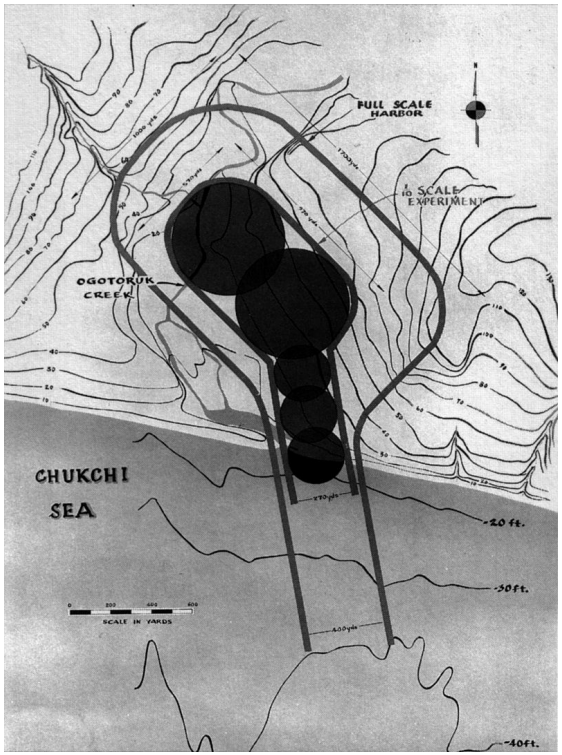
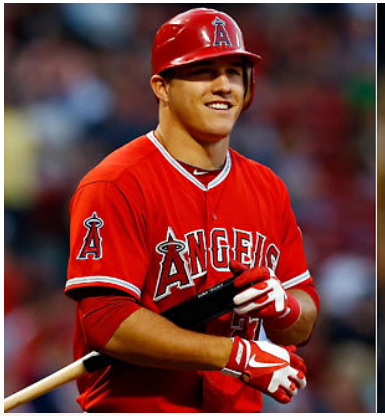
California ISO

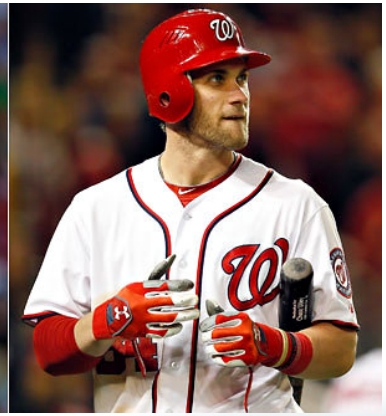
Storage at the Starting Gate

Bill Weaver, Senior Counsel
California Independent System Operator Corp.

