research & economic analysis division

Solar PV Battery Installations in Honolulu: 2018 Update[1]

This report is an update of the previous report published in 2018. Since October 2015, 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, making battery-connected PV system 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 continued to double in 2018. Based on the building permit data from the City and County of Honolulu, this report provides detailed information on solar PV battery installations in 2018, 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 PV plus battery installation: 2008-2018

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

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.

The first building permit for residential[2] PV battery installation was issued in February 2008. Since then, the annual number of PV plus battery building permits was less than 10 until

[1] This report is prepared by Dr. Jie Bai, Economist, under the direction of Dr. Eugene Tian, Division Administrator. Dr. David Shuai, Research Statistician, tabulated the data for this report.
[2] Our analysis focuses on residential PV battery installations, as only six percent of PV battery installations were for commercial use. A summary table of commercial PV battery installation is provided in the Appendix.

2015. From 2016, the number began to pick up. In 2018, a total of 1,659 permits were issued by Honolulu DPP for PV plus battery installation, accounted for 62.3 percent of the total PV related or PV battery related projects. This percentage jumped significantly compared with 26.5 percent in 2017[3], indicating that installing battery storage together with the PV system became more popular in 2018. The average installation cost in 2018, as measured by the permit values, was $5,520 higher than the year of 2017.

Table 2 summarizes the building permits related to residential PV plus battery installations in each month of 2018. Installations spread almost evenly in the first nine months; the number began to climb since October. On average, about 138 permits were issued each month. Although the majority cases were solar battery installed together with PV, 21 solar batteries were or will be installed to the existing PV systems. As a comparison, Table 2 also shows that 985 building permits were issued for installing PV alone.

Table 2: Summary of building permits related to residential PV and battery installation in 2018

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2018	Number of permits	% completed as of Dec 31, 2018	Number of permits	% completed as of Dec 31, 2018
1	113	91%	0	-	89	96%
2	108	91%	2	100%	72	100%
3	110	92%	3	100%	73	100%
4	107	77%	1	100%	81	85%
5	166	89%	3	100%	106	76%
6	123	91%	1	100%	83	90%
7	127	88%	5	60%	73	92%
8	137	88%	1	100%	66	82%
9	115	89%	0	-	50	96%
10	157	90%	1	100%	131	93%
11	219	87%	4	75%	85	93%
12	177	72%	0	-	76	84%
Total	**1,659**	**87%**	**21**	**86%**	**985**	**91%**
Annual average permit value ($)	34,995		7,971		23,045	
Annual median permit value ($)	32,000		8,000		22,000	

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

The average cost that households in Honolulu paid to install a solar PV system together with battery in 2018 was $34,995. By contrast, the average costs of installing battery alone and PV alone were $7,971 and $23,045 respectively.

[3] Solar PV Battery Installations in Honolulu: 2017, Jan 2018, DBEDT, State of Hawaii.

The median project cost of PV plus battery was $32,000, 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 table below. Among the 1,653 permits issued for PV installation with battery, 84 percent were above $20,000 and over a half were above $30,000. All the battery only permits were below $20,000. As for the PV only installations, about 80 percent out of the 966 permits had the permit values between $10,000 and $30,000. Only 6.7 percent of the permits were issued for the PV only installations with values above $40,000; by contrast, this ratio is almost 30 percent for the PV plus battery installations.

Table 3: Cost distribution of residential PV and battery installation: 2018

Price range	PV plus battery		Battery only		PV only	
	Number of permits	percent	Number of permits	percent	Number of permits	percent
< $5,000	10	0.6%	3	14.3%	90	9.3%
$5000 - $10,000	29	1.8%	14	66.7%	44	4.6%
$10,000 - $20,000	225	13.6%	4	19.0%	272	28.2%
$20,000 - $30,000	493	29.8%	0	0%	331	34.3%
$30,000 - $40,000	403	24.4%	0	0%	164	17.0%
> $40,000	493	29.8%	0	0%	65	6.7%
Total	**1,653**	**100.0%**	**21**	**100%**	**966**	**100%**

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 2018. Ewa area hosted the most PV plus battery installations, with 294 permits issued by the end of 2018; it also had the highest battery only and PV only installations, 5 and 111 respectively. The next is Makakilo/Kapolei/Honokai Hale, with 164 PV plus battery, 2 battery only, and 101 PV only installations. Other areas where the installation of PV together with battery was popular were Waipahu (114), Nanakuli/Maili (101) and Kailua (94).

