Solar PV Battery Installations in Honolulu: 2020 Update

Research and Economic Analysis Division

Department of Business, Economic Development and Tourism

STATE OF HAWAII

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This report is prepared by Dr. Jie Bai, Economist and Dr. David Shuai, Research Statistician, under the direction of Dr, Eugene Tian, Division Administrator.

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This report is an update of the previous reports published in 2018, 2019, and 2020. Since October 2015 when the State Public Utilities Commission has limited the number of new solar photovoltaic (PV) customers to send excess power to the electric grid for credit, battery-connected PV system has become a more attractive option. As a result, the year of 2017 has seen an exponential growth of battery storage installed together with solar PV systems; and this number doubled in 2018. The strong growth continued into the year of 2019 and 2020. In 2019, solar PV plus battery installations exceeded all the previous years combined. The report is based on building permits data downloaded from the website of Department of Planning and Permitting, City and County of Honolulu on March 31, 2021; and only permits issued in 2020 are included in this analysis. This report provides detailed information on solar PV battery installations in 2020, in the hope of increasing our understanding of the solar battery installation activities in the Honolulu County.

Table 1: Summary of building permits related to residential[1] PV plus battery installation: 2008-2020

Year	Number of permits	Average permit value* ($)	Median permit value* ($)
2008	7	32,065	27,581
2009	5	32,203	34,000
2010	4	29,000	28,000
2011	1	34,000	34,000
2012	1	10,000	10,000
2013	10	23,961	24,000
2014	5	31,904	15,000
2015	5	54,480	45,000
2016	40	25,086	21,000
2017	731	29,475	27,552
2018	1,659	34,995	32,000
2019	3,003	35,491	31,000
2020	3,336	30,987	28,000

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
*: The PV plus battery installation projects were excluded from calculating the average or median permit values if they were combined with other types of building work which were not related to PV or battery storage installation.

[1] Our analysis focuses on residential PV battery installations, as less than two percent of PV battery installations were for commercial use. A summary table of commercial PV battery installations is provided in the Appendix.

The first building permit for residential PV battery installation was issued in February 2008. Annual numbers of PV plus battery building permits did not go beyond ten until 2016. Since then, installing battery storage together with the PV system became an increasingly popular choice. In 2017, a total of 731 permits were issued by Honolulu DPP for PV plus battery installation, accounting for 26.5 percent of the total PV related or PV battery related projects. This percentage jumped significantly to 62.3 percent in 2018 and continued to climb to 76.2 percent in 2020[2], with a total of 3,336 permits for PV plus battery installations[3]. While the PV plus battery installation became more attractive, installation cost stabilized over time. In 2020, average installation cost, measured by permit values, was $30,987, a 12.7 percent decrease from $35,491 in 2019. The median installation cost was $28,000, compared with $31,000 in 2019.

Table 2: Summary of building permits related to residential PV and battery installation in 2020

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2020*	Number of permits	% completed as of Dec 31, 2020*	Number of permits	% completed as of Dec 31, 2020*
1	252	100%	6	100%	61	100%
2	237	99%	4	100%	77	97%
3	198	97%	3	100%	71	99%
4	210	97%	3	100%	57	100%
5	191	98%	3	100%	57	96%
6	203	94%	5	80%	105	65%
7	223	95%	1	0%	90	96%
8	271	94%	1	0%	92	87%
9	340	76%	0	-	82	82%
10	438	68%	7	80%	105	80%
11	343	50%	5	40%	88	51%
12	430	22%	1	0%	118	18%
Total	**3,336**	**79%**	**39**	**78%**	**1,003**	**78%**
Annual average permit value ($)**	30,987		6,788		18,737	
Annual median permit value ($)**	28,000		4,000		15,000	

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
*: The completion rate is calculated as the percentage of the PV or PV battery-related building permits which completed construction by Dec. 31, 2020 over all the PV or PV battery-related building permits which showed "Permit application closed" on the permit records.
**: PV or PV battery-related installation projects were excluded from calculating the average or median permit values if they were combined with other types of building work which were not related to PV or battery storage installation.

[2] DBEDT, State of Hawaii. *Solar PV Battery Installations in Honolulu: 2017, 2018, and 2019 Update*.
[3] As of March 31, 2021, 42.7 percent of PV or PV battery-related building permits in 2020 are still in the process of inspection. As these building permits complete inspection, the final installation counts are expected to be slightly smaller, since some permits may be revoked, and projects may be cancelled.

