Flexible Resource Adequacy Criteria and Must-Offer Obligation

December 20, 2012

Karl Meeusen, Ph.D.
Market Design and Regulatory Policy Lead

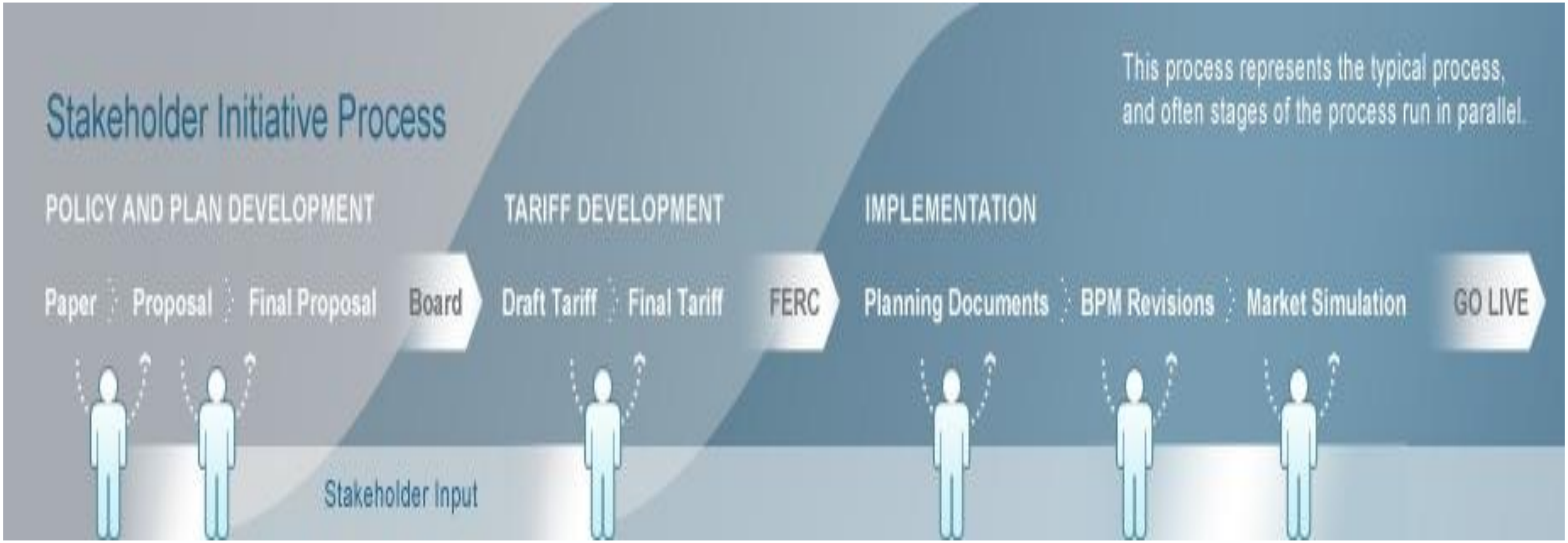
Introduction and Stakeholder Process

Tom Cuccia

Purpose of this initiative is to ensure the ISO has sufficient tariff authority to manage Flexible Capacity RA Resources

- ISO will conduct a two stage process
- The first stage, for 2014 RA compliance, focuses on:
  - Default provisions for LRA's without flexible capacity procurement obligations
  - Backstop procurement authority
- The second stage, for 2015 RA compliance, will focus on:
  - Enhanced performance obligations for flexible capacity resources, including must-offer obligations
  - Backstop procurement compensation for flexible capacity resource obligations, and
  - Revisions to the ISO Standard Capacity Product tariff provisions to apply to flexible RA capacity resources.

ISO Stakeholder Initiative Process



We Are Here

Stakeholder Meeting – Agenda - 12/20/12

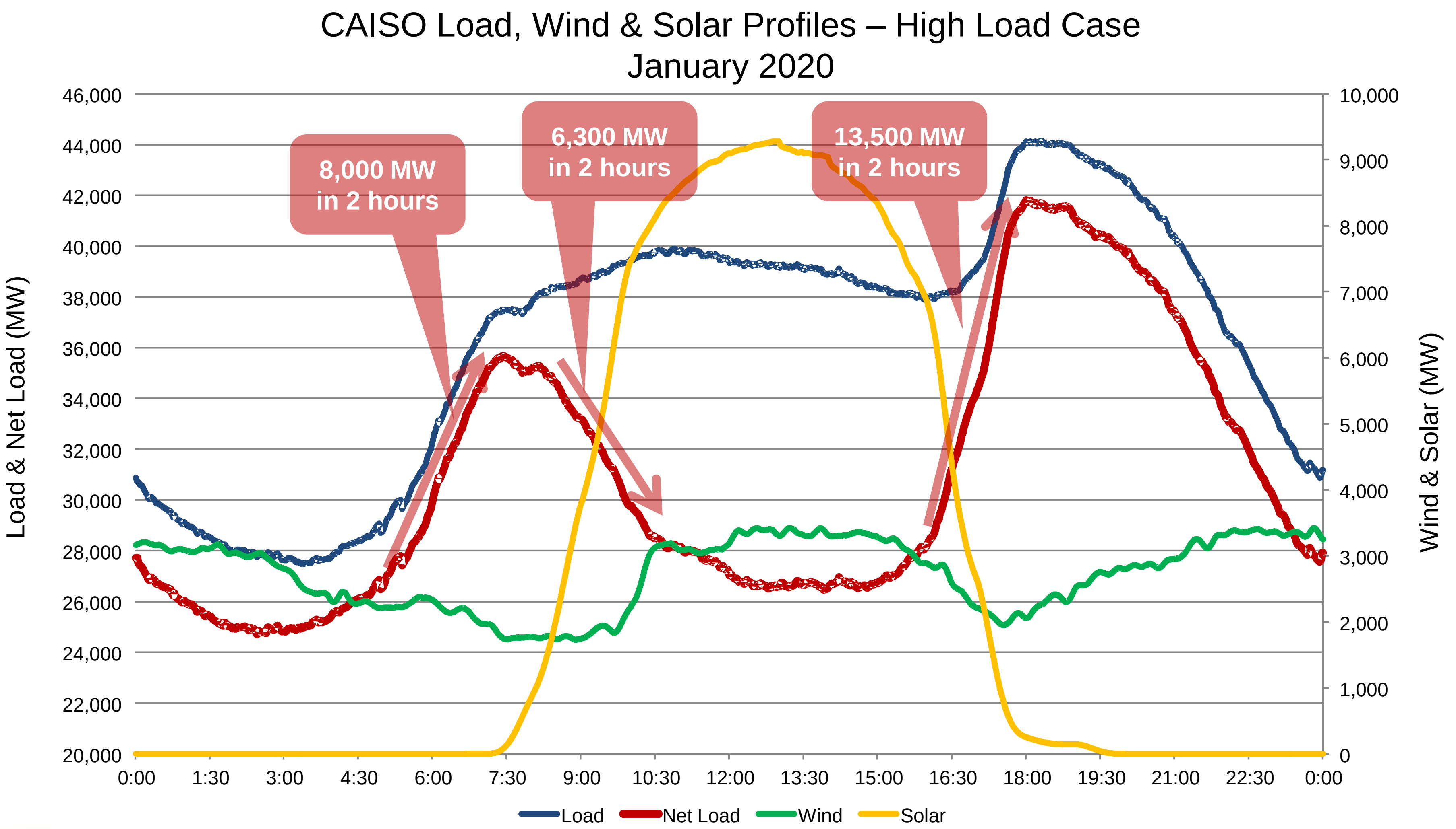
Time	Topic	Presenter
10:00 – 10:15	Introduction & Meeting Objective	Tom Cuccia
10:15 – 10:45	Overview of Need and of the Joint Parties' Proposal	Karl Meeusen
10:45 – 12:30	Methodology for Determining Flexible Capacity Procurement Requirements	Clyde Loutan and SCE
12:30 – 1:30	Lunch	
1:30 – 2:30	Flexible Capacity Procurement Requirements and Backstop Procurement Authority	Karl Meeusen
2:30 – 3:15	Procurement and Counting for Flexible Capacity Resources	Karl Meeusen
3:15 – 3:30	Alternative Hydro Proposal	Glenn Goldbeck (PG&E)
3:30 – 3:50	Issues to Resolve in Stage Two	Karl Meeusen
3:50 – 4:00	Next Steps	Tom Cuccia

