

Analysis of Solar Incentives in California

California has a long history of forward-thinking policies and programs that demonstrate its commitment to a clean, sustainable energy future. For this report we will examine the California Public Utilities Commission's California Solar Initiative (CSI). This statewide effort has a campaign goal of 3,000 MW of solar generating capacity with a budget of \$3.35 billion. To this end a Renewable Portfolio Standard (RPS) has been established which requires that 20% of California's electricity come from renewable resources by 2010, and 33% by 2020.

CSI Program Statistics

\$1.919 *billion incentivized*

1710 *megawatts installed*

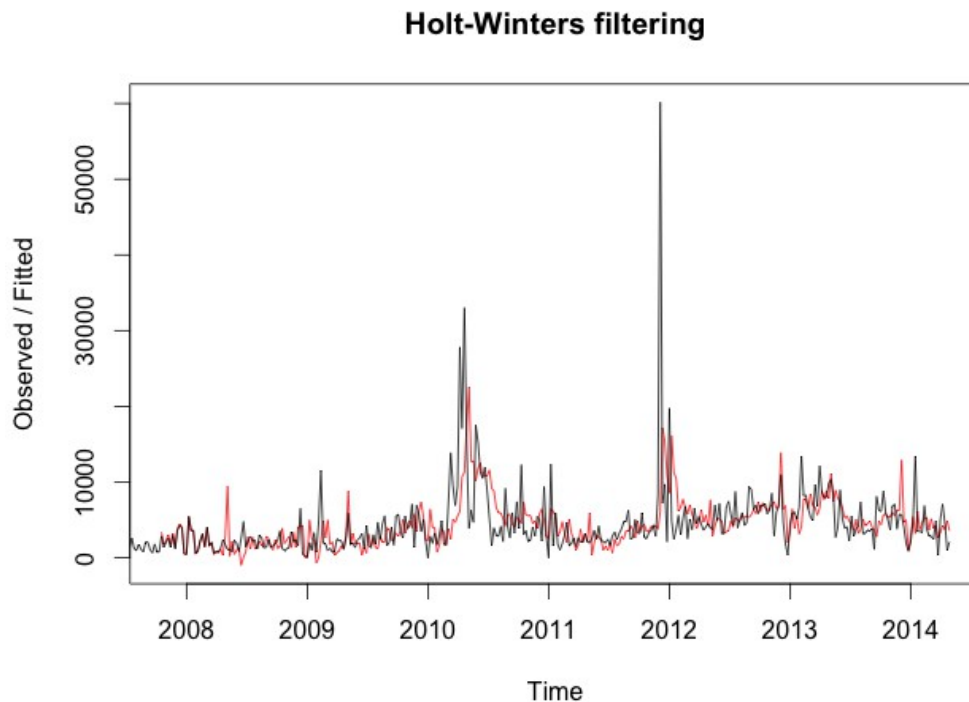
(05/07/2014) Actual calculated data from dataset

In this report we are first going to examine if the 33% by 2020 goal is achievable and if it is on track today. Below are the goals set out by California Public Utilities Commission's California Solar Initiative.