In the appendix, the commercial building permits related to PV battery installations are also summarized. In 2018, 49 commercial PV plus battery were installed, with average permit value of $89,360 and median permit value of $42,500. The fact that the average permit value was much higher than the median reveals that the permit values of some top-ranked commercial PV battery projects were rather high. By contrast, the difference between the average and median permit values of commercial PV only projects was even more prominent, indicating that some exceptionally large commercial PV projects broke ground in 2018. In total, there were 113 commercial PV only installations, with 80 percent completion rate by the end of 2018.

Table 4: Residential PV and battery installation by neighborhood area: 2018

Neighborhood Name	Number of building permits related to PV and battery installation		
	PV plus battery	Battery Only	PV only
Aiea	60	0	39
Airport	2	0	1
Ala Moana/Kakaako	0	0	2
Aliamanu/Salt Lake/Foster Vill	44	1	18
Diamond Head/Kapahulu/St. Loui	29	0	30
Downtown	0	0	1
Ewa	294	5	111
Hawaii Kai	62	0	39
Kahaluu	26	0	11
Kailua	94	0	78
Kaimuki	47	1	31
Kalihi Valley	15	0	9
Kalihi-Palama	17	0	8
Kaneohe	56	0	37
Koolauloa	56	0	13
Kuliouou-Kalani Iki	42	1	29
Liliha/Kapalama	24	0	30
Makakilo/Kapolei/Honokai Hale	164	2	101
Makiki/Lower Punchbowl/Tantalu	12	0	5
Manoa	32	0	28
Mililani Mauka-Launani Valley	26	0	22
Mililani/Waipio/Melemanu	44	0	43
Moanalua	9	1	9
Mccully/Moiliili	2	0	8
Nanakuli/Maili	101	2	37
North Shore	33	2	25
Nuuanu/Punchbowl	14	1	10
Palolo	9	0	22
Pearl City	61	1	38
Wahiawa	15	0	11
Waialae-Kahala	25	1	30
Waianae	47	0	29
Waimanalo	11	0	9
Waipahu	114	0	45