Overview of Need and of the Joint Parties' Proposal

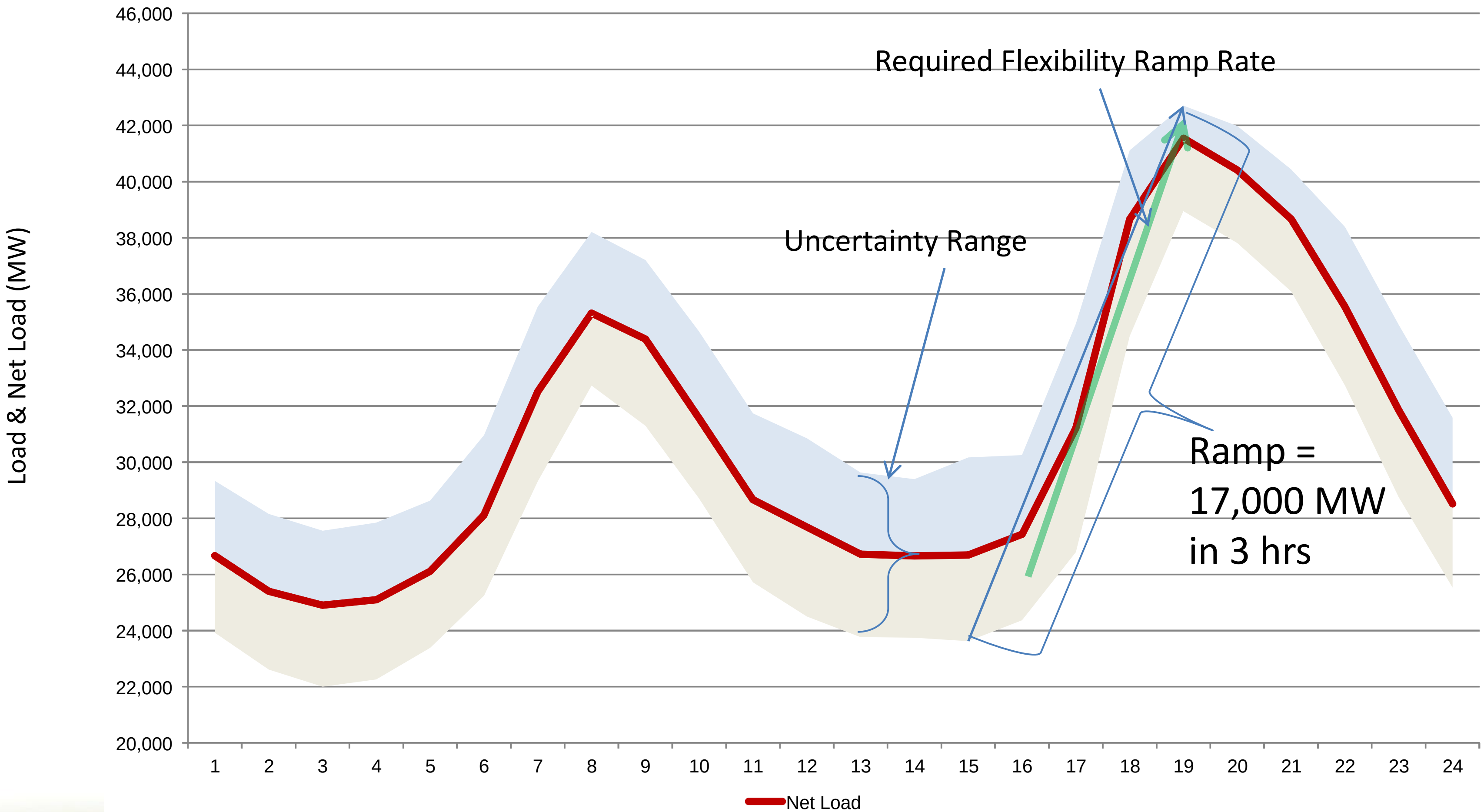
Karl Meeusen, Ph.D.

Market Design and Regulatory Policy Lead

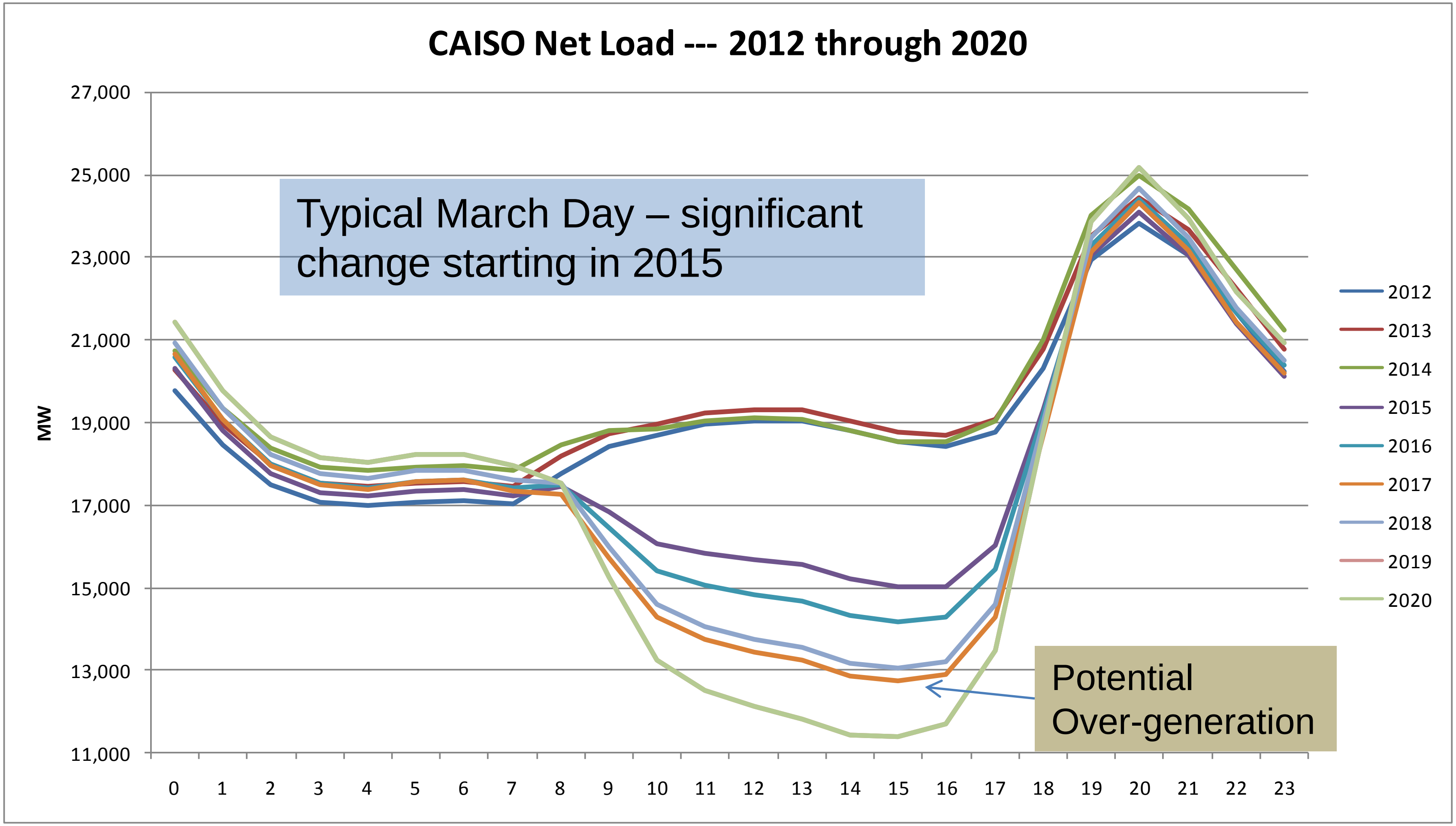
Conventional resources will be dispatched to the net load demand curve



Assessing future ramping needs: An example



Net load pattern changes significantly starting in 2015



Objective of the Joint Parties' Interim Flexible Capacity Proposal

- The result of extensive negotiations with IOUs.
- Craft an interim flexible capacity proposal that could:
  - Be implemented by the 2014 RA compliance year
  - Minimize added complexity and modifications to the current RA program and
  - Start the process of adding flexibility to the forward procurement process, allowing a more comprehensive solution to be developed and implemented by 2017 RA compliance

Outline of Joint Parties Proposal

- Main points of agreement
  - Determination of need
  - Obligations allocated based on LRA contribution to system peak
  - The flexible attribute “bundled” with underlying generic capacity
  - Counting of thermal resources towards LSE’s obligation
  - A resource may not sell more flexible capacity than NQC
  - Non-unit specific intertie resource cannot provide flexible capacity
  - No changes to standard capacity product for at least the first year
  - Flexible capacity MOO established in ISO stakeholder process
- Main points without consensus (includes PG&E concerns)
  - Counting convention and MOO for hydro resources
  - MOO for use-limited resources