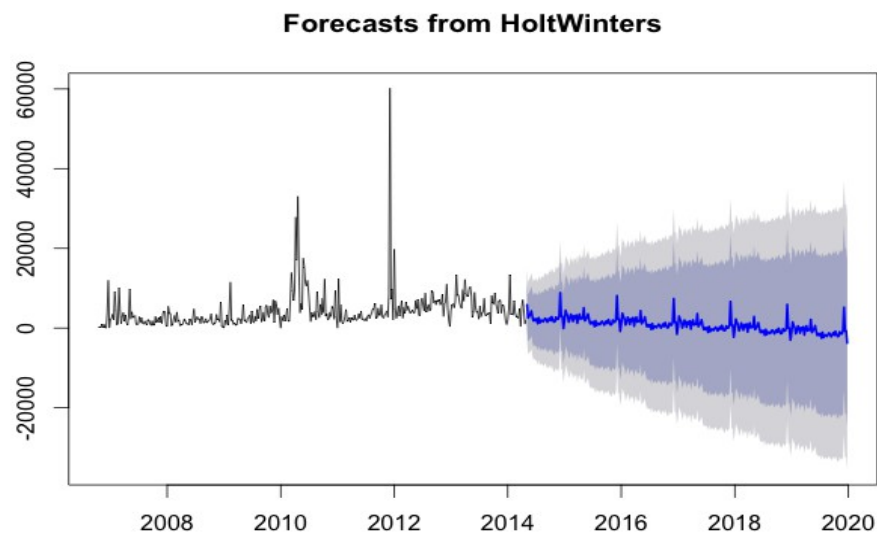
Year	Target RPS	Capacity in MW	Budget
2004	0.14	1086	\$1.42 <i>billion</i>
2005	0.15	1164	\$1.52 <i>billion</i>
2006	0.16	1241	\$1.62 <i>billion</i>
2007	0.17	1318	\$1.72 <i>billion</i>
2008	0.18	1396	\$1.82 <i>billion</i>
2009	0.19	1475	\$1.92 <i>billion</i>
2010	0.2	1706	\$2 <i>billion</i>
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2013	0.2	1706	\$2 <i>billion</i>
2014	0.22	2095	\$2.7 <i>billion</i>
2015	0.23	2172	\$2.8 <i>billion</i>
2016	0.25	2250	\$2.9 <i>billion</i>
2017	0.27	2327	\$3 <i>billion</i>
2018	0.29	2405	\$3.1 <i>billion</i>
2019	0.31	2482	\$3.2 <i>billion</i>
2020	0.33	2560	\$3.35 <i>billion</i>

Data Source: DSIRE(Database of State Incentives for Renewables and Efficiency) for Year and Target RPS. The capacity and budget values are calculated values from the stated target goal of 2560MW.

We can examine the historical data and plot a HoltWinters graph to understand the trend and then forecast fit to the year 2020.



The y-axis shows the kW installed capacity over time. The red line is the fitted seasonality and trend line. These graphs use data aggregated by week.



The forecast shows us that at the 85% confidence interval the current trend continues. The approximately .01 percent incremental capacity goal per year falls in the forecast at the 85% confidence interval. The goal of adding 75000 kW per year to account for the 33% by the year 2020 is projected by this graph as achievable.

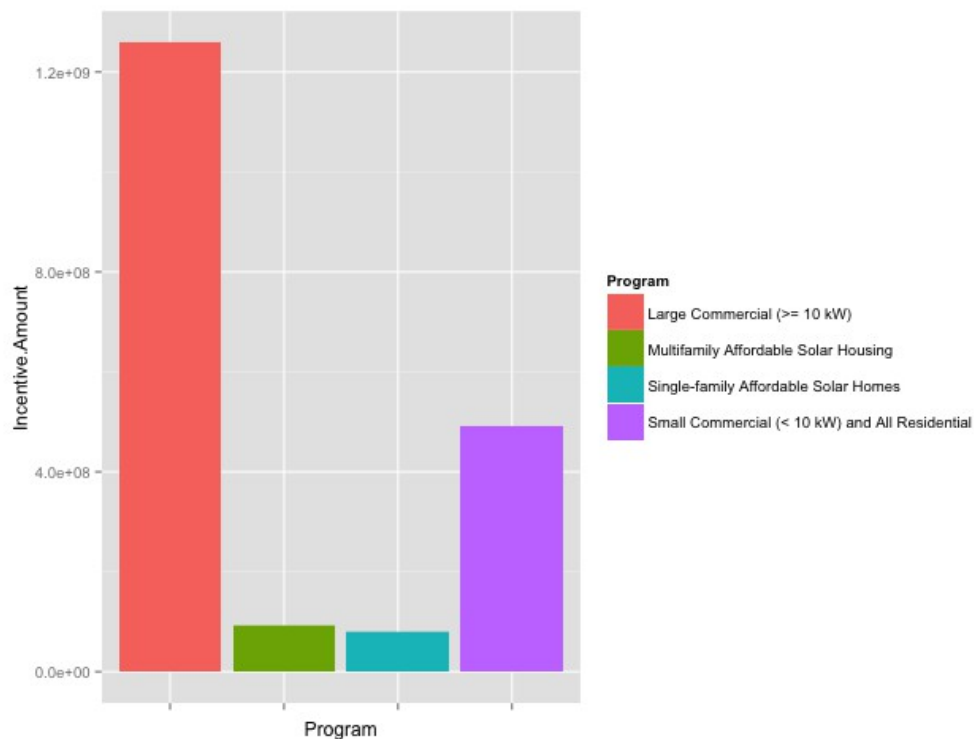
Summary of Budget Distribution for each Incentive Program

