Loudat, Thomas A.; Kasturi, Prahlad

Article

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The Economic and Fiscal Impacts of Hawaii's Solar Tax Credit

Thomas A. Loudat[1], Prahlad Kasturi[2]*

[1]President, Tal Associates, 46-281 Auna Street, Kaneohe, HI 96744, USA, [2]Department of Economics, Radford University, Radford, Virginia, USA. *Email: pkasturi@radford.edu

ABSTRACT

This research paper assesses the economic and fiscal impacts of Hawaii's solar tax credit-stimulated solar installations. The method entails estimating the economic effects created by (i) the purchase of a solar system as well as, (ii) of the alternatives foregone. Our study shows that the State receives full repayment of its solar credit investment in 9-15 years. For each solar credit dollar spent, the State receives $1.97-$2.67 dollars in additional tax revenues. The fiscal results of the tax credit reported by this research have been replicated in a federal solar tax credit study published by the US Partnership for Renewable Finance USPRF (2012) that estimates an internal rate of return (IRR) of 10% for the government's tax credit "investment" in residential solar systems. The findings of the federal study comports closely with our Hawaii's estimate of an IRR of 9.5% for residential and 11.1% for commercial solar systems.

Keywords: Solar Energy, Solar Tax Credit, Internal Rate of Return
JEL Classification: O4

1. INTRODUCTION

Solar system technologies typically use renewable energy in the form of sunlight to generate electricity (e.g., photovoltaic panels, abbreviated as "PV"), or to heat water (solar hot water or abbreviated as "SHW"). These technologies can be installed at residential or commercial locations as a form of distributed energy generating systems to reduce the demand for electricity from centralized, utility-based generating systems. The installation and use of solar systems decrease Hawai'i's reliance on imported oil, gas, coal, and other fossil fuels used to generate electricity or heat water. As such, installing a solar system has an economic benefit for both the system purchasers (in the form of lower electric bills) and the broader Hawai'i community (in the form of reduced reliance on imported fossil fuels).

The state of Hawai'i enacted a tax credit in 1976 to stimulate installation of solar technologies[1]. Since its inception, the solar credit has been expanded to include other renewable technologies and increased from its original level of 10% of a system's cost to the current 35% level with a cap on the amount of the credit claimed[2]. The tax credit for commercial systems is capped at $500,000 for PV and $250,000 for SHW. Single-family residential solar systems have caps of $5,000 for PV and $2,250 for SHW. Multi-family residential solar systems have a cap of $350 per residential unit.

A federal solar tax credit was introduced in the late 1970s, and has generally varied between 30% and 40% of system cost. The federal credit is currently 30%, with no cap on the amount that can be claimed. Through various programs, rebates for SHW systems have also been offered in Hawai'i, varying between islands.

Using available data, we calculate the cost of total credit refunds for SHW systems, which is roughly $126 million (in 2005$) over the life of the Hawai'i solar credit through 2011. Adding solar credit refunds for other renewable energy systems would increase this amount. While the cost to the state is readily tractable, the potential benefits of the solar credit are less transparent. Relying solely on the credit cost without also considering the economic,

1 State of Hawaii Department of Taxation ("DoT"), Tax Credits Claimed by Hawaii Residents (various years), Available from: http://www.state.hi.us/tax/a5_4credits.htm.

2 Haw. Rev. Stat. § 235-12.

fiscal, and other benefits, would inevitably lead to non-optimal policy choices regarding solar credit.

This research paper provides a more complete picture of the economic and fiscal performance of Hawaii's solar credit, showing that their benefits outweigh their costs. Moreover, data utilized in the study and our analyses suggest that that solar installations have not detrimentally impacted the utility nor revenues the State derives therefrom. This study shows that the solar tax credit is increasingly making solar power a viable option for Hawai'i ratepayers across the income distribution spectrum.

The objective of this research is to assess the economic and fiscal impacts of Hawaii's solar credit-stimulated solar system installations. It entails estimating the economic effects created by the purchase of a solar system, and also of those foregone due to its purchase. The net impact is the difference between the economic effects and derivative fiscal effects created, and those foregone. The net impact of the solar tax credit is the operative measure required for policy makers to assess the economic and more importantly fiscal performance, of Hawaii's solar tax credit.

2. METHODOLOGY

The Hawai'i solar credit affects both the purchase decision, the economic outcome to the purchaser, and State finances. That is, it has behavioral as well as economic and fiscal impacts. Behavioral impacts are measured via observing the relationship between annual systems installed and the overall credit level for the corresponding year. Economic and fiscal impacts are the sum of total annual net impacts, measured as benefits less costs (i.e., what is foregone) over a system's life. A solar system is a capital item with a life greater than 1 year. Thus, its energy saving capacity and its consequent economic and fiscal impacts extend over a multi-year life cycle. As capital items with consequent returns greater than the capital cost, solar systems transform the State's credit related expenditure into an investment, not an expense, with a consequent return that is measured in this research report.

In this study, cost and benefit cash flows for both users and the state are formulated for the solar systems analyzed. Owners use electricity generated from the PV system or export the surplus to the utility. The consumer retail cost of electricity equals the value per solar system kW electricity generated. Cash flows extend for 30 years (the assumed life of a PV solar system) or 25 years (the assumed life for a SHW system). The analysis assumes systems are cash purchased.

Costs and benefits for the respective entities are the following:

- For user or system purchaser:
  - Stimulated by a solar system purchase:
    - Costs include system purchase and installation costs, and required maintenance costs over a system's life.
    - Benefits are the value of fossil fuel-free energy generated using sunlight, any tax savings from depreciation deductions and solar tax credits received.
  - Foregone by a solar system purchase:
    - The cost of purchasing the utility-generated equivalent amount of electricity a solar system generates over its life after installation.
    - The benefit of using solar system purchase dollars for alternative expenditures.
- For the State:
  - Stimulated by a solar system purchase:
    - Costs are the solar credit refunds the year the credit is taken and lower tax revenues due to any depreciation expenses (commercial systems only) that reduce a purchaser's tax liability in subsequent years until a solar system is fully depreciated.
    - Benefits are the increased level of tax revenues by virtue of increased local economic activity from consumer expenditures generated from the substitution of local sunlight for imported fossil fuels for energy.
  - Foregone by a solar system purchase:
    - The cost is the loss of the stream of tax revenues generated by a solar system's substitution of local sunlight for imported fossil fuel for energy.
    - Benefits are the use of credit monies for alternative to credit refund expenditures the year credit is taken and any tax decreases due to depreciation deductions in subsequent years.

Based on these cash flows, the economic and fiscal performance of the solar credit is measured[3] for each system type.

Cost and benefit cash flows allow determination of final demand amounts over the life of a system. Multiplier effects are estimated from final demand using the 2007 Hawai'i State input/output model. The analysis does not account for changes in consumer expenditure when a solar system is purchased that could lead to economic leakages from Hawaii's economy. On the benefit side of the solar credit impact accounting, it is assumed that all expenditures on solar systems are for Hawaii-based products and services. On the cost side of the solar credit impact accounting we assume equivalent monies expended on consumer goods in the year of installation offset the investment in the solar system. These assumptions posit that the percentage of a system cost represented by monies to the solar manufacturers is no more than the percentage of monies to consumer goods manufacturers. Due to the large local labor component required for a solar system installation, it seems reasonable to posit that the portion of expenditure going to mainland-based companies for a solar system installation is less than that for consumer goods assumed foregone. It is important to note that leakages for any reason not accounted for in this analysis reduce the net economic and fiscal impacts of credit-simulated solar system installations.

3 Economic and fiscal performance measures are deterministic once variable values are specified. A change in any variable value could result in changes in the value of performance measures reported herein. Thus, issues about any performance measure reported herein should refer back to the variable values. It is noteworthy that the performance measures are not the measure of the true impact of policy. The policy context of the solar credit program over its existence relates to State energy goals, not performance measures per se, which are incidental to solar credit policy.