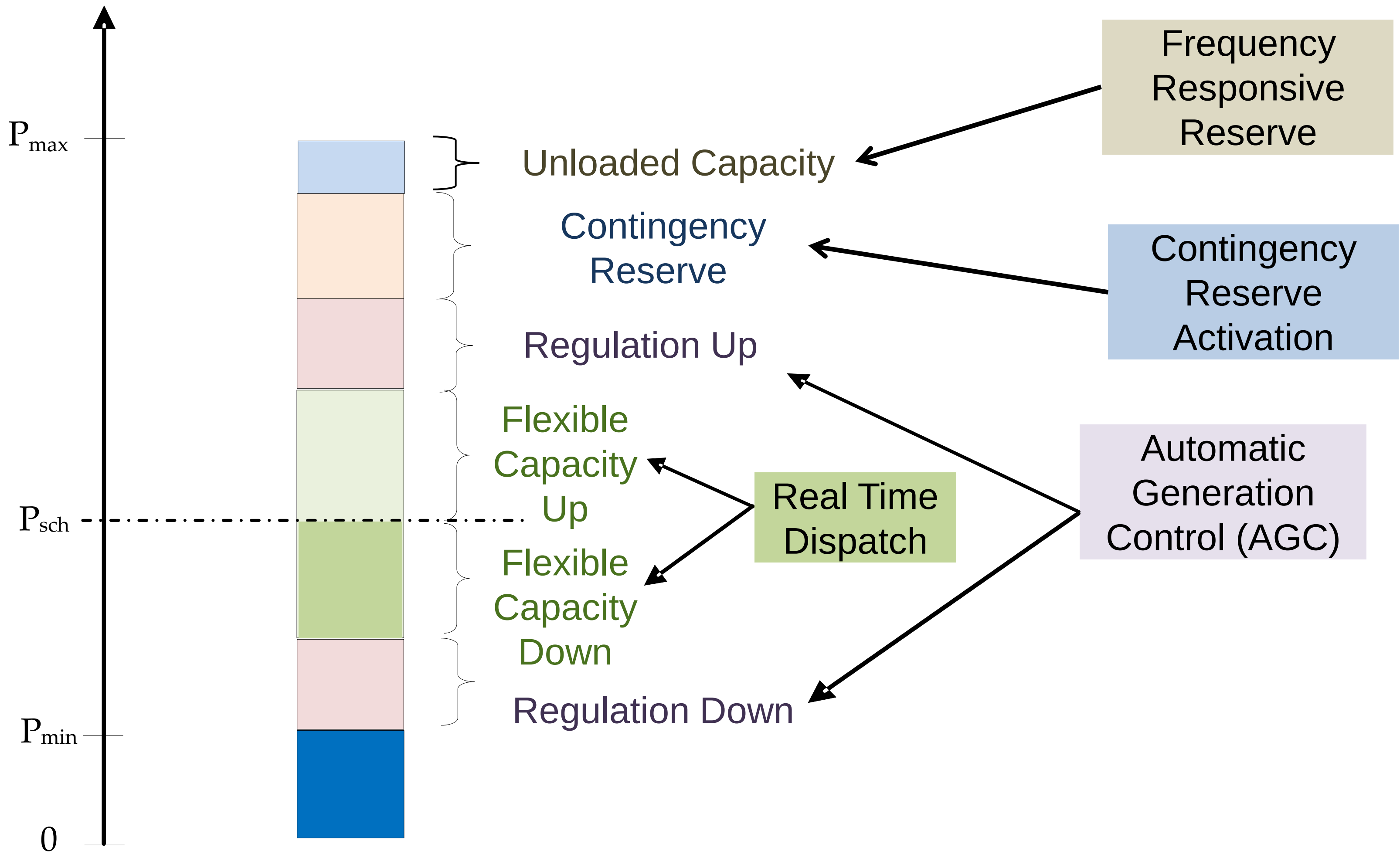
Methodology for Determining Flexible Capacity Procurement Requirements

Clyde Loutan
Senior Advisor – Renewable Energy Integration

Methodology for determining flexible capacity procurement requirements

- CPUC/CEC LTPP Portfolios
  - Work with IOUs to choose a portfolio that best represents their RPS trajectory
- Methodology for 2014 through 2016
  - Develop 1-minute data by RPS CREZs
  - Calculate intra-hour flexibility needs
  - Calculate hourly regulation requirements
- Calculating maximum continuous ramp
- Why is the flexibility capacity needs calculated for 3-hours?
- Flexible needs formula
- Methodology moving forward

A single generator can provide multiple services



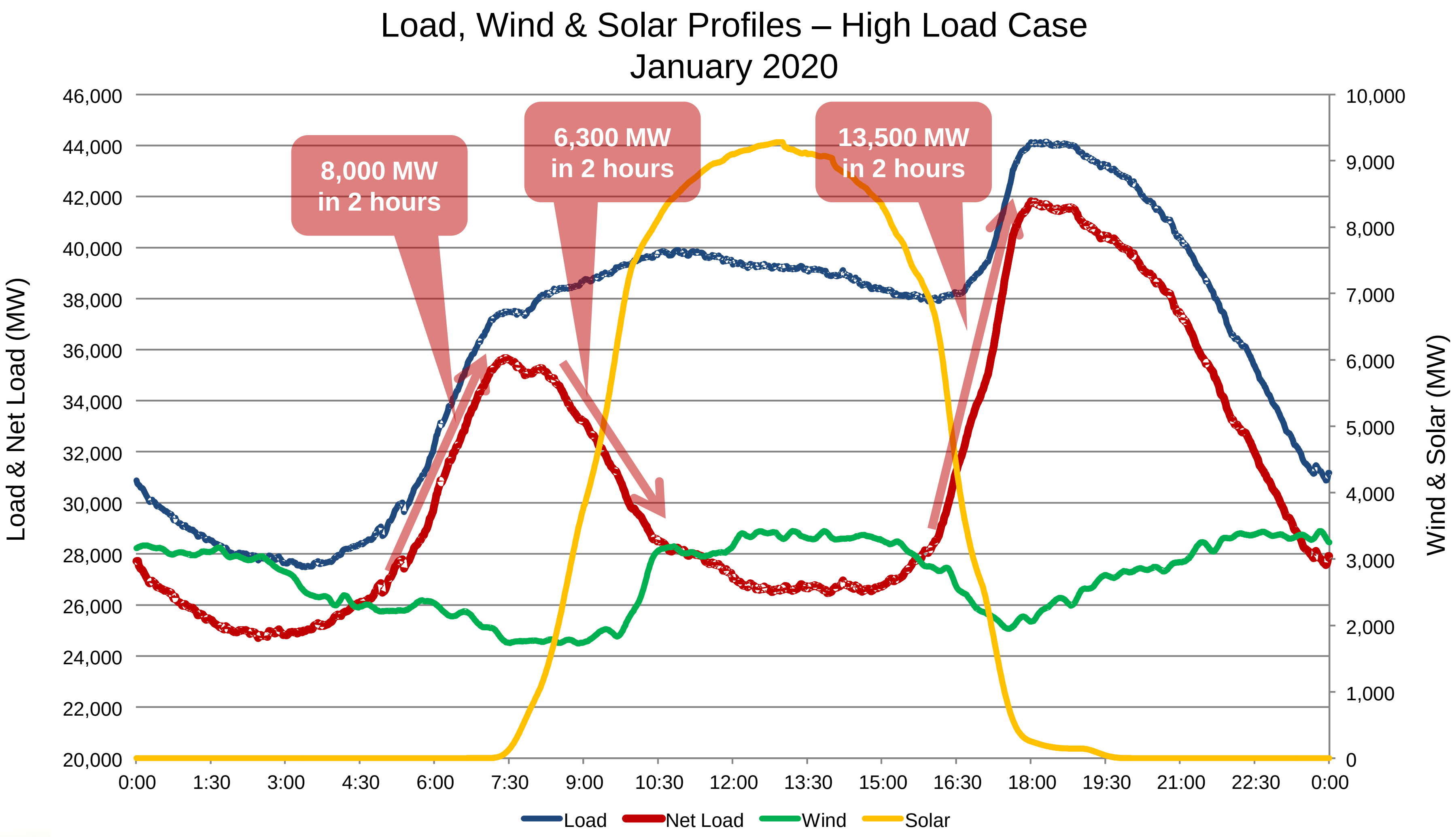
Scenarios would be developed from CPUC's LTPP Portfolios