Program	Capacity Installed (kW)	Incentive Amount	Cost Per kW	Budget Percent	Capacity Percent
Large Commercial (>= 10 kW)	962039.12	\$1,258,712,440.00	\$1,308.38	65.58%	56.23%
Small Commercial (< 10 kW) and All Residential	706199.53	\$490,053,037.00	\$693.93	25.53%	41.28%
Multifamily Affordable Solar Housing	29562.68	\$91,596,785.00	\$3,098.39	4.77%	1.73%
Single-family Affordable Solar Homes	12995.61	\$79,101,394.00	\$6,086.78	4.12%	0.76%

The table above shows us that

- **25.5% of the budget was able to incentivize 41%** from the Small Commercial (< 10 kW) and All Residential program.
- **65.5% of the budget was able to incentivize 56%** from the Large Commercial (>= 10 kW) program.

This is an important observation depicted by the graph below.



This is an important observation as it clearly indicates that the best performing incentive program is the Small Commercial (< 10 kW) and All Residential program.

The tariff for the non residential sector is typically twice as much and higher than for the residential sector.

A closer look at the Residential sector

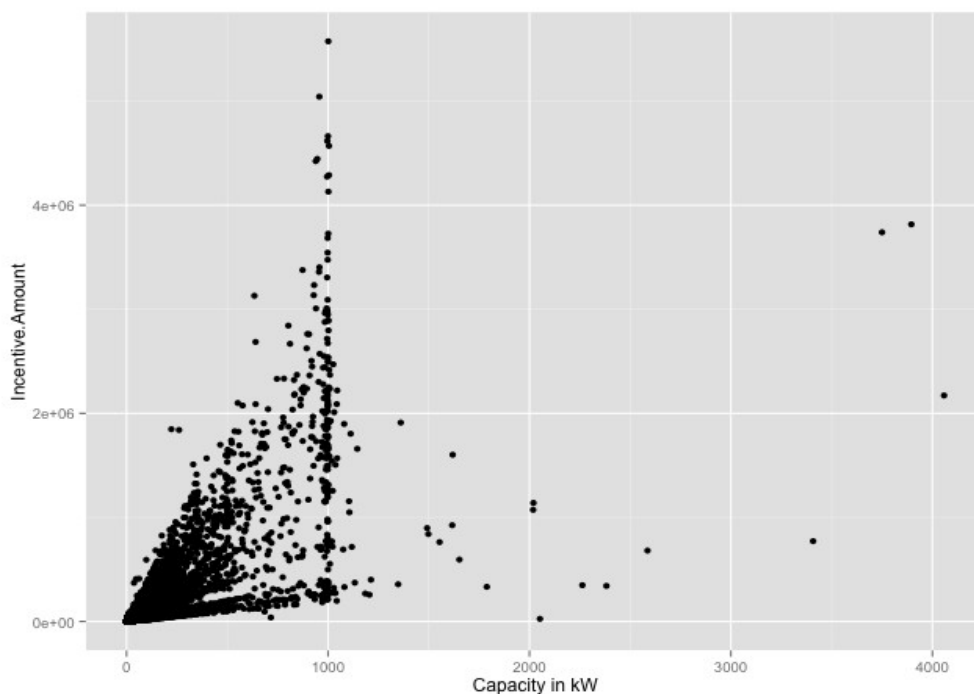
Even with the success of the residential sector, a large potential market for solar will continue to exist once the program's monetary incentives are exhausted. There are more than 7.8 million single-family homes in California. **With 141,295 residential installations, only 1.8% of the residential sector has solar installations**, suggesting that the CSI Program has only just scraped the surface of this market.

Moreover, 40 percent of the state's population lives in multitenant buildings, leaving a large, untapped segment of the residential market for solar development. And, despite the CSI's budget reservation (MASH) for accessing low-income markets, there is still considerable opportunity to increase access for the Multifamily Affordable Solar Housing sector.

