Solar PV Battery Installations in Honolulu: 2022 Update

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Department of Business, Economic Development and Tourism

STATE OF HAWAII

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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. The statistics for 2022 in this report are 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, 2023, and only permits issued in 2022 are included in the analysis.

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.

Table 1: Summary of building permits related to residential PV plus battery installation: 2008-2022

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
2022	4,743	34,351	30,000

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 the calculation of average or median permit values if they were combined with other types of building work as other costs could not be separated from the cost of PV or battery installation.

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 a significant growth of battery storage installed together with solar PV systems, and this number doubled in 2018. In 2019, solar PV plus battery installations exceeded all the previous years combined.

PV plus battery installations continued to increase in 2020 but the growth was much slower than the previous two years. In 2021, as the slated retirement of AES Hawaii, Oahu's coal-fired plant at Campbell Industrial Park, approached near, there was a concern that not enough new utility-scale solar power would be developed in time. To encourage battery installation, HECO begun the Battery Bonus program in July 2021, a new battery incentive program that pays a cash incentive to the customers on Oahu when they add batteries to their rooftop solar systems. This Battery Bonus program further boosted installations of solar PV plus battery systems in 2021 and 2022 with 23 and 16 percent increase from the previous year, respectively.

Table 2: Summary of building permits related to residential PV and battery installation in 2022

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Mar 31, 2023*	Number of permits	% completed as of Mar 31, 2023*	Number of permits	% completed as of Mar 31, 2023*
1	308	85%	2	50%	32	97%
2	266	86%	0	-	32	100%
3	287	90%	0	-	37	92%
4	256	88%	0	-	36	83%
5	284	89%	0	-	28	100%
6	373	88%	0	-	23	87%
7	407	85%	1	100%	22	64%
8	471	82%	0	-	31	84%
9	447	80%	0	-	39	79%
10	511	73%	0	-	31	71%
11	487	65%	0	-	33	67%
12	646	54%	1	0%	62	45%
Total	**4,743**	**78%**	**4**	**50%**	**406**	**78%**
Annual average permit value ($)**	34,351		9,750		19,220	
Annual median permit value ($)**	30,000		11,500		16,250	

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
*: The completion rate is calculated as the percentage of completed projects among total PV or PV battery-related permits issued in 2022.
**: The PV or PV battery-related installation projects were excluded from the calculation of average or median permit values if they were combined with other types of building work as other costs could not be separated from the cost of PV or battery installation

Combining battery storage with PV system installation has become an increasingly popular choice since 2017. In 2017, PV plus battery installation accounted for 26.5 percent of the total PV-related projects. This percentage more than doubled to 62.3 percent in 2018 and continued to climb to 92.0 percent in 2022.

According to Table 2, a monthly average of 296 permits were issued for installation of PV plus battery storage systems in the first half of 2022. The monthly average increased to 494 permits in the second half of 2022.

By the end of March 2023, 78 percent of these projects were completed. In addition, there were 4 permits issued to add batteries to the existing PV systems, and 406 permits issued for installation of a PV system alone. Their completion rates by the end of March 2023 were 50 percent and 78 percent respectively.

The average installation cost of PV plus battery systems, indicated in the permits, was $34,351 in 2022, an 8.3 percent increase from $31,708 in 2021. The average costs of installing battery alone and PV alone were $9,750 and $19,220, respectively. The median project cost of PV plus battery was $30,000, about $4,000 less than the average cost. As we can see from Table 3, 80.8 percent of permits issued for PV plus battery installation were above $20,000 and 51.1 percent were above $30,000. Almost all the battery-only permits were below $20,000. As for the PV-only permits, only 17 percent had values above $30,000 while nearly 60 percent had values below $20,000.

