

Solar PV Installations in Honolulu

-an analysis based on building permit data-

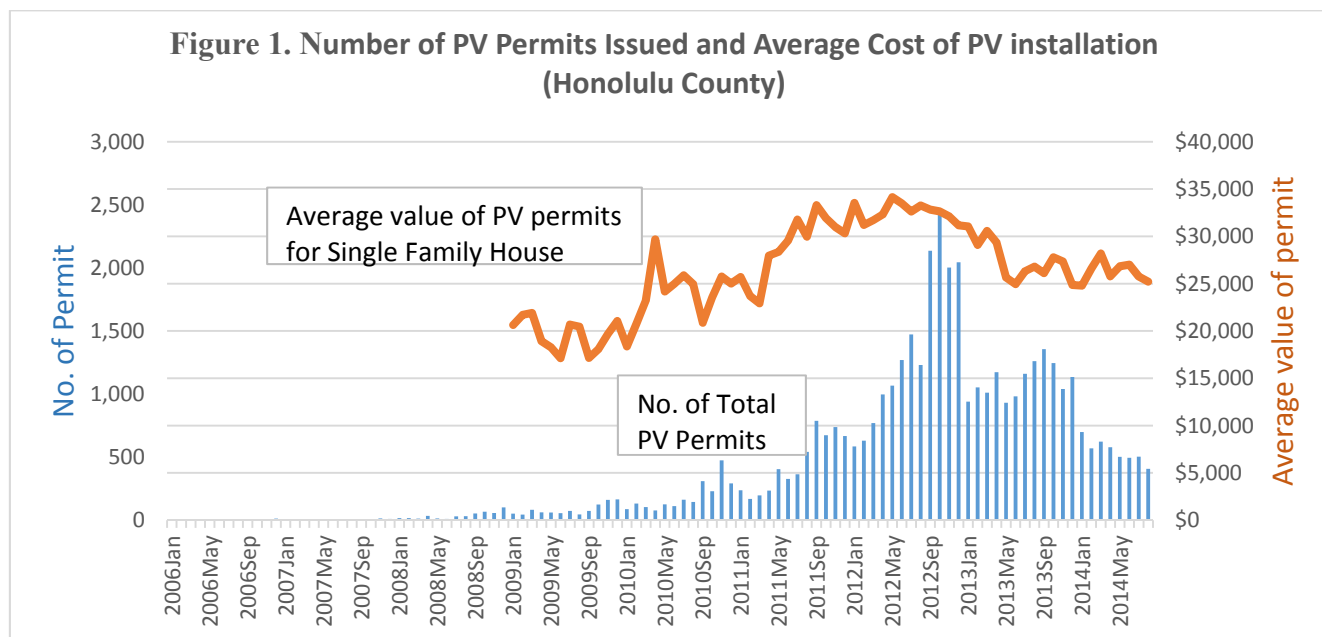
Statistics Brief

January, 2015

With generous tax credits and dropping solar photovoltaic (PV) price, installation of solar PV systems has been proliferating nationwide in recent years. Hawaii was one of the states that led the movement, ranking third in the nation for cumulative installed PV capacity per capita in 2013.¹ This statistical brief was prepared to fill the need of a deeper understanding of solar PV installation activities in Hawaii. Based on building permit data from the City and County of Honolulu, this brief provides detailed information on solar PV installations that took place from 2000 to 2014 in the Honolulu County.

Trends of Solar PV Installation

Solar PV installation in Honolulu began to increase gradually from 2008. After years of slow progress, PV installation exploded in 2012. A peak of PV installation was observed in September to December 2012. With the expected enforcement of new rules for Hawaii solar tax credit, over 2,000 permits for PV installation were submitted and issued each month during the period. Although permit issuance declined slightly in 2013, the solar boom continued. A total of 16,631 permits for 2012 and 13,287 permits for 2013 were issued for solar PV installation in Honolulu.



¹ Hawaii Energy Facts & Figures, Hawaii State Energy Office, November 2014

PV installation slowed down in 2014. A total of 4,376 permits was issued for solar PV installation in Honolulu from January to August 2014, which was about half of the number issued in 2012 and 2013 for the same eight month period.

Not all issued building permits were actually finished. Some permits were canceled or revoked due to a change in plan or other issues, or never passed inspections required. Compared to other types of building permits, solar PV permits showed high completion rates. As of October 1, 2014, 91.3 percent of permits issued in 2012 and 87.3 percent of permits issued in 2013 for PV installation were successfully closed. 5.8 percent of PV permits issued in 2012 and 4.0 percent of PV permits issued in 2013 were canceled or revoked after they were issued.

The majority of PV permits issued during the 2000-2014 period was for residential buildings. Although PV projects for non-residential buildings such as hotels, industrial and commercial buildings, were mostly big projects, the total number of permits issued for non-residential buildings was less than 2 percent of total PV permits. Of the 42,625 PV permits issued for residential buildings since 2000, 98 percent (41,795 permits) was for single family houses, while totals of 406 and 424 permits were issued for two family houses and apartment building respectively.

Table 1. Number of PV Permits Issued from January 2000 to August 2014 (by Housing Type)

year	Number of PV Permits Issued (by housing type)						Permit Status as of Oct 1, 2014	
	Total	Single Family	Two Family	Apart- ment	Hotel	Other Types	Closed (%)	Canceled or revoked (%)
2000	1	0	0	0	0	1	100%	0%
2001	4	4	0	0	0	0	100%	0%
2002	5	5	0	0	0	0	100%	0%
2003	3	3	0	0	0	0	100%	0%
2004	2	0	0	0	0	2	100%	0%
2005	8	8	0	0	0	0	100%	0%
2006	40	33	3	1	0	3	97.5%	2.5%
2007	71	54	1	0	0	16	97.2%	1.4%
2008	443	380	2	2	0	59	95.9%	2.3%
2009	1,000	922	10	7	0	61	95.0%	1.4%
2010	2,248	2,110	35	15	0	88	97.0%	1.2%
2011	5,338	5,037	78	65	0	158	96.7%	1.9%
2012	16,631	16,231	168	80	0	152	91.3%	5.8%
2013	13,287	12,796	71	193	2	225	87.3%	4.0%
2014 (~ Aug)	4,376	4,212	38	61	0	65	68.7%	1.1%

Cost of Solar PV Installation

Average cost of solar PV installation in Honolulu was calculated based on the construction value submitted by applicants in their building permit application. A building permit may include multiple jobs, which are not necessarily interrelated. Although a separate building permit is required for PV installation, some PV permits were still combined with other jobs, and those permits were excluded from average cost calculation.

