Slow Response Local Capacity Resource Assessment

CAISO-CPUC Joint Workshop

October 4, 2017

Revision as of 10/11/17: Revisions were made on page 62 and page 64 is marked for deletion

Agenda

Time	Topic	Presenter
10:00 – 10:05	Welcome	Kim Perez, CAISO
10:05 – 10:15	Introduction and purpose	Bruce Kaneshiro, CPUC
10:15 – 12:00	**Slow Response Local Capacity Resources Technical Study:** 1) Framing the discussion 2) Study design, methodology overview, and results update 3) Party discussion and Q&A panel with participating transmission owners	 1) John Goodin, CAISO 2) Nebiyu Yimer, CAISO and Catalin Micsa, CAISO 3) CAISO, PGE, SCE, SDGE
12:00 – 1:00	Lunch	All
1:00 – 1:15	PDR and RDRR slow response barriers	Delphine Hou, CAISO
1:15 – 2:00	**PDR discussion:** CAISO's 15-minute market and bidding options for real-time imports and exports	Don Tretheway, CAISO
2:00 – 3:00	**PDR discussion:** Party discussion on feasibility of import/export options for PDR	All, moderated by CAISO and CPUC

Agenda (cont'd)

Time	Topic	Presenter
3:00 – 3:15	**RDRR discussion**: CAISO limitations under the RDRR settlement	John Goodin, CAISO Delphine Hou, CAISO
3:15 – 3:45	**RDRR discussion**: Party discussion of limitations and possibilities	All, moderated by CAISO and CPUC
3:45 – 4:00	Next steps	Bruce Kaneshiro, CPUC John Goodin, CAISO

Slow Response Local Capacity Resources Technical Study: framing the discussion

John Goodin, Manager, Infrastructure and Regulatory Policy, CAISO

Separating technical studies from market and policy issues

- Presentations in the morning focus on studies identifying the “technical potential” of slow response resources in the local area.
  – Therefore, simplifying assumptions are made to conduct the analysis (see page 8).
- Market and policy issues will be addressed in the afternoon.
- Eventually, the studies and the market realities will need to be aligned but for now the we would like to address each in turn.

Slow Response Local Capacity Resources Technical Study

Results Update

Nebiyu Yimer, Regional Transmission Engineer Lead
Catalin Micsa, Sr. Advisor Regional Transmission Engineer

October 4, 2017

Changes from previous study

- Hourly load scaling method changed. Only five days around the peak are now scaled to CEC 1-in-10 forecast. Remaining 360 days are scaled to 1-in-2.
- 2013 recorded data was replaced with 2016 data (SCE & SDGE)
- SDG&E existing slow-response DR amount updated from 10 MW to 52 MW. Scenarios changed to 2%, 5% and 10% of peak.
- ISO Step 2 analysis performed for the 5% scenario in addition to existing scenario.
- Refined ISO Step 2 power flow analysis: i.e., reduced reactive power capability proportionally when reducing active power output of a generator

Introduction

- The study assesses availability requirements for slow-response resources (such as DR) to count for local resource adequacy based on precontingency dispatch:
  - annual, monthly and daily event hours
  - number of events per year and month
- The study assumes
  - slow response resources will be dispatched in anticipation of loading conditions that would be problematic if contingencies occurred.
  - no emergency declaration from ISO Operations is required.
  - they are called last and therefore have the <u>lightest</u> possible duty.
  - idealized "perfect" forecast and dispatch capabilities – operational implementation issues are not in the study scope

Methodology

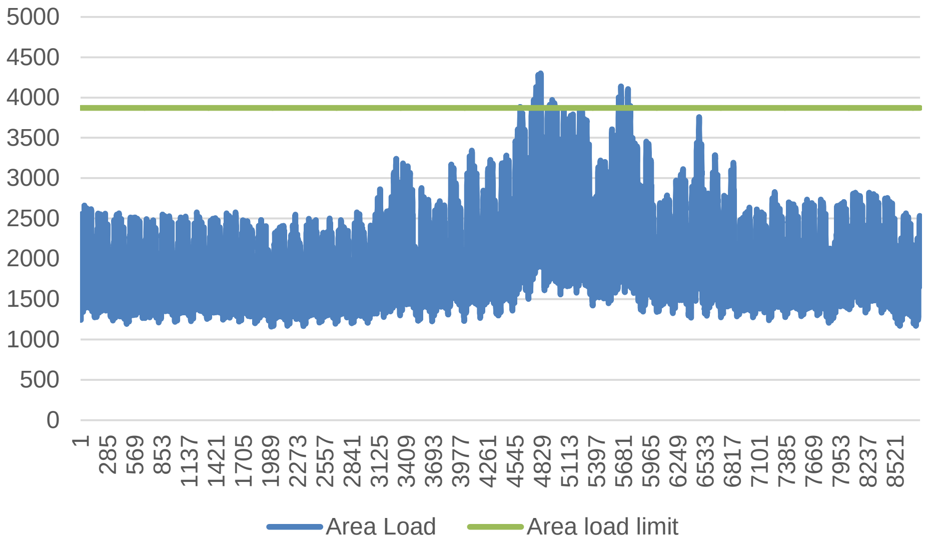
- LSEs selected LCAs and sub-areas to be studied and provided assessment using study step 1 – which assumes all resources are equally effective within a study area
- ISO:
  - reviewed LSE results
  - Evaluated selected areas using study step 2 – which tests locational and reactive capability impacts within the study area
  - evaluated results against existing DR program characteristics
- Study is based on hourly load data for 2017 derived from three years of recorded data.

