Solar PV Battery Installations in Honolulu: 2021 Update

Research and Economic Analysis Division

Department of Business, Economic Development and Tourism

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This report is an annual update of the previous reports published since 2018. The report series provides detailed information on solar photovoltaic (PV) battery installations in Honolulu County, in the hope of increasing our understanding of the battery storage installation activities. This 2021 report is based on building permits data downloaded from the website of the Department of Planning and Permitting (DPP), City and County of Honolulu as of March 29th, 2022; and only permits issued in 2021 are included in this analysis.

Table 1: Summary of building permits related to residential PV plus battery installation: 2008-2021

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
2021	4,092	31,708	29,000

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
*: 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 whose costs cannot be separated from the installation costs of PV or battery storage.

Our analysis focuses on residential PV battery installations. A summary table of commercial PV battery installations is provided in the Appendix. The type of building permit (residential or commercial) was indicated in the DPP data. Residential permits are those on the rooftop of single-family or duplex homes. Commercial projects are those on rooftops or non-roof structures of industrial, office, storage, other commercial, and apartment buildings. Utility-scale projects are classified as commercial. There were some projects on the rooftop of a single-family home but classified as commercial and also a few permits on the rooftop of apartment buildings

but classified as residential projects. This report did not make any adjustments to the type of projects.

Since October 2015 when the State Public Utilities Commission has limited the number of new solar 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 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 following years. In 2019, solar PV plus battery installations exceeded all the previous years combined.

Table 2: Summary of building permits related to residential PV and battery installation in 2021

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2021*	Number of permits	% completed as of Dec 31, 2021*	Number of permits	% completed as of Dec 31, 2021*
1	196	76%	2	50%	36	78%
2	234	83%	0	-	45	96%
3	282	86%	3	67%	55	91%
4	254	86%	5	80%	54	83%
5	206	83%	5	100%	36	92%
6	327	83%	5	60%	42	90%
7	317	76%	3	100%	40	85%
8	367	71%	2	50%	32	84%
9	517	61%	4	75%	64	72%
10	487	48%	2	100%	66	68%
11	463	27%	4	75%	54	43%
12	442	7%	85	4%	75	7%
Total	**4,092**[1]	**60%**	**120**	**25%**	**599**	**70%**
Annual average permit value ($)**	31,708		15,506		19,045	
Annual median permit value ($)**	29,000		14,000		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 the construction by Dec. 31, 2021.
**: 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 whose costs cannot be separated from the installation costs of PV or battery storage.

In 2021, as the slated retirement of AES Hawaii, Oahu's coal-fired plant at Campbell Industrial Park, grew near, there was concern that not enough planned new utility-scale solar power will be developed in time. Since July 2021, HECO has begun the Battery Bonus program,

[1] As of March 29, 2022, 21.2 percent of PV or PV battery-related building permits in 2021 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.

a new battery incentive program that will pay a cash incentive for customers on Oahu to add batteries to their rooftop solar systems. This Battery Bonus program further boosted installations of solar PV plus battery systems, the amount of which grew up to 4,092 in 2021[2], a 23 percent increase from the previous year. According to Table 2, in the first half of 2021, a monthly average of 250 permits were issued to install PV plus battery storage systems; it increased by 73 percent and climbed to 432 in the second half of 2021.

Since 2017, combining battery storage with PV system installation has become 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 projects. This percentage jumped significantly to 62.3 percent in 2018 and continued to climb to 85.1 percent in 2021[3]. By the end of 2021, 60 percent of these projects completed construction. In addition, 120 projects added batteries to the existing PV systems, and 599 building permits were issued for installing PV systems alone. Their completion rates are 25 percent and 70 percent respectively.

In 2021, the average installation cost of PV plus battery systems, as measured by permit values, was $31,708, a 2.3 percent increase from $30,987 in 2020. By contrast, the average costs of installing battery alone and PV alone were $15,506 and $19,045 respectively. The median project cost of PV plus battery was $29,000, about $2,000 less than the average cost. As we can see from Table 3 below, 75.9 percent of permits issued for PV plus battery installation were above $20,000 and over 45.5 percent were above $30,000. Almost all the battery-only permits were below $30,000. Nearly two-thirds of PV-only installations had permit values below $20,000 but only 16.7 percent of the permits were issued to install PV alone with permit values above $30,000.