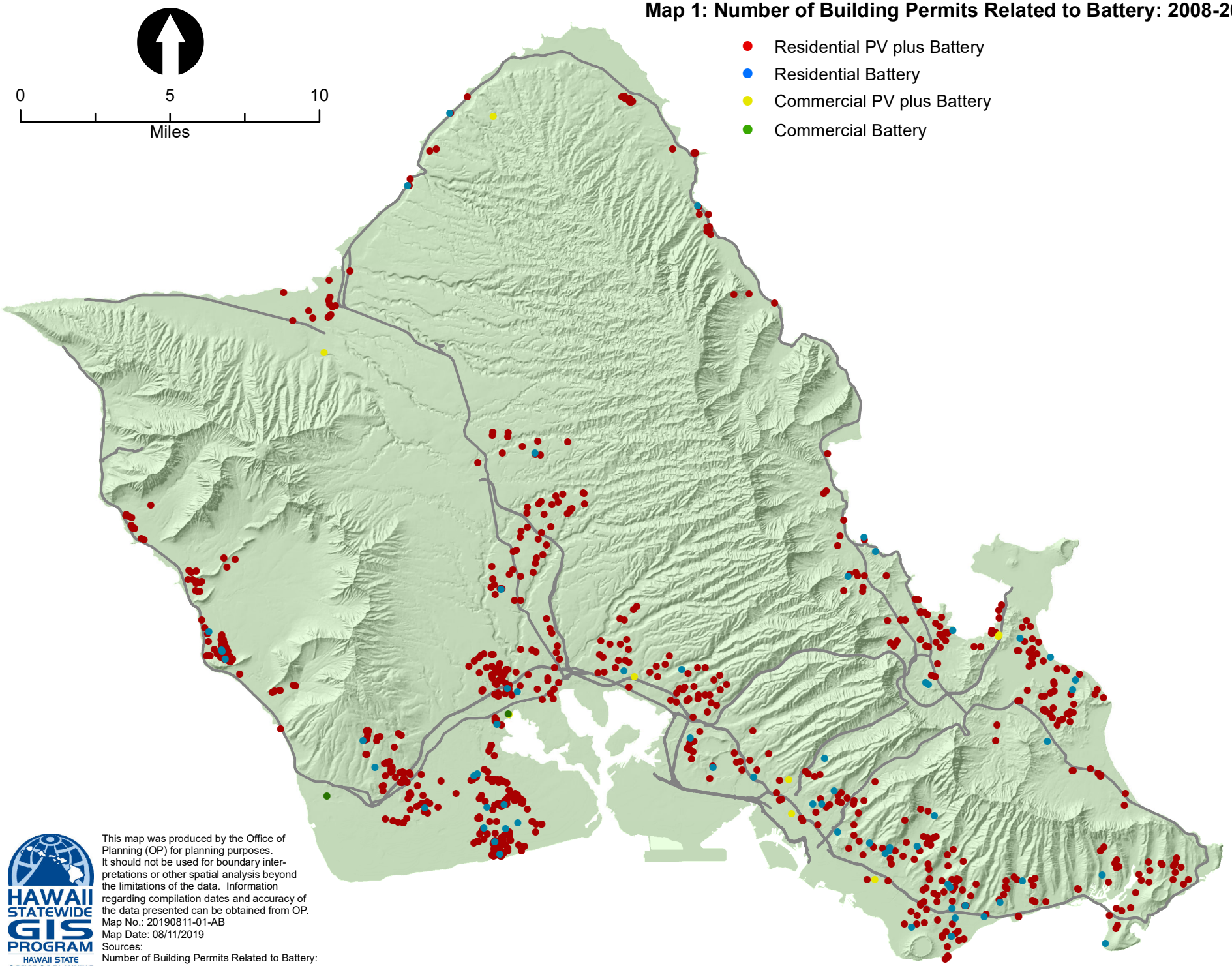
Source: Department of Planning and Permitting, City and County of Honolulu. Calculation by DBEDT.

Table A1: Summary of building permits related to commercial PV and battery installation in 2018

Month	PV plus battery		Battery Only		PV Only	
	Number of permits	% completed as of Dec 31, 2018	Number of permits	% completed as of Dec 31, 2018	Number of permits	% completed as of Dec 31, 2018
1	2	50%	0	-	14	86%
2	4	75%	0	-	7	100%
3	4	75%	0	-	14	86%
4	2	0%	0	-	11	100%
5	2	100%	0	-	10	70%
6	0	-	0	-	8	50%
7	2	50%	0	-	12	100%
8	4	100%	0	-	4	100%
9	1	100%	0	-	6	83%
10	17	94%	1	100%	12	42%
11	5	80%	0	-	4	25%
12	6	0%	0	-	11	82%
Total	49	71%	**1**	**100%**	113	80%
Annual average permit value* ($)		89,360		12,400		486,727
Annual median permit value* ($)		42,500		12,400		85,675

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 the PV or battery installation.