Analysis economic impact variables measured in this study include:

- Indirect and induced output (sales);
- Employment or jobs; and
- Labor income.

General excise tax revenues generated by the purchase decision are measured on economic output (i.e., direct + indirect + induced output) and income tax revenues on labor and corporate income over the life of a system. These amounts, together with the solar credit cost plus the depreciation cost for commercial PV systems to the state, allow the determination of the net fiscal impact to the state of the solar credit program.

Systems analyzed include:

- Residential SHW (234 kWh per month energy savings);
- Residential PV (5.27 kW nameplate capacity); and
- Commercial PV (118 kW nameplate capacity).

Detailed information regarding system parameters, assumptions, and other variables are presented in Appendix 1. Results are generally reported on per kW and/or per system basis for PV systems, and per system basis for SHW systems.

3. RESULTS

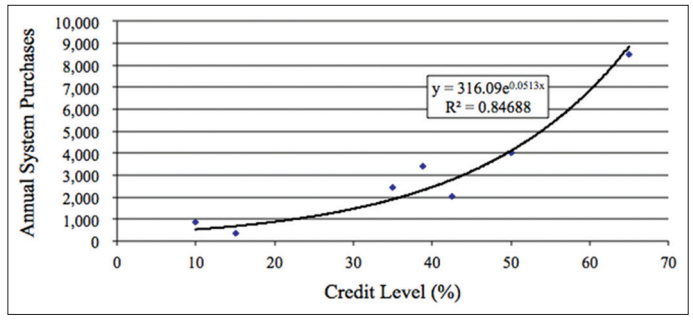
3.1. The Relationship between Tax Credits in Hawai'i and SHW Installations

Figure 1 shows the relationship between the solar credit and the number of SHW system installations. Data is available from 1977 to 2011. Figure 1 shows a clear, statistically significant relationship between the credit level and the number of systems installed - the higher the credit, the more systems installed. This relationship is due not only to the fact that the credit lowers the net cost of a solar system leading to more sales, but also due to other market signals sent by the State by virtue of a substantial credit[4].

Given the relationship between the solar credit level and the number of systems installed, it is noteworthy that for each solar system installed in Hawai'i, there is a potential Federal tax reduction to the purchaser of 30% of the cost of a solar system. If a reduction or elimination of the State tax credit reduces the number of system installs, this will lead to a reduction of these Federal dollars circulating in Hawai'i's economy with direct and multiplier economic and fiscal consequences.

The relationship between the solar credit and SHW system installations reported above has persisted over the long term (i.e. the past 35 years). The analysis thus assumes that this will be

Figure 1: Solar hot water systems installed as a function of total credit level[5]



the case at least over the near-term. It seems reasonable to posit that the significance of the impact of the solar credit would be less for solar electric then SHW because of significant price declines in solar electric technology that have not occurred for SHW systems. An equivalent data set for solar electric installations (as is available for SHW systems) do not exist to investigate this relationship. Nonetheless, the analysis assumes that the relationship between the credit level and the number of installations holds for solar electric systems as well as SHW systems for purposes of this analysis.

While tractable, this analysis makes no attempt to determine the optimal credit level. For any such determination it would be necessary to specify the objective function and its related constraints from a policy maker's perspective. Determination of an optimal credit level is not necessary to assess any net benefits of the solar credit at its current level.

3.2. Tax Credit-stimulated Solar System Cash Flow Determination

- Tables 1-3 show the variables and variable values used to project cash flows from solar systems for each type of solar system.
- Estimated cash flows with the solar credit stimulated purchases, those forgone due to solar credit stimulated purchases, and the net overall cash flow situation due to solar credit stimulated solar system purchases for commercial PV systems are shown in:
  - Tables 4-6 for residential SHW systems
  - Tables 7-9 for residential PV systems
  - Tables 10-12 for commercial PV systems.

The analysis results below are derived from these tables.

3.3. Parameters of Solar Systems Analyzed

Table 1 presents the solar system parameters underlying the cash flow analysis. The data in Table 1 is self-explanatory descriptive data noting the difference in the types of solar systems analyzed - SHW and PV. It merits reiteration that SHW system results are presented on a per-system basis while PV system results are presented on a per-system as well as per-kW generating capacity basis.

4 Inclusion into the analysis of a time variable measuring awareness of the technology with simultaneous system price decreases leading to uptake over time, proved statistically insignificant. Inclusion of average residential electricity prices into the analysis while statistically significant in one specification was not in others. More importantly, inclusion of either of these variables did not change the coefficient of the credit variable, which remained statistically significant in all specifications. The credit level at least for SWH systems is the most significant factor impacting the uptake of these technologies.

5 Data from DoT, Tax Credits Claimed by Hawaii Residents (various years), Available from: http://www.state.hi.us/tax/a5_4credits.htm; and HECO Demand Side Management Information System Reports. The "Total Credit Level" includes State and Federal tax credits.

Table 1: Solar system parameters[6]

Solar system	System			Cost per system or per installed kW	Annual savings per system or per installed kW
	Size (kW)	Cost	Life		
SHW (system)	Average HI	$6,615	25	$6,615	$1,018
Residential PV (kW)	5.27	$29,000	30	$5,503	$554
Commercial PV (kW)	118	$442,500	30	$3,750	$554

Source: Internal calculations. SHW: Solar hot water, PV: Photovoltaic

Table 2: Solar credit economic performance

Solar system	Credit cost per system or per kW	Output (sales) generated		Output per system over life
		Per system or per kW per year	Per credit $ per system or kW	
SHW (system)	$2,315	$4,105	$44.32	$102,622
Residential PV (kW)	$1,926	$2,227	$34.69	$66,810
Commercial PV (kW)	$1,313	$2,407	$55.03	$8,522,259
		Labor income generated		
		Per system or per kW per year	Per credit $ per system or kW	Labor income per system over life
SHW (system)		$1,245	$13.45	$31,131
Residential PV (kW)		$672	$10.46	$106,189
Commercial PV (kW)		$736	$16.82	$2,604,386
		Jobs generated		
		Per system or per kW per year	Per credit $ per system or kW	Jobs per system over life
SHW (system)		0.038	0.00041	0.95
Residential PV (kW)		0.020	0.00032	3.24
Commercial PV (kW)		0.023	0.00052	81

Source: Internal calculations. SHW: Solar hot water, PV: Photovoltaic

Table 3: Fiscal impacts and investment performance of the solar tax credit

Solar system	State expenditure per system	State revenues			State IRR (%)	Break-even (years)
		Revenues over life	Total per system or per kW	State revenues per $ credit		
SHW (system)	$2,315	$5,832		2.52	9.9	9
Residential PV (kW)	$10,150	$20,010	$3,797	1.97	5.4	15
Commercial PV (kW)	$181,468	$484,955	$4,110	2.67	10.3	10

Source: Internal calculations. IRR: Internal rate of return, SHW: Solar hot water, PV: Photovoltaic

3.4. The Economic Performance of the Solar Tax Credit

Table 2 presents economic performance data of the solar tax credit. Of the various results presented in Table 2, a measure of potential interest to policy makers is the performance of the solar credit with respect to specific economic outcomes. These include the following.

- Solar tax credits stimulate additional sales in Hawai'i, spurred by money not sent out of the State to pay for imported fossil fuels. These additional in-State sales range from $34.69 for residential solar PV systems to $55.03 for commercial PV systems, for each dollar spent by the State on tax credits.
- Each dollar spent on tax credits also stimulates additional in-State labor income (i.e., earnings). These additional earnings range from $10.46 for residential solar PV systems to $16.82 for commercial PV systems, for each dollar spent by the State on tax credits.
- By sending less money out of the State to pay for oil, Hawai'i's economy can support more local jobs. For example, each commercial PV system analyzed generates 81 new full-time equivalent jobs over the life of the system.