Scenario Name	Base	Replicating TPP	High DG + High DSM	High DG + High DSM - 2030, 40%
Load	Mid	Mid (1-in-5 peak weather)	Mid	Mid
Inc EE	Mid	None	High	High
Inc PV	Mid	None	High	High
Inc CHP	Low	None	High	High
Net Short (GWh)	32,796	39,957	26,618	42,660
	Portfolio Totals (MW)	Portfolio Totals (MW)	Portfolio Totals (MW)	Portfolio Totals (MW)
Discounted Core	10,505	10,521	10,767	15,767
Generic	1,639	4,597	0	1,500
Total	**12,144**	**15,119**	**10,767**	**17,267**
Biogas	**136**	**136**	**133**	**136**
Biomass	**57**	**75**	**57**	**57**
Geothermal	**688**	**719**	**211**	**607**
Hydro	-	-	-	-
Large Scale Solar PV	**5,578**	**7,421**	**3,816**	**5,491**
Small Solar PV	**2,135**	**2,381**	**3,913**	**7,441**
Solar Thermal	**1,402**	**1,402**	**787**	**1,402**
Wind	**2,149**	**2,984**	**1,850**	**2,134**
Total	**12,144**	**15,119**	**10,767**	**17,267**
New Transmission Segments	**Merced - 1**	**Merced - 1**	**Merced - 1**	**Merced - 1**
	Kramer - 1	**Kramer - 1**		**Kramer - 1**
	Los Banos - 1	**Los Banos - 1**		**Los Banos - 1**

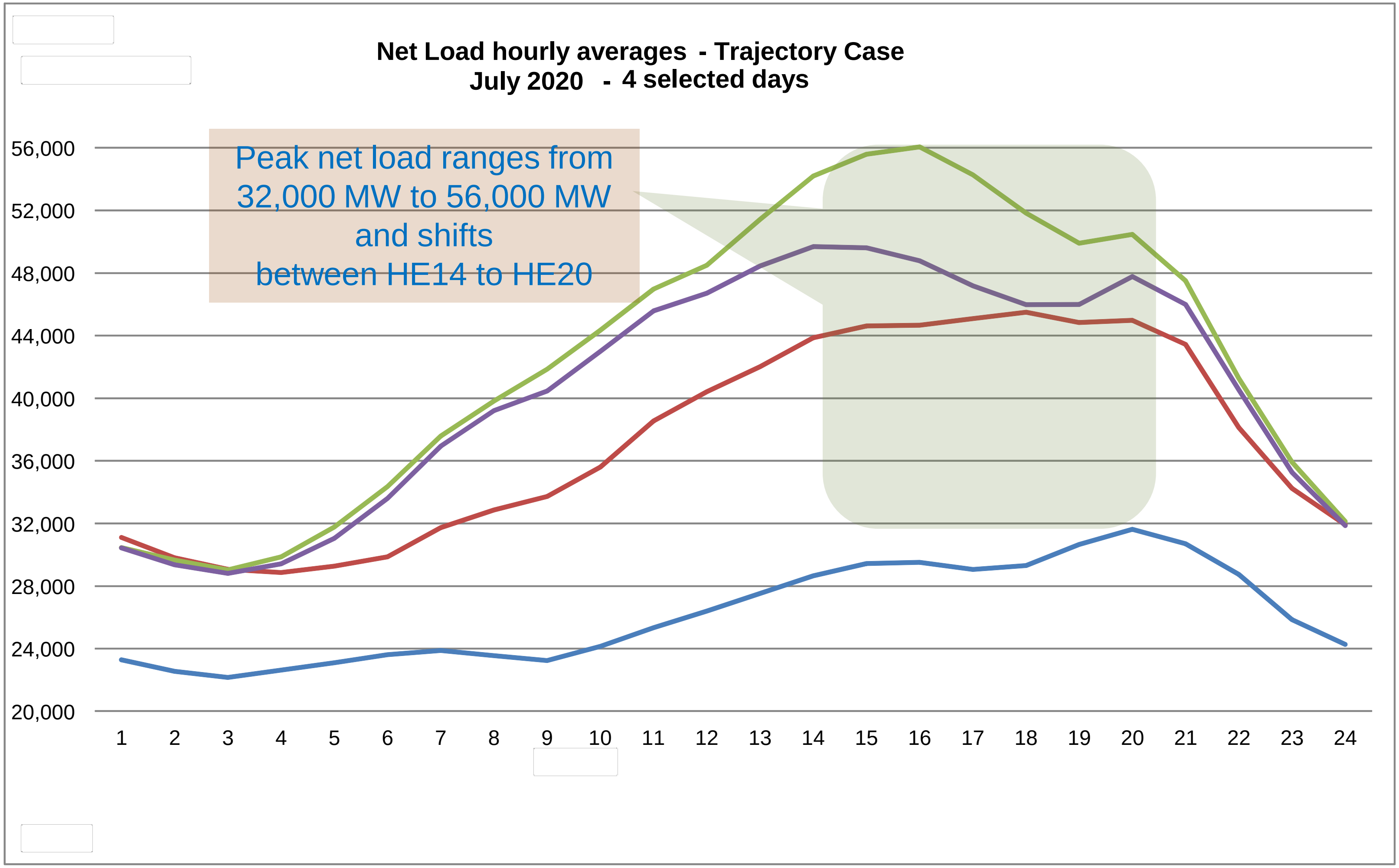
CPUC's LTPP scenario portfolio would be used to develop 1-minute data for the entire year

.	2011	2012	2013	2014	2015	2016	2017	2018
CPUC High Load scenario 2012 LTPP (R.12-03-014)	45,527	49,843	50,929	52,146	53,149	54,042	54,918	55,843
Load Growth (%)		1.095	1.022	1.024	1.019	1.017	1.016	1.017
Small PV (Demand side) (MW)		367	733	1,100	1,467	1,833	2,200	2,567
New_Installed small_Solar_PV (MW)		97	120	1,930	2,074	2,074	2,074	2,074
Large scale solar PV (MW)		172	422	1,525	2,279	3,113	3,652	4,248
Solar thermal (MW)			583	1,100	1,293	1,440	1,440	1,440
New_Installed _Wind_Capacity (MW)		301	301	301	1,223	1,223	1,361	1,361
Total Solar (MW)	1,160	2,097	3,319	7,116	9,496	10,843	11,887	12,850
Total Wind (MW)	4,697	4,998	4,998	4,998	5,920	5,920	6,058	6,058
Total Wind & Solar	***5,857***	***7,095***	***8,317***	***12,114***	***15,416***	***16,763***	***17,945***	***18,908***

Conventional resources will be dispatched to the net load demand curve – High Load Case



Preliminary analysis demonstrates the need for rethinking RA and considering flexibility