Table 2 shows the average cost of PV system installation in Honolulu by various housing types. For single family houses, the average cost of PV installation decreased since 2012 from \$32,535 in 2012 to \$26,284 in 2014. Of PVs installed at a single family house from 2009 to August 2014, 31 percent cost \$20,000-\$30,000 while another 31 percent cost \$30,000-\$50,000. Median cost of single family house PV installation was \$26,700 for the period. (Table 3).

Table 2. Average Cost of PV Installation by Housing Type

	PV permits by housing type							
	Single Family House		Two Family House		Apartment		Non-Residential ²	
	No. of permit ¹	average cost	No. of permit ¹	Average cost	No. of permit ¹	average cost	No. of permit ¹	average cost
2009	917	\$19,659	10	\$66,057	6	\$15,300	61	\$335,344
2010	2,102	\$24,038	35	\$30,745	15	\$51,680	87	\$368,656
2011	5,036	\$30,151	78	\$26,283	65	\$180,681	158	\$420,377
2012	16,223	\$32,535	168	\$30,323	78	\$67,479	152	\$713,796
2013	12,791	\$27,420	71	\$30,498	193	\$48,837	218	\$337,119
2014 (~ Aug)	4,204	\$26,284	36	\$26,655	61	\$48,894	59	\$285,875

¹ PV permits that were combined with works other than electrical job were excluded from cost calculation

² “Non-residential” includes all building types other than single and two family house, and Apartment

Table 3. Distribution of PV Installation Cost for Single Family House (2009-2014)

PV installation cost	Percentage	Mean: \$29,300 Median: \$26,700
Less than \$5,000	0.2%	
\$5,000 ≤ cost < \$10,000	3.8%	
\$10,000 ≤ cost < \$20,000	24.5%	
\$20,000 ≤ cost < \$30,000	30.6%	
\$30,000 ≤ cost < \$50,000	30.9%	
\$50,000 ≤ cost < \$100,000	8.9%	
\$100,000 ≤ cost < \$200,000	0.4%	
Over \$200,000	0.1%	
Total	100%	

Solar PV Installation by Area

The number of PV system installations so far in Honolulu and in each smaller geographic area is useful information for various planning purposes. Table 4 shows the number of building permits issued for PV installation from January 2000 to August 2014 and closed as of October 1, 2014 by city's 35 neighborhood areas. Ewa area hosted the most PV installations so far, with 3,612 PV installation finished until September 2014. Other areas where PV installation has been very popular in the past years include Kailua (3,102), Waipahu (2,972), Makakilo/Kapolei (2,352), Mililani/Waipio (2,278), Hawaii Kai (2,262) and Aiea (2,237). The last column of table 4 shows the average cost of PV installation for a single family house by neighborhood area. Except the Airport area, the average cost of PV installation for a single family house was in the range of \$26,000 and \$37,000 with the highest average cost of \$36,816 found in the Waiialae/Kahala area.

One of the measures of interest is the *market penetration rate* of solar PV. "Households with solar PV, as a percentage of total households" would serve as an indicator of market penetration of solar PV. To calculate this indicator, the PV installations data in Table 4 were re-grouped into census tracts, the geographic areas where various housing counts and characteristics were readily available from census data. Since data on "the number of households with solar PV" is not available, market penetration of solar PV was calculated in Table 5 by dividing "total number of residential PV permits" by "total number of households". Caution is required here because of the following two factors. First, a permit for residential buildings other than a single family house would cover multiple households in the building. Second, it's possible that a house installed PVs multiple times. However, since 98 percent of total Honolulu PV permits was for single family houses, the "total number of PV permits for residential housings" would serve as a good proxy for "the number of households with solar PV".

Table 5 shows that market penetration of solar PV in Honolulu was 12.2% in 2014 based on the building permit data closed by October 1, 2014.

The areas with a high market penetration of solar PV include the residential areas near some west side golf courses, Mililani area, and census tracts in East Honolulu. The table also confirms that the areas with higher owner occupancy rates tend to show higher market penetration of solar PV.