Table 3: Cost distribution of residential PV and battery installation: 2021

Price range	PV plus battery		Battery only		PV only	
	Number of permits	percent	Number of permits	percent	Number of permits	percent
< $5,000	19	0.5%	3	2.5%	41	6.9%
$5000 - $10,000	96	2.4%	31	25.8%	131	22.2%
$10,000 - $20,000	860	21.3%	56	46.7%	206	34.9%
$20,000 - $30,000	1,231	30.4%	26	21.7%	114	19.3%
$30,000 - $40,000	969	24.0%	3	2.5%	57	9.6%
> $40,000	868	21.5%	1	0.8%	42	7.1%
Total	**4,043**	**100.0%**	**120**	**100.0%**	**591**	**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.

[2] HECO estimated that about 728 customers who installed solar PV battery storage systems in 2021 applied for the Battery Bonus program (residential and commercial permits combined).
[3] DBEDT, State of Hawaii. *Solar PV Battery Installations in Honolulu: 2017, 2018, 2019, and 2020 Update.*

Table 4 shows the number of building permits issued for PV battery installation by city's neighborhood areas in 2021. Ewa area hosted the most PV plus battery installations, with 490 permits issued by the end of 2020; it also had the second-highest PV only installations, next to Kailua where 58 PV were or are to be installed. Other areas where the installation of the PV plus battery storage system was popular were Kailua (317), Waipahu (282), and Makakilo-Kapolei (244).

Table 4: Residential PV and battery installation by neighborhood area: 2021

Neighborhood Name	Number of building permits related to PV and battery installation		
	PV plus battery	Battery Only	PV only
Aiea	181	4	31
Ala Moana-Kakaako	3	0	2
Aliamanu-Salt Lake	74	4	13
Diamond Head-Kapahulu	87	3	18
Ewa	490	5	46
Hawaii Kai	200	5	42
Kahaluu	44	1	7
Kailua	317	17	58
Kaimuki	131	6	20
Kalihi Valley	54	0	5
Kalihi-Palama	29	0	9
Kaneohe	226	7	31
Koolauloa	57	0	12
Kuliouou-Kalani Iki	184	11	24
Liliha-Alewa	72	6	17
Makakilo-Kapolei	244	3	30
Makiki-Tantalus	41	1	6
Manoa	108	7	15
Mccully-Moiliili	6	0	1
Mililani Mauka-Launani Valley	105	5	22
Mililani-Waipio	185	8	36
Moanalua	42	1	5
Mokapu	1	0	0
Nanakuli-Maili	107	1	11
North Shore	48	0	4
Nuuanu-Punchbowl	59	3	11
Palolo	50	0	8
Pearl City	148	8	23
Wahiawa	73	4	9
Waialae-Kahala	85	1	15
Waianae Coast	120	1	10
Waimanalo	39	0	1
Waipahu	282	6	43

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

Appendix: Commercial PV Battery Installations in 2021

This appendix summarizes the commercial building permits related to PV battery installations in 2021. 40 commercial PV plus battery systems were installed, with an average permit value of $2.2 million and a median permit value of $38,480. The fact that the average permit value was exceedingly higher than the median value reflects some exceptionally large commercial PV plus battery projects in 2021. HECO has two solar plus battery projects under construction in Mililani and Waiawa. Their accepted permit values are set at $53 million and $50.5 million[4] respectively.