Table 2 summarizes the building permits issued monthly to install residential PV battery and PV alone projects in 2020. An average of 278 permits were issued each month to install PV plus battery storage system. By the end of 2020, 79 percent of these projects completed construction. Although majority cases were solar battery installed together with PV, 39 projects added batteries to the existing PV systems, and 1,003 building permits were issued for installing PV alone. The average cost that households in Honolulu paid to install a solar PV system together with battery in 2020 was $30,987. By contrast, the average costs of installing battery alone and PV alone were $6,788 and $18,737 respectively.

The median project cost of PV plus battery was $28,000, about $3,000 less than the average cost, suggesting that the cost distribution was slightly skewed to the right, as we can see from the cost distribution below (Table 3). 75.3 percent of permits issued for PV installation with battery were above $20,000 and over 40 percent were above $30,000. Almost all the battery only permits were below $20,000. As for the PV only installations, nearly two thirds had the permit values between $10,000 and $30,000. Only 4.4 percent of the permits were issued to install PV alone with permit values above $40,000; by contrast, this ratio is almost 20.3 percent for the PV plus battery installations.

Table 3: Cost distribution of residential PV and battery installation: 2020

Price range	PV plus battery		Battery only		PV only	
	Number of permits	percent	Number of permits	percent	Number of permits	percent
< $5,000	24	0.7%	21	61.8%	44	4.6%
$5000 - $10,000	105	3.2%	8	23.5%	173	18.2%
$10,000 - $20,000	690	20.8%	4	11.8%	396	41.6%
$20,000 - $30,000	1,107	33.3%	0	0.0%	207	21.7%
$30,000 - $40,000	723	21.7%	0	0.0%	90	9.5%
> $40,000	676	20.3%	1	2.9%	42	4.4%
Total	**3,325**	**100.0%**	**34**	**100.0%**	**952**	**100.0%**

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
Note: The total permit numbers are slightly smaller than those in table 2, because some PV installation projects were combined with other types of building work which were not related to PV or battery installation, so these were excluded from the cost distribution table.

Table 4 shows the number of building permits issued for PV battery installation by city's neighborhood areas in 2020. Ewa area hosted the most PV plus battery installations, with 435 permits issued by the end of 2020; it also had the second highest PV only installations, next to Kailua where 96 PV were or are to be installed alone. Other areas where the installation of PV together with battery storage system was popular were Waipahu (321), Kailua (260), and Makakilo-Kapolei (214).

Table 4: Residential PV and battery installation by neighborhood area: 2020

Neighborhood Name	Number of building permits related to PV and battery installation		
	PV plus battery	Battery Only	PV only
Aiea	143	2	54
Ala Moana-Kakaako	3	0	2
Aliamanu-Salt Lake	74	1	24
Diamond Head-Kapahulu	69	0	26
Ewa	435	5	89
Hawaii Kai	154	1	49
Kahaluu	50	1	8
Kailua	260	1	96
Kaimuki	73	2	30
Kalihi Valley	32	0	7
Kalihi-Palama	26	0	7
Kaneohe	167	1	52
Koolauloa	39	1	10
Kuliouou-Kalani Iki	136	1	45
Liliha-Alewa	48	0	17
Makakilo-Kapolei	214	2	42
Makiki-Tantalus	27	1	9
Manoa	59	2	41
Mccully-Moiliili	7	0	2
Mililani Mauka-Launani Valley	93	0	37
Mililani-Waipio	153	1	50
Moanalua	39	0	12
Mokapu	2	0	0
Nanakuli-Maili	110	2	20
North Shore	39	2	16
Nuuanu-Punchbowl	49	0	12
Palolo	44	0	13
Pearl City	127	2	36
Wahiawa	35	0	14
Waialae-Kahala	69	4	20
Waianae Coast	81	2	12
Waimanalo	21	1	5
Waipahu	321	3	82

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.

Appendix: Commercial PV Battery Installations in 2020

In this appendix, the commercial building permits related to PV battery installations are summarized. In 2020, there were 56 commercial PV plus battery installed, with average permit value of $230,613 and median permit value of $35,000. The fact that the average permit value was much higher than the median value reveals that there were some exceptionally large commercial PV plus battery projects in 2020. There were three commercial battery only projects, with the permit value of $4,000. Majority of commercial PV-related permits did not include battery installation. In 2020, there were 94 commercial PV only installations, with the average permit values of $424,723.