Table 3: Cost distribution of residential PV and battery installation: 2022

Price range	PV plus battery		Battery only		PV only	
	Number of permits	percent	Number of permits	percent	Number of permits	percent
< $5,000	12	0.3%	1	25%	18	5.0%
$5000 - $10,000	37	0.8%	0	0%	65	18.0%
$10,000 - $20,000	793	18.1%	3	75%	135	37.3%
$20,000 - $30,000	1,302	29.7%	0	0%	82	22.7%
$30,000 - $40,000	927	21.1%	0	0%	33	9.1%
> $40,000	1,312	29.9%	0	0%	29	8.0%
Total	**4,383**	**100.0%**	**4**	**100%**	**362**	**100.0%**

Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.
Note: The total permit numbers may be 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. These combined permits 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 2022. Ewa area hosted the most PV plus battery and PV only installations, with 543 and 53 permits issued in 2022, respectively. Other areas where the installation of the PV plus battery storage system was popular include Kailua (366), Waipahu (345), Kaneohe (279), Mililani-Waipio (268), Hawaii Kai (261), and Makakilo-Kapolei (253).

Table 4: Residential PV and battery installation by neighborhood area: 2022

Neighborhood Name	Number of building permits related to PV and battery installation		
	PV plus battery	Battery Only	PV only
Aiea	214	0	20
Ala Moana-Kakaako	1	0	0
Aliamanu-Salt Lake	114	0	8
Diamond Head-Kapahulu	117	0	9
Ewa	543	0	53
Hawaii Kai	261	0	19
Kahaluu	78	0	5
Kailua	366	0	37
Kaimuki	154	0	17
Kalihi Valley	48	0	3
Kalihi-Palama	43	0	8
Kaneohe	279	0	18
Koolauloa	39	0	7
Kuliouou-Kalani Iki	212	0	16
Liliha-Alewa	99	0	11
Makakilo-Kapolei	253	0	11
Makiki-Tantalus	33	0	6
Manoa	134	2	8
Mccully-Moiliili	6	0	1
Mililani Mauka-Launani Valley	110	1	13
Mililani-Waipio	268	0	19
Moanalua	52	1	3
Mokapu	1	0	0
Nanakuli-Maili	155	0	9
North Shore	60	0	3
Nuuanu-Punchbowl	100	0	6
Palolo	70	0	7
Pearl City	215	0	18
Wahiawa	96	0	9
Waialae-Kahala	109	0	7
Waianae Coast	144	0	12
Waimanalo	25	0	6
Waipahu	345	0	31

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

Appendix: Commercial PV Battery Installations in 2022

This appendix summarizes the commercial PV battery-related building permits issued in 2022. A total of 30 PV plus battery permits were issued for commercial use in 2022 with an average permit value of $97,382 and a median permit value of $42,460. The fact that the average permit value was higher than the median value reflects some large commercial PV plus battery projects taken place in 2022.

There were also 42 permits issued for commercial battery-only projects. Almost all of them (41 permits) were for Kapolei Energy Storage and their average permit value was $656,250. Unlike residential PV-related permits, nearly 40 percent of commercial PV-related permits did not include battery installation. In 2022, 47 PV-only permits were issued for commercial use with an average permit value of $164,068.

