

RESOURCE ADEQUACY WORKING GROUP DEMAND RESPONSE

SEPTEMBER 16, 2021

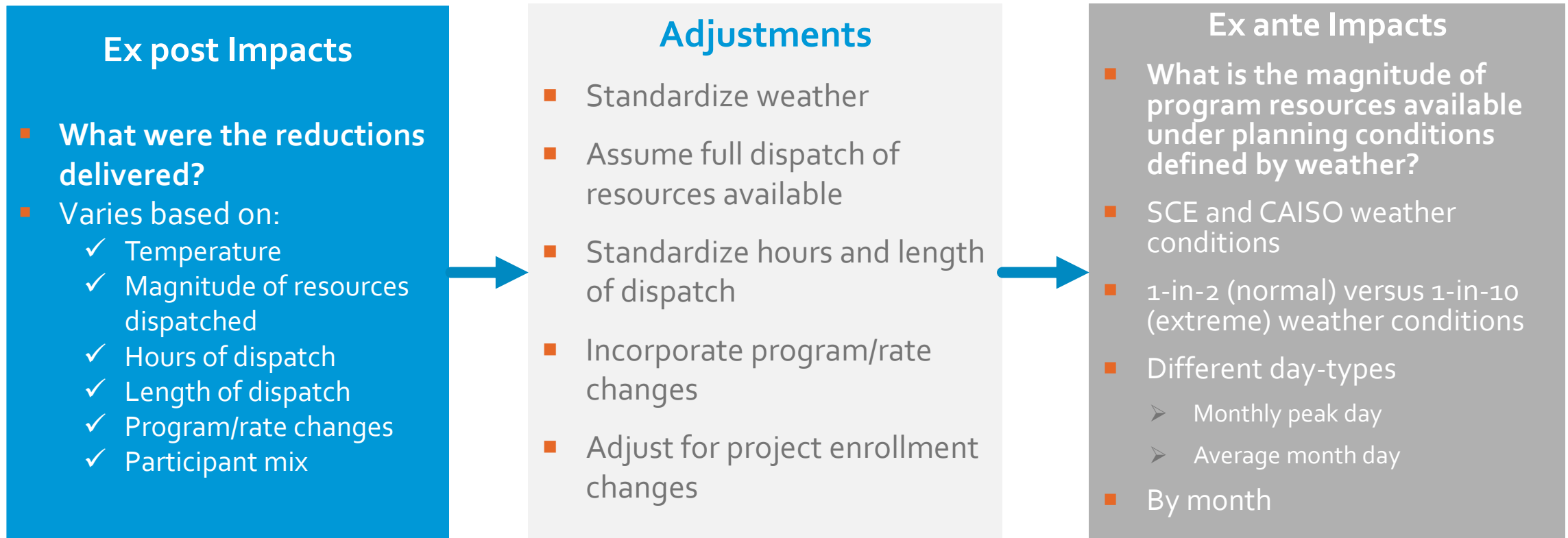


OVERVIEW

- What is currently produced?
- What modifications are needed to align with the slice-of-day framework?

WHAT IS CURRENTLY PRODUCED?

THE CURRENT PROCESS REQUIRES STANDARDIZED OUTPUTS OF DEMAND REDUCTIONS FOR ACTUAL EVENTS AND PLANNING CONDITIONS



When possible, ex ante impacts are based on multiple years of historical performance during actual events