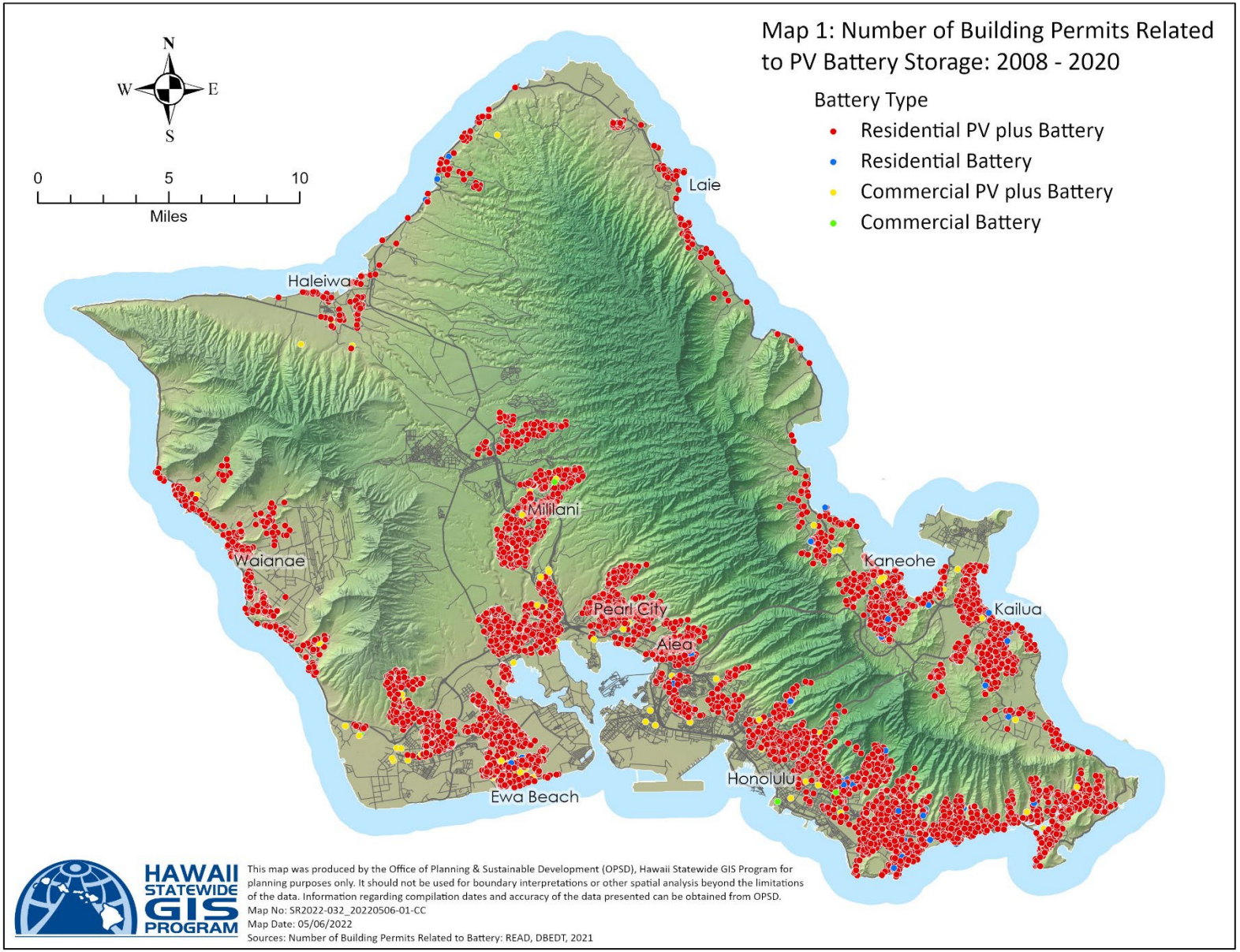
There were also two commercial battery-only projects, with an average permit value of $8,000. Over half of the commercial PV-related permits did not include battery installation. In 2021, there were 49 commercial PV-only installations, with an average permit value of $152,296.

Table A1: Summary of building permits related to commercial PV and battery installation in 2021

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2021*	Number of permits	% completed as of Dec 31, 2021*	Number of permits	% completed as of Dec 31, 2021*
1	1	100%	0	-	1	100%
2	5	80%	1	100%	7	100%
3	7	71%	0	-	4	75%
4	5	60%	0	-	4	75%
5	14	36%	0	-	3	33%
6	1	100%	0	-	5	60%
7	1	100%	1	100%	6	50%
8	1	100%	0	-	7	14%
9	2	100%	0	-	5	60%
10	0	-	0	-	5	40%
11	2	50%	0	-	2	50%
12	1	0%	0	-	0	-
Total	**40**	**60%**	**2**	**100%**	**49**	**57%**
Annual average permit value ** **($)**	2,256,862		8,000		152,296	
Annual median permit value ** **($)**	38,480		8,000		45,000	

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 the construction by Dec. 31, 2021.
**: 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 whose costs cannot be separated from the installation costs of PV or battery storage.

[4] The average permit value does not include the Waiawa Solar plus battery project, because its building permit indicates that the solar PV and battery installation was combined with the other type of work whose cost cannot be singled out.


