Memorandum

To: ISO Board of Governors

From: Neil Millar, Vice President, Transmission Planning & Infrastructure Development

Date: July 15, 2020

Re: Briefing on renewable and energy storage in the generator interconnection queue

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This memorandum does not require Board action.

EXECUTIVE SUMMARY

This briefing provides the status of renewable and energy storage in the ISO's generator interconnection queue as of June 2020. Key highlights include:

1. The current ISO queue contains approximately 91,000 MW of project capacity actively seeking to interconnect to the ISO controlled grid, measured at the point of delivery to the ISO.

2. There are approximately 68,000 MW of renewables, of which 39 percent has completed the study process and 61 percent are in various stages of the study process.

3. The ISO queue also contains a significant number of energy storage projects totaling approximately 69,000 MW. The technologies include battery, pumped storage, and rail gravity and compressed air energy storage.

DISCUSSION

The following graphs illustrate the renewables in the ISO queue from several perspectives.

Figure 1 shows the amount of renewable generation in the interconnection queue over time and breaks out the types of renewable capacity. During the July 2019 to June 2020 period, the queue experienced a net increase of 1,472 MW in renewable project capacity. The change is a result of approximately 2,400 MW of capacity that reached commercial operation, 23,800 MW of project withdrawals, 31,400 MW that entered in the cluster 13 window that closed April 15, and a decrease of 3,700 MW related to project downsizings and various project modifications.