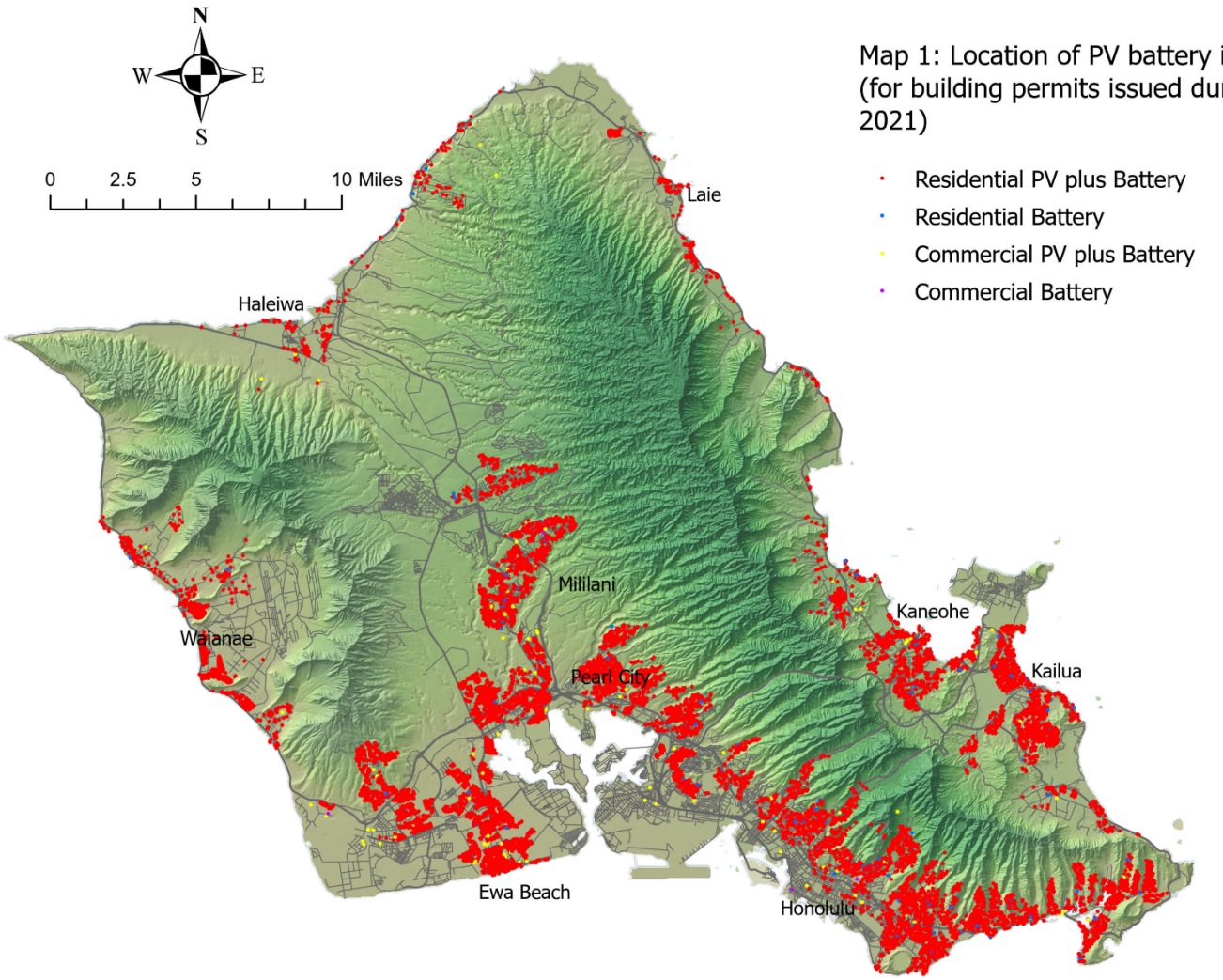
Table A1: Summary of building permits related to commercial PV and battery installation in 2022

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Mar 31, 2023*	Number of permits	% completed as of Mar 31, 2023*	Number of permits	% completed as of Mar 31, 2023*
1	1	100%	0		2	100%
2	1	100%	0		2	50%
3	3	67%	0		3	100%
4	3	100%	0		4	75%
5	6	83%	0		1	100%
6	6	67%	0		1	100%
7	0		0		8	75%
8	2	100%	1	0%	2	100%
9	2	50%	0		11	82%
10	4	100%	41	0%	6	67%
11	1	100%	0		4	100%
12	1	100%	0		3	67%
Total	**30**	**83%**	**42**	0%	**47**	**81%**
Annual average permit value ** **($)**	97,382		656,250		164,068	
Annual median permit value ** **($)**	42,460		656,250		80,384	