EX-POST IMPACTS RECORD THE HOURLY CHANGE IN LOADS FOR EACH DR EVENT CALLED

Southern California Edison

PY2020 Summer Discount Plan - Residential Ex Post

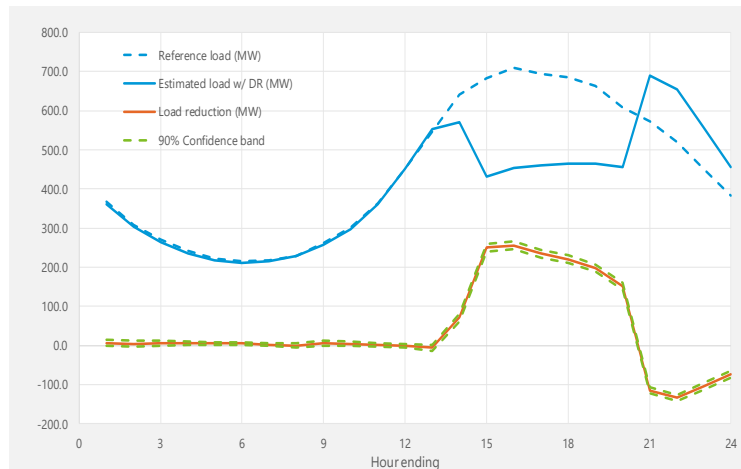


Table 1: Menu options

Program	SDP-R
Type of result	Aggregate
Category	ALL
Subcategory	All
Event date and hours	2020-08-18 (13:40-19:48 PM)

Table 2: Event day information

Event start	1:40 PM
Event end	7:48 PM
Total sites	199,557
Total devices	232,734
Total AC tonnage	845,367
Daily maximum temperature	102.6
Full event hours load reduction (MW)	232.08
Full event hours % load reduction	33.7%
All event hours load reduction (MW)	197.60
All event hours % load reduction	29.5%



Hour ending	Reference load (MW)	Estimated load w/ DR (MW)	Load reduction (MW)	% Load reduction	Avg temp (F, site weighted)	Uncertainty adjusted impact - Percentiles							Std. error	T-statistic
						5th	10th	30th	50th	70th	90th	95th		
1	366.65	360.12	6.53	1.8%	80.84	-0.88	0.76	4.17	6.53	8.90	12.31	13.95	4.51	1.45
2	308.05	303.65	4.40	1.4%	79.91	-2.77	-1.18	2.12	4.40	6.69	9.99	11.57	4.36	1.01
3	269.63	263.61	6.01	2.2%	78.85	0.09	1.40	4.12	6.01	7.90	10.63	11.93	3.60	1.67
4	242.15	236.22	5.93	2.4%	77.73	1.09	2.16	4.39	5.93	7.48	9.71	10.78	2.95	2.01
5	222.43	217.56	4.87	2.2%	76.92	0.83	1.72	3.58	4.87	6.16	8.02	8.91	2.46	1.98
6	215.20	210.46	4.75	2.2%	76.54	0.86	1.72	3.51	4.75	5.99	7.78	8.64	2.36	2.01
7	216.84	214.49	2.35	1.1%	76.36	-2.03	-1.06	0.95	2.35	3.74	5.76	6.73	2.66	0.88
8	228.55	228.70	-0.15	-0.1%	76.26	-5.07	-3.98	-1.72	-0.15	1.42	3.68	4.77	2.99	-0.05
9	262.10	256.57	5.53	2.1%	78.30	-0.22	1.05	3.70	5.53	7.36	10.01	11.28	3.50	1.58
10	301.53	297.01	4.52	1.5%	83.13	-1.65	-0.29	2.55	4.52	6.49	9.34	10.70	3.76	1.20
11	363.25	361.79	1.46	0.4%	88.84	-3.04	-2.04	0.03	1.46	2.89	4.96	5.96	2.73	0.53
12	451.15	452.61	-1.46	-0.3%	93.72	-5.96	-4.96	-2.89	-1.46	-0.03	2.04	3.04	2.73	-0.53
13	546.71	552.82	-6.10	-1.1%	97.45	-14.47	-12.62	-8.77	-6.10	-3.44	0.42	2.27	5.09	-1.20
14	641.57	570.71	70.86	11.0%	101.11	61.29	63.40	67.81	70.86	73.91	78.31	80.43	5.82	12.18
15	683.01	432.55	250.46	36.7%	101.78	240.43	242.64	247.26	250.46	253.65	258.27	260.48	6.10	41.08
16	710.12	453.96	256.16	36.1%	102.55	245.48	247.83	252.75	256.16	259.56	264.48	266.84	6.49	39.45
17	694.41	459.78	234.64	33.8%	99.99	224.29	226.57	231.34	234.64	237.94	242.70	244.98	6.29	37.30
18	686.29	465.77	220.52	32.1%	97.35	210.27	212.54	217.25	220.52	223.78	228.50	230.76	6.23	35.41
19	664.60	465.98	198.62	29.9%	94.96	189.73	191.70	195.79	198.62	201.45	205.54	207.50	5.40	36.77
20	608.06	456.14	151.93	25.0%	91.92	143.01	144.98	149.08	151.93	154.77	158.87	160.84	5.42	28.03
21	574.07	689.24	-115.18	-20.1%	87.97	-123.35	-121.54	-117.78	-115.18	-112.57	-108.81	-107.01	4.97	-23.19
22	521.13	655.03	-133.91	-25.7%	85.33	-142.01	-140.22	-136.49	-133.91	-131.33	-127.60	-125.81	4.92	-27.20
23	452.38	557.44	-105.06	-23.2%	83.61	-113.95	-111.99	-107.90	-105.06	-102.23	-98.14	-96.17	5.40	-19.44
24	382.90	456.86	-73.96	-19.3%	82.25	-82.21	-80.38	-76.59	-73.96	-71.33	-67.53	-65.70	5.02	-14.74
Daily kWh	Reference load (MWh)	Estimated load w/ DR (MWh)	Energy savings (MWh)	% Change	Avg. Daily Weighted temp (F)	Uncertainty adjusted impact - Percentiles							Std. error	T-statistic
Daily kWh	10612.77	9619.07	993.71	10.3%	87.24	956.59	964.79	981.87	993.71	1005.54	1022.62	1030.82	22.56	44.04