Map 1: Number of Building Permits Related to PV Battery Storage: 2008 - 2020
Battery Type
Residential PV plus Battery
Residential Battery
Commercial PV plus Battery
Commercial Battery
N
W
E
S
0
5
10
Miles
Laie
Haleiwa
Mililani
Waianae
Kaneohe
Pearl City
Kailua
Aiea
Honolulu
Ewa Beach
HAWAII STATEWIDE GIS PROGRAM
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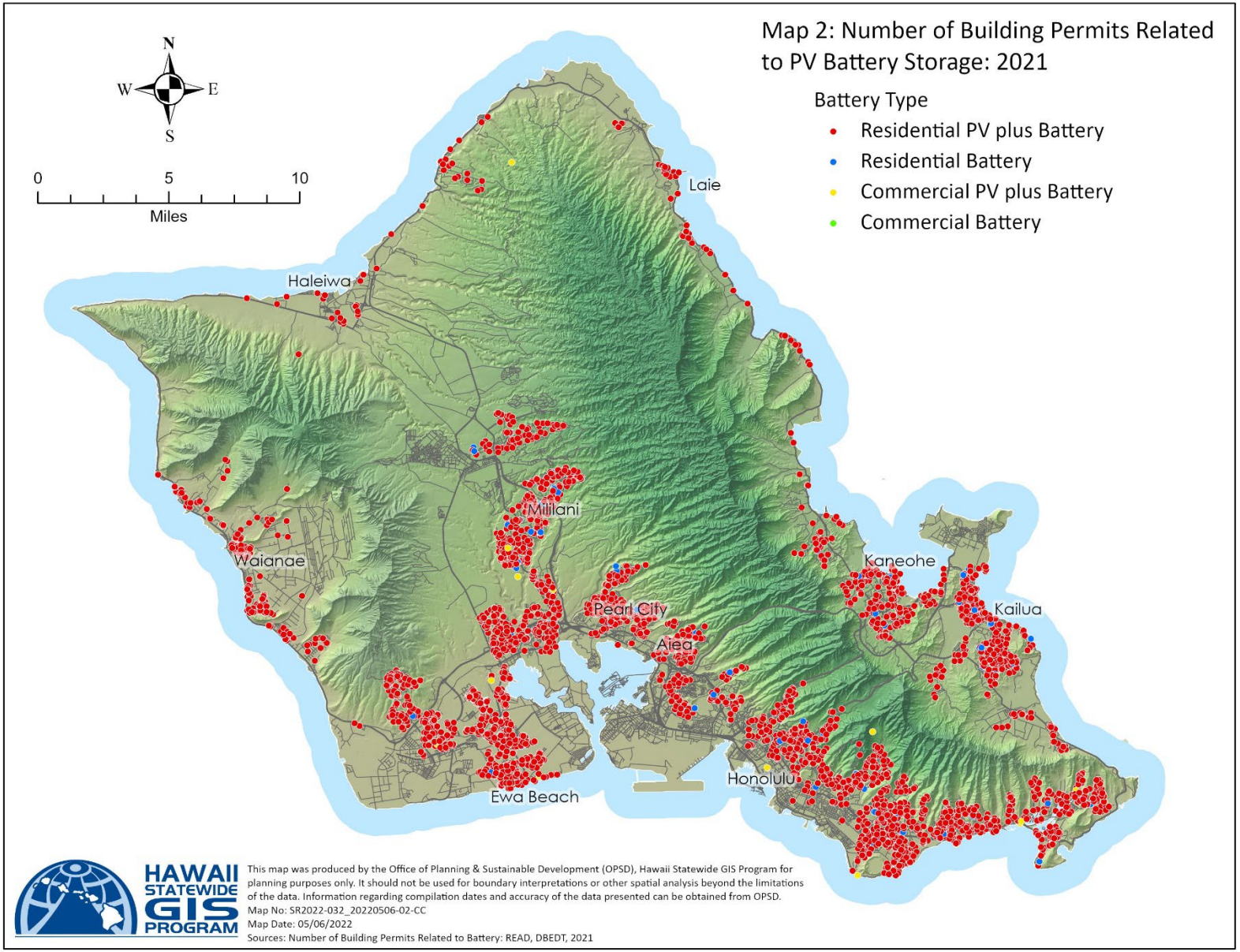
Map No: SR2022-032_20220506-01-CC
Map Date: 05/06/2022
Sources: Number of Building Permits Related to Battery: READ, DBEDT, 2021


Map 2: Number of Building Permits Related to PV Battery Storage: 2021
Battery Type
Residential PV plus Battery
Residential Battery
Commercial PV plus Battery
Commercial Battery
N
W
E
S
0
5
10
Miles
Laie
Haleiwa
Mililani
Waianae
Kaneohe
Kailua
Pearl City
Aiea
Honolulu
Ewa Beach
HAWAII STATEWIDE GIS PROGRAM
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Map No: SR2022-032_20220506-02-CC
Map Date: 05/06/2022
Sources: Number of Building Permits Related to Battery: READ, DBEDT, 2021