The majority of the applications are in the less than 0.5MW capacity and under 1MW capacity range.

MW Installed Range	Volume of Applications
0 – 0.5 MW	146980
0.5 – 1 MW	459
> 1 MW	46

(05/07/2014) Actual calculated data from dataset



Applications on Wait List

After spending over \$1.919 billion incentivizing more than 1,710 MW, the general market CSI Program has proven to be effective and is approaching attainment of its goals with **4031 applications currently on the wait list**. Here is a look at the distribution of applications for each incentive program in the wait list.

Program	Capacity in Wait List (kW)	Incentive Amount	Incentive Per kW	Budget Percent	Capacity Percent
Large Commercial (≥ 10 kW)	93433.77	\$32,440,985.00	\$347.21	18.82%	56.49%
Small Commercial (< 10 kW) and All Residential	18172.39	\$3,472,757.00	\$191.10	2.01%	10.99%
Multifamily Affordable Solar Housing	53789.57	\$136,431,710.00	\$2,536.40	79.16%	32.52%

The table above shows us that

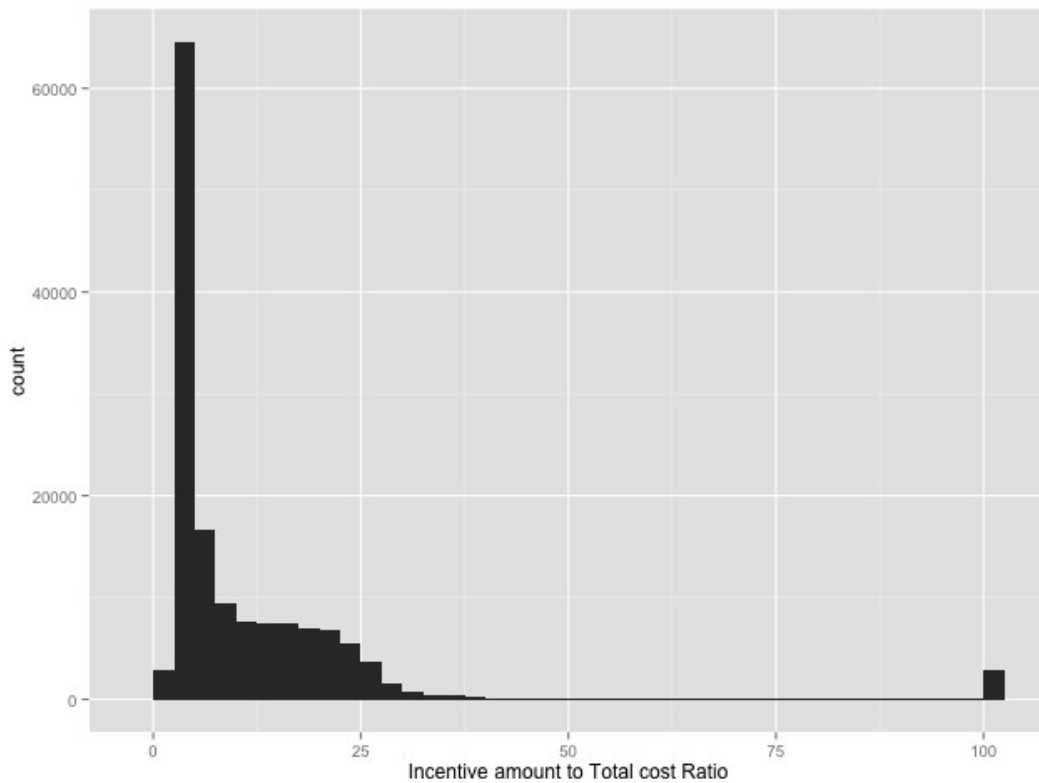
- The bulk of the Wait list applications are for the heavily subsidized Multifamily Affordable Solar Housing program. This is to fulfill the reserved budget quota for low-income housing.
- **The budget has dropped from 25.5% to 2% to incentivize** solar installations in the Small Commercial (< 10 kW) and All Residential program.
- The incentive amount disbursed per kW has significantly dropped in the residential and commercial programs.