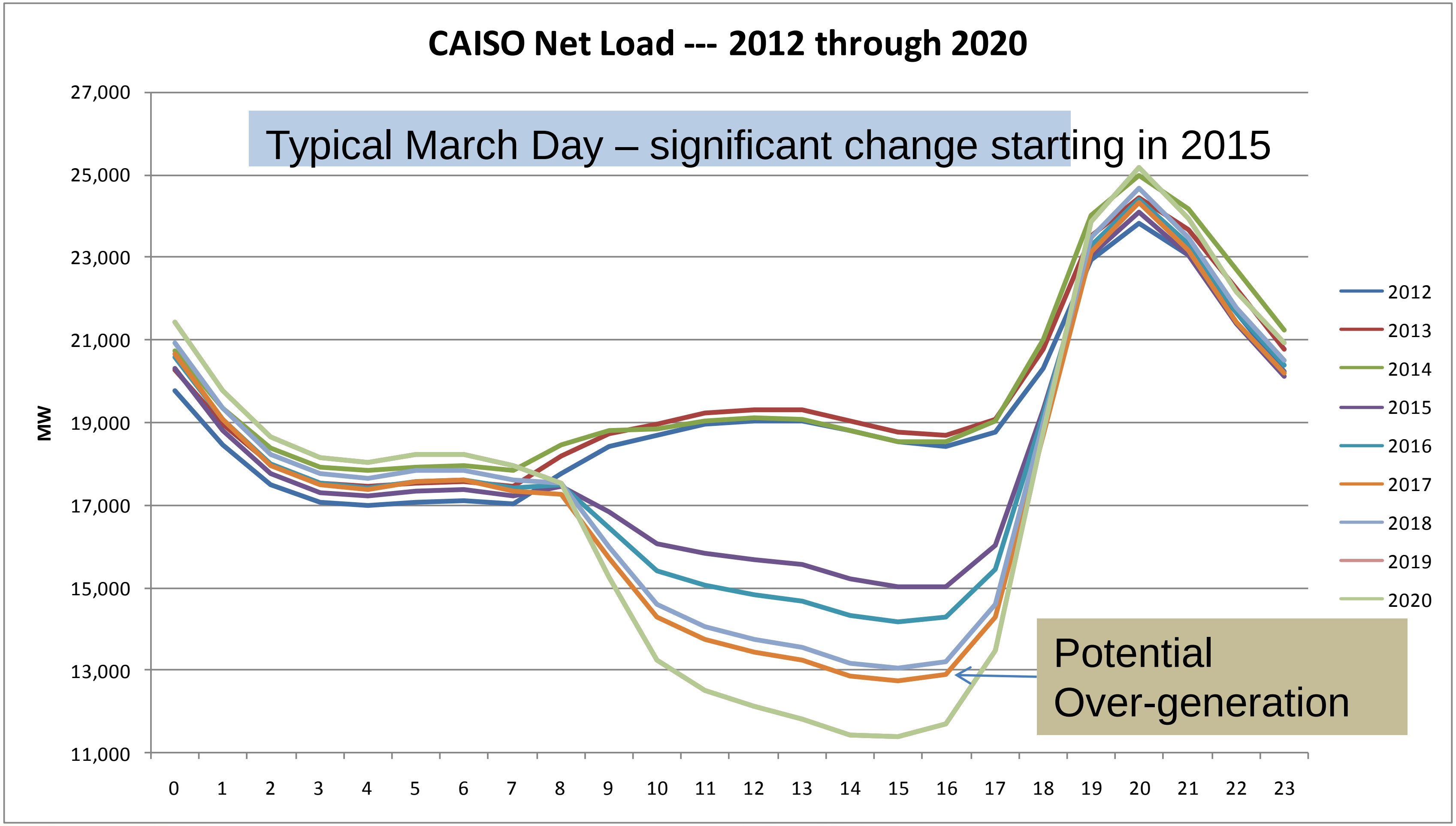


Flexible needs assessment

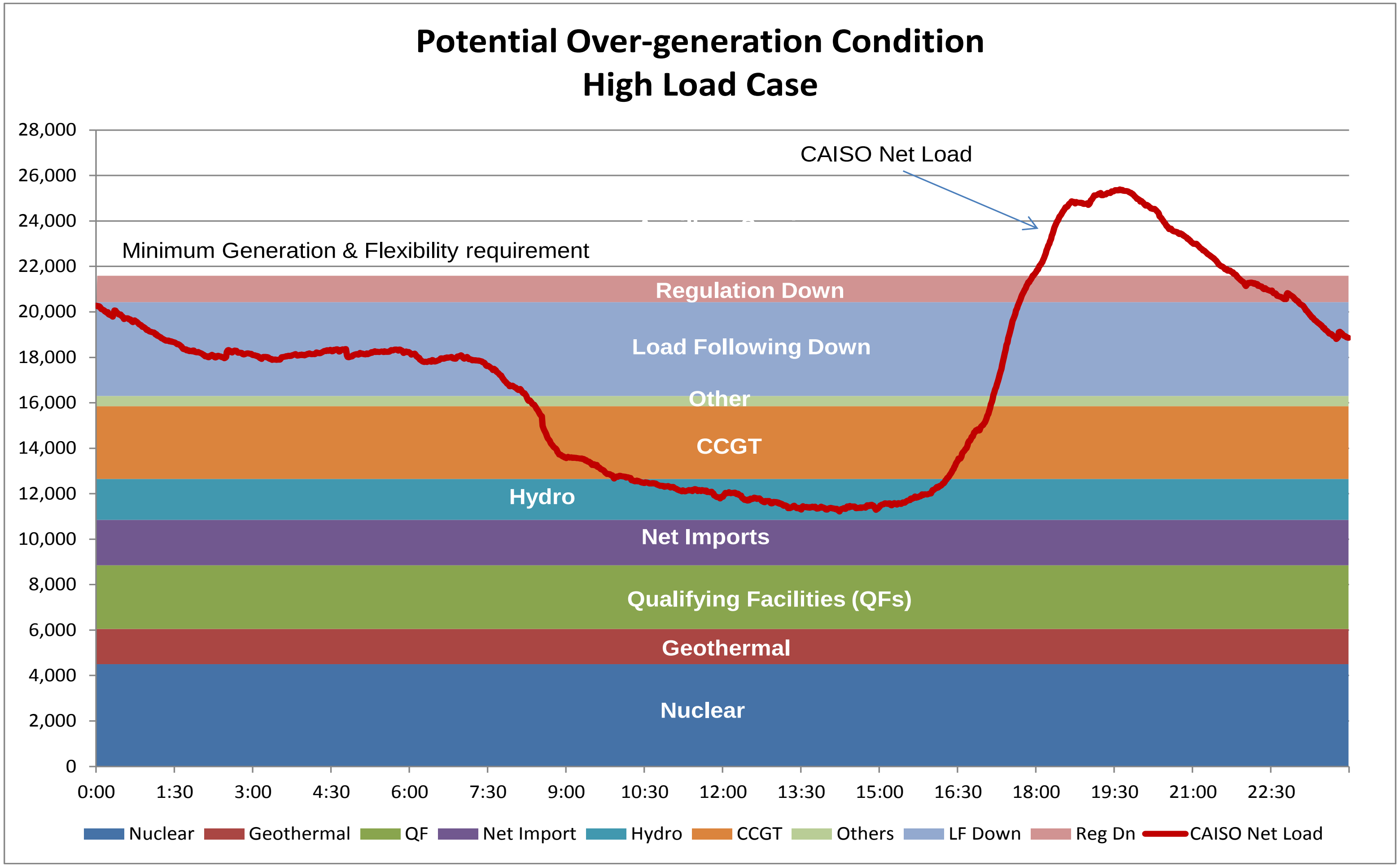
Data source for sea horse plot

- Actual 2011 average hourly load data
- Actual 2011 average hourly wind and solar production
  - CPUC RA capacity build-out (1 in 2 Peak Summer Demand)
  - Convert RA capacity into installed capacity
  - Scale 2011 wind production to subsequent year build-out
  - Scale 2011 solar production to subsequent year build-out
  - Scaled 2011 hourly load by yearly load growth factor
- Calculate net load for each hour of each year
- Potential over-generation

Spring net load pattern changes significantly starting in 2015



Potential over-generation conditions



California ISO
Shaping a Renewed Future

Recommend methodology for determining flexible capacity need for a given month – Interim proposal

- Interim Methodology

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

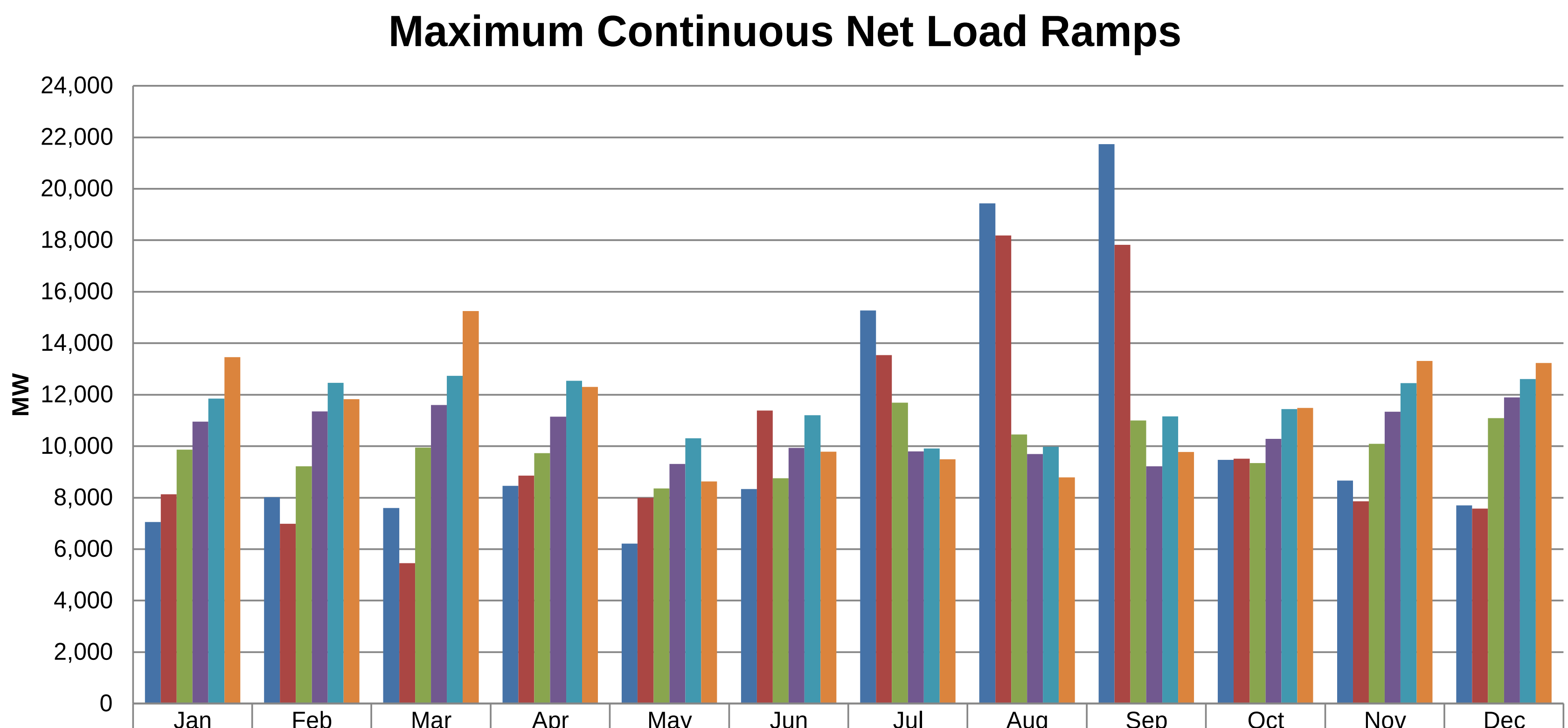
  Where:

  - $\text{Max}[(3RR_{HRx})_{MTHy}]$ = 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 uncertainties such as load following

- Methodology beyond 2016 needs to be developed

Maximum continuous net load ramp capacity

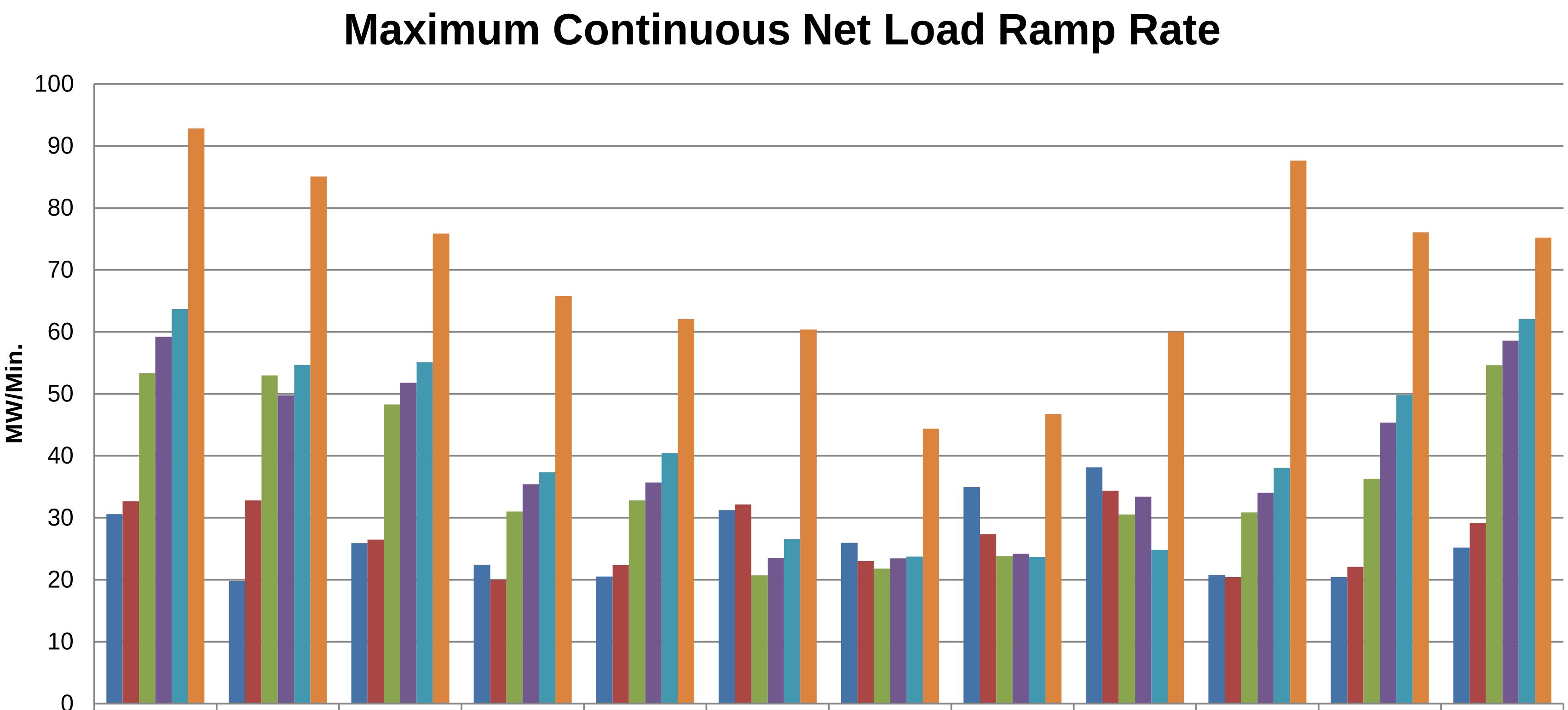
Actual 2010 & 2011---- Simulated 2014, 2015, 2016 & 2020



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	7,057	8,022	7,594	8,465	6,217	8,337	15,275	19,432	21,732	9,464	8,667	7,706
2011	8,133	6,982	5,453	8,859	8,000	11,382	13,544	18,181	17,824	9,510	7,855	7,577
2014	9,866	9,219	9,942	9,730	8,361	8,758	11,692	10,451	10,998	9,344	10,093	11,091
2015	10,952	11,347	11,597	11,144	9,315	9,931	9,802	9,696	9,220	10,282	11,340	11,890
2016	11,848	12,464	12,731	12,544	10,311	11,203	9,909	9,983	11,154	11,444	12,452	12,606
2020	13,459	11,825	15,254	12,298	8,630	9,782	9,496	8,785	9,777	11,483	13,308	13,234

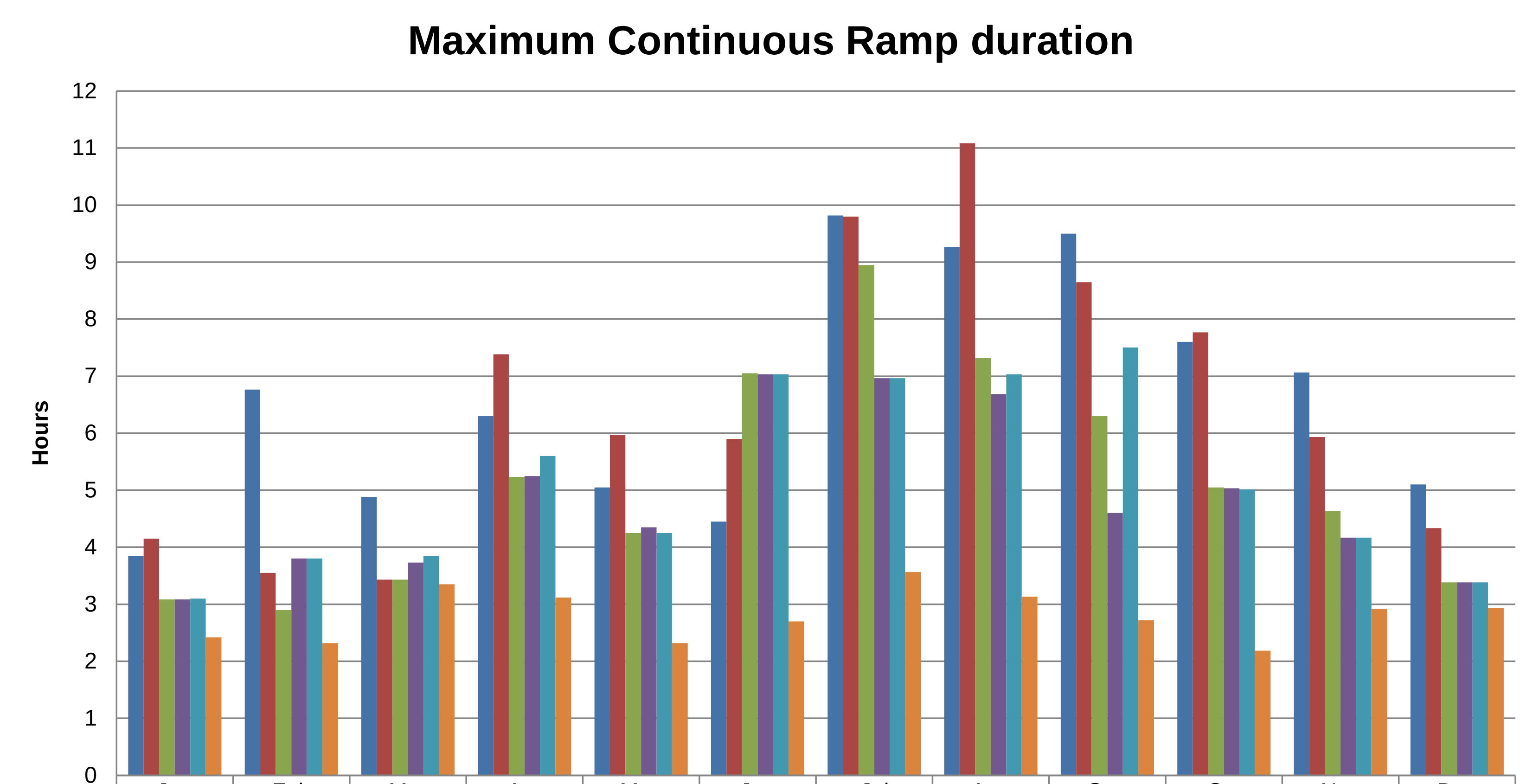
Maximum continuous ramp rates based on net load