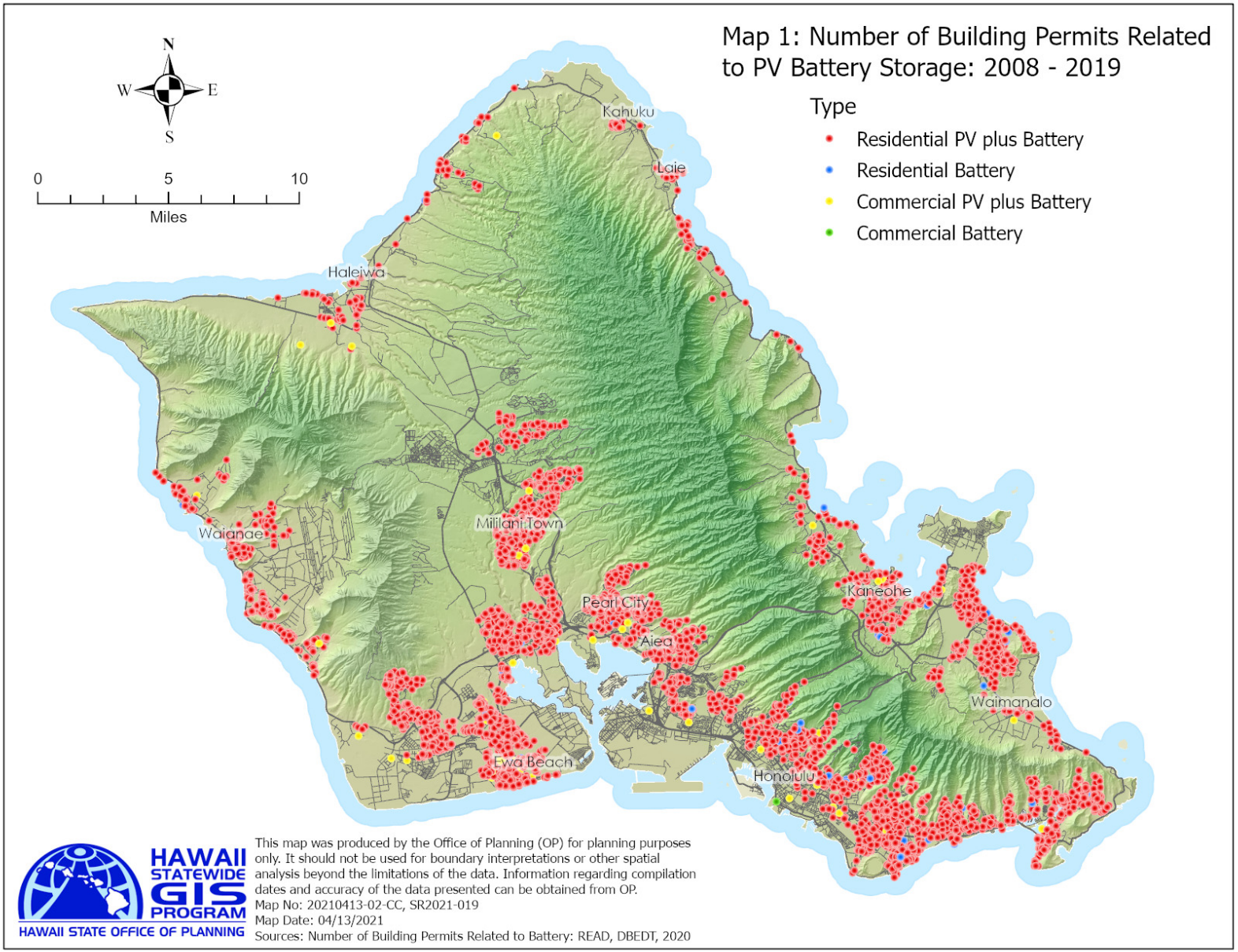
Table A1: Summary of building permits related to commercial PV and battery installation in 2020

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2020*	Number of permits	% completed as of Dec 31, 2020*	Number of permits	% completed as of Dec 31, 2020*
1	9	100%	0	-	7	83%
2	0	-	0	-	0	-
3	3	100%	0	-	13	100%
4	4	100%	1	100%	10	100%
5	3	0%	0	-	7	67%
6	1	0%	0	-	11	100%
7	2	50%	0	-	4	100%
8	8	75%	0	-	4	100%
9	2	100%	0	-	5	60%
10	7	71%	1	-	12	25%
11	9	29%	0	-	9	67%
12	8	33%	1	0%	12	11%
Total	**56**	**67%**	**3**	**50%**	**94**	**73%**
Annual average permit value ** **($)**	230,613		4,000		424,723	
Annual median permit value ** **($)**	35,000		4,000		188,824	

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.

*: The completion rate is calculated as the percentage of the PV or PV battery-related building permits which completed the construction by Dec. 31, 2020 over all the PV or PV battery-related building permits which showed "Permit application closed" on the permit records.

**: The PV or PV battery-related installation projects were excluded from calculating the average or median permit values if they were combined with other types of building work which were not related to the PV or battery installation.