- Produced for all programs since 2008
- Relies on evaluation methods, which often include accuracy tournaments and matched controls with difference in differences.
- Can differ from CAISO settlement which uses and easy to understand but less accurate heuristics

EX-ANTE IMPACTS RECORD THE RESOURCE CAPABILITY UNDER PLANNING CONDITIONS

Southern California Edison
 PY2020 Summer Discount Plan - Residential Ex Ante

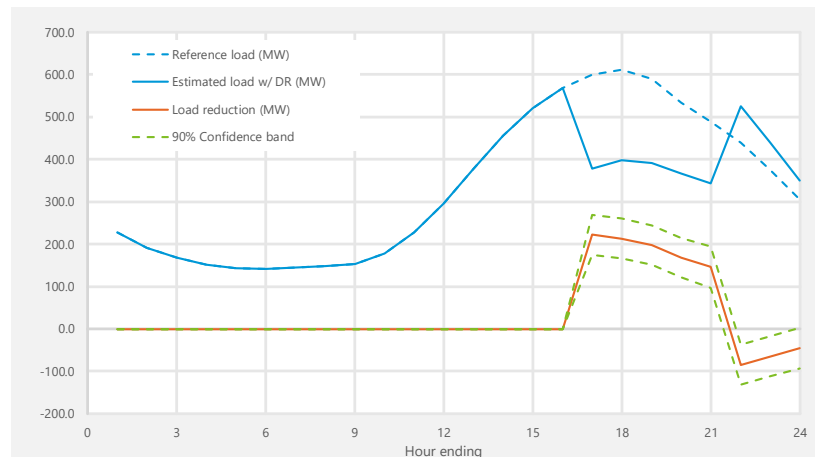


Table 1: Menu options

Program	SDP-R
Type of result	Aggregate
Category	ALL
Subcategory	All
Weather Data	SCE Weather
Weather Year	1-in-10
Day Type	MONTHLY SYSTEM PEAK DAY
Month	8
Forecast Year	2021

Table 2: Event day information

Event start	4:00 PM
Event end	9:00 PM
Total sites	189,795
Total devices	221,618
Total AC tonnage	808,299
Event window temperature (F)	96.2
Event window load reduction (MW)	189.41
% Load reduction (Event window)	33.5%
COVID Index	0.50