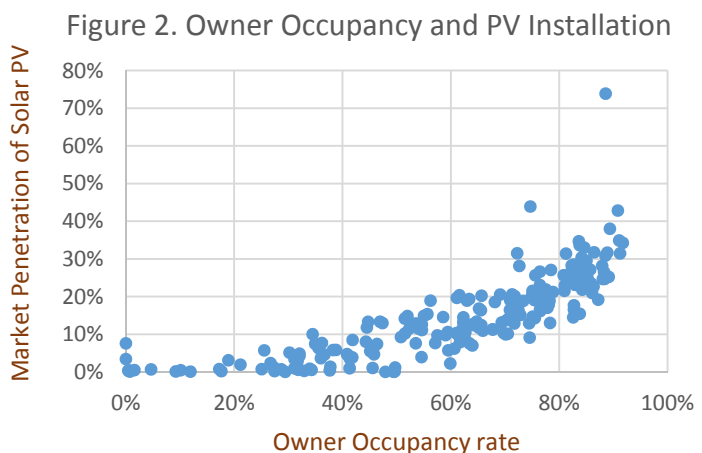


Table 4. PV Permits by Household Types by Neighborhood

Neighborhood	Number of PV permits (Issued from Jan. 2000 to Aug. 2014 And closed as of Oct 1, 2014)					Average permit value for SF house (2009-2014) ¹
	Total	Single Family House	Two Family House	APT	Non- residential	
Aiea	2,237	2,178	15	18	27	\$27,319
Airport	43	6	0	0	37	\$21,698
Ala moana/Kakaako	43	12	1	4	26	\$31,103
Aliamanu/Salt lake/Foster Vill	744	715	9	13	7	\$29,794
Diamond Head/Kapahulu/St. Louis	847	811	10	1	25	\$26,834
Downtown	26	8	0	5	13	\$31,403
Ewa	3,612	3,527	6	67	12	\$27,303
Hawaii Kai	2,262	2,186	39	30	7	\$31,792
Kahaluu	583	559	6	14	4	\$29,776
Kailua	3,102	3,013	28	38	24	\$32,433
Kaimuki	1,257	1,197	43	0	17	\$27,519
Kalihi Valley	385	378	2	0	5	\$31,483
Kalihi-Palama	451	272	9	13	157	\$34,885
Kaneohe	1,971	1,932	12	14	14	\$31,087
Koolauloa	391	374	9	0	8	\$34,353
Kuliouou-Kalani Iki	1,518	1,497	17	0	4	\$34,534
Liliha/Kapalama	875	835	21	2	17	\$28,146
Makakilo/Kapolei/Honokai Hale	2,352	2,210	7	66	69	\$27,211
Makiki/Lower Punchbowl/Tantalus	380	308	20	30	22	\$31,671
Manoa	1,029	970	28	2	29	\$29,901
Mililani Mauka-Launani Valley	1,704	1,695	3	3	3	\$27,404
Mililani/Waipio/Melemanu	2,278	2,247	2	16	13	\$26,073
Moanalua	405	397	2	2	4	\$27,460
Mccully/Moiliili	166	115	5	18	28	\$26,955
Nanakuli/Maili	685	663	9	2	11	\$30,289
North Shore	571	549	6	1	15	\$29,149
Nuuanu/Punchbowl	753	720	20	0	13	\$29,323
Palolo	504	486	11	1	7	\$24,864
Pearl City	1,905	1,874	13	1	17	\$25,836
Wahiawa	657	637	2	5	14	\$27,688
Waialae-Kahala	852	826	16	2	8	\$36,816
Waianae	698	683	4	0	11	\$30,371
Waikiki	13	0	0	3	10	-
Waimanalo	381	372	4	2	3	\$36,063
Waipahu	2,972	2,885	4	14	69	\$28,566

¹ PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000.Jan- 2014. Aug), closed					Average permit value for SF house (2009-2014) ²	
						Total	Residential housing			Non-Residential		
					total		Single Family	Two Family	APT			
Honolulu County (242 census tracts)		311,047	917,907	56.1%	12.2%	38,643	37,897	37,129	383	385	746	\$29,233
84.10	Coral Creek Golf Course	682	2,346	88.6%	73.9%	508	504	496	-	8	4	\$17,424
84.08	Hoakalei Country Club	1,508	4,720	74.7%	43.9%	665	663	626	1	36	2	\$27,563
89.31	Waiawa Prison	828	3,034	90.8%	42.9%	356	355	353	1	1	1	\$28,384
89.30	Mililani: Ainamakua Drive	836	2,560	89.4%	38.0%	319	318	318	-	-	1	\$28,765
89.28	Mililani Mauka Middle	1,142	3,884	91.1%	34.9%	400	399	399	-	-	1	\$25,712
89.17	Mililani Town Center	1,526	4,554	83.6%	34.7%	532	530	530	-	-	2	\$26,010
4.02	Waialae Iki	1,404	3,999	91.7%	34.3%	483	482	476	6	-	1	\$35,159
84.06	Hawaii Prince Golf Course	1,584	5,997	83.8%	33.7%	534	534	534	-	-	-	\$28,291
78.09	Newtown	1,144	3,377	84.6%	33.0%	378	378	372	6	-	-	\$27,529
89.08	Mililani Marketplace	1,859	5,837	86.4%	31.8%	595	591	585	1	5	4	\$24,417
1.10	Kalama Valley	1,457	4,274	88.9%	31.7%	462	462	458	-	4	0	\$28,807
112.01	Kalaheo Avenue	1,527	4,364	72.2%	31.5%	485	482	482	-	-	3	\$35,814
1.11	Lunalilo Park Subdivision	1,572	5,025	91.2%	31.5%	495	495	492	2	2	-	\$30,680
4.01	Waialae Nui Ridge-Ainakoa	1,029	2,814	81.2%	31.4%	325	324	317	7	-	1	\$27,852
89.24	Royal Kunia	2,039	7,623	88.5%	30.9%	632	630	630	-	-	2	\$27,526
1.14	Portlock	554	1,594	84.1%	30.4%	168	168	168	-	-	-	\$47,485
78.10	Royal Summit	1,930	5,435	85.0%	29.6%	571	571	562	4	5	-	\$25,500
115	Kapolei	1,414	5,381	82.7%	28.5%	413	404	379	1	24	10	\$26,150
6	Diamond Head	480	1,218	82.3%	28.3%	140	136	133	3	-	4	\$39,547
80.07	Pearl City Highlands	1,631	5,292	87.9%	28.2%	462	460	458	2	-	2	\$25,663
84.07	Ocean Pointe	1,067	3,325	72.6%	28.2%	301	301	292	-	9	-	\$30,959
111.03	Olomana	1,199	3,791	84.2%	27.4%	330	329	326	3	-	1	\$32,079
110	Maunawili	1,162	3,538	85.7%	27.2%	322	316	314	1	1	6	\$31,559
5	Waialae-Kahala	1,380	3,788	78.5%	27.1%	378	374	369	5	-	4	\$46,788
2	Kuliouou	1,879	5,675	76.4%	26.7%	503	501	496	5	-	2	\$30,600

¹ "total number of residential PV permits" divided by "total number of households"

² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000.Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
						Total	Residential housing				Non-Residential	
							total	Single Family	Two Family	APT		
78.04	Lower Pearl City	596	1,907	88.3%	26.6%	159	159	159	-	-	-	\$24,928
109.01	Kalaheo Hillside	1,004	3,133	81.9%	26.1%	265	262	226	7	29	3	\$31,660
111.04	Enchanted Lakes	1,515	4,849	83.9%	25.8%	391	391	389	1	1	-	\$30,933
77.02	Aiea Heights	1,642	5,090	80.8%	25.7%	424	422	416	3	3	3	\$28,501
86.06	Kapolei Golf Course	2,736	9,693	75.6%	25.7%	706	703	700	2	1	3	\$27,333
89.21	Waipio	580	2,623	83.4%	25.6%	149	149	147	2	-	-	\$29,444
68.06	Ala Liliko	552	1,690	89.1%	25.3%	140	140	139	1	-	-	\$27,482
80.06	Pearl City	1,469	4,813	85.2%	24.9%	374	366	365	1	-	8	\$25,926
33	Makiki Heights	384	1,127	83.6%	24.7%	96	95	92	3	-	1	\$31,329
105.05	Heeia Kea	1,084	3,524	88.4%	24.7%	270	268	267	-	1	2	\$32,663
89.13	Robinson Heights	836	4,046	88.0%	24.7%	207	207	207	-	-	-	\$33,142
111.06	Keolu	1,863	5,910	82.8%	24.3%	453	453	452	-	1	-	\$30,821
89.27	Koolani Drive	1,746	5,180	81.8%	23.7%	415	415	414	1	-	-	\$27,084
1.07	Kuapa Isle	956	2,818	85.9%	23.5%	226	225	225	-	-	1	\$31,893
86.22	Lower Makakilo	1,024	4,056	82.9%	23.1%	238	237	237	-	-	1	\$29,287
32	Round Top-Tantalus	314	824	76.4%	23.1%	75	73	73	-	-	2	\$33,133
84.05	Holomua School	1,196	4,664	84.0%	23.1%	276	276	275	1	-	-	\$31,485
89.18	Mililani: Nob Hill	1,755	5,429	81.0%	23.0%	405	403	394	-	9	2	\$26,320
80.05	Pacific Palisades	2,028	6,857	86.3%	22.7%	461	460	459	1	-	1	\$25,732
9400.0	Waimanalo Beach-	1,063	4,435	77.5%	21.9%	235	233	231	2	-	2	\$36,263
3.02	Wailupe	1,022	2,961	84.2%	21.9%	225	224	221	3	-	1	\$31,849
106.02	Castle High School-Halekou	1,644	5,298	81.0%	21.6%	356	355	351	4	-	1	\$29,557
46	Puunui-Waokanaka Street	1,211	3,601	75.1%	21.6%	264	261	256	5	-	3	\$31,194
67.01	Tripler-Moanalua	1,854	5,582	78.9%	21.3%	396	394	391	2	1	2	\$27,460
3.01	Aina Haina-Hawaii Loa	1,134	3,307	86.1%	21.0%	238	238	236	2	-	-	\$39,245
88	Managers Drive	1,666	7,802	71.3%	20.6%	363	344	344	-	-	19	\$29,277

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000.Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
						Total	Residential housing				Non-Residential	
							total	Single Family	Two Family	APT		
9.02	Maunalani Heights	1,482	3,983	69.1%	20.6%	305	305	299	6	-	-	\$27,853
14	Kapaolono Field	890	2,550	61.6%	20.4%	182	182	175	7	-	-	\$26,785
75.03	Halawa Heights	1,605	5,119	75.0%	20.3%	329	325	322	3	-	4	\$27,254
30	Judd Hillside-Lowrey	1,572	4,263	65.6%	20.3%	324	319	315	3	1	5	\$31,425
109.04	Maluniu Avenue	1,084	3,558	71.8%	20.2%	220	219	211	8	-	1	\$31,953
7	Kaimuki: 22nd Avenue	1,002	2,919	76.5%	19.9%	202	200	194	6	-	3	\$29,480
112.02	Lanikai	622	1,609	61.1%	19.7%	124	123	123	-	-	1	\$35,799
86.14	Kunia West	2,518	8,144	63.4%	19.4%	492	489	471	2	16	4	\$26,977
103.08	Kapunahala	1,023	3,285	87.2%	19.2%	197	197	195	2	-	-	\$29,103
1.08	Hawaii Kai Marina	1,278	3,264	75.4%	19.1%	246	244	199	34	11	2	\$28,941
47	Alewa-Kawananakoa	1,553	4,522	71.0%	19.0%	299	296	286	10	-	3	\$27,467
8	Kaimuki: Kapiolani	1,266	3,592	63.0%	19.0%	245	240	228	12	-	5	\$26,572
9.03	Lower Wilhelmina	1,058	2,858	56.2%	19.0%	202	201	195	6	-	1	\$26,533
89.12	August Ahrens School	491	2,450	78.2%	18.9%	93	93	93	-	-	-	\$33,501
107.02	Mokulele Drive	1,198	3,574	73.4%	18.9%	227	227	226	1	-	-	\$30,642
28	St. Louis Heights	1,415	3,678	72.1%	18.8%	268	266	259	7	1	2	\$25,402
84.02	Ewa Beach	1,929	8,133	68.1%	18.6%	359	359	356	3	-	-	\$32,200
78.11	Pearl Country Club	1,795	4,984	78.1%	18.2%	327	327	321	-	6	-	\$27,798
97.03	Lualualei-Camp Waianae	1,422	6,206	78.1%	17.9%	259	255	254	1	-	4	\$29,382
31.02	Upper Manoa	1,157	3,310	82.7%	17.7%	206	205	201	4	-	1	\$31,347
89.09	Mililani District Park	1,271	3,806	77.0%	17.4%	221	221	219	-	2	-	\$26,473
31.01	Woodlawn	1,335	3,687	77.8%	17.1%	229	228	228	-	-	1	\$30,132
86.12	Upper Makakilo	1,902	6,017	65.2%	16.9%	322	321	311	1	9	1	\$25,472
1.12	Koko Marina	2,017	5,524	82.7%	16.6%	338	335	320	2	13	3	\$29,691
80.02	Lower Waiau	815	2,651	76.4%	16.6%	141	135	135	-	-	6	\$24,933
107.01	Kokokahi	1,343	3,661	72.4%	16.5%	224	222	204	3	15	2	\$33,716