Map 1: Number of Building Permits Related to PV Battery Storage: 2008 - 2019
Type
Residential PV plus Battery
Residential Battery
Commercial PV plus Battery
Commercial Battery
N
W
E
S
0
5
10
Miles
Kahuku
Laie
Haleiwa
Waianae
Mililani Town
Pearl City
Aiea
Kaneohe
Waimanalo
Ewa Beach
Honolulu
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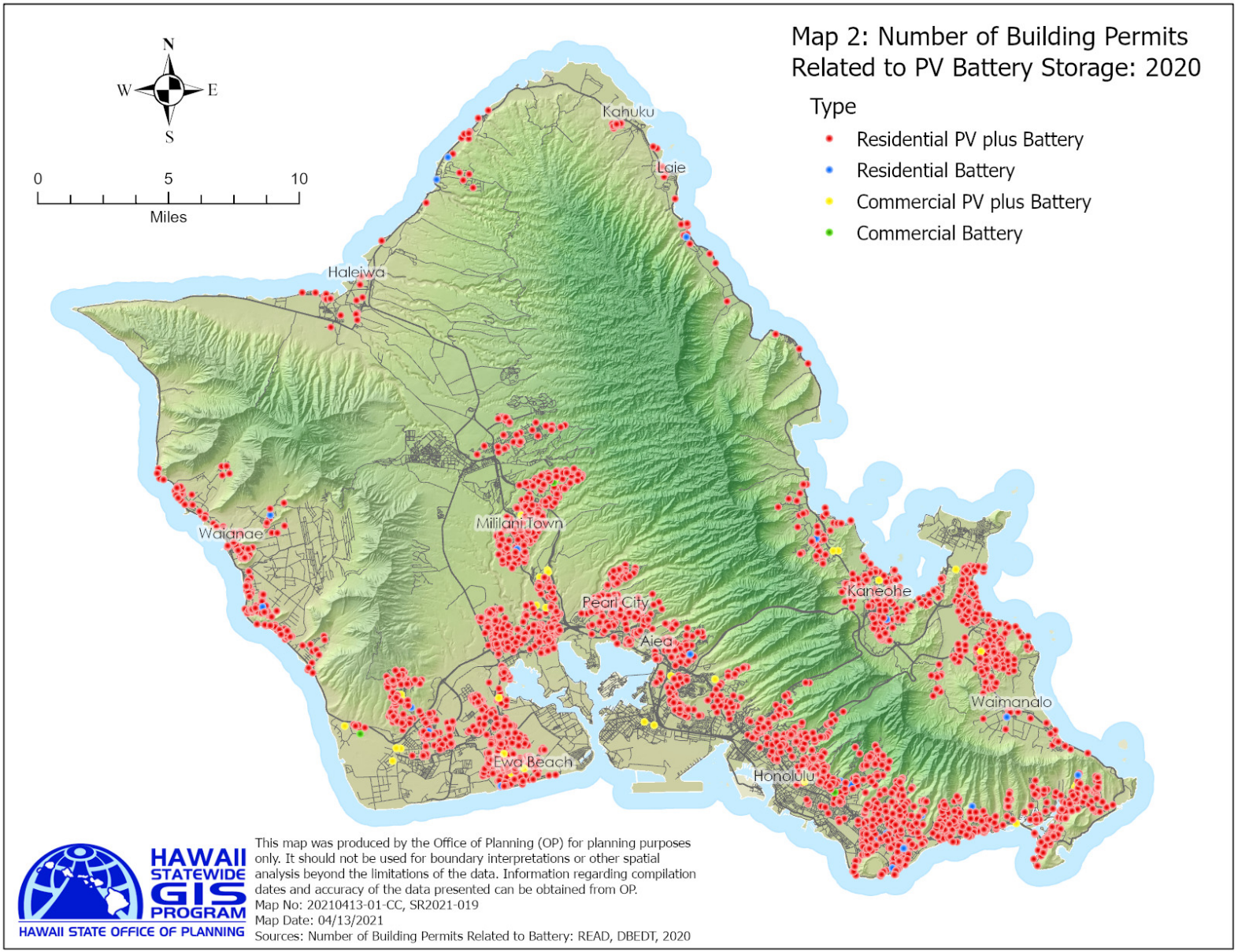
Map No: 20210413-02-CC, SR2021-019
Map Date: 04/13/2021
Sources: Number of Building Permits Related to Battery: READ, DBEDT, 2020


Map 2: Number of Building Permits Related to PV Battery Storage: 2020
Type
Residential PV plus Battery
Residential Battery
Commercial PV plus Battery
Commercial Battery
N
W
E
S
0
5
10
Miles
Kahuku
Laie
Haleiwa
Waianae
Mililani Town
Pearl City
Aiea
Kaneohe
Waimanalo
Ewa Beach
Honolulu
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