Figure 1

Change in renewable capacity in the ISO queue since June 2011

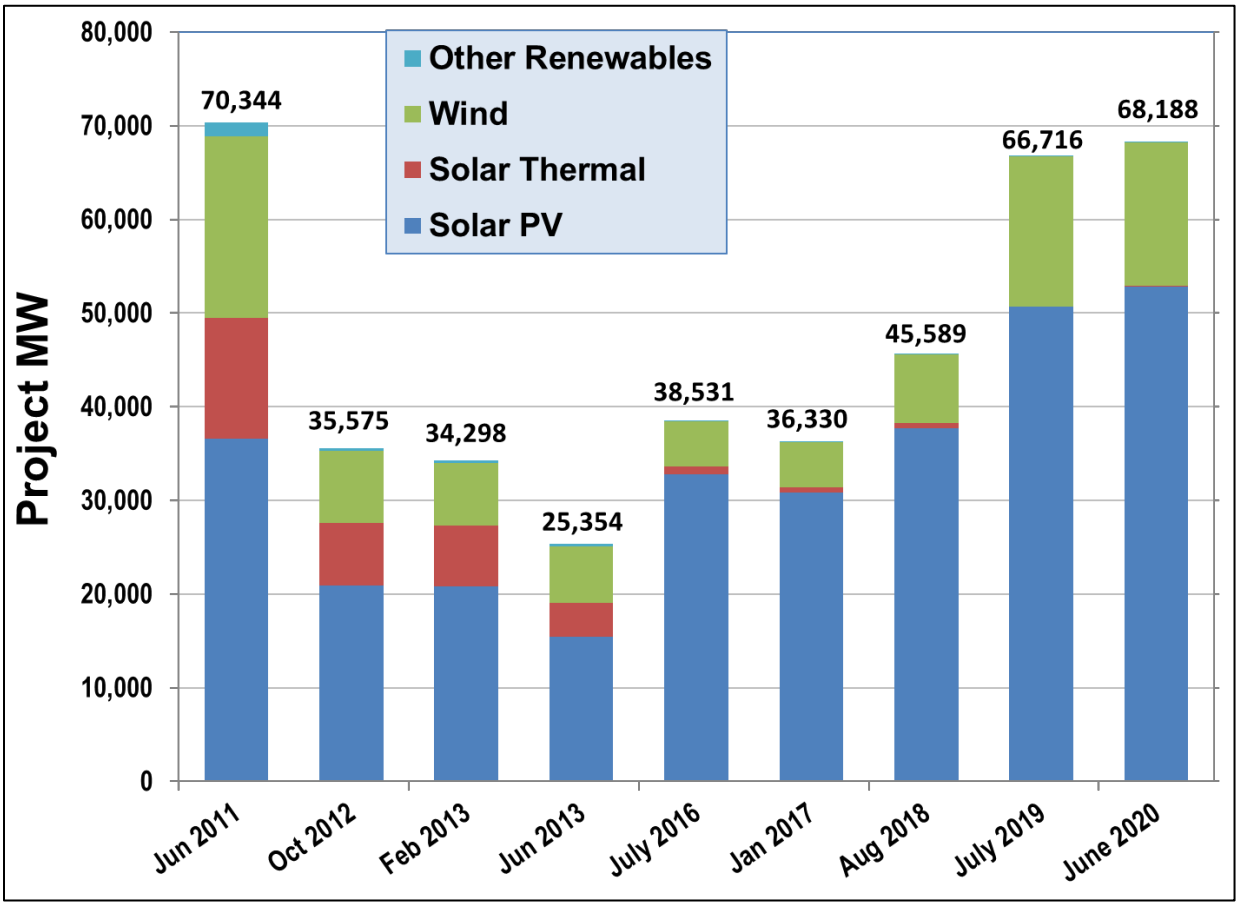
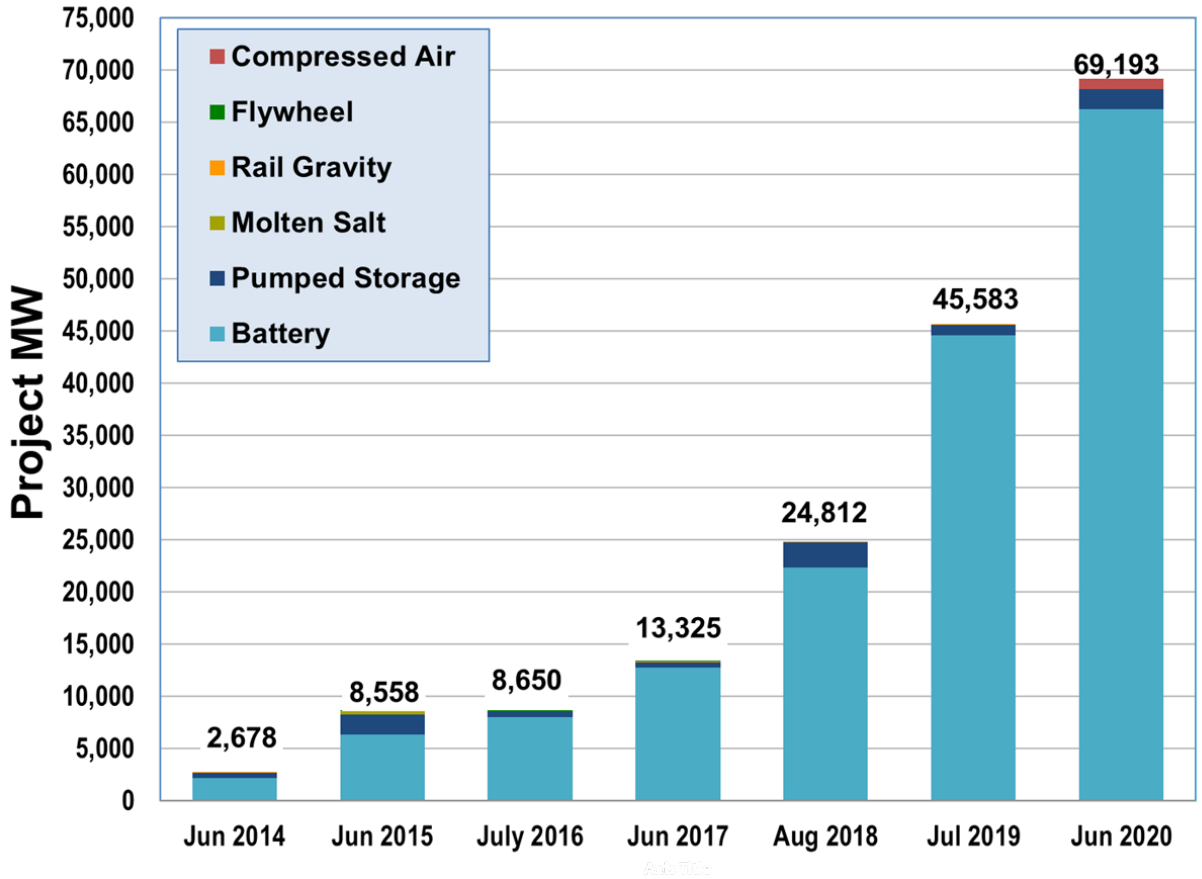


Figure 2 provides the current and historical levels of energy storage capacity in the queue. Nearly all of the 69,193 MW are battery energy storage systems, which include stand-alone projects and capacity associated with hybrid projects where the battery energy storage system is a component of project that includes renewable capacity, typically solar[1].