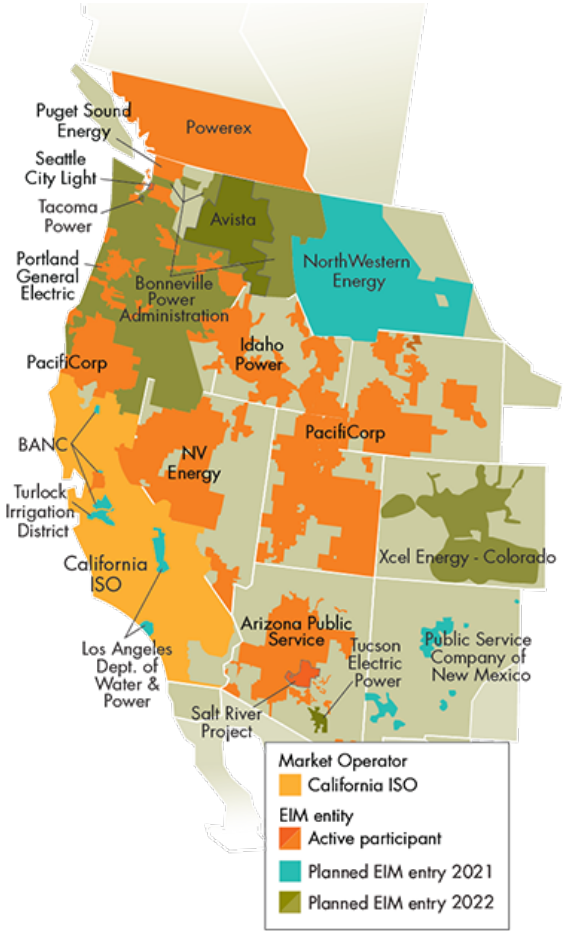
July 16, 2020


FULL SCALE HARBOR
1/10 SCALE EXPERIMENT
OGOTORUK CREEK
CHUKCHI SEA
-20 ft.
-30 ft.
-40 ft.
SCALE IN YARDS





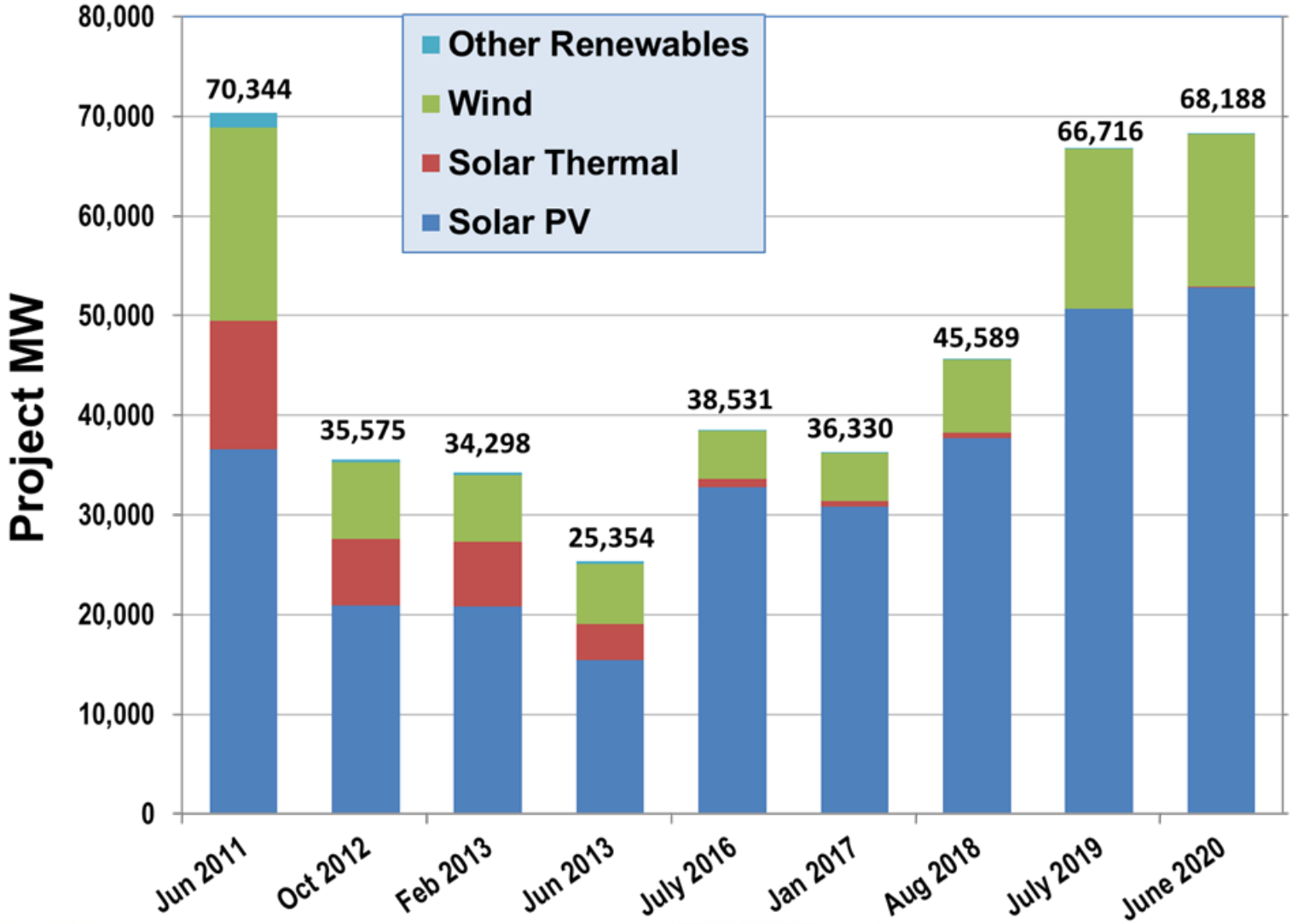
The California Independent System Operator ("CAISO")