A noteworthy result for Hawai'i's labor market, most particularly for the construction sector, is that for each solar system type

6 International Energy Agency PV Power Systems Programme, Methodology Guidelines on Life Cycle Assessment of PV Electricity, notes "The degradation of the modules results in a reduction of efficiency over the life time. The degradation rate recommended: For mature module technologies is 80% of the initial efficiency at the end of the 30 years lifetime. Assume linear degradation during these 30 years." Since the modules have 80% capacity remaining after 30-years they can remain in service or be sold for their salvage value. To account for this fact, the analysis makes no accounting of annual degradation to the modules. Consistent with this assumption, the analysis makes no accounting of module salvage value at the end of their assumed 30-year life.

investigated, dollar credit expenditure leads to a dollar return with respect to labor income greater than the credit amount expended. The solar credit expenditure is generating more in labor income than its dollar cost.

3.5. Fiscal Impact and Investment Return to the State of the Solar Credit

Table 3 shows the fiscal impacts of the Hawai'i's solar tax credit and the performance of the credit when viewed as an investment by the State. The State receives full repayment of its solar credit investment in 9-15 years. This is due to the economic stimulative effects of solar systems substituting sunlight for imported fossil fuel, and the additional tax revenues earned by the State because money continues to cycle through Hawai'i's economy, rather than being sent out of the State to pay for imported fossil fuel.

- For each solar credit dollar spent, over the life of a solar system, the State receives $1.97 to $2.67 dollars in additional tax revenues.
- When viewed as an investment by the State, solar systems provide a internal rate of return (IRR) ranging from 5.4% to 10.3% over the system's life.

These results indicate that the solar credit, far from being an annual expenditure with no subsequent fiscal consequence, is more accurately viewed as an investment by the State yielding a significant positive return. That is, over the life of a solar system, the State gets back in revenues more than it spends in the form of solar credit refunds. This significant positive fiscal outcome, as well as the economic outcomes resulting from credit-stimulated solar system installations, is the result of solar systems substituting free local sunlight for imported fossil fuel for the entire life of each system. A solar system's life extends upwards of 30 years beyond the year the credit is taken by a solar system installer.

Notably, the fiscal results of the tax credit reported in Table 3 have been replicated at the national level. A study recently published by the US Partnership for Renewable Finance (USPRF, 2012) reported the following[7]:

- The federal solar tax credit can deliver a 10% IRR to taxpayers on the government's initial tax credit "investment" in residential and commercial solar systems. This result comports with the Hawai'i IRRs presented above (9.5% residential and 11.1% commercial).
- A $10,500 tax credit for a residential system can provide a $22,882 nominal benefit to the government over the life of the solar asset, and a $300,000 commercial solar credit can create a $677,627 nominal benefit in a similar time period. The ratio of tax dollars spent to tax revenue generated, based on USRPF's analysis, is approximately 2.2. This is similar to the Hawai'i ratio presented above (2.0-2.7). Hawai'i's payback ratio is more favorable due to Hawai'i's high-energy costs.
- The credit has encouraged a significant increase in job and installation growth in the U.S. solar industry. "Approximately 90% of the nearly 5,000 megawatts of solar capacity in the U.S. today has been installed since the (federal tax credit) was increased at the beginning of 2006." Figure 1 presented above shows that solar tax credits have the same impact on solar installations in Hawai'i.

3.6. The Impact of Rising Oil Prices and Decreasing Solar Costs

The results presented in Tables 2 and 3 are based on the assumptions and parameters noted. Results would vary with changes in those underlying parameters. The impact of such changes is as follows:

3.6.1. Decreasing solar costs improve the performance of the tax credit

Historically, solar system cost changes have either moved with inflation or decreased with time. Since 2002, solar PV costs have decreased at an average annual rate of −4.62%. SHW system costs have increased at an average annual rate (3.83%)[8], paralleling the Honolulu consumer price index ("CPI") (3.34%) over the same time period. More recently (i.e., from 2008 to 2011), SHW system costs have decreased (−0.79%), lagging the Honolulu CPI (2.1%).

Decreasing costs mean lower dollar credit expenditure per installed kW. In 2001, the credit cost to install a solar PV system per kW was $5,150 (2012 dollars). Currently, the credit cost to stimulate the installation of a kW of solar PV system capacity for an equivalent-sized system is $1,348. In other words, in order to get the same benefit of renewable energy generating capacity per dollar of credit expenditure, it currently costs the State approximately 25% as much as 10 years ago due to decreasing solar system costs[9].

Solar system cost decreases are the result of the increased diffusion of this technology, which leads to technological advances as well as production efficiencies due to higher production levels. Hawai'i's historic progressive policy with respect to the credit has played a part in the diffusion of these technologies and their consequent cost decreases.

It appears unlikely that solar PV costs will continue to decline at the same rate as the recent historic past. A recent report[10] found that U.S. producers have been injured due to dumped and subsidized imports from China. If significant duties are ultimately imposed, U.S. production could become more competitive with imports, but this may also contribute to stalling the decline in solar PV costs[11]. Those trends could also be impacted by other Federal policies. Hawaii lawmakers cannot control these global forces

7 US Partnership for Renewable Finances, Paid in Full: An analysis of the Return to the Federal Taxpayer for Internal Revenue Code Section 48 Solar Energy Investment Tax Credit (July 12, 2012), Available from: http://www.uspref.org/images/docs/SC_ITC-Payback_July_12_2012.pdf.

8 Loudat, PhD, The Economic and Fiscal Impacts of the Hawaii Solar Water Heating Energy Conservation Credit, prepared for the Hawaii Energy Efficiency Policy Task Force (March 8, 2002).

9 The authors acknowledge that while rising oil prices and decreasing solar costs will improve the performance of the tax credit as described, such changes would likely simultaneously increase non-credit-driven solar uptake. Preliminary analyses performed as part of this research process indicate that while this is the case, the solar credit yet remains the most significant factor stimulating the uptake of solar systems.

10 Michaela D. Platzer, U.S. Solar PV Manufacturing: Industry Trends, Global Competition, Federal Support, Specialist in Industrial Organization and Business (June 13, 2012).

11 The 10/11/12 Honolulu Star Advertiser, page B5, reported "U.S. affirms steep tariffs on Chinese solar panels."

that may put an end to the solar PV decreasing cost trend. They can, however, positively react to this changing trend by instituting or maintaining policy measures to best achieve Hawaii's unique energy goals given its high dependence on imported fossil fuels for electricity generation.

3.6.2. Rising oil prices improve the performance of the tax credit

Oil price changes will significantly impact analysis results presented herein due to Hawai'i's continued significant dependence on imported oil for electricity generation. Oil price changes lead to changes in energy cost savings from a solar system, which directly impact the economic and fiscal performance of the solar tax credit. For example, with respect to the commercial solar PV system investigated, an increase in benchmark oil prices to their previous high of approximately $150 per barrel increases the State revenue per dollar credit from $2.67 to $3.19, a 20% increase. The State's return on investment increases from 10.3% to 13.2%. Conversely, lower benchmark oil prices would have the opposite effect.

The Hawai'i solar tax credit stimulates the installation of solar systems. These systems buffer the economic and fiscal impacts of any oil supply disruption. Supply disruptions can lead to abrupt and significant price changes to which Hawai'i is especially sensitive given its high dependence on imported oil. Other than as noted, this analysis makes no further accounting of the economic and fiscal benefit of the value of the solar credit mitigating negative impacts of oil supply disruptions.

3.6.3. Tax credit level changes and the effective credit level taken

A higher solar tax credit decreases the State's fiscal benefit for each system. However, a higher credit also increases the number of installed systems (Figure 1). This relationship is such that a higher solar credit would reduce average fiscal benefits on a per system basis, but increase the total fiscal benefit because of the installation of more systems. The reverse would also be true; a lower credit would increase fiscal benefits on a per system basis, but decrease the overall fiscal benefit because of the installation of fewer systems.

