An Assessment of Incentives for Solar Power in Washington State

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For:

Solar Installers of Washington

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Executive Summary

This study assesses the economic impact for the State of Washington of the solar energy incentive program introduced in House Bill 2346. A survey was undertaken to define the relationship between each kilowatt of solar installed in the state over the past three years and labor and economic activity involved in manufacturing and installing it. These metrics were combined with the incentive rates and program details of the proposed incentive program to determine the economic impact of each incentive dollar spent. The study finds that each incentive dollar leads to $6.82 in payroll in the state and $15.84 in purchases from local installers, manufacturers and suppliers.

Introduction

Both the federal government and the state of Washington have a variety of policies to encourage the production of renewable energy, including solar power. For example, the federal government provides tax incentives for homeowners and businesses that install solar panels. Washington State also provides incentives such as a production credit for electricity generated by solar panels.

With governments wondering whether to extend or renew their incentive programs, it is worth asking how the benefits generated by the incentives compare to the costs.

This report focuses on the proposed incentives, which may be enacted by Washington State in the near future. In particular, this report offers an estimate of the cost of the state incentives per kW of installed capacity and estimates of the various benefits that can be attributed to each kW of installed capacity.

Each installation project is unique. Different projects have different costs and will result in different benefits (as no two installations will be exactly the same in terms of construction challenges, electricity generated per square foot of solar panels, etc.). As such, our estimates are based on scenarios or sets of assumptions.

The costs and direct benefits include the following:

Costs

- The state pays for production incentives through tax credits, with the amount paid depending on assumptions about the distribution of solar panels across residential, commercial, and community uses – as well as the portion of material purchased from in-state suppliers (where incentives differ for different user groups and are higher for projects with material made in Washington);

Benefits

- The state, and other public entities such as counties and cities, receive tax revenues from consumers and installers who purchase materials and services;
- The state, cities, and counties receive tax revenues when system owners spend (some portion) of the money they do not have to pay the utilities for electricity and they receive for the power produced by their panels;
- The state, cities, and counties receive tax revenues when system owners spend (some portion) of the money they do not have to pay the Internal Revenue Service;
- The public receives tax revenues from workers employed in the manufacturing and installation industries, and the related industries;
- The public receives environmental benefits in the form of reduced carbon emissions; and
- The state receives real estate tax revenues due to home price premiums for homes with solar panels.

Table 1 shows the incentive rates proposed in HB2346 used in this analysis.

Table 1. Incentive Rates per kWh

Fiscal Year	Base Rate			Made in WA Bonus
	Class A	Class B	Community Solar	
2017	$0.22	$0.18	$0.32	$0.10
2018	$0.20	$0.16	$0.30	$0.08
2019	$0.18	$0.14	$0.28	$0.06
2020	$0.16	$0.12	$0.26	$0.04

Table 2 shows the values for the different assumptions used in this analysis.

Table 2. Scenario Values

Item	Assumed Value	Notes
Installation costs ($/kW)		
Residential – made in WA	$4,210	
Residential – made out of state	$3,610	
Commercial – made in WA	$3,510	Assuming same costs for commercial and community projects
Commercial – made out of state	$2,910	
kWh per kW per year from solar panels	1,000	Implies a capacity factor of roughly 11-12 percent
Blended rate for production payments ($ per kWh)	$0.20	Benefits based on 10 year planning period: Cost calculations use same blended rate
Discount rate	2%	
Retail price of electricity	$0.10	Benefits based on 30 year project life; further assumptions include that system size allows production to offset owner demand for electricity 1:1
Inflation rate for $/kWh	1% per year	
Tons of carbon per kWh	1.4[1]	Presumes that solar offsets natural gas rather than coal or hydropower
Price of carbon ($/ton)	$13.00	
Inflation rate for price of carbon	1.5% per year	
Marginal propensity to consume	70%	The portion of savings or new income that is spent (rather than saved)
Jobs per kW – installation (including direct, indirect, and induced jobs)	0.046	From survey of installers
Jobs per kW – fabrication and production (including direct, indirect, and induced jobs)	0.012	Communication with Itek Energy and assumptions about other firms in the manufacturing area
Taxes paid per year, per worker	$4,500[2]	Based on per capita average in Washington
Average value to state of home price premium	$60	Assuming solar panels add an average of $3,000 per kW in value to a home (more at first, but depreciating over time); the state collects more in real estate taxes

1 https://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11

2 http://www.ofm.wa.gov/trends/revenue/fig504.asp

Average wage earned by workers	$25/hour	This assumption does not affect costs or benefits per kW, but can matter given other perspectives

With these scenario values, incentives paid exceed direct revenue benefits for each kW installed.

