CALCULATING THE DEMAND CHARGE REDUCTION OF A 598 kW COMMERCIAL SOLAR ARRAY ON MAUI

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SUMMARY

It is commonly assumed that solar alone cannot effectively reduce peak demand charges due to their weather-induced intermittency and the unpredictable nature of many electrical loads. Therefore, this potential revenue stream is often omitted when building the business case for solar. In this project we analyzed one year of historical solar production data for one of the largest solar arrays on Maui to calculate the efficacy at which solar is able to reduce peak demand charges. We found that the 598 kW solar array was able to reduce peak demand by an average of 76 kW per month over the course of one year for an efficacy of 15%. This represents a utility bill savings of about $1500 per month given the current Maui Electric Company tariff.

BACKGROUND

In January 2016, the Hyatt Regency Maui Hotel and Resort energized a 598 kW-DC solar array, one of the largest rooftop solar installations on the island. The array was projected to produce 858,000 kWh of electricity each year, or 7.1% of the hotel's consumption.

The Hyatt Regency is served by Maui Electric Company on their Large Service (P) rate tariff which has a demand charge component of $20 / kW / month. There is also a 12-month look back such that the billed demand is calculated at the average of the measured demand for the month and the peak of the previous 12-months.

METHODOLOGY

1. Obtained 1-minute solar production data from cloud-based data logging system
2. Obtained 15-minute electrical load profile (meter) from MECO for past 12-months
3. Downsampled solar production to 15-minute resolution and aligned with meter load data
4. Add solar production to metered load profile to recreate "no solar" load (see Table 1)
5. Find peak demand for each month from "no solar" load
6. Compare "no solar" peak demand to "with solar" peak demand to create Table 2

	Meter		Solar [kW]		Total Load [kW]
6:00 AM	1155.6	+	0.0	=	1155.6
6:15 AM	1206.6	+	3.0	=	1209.6
6:30 AM	1265.4	+	10.2	=	1275.6
6:45 AM	1245.6	+	19.6	=	1265.2
7:00 AM	1221.6	+	34.3	=	1255.9
7:15 AM	1213.2	+	63.9	=	1277.1
7:30 AM	1214.4	+	91.3	=	1305.7
7:45 AM	1218.0	+	75.8	=	1293.8
8:00 AM	1260.0	+	45.2	=	1305.2
8:15 AM	1312.2	+	49.9	=	1362.1
8:30 AM	1371.6	+	43.2	=	1414.8

Table 1. Recreating the load without solar

Month	w/o Solar Demand [kW]	Time	w/ Solar Demand [kW]	Time	Demand Reduction	Bill Savings
Jan	1619.9	17:00	1594.2	17:30	25.7	$513
Feb	1607.2	11:45	1558.8	17:30	48.4	$967
Mar	1731.4	18:00	1731.0	18:30	0.4	$8
Apr	1722.9	12:00	1630.8	17:15	92.1	$1,841
May	1771.5	12:00	1650.0	19:00	121.5	$2,431
Jun	1755.9	17:15	1702.8	17:30	53.1	$1,061
Jul	1796.4	10:00	1615.8	19:15	180.6	$3,611
Aug	1731.3	10:00	1625.4	18:45	105.9	$2,118
Sep	1713.8	11:30	1539	19:15	174.8	$3,495
Oct	1696.5	10:30	1607.4	18:15	89.1	$1,781
Nov	1627.6	12:15	1548	17:30	79.6	$1,593
Dec	1583.5	12:00	1539	17:15	44.5	$891
		12:51		**18:07**		**$1,693**

Table 2. Peak demand and time of occurrence by month

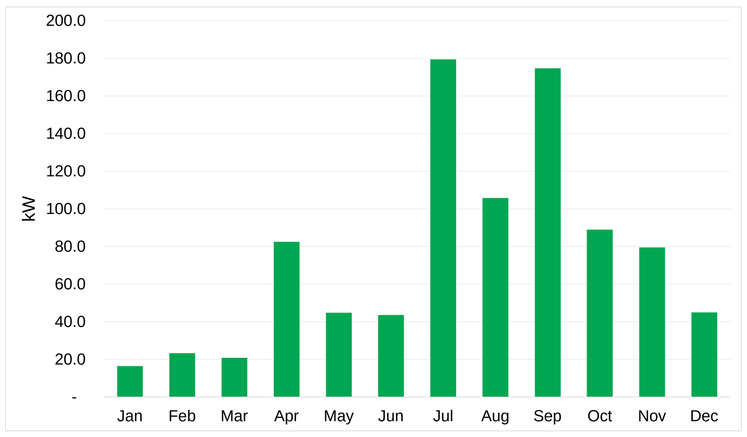

Figure 1. Peak demand reduction from solar by month

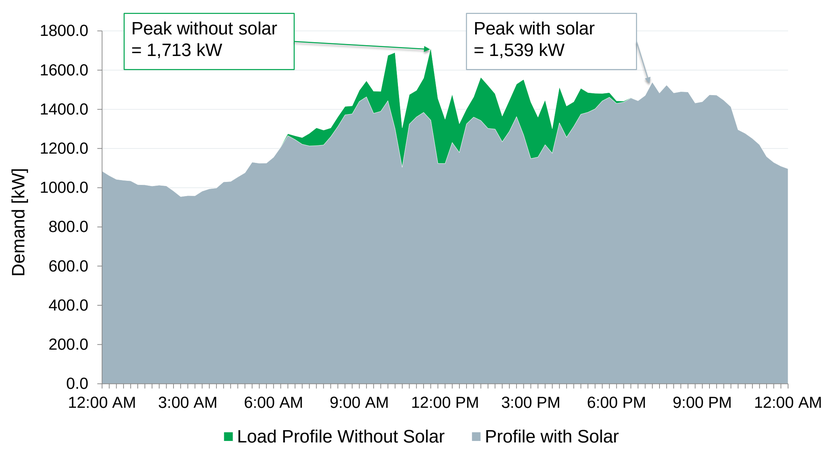

Figure 2. Electrical load profile with and without solar for a representative day in July

RESULTS

Over the first year of operation, the 598 kW-DC solar array on the Hyatt Regency Maui reduced peak demand by an average of 85 kW per month (Figure 1). This is worth approximately $1500 / per month in utility bill savings. The time that the peak occurred shifted from an average of just before 1 PM to after 6 PM, which is very close to sunset. A representative day is shown in Figure 2.

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CONCLUSION

Depending on the weather patterns of the region and shape of the load profile for the site, solar may be able to achieve a modest amount of demand reduction. At the Hyatt Regency Maui, the 598 kW-DC solar array reduces peak demand by an average of 85 kW per month, for an efficacy of 15%. It should be noted, however, that since the peak demand now occurs after 6 PM – which is approximately sunset – additional solar at the hotel will have minimal effect on demand. Battery energy storage, however, could be used to further reduce demand charges and we are currently exploring the potential for storage at the site. We are also continuing to monitor the performance of the solar array on the Hyatt Regency Maui to analyze the year-to-year variation on the demand reduction capability.