Areas and scenarios studied

Performer	Areas studied	Slow-response resource amounts studied
SCE	- All LCAs, - All sub-areas	- Existing DR (Slow Response) - 2% of study area load - 5% of study area load - 10% of study area load
PG&E	- All LCAs	
SDG&E	- San Diego sub-area	
ISO	- Voltage stability limited areas in southern California	- Verify LSE Results - Existing DR (Slow Response) - 5% of study area load

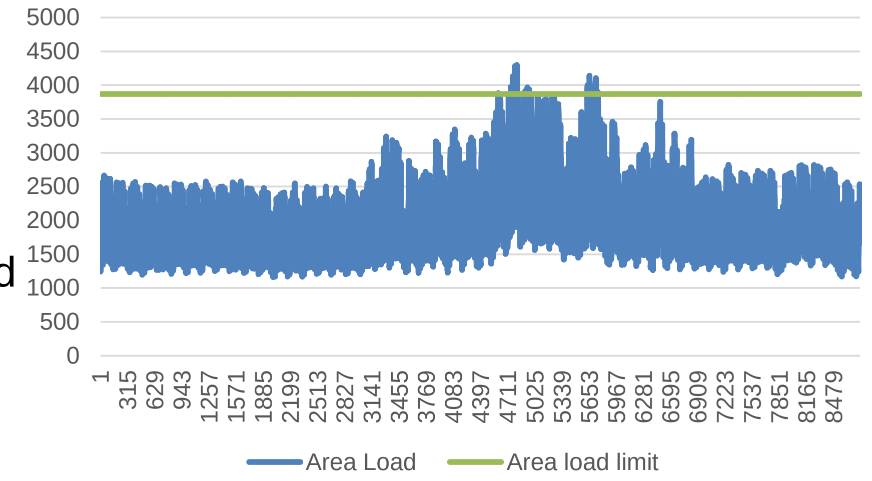
Study Sequence – Step 1 (LSEs)

1. Get hourly forecast load data for the LCR area or sub-area under consideration
2. Calculate forecast area peak load minus slow response resource amount
3. Using a spreadsheet, identify instances where the forecast hourly load for the area exceeds the level obtained in step 2. Record relevant data.
4. Repeat steps 2-3 for the various slow response resource amount scenarios
5. Repeat steps 2-4 for each LCA and sub area to be assessed



Study Sequence – Step 2 (ISO)

1. Get hourly forecast load data for the LCR area or sub-area under consideration
2. Starting from the marginal 2017 LCR base case reduce online generation in the LCR area by the amount of slow response resource
3. Apply the limiting contingency, which should cause loading, voltage, etc. violation
4. Reduce area load proportionally until the loading, voltage, etc. is acceptable. Record the resulting area load
5. Using a spreadsheet, identify instances where the forecast hourly load exceeds the level obtained in step 4. Record relevant data.
6. Repeat steps 2-5 for the various slow-response resource scenarios
7. Repeat steps 2-6 for each LCR area and sub area to be assessed



SCE/SDG&E Area Results

Adjustment for non-coincident calls among overlapping areas

- A resource located in a sub-area can be called due to need in the sub-area or overlapping LCA and sub-areas
- Non-coincident calls in overlapping areas must be included in the sub-area results where applicable

Resource location	Areas resource can be called for
El Nido	El Nido, Western LA, LA Basin
West of Devers	West of Devers, LA Basin
Valley-Devers	Valley-Devers, LA Basin
Western LA	Western LA, LA Basin
LA Basin	LA Basin

Resource Location	Areas DR can be called for
Rector	Rector, Vestal, Big Creek Ventura
Vestal	Vestal, Big Creek-Ventura
Santa Clara	Santa Clara, Moorpark, Big Creek-Ventura
Moorpark	Moorpark, Big Creek-Ventura
Big Creek - Ventura	Big Creek-Ventura

SCE existing DR with >20 min response time

Program name	Max annual hours	Max event days per month	Max event hours per month	Max event duration in hours	Max events per day	Additional restrictions	MW Capacity
BIP-30	180	10	N/A	6	1	N/A	516
CBP	N/A	N/A	30	4,6,8	1	Monday-Friday, 11 a.m. - 7 p.m.	86
AMP	N/A (varies by contract)						45

Program name	Level of Dispatch	Notification Time	Triggers
BIP-30	System-wide, SubLap, A-Bank	30 minutes	System, local, distribution reliability
CBP	System-wide, SubLap	Day Of: 1 hour, Day Ahead by 3 p.m.	Economic criterion (15,000 Btu/kWh heat rate)
AMP		Day of: 1 hour	varies by contract

SCE slow-response resource amounts assessed, MW

Area	Existing Slow DR	2% of Peak	5% of Peak	10% of Peak
El Nido	34.3 (2.1%)	33.2	83.0	165.9
West of Devers	9.4 (1.3%)	14.4	36.0	72.0
Valley-Devers	18.8 (0.7%)	52.7	131.8	263.6
Western LA Basin	354.9 (3.1%)	230.0	575.1	1150.1
LA Basin	566.7 (3.0%)	374.9	937.3	1874.6
Rector	16.6 (1.5%)	21.9	54.7	109.4
Vestal	27.7 (2.2%	25.7	64.2	128.3
Santa Clara	30.1 (3.7%)	16.3	40.7	81.4
Moorpark	37.5 (2.3%)	32.0	80.1	160.1
Big Creek Ventura	79.7 (1.8%)	86.0	215.0	429.9
Total	646.4	460.9	1152.3	2304.5