Map 1: Number of Building Permits Related to Battery: 2008-2017



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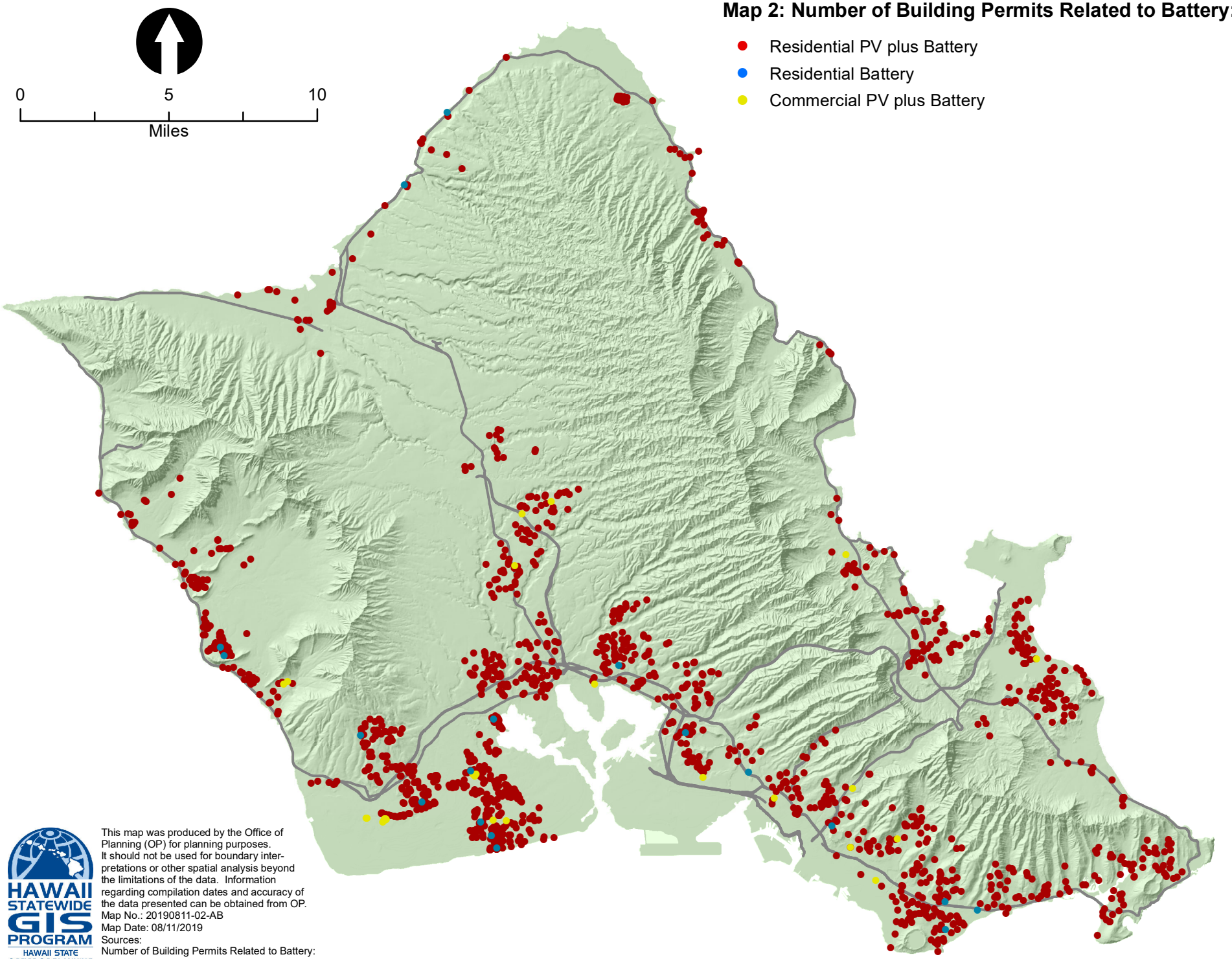
Map No.: 20190811-01-AB
Map Date: 08/11/2019
Sources:
Number of Building Permits Related to Battery:
READ, DBEDT, 2018.

Map 2: Number of Building Permits Related to Battery: 2018



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Map No.: 20190811-02-AB
Map Date: 08/11/2019
Sources:
Number of Building Permits Related to Battery:
READ, DBEDT, 2018.