Figure 2

Change in energy storage capacity in the ISO queue since June 2014



[1] The majority of hybrid projects are configured such that the capacity at the point of interconnection does not exceed the rating of the renewable portion of the facility. Therefore, the renewable capacity and the energy storage capacity are not additive at the point of interconnection/point of delivery for purposes of determining the total MW in the queue.

Figure 3 provides insight into the amount of active renewable and energy storage project capacity in the ISO queue by project size and type. Solar PV accounts for the greatest amount of renewable technology. Figure 3 also provides a breakdown of the capacity in the ISO queue by the number of projects for each project size category. Projects in the 100 to 500 MW category make up 61% of project capacity. The queue has 16 project components of over 1,000 MW in size within various combinations of solar, wind and battery energy storage system components, totaling over 23,000 MW.

Figure 3

Capacity of renewable and energy storage projects in ISO queue

As of June 2020 – by size and type

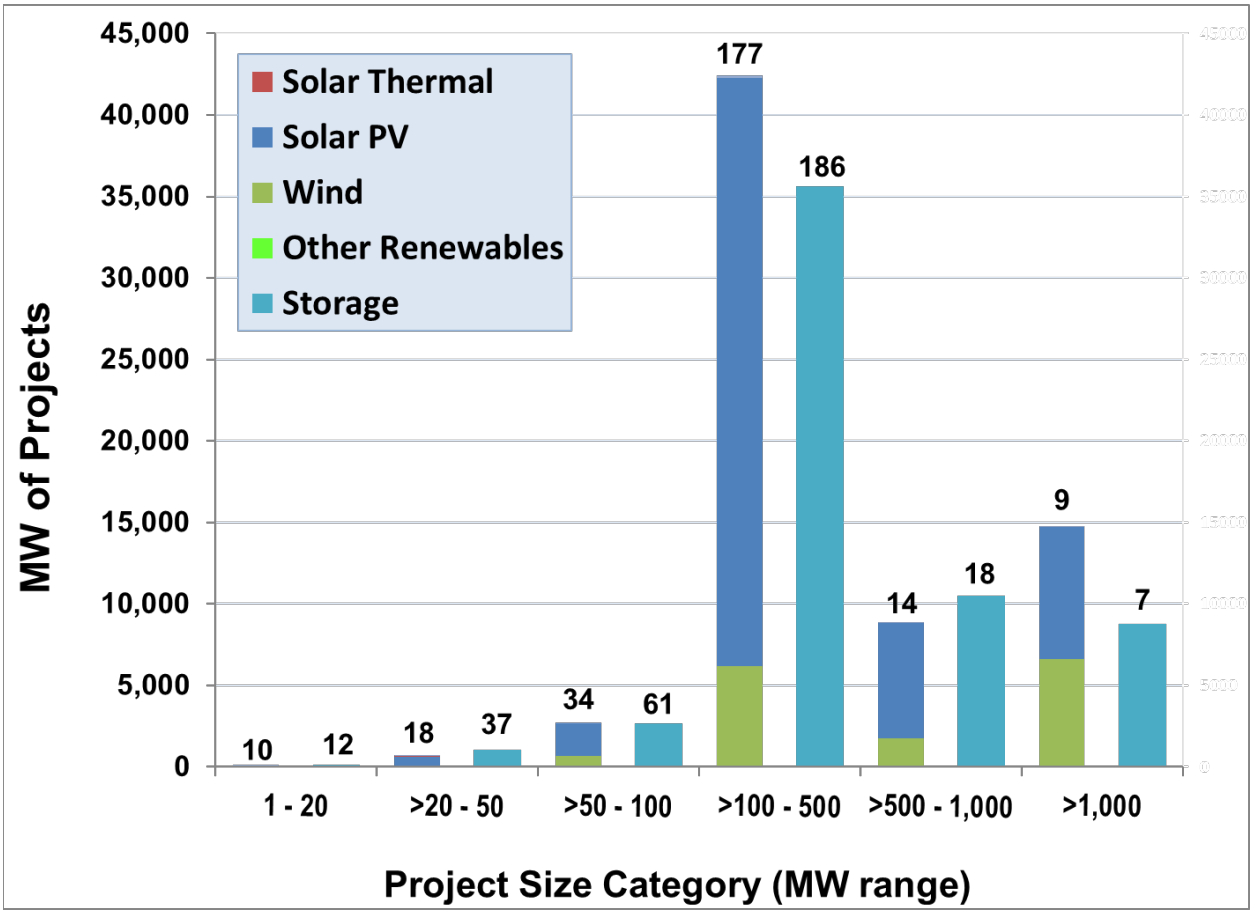


Figure 4 shows the historical build-out of renewable capacity by technology type and a projection for the year 2030 based on the California Public Utilities Commission's projected renewable portfolio for 2030. The ISO currently has approximately 24,300 MW of ISO grid-connected renewable generation in operation. The projected ISO connected renewable generation needed to meet the 60% renewable requirement by 2030 is approximately 36,700 MW.

Figure 4

Projected RPS capacity build-out through 2030

(CPUC Renewable Portfolio)