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

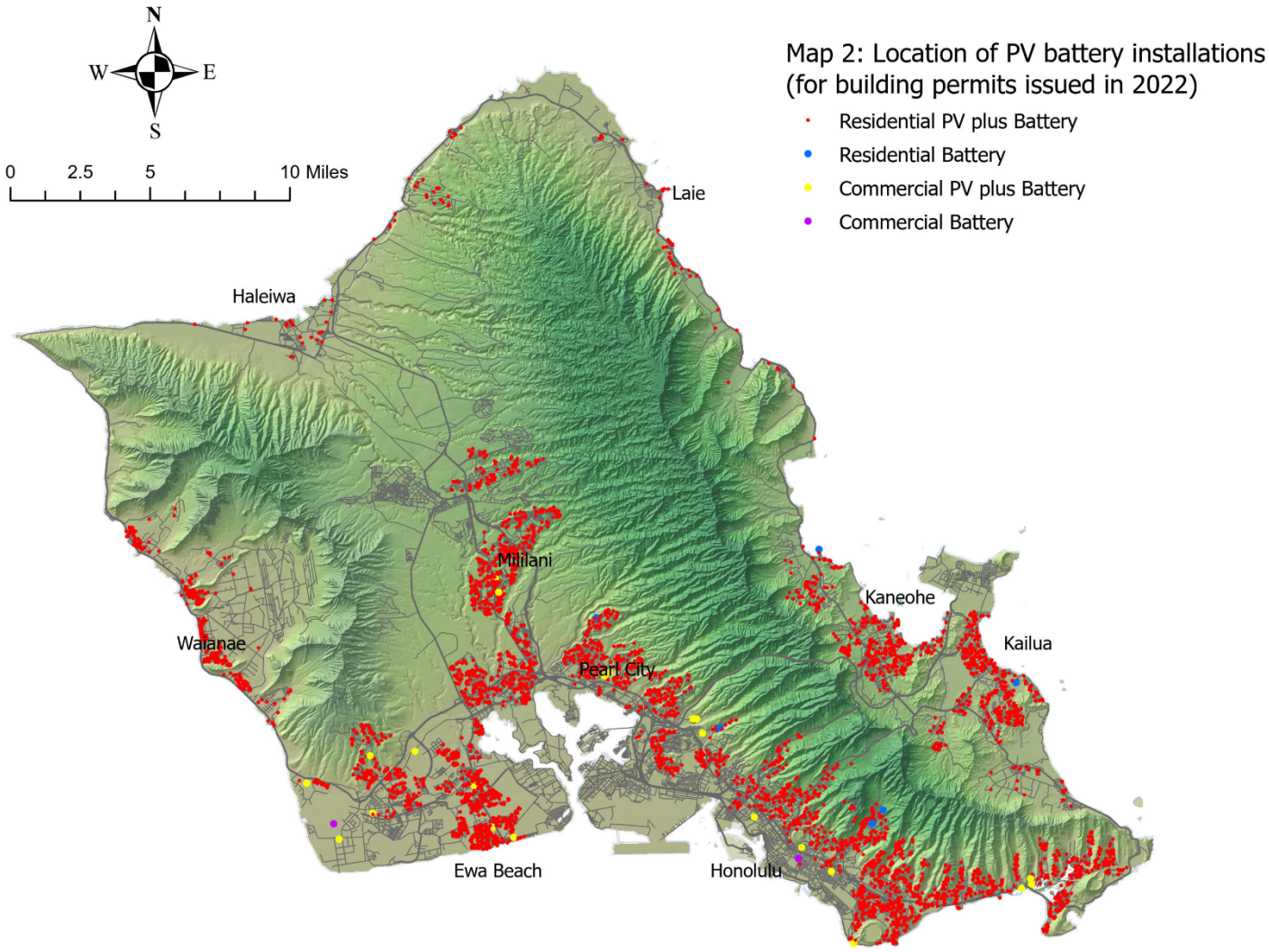
*: The completion rate is calculated as the percentage completed installation among total PV or PV battery-related permits issued in 2022

**: The PV or PV battery-related installation projects were excluded from the calculation of average or median permit values if they were combined with other types of building work as other costs could not be separated from the cost of PV or battery installation.



Map 1: Location of PV battery installations (for building permits issued during 2008 to 2021)

- Residential PV plus Battery
- Residential Battery
- Commercial PV plus Battery
- Commercial Battery


N
W
E
S
0
2.5
5
10 Miles
Map 2: Location of PV battery installations
(for building permits issued in 2022)
Residential PV plus Battery
Residential Battery
Commercial PV plus Battery
Commercial Battery
Laie
Haleiwa
Mililani
Kaneohe
Kailua
Waianae
Pearl City
Ewa Beach
Honolulu