Solar tax credits stimulated 115,000 residential SHW system installations from 1977 through 2011[12]. The number of commercial SHW systems, both commercial and residential PV solar systems and other renewable energy systems is unknown. The most recent year for which data are available is 2005, with an average credit amount refunded of approximately $1,100 per residential system for individual solar and PV systems[13]. The average SHW system installation cost is approximately $6,500 for SHW systems. This solar credit cost data translates into an effective credit refund rate of 17%, or roughly half of the gross solar credit percentage of 35%[14]. If the analysis used the effective credit rate as opposed to the gross credit rate, fiscal results reported herein would be even more positive. In other words, fiscal results reported herein may be conservative and the true cost of the credit could be considerably less than reported[15].

3.6.4. Impact on utilities and the hypothetical "stranded" utility customer

The analysis does not measure any impact, positive or negative, on the local electric utilities or on ratepayers due to credit-induced solar installations. Reasons include:

- While a solar system user may purchase less electricity directly from the utility, that decrease may be offset by indirect purchases by solar system users of electricity required to produce the goods and services purchased with dollars that would otherwise have been exported from the State and from self-generated electricity savings.
- Some net-metered solar systems are oversized, producing more electricity than consumed by the user. This provides a direct subsidy to the utility and an indirect subsidy to ratepayers in the form of free electricity exported to the utility grid. While it is known that some installed solar systems are oversized, the extent and degree that this occurs is unknown.
- Without past as well as future solar system installations, electricity demand would have to be met by utility-generated electricity greater than what has occurred and what is expected to occur. If such an increased electricity demand could not be met by existing utility generating capacity, additional capacity would have to be added. Such an eventuality would spur the need to spend more money to operate, maintain, update, or install fossil generating units. It seems reasonable to posit that these costs would lead to ratepayer impacts. Any such costs have not been accounted for in this analysis.
- Negative economic and fiscal impacts due to reduced utility electricity sales caused by solar system are so insignificant that they can be ignored for this analysis.

Blue planet foundation has analyzed trends in recent solar installations. These trends show that residential households at all income levels increasingly utilize solar power. This suggests that it is incorrect to assume that solar installations by one subset of utility customers will detrimentally leave another subset of (non-solar) customers "stranded" on the utility grid without access to the benefits of solar power. In addition empirical data suggests that solar installations have not detrimentally impacted the utility.

3.7. Other Impacts of the Solar Tax Credit

The economic and fiscal impacts reported in this study are based on traditional measures of energy savings. But the solar systems stimulated by solar tax credits can also impact the economy in broader ways. This is highlighted by the USPRF report on federal tax credits wherein they note:

12 DoT, Tax Credits Claimed by Hawaii Residents (various years), Available from: http://www.state.hi.us/tax/a5_4credits.htm; and HECO Demand Side Management Information System Reports.

13 DoT, Tax Credits Claimed by Hawai'i Taxpayers 2005 (December 2007), Available from: http://www.state.hi.us/tax/pubs/credits/2005credit.pdf.

14 This result may be due to the fact that not all credit claimants take the full credit amount because they lack sufficient tax liability or do not take the credit at all.

15 The Hawaii Counsel on Revenues (9/10/12) reported via a DBEDT study that estimated the solar tax credit amount for 2012 will be $174 million. Appendix 3 provides critical commentary about this estimate.

"Moreover, this fiscal return [on solar tax credits] is independent of, and additive to the numerous other benefits of solar projects, including job creation, energy independence, the preservation of natural resources and the health benefits of cleaner air"[16].

These beneficial impacts are even more critical in Hawai'i and include the following.

1. Each purchase or lease of a solar system represents a long-term private investment in Hawaii's energy infrastructure. These distributed generation assets benefit all Hawai'i ratepayers, by (i) potentially reducing day time peak demand, (ii) reducing the need to invest in new utility generating assets, and (iii) delivering power at (or near) the demand site, thus reducing transmission losses and relieving stress on grid infrastructure.
2. The fiscal benefits of solar tax credits are "particularly significant given the increasing popularity of lease and power purchase agreement (PPA) financing models in the solar industry"[17]. Around the country, and in Hawai'i, the PPA and lease models are accounting for the majority of new residential PV installations, allowing households at every income level to benefit from solar cost savings[18].
3. Every state tax credit is matched essentially 1:1 by the federal tax credit. That federal credit represents additional money flowing into, and cycling through, Hawai'i's economy. The inverse is also true; for every State tax credit not issued, Hawaii loses the benefit of that "matching" credit because the money flows out of the State in the form of Federal taxes.
4. Department of Business Economic Development & Tourism reports that the solar industry accounts for "15% of all construction expenditures in the State"[19]. A sudden elimination of the solar credit would likely burden the State and private sector with immediate and significant economic and fiscal costs associated with unemployment and other costs related to retraining displaced workers. Moreover, the solar industry is becoming a backbone of Hawai'i's broader energy service industry. This industry is a key player in developing and sustaining Hawai'i's technology sector.
5. Renewable energy systems reduce Hawai'i's emissions of greenhouse gases, mercury, and other pollutants from fossil fuel plants. These benefits extend to ratepayers in the form of reducing the utility's environmental compliance costs for fossil-fuel generation. The same benefits extend to the entire community in the form of reduced environmental impact.
6. Distributed solar enhances Hawai'i's energy security, by providing a hedge against volatile fossil fuel prices.

Intangible solar credit economic and fiscal impacts arise due to positive externalities (spillovers) from reduced oil consumption brought about by the credit. These are reduced air, land and water pollution and attendant problems including global warming and acid rain. If the cost of these negative consequences of burning fossil fuels were incorporated into the price of oil, the energy cost savings estimated in this analysis would be significantly larger. Those larger energy cost savings would further increase the beneficial economic and fiscal impacts of the solar credit.

4. CONCLUSION

Solar credit stimulated solar system purchases have positive economic and fiscal impacts to the State of Hawai'i when one analyzes the impacts of these systems over their entire life, not just the year of system installation when the credit is taken. Life cycle impacts are the following:

- Solar system use results in annual electricity cost savings of $554 per installed kW of solar PV systems and $1,018 on average for SHW systems. This annual savings persists for the system's life and is foregone by not installing a solar system. This annual electricity cost savings is the significant factor resulting in the positive economic and fiscal created by solar credit stimulated system installations.
- Average annual life cycle economic impacts of solar credit stimulated system installations include:
  - Labor income per dollar credit expended of:
    - 13.45 for the average SHW system
    - 10.46 per kW capacity for residential PV systems
    - 16.82 per kW capacity for commercial PV systems.
  - Jobs created over solar system's life of:
    - 0.95 for the average SHW system
    - 3.24 for a 5.27 kW residential PV system
    - 81 for a 118 kW commercial PV system.
- Fiscal impacts of solar credit stimulated system purchases are the following:
  - The State breaks even on the solar credit investment in:
    - 9 years for the average SHW system
    - 15 years for a 5.27 kW residential PV system
    - 10 years for a 118 kW commercial PV system.
  - A rate of return on the solar credit investment of:
    - 9.9% for the average SHW system
    - 5.4% for a 5.27 kW residential PV system
    - 10.3% for a 118 kW commercial PV system.
  - Total revenue generated per dollar credit expenditure over solar system's life of:
    - 2.52 for the average SHW system
    - 1.97 for a 5.27 kW residential PV system
    - 2.67 for a 118 kW commercial PV system.

These solar credit fiscal performance results comport with those from a national study. They also change with changes in: System costs improving with cost decreases and vice versa, oil price changes improving with oil price increases and vice versa, and credit level changes.