Item	Value
Cost ($/kW)	**$1,808**
Benefits ($/kW)	
Tax revenue from equipment purchases	$374
Tax revenue from spending of incentive $	$37
Tax revenue from workers spending income	$263
Tax revenue from spending of federal tax savings	$258
Environmental benefit	$342
Increase in real estate taxes collected	$60
Total benefit ($/kW)	**$1,383**

These figures suggest that the state pays a net subsidy of roughly $425 per kW of installed power.

The assumptions described in Table 2 potentially overstate the benefits because solar array owners probably would have spent some of the money they spent on the array on other things, if they hadn't purchased the array. That is, the state would have received some of the sales tax dollars without the activity related to the solar incentives. At the same time, however, the assumptions are also conservative in many ways and could understate the benefits. For example, we've been conservative with our estimates about the number of workers employed directly in solar panel related work. If we assume more workers, we'd have a higher estimate of taxes paid by workers. We've also not factored in the benefit to local governments in permit and inspection fees.

Results are not very sensitive to changes in the discount rate, various inflation rates, retail price of electricity, or worker wages. For example, if assume the retail price for electricity is $0.14 per kWh, let that price increase 2 percent per year, and make other similar small changes, the benefits increase very slightly. Moreover, if you assume the cost of solar panels may fall in the future, the lower cost is offset to a large degree by a reduction in benefits captured directly by the state. (Note, when we say state we really mean state, cities, and counties: public jurisdictions that receive tax revenues.) The lower cost means a smaller federal subsidy and less savings that might be spent in the state.

However, the price of carbon does matter. If we assume $20 as a starting price for carbon or a noticeably higher rate of inflation in the price of carbon the calculated benefits increase dramatically. These alternative assumptions could be considered plausible given the uncertainty surrounding the price of carbon and the possibility of carbon pricing of some kind.

In the end, we think the figures give a reasonable starting point for discussion about the costs and benefits of the incentives. We also note that additional consideration should be given to the potential environmental benefits as greater environmental benefits could alter the conclusions.

Considering Employment Impacts

While the cost of the incentives exceed the readily measurable increase in state revenue, the incentives were not intended solely to generate benefits like direct tax revenues. The incentives were also intended to create jobs in the solar panel manufacturing and installation sectors.

The solar industry is growing rapidly in the state, with roughly 400 jobs in the installation category and more than 80 in-state panel manufacturing jobs in 2015, along with a number of related jobs in business that focus on inverters, racking materials, etc. For our calculations we assume 400 direct installation jobs and 125 jobs in manufacturing or manufacturing related jobs. Due to business-to-business activity and the spending of household income (as workers in the solar industry spend their income) – the solar industry also supports jobs in other industries. We estimate that the 400 installer jobs result in another 400 jobs throughout the state economy (at restaurants, credit unions, etc.) and the 125 production jobs result in an another 114 jobs. In total, the solar industry can be said to support nearly 1,100 jobs in the state.

Some reports suggest that 2,400 people work in the solar industry in Washington State. This figure might include workers in the manufacturing sector who work in positions partially tied to the solar industry, but also connected to other industry sectors and also manufacturing of solar equipment exported from the state. It might also include a variety of related jobs that we do not count as being directly employed in the solar industry. In short, we use a very conservative estimate based on our survey results and a limited number of interviews and other data points. We also highlight the obvious growth in the industry in recent years.

While the benefit the state receives from workers in the industry in the form of tax revenue is included in the calculations above, non-tax related benefits are not included. One could argue that without the subsidy some of these workers would be unemployed and relying on various state agencies for assistance. Moreover, many of the jobs pay above median wage. Moreover, if much of the incentive money comes back to the state in tax revenues, only the remaining – unreturned portion – might be weighed against the jobs created in considering the money spent per job.