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Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000-Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
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							total	Single Family	Two Family	APT		
44	Pauoa	1,570	5,160	70.9%	16.5%	261	259	251	8	-	2	\$27,677
89.25	Village Park	1,956	6,902	65.5%	16.4%	322	321	321	-	-	1	\$28,159
86.17	Ewa Villages	2,421	9,354	76.5%	16.2%	393	392	385	-	7	1	\$26,690
103.06	Haiku	2,122	6,369	83.8%	15.5%	328	328	314	-	14	-	\$30,157
48	Kamehameha Heights	1,651	6,033	55.7%	15.4%	257	254	249	5	-	3	\$28,695
103.05	Ahuimanu	1,468	5,007	72.8%	15.1%	222	222	219	3	-	-	\$29,307
109.05	Ulupaina Street	894	2,497	55.0%	14.9%	139	134	130	3	1	5	\$29,710
109.03	Oneawa Street-Kawainui	1,349	4,115	52.0%	14.9%	202	201	196	5	-	1	\$31,265
89.22	Waiekele	2,842	7,479	75.1%	14.7%	419	418	406	2	10	1	\$25,489
15	Upper Kapahulu	1,267	3,524	58.6%	14.6%	191	185	184	1	-	6	\$25,059
96.03	Maili	2,443	9,747	62.3%	14.5%	359	355	346	7	2	4	\$29,320
86.13	Makakilo: Wainohia Street	241	900	82.6%	14.5%	35	35	34	-	1	-	\$27,815
97.04	Lualualei: Halona Road	690	2,872	70.9%	14.5%	103	100	100	-	-	3	\$31,078
89.06	Mililani Golf Course	1,334	3,771	75.5%	14.3%	191	191	191	-	-	-	\$27,790
13	Kaimuki: 6th Avenue	1,511	4,163	51.5%	14.2%	227	215	207	8	-	12	\$27,011
45	Dowsett Highlands	2,143	5,085	70.3%	13.8%	302	296	290	6	-	6	\$29,949
89.07	Mililani High School	1,293	4,232	64.7%	13.4%	176	173	172	1	-	3	\$27,460
12.01	Waialae Avenue-Pukele	1,070	2,886	46.9%	13.4%	148	143	140	3	1	5	\$25,570
102.02	Laie	1,342	5,776	44.7%	13.3%	179	179	170	9	-	-	\$36,557
12.02	Lower Palolo	1,018	3,009	62.3%	13.2%	135	135	132	3	-	-	\$24,763
89.23	Seaview	1,800	4,737	69.4%	13.2%	238	237	237	-	-	1	\$25,787
83.02	Campbell High School	1,369	6,715	78.3%	13.0%	181	179	176	-	3	2	\$33,196
98.02	Makaha	1,592	6,226	47.4%	13.0%	208	207	204	3	-	1	\$30,749
9400.0	Nanakuli	1,483	7,380	74.4%	12.9%	196	192	191	1	-	4	\$33,000
16	Lower Kapahulu	1,339	3,755	53.5%	12.9%	179	173	172	1	-	7	\$25,946
75.05	Foster Village	1,710	5,240	71.7%	12.9%	223	221	207	1	13	2	\$28,984

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000-Jan- 2014. Aug), closed					Average permit value for SF house (2009-2014) ²	
						Total	Residential housing					Non-Residential
							total	Single Family	Two Family	APT		
105.04	Waikalua Road	1,416	4,995	64.0%	12.7%	181	180	177	1	2	1	\$30,326
91	Kaukonahua Road	1,190	5,081	54.6%	12.6%	151	151	147	-	4	-	\$33,257
87.01	Leeward Community	1,858	8,614	64.2%	12.5%	232	232	232	-	-	-	\$33,615
92	Wahiawa Mauka	2,457	7,945	65.6%	12.5%	308	307	305	2	-	1	\$26,378
106.01	Puohala	1,080	3,396	62.3%	12.0%	136	130	129	1	-	6	\$31,543
29	East Manoa	870	2,332	44.5%	11.8%	106	103	98	5	-	3	\$27,199
84.11	Geiger Road	1,133	3,448	65.1%	11.8%	135	134	132	1	1	1	\$24,035
101	Waimea-Kahuku	2,457	7,848	52.3%	11.6%	291	284	280	4	-	7	\$31,556
105.03	Kaneohe District Park	546	1,762	54.0%	11.5%	63	63	63	-	-	-	\$28,506
10	Upper Palolo	1,040	3,000	67.7%	11.3%	119	118	115	3	-	1	\$25,332
89.20	Waipio Gentry	1,572	4,288	67.7%	11.3%	197	178	178	-	-	19	\$23,109
86.09	Ko Olina-Honokai Hale	646	2,052	54.6%	11.1%	77	72	70	-	2	5	\$32,324
65	Upper Kalihi Valley	1,038	4,514	65.9%	11.0%	114	114	113	1	-	-	\$30,551
111.05	Kailua Town	1,387	3,192	61.7%	10.8%	152	150	150	-	-	2	\$36,984
113	Waimanalo	1,341	5,425	59.4%	10.6%	144	143	139	2	2	1	\$35,672
77.01	Lower Aiea	1,144	4,229	62.7%	10.6%	123	121	121	1	-	2	\$28,088
1.06	Hahaione-Mariners Ridge	3,106	7,703	69.7%	10.4%	324	323	321	2	-	1	\$33,249
103.03	Kahaluu-Waikane	1,368	4,766	61.0%	10.3%	145	141	138	3	-	4	\$32,614
99.04	Kaena Point	1,917	5,648	51.5%	10.3%	206	197	194	2	1	9	\$27,641
89.29	Mililani Mauka-Meheula	1,970	4,836	70.5%	10.2%	200	200	198	-	2	0	\$27,654
27.01	UH Manoa Campus	676	1,644	34.5%	10.1%	75	68	66	-	2	7	\$29,479
68.05	Salt Lake Country Club	2,546	6,119	70.1%	10.0%	256	255	252	3	-	1	\$29,687
63.01	Kalihi Valley Park	871	3,673	61.3%	9.9%	89	86	86	1	-	3	\$30,399
96.08	Lualualei Transmitter	1,286	5,594	59.0%	9.8%	129	126	125	1	-	3	\$29,215
64.01	Gulick Avenue-Likelike	400	2,035	57.5%	9.7%	39	39	39	1	-	-	\$33,154
102.01	Hauula-Kaaawa	1,684	5,531	50.8%	9.3%	159	157	157	-	-	2	\$31,879

