

Energy and Water Efficiency Measurement and Verification Case Study



1 Introduction

1.1 Company Overviews

The Backpackers Vacation Inn and Hostel, located on Oahu's scenic North Shore, is a sprawling complex of four properties that hosts visitors throughout the year. The peak tourist season is in the winter, meaning that total energy and water consumption naturally increases from October to March. The lodgings range from bunk bed dorm style rooms to kitchen-equipped full apartments. Each property is submetered for both energy and water.

Pono Home is an energy and water efficiency company based in Honolulu, HI. Pono Home's service is broken down into three main subject areas: installation of efficiency hardware (e.g., LED lights), education of stakeholders, and maintenance of appliances to optimize them for efficient use.

1.2 Project and Results

On August 3, 2015, Pono Home installed energy and water saving devices on site, for a total price of \$1134. There was no lighting installed, only other efficiency hardware, as the property had already undergone a lighting efficiency retrofit several years previous, when CFLs were installed throughout the properties. No maintenance or education was conducted except to brief hostel staff on the hardware being installed and what to expect from its use.

After 6 months, energy and water consumption figures were used to calculate the differential before and after service. We calculated the trailing kWh consumption average by averaging all full month bills prior to the month of service (n=7). We calculated the average post-service kWh consumption by averaging August 2015 plus all full month bills after the month of service (n=6). The month of service, August 2015, was included in the "post" service grouping, since the service was conducted so early in the month. Raw data are presented below.

		2015												2016	
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	
		Electric (in kWh)													
59788 Kam Hwy	Property 1	1498	1279	1263	1012	644	742	760	810	831	643	744	1180	1051	
59784 Kam Hwy	Property 2	1011	870	942	881	855	954	873	863	840	777	795	963	840	
59775 Kam Hwy	Property 3	1609	1596	1072	649	799	1036	741	656	585	647	860	1246	866	
59754 Kam Hwy	Property 4	199	172	159	239	229	180	270	187	189	123	223	202	253	
		Water (thousand gallons)													
59788 Kam Hwy	Property 1	17	15	17	14	10	8	7	6	14	5	10	12	15	
59784 Kam Hwy	Property 2	11	10	11	10	8	10	9	10	7	7	9	8	10	
59775 Kam Hwy	Property 3	28	66	30	32	51	16	22	17	7	13	14	60	26	
59754 Kam Hwy	Property 4	63	63	59	38	52	35	29	36	45	41	43	47	48	

Some items to note in the data.

1. There were some outliers. The property owner has complained several times to both HECO (electric) and the Board of Water Supply that the monthly billing seems erratic. Note Property 3 in December 2015 for a good example. All outliers were left in the analysis for simplicity sake.
2. Measurement and Verification is clearly complicated by the confounding variable of seasonality in a business of this type. The property owner was not able to provide occupancy rates for this analysis (she doesn't have a computerized system for reservations, instead relying on scraps of paper and a large magnetic board). The slow tourist season (summer) was roughly evenly split in the "pre" and "post" samples, though, so while it's something we wish to keep an eye on, we feel reasonably certain that this is a fairly accurate depiction of consumption pattern changes caused by the new, high efficiency hardware installed on site. In addition, we looked at January 2015 compared to January 2016, in order to give a simpler "same month" comparison:

		2015	2016
		Jan	Jan
		Electric (in kWh)	
59788 Kam Hwy	Property 1	1498	1051
59784 Kam Hwy	Property 2	1011	840
59775 Kam Hwy	Property 3	1609	866
59754 Kam Hwy	Property 4	199	253
		Water (thousand gallons)	
59788 Kam Hwy	Property 1	17	15
59784 Kam Hwy	Property 2	11	10
59775 Kam Hwy	Property 3	28	26
59754 Kam Hwy	Property 4	63	48

The results of the analyses show a decrease in both energy and water consumption.