While the cost of the solar credit is tractable and a justifiable concern of policymakers, assessing this cost without consideration of the life cycle impacts of a solar system is a gross oversight. Policymakers and most particularly analysts advising these policymakers about the fiscal performance of the solar tax credit need to consider all economic and fiscal impacts of the credit, not just those occurring the year of installation. Not doing so results in

16 USPRF Federal Tax Credit Study, supra n. 5.

17 i.d.

18 i.d. (noting that "63% of California residential installations, and more than 80% of Colorado residential installations in the first quarter of 2012" were based on lease/PPA models).

19 DBEDT Energy Update (March 2012), Available from: http://energy.hawaii.gov/wp-content/uploads/2011/08/DBEDT-Energy-Update-Edition-2-March-2012.pdf.

conclusions about the solar credit far removed from their economic and fiscal reality.

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APPENDIX 1

TABLE 1: ASSUMPTIONS FOR ESTIMATION OF FISCAL AND ECONOMIC IMPACTS OF SOLAR CREDIT STIMULATED SOLAR HOT WATER SYSTEM PURCHASES

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		25	Hawaii Solar Industry Association
Average System Cost	$6,615	$6,615	HECO data, average of HECO, HELCO and MECO installed systems in 2010
Maintenance Costs			
Year 5 - periodic maintenance	$306		O&M Schedule (12/12/01 Rolf Christ), current costs (Ron Richmond)
Year 12 - Pump Replacement	$273		O&M Schedule (12/12/01 Rolf Christ), current costs (Ron Richmond)
Year 15 - tank & controller replacement	$1,747		O&M Schedule (12/12/01 Rolf Christ), current costs (Ron Richmond)
Year 20	$306		O&M Schedule (12/12/01 Rolf Christ), current costs (Ron Richmond)
Purchase Costs over System Life			
Equity % of purchase	100%	100%	assumed cash purchase
Average Annual GrossDollar Imported Oil Savings per Unit			
Retail price per kWh	$0.363		4/13/12 Star-Advertiser, p. B3, average Hawaii electricty rate
Benchmark Price per Barrel Oil	$107.00		West Texas Intermediate Cost day of analysis
Annual kWh savings per installed solar system	2,808		HEI, Energy Tips & Choices, http://www.heco.com/vcmcontent/StaticFiles/pdf/2010_HECO_ETC-web.pdf; pp. 77; assumes a family of four
Annual Savings	$1,018	$1,018	calculated
Savings at Alternative Benchmark Oil Price Levels	Estimated	% Change	
Bench mark $/barrel (for HECO $/barrel multiply by 1.27)	Oahu kWh	from Now	Savings
$59	$0.2189	-39.6%	$615
$79	$0.2669	-26.4%	$749
$107	$0.3625	0.0%	$1,018
$118	$0.3773	4.1%	$1,059
$157	$0.4373	20.6%	$1,228
$200	$0.5573	53.7%	$1,565
Credit & Taxes			
Effective Tax Credit with Cap	65%	65%	calculated
Hawaii State tax credit on purchase w/o cap	35%	35%	State
Federal tax credit	30%	30%	Federal
Effective Federal tax credit	30.0%	30.0%	Mark Duda
State Credit Amount Cap	5,000	5,000	Mark Duda
per system	$5,000	$5,000	calculated
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.55%	DoT, 2009-2010 Annnual Report, based on p. 45 used to weight Oahu GET Rate (0.04712) and the neighbor islands (0.0416)
State Income Taxes on Labor Income		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Ratio of Corporate Income Tax to Labor Income Tax		3.87%	DoT Annual Report
Taxes on Induced and Indirect Output			
Note: It is impossible to determine the mix of transactions from indirect and induced output effects from $1 of final demand. For example, for retail transactions the GET is 4%. If the transactions are at the intermediate or wholesale level, they are taxed at 0.5%. To account for such tax effects from induced and indirect sales (output), an aggregated approach is used. Specifically, it is estimated that general excise and income taxes on indirect and induced transactions from $1 of final demand are the % indicated of total indirect plus induced output			
Total Taxes as a % of Indirect & Induced Output		3.5%	calculated
Ratio of GSP to Output	60.7%		2007 Hawaii State I/O model (value added ÷ interindustry output)
Total Taxes as a % of GSP	5.85%		DoT Annual Report
Tax on Income			
Individual			
State		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Federal		12.78%	http://www.irs.gov/pub/irs-soi/09in34tr.xls
Corporate			
State		6.01%	http://www6.hawaii.gov/tax/pubs/businc/02businc.pdf
Federal		23.80%	http://www.irs.gov/pub/irs-soi/08coccr.pdf
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.17	2007 Hawaii State I/O model ($ economy output per $ construction final demand)
employment		13.86	2007 Hawaii State I/O model (jobs per million $ construction final demand)
labor income		0.65	2007 Hawaii State I/O model (earnings per $ construction final demand)
from annual loan amortization			
output (sales)		2.13	2007 HI I/O model ($ economy output per Credit intermediation and related activities final demand)
employment		14.51	2007 HII/O model (total jobs per million $ Credit intermediation and related activities final D)
labor income		0.539	2007 Hawaii State I/O model ($ labor income per Credit intermediation and related activities final D)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.05	2007 Hawaii State I/O model ($ output per $ final demand pers. Consump.
total jobs		20.42	2007 Hawaii State I/O model (total jobs per $ mil. final demand pers. Consump.
labor income		0.639	2007 Hawaii State I/O model ($ labor income per $ final demand pers. Consump.
from State Expenditures			
output (sales)		2.02	2007 HI I/O model ($ economy output per $ state & local gov. final demand)
total jobs		21.97	2007 HII/O model (total jobs per $ mil. Final demand state & local gov.)
labor income		0.894	2007 Hawaii State I/O model ($ labor per $ state & local gov. final demand)
system savings assumed to remain in-state		100%	assumed % of equity owned within State

TABLE 2: ASSUMPTIONS FOR ESTIMATION OF FISCAL AND ECONOMIC IMPACTS OF SOLAR CREDIT STIMULATED RESIDENTIAL PV SYSTEM PURCHASES