Hour ending	Reference load (MW)	Estimated load w/ DR (MW)	Load reduction (MW)	% Load reduction	Avg temp (F, site weighted)	Customer adjusted impact - Percentiles		Std. error	T-statistic
						5th	95th		
1	227.37	227.37	0.00	0.0%	81.41	0.00	0.00	0.00	0.00
2	191.07	191.07	0.00	0.0%	79.87	0.00	0.00	0.00	0.00
3	167.61	167.61	0.00	0.0%	78.56	0.00	0.00	0.00	0.00
4	151.48	151.48	0.00	0.0%	77.15	0.00	0.00	0.00	0.00
5	142.83	142.83	0.00	0.0%	76.02	0.00	0.00	0.00	0.00
6	142.06	142.06	0.00	0.0%	75.10	0.00	0.00	0.00	0.00
7	145.06	145.06	0.00	0.0%	74.06	0.00	0.00	0.00	0.00
8	147.49	147.49	0.00	0.0%	74.05	0.00	0.00	0.00	0.00
9	152.52	152.52	0.00	0.0%	76.91	0.00	0.00	0.00	0.00
10	178.66	178.66	0.00	0.0%	82.29	0.00	0.00	0.00	0.00
11	227.90	227.90	0.00	0.0%	88.22	0.00	0.00	0.00	0.00
12	296.21	296.21	0.00	0.0%	92.48	0.00	0.00	0.00	0.00
13	377.73	377.73	0.00	0.0%	94.90	0.00	0.00	0.00	0.00
14	456.08	456.08	0.00	0.0%	96.75	0.00	0.00	0.00	0.00
15	519.70	519.70	0.00	0.0%	98.29	0.00	0.00	0.00	0.00
16	568.72	568.72	0.00	0.0%	99.41	0.00	0.00	0.00	0.00
17	600.33	378.26	222.07	37.0%	98.85	175.41	268.74	28.37	7.83
18	611.38	398.05	213.33	34.9%	98.67	166.78	259.88	28.30	7.54
19	589.55	391.52	198.03	33.6%	97.63	151.54	244.52	28.26	7.01
20	533.92	366.08	167.84	31.4%	94.78	121.34	214.34	28.27	5.94
21	488.61	342.83	145.79	29.8%	90.97	96.89	194.69	29.73	4.90
22	439.99	524.93	-84.94	-19.3%	87.67	-132.36	-37.51	28.83	-2.95
23	374.63	439.37	-64.74	-17.3%	85.09	-112.11	-17.36	28.80	-2.25
24	304.97	350.65	-45.69	-15.0%	83.43	-93.14	1.77	28.85	-1.58
Daily kWh	Reference load (MWh)	Estimated load w/ DR (MWh)	Energy savings (MWh)	% Change	Avg. Daily Weighted temp (F)	Customer adjusted impact - Percentiles		Std. error	T-statistic
	8035.86	7284.16	751.70	10.3%	86.77	618.27	885.13	81.12	9.27

- Produces hourly results by hour and month
- Factors in:
 - ✓ Load shape
 - ✓ Spillover effects – pre-cooling, snapback, and/or reduction persistence.
 - ✓ Decay across the event window
- Produced in aggregate (MW) and per customer (kW)
- Produced for IOU specific and CAISO weather
- 1-in-2 and 1-in-10 monthly system peak condition

Although hourly results are available, the CPUC currently uses the average from 4-9 pm under 1-in-2 conditions for resource adequacy

THEY INCLUDE THE LOAD SHAPE, WEATHER SENSITIVITY, AND SPILLOVER EFFECTS (WHETHER POSITIVE OR NEGATIVE)