- Percentage values are relative to respective area 2017 peak load

Step 1 & 2 area load limits with existing slow DR

Area	Area load MW (A)	Step 1		Step 2	
		Existing Slow DR MW (B)	Area load limit (A-B)	Required load reduction from power flow (C)	Area load limit (A-C)
El Nido *	1,659	34.3	1,625	34.3	1,625
West of Devers *	720	9.4	711	9.4	711
Valley-Devers	2,636	18.8	2,617	N/A	N/A
Western LA Basin	11,501	354.9	11,146	N/A	N/A
LA Basin	18,746	566.7	18,179	N/A	N/A
San Diego	4,817	52	4765	N/A	N/A
Combined LA Basin/San Diego *	23,466	618.7	N/A	1184	22,282
Rector	1,094	16.6	1,077	N/A	N/A
Vestal	1,283	27.7	1,255	N/A	N/A
Santa Clara *	814	30.1	784	34.9	779
Moorpark *	1,601	37.5	1,564	38.6	1562
Big Creek Ventura	4,299	79.7	4,219	N/A	N/A

* Areas further assessed using Step 2.

Step 1 & 2 area load limits with 5% slow resource

Area	Area load MW (A)	Step 1		Step 2	
		5% of Peak Slow DR MW (B)	Area load limit (A-B)	Required load reduction from power flow (C)	Area load limit (A-C)
El Nido *	1,659	83.0	1,576	79	1,580
West of Devers *	720	36.0	684	52	668
Valley-Devers	2,636	131.8	2,504	N/A	N/A
Western LA Basin	11,501	575.1	10,926	N/A	N/A
LA Basin	18,746	937.3	17,809	N/A	N/A
San Diego	4,817	240.8	4,576	N/A	N/A
Combined LA Basin/San Diego *	23,466	1,178	N/A	1,916	21,550
Rector	1,094	54.7	1,039	N/A	N/A
Vestal	1,283	64.2	1,219	N/A	N/A
Santa Clara *	814	40.7	773	51	763
Moorpark *	1,601	80.1	1,521	96	1,505
Big Creek Ventura	4,299	215.0	4,084	N/A	N/A

* Areas further assessed using Step 2.

SCE total annual event hours (3-year max.)

	Existing DR*		2% of Peak		5% of Peak*		10% of Peak	
	Local	Overall	Local	Overall	Local	Overall	Local	Overall
El Nido*	6	10(14)	6	9	17	21(25)	35	44
West of Devers *	3	6(12)	5	5	15(35)	18(36)	74	75
Valley-Devers	3	6(13)	8	11	13	22(29)	20	40
Western LA Basin	7	8(12)	3	6	13	14(22)	32	32
LA Basin*	6(12)	6(12)	5	5	12(22)	12(22)	24	24
Rector	9	14	9	15	17	26	33	57
Vestal	12	14	12	15	22	25	37	55
Santa Clara*	22(26)	26(30)	13	17	26(37)	34(44)	79	90
Moorpark*	3(4)	11(12)	3	13	8(10)	23	26	45
Big Creek Ventura	9	9	11	11	19	19	36	36

* Areas and resource levels further assessed using Step 2. Results are provided in parenthesis where different. Step 2 assessment for LA Basin is based on the combined LA Basin-San Diego LCA.

- BIP-30 ≤ 180 hours/year, RDRR 48 hours per term (June to Sept. & Oct.-May)

SCE maximum monthly event hours (3-year max.)

	Existing DR*		2% of Peak		5% of Peak*		10% of Peak	
	Local	Overall	Local	Overall	Local	Overall	Local	Overall
El Nido*	6	10(14)	6	9	17	21(25)	35	36
West of Devers*	2	6(12)	3	5	10(22)	12(22)	35	35
Valley-Devers	3	6(12)	8	8	13	13(22)	20	28
Western LA Basin	7	8(12)	3	6	13	14(22)	24	25
LA Basin*	6(12)	6(12)	5	5	12(22)	12(22)	24	24
Rector	9	14	9	15	17	26	29	42
Vestal	12	14	12	15	22	25	35	40
Santa Clara*	14(16)	14(16)	9	11	16(23)	19(23)	42	42
Moorpark*	3(4)	9	3	11	8(10)	19	21	34
Big Creek Ventura	9	9	11	11	19	19	34	34

* Areas and resource levels further assessed using Step 2. Results are provided in parenthesis where different. Step 2 assessment for LA Basin is based on the combined LA Basin-San Diego LCA.

- CPB ≤ 30 hours/month

SCE max event duration in hours (3-year max.)

	Existing*		2% of Peak		5% of Peak*		10% of Peak	
	Local	Overall	Local	Overall	Local	Overall	Local	Overall
El Nido*	6	6	6	6	7	7(10)	11	11
West of Devers*	2	4(5)	3	3	4(6)	5(9)	6	9
Valley-Devers	1	4(5)	3	3	4	5(9)	7	9
Western LA Basin	4	4(5)	3	3	5	5(9)	9	9
LA Basin*	4(5)	4(5)	3	3	5(9)	5(9)	9	9
Rector	4	4	4	4	7	7	8	9
Vestal	4	4	4	4	7	7	9	9
Santa Clara*	5	5	4	4	6(10)	6(10)	11	11
Moorpark*	3	3	3	3	5(6)	5(6)	9	9
Big Creek Ventura	3	3	3	3	5	5	8	8

* Areas and resource levels further assessed using Step 2. Results are provided in parenthesis where different. Step 2 assessment for LA Basin is based on the combined LA Basin-San Diego LCA.