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000.Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
						Total	Residential housing				Non-Residential	
							total	Single Family	Two Family	APT		
78.05	Waiau Townhouses	1,685	5,113	74.5%	9.1%	154	154	149	2	3	-	\$27,215
89.15	Waipio Acres	1,822	5,236	62.7%	8.6%	157	156	156	-	-	1	\$27,752
11	Central Palolo	1,116	3,858	41.8%	8.5%	97	95	93	2	-	2	\$23,451
27.02	Punahou School	2,083	4,867	44.3%	8.1%	182	168	150	16	2	14	\$25,896
68.02	Aliamanu	1,495	6,725	61.7%	7.9%	120	119	115	4	-	1	\$34,324
75.04	Aloha Stadium	829	3,171	36.2%	7.7%	65	64	64	-	-	1	\$27,929
64.02	Kamanaiki Street	1,422	6,281	57.1%	7.7%	110	110	110	-	-	1	\$31,117
99.02	Haleiwa	1,112	3,683	53.5%	7.6%	85	85	85	-	-	-	\$28,103
66	Kahauiki Street	59	173	0.0%	7.6%	6	5	5	-	-	1	\$26,537
105.08	Lilipuna Road	1,069	2,569	63.4%	7.6%	82	82	81	1	-	0	\$32,508
87.03	West Loch	1,643	6,766	34.9%	7.5%	142	123	120	0	3	19	\$26,385
49	Lanakila	964	3,066	46.4%	7.5%	78	72	70	2	-	6	\$28,007
105.07	Kahuhipa Street	1,820	5,419	64.0%	7.1%	132	129	129	-	-	3	\$31,035
61	Kalihi Waena	840	4,144	45.8%	6.8%	59	57	57	-	-	2	\$36,684
93	Wahiawa Waena	1,532	4,634	35.6%	6.3%	100	97	97	-	-	3	\$25,796
9.01	Waialae Nui Valley	1,283	2,736	60.6%	6.2%	80	80	75	4	2	0	\$25,964
86.10	Ko Olina Resort	459	1,051	38.8%	5.9%	28	27	13	1	13	1	\$33,979
56	Kapalama	1,862	6,722	38.2%	5.9%	115	109	102	7	-	6	\$35,410
84.12	Ewa Gentry	2,359	6,543	59.5%	5.8%	137	136	133	-	3	1	\$25,339
63.02	Kalena Drive	556	2,615	25.5%	5.8%	32	32	32	-	-	-	\$34,994
78.08	Pearlridge Center	1,053	3,312	45.1%	5.6%	67	59	57	1	1	8	\$30,758
80.01	Hale Mohalu Hospital	659	1,858	30.2%	5.2%	35	34	33	1	-	1	\$34,874
94	Wahiawa Makai	1,760	5,132	32.0%	4.9%	86	86	85	-	1	-	\$24,812
97.01	Waianae Kai	1,703	6,141	40.8%	4.8%	84	81	81	-	-	3	\$31,043
87.02	St. Joseph School	1,487	5,511	45.8%	4.7%	76	70	70	-	-	6	\$34,986
43	Punchbowl	2,330	5,568	36.7%	4.6%	112	108	96	5	7	4	\$27,109

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000.Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
						Total	Residential housing				Non-Residential	
							total	Single Family	Two Family	APT		
50	Kuakini	1,549	3,694	40.9%	4.6%	74	71	69	-	2	3	\$26,716
55	Palama	587	2,078	32.0%	4.3%	25	25	22	2	1	-	\$33,560
17	Kapiolani Park	1,270	2,318	54.6%	4.0%	51	50	50	-	-	1	\$43,939
98.01	Makua Valley	1,127	2,542	41.8%	3.9%	45	44	44	-	-	1	\$28,095
62.01	Kam IV Road	1,467	5,979	36.0%	3.7%	60	54	52	-	2	6	\$33,014
80.03	Manana	1,697	4,652	31.1%	3.5%	62	59	55	4	-	3	\$27,890
75.02	Halawa Valley	87	313	0.0%	3.4%	10	3	3	-	-	7	\$24,610
86.11	Kahe	29	84	41.4%	3.4%	1	1	1	-	-	-	-
100	Kawailoa	1,163	3,170	18.9%	3.1%	42	37	37	-	-	5	\$29,237
60	Umi Street	1,281	5,403	31.7%	2.9%	63	37	36	-	1	26	\$34,308
26	Bingham Tract	1,933	3,921	26.7%	2.4%	62	46	40	-	6	16	\$31,346
89.26	Laulani Valley-Mililani	678	1,572	59.9%	2.3%	23	16	14	2	-	8	\$22,987
25	Lower Pawaa	1,986	3,872	21.1%	2.0%	42	39	36	2	1	3	\$23,200
89.14	Honowai School	1,203	4,942	37.7%	1.4%	20	17	16	-	1	3	\$35,334
34.07	Maryknoll School	491	833	49.7%	1.2%	6	6	4	1	1	-	\$30,250
24.02	Upper McCully	1,601	3,202	27.4%	1.2%	20	19	13	3	3	1	\$27,813
34.03	Thurston Street	2,874	5,530	45.5%	1.1%	34	31	23	6	2	3	\$24,576
34.04	Makiki Fire Station	2,259	4,431	41.3%	1.0%	23	23	19	2	2	-	\$32,147
41	Queen's Hospital	2,274	4,414	31.1%	1.0%	29	23	18	2	3	6	\$32,219
35.01	Academy of Arts	1,238	2,237	33.9%	0.9%	13	11	6	-	5	2	\$35,461
24.01	Lower McCully	1,381	3,096	17.2%	0.8%	11	11	9	-	2	-	\$18,794
21	Olokele Avenue	1,655	3,619	27.6%	0.8%	16	13	13	-	-	3	\$27,250
36.01	Sheridan Street	1,951	4,096	25.1%	0.8%	18	15	11	1	3	3	\$29,930
34.05	Poki Street	1,798	3,250	28.7%	0.7%	14	13	7	1	5	1	\$32,640
74	Ford Island	840	2,801	4.6%	0.7%	12	6	6	-	-	6	\$21,698
22.01	Kamoku Street-Iolani	1,660	3,647	31.8%	0.6%	13	10	9	-	1	3	\$22,026