PG&E Base Interruptible Program (BIP) for PY2020: Ex-Ante Analysis

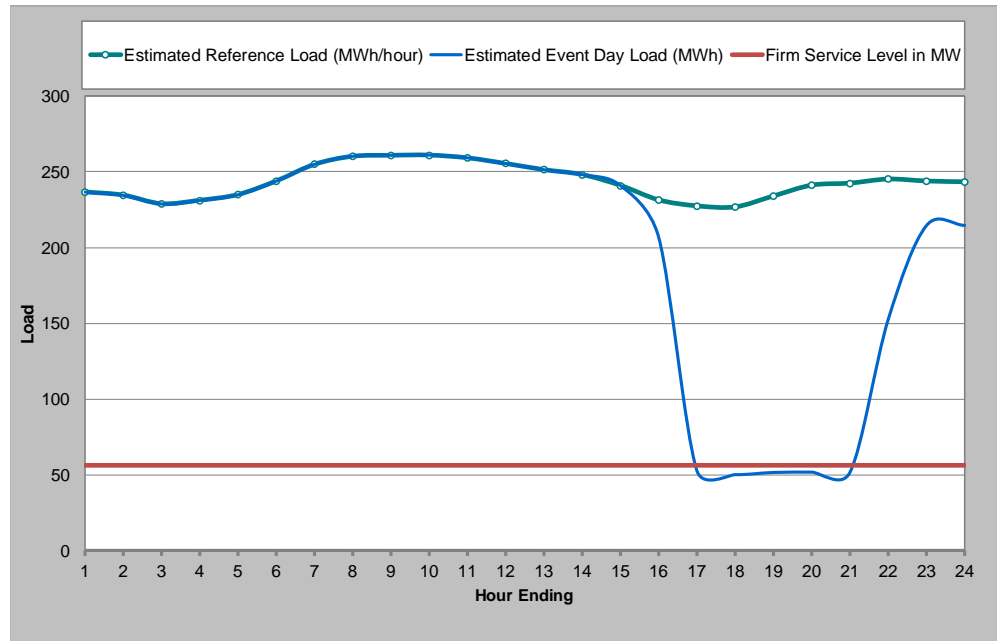


Menu Options:

Type of Results:	Aggregate Impact
Day Type:	AUG monthly peak
Forecast Year:	2021
Weather Year:	Utility 1-in-2
Impact Level:	Portfolio-level impacts
Local Capacity Area:	All
Size Group:	All

Event Day Information:

Event Hours	Hours Ending 17 to 21
Heat Buildup (Avg. °F, 12 AM to 5 PM)	82
Number of Accounts Enrolled	308
Firm Service Level in MW	56
Event Hour Reference Load	234
Avg. Load Reduction for Event Window (MW)	183
% Load Reduction for Event Window	78%
Program FSL Achievement Rate	102%



Hour Ending	Estimated Reference Load (MWh/hour)	Estimated Event Day Load (MWh)	Estimated Load Impact (MWh/hour)	Weighted Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr)- Percentiles				
					10th%ile	30th%ile	50th%ile	70th%ile	90th%ile
1	237	237	0	76	0	0	0	0	0
2	234	234	0	75	0	0	0	0	0
3	229	229	0	73	0	0	0	0	0
4	231	231	0	72	0	0	0	0	0
5	235	235	0	71	0	0	0	0	0
6	244	244	0	70	0	0	0	0	0
7	255	255	0	69	0	0	0	0	0
8	260	260	0	72	0	0	0	0	0
9	261	261	0	76	0	0	0	0	0
10	261	261	0	81	0	0	0	0	0
11	259	259	0	86	0	0	0	0	0
12	255	255	0	90	0	0	0	0	0
13	251	251	0	93	0	0	0	0	0
14	248	248	0	95	0	0	0	0	0
15	241	241	0	97	0	0	0	0	0
16	231	207	25	98	11	19	25	30	38
17	227	53	175	98	170	173	175	177	179
18	227	50	176	97	174	175	176	178	179
19	234	52	182	94	180	181	182	183	185
20	241	52	189	91	186	188	189	190	192
21	242	52	191	86	187	189	191	192	194
22	245	153	93	83	91	92	93	93	94
23	244	214	29	81	27	28	29	30	31
24	243	215	29	79	26	28	29	30	31
	Reference Energy Use (MWh)	Estimated Event Day Energy Use	Change in Energy Use (MWh)	Cooling Degree Hours	Uncertainty Adjusted Impact (MWh/hour) - Percentiles				
					10th	30th	50th	70th	90th
Daily	5,837	4,748	1,088	226	n/a	n/a	n/a	n/a	n/a
RA Window	234	52	183	91	179	181	183	184	186