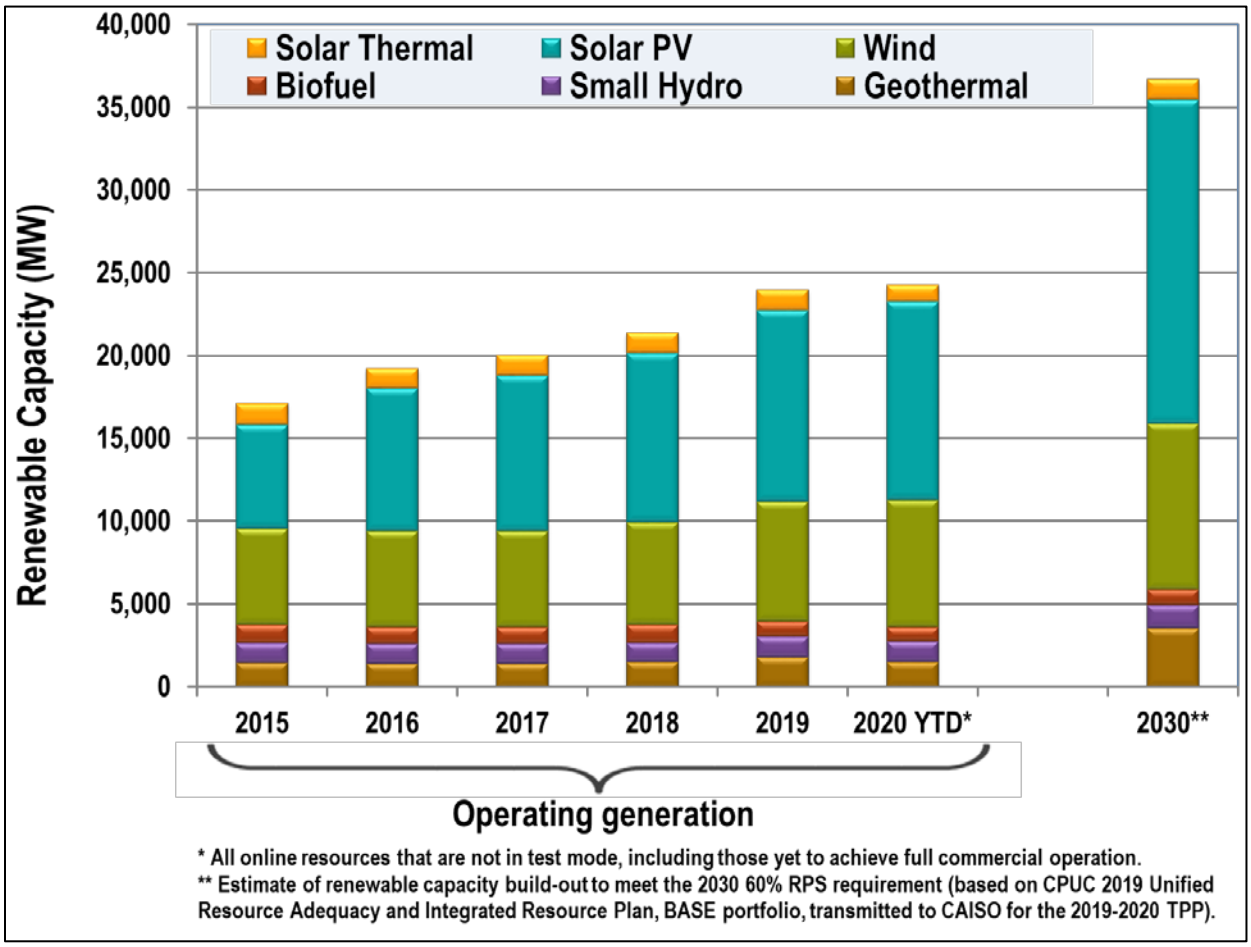
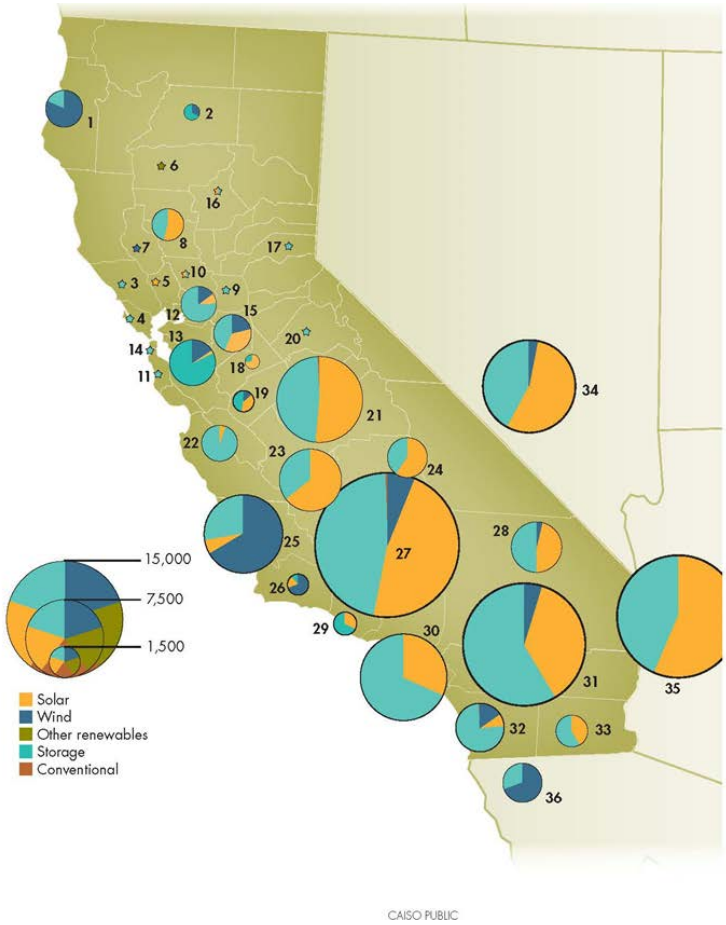


Figure 5 is a map of all projects in the generation interconnection queue as of June 2020 and shows the general location and capacity by project type, including conventional generation and storage project capacity. Some storage capacity is associated with other generation technologies within a single project. In a number of these cases, the total project output is designed to not exceed the capacity of the project's primary generation technology. However, in this figure, all technology types are provided at their full capability on a stand-alone basis (*e.g.* for a combined solar / storage project, both the solar capacity and the storage capacity are shown separately even though in the majority of hybrid projects the output of the facility to the point of delivery is configured to not exceed the rating of the solar portion of the facility). As a result, the total capacity of all projects shown here is greater than the total project capacity in the ISO generation interconnection queue.

Figure 5

ISO Queue Map – Conventional & Renewables

As of June 2020



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	3903	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**