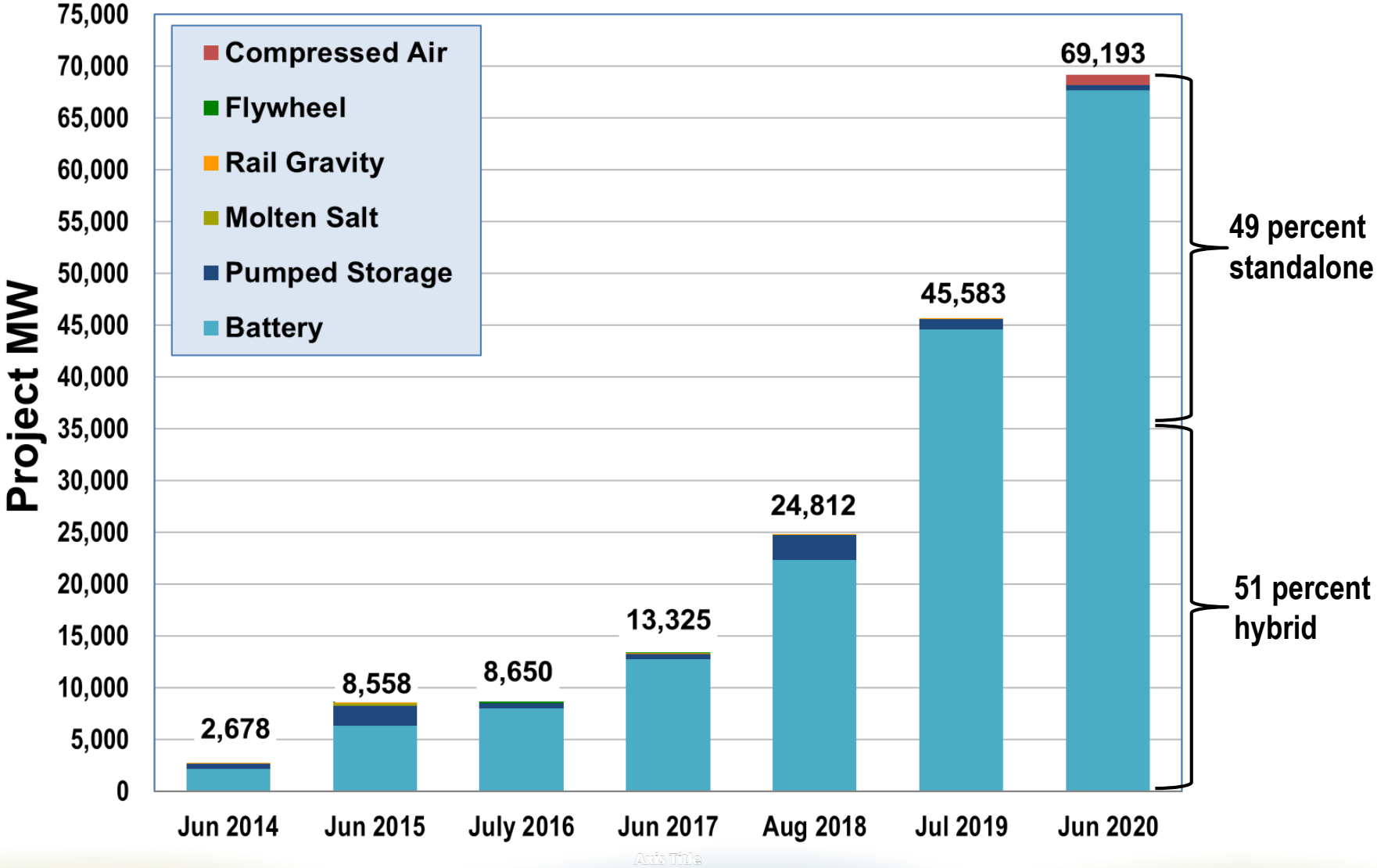
- CAISO administers the wholesale power market for most of California and the West
- Operates the high-voltage transmission grid (peak load was 50,270 MW)
- Oversees future transmission planning and new generator interconnections
- 501(c)(3) public benefit corporation created by CA statute, regulated by the Federal Energy Regulatory Commission
  - (CAISO is not a government agency)

- Currently ~300 MW installed battery capacity + ~2,500 MW of pumped storage capacity