THE EX-ANTE TABLE PRODUCE RESULTS BY HOUR AND MONTH FOR PEAK LOAD CONDITIONS AND LARGELY ALIGN WITH THE 24-HOUR SLICE OF DAY

Summer Discount Plan Residential 1-in-2 Monthly Peaks

Hour ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	5.5	60.0	66.5	129.8	186.0	197.3	198.8	92.2	52.6	0.1
18	0.0	0.0	3.0	52.3	58.5	121.2	176.8	186.7	189.6	83.8	44.5	0.0
19	0.0	0.0	0.4	40.8	45.2	106.3	161.0	171.3	174.6	70.7	32.8	0.0
20	0.0	0.0	0.0	22.2	23.1	80.0	132.6	144.2	145.6	47.8	16.1	0.0
21	0.0	0.0	0.0	11.6	12.1	63.6	112.0	123.5	124.2	35.2	8.2	0.0
22	0.0	0.0	-3.0	-38.0	-38.6	-42.9	-68.8	-70.0	-78.3	-57.3	-28.6	0.0
23	0.0	0.0	-0.4	-21.6	-21.7	-27.3	-49.3	-51.7	-59.8	-39.5	-16.9	0.0
24	0.0	0.0	0.0	-6.5	-7.3	-12.6	-30.8	-33.1	-39.6	-23.3	-5.6	0.0

WHAT MODIFICATIONS ARE NEEDED TO ALIGN
WITH THE SLICE-OF-DAY FRAMEWORK?

1

Aligning weather conditions with the worst day of the month as defined by the RA working group

2

Allow flexibility to target the DR programs on hours that coincide with the need (don't force everyone into 4-9 pm)

3

Ensure slice of day load impacts factors in:

- Resource shape
- Maximum event duration
- Spillover effects, including pre-cooling, snapback, and/or persistence of impacts beyond dispatch
- Resource decay based on event duration

4

Produce a slice-of-day summary table, so staff doesn't have to search for the information

PRODUCE A SLICE OF DAY TABLE

Hour ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	97.9	186.9	213.7	212.3	0.0	38.4	0.1
18	0.0	0.0	0.0	55.5	64.6	94.2	179.6	203.0	202.7	115.5	36.5	0.0
19	0.0	0.2	0.0	41.4	50.0	78.2	156.1	175.3	176.1	96.1	21.7	0.0
20	0.0	0.5	0.0	27.6	34.8	60.1	127.4	143.7	144.3	74.1	-5.7	0.0
21	0.0	0.0	0.0	24.4	31.0	54.2	112.4	127.3	126.6	65.5	-5.6	0.0
22	0.0	0.0	0.0	22.6	27.9	48.5	98.9	112.8	111.1	57.8	-5.2	0.0
23	0.0	0.0	0.0	-11.1	-13.4	-26.5	-53.1	-60.0	-58.9	-31.3	-4.0	0.0
24	0.0	0.0	0.0	-6.4	-7.8	-17.3	-35.6	-40.0	-39.8	-20.4	-1.9	0.0

Table reflects targeted hours of for RA, but the resources available for



- Table must be produced by hour and month for the worst day of each month as defined in RA working group
- DR providers need flexibility to target the hours that to maximize the coincidence with need
- Slice of day must factor in:
 - ✓ Resource shape
 - ✓ Maximum event duration
 - ✓ Spillover effects, including pre-cooling, snapback, and/or persistence of impacts beyond dispatch
 - ✓ Resource decay based on event duration (e.g., reductions are lower in hour 3 of event)
- Ex-ante impacts are modified so the hourly load impacts for the worst day of the month is and output (and aligns with slice of day)

NEED TO SET SOME MINIMUMS

- Minimum duration of resource capability
- Minimum annual dispatch hours of availability
- Minimum monthly dispatch hours of availability
- Minimum consecutive days available
- Resources must be made available when loads reach 85% of 1-in-2 annual peak (or some other threshold)

QUESTIONS?



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