If we imagine a net subsidy of $425 per kW and 0.058 jobs per kW[3], we estimate a subsidy of roughly $7,300 per job in the solar industry. While it is important to ask if more jobs could be created per dollar of incentives in other industries, it is also important to ask about the quality of the jobs created. Our survey results show that the jobs in the solar industry pay at least $50,000 per year, with many higher paying jobs in the manufacturing and engineering side of the installation sector. **These figures suggest that the payroll impacts of the incentives are roughly $6.82 dollars in wages for each $1 in net incentive spending** (after considering the tax revenues and other readily measurable benefits of the incentives).

It may also be important to ask how a subsidy of roughly $7,300 per job compares to other job creation or job support subsidies. Small businesses receive a variety of subsidies, including free counseling from the Small Business Administration (SBA) and various loan assistance programs. The SBA tracks the number of businesses that utilize their services and the number of employees at those businesses, but data are not readily available on the actual cost per job of the various programs. Similarly, large businesses also receive a variety of subsidies and different types of assistance. The most notable example in Washington State was the tax incentives provided to Boeing in 2013, with an expected value of $8.7 billion. The main item in the incentive package was a 16 year extension of tax breaks put in place in 2003. While it isn't clear exactly how to allocate this incentive on a per job basis (in part because the number of jobs preserved isn't clear – employment changes year to year and could change significantly depending on whether Boeing moves more jobs to other locations such as Charleston, SC), the cost per job is clearly many times larger than the incentives intended for the solar industry. Good Jobs First estimates that the sort of megadeals provided to Boeing cost over $450,000 per job.[4] Even if that amount is spread over a 20 year planning period, the cost would be more than $20,000 per job per year.

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3 We found 0.046 jobs per kW in the installation industry and 0.012 in the manufacturing industry to get an overall average of 0.058 jobs per kW.

4 See for example http://www.dontmesswithtaxes.com/2013/11/boeing-gets-27-year-87-billion-tax-break-to-stay-in-seattle.html (searching for more information and more well known source)

Notes on Key Assumptions

Several of the assumptions could be challenged. For example, one could assume that direct tax revenues could be much higher if in-state manufacturers were able to sell solar panels to customers outside the state – thereby collecting tax revenues without any increase in subsidy costs. Manufacturers have plans to export in just that way.

We do not assume exports and the corresponding increase in tax revenues because it isn't clear that the exports are likely to happen in the near future. Being able to export panels would require in-state producers be able to sell panels at a price below the price of alternatives (including those from China) or at quality premium. Moreover, manufacturers in other states have the same plan, suggesting that not all may be successful.

Another assumption that can be challenged is the amount of increased income (or savings) that panel owners decide to spend. We assume homeowners who install panels consume 70 percent of the money they save on electricity bills, the production incentives, and lower federal tax payments. This "marginal propensity to consume" is consistent with averages for people with higher income, and differs from average propensity to consume and other measures such as the average savings rate in the U.S. In short, the marginal propensity for consume is the portion of extra money that is consumed rather than saved. Data show that the portion declines with income – and we assume that homeowners installing solar panels have above average income. Programs exist to help lower income homeowners install panels, but some of the programs also capture the benefits, making the marginal propensity to consume for higher income households more relevant.

We assume there are roughly 400 installer jobs and 125 jobs in manufacturing and manufacturing related jobs in the solar industry. The number of installer jobs comes from information based on our survey of installers. The number of manufacturing jobs is based on knowing that Itek Energy (a manufacturer in Bellingham) employed 82 people last year, and there were other manufacturing jobs at companies like Alpha/Outback, Magnum, APS America, and Sun Modo. These companies manufacturing inverters, racking equipment, and other components of solar panels or items used in the installation of solar panels. The increase from 82 known manufacturing jobs at one company to a total of 125 jobs is arbitrary and deserves further consideration. It is our attempt to capture the fact there are more manufacturing jobs other than those at Itek, even though some of these jobs are only partially supported by solar related work. Employment estimates are very important because they influence heavily the payroll return figure shown above.

Data from Lawrence Berkeley Lab suggest higher per kW home price premiums due to solar panels than we assume in this analysis. In particular, the data show values close to $6,000 per kW, with a high depreciation rate. We note these figures were for solar panels installed roughly a decade ago, when prices were much higher. Allowing for lower capital cost and some degree of depreciation, we assume a premium of $3,000 per kW. This figure is based on the assumption that anyone installing a solar array on their home or business would not be planning on selling the building for at least 5-7 years, so they could see a positive return on their investment. Even if we assume the panels add $4,000 per kW to the building value (roughly the original price or full cost of the panel), they would add noticeably less the next time the building was sold. We use $3,000 per kW as a rough average. It may also be helpful to note that assuming a higher premium adds little to the benefits shown above. For example, increasing the home value premium by $1,000 per kW adds $20 to the benefits.