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000-Jan- 2014. Aug), closed						Average permit value for SF house (2009-2014) ²
						Total	Residential housing				Non-Residential	
							total	Single Family	Two Family	APT		
34.06	Lower Makiki	2,807	5,777	34.3%	0.6%	18	16	7	5	4	2	\$29,095
62.02	Linapuni Street	383	1,701	1.6%	0.5%	3	2	2	-	-	1	\$33,950
53	Aala	1,413	3,596	10.1%	0.5%	12	7	-	-	7	5	-
35.02	Upper Pawaa	2,006	3,829	37.6%	0.4%	19	9	7	-	2	10	\$23,966
83.01	Iroquois Point	1,388	4,661	0.4%	0.4%	6	6	6	-	-	-	\$32,140
108.02	Mokapu East	1,549	4,654	0.7%	0.4%	7	6	6	-	-	1	\$37,153
23	Moiiliili	2,591	5,519	32.9%	0.3%	10	8	7	-	1	2	\$31,578
68.04	Aliamanu Crater	729	2,835	0.5%	0.3%	2	2	2	-	-	-	\$43,667
20.04	International Market Place	813	1,398	27.4%	0.2%	3	2	-	-	2	1	-
57	Iwilei-Anuenue	868	1,725	17.6%	0.2%	61	2	-	-	2	59	-
22.02	Ala Wai Park-Lauiki Street	1,677	3,329	49.6%	0.2%	6	3	1	-	2	3	-
59	Mokauea Street	609	1,892	9.2%	0.2%	48	1	1	-	-	47	-
68.08	Ala Ilima Mauka	1,974	4,423	49.4%	0.2%	5	3	3	-	-	2	\$10,300
52	Chinatown	1,473	2,993	0.7%	0.1%	4	2	-	-	2	2	-
67.02	Red Hill	848	1,989	11.9%	0.1%	2	1	-	-	1	1	-
37	Ala Moana	2,817	5,397	49.5%	0.1%	11	2	1	-	1	9	-
42	Queen Emma Gardens	1,873	3,425	47.9%	0.1%	2	1	-	-	1	1	-
18.03	Tusitala Street	1,925	3,360	29.4%	0.1%	1	1	-	-	1	0	-
78.07	Pearl Ridge High Rise	2,744	5,405	46.2%	0.0%	1	1	-	-	1	0	-
114	Waipio Peninsula	630	2,131	2.5%	0.0%	1	-	-	-	-	1	-
18.01	Koa Avenue	928	1,527	22.5%	0.0%	3	-	-	-	-	3	-
19.04	Hobron Lane	2,303	3,912	36.3%	0.0%	1	-	-	-	-	1	-
20.03	Seaside Avenue	1,226	2,050	31.8%	0.0%	2	-	-	-	-	2	-
20.05	Ala Wai-Niu Street	1,364	2,376	28.4%	0.0%	1	-	-	-	-	1	-
20.06	Ala Wai-Olohana Street	1,276	2,364	40.6%	0.0%	2	-	-	-	-	2	-
38	Kakaako	2,113	3,731	46.3%	0.0%	14	-	-	-	-	14	-