- BIP-30 ≤ 6 hours, CPB ≤ 4,6 or 8 hours, RDRR ≥ 4 hours
- This limitation applies to run-time limited fast response resources such as fast DR and battery storage as well

SCE run-time limited resources (MW)

Area	Existing Slow DR	Existing Fast DR	Procured DR & Storage*	Total DR & Storage	Load (2017)	Percent of load
El Nido	34	8	17	60	1659	3.6%
West of Devers	9	10	0	20	720	2.7%
Valley-Devers	19	48	0	67	2636	2.5%
Western LA Basin	355	113	271	739	11,501	6.4%
LA Basin	567	225	271	1063	18,746	5.7%
Rector	17	45	0	62	1,094	5.7%
Vestal	28	60	0	88	1,283	6.8%
Santa Clara	30	5	0	45	814	4.3%
Moorpark	38	13	0	60	1,601	3.1%
Big Creek Ventura	80	123	0	212	4,299	4.7%
Total	646	348	271	1275	23,045	5.5%

* Excludes hybrid gas/battery storage projects

SCE total annual event days (3-year max.)

	Existing DR*		2% of Peak		5% of Peak*		10% of Peak	
	Local	Overall	Local	Overall	Local	Overall	Local	Overall
El Nido*	2	3	2	3	3	4(5)	4	7
West of Devers*	2	3(4)	2	3	5(12)	6(12)	21	21
Valley-Devers	3	5(6)	3	5	4	7(8)	4	10
Western LA Basin	3	3	1	2	3	3(4)	7	7
LA Basin*	2(3)	2(3)	2	2	3(4)	3(4)	6	6
Rector	3	4	3	4	4	6	7	12
Vestal	4	4	4	4	5	6	8	12
Santa Clara*	6	8	6	8	6(7)	8(9)	13	13
Moorpark*	1	5	1	5	2	5	6	8
Big Creek Ventura	4	4	4	4	4	4	6	6

* Areas and resource levels further assessed using Step 2. Results are provided in parenthesis where different. Step 2 assessment for LA Basin is based on the combined LA Basin-San Diego LCA.

- RDRR ≥ 15 events per term (minimum)

SCE maximum monthly event days (3-year max.)

	Existing DR*		2% of Peak		5% of Peak*		10% of Peak	
	Local	Overall	Local	Overall	Local	Overall	Local	Overall
El Nido*	2	3	2	3	3	4	4	4
West of Devers*	1	2(3)	1	2	3(7)	3(7)	9	9
Valley-Devers	3	3	3	3	4	4(5)	4	6
Western LA Basin	3	3	1	2	3	3	4	4
LA Basin*	2(3)	2(3)	2	2	3	3	4	4
Rector	3	4	3	4	4	6	5	7
Vestal	4	4	4	4	5	5	6	7
Santa Clara*	3	4	3	4	3(4)	4	6	6
Moorpark*	1	4	1	4	2	4	4	5
Big Creek Ventura	4	4	4	4	4	4	5	5

* Areas and resource levels further assessed using Step 2. Results are provided in parenthesis where different. Step 2 assessment for LA Basin is based on the combined LA Basin-San Diego LCA.

- BIP-30 ≤ 10 events/month

SDG&E area assessment

Slow resource amounts assessed, MW

LCR Area	Existing Slow DR	2% of Peak	5% of Peak	10% of Peak
San Diego	52 (1.1%)	96	241	482

SDG&E existing DR with >20 min response time

Program name	Max annual hours	Max annual event days	Max annual hours	Max event hours	Max events/day	Additional restrictions	MW Capacity
Summer Saver	60	15	60	4	1	May – October only; 2 minimum hour per event; max 3 in a week	10 MW
Base Interruptible Program	120	120	120	4	1		2 MW
Capacity Bidding Program	264 (May-Oct)	33 to 184 days (depending on how many hours are called per event).	44 hours per month (May-Oct)	4 to 8	1	May-October only	11 MW
Critical Peak Pricing*	126	18	126	7	1		~29 MW
						Total	52 MW

* Currently the impact of the Critical Peak Pricing Program is included in the CEC demand forecast

San Diego area results (3-year max.)

	Slow resource amounts			
	Existing DR*	2% of Peak	5% of Peak*	10% of Peak
Total annual event hours	2 (12)	5	17(22)	34
Monthly maximum event hours	2(12)	5	17(22)	30
Max event duration in hours	2(5)	6	8(9)	10
Total annual event days	1(3)	2	3(4)	6
Monthly maximum event days	1(3)	2	3	4

* Slow-response resource levels further assessed using Step 2. Results are provided in parenthesis. Step 2 assessment is based on the combined LA Basin-San Diego LCA

Conclusions

- Availability needs increase as the amount of DR increases and vary from area to area
- At current levels, most existing slow-response DR resources and the ISO RDRR model appear to have the required availability characteristics needed for local resource adequacy with the exception of run-time duration limitation.
- The most limiting characteristic is the run-time limitation. At current levels, a minimum of 5 hour duration is needed in most areas not taking into account other energy-limited local capacity resources such as fast-response DR and energy storage.

Conclusions – cont'd

- When the amount of slow and fast response energy limited resources is combined the minimum run-time need could reach 9 hours in many areas including LA Basin and San Diego areas.