Actual 2010 & 2011---- Simulated 2014, 2015, 2016 & 2020



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	31	20	26	22	21	31	26	35	38	21	20	25
2011	33	33	26	20	22	32	23	27	34	20	22	29
2014	53	53	48	31	33	21	22	24	31	31	36	55
2015	59	50	52	35	36	24	23	24	33	34	45	59
2016	64	55	55	37	40	27	24	24	25	38	50	62
2020	93	85	76	66	62	60	44	47	60	88	76	75

Maximum continuous ramp duration based on net load Actual 2010 & 2011---- Simulated 2014, 2015, 2016 & 2020



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	3.9	6.8	4.9	6.3	5.1	4.5	9.8	9.3	9.5	7.6	7.1	5.1
2011	4.2	3.6	3.4	7.4	6.0	5.9	9.8	11.1	8.7	7.8	5.9	4.3
2014	3.1	2.9	3.4	5.2	4.3	7.1	9.0	7.3	6.3	5.1	4.6	3.4
2015	3.1	3.8	3.7	5.3	4.4	7.0	7.0	6.7	4.6	5.0	4.2	3.4
2016	3.1	3.8	3.9	5.6	4.3	7.0	7.0	7.0	7.5	5.0	4.2	3.4
2020	2.4	2.3	3.4	3.1	2.3	2.7	3.6	3.1	2.7	2.2	2.9	2.9

Flexible Capacity Procurement Requirements and Backstop Procurement Authority

Karl Meeusen, Ph.D.
Market Design and Regulatory Policy Lead

The Joint Parties Considered three methodologies for allocating flexible capacity procurement obligations

- The allocation methodologies considered were:
  - LRA’s share of system peak
  - LSE’s relative monthly load factor
  - LSE’s load characteristics *and* the composition of its RA resource portfolio
- Evaluated the impact of each option on
  - the quantity of flexible capacity procurement required
  - Implementation challenges
  - reason/causation for using an allocation methodology

The ISO will allocate flexible capacity needs based on LRA's contribution to system peak

- Consistent with current RA allocation methodology
  - Eliminates for separate allocation methodology
- System peak-to-ramping should remain highly correlated for the interim period
- Superior long-run solution may exist
  - i.e. using load factors may yield flexible capacity needs
    - Requires significant work to develop and have the CEC would have to analyze, validate, and reconcile this process
- Allocating requirements using relative share of monthly system peak balances implementation challenges of causation during for interim period proposed

The ISO is proposing default flexible capacity procurement requirements

- Flexible capacity procurement requirements for Local Regulatory Authorities that do not set their own requirements will be the flexible capacity obligation identified by the ISO in the annual flexible capacity need study

LSEs will have annual and monthly Flexible Capacity Procurement demonstrations

- LSEs required to demonstrate
  - 90 percent monthly flexibility procurement obligations year-ahead
  - 100 percent of flexibility procurement obligation in monthly showing
- Existing Resource Adequacy replacement requirement for planned generator outages and unit substitution for forced outages will apply to Flexible Capacity
  - Only flexible capacity can replace flexible capacity

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

- ISO proposes backstop procurement authority that allows the ISO to make 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 total annual or monthly flexibility need requirements
- Compensation will be at the exiting CPM rate until a Flexible Capacity Procurement Mechanism rate is established
- Costs of backstop procurement will be allocated to deficient LSEs

The ISO will procure only as much flexible capacity as is needed to resolve the identified deficiency

- When using backstop procurement authority for flexible capacity deficiencies the ISO will use the following criteria in the order listed:
  - An RA resource not listed on RA plans as having fully providing all of its eligible flexible capacity
  - A partial RA that a) is not listed on RA plans has having fully provided all of its eligible flexible capacity or b) has additional capacity available that is eligible to provide flexible capacity
  - A non-RA resource which best satisfies the remaining need while considering resource's Pmin, ramp rate, and start-up time that is able to provide flexible capacity

Procurement and Counting for Flexible Capacity Resources

Karl Meeusen, Ph.D.
Market Design and Regulatory Policy Lead

Flexible capacity resources must be able to ramp or provide output for at least three hours

- “Technology agnostic” approach in determining a resource’s eligibility to be a flexible capacity resource
  - However, resource must be able to ramp *and* subsequently sustain energy output for a minimum of three hours
    - Meeting a steep three hour ramp could be exacerbated by relying on a resource that is only able to produce energy for 60 minutes and no longer

Flexible and generic capacity cannot be split and sold separately

- The flexible capacity a resource offers must remain "bundled" with the generic capacity for the specific megawatt
  – flexible capability of that megawatt of capacity cannot be stripped off and sold as a separate product
  – For example, a resource, for the same megawatt, may not sell the system capacity to one LSE and its flexible capability of that megawatt of capacity to another
- A resource may not offer more flexible capacity than its rated NQC

Joint parties evaluated three options for counting how a resource’s flexible capacity quantity would satisfy a flexible capacity procurement obligation

1. Pro-rata Option: Flexible capacity is based on the ratio of a resource’s effective flexible capacity to NQC.
2. Differentiated Capacity Option: Requires a resource keep its generic and flexible capacity bundled, but capacity that is inflexible, such as megawatts associated with Pmin, must be sold as generic capacity, not flexible capacity.
3. Count-all Option: Identifies a resource as either dispatchable or not. In other words, if a resource is dispatchable in the ISO’s masterfile, then it counts toward meeting an LSE’s flexible capacity procurement obligation, regardless of the resource’s Pmin.

