal behavior

Availability incentive mechanism price- flexible, system, and local RA

- Propose to use a single availability metric and price for system, local, and flexible resources
- In order to be considered available, resource must be in compliance with highest must-offer requirement
- All resources not exempt from the availability incentive mechanism will therefore be subject to the same price and availability standard percentage

Availability incentive potential prices

- Fixed going forward cost of marginal resource
- Negotiated price
- Tied to CPM price
- Tied to voluntary forward auction
- Other

Objective: Align availability incentive mechanism with substitution and replacement rules

- Resources with substitute capacity will not be subject to availability incentive mechanism during those hours
- Resources with replacement capacity will not be subject to availability incentive mechanism during those hours
- Resources substituted in during exempt outages will be subject to availability incentive mechanism rules
- Further replacement and substitution rules to follow

California ISO
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Other Deferred FRAC MOO Issues

The ISO has begun examining other issues deferred in FRAC-MOO

- Flexible capacity from intertie resources
- Energy storage resources not registered as non-generator resources

Appendix

Estimating real time prices: Formulation

- Real time energy prices will be estimated using the following formula:

$$LMPi,t = ImpHR_{i,t-1} * (NatGas_{l,t} + (GHGasF_t * EmRate))$$

$LMP_{i,t}$	*is the forecasted real time price at pnode i for internal t*
$ImpHR_{i,t-1}$	*is the calculated implied heat rate at pnode I from a base period, t-1*
$NatGas_{l,t}$	*is the estimated nat gas price for region l and time period t based on the average daily more recent 30 day set of prices available*
$GHGasF_t$	*is the greenhouse gas allowance price for time period t*
EmRate	*is the emissions rate per MMBtu of gas, which is .053073 mtCO_2e/MMBtu*

Estimating real time prices: Implied heat rate calculation

- The implied heat rate used to estimate the energy prices will be calculated as follows:

$$\mathrm{Im}\,pHR_{i,t-1} = \frac{LMP_{i,t-1}}{NatGasP_{l,t} + (GHGas_{t-1} * EmRate)}$$

Where

$LMP_{i,t-1}$ is the real time energy price at pnode *i* from the previous year's period, *t-1.*

$GHGas_{t-1}$ is the greenhouse gas allowance price from the previous year's period, *t-1*.

EmRate is the emissions rate per MMBtu of gas, which is $.0530731 mtCO_2e / MMBtu$

$NatGasP_{l,t}$ is the daily natural gas price from the region *l* of pnode *i* and the previous year's period, *t-1*

Estimating real time prices: Preliminary comparison northern pricing node

LMP Price ($/MWh)	Apr-13		Sep-13	
	Actual LMP	Estimated LMP	Actual LMP	Estimated LMP
Less than $0/MWh	4%	7%	0%	1%
Between $0/MWh and $25/MWh	7%	13%	4%	8%
Between $25/MWh and $50/MWh	81%	67%	88%	87%
Between $50/MWh and $100/MWh	6%	12%	6%	4%
Between $100/MWh and $250/MWh	2%	1%	0%	1%
Greater than $250/MWh	1%	1%	0%	1%

- September estimations were fairly accurate
- April estimations more distributed around the $25/MWh and $50/MWh price bin
- Congestion during base year (2012) impacted the implied heat rate calculation
  - If congestion does not materialize in 2013, estimated prices vary

Estimating real time prices: Preliminary comparison southern pricing node

LMP Price ($/MWh)	Apr-13		Sep-13	
	Actual LMP	Estimated LMP	Actual LMP	Estimated LMP
Less than $0/MWh	3%	3%	2%	2%
Between $0/MWh and $25/MWh	6%	11%	7%	8%
Between $25/MWh and $50/MWh	81%	67%	82%	80%
Between $50/MWh and $100/MWh	8%	15%	8%	8%
Between $100/MWh and $250/MWh	1%	2%	1%	1%
Greater than $250/MWh	1%	2%	0%	2%

- In September, estimated 80% of LMPs to be between $25/MWh and $50/MWh, only 2% less than actual LMPs
- April estimated LMPs are more distributed around the $25/MWh and $50/MWh price range than actual LMPs