PG&E Area Results

Existing Sublap DR programs Identified by PG&E with >20 min response time

Program name	Notification time	Max annual hours	Period	Max monthly event days	Days	Max monthly hours	Hours of the day	Max event hours	Capacity MW
BIP	30 m	180	any	10	any	N/A	any	N/A	102.4
CBP	3Hr /1500		5/1-10/31	30	M-F	N/A	11:00 19:00	1-6	14.1
SmartAC™	N/A	100	5/1-10/31	N/A	any	N/A	any	6	53.9

Note: Capacity MW represents August 2017 portfolio adjusted 1-in-2 weather conditions. The figures from April 3rd 2017 CPUC Annual DR Load Impacts Filing. They exclude LCRA 'Other' and reflect PG&E peaking conditions.

PG&E slow-response resource amounts assessed, MW

Area	Existing DR	2% of Peak	5% of Peak	10% of Peak
Humboldt	6.0	2.9	7.2	14.4
N Coast & N Bay	11.2	29.4	73.4	146.9
Greater Bay	44.9	162.3	405.7	811.3
Sierra	13.7	23.7	59.4	118.7
Stockton	19.9	25.8	64.5	129.0
Fresno	28.9	63.4	158.4	316.9
Kern	45.8	34.4	86.0	172.0
Total	170.4	323.9	809.8	1619.5

Sierra, Stockton and Kern process book definitions (herein) do not align with local capacity area definitions.

Note: Existing DR represents August 2017 portfolio adjusted 1-in-2 weather conditions under PG&E peaking conditions. The figures from April 3rd 2017 CPUC Annual DR Load Impacts Filing.

Humboldt (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	4	2	4	10
Monthly # of hours	4	2	4	9
Monthly event days	1	1	1	3
Weekend Events	0	0	0	1
Events outside 11-7	1	1	1	4
Days in a row	1	1	1	4
Other	Need is November-March only	Need is November-March only	Need is November-March only	5 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

N Cost & N Bay (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	1	2	3	7
Monthly # of hours	1	2	3	6
Monthly event days	1	1	1	2
Weekend Events	0	0	0	0
Events outside 11-7	0	0	0	0
Days in a row	1	1	1	2
Other	-	-	-	5 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Bay Area (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	2	2	4	20
Monthly # of hours	2	2	4	14
Monthly event days	1	1	1	3
Weekend Events	0	0	0	0
Events outside 11-7	0	0	0	1
Days in a row	1	1	1	2
Other	-	-	-	7 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Sierra (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	2	2	8	16
Monthly # of hours	2	2	8	16
Monthly event days	1	1	3	5
Weekend Events	0	0	0	0
Events outside 11-7	0	0	0	1
Days in a row	1	1	3	5
Other	-	-	-	5 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Stockton (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	3	4	8	20
Monthly # of hours	3	4	8	20
Monthly event days	1	1	3	4
Weekend Events	0	0	0	0
Events outside 11-7	0	0	0	2
Days in a row	1	1	3	4
Other	-	-	-	6 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Fresno (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	4	7	23	41
Monthly # of hours	4	7	23	40
Monthly event days	2	3	5	6
Weekend Events	0	0	0	1
Events outside 11-7	0	0	3	5
Days in a row	1	3	5	6
Other	-	-	6 hours/day	9 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Kern (heat wave over average year)

Parameter	Existing DR	2% of Peak	5% of Peak	10% of Peak
Yearly # of hours	8	5	12	65
Monthly # of hours	7	5	9	27
Monthly event days	2	2	2	8
Weekend Events	0	0	1	1
Events outside 11-7	2	0	2	6
Days in a row	2	2	2	6
Other	-	-	6 hours/day	8 hours/day

Result values do not take into account observed non-coincidence of DR calls among areas and sub areas.

Conclusions

Current programs suitable for:

1. Overall constraints in:
    - North Coast/North Bay,
    - Bay Area,
    - Sierra and
    - Fresno

Current programs not suitable for:

1. Humboldt - due to season and time of need
    - *With exception of BIP*
2. Overall constraints in Stockton and Kern
    - *Due to gross definition mismatch, which would require correcting*
3. Any sub-area constraints
    - *PG&E has indicated that they are not intending to use for sub-areas due to number of sub-areas, sub-area definition and data requirements*
4. Any deficient sub-areas
    - *Events and hours will be grossly understated based upon current methodology*

Other considerations

- Availability requirements increase as the amount of DR (or other slow response resources) counted for local RA increases.
  - Setting a target limit could help in establishing minimum requirements.
- Study assumes critical N-1/N-1 contingencies are monitored in or close to real time in order to pre-dispatch slow-response resources exactly when needed.
  - How precisely can these needs be forecast and the resources dispatched?

Other considerations – cont'd

- The availability results are for local resource adequacy purposes. Upward adjustments may be needed to account for other non-coincident uses:
  - in response to price or triggers
  - for system events or by PTOs for distribution system issues
  - due to planned outages and unforeseen events
  - for program evaluation
- Historical hourly load profiles were used for this study, which does not capture future changes in load shape due to increasing load modifying DR, BTM PV and battery storage charging.

Other considerations – cont'd

- DR contracts typically have a short term and future availability may be impacted as event burden increases. This is a concern in particular in areas where slow-response DR is used to avoid investment in transmission or other assets with longer contract terms.