Analysis 1: 13 months

	Electric (in kWh)	Ave Before	Ave after	Diff	Ave monthly \$ difference	Annualized savings
59788 Kam Hwy	Property 1	1028.29	876.50	151.79	\$38.71	\$464.46
59784 Kam Hwy	Property 2	912.29	846.33	65.95	\$16.82	\$201.81
59775 Kam Hwy	Property 3	1071.71	810.00	261.71	\$66.74	\$800.85
59754 Kam Hwy	Property 4	206.86	196.17	10.69	\$2.73	\$32.71
	Water (thousand gallons)					
59788 Kam Hwy	Property 1	12.57	10.33	2.238	\$12.98	\$155.77
59784 Kam Hwy	Property 2	9.86	8.50	1.357	\$7.87	\$94.46
59775 Kam Hwy	Property 3	35.00	22.83	12.167	\$70.57	\$846.80
59754 Kam Hwy	Property 4	48.43	43.33	5.095	\$29.55	\$354.63
					Annual Savings	
					Energy:	\$1,499.84
					Water:	\$1,451.66
					Total:	\$2,951.49

Analysis 2: January 2015 vs. January 2016

		2015	2016			
		Jan	Jan			
	Electric (in kWh)			Diff	\$ Diff	
59788 Kam Hwy	Property 1	1498	1051	447	\$113.99	
59784 Kam Hwy	Property 2	1011	840	171	\$43.61	
59775 Kam Hwy	Property 3	1609	866	743	\$189.47	
59754 Kam Hwy	Property 4	199	253	-54	-\$13.77	
				1,307	\$333.29	Total Energy Savings
	Water (thousand gallons)					
59788 Kam Hwy	Property 1	17	15	2	\$11.60	
59784 Kam Hwy	Property 2	11	10	1	\$5.80	
59775 Kam Hwy	Property 3	28	26	2	\$11.60	
59754 Kam Hwy	Property 4	63	48	15	\$87.00	
				19	\$116.00	Total Water Savings
					\$449.29	Total Savings

1.3 Project Analysis

There appears to be a fairly consistent and strong result in both energy and water consumption across the four properties. In the analysis of a full calendar year (plus one month), the average monthly reduction was 490 kWh and 21,000 gallons of water. The hostel pays 25.5 cents per kWh for its power and has a blended water rate depending on consumption. For this analysis, we used \$5.80 per thousand gallons, based on a sampling of random calculations from the hostel's water billing statements. Thus, the average monthly savings were \$124 in electricity and \$120 in water. This represents a 15.23% decrease in energy use, and 19.7% decrease in water use.

Attempting to correct for seasonality in the January vs. January analysis, we found that the hostel used 1300 kWh and 19,000 gallons of water less in January 2016 than it did in January 2015. Assuming occupancy rates were roughly similar, this equates to savings of \$333 and \$120, respectively, or a total of \$449, and a 30.3% and 16.8% drop in energy and water use, respectively.

“Pono Home’s service was terrific. The products they installed on site were a nice upgrade over our previous setup, and have helped us save money and decrease our environmental footprint. I’d highly recommend this service to any other business that hosts visitors who may not be as conscious about conservation while they’re on vacation and not paying a utility bill.”

-Sharlyn Foo, Owner, Backpacker’s Hostel

2 Conclusion and Key Stats

2.1 Key Stats

- 13 month average monthly energy usage reduction: 490 kWh
- 13 month average water usage reduction: 21,000 gallons
- Same month (January 2015 to January 2016) energy reduction: 1300 kWh
- Same month (Jan 2015 to Jan 2016) water reduction: 19,000 gallons
- Estimated annualized savings: \$2950
- Estimated annual carbon emission reduction:
- Payback Period: 4.6 months
- One year Return on Investment: 61%

2.2 Conclusion

The project appears to have been a success in making the hostel more energy and water efficient. The brief payback period and solid ROI should help convince other similar property owners of the efficacy of efficiency solutions for generating great returns as well as helping the

environment. Now that the hardware inside the hostel is efficient, the next steps for the hostel might be to install solar PV and/or solar hot water to further reduce its bills and environmental footprint.

More importantly, the client is satisfied with the results. The owner had nothing but positive things to say about the work done by Pono Home. One caveat is that we had to return to remove a handful of toilet efficiency devices that were unpopular with the hostel staff and clientele. These devices should work fine and be fully adjustable on site, but hostel staff lacked the know-how and/or willingness to attempt an adjustment, and given the sheer number and diversity of visitors, it was decided that the best course of action was to simply undo what was done. Thus, 6 of the older toilets (out of an estimated 30 toilets on site) had their efficiency hardware removed shortly after the service. Otherwise, the client was extremely satisfied with the results. If we had had unlimited budget, customer surveys would have been given to hostel visitors inquiring about their experience, but lacking that, in a quick scan of the hostel's online reviews, no one appears to have complained about underperforming fixtures on the property, meaning that the client experience was most likely relatively unimpeded by the high efficiency devices we installed.

Pono Home is ready to expand on this success, and aims to target small businesses like the Backpackers Hostel, which are underserved by the larger efficiency providers.