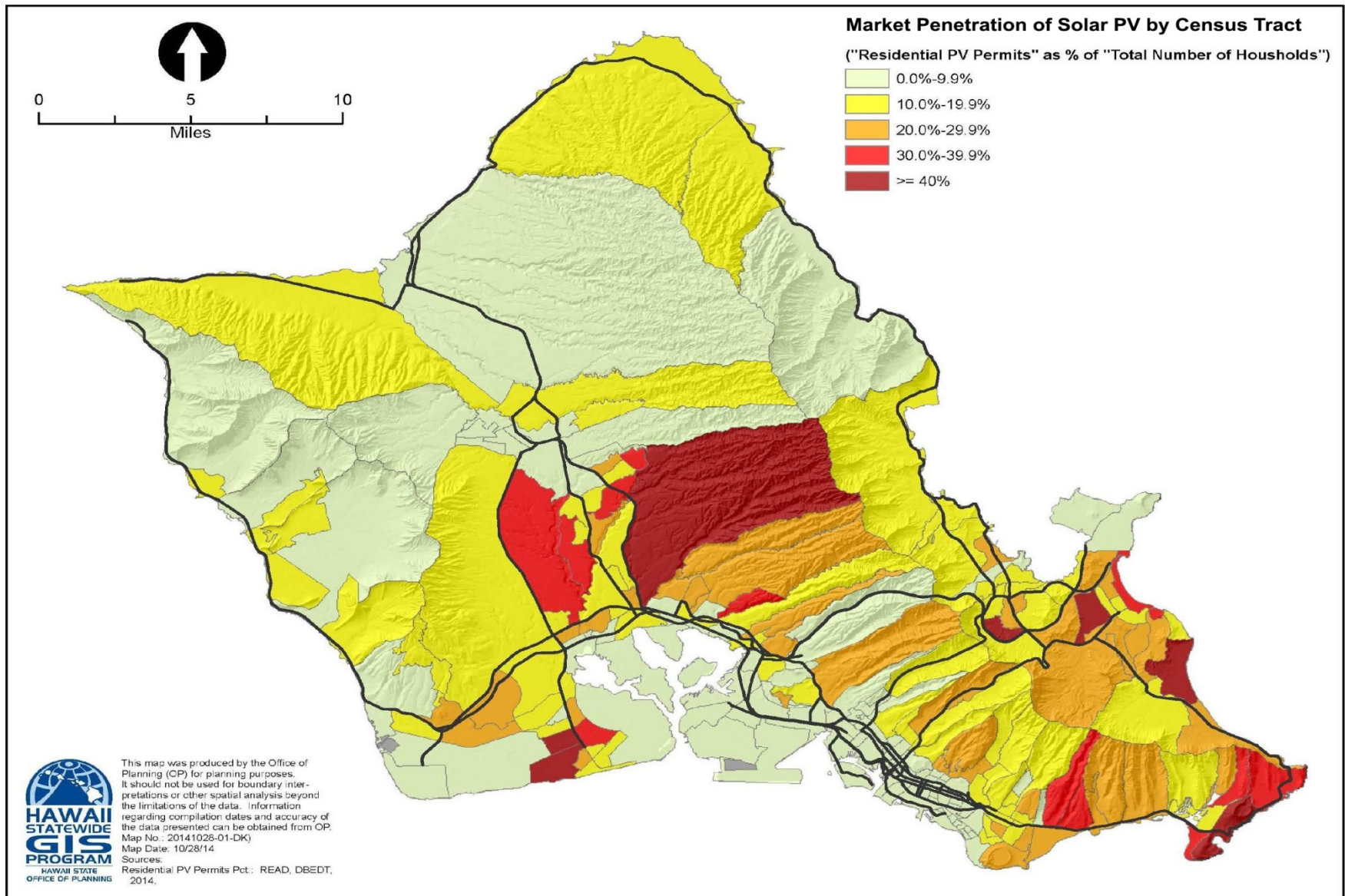
¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Table 5. PV permit, Housing characteristics, and Market Penetration of PV by Census Tract -continued

Census Tract		Households (HH) (2010)	Population in HH (2010)	Owner Occupancy rate (2010)	Market Penetration Rate ¹	No. of PV permits (2000-Jan- 2014. Aug), closed					Average permit value for SF house (2009-2014) ²	
						Total	Residential housing			Non-Residential		
							total	Single Family	Two Family			APT
40	Financial District	837	1,415	41.2%	0.0%	4	-	-	-	-	4	-
51	Foster Botanical Garden	1,535	3,090	31.3%	0.0%	1	-	-	-	-	1	-
58	Waiakamilo Road	1,022	3,440	39.9%	0.0%	5	-	-	-	-	5	-
68.09	Ala Ilima Makai	1,905	5,040	47.0%	0.0%	1	-	-	-	-	1	-
69	Arizona Road	978	3,823	0.2%	0.0%	1	-	-	-	-	1	-
85.02	Kalaeloa	498	1,491	0.0%	0.0%	22	-	-	-	-	22	-
90	Wheeler-East Range	554	1,604	0.5%	0.0%	1	-	-	-	-	1	-
108.01	Mokapu West	566	1,880	1.2%	0.0%	-	-	-	-	-	-	-
18.04	Jefferson School	1,021	1,818	35.9%	0.0%	-	-	-	-	-	-	-
19.01	Waikiki Beach	523	774	43.6%	0.0%	-	-	-	-	-	-	-
19.03	Ena Road	1,623	2,770	44.0%	0.0%	-	-	-	-	-	-	-
36.03	Ahana Street	1,673	2,807	24.7%	0.0%	-	-	-	-	-	-	-
36.04	Kaheka Street-Makaloa	1,460	2,519	32.7%	0.0%	-	-	-	-	-	-	-
39	Civic Center	234	270	24.8%	0.0%	-	-	-	-	-	-	-
54	Mayor Wright Housing	396	1,637	0.0%	0.0%	-	-	-	-	-	-	-
70	Navy Marine Golf Course	1,331	4,041	0.3%	0.0%	-	-	-	-	-	-	-
71	Nimitz Elementary School	680	2,610	0.1%	0.0%	-	-	-	-	-	-	-
73.02	Hangar Avenue-Vickers	1,237	3,866	0.5%	0.0%	-	-	-	-	-	-	-
73.03	Hickam Air Force Base	1	4	0.0%	0.0%	-	-	-	-	-	-	-
75.06	Red Hill Military Housing	265	933	1.1%	0.0%	-	-	-	-	-	-	-
95.01	Kolekole Avenue	1,276	4,770	0.7%	0.0%	-	-	-	-	-	-	-
95.02	Menoher Street	1,140	4,243	0.3%	0.0%	-	-	-	-	-	-	-
95.03	Foote Avenue	233	881	0.0%	0.0%	-	-	-	-	-	-	-
95.04	Leilehua Avenue	377	1,271	1.1%	0.0%	-	-	-	-	-	-	-
95.07	Schofield: McCarthy Field	576	1,639	0.3%	0.0%	-	-	-	-	-	-	-

¹ "total number of residential PV permits" divided by "total number of households"² PV permits that were combined with works other than electrical job were excluded from cost calculation

Figure 3. Market Penetration of Solar PV by Census Tracts



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