Study Contacts

PTO	Contact Info.
SCE	Garry Chinn, Transmission Planning, Garry.Chinn@sce.com
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Thank you

Slow Response Local Capacity Resources Technical Study: Party discussion and Q&A panel with participating transmission owners

CAISO, PG&E, SCE, SDGE

California ISO

Proxy Demand Resource (PDR) and Reliability Demand Response Resource (RDRR) slow response barriers

Delphine Hou

Manager, State Regulatory Affairs, CAISO

Transition from planning to market

- Morning presentations reflected a “technical potential” assuming market and administrative barriers do not exist and usage based only on contingency analysis.
- Afternoon presentations discuss the potential options and remaining challenges to reaching the technical potential.
- We will need additional discussions and market experience to understand resource capabilities and market performance. This will help us understand the gap between actual usage and the technical potential.
  - We will need to develop a process to incorporate these lessons learned back into planning analysis.

PDR and RDRR slow response barriers

- Discussion excludes "fast response" resources
- Major issues to address for "slow response" are slightly different between PDR and RDRR
- Observation: many barriers for slow response PDR overlaps with general market barriers.

	≤ 20 minutes ***"fast response"***	**>20 minutes** ***"slow response"***
PDR	Qualifies for local RA	Barriers include: 1. Unable to respond to 5 minute dispatch / discrete dispatch 2. Need a notification time with no load drop 3. Pmin may be zero 4. Uncertain of commitment costs (start-up and minimum load) 5. "Pre-dispatched" for contingency 6. Others? *Potential solution with import/export options*
RDRR	Qualifies for local RA	Barriers include: 1. Unable to respond to 5 minute dispatch 2. Need a notification time with no load drop 3. "Pre-dispatched" for contingency 4. Others? *Significant barriers from Settlement Agreement*

PDR and RDRR slow response barriers (cont'd)

- For PDR, CAISO has an idea for stakeholders to consider, which leverages existing policy and functionality:
  - CAISO believes that the proposal (presented next) may successfully address the barriers listed for slow response PDR and for fast-response PDR resources that are facing similar market challenges.
  - Additional market rule changes may be needed.
- For RDRR, CAISO would like to walk through the barriers in greater detail to understand where opportunities may exist for change.

California ISO

ISO's 15-minute market and bidding options for real-time imports and exports

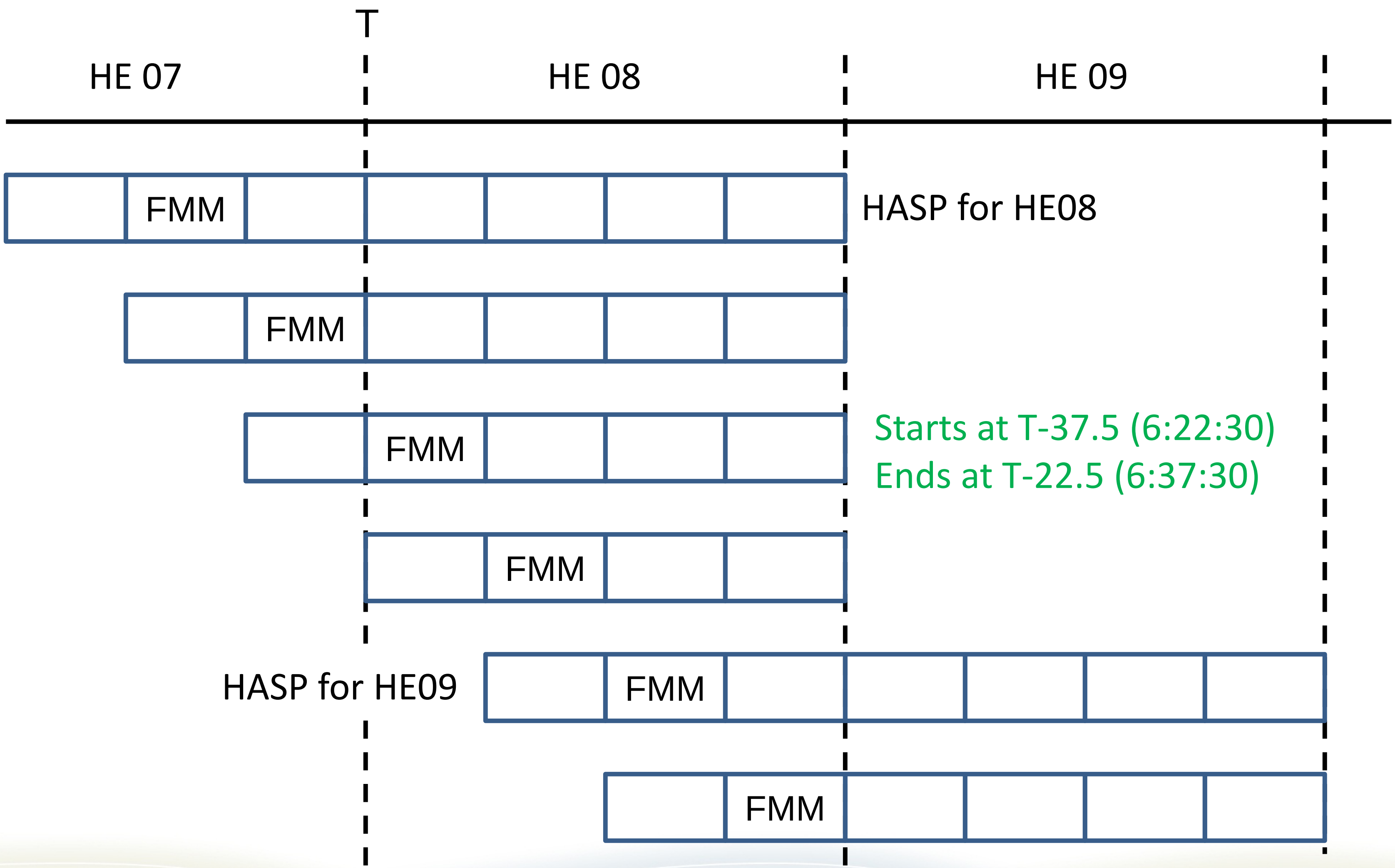
Don Tretheway
Senior Advisor, Market Design Policy, CAISO