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		30	INTERNATIONAL ENERGY AGENCY PHOTOVOLTAIC POWER SYSTEMS PROGRAMME, Methodology Guidelines on Life Cycle Assessment of Photovoltaic Electricity, 10/01, posits 30 years for all system components except the inverter
Estimated Annual kWh Output per Installed kW System	1,528	1,528	Calculated. Uses Sun zone estimate of 450 (DBEDT) and de-rating factor of .8. (Formula = (475/86)*kW*.8*365)
Days per Year	365	365	given
kW Size	5.27	5.27	
Average Installed Cost (2012 $) per kW	$5,503	$5,503	calculated
Total system cost	$29,000	$29,000	Residential is mean from 2012 C&C building permit data. Commercial is calcualted from NEM size cap and cost/watt.
Delivered system capacity (kW)	5.27	5.27	given system capacity for specific cost
Purchase Costs over System Life			
Equity % of purchase	100%	100%	assumed cash purchase
Typical Annual Operations & Maintenance Cost per kW			
Assumed Year Maintenance Required	16	16	assumed
Year 15 inverter replacement cost		$3,915	An inverter equipment cost is 13.5% of a solar PV system total equipment cost (Source: actual system costs). This percentage is multiplied by the total system cost to account for the inverter cost in year 15. The source for this requirement is the same noted for system life.
Analysis Value per kWh	$743		calculated (replacement cost/system size)
Notes			
The only other anticipated maintenance is to wash the panels if there has been no rain to maintain efficiency.			
Average Annual Gross Imported Oil Savings per Unit			
Retail price per kWh	$0.363		4/13/12 Star-Advertiser, p. B3, average Hawaii electricty rate
Note: This per kWh cost corresponds to a per barrel of West Texas Intermediate cost of $100 to $110 per barrel.			
Benchmark Price per Barrel Oil	$107.00		West Texas Intermediate Cost day of analysis
Annual Savings	$554	$554	calculated
Savings at Alternative Oil Price Levels	Estimated	% Change	
$/barrel (for HECO cost multiply by 1.27)	Oahu kWh	from Now	Savings
$59	$0.2189	-39.6%	$334
$79	$0.2669	-26.4%	$408
$107	$0.3625	0.0%	$554
$118	$0.3773	4.1%	$576
$157	$0.4373	20.6%	$668
$200	$0.5573	53.7%	$852
Credit & Taxes			
Effective Tax Credit with Cap	55%	55%	calculated
Hawaii State tax credit on purchase w/o cap	25%	25%	State
Federal tax credit	30%	30%	Federal
Effective Federal tax credit	30.0%	30.0%	Mark Duda
State Credit Amount Cap	5,000	5,000	Mark Duda
per kW installed	$949	$949	calculated
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.55%	DoT, 2009-2010 Annnual Report, based on p. 45 used to weight Oahu GET Rate (0.04712) and the neighbor islands (0.0416)
State Income Taxes on Labor Income		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Ratio of Corporate Income Tax to Labor Income Tax		3.87%	see Table _
Taxes on Induced and Indirect Output			
Note: It is impossible to determine the mix of transactions from indirect and induced output effects from $1 of final demand. For example, for retail transactions the GET is 4%. If the transactions are at the intermediate or wholesale level, they are taxed at 0.5%. To account for such tax effects from induced and indirect sales (output), an aggregated approach is used. Specifically, it is estimated that general excise and income taxes on indirect and induced transactions from $1 of final demand are the % indicated of total indirect plus induced output			
Total Taxes as a % of Indirect & Induced Output		3.5%	calculated
Ratio of GSP to Output	60.7%		20072 Hawaii State I/O model (value added ÷ interindustry output)
Total Taxes as a % of GSP	5.8%		see Table _
Tax on Income			
Individual			
State		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Federal		12.78%	http://www.irs.gov/pub/irs-soi/09in34tr.xls
Corporate			
State		6.01%	http://www6.hawaii.gov/tax/pubs/businc/02businc.pdf
Federal		23.80%	http://www.irs.gov/pub/irs-soi/08coccr.pdf
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.17	2007 Hawaii State I/O model ($ economy output per $ construction final demand)
employment		13.90	2007 Hawaii State I/O model (jobs per million $ construction final demand)
labor income		0.65	2007 Hawaii State I/O model (earnings per $ construction final demand)
from annual loan amortization			
output (sales)		2.13	2007 HI I/O model ($ economy output per Credit intermediation and related activities final demand)
employment		14.51	2007 HII/O model (total jobs per million $ Credit intermediation and related activities final D)
labor income		0.539	2007 Hawaii State I/O model ($ labor income per Credit intermediation and related activities final D)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.05	2007 Hawaii State I/O model ($ output per $ final demand pers. Consump.
total jobs		20.42	2007 Hawaii State I/O model (total jobs per $ mil. final demand pers. Consump.
labor income		0.639	2007 Hawaii State I/O model ($ labor income per $ final demand pers. Consump.
from State Expenditures			
output (sales)		2.02	2007 HI I/O model ($ economy output per $ state & local gov. final demand)
total jobs		21.97	2007 HII/O model (total jobs per $ mil. Final demand state & local gov.)
labor income		0.894	2007 Hawaii State I/O model ($ labor per $ state & local gov. final demand)
system savings assumed to remain in-state		100%	assumed % of equity owned within State

TABLE 3: ASSUMPTIONS FOR ESTIMATION OF FISCAL AND ECONOMIC IMPACTS OF SOLAR CREDIT STIMULATED COMMERCIAL PV SYSTEM PURCHASES

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		30	INTERNATIONAL ENERGY AGENCY PHOTOVOLTAIC POWER SYSTEMS PROGRAMME, Methodology Guidelines on Life Cycle Assessment of Photovoltaic Electricity, 10/01, posits 30 years for all system components except the inverter
Estimated Annual kWh Output per Installed kW System	1,528	1,528	Calculated. Uses Sun zone estimate of 450 (DBEDT) and de-rating factor of .8. (Formula = (475/86)*kW*.8*365)
kW Size	118	118	
Average Installed Cost (2001 $) per kW	$3,750	$3,750	calculated
Total system cost	$442,500	$442,500	Residential is mean from 2012 C&C building permit data. Commercial is calcualted from NEM size cap and cost/watt.
Delivered system capacity (kW)	118	118	given system capacity for specific cost
Purchase Costs over System Life			
Typical Annual Operations & Maintenance Cost per kW			
Assumed Year Maintenance Required	16	16	assumed
Inverter at Mid-Point of System Life	$33,000	$33,000	Mark Duda (Estimated cost to contractor without margin.)
Cost per kW	$280	$280	calculated
Analysis Value	$280		model calculator
Notes			
The only other anticipated maintenance is to wash the panels if there has been no rain to maintenance efficiency.			
Average Annual Gross Imported Oil Savings per Unit			
Retail price per kWh	$0.363		4/13/12 Star-Advertiser, p. B3, average Hawaii electricty rate
Note: This per kWh cost corresponds to a per barrel of West Texas Intermediate cost of $100 to $110 per barrel.			
Benchmark Price per Barrel Oil	$107.00		West Texas Intermediate Cost day of analysis
Sensitivity Chanage Variable ($/bbl)			34.81
Annual Savings	$554	$554	calculated
Savings at Alternative Benchmark Oil Price Levels	Estimated	% Change	
$/barrel (for corresponding HECO cost multiply by 1.27)	Oahu kWh	from Now	Savings
$59	$0.2189	-39.6%	$334
$79	$0.2669	-26.4%	$408
$107	$0.3625	0.0%	$554
$118	$0.3773	4.1%	$576
$157	$0.4373	20.6%	$668
$200	$0.5573	53.7%	$852
Credit & Taxes			
Effective Tax Credit with Cap	65%	65%	calculated
Hawaii State tax credit on purchase w/o cap	35%	35%	State
Federal tax credit	30%	30%	Federal
Effective Federal tax credit	30.0%	30.0%	Mark Duda
State Credit Amount Cap	500,000	500,000	Mark Duda
per kW installed	$4,237	$4,237	calculated
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.55%	DoT, 2009-2010 Annnual Report, based on p. 45 used to weight Oahu GET Rate (0.04712) and the neighbor islands (0.0416)
State Income Taxes on Labor Income		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Ratio of Corporate Income Tax to Labor Income Tax		3.87%	see Table _
Taxes on Induced and Indirect Output			
Note: It is impossible to determine the mix of transactions from indirect and induced output effects from $1 of final demand. For example, for retail transactions the GET is 4%. If the transactions are at the intermediate or wholesale level, they are taxed at 0.5%. To account for such tax effects from induced and indirect sales (output), an aggregated approach is used. Specifically, it is estimated that general excise and income taxes on indirect and induced transactions from $1 of final demand are the % indicated of total indirect plus induced output			
Total Taxes as a % of Indirect & Induced Output		3.5%	calculated
Ratio of GSP to Output	60.7%		20072 Hawaii State I/O model (value added ÷ interindustry output)
Total Taxes as a % of GSP	5.8%		see Table _
Tax on Income			
Individual			
State		5.14%	DoT, HI Individual Income Patterns - 2005, Table A1
Federal		12.78%	http://www.irs.gov/pub/irs-soi/09in34tr.xls
Corporate			
State		6.01%	http://www6.hawaii.gov/tax/pubs/businc/02businc.pdf
Federal		23.80%	http://www.irs.gov/pub/irs-soi/08coccr.pdf
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.17	2007 Hawaii State I/O model ($ economy output per $ construction final demand)
employment		13.9	2007 Hawaii State I/O model (jobs per million $ construction final demand)
labor income		0.65	2007 Hawaii State I/O model (earnings per $ construction final demand)
from annual loan amortization			
output (sales)		2.13	2007 HI I/O model ($ economy output per Credit intermediation and related activities final demand)
employment		14.51	2007 HII/O model (total jobs per million $ Credit intermediation and related activities final D)
labor income		0.539	2007 Hawaii State I/O model ($ labor income per Credit intermediation and related activities final D)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.05	2007 Hawaii State I/O model ($ output per $ final demand pers. Consump.
total jobs		20.42	2007 Hawaii State I/O model (total jobs per $ mil. final demand pers. Consump.
labor income		0.639	2007 Hawaii State I/O model ($ labor income per $ final demand pers. Consump.
from State Expenditures			
output (sales)		2.02	2007 HI I/O model ($ economy output per $ state & local gov. final demand)
total jobs		21.97	2007 HII/O model (total jobs per $ mil. Final demand state & local gov.)
labor income		0.894	2007 Hawaii State I/O model ($ labor per $ state & local gov. final demand)
system savings assumed to remain in-state		100%	assumed % of equity owned within State