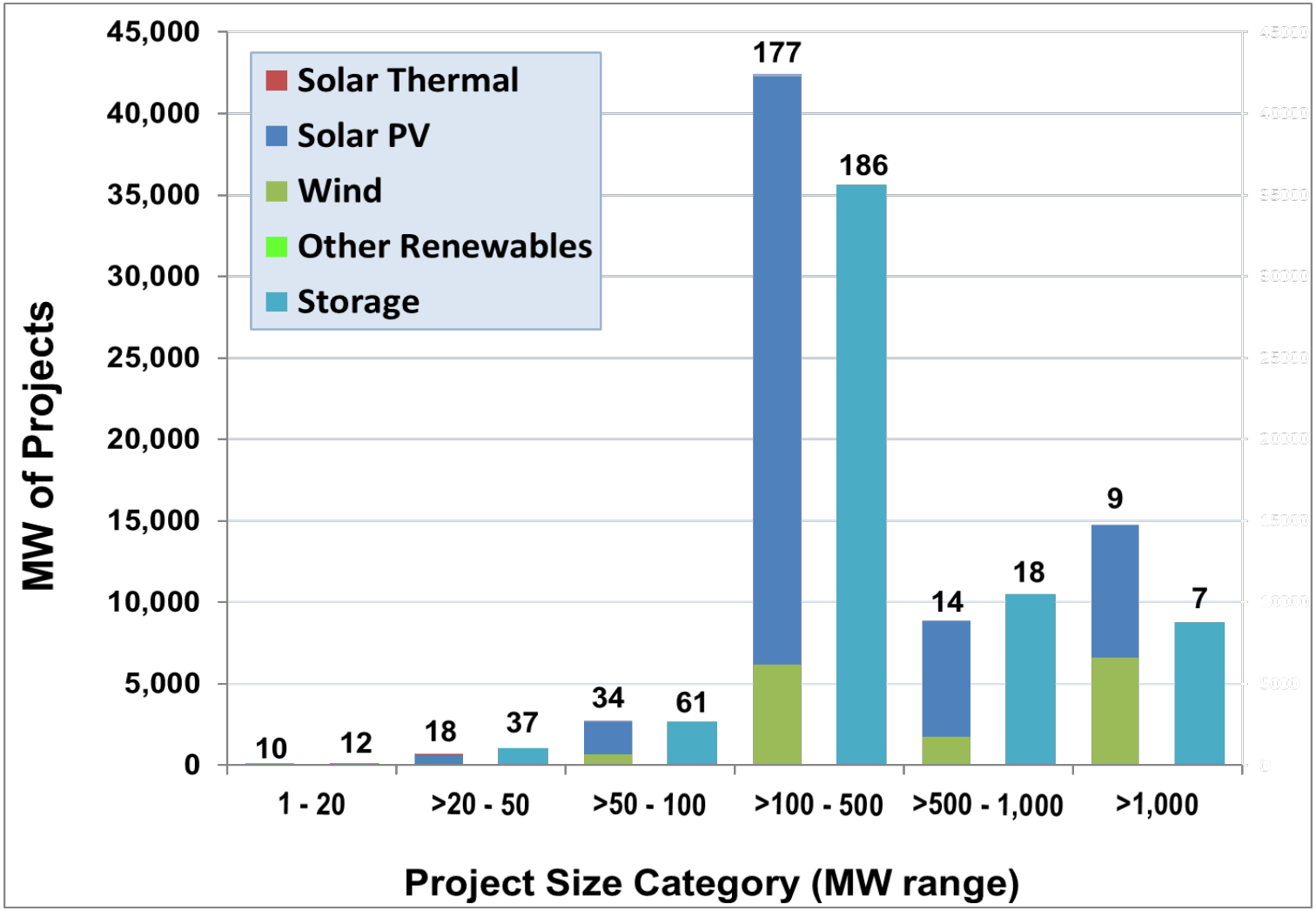
Generator Interconnection Queue: ~91 GW



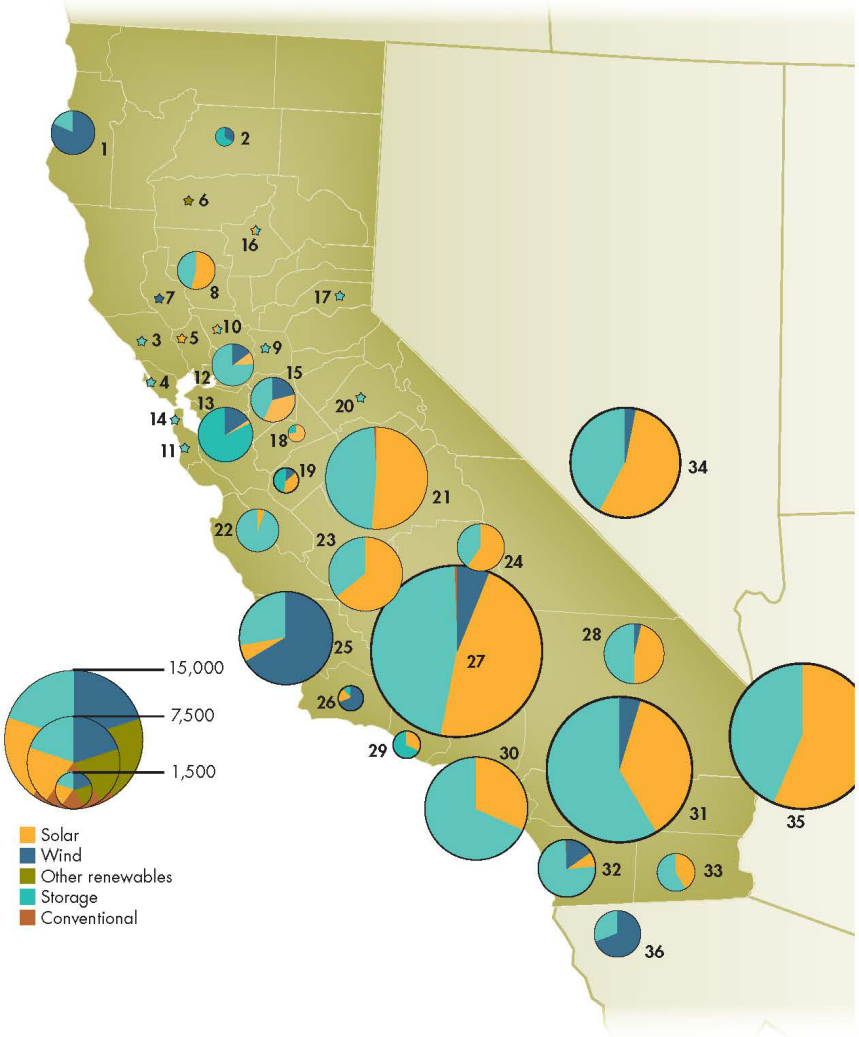
Generator Interconnection Queue: Storage