Currently, the Residential Solar market is clearly driven by incentives.

The volume of applications in the residential sector have clearly dropped as the incentives have come to an end.

Typically, the cost of installation is high for solar generation. The Department of Energy (DOE) SunShot Initiative Rooftop Solar Challenge is a collaborative national effort to make solar energy cost competitive with other forms of energy. The DOE indicates that non hardware, or “soft,” costs associated with processes such as permitting and interconnection make up as much as 40% of the total installed cost of a rooftop solar PV system.

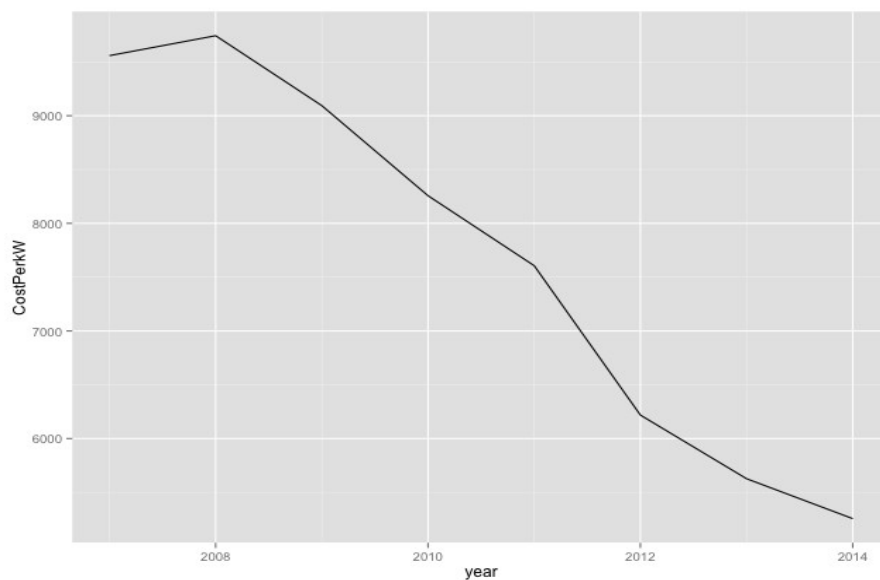
Let us look at the cost recovered as a percentage of the total cost of the installation project.



Most of the projects are able to **recover 5% of their total cost** through the incentive programs offered by CSI.

Has the cost of Installation gone down since the CSI incentives program took off

Let us look at the total cost per kW of solar installation. This has been steadily decreasing over the years. Since the year 2008 the **cost is down by 54% per kW** in the 2014.



Conclusion

It appears that the incentive program has seen the most traction in the **residential sector** for the program labeled **Small Commercial (< 10 kW) and All Residential** program. In the coming years as the incentive program for solar installations is phased out and the 33% by 2020 goal is achieved, the big question is how to retain customer interest in solar power generation. One could argue that a significant effort at reducing the total cost of solar installations is one way to drive continued adoption – especially in the residential sector.

But will a discounted or reduced cost drive continued adoption. A proven marketing theory indicates that people prefer a rebate over a discount. An example to illustrate this is the case of a discount verses a rebate in a car purchase. A rebate cheque is valued much more by a consumer than a discount on the price even when the financial parameters are identical in value. So a rebate cheque of \$2000 is valued more in the eyes of a consumer than a discount of \$2000 on the retail price.

Perhaps, the better approach for the state of California is to find ways to reduce cost of installation especially if the “soft” cost component is estimated at 40%. As well as continue to offer an incentives / rebate program similar to the one that CSI currently offers.

Notes:

1. The main datasource is a csv file WorkingDataSet_5-07-2014.csv from the California Solar Initiative website <http://www.californiasolarstatistics.ca.gov>
2. solar_knitr_explore_data.html is the knitr html that explores the data and trims, aggregates, and creates initial plots for the data.
3. ts_and_lm_and_weeklyts.html is the knitr html that does the Time Series analysis, explores creating a Linear Model. And in a second iteration of Time Series analysis that aggregates data by week instead of month. An attempt was made to create a matrix of other dependant variables. I was unable to completely follow through with this analysis.
4. Solar_conclusions.html is the knitr html with the conclusions of the data analysis.