October 4, 2017

15-Minute Market fine tunes day-ahead schedules to meet actual system conditions

- Multi-interval optimization with 15-minute granularity
  - 7 to 4 intervals
- Clears imports, exports and generation against ISO forecasted demand
- Procures incremental ancillary services
- Commits short start units and introduces the flexible ramping products
- 15-minute deviations from DA hourly schedule paid 15-minute LMP

15-minute market (FMM) provides binding awards 22.5 minutes prior to flow



With introduction of FMM in Spring 2014, the ISO expanded economic bidding options to imports/exports

- Hourly block
- Hourly block with a single intra-hour economic schedule change
- 15-minute dispatchable

FERC Order No. 764 did not change the WECC tagging deadline.
Market results needed before T-20 tagging deadline.

Hourly block bid option allows an hourly schedule, but does not have price certainty

- RT bids for the hour submitted at T-75
- In hour ahead schedule process, enforce constraint that all 4 15-minute intervals must be at the same MW quantity
- If economic over hour, receives a binding hourly schedule. Prices are advisory.
- Binding schedule communicated 52.5 minutes prior to flow
- In binding FMM run, the schedule is a price taker

Hourly block with single schedule change bid option allows an hourly schedule with <u>some</u> price certainty

- RT bids for the hour submitted at T-75
- In FMM, enforce constraint that all remaining 15-minute intervals in the hour must be at the same MW quantity
- If economic over remainder hour, receives a binding schedule at FMM price in binding interval, advisory for remaining intervals
- Binding schedule communicated 22.5 minutes prior to flow
- In remaining FMM runs, the schedule is a price taker

15-minute dispatchable schedules have price certainty

- RT bids for the hour submitted at T-75
- If economic in FMM, receives a binding schedule at FMM price
- Binding schedule communicated 22.5 minutes prior to flow
- Eligible for bid cost recovery

Interties assumed to have infinite ramp rates

- Results in block energy
- If scheduled at 120 MW for 15-minute interval,
  - Instructed imbalance energy (IIE) is 10 MWh for each 5-minute interval in the 15-minute interval
- Differences between instructed imbalance energy and meter uninstructed imbalance energy (UIE)
  - Settled at the RTD price for the five-minute interval
  - Flexible ramping cost allocated based on UIE
  - May also be subject to other uplift costs

Links to additional information

- FERC Order No. 764 initiative webpage
  - http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedClosedStakeholderInitiatives/FERCOrderNo764MarketChanges.aspx
- Settlement examples
  - Hourly block tab
  - 15-minute tab
  - Dynamic transfer tab (settlement of internal resource)
  - Doesn’t have the one and done option
  - http://www.caiso.com/Documents/RevisedSettlementExamples-FERCOrderNo764.xls

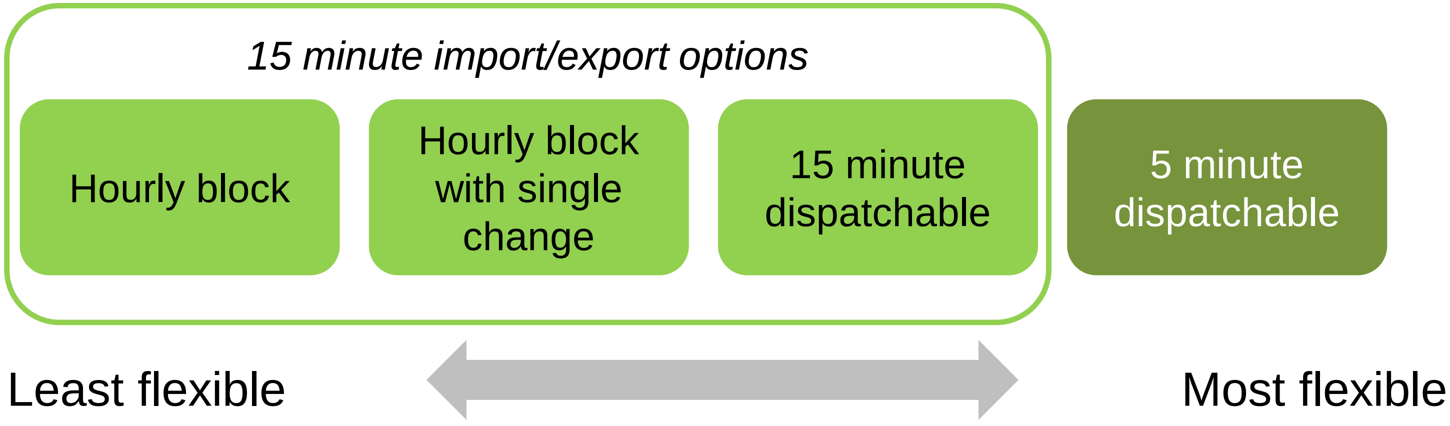
PDR discussion: Party discussion on feasibility of import/export options for PDR

All, moderated by CAISO and CPUC

Introduction by Delphine Hou, Manager, State Regulatory Affairs, CAISO

Benefits of leveraging import/export options

- Functionality already exists – though only available for imports/exports
  - Would need tariff change
- Modeling of PDR remains largely the same
- Is presented as an option for all PDR, in addition to current model and generator bidding parameters
- Continuum of real-time dispatch options for PDR



Have slow response PDR barriers been addressed?