Generator Interconnection Queue: Project Size



Generator Interconnection Queue

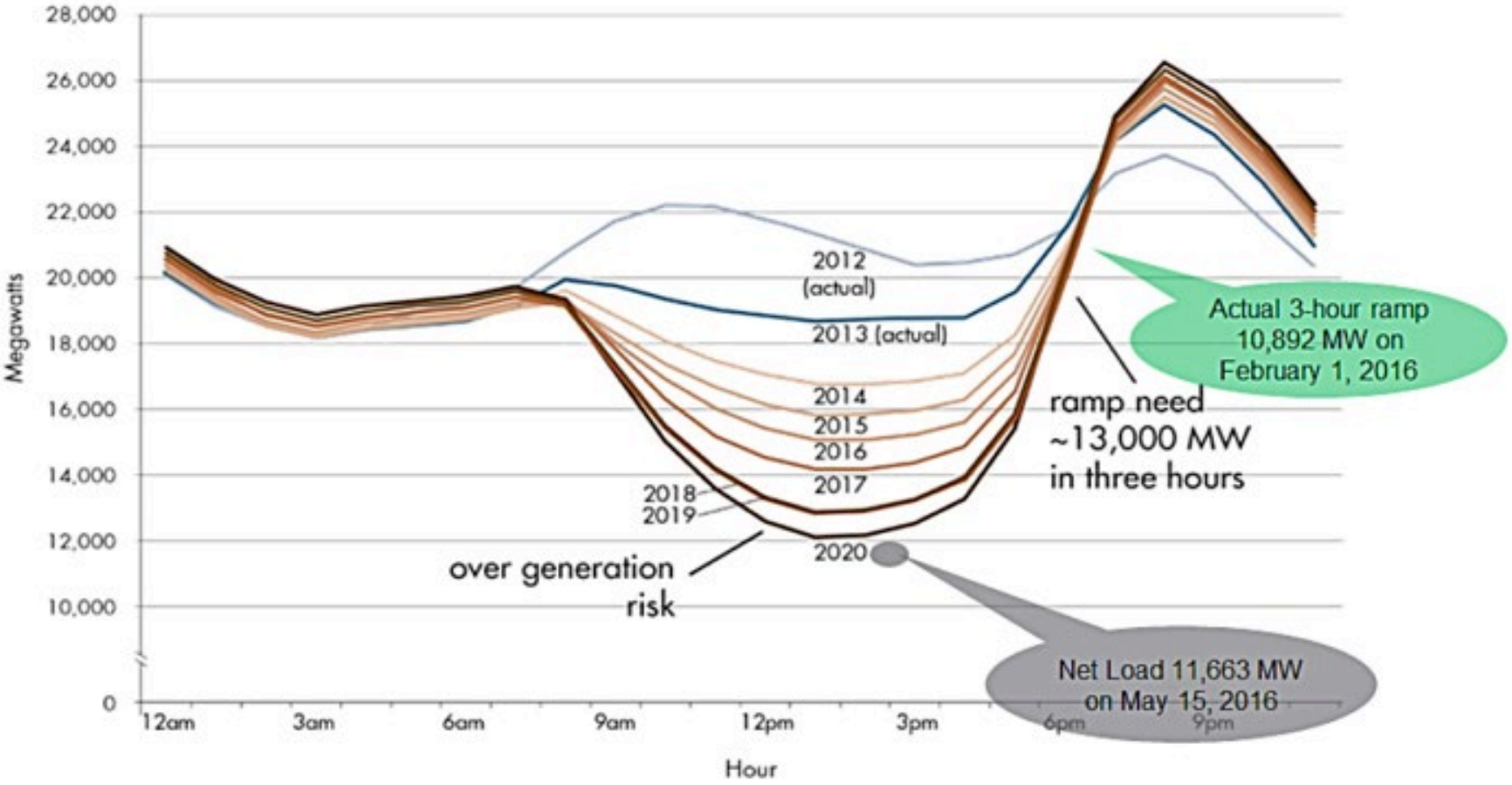


CAISO PUBLIC

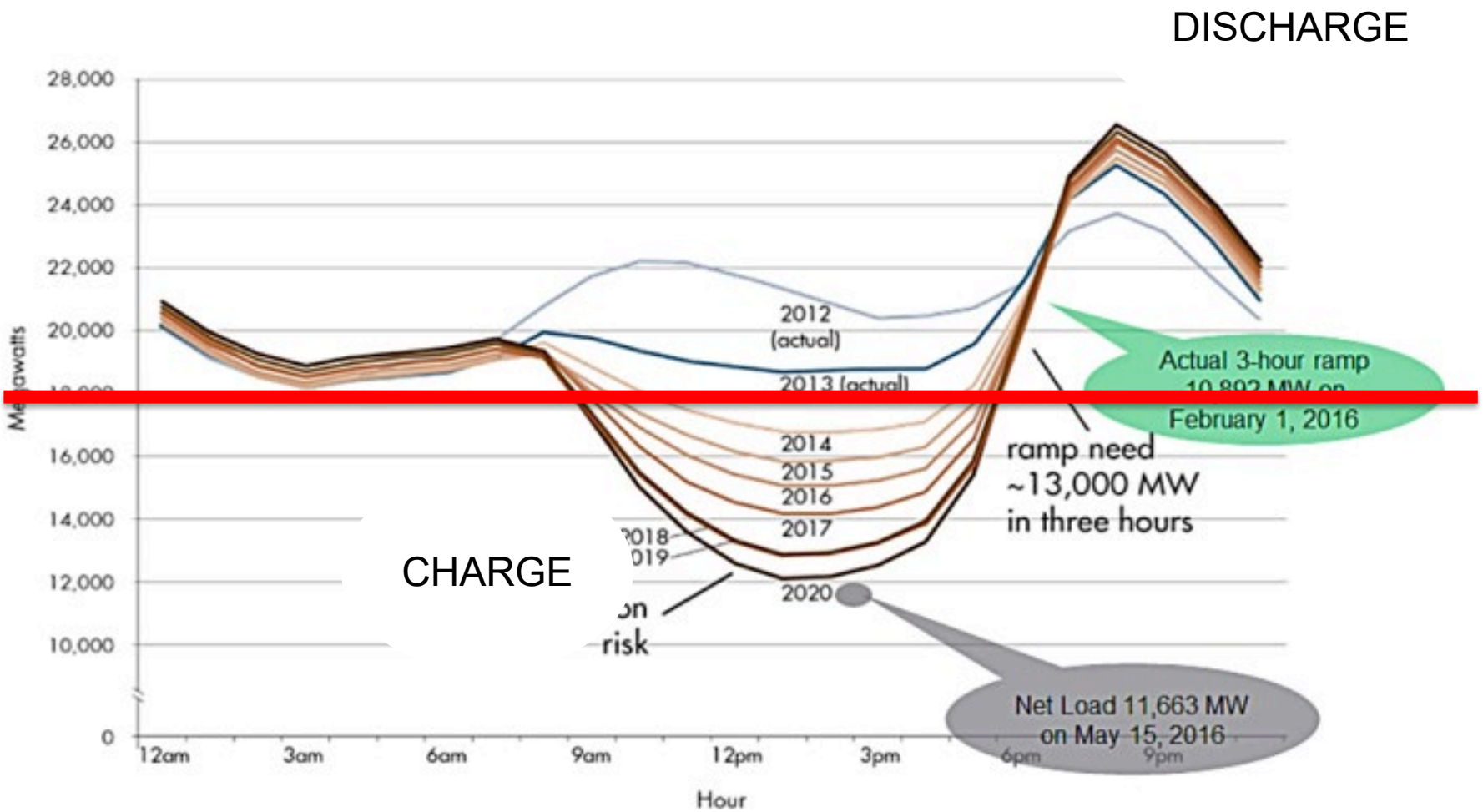
Interconnection queue by county

	County	# of Projects	Megawatts: Renewables	Storage	Conventional	Total
1	Humboldt	5	1,827	410		2,238
2	Shasta	2	206	415		621
3	Sonoma	7		103		103
4	Marin	9		305		305
5	Napa	1	25			25
6	Tehama	6	6			6
7	Lake	3	145	39		184
8	Colusa	9	1,048	890		1,938
9	Sacramento	1		59		59
10	Yolo	8	92	92		184
11	San Mateo	5		254		254
12	Solano	2	521	1,618		2,139
13	Alameda-Contra Costa-Santa Clara	26	734	3,335		4,069
14	San Francisco	40		250		250
15	San Joaquin	9	1,318	1,016		2,334
16	Butte	3	87	189		275
17	Placer	33		102		102
18	Stanislaus	7	341	116		457
19	Merced	6	554	499		1,053
20	Tuolumne	9		10		10
21	Fresno-Madera	38	4,221	3,903	63	8,187
22	San Benito-Monterey	5	115	2,042		2,156
23	Kings	25	3,476	1,937		5,413
24	Tulare-Inyo	12	1,562	1,055		2,618
25	San Luis Obispo	5	5,706	2,190		7,896
26	Santa Barbara	3	978	134		1,111
27	Kern	129	11,818	10,294	109	22,221
28	San Bernardino	29	3,151	3,146	15	6,311
29	Ventura	2	500	1,060		1,560
30	Los Angeles-Orange	20	2,536	5,452		7,988
31	Riverside	31	7,387	10,375		17,762
32	San Diego	30	1,235	3,912	49	5,195
33	Imperial	9	814	1,162		1,976
	In-state Totals	529	50,401	56,363	236	107,000
34	Nevada	32	5,673	4,123		9,796
35	Arizona	37	10,204	7,857		18,061
36	Mexico	8	1,910	850		2,760
	Out-of-state Totals	77	17,787	12,830		30,617
	TOTAL ALL PROJECTS	**606**	**68,188**	**69,193**	**236**	**137,617**