Background Information

Washington State has over 45 MW of installed electric generating capacity from solar power, supported by the Renewable Energy System Cost Reduction Program. Data from the Washington State Department of Revenue (DOR) shows that capacity roughly doubled from 2013 through the third quarter of 2015.

Table 3 shows basic indicators such as the number of cost reduction projects, annual capacity installed, and the portion of those projects that are in the residential sector. It includes data from the survey on two of the items.

Table 3. Basic Indicators

	2011	2012	2013	2014	2015 (Q1-Q3)
Number of PV Systems Installed	649	987	1,552	2,063	2,146
From Survey Respondents:			1,832	1,774	1,798
Annual Capacity Installed (MW)	4.27	5.17	8.53	13.71	16.0
From Survey Respondents:			7.03	10.04	11.58
Percentage of Installations that are Residential	86.9%	91.7%	96.2%	96.7%	97.4%
Percentage of Installations from WA Components	48.4%	71.4%	71.2%	84.9%	89.2%

Survey respondents accounted for 82% of the installed capacity in 2013, 73% in 2014, and 73% in the first three quarters of 2015. These figures suggest that the survey responses give an accurate glimpse into the solar installation industry.

Survey respondents highlight projects in roughly 30 different counties in the state. Respondents indicated that in 2013 they completed over 1,800 projects in 27 different counties. The number of projects completed exceeds what the state has reported for total cost recovery projects. We assume the extra projects were projects that were approved by the state in 2012 but not completed by installers until 2013, non cost reduction projects,[5] or off grid systems. In 2014 they completed 1,774 projects in 30 different counties. And in just the first three quarters of 2015 they've completed 1,798 projects in 29 different counties.

Most counties show an increase year-to-year in the number of systems installed. However, some counties, such as Island County, show a decrease. Decreases in smaller counties could be due to saturation effects and/or utilities reaching installation levels that ultimately lower production incentives.

The survey data and information in the "Solar Energy in Washington State – Part One" report show that solar photovoltaic systems have been installed in almost all counties in the state. A majority of the installations are in Thurston County and north – in the Puget Sound region.

Table 4 shows the number of projects and capacity installed each year since 2011 (as reported by DOR). These data show a clear trend of growth in the number of systems using panels and inverters made in Washington.

5 "Solar Energy in Washington State – Part One" notes that systems outside the cost reduction program account for over 2 MW of capacity. Some are third-party owned or leased systems, making them ineligible for incentives under the cost reduction program.

Table 4. Washington Originated Systems

	2011		2012		2013		2014		2015 (Q1-Q3)	
	WA	Non-WA	WA	Non-WA	WA	Non-WA	WA	Non-WA	WA	Non-WA
Residential										
Projects	281	283	663	242	1073	420	1709	286	1874	217
MW	1.20	1.29	2.99	1.22	5.18	2.37	10.38	2.17	12.90	1.62
Commercial										
Projects	26	51	33	40	24	27	33	26	23	14
MW	0.17	1.38	0.20	0.55	0.17	0.63	0.40	0.54	0.23	0.34
Community										
Projects	7	1	9	0	8	0	9	0	18	0
MW	0.21	0.02	0.21	0	0.18	0	0.22	0	0.91	0

The survey conducted for this report show that installers directed 87 percent of their gross revenues to manufacturers or suppliers in Washington State. This figure is consistent with share of projects and installed capacity using WA versus non-WA equipment as shown in Table 4 above (see especially the figures for 2015). It is also a big part of the reason the incentive program is as successful as it is, with money recycling in the state economy. And it isn't just the incentive money itself that is recycled. The incentive money is combined with project owner capital. Put another way, the incentive money is just that: money that incentivizes homeowners and business owners to invest in solar panels, with more money going to manufacturers and installers than the state invests on its own. In fact, the amount of money received by installers and manufacturers is nearly four times as large per kW than the state invests.