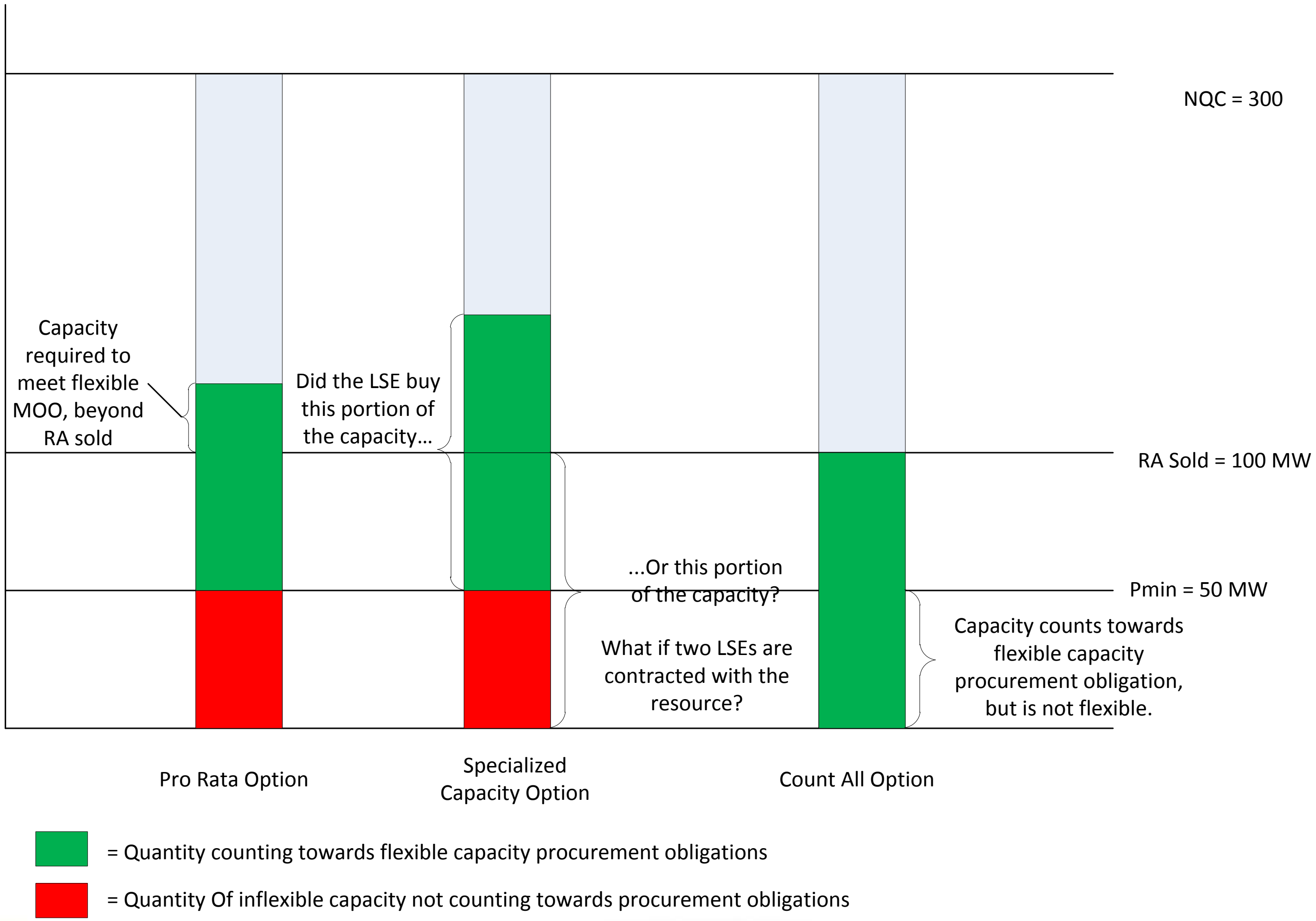
For Partial RA resources, each methodology would count the same resource differently

- Example

NQC	300 MW
Pmin	50 MW
EFC (NQC -Pmin)	250 MW
RA capacity sold	100 MW

- Flexible RA counting for RA sold
  - Pro Rata: 83 MW
  - Differentiated: 50 MW
  - Count-all: 100 MW
- Pro rata and Differentiated converge for full RA resources
- All three options converge for resources that are full RA resources and are flexible from zero to NQC

Each option has challenges that must be addressed



Joint Parties recommend the Differentiated Capacity option

- The Count-all option would require a “flexibility capacity margin” to account for resources’ Pmins
  - Not feasible develop as part this interim solution
- Differentiated Capacity option provides superior incentives for resources to enhance their ability to provide flexible capacity
- Differentiated Capacity option is likely more durable than the Pro-rata option
  - Long-term solution likely to include greater separation of flexible capacity attributes, not a Pro-rata accounting

Joint Parties proposed counting conventions for thermal resources

- Resource counting:
  - If start-up time greater than 90 minutes
    - minimum of (NQC-Pmin) or (180 min * RRavg)
  - If start-up time less than 90 minutes
    - minimum of (NQC) or (Pmin + (180 min – SUT) * RRavg)
- MSG resources measured based on 1x1 configuration
- If a use-limited resource reaches its run-time limits
  - Treated as a forced outage and,
  - subject to standard capacity product non-availability charges

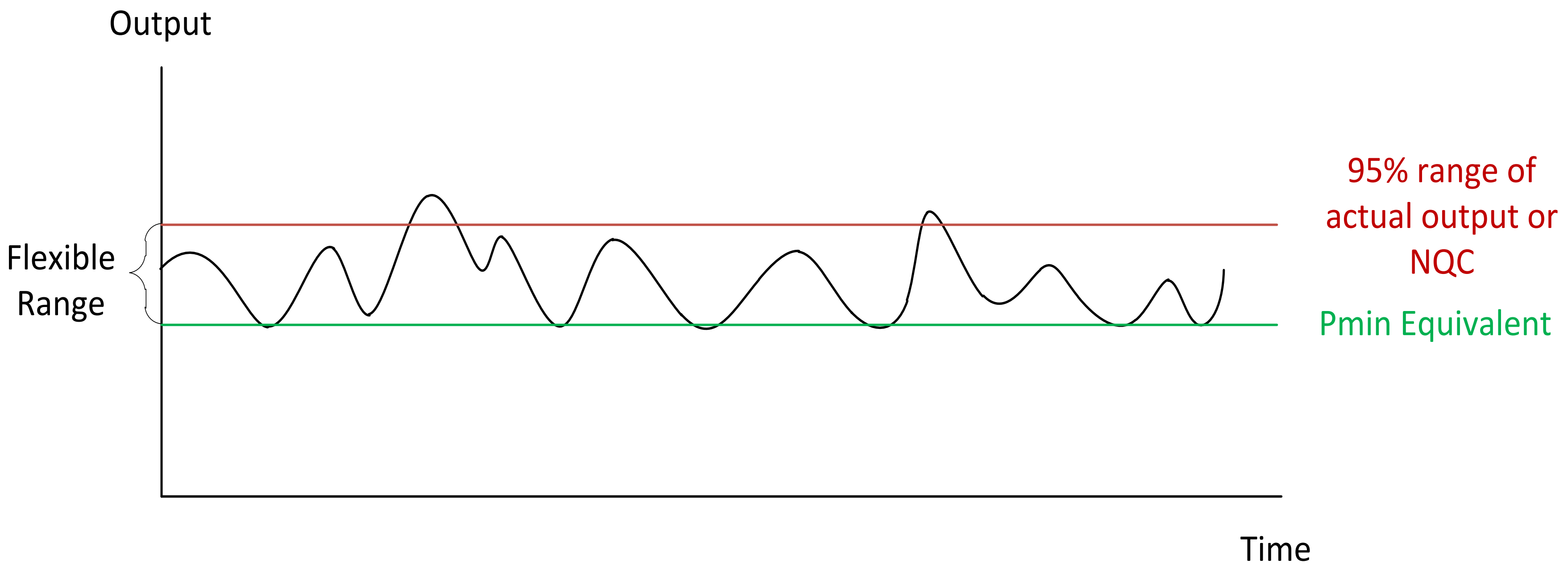
There are unique challenges associated with determining the amount flexible capacity hydro can provide

- Effective flexible capacity of hydro resources can differ month-to-month
- Flexibility may not be tied directly with NQC
  - NQC are set conservatively, using a 1-in-5 low hydro year
  - A low hydro year may actually allow a hydro resource to be more flexible because of lower spill concerns
- ISO recommends using a variation of the Differentiated Capacity option to determine contribution towards meeting and LSE's flexible capacity procurement obligation

The ISO proposes a counting convention specific to hydro resources

- ISO and SDG&E Proposal from the Joint Parties proposal
  - ISO establishes baseline output for hydro resources using the average hydro output over the previous five years
  - Based on energy bids and available capacity from the reference period (i.e. 5 years) to establish a Pmin equivalent for each hydro resource
    - Based on range of lowest to highest output of a resource in a given month from the reference year.
    - Hydro resource would be required to submit economic bids for the flexibility range specified in the LSE's flexible capacity procurement obligation showing
      - Can self schedule balance of the capacity
  - ISO examining the possibility of ambient derates without substitution or availability charges for hydro resources
    - LSE utilizing a hydro resources that exceeds derate range would have to offer substitute capacity or be subject to availability charges

An example of counting a hydro resource



The ISO proposes specific treatment for other resources

- Flexible pseudo-tie and dynamically scheduled capacity resources can count toward meeting an LSE's flexible capacity procurement obligation
  - Flexibility and ramping provided by non-resources specific intertie resources is concidered through the needs determination
- Resources like distributed generation, demand response, and storage should ultimately count towards an LSE's flexible capacity procurement obligation
  - For the interim proposal preferred resources and storage should use the counting convention as thermal

Issues to Resolve in Stage Two

Karl Meeusen, Ph.D.
Market Design and Regulatory Policy Lead

There are three major items the ISO must resolve in stage two of this stakeholder initiative

- Flexible Capacity Bidding Obligations
- Compensation for Flexible Capacity Procurement Mechanism Designation
- Standard Flexible Capacity Product

Next Steps

- Comments on straw proposal
  - Comments Template posted December 21, 2012
  - Due January 9, 2013
  - Submit comments to fcp@caiso.com
- Board of Governors
  - May 2013