The Duck Curve

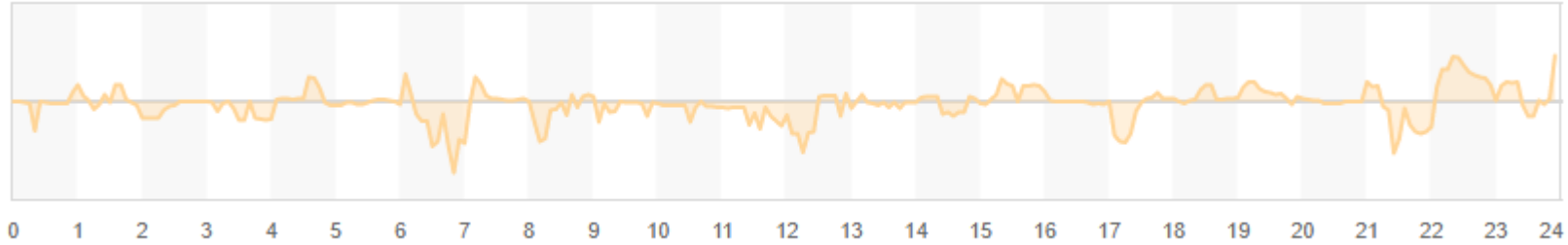


The Duck Curve: Battery Expectation

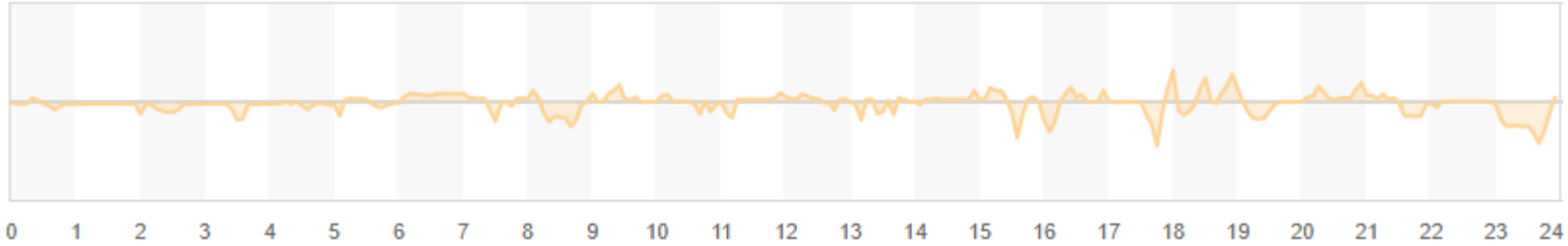


Current Battery Performance

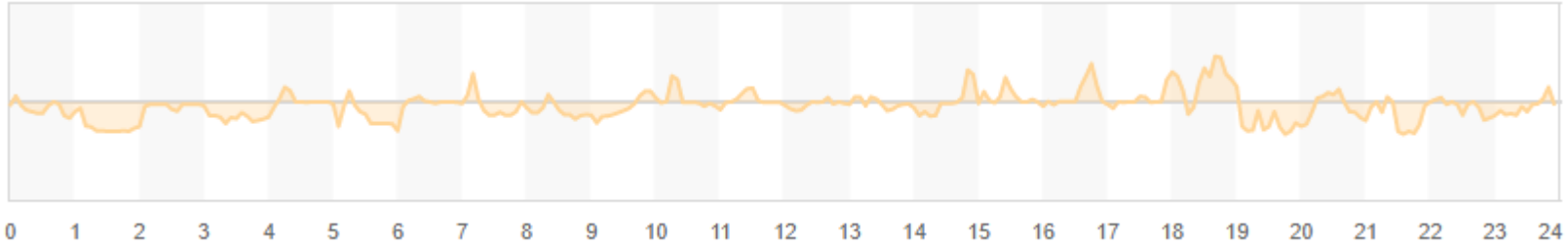
Tuesday, June 16, 2020



Wednesday, April 15, 2020



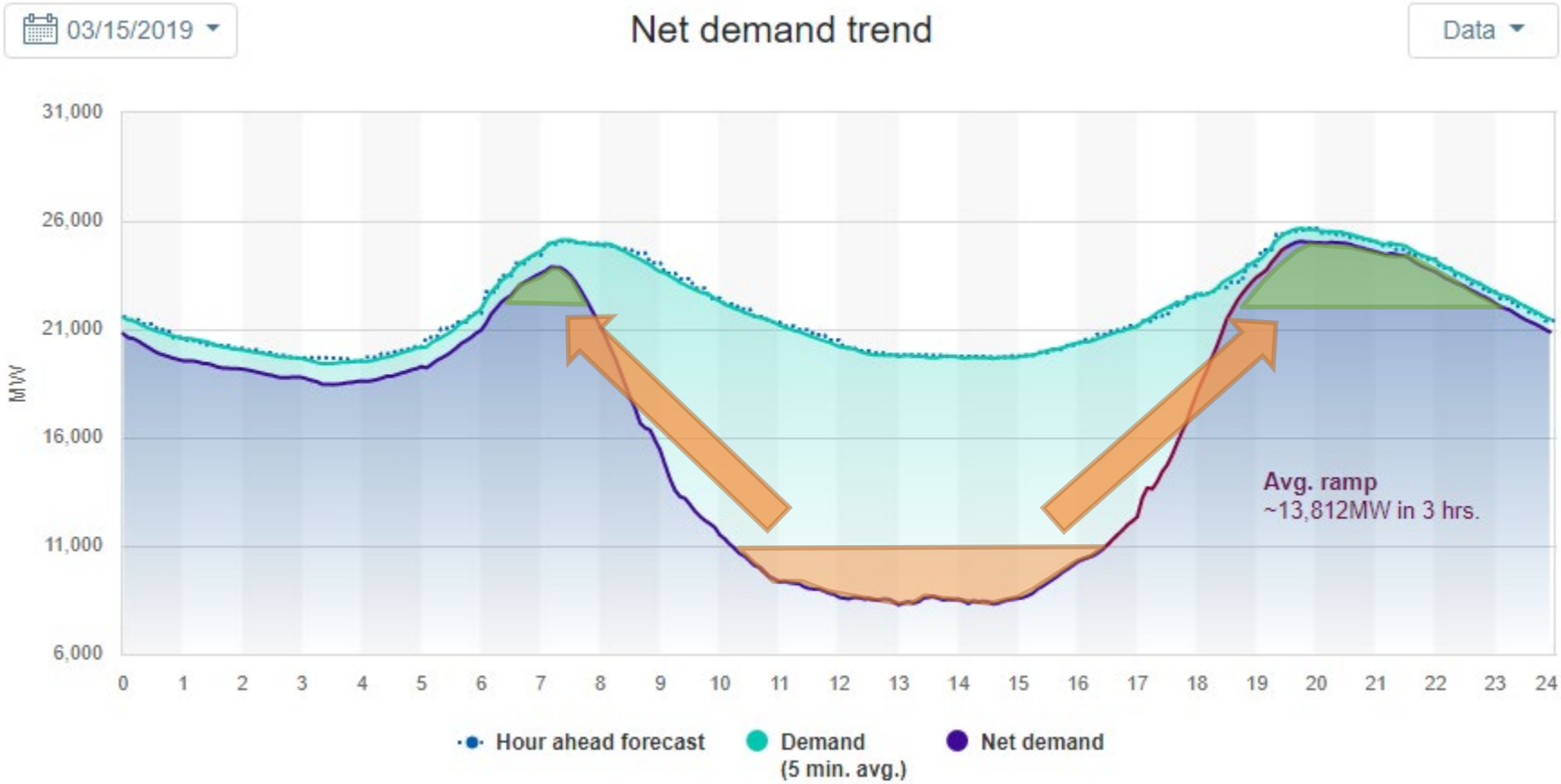
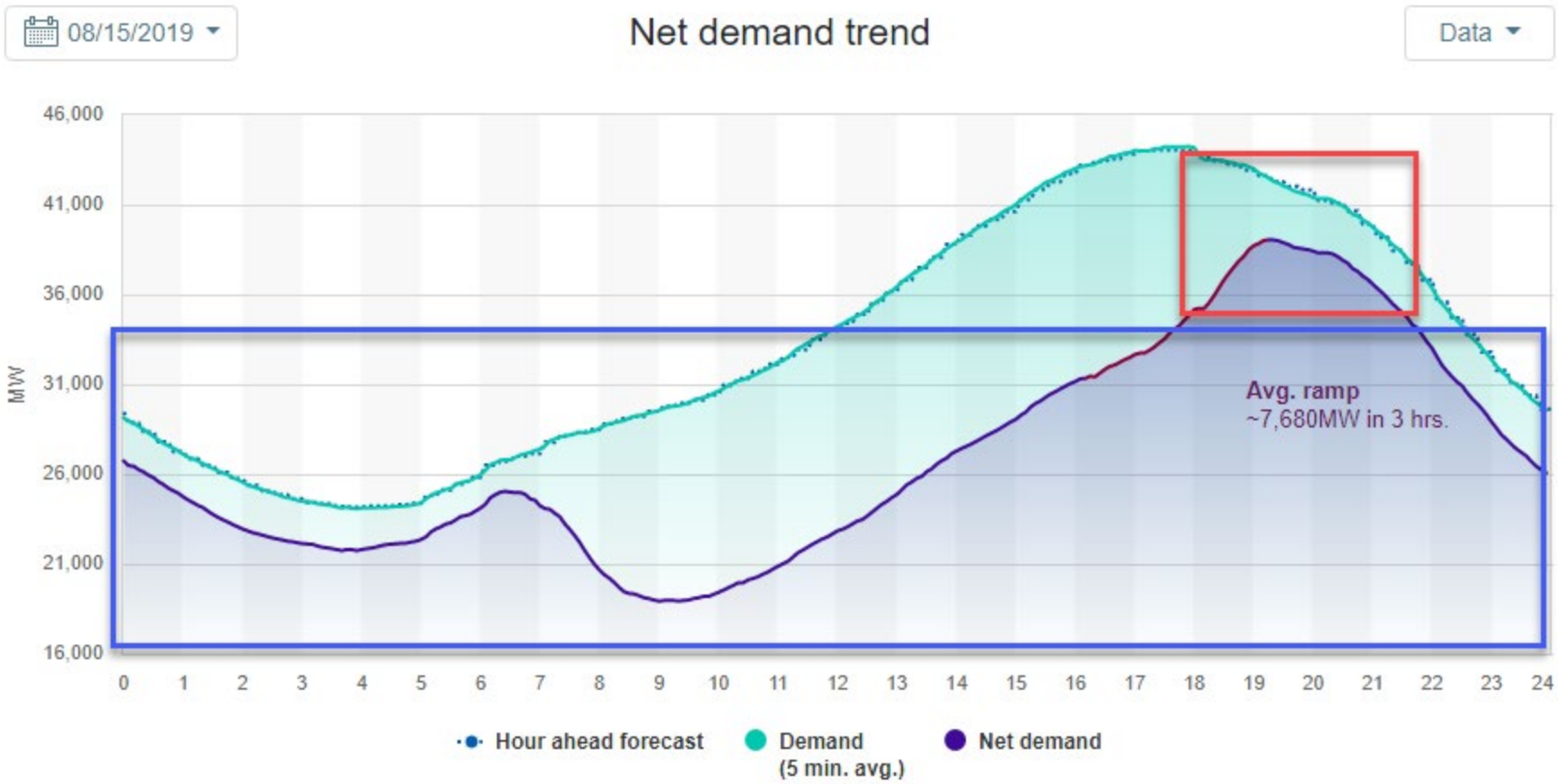
Thursday, August 15, 2019 (2019 Demand Peak)



Explanations?

- Cycling costs and manufacture warranties?
- Arbitrage opportunities insufficient?
- Regulation economics superior?
- Capacity contracts sufficient?

Storage to be Pivotal Soon?



In the future storage will be critical for meeting load on days with the highest ***net load*** peak