Table 4 Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Residential SHW System Purchases (per system)

												Year and Period Number			
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PV Purchaser Account															
Costs															
System cash purchase	$6,615														
Amortization costs (cost borrowed)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs		$0.0	$0.0	$0.0	$0.0	$305.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$273.3	$0	$0.0
Annual Costs	$6,615	$0	$0	$0	$0	$306	$0	$0	$0	$0	$0	$0	$273	$0	$0
Benefits															
ECITC Refund	$2,315	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	$1,985	$0	$0	$0	$0	$92	$0	$0	$0	$0	$0	$0	$82	$0	$0
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions															
State		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings		$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018
Annual Benefits	$4,300	$1,018	$1,018	$1,018	$1,018	$1,110	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,100	$1,018	$1,018
BENEFITS - COSTS	($2,315)	$1,018	$1,018	$1,018	$1,018	$804	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$827	$1,018	$1,018
(assumed spent on personal consumption expenditures)															
Multiplier Effects of Expenditure															
System Purchase Cost & Maintenance Effects															
Final Demand	$6,615	$0	$0	$0	$0	$306	$0	$0	$0	$0	$0	$0	$273	$0	$0
Multiplier Effects															
Indirect & Induced Output	$7,755	$0	$0	$0	$0	$358	$0	$0	$0	$0	$0	$0	$320	$0	$0
Labor	0.092	0.0000	0.0000	0.0000	0.0000	0.0042	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0038	0.0000	0.0000
Labor income	$4,278	$0	$0	$0	$0	$198	$0	$0	$0	$0	$0	$0	$177	$0	$0
Due to User Benefits - Costs															
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	($2,315)	$1,018	$1,018	$1,018	$1,018	$804	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$827	$1,018	$1,018
Multiplier Effects															
Indirect & Induced Output	($2,427)	$1,067	$1,067	$1,067	$1,067	$843	$1,067	$1,067	$1,067	$1,067	$1,067	$1,067	$866	$1,067	$1,067
Labor	(0.047)	0.021	0.021	0.021	0.021	0.016	0.021	0.021	0.021	0.021	0.021	0.021	0.017	0.021	0.021
Labor income	($1,480)	$651	$651	$651	$651	$514	$651	$651	$651	$651	$651	$651	$528	$651	$651
Foregone to State															
Final Demand	($2,315)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects															
Indirect & Induced Output	($2,357)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	(0.05)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labor income	($2,070)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS															
Final Demand	$1,985	$1,018	$1,018	$1,018	$1,018	$1,110	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,100	$1,018	$1,018
Multiplier Effects															
Indirect & Induced Output	$2,971	$1,067	$1,067	$1,067	$1,067	$1,201	$1,067	$1,067	$1,067	$1,067	$1,067	$1,067	$1,187	$1,067	$1,067
Labor	(0.006)	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Labor income	$727	$651	$651	$651	$651	$712	$651	$651	$651	$651	$651	$651	$705	$651	$651
State Fiscal Account															
Costs															
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$2,315	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COST	$2,315	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$90	$46	$46	$46	$46	$50	$46	$46	$46	$46	$46	$46	$50	$46	$46
Individual income (x labor income)	$37	33.43	33.43	33.43	33.43	36.55	33.43	33.4	33.4	33.4	33.4	33.4	36.2	33.4	33.4
Corporate income (% of GSP)	$1	1.29	1.29	1.29	1.29	1.42	1.29	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3
Taxes on Indirect & Induced Output	$105	37.84	37.84	37.84	37.84	42.60	37.84	37.8	37.8	37.8	37.8	37.8	42.1	37.8	37.8
TOTAL BENEFIT	$234	118.85	118.85	118.85	118.85	131.02	118.85	118.8	118.8	118.8	118.8	118.8	129.7	118.8	118.8
NET BENEFIT TO STATE GOVERNMENT	($2,081)	$119	$119	$119	$119	$131	$119	$119	$119	$119	$119	$119	$130	$119	$119

Table 4 Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Residential SHW System Purchases (per system)

Year and Period Number Item	2015 15	2016 16	2017 17	2018 18	2019 19	2020 20	2021 21	2022 22	2023 23	2024 24	2025 25	TOTALS	Present Value @ Discount
													0.0%
PV Purchaser Account													
Costs													
System cash purchase													
Amortization costs (cost borrowed)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs	$1,747	$0.0	$0.0	$0.0	$0.0	$305.5	$0.0	$0.0	$0.0	$0.0	$0.0	$2,631	$2,631
Annual Costs	$1,747	$0	$0	$0	$0	$306	$0	$0	$0	$0	$0	$9,246	$9,246
Benefits													
ECITC Refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,315	$2,315
Federal Tax Credit	$524	$0	$0	$0	$0	$92	$0	$0	$0	$0	$0	$2,774	$2,774
System Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions													
State	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$1,018	$25,448	$25,448
Annual Benefits	$1,542	$1,018	$1,018	$1,018	$1,018	$1,110	$1,018	$1,018	$1,018	$1,018	$1,018	$30,537	$30,537
BENEFITS - COSTS	($205)	$1,018	$1,018	$1,018	$1,018	$804	$1,018	$1,018	$1,018	$1,018	$1,018	$21,291	$21,291
(assumed spent on personal consumption expenditures)													
Multiplier Effects of Expenditure													
System Purchase Cost & Maintenance Effects													
Final Demand	$1,747	$0	$0	$0	$0	$306	$0	$0	$0	$0	$0		
Multiplier Effects													
Indirect & Induced Output	$2,048	$0	$0	$0	$0	$358	$0	$0	$0	$0	$0	$10,840	$10,840
Labor	0.0242	0.0000	0.0000	0.0000	0.0000	0.0042	0.0000	0.0000	0.0000	0.0000	0.0000	0.128	
Labor income	$1,130	$0	$0	$0	$0	$198	$0	$0	$0	$0	$0	$5,979	$5,979
Due to User Benefits - Costs													
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	($205)	$1,018	$1,018	$1,018	$1,018	$804	$1,018	$1,018	$1,018	$1,018	$1,018	$21,291	$21,291
Multiplier Effects													
Indirect & Induced Output	($215)	$1,067	$1,067	$1,067	$1,067	$843	$1,067	$1,067	$1,067	$1,067	$1,067	$22,314	$22,314
Labor	(0.004)	0.021	0.021	0.021	0.021	0.016	0.021	0.021	0.021	0.021	0.021	0.435	
Labor income	($131)	$651	$651	$651	$651	$514	$651	$651	$651	$651	$651	$13,611	$13,611
Foregone to State													
Final Demand	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($2,315)	($2,315)
Multiplier Effects													
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($2,357)	($2,357)
Labor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.051)	
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($2,070)	($2,070)
TOTAL MULTIPLIER EFFECTS													
Final Demand	$1,542	$1,018	$1,018	$1,018	$1,018	$1,110	$1,018	$1,018	$1,018	$1,018	$1,018	$28,221	$28,221
Multiplier Effects													
Indirect & Induced Output	$1,833	$1,067	$1,067	$1,067	$1,067	$1,201	$1,067	$1,067	$1,067	$1,067	$1,067	$30,796	$30,796
Labor	0.020	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.512	
Labor income	$999	$651	$651	$651	$651	$712	$651	$651	$651	$651	$651	$17,520	$17,520
State Fiscal Account													
Costs													
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,315	$2,315
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,315	$2,315
Revenues													
Taxes on Final Demand & Labor Income													
GET (% of GSP)	$70	$46	$46	$46	$46	$50	$46	$46	$46	$46	$46	$1,283	$1,283
Individual income (x labor income)	51.3	$33.43	$33.43	$33.43	$33.43	$36.55	$33.43	$33.43	$33.43	$33.43	$33.43	$900	$900
Corporate income (% of GSP)	2.0	$1.29	$1.29	$1.29	$1.29	$1.42	$1.29	$1.29	$1.29	$1.29	$1.29	$35	$35
Taxes on Indirect & Induced Output	65.0	$37.84	$37.84	$37.84	$37.84	$42.60	$37.84	$37.84	$37.84	$37.84	$37.84	$1,092	$1,092
TOTAL BENEFIT	188.4	$119	$119	$119	$119	$131	$119	$119	$119	$119	$119	$3,310	$3,310
NET BENEFIT TO STATE GOVERNMENT	$188	$119	$119	$119	$119	$131	$119	$119	$119	$119	$119	$995	$995