Red font text is revised from 10/4 version.

	Slow response PDR barriers	Import/export option offers:	Comments
1	Unable to respond to 5 minute dispatch / discrete dispatch	3 additional options: hourly block, hourly with single change, 15 minute	• Bidding can be in one or more segments and will be dispatched as block energy per segment. • There may be instances of marginal dispatch. • 15 min dispatch uses MasterFile ramp rate but hourly block is infinite ramp rate. • Would make the "min run time" field more relevant
2	Need a notification time with no load drop	22.5 minute notification (52.5 minute if hourly block)	~~This leads to a natural dividing line where:~~ ~~≤ 22.5 min = fast~~ ~~>22.5 min = slow~~
3	Pmin may be zero	Pmin is not modeled	n/a
4	Uncertain of commitment costs (start-up and minimum load)	Pmin is not modeled	Optimization will still use ramp rate in MasterFile

- Barriers listed above may also affect fast response PDR.

Have slow response PDR barriers been addressed?

	Slow response PDR barriers	Import/export option offers:	Comments
5	“Pre-dispatched” for contingency	Real-time bidding to meet RA MOO	Requires additional policy change (see below)
6	Others?	?	?

“Pre-dispatched” for contingency

- For local area contingencies, the CAISO uses the minimum online commitment (MOC) constraint in the integrated forward market (IFM) to commit resources.
  - Similarly, the residual unit commitment process may commit resources.
- Once committed, the resources must submit economic bids into the real-time market per resource adequacy policy.
- For vast majority of PDR, the start-up times are short enough that the resource is reoptimized in the real-time.
- Proposed policy change: If MOC commits resource regardless of start-up time, the resource has “binding” commitment and a real-time must offer obligation (MOO). This would apply to all resources, not just PDR. PDR resources can use the intertie scheduling options to meet their MOO.

REMOVE SLIDE

Questions for parties

- Would applying the import/export option help some PDR programs operate better in the market and count towards local RA?
- How many MWs of PDR would benefit from the import/export option?
- Are there other barriers we haven't addressed?
- Complications or new issues?
- Others?

RDRR slow response barriers

- Of all the barriers, the most significant for CAISO is the Settlement Agreement which would preclude any "pre-dispatch" of the resource.

	>20 minutes ***"slow response"***
RDRR	Barriers include: 1. Unable to respond to 5 minute dispatch 2. Need a notification time with no load drop 3. "Pre-dispatched" for contingency 4. Others?

Limitations for CAISO under RDRR

- Per the Settlement Agreement, for CAISO to use RDRR for reliability, we must declare a 'Warning' or 'Emergency Stage'
- See: http://www.caiso.com/Documents/4420.pdf
  - **Warning** - The ISO issues a Warning notice when the Real-Time Market run results indicate that Contingency Reserves are anticipated to be less than Contingency Reserve requirements and further actions are necessary to maintain the Contingency Reserve requirements.
  - **Stage 1** - The ISO issues an Emergency Stage 1 when Contingency Reserve shortfalls exist or are forecast to occur, and available market and non-market resources are insufficient to maintain Contingency Reserve requirements.
  - **Stage 2** - The ISO issues an Emergency Stage 2 when it has taken all actions listed above and cannot maintain its Non-Spinning Reserve requirement as indicated by the EMS system.
  - **Stage 3** - The ISO issues an Emergency Stage 3 when the Spinning Reserve portion of the Contingency Reserve depletes, or is anticipated to deplete below the Contingency Reserve requirement and cannot be restored. The Contingency Reserve requirement states that Spinning Reserve shall be no less than 50% of the total Contingency Reserve requirements.

Limitations for CAISO under RDRR (cont'd)

- Does not make sense to call a 'Warning' or 'Emergency Stage' in the day-ahead market so that RDRR can be "pre-dispatched"
- Calling a 'Warning' or 'Emergency Stage' sets off reporting requirements:
  - NERC/WECC standards dictate that when an ISO declares an "Emergency," the ISO must report to our reliability coordinator (Peak Reliability) and it is seen as a declaration that the CAISO does not have sufficient resources to manage grid conditions.
  - CAISO reports to Peak Reliability any time there is an Emergency declaration and this in turn goes into metrics measuring CAISO against other ISOs.
  - See: http://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-011-1.pdf

RDRR discussion: Party discussion of limitations and possibilities

All, moderated by CAISO and CPUC

Next steps

Bruce Kaneshiro, Program Manager for the Demand Response, Customer Generation and Retail Rates Branch, CPUC

John Goodin, Manager, Infrastructure and Regulatory Policy, CAISO

Next steps

- PDR Issues: what actions/work can be undertaken in the next 3-4 months with regard to the CAISO proposal and stakeholder comments on that proposal?
- RDRR Issues: what actions/work can be undertaken in the next 3-4 months with regard to the discussion on the limitations and possibilities for RDRR resources?
- Another workshop is likely needed. What topics should be covered then?
- Please submit comments on the workshop to regionaltransmission@caiso.com by close of business October 18.