If we look at the state's net incentive of $425 rather than the total incentive of $1808, the return on the incentive investment looks much more attractive. For example, we might refer to the $3,600 per kW paid to installers as the return on the state's net investment of $425 per kW. Those figures suggest the solar industry sees economic activity eight times larger than the net incentives provided. And if we include the fact that 87 percent of the money received by installers also goes to manufacturers, we might conclude that the final economic activity is roughly 15 times as large as the state's initial investment. **Stated another way, each incentive dollar invested by the state leads to $15.84 in economic activity in the solar industry within the state.**

Survey results also suggest that electrical engineers in the state are increasingly using suppliers in the state and that suppliers are steadily developing the capacity to meet the growing demand for solar power. An important next step is determining whether the manufacturers/suppliers can continue to grow and generate sales to customers outside the state.

Table 5. Incentives Paid Under Existing Incentive Program

	2011	2012	2013	2014
Cost Reduction Program Incentives	$1,145,081	$1,929,196	$3,831,735	$6,822,345

Sources: Figures for cost reduction program incentives provided by DOR. Other figures from public disclosure surveys and reports (https://fortress.wa.gov/dor/efile/MyAccount/TaxIncentivePublicDisclosure/)

Solar Washington conducted a survey in 2014 and found that the state provided $19.6 million in incentives. That figure is higher than suggested by the data provided to us by WSU Energy Extension and DOR. Solar Washington also claims that the state's program enabled utilities to redirect $2.8 million in taxes as incentives to homeowners and small businesses that installed new solar systems in 2013.[6] DOR provided us with data that suggests the number was $3.8. More work is needed to understand these discrepancies.

6 http://solarwa.org/results-solar-washington-survey-released

Installation Jobs and Existing Incentives

Table 6 provides a very brief summary of the installer jobs per kW, total kW, and total jobs. These figures are based largely on a survey of installers. Similar data are not readily available for manufacturing jobs.

Table 6. Cost Reduction Incentives per Installer Job

Year	Average Jobs/kW [a]	Total kW Installed [b]	Total Jobs
2013	0.02455	8,530	209
2014	0.023	13,710	315
2015	0.02445	16,000 (Q1 to Q3)	391

Sources: Survey (a) and WSU Energy Extension (b)

Our survey data also show an average hourly wage of $25 per hour for W-2 workers in the installer segment. Subcontractors and 1099 workers earn less, but not significantly less – still in the $20 per hour range and sometimes higher.

Solar Washington estimated a return of $2.46 for each $1 in subsidy for the solar industry in Washington under the existing incentive program.[7] Our estimates of impacts of the proposed incentive program suggests a much higher return of $6.82 in payroll and $15.84 in economic activity per $1 in incentives.

Environmental Benefits

The California Carbon Dashboard shows carbon allowances currently trading for close to $13 per ton. Unfortunately, we do not have a model that lets us know how much carbon emissions have been avoided with the additional solar panels.

For this analysis we assume that the electricity generated by solar panels takes the place of electricity that would otherwise be generated by natural gas facilities. (We assume the hydropower generated in the region will be generated as base power and that load adjustments will be made with other sources, including solar, wind, and natural gas.)

If we assume 1,000 kWh per kW per year from solar panels, 1.4 pounds of avoided carbon per kWh[8], and $13 per ton of carbon offset or avoided is worth $13, we find that each kW of solar power generates just over $9 in environmental benefits annually. To find the total environmental value we have to also consider the fact that the price of carbon is likely to increase over time and that the environmental benefits are generated every year for the life of the solar panel. We start by assuming that carbon prices increase each year by 1.5 percent and that the panels last for 30 years. We also use a discount factor of 2 percent to get the present value of all environmental benefits provided over the 30 year period.

7 http://solarwa.org/results-solar-washington-survey-released

8 http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11 (This website suggests that 1.4 pounds of carbon per kWh generated from natural gas may be high. We use the higher number because there are different ways of generating electricity with natural gas, some of which result in more carbon per kWh. In addition, not all systems are operated optimally.)

Additional Considerations

Opportunity cost is one of the simpler and more basic concepts in economics, and perhaps one of the more important when it comes to public policy. When resources are devoted to one endeavor, they are not available for other efforts. As such, it is always important to ask what else could have been done with the resources devoted to one action. The use of the resources might result in something good – but it is still important to ask what else might have been accomplished.

In this case, it would appear that the solar incentives are generating large benefits. With one of the primary stated purposes of the program being job creation and solar industry promotion, the incentives seem to be serving their purpose.