Table 5: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to SHW SystemPurchases

Item	Install	2001 1	2002 2	2003 3	2004 4	2005 5	2006 6	2007 7	2008 8	2009 9	2010 10	2011 11	2012 12	2013 13
														Year and Period Number
Purchaser Account														
BENEFITS - COSTS	$2,315	($1,018)	($1,018)	($1,018)	($1,018)	($804)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($827)	($1,018)
(assumed spent on personal consumption expenditures)														
Multiplier Effects of Expenditure														
Due to User Benefits - Costs														
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	$2,315	($1,018)	($1,018)	($1,018)	($1,018)	($804)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($827)	($1,018)
Multiplier Effects														
Indirect & Induced Output	$2,427	($1,067)	($1,067)	($1,067)	($1,067)	($843)	($1,067)	($1,067)	($1,067)	($1,067)	($1,067)	($1,067)	($866)	($1,067)
Labor	0.047	(0.021)	(0.021)	(0.021)	(0.021)	(0.016)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.017)	(0.021)
Labor income	$1,480	($651)	($651)	($651)	($651)	($514)	($651)	($651)	($651)	($651)	($651)	($651)	($528)	($651)
TOTAL MULTIPLIER EFFECTS														
Final Demand	2,315	(1,018)	(1,018)	(1,018)	(1,018)	(804)	(1,018)	(1,018)	(1,018)	(1,018)	(1,018)	(1,018)	(827)	(1,018)
Multiplier Effects														
Indirect & Induced Output	2,427	(1,067)	(1,067)	(1,067)	(1,067)	(843)	(1,067)	(1,067)	(1,067)	(1,067)	(1,067)	(1,067)	(866)	(1,067)
Labor	0.04728	(0.021)	(0.021)	(0.021)	(0.021)	(0.016)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.017)	(0.021)
Labor income	1,480	(651)	(651)	(651)	(651)	(514)	(651)	(651)	(651)	(651)	(651)	(651)	(528)	(651)
State Fiscal Account														
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	105	(46)	(46)	(46)	(46)	(37)	(46)	(46)	(46)	(46)	(46)	(46)	(38)	(46)
Individual income (x labor income)	76	(33)	(33)	(33)	(33)	(26)	(33)	(33)	(33)	(33)	(33)	(33)	(27)	(33)
Corporate income (% of GSP)	3	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Lease Rents														
Taxes on Indirect & Induced Output	86	(38)	(38)	(38)	(38)	(30)	(38)	(38)	(38)	(38)	(38)	(38)	(31)	(38)
TOTAL BENEFIT	270	(119)	(119)	(119)	(119)	(94)	(119)	(119)	(119)	(119)	(119)	(119)	(97)	(119)
NET BENEFIT TO STATE GOVERNMENT	$270	($119)	($119)	($119)	($119)	($94)	($119)	($119)	($119)	($119)	($119)	($119)	($97)	($119)

2014 14	2015 15	2016 16	2017 17	2018 18	2019 19	2020 20	2021 21	2022 22	2023 23	2024 24	2025 25	TOTALS	Present Value @ Discount 0.0%
($1,018)	$205	($1,018)	($1,018)	($1,018)	($1,018)	($804)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($21,291)	($21,291)
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
($1,018)	$205	($1,018)	($1,018)	($1,018)	($1,018)	($804)	($1,018)	($1,018)	($1,018)	($1,018)	($1,018)	($21,291)	($21,291)
($1,067)	$215	($1,067)	($1,067)	($1,067)	($1,067)	($843)	($1,067)	($1,067)	($1,067)	($1,067)	($1,067)	($22,314)	($22,314)
(0.021)	0.004	(0.021)	(0.021)	(0.021)	(0.021)	(0.016)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.435)	
($651)	$131	($651)	($651)	($651)	($651)	($514)	($651)	($651)	($651)	($651)	($651)	($13,611)	($13,611)
(1,018)	205	(1,018)	(1,018)	(1,018)	(1,018)	(804)	(1,018)	(1,018)	(1,018)	(1,018)	(1,018)	(21,291)	(21,291)
(1,067)	215	(1,067)	(1,067)	(1,067)	(1,067)	(843)	(1,067)	(1,067)	(1,067)	(1,067)	(1,067)	(22,314)	(22,314)
(0.021)	0.004	(0.021)	(0.021)	(0.021)	(0.021)	(0.016)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.435)	
(651)	131	(651)	(651)	(651)	(651)	(514)	(651)	(651)	(651)	(651)	(651)	(13,611)	(13,611)
(46)	9	(46)	(46)	(46)	(46)	(37)	(46)	(46)	(46)	(46)	(46)	(968)	(968)
(33)	7	(33)	(33)	(33)	(33)	(26)	(33)	(33)	(33)	(33)	(33)	(699)	(699)
(1)	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(27)	(27)
(38)	8	(38)	(38)	(38)	(38)	(30)	(38)	(38)	(38)	(38)	(38)		
(119)	24	(119)	(119)	(119)	(119)	(94)	(119)	(119)	(119)	(119)	(119)	(2,486)	(2,486)
($119)	$24	($119)	($119)	($119)	($119)	($94)	($119)	($119)	($119)	($119)	($119)	($2,486)	($2,486)

TABLE 6: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER SHW SYSTEM

Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	Period Number 13
Net Benefits														
PV System Purchaser	($4,631)	$2,036	$2,036	$2,036	$2,036	$1,608	$2,036	$2,036	$2,036	$2,036	$2,036	$2,036	$1,653	$2,036
State Fiscal Account	($2,351)	$238	$238	$238	$238	$225	$238	$238	$238	$238	$238	$238	$226	$238
Net Economic Impacts														
Final Demand	($331)	$2,036	$2,036	$2,036	$2,036	$1,914	$2,036	$2,036	$2,036	$2,036	$2,036	$2,036	$1,926	$2,036
Multiplier Effects														
Indirect & Induced Output	$545	$2,134	$2,134	$2,134	$2,134	$2,044	$2,134	$2,134	$2,134	$2,134	$2,134	$2,134	$2,053	$2,134
Employment	(0.0537)	0.0416	0.0416	0.0416	0.0416	0.0371	0.0416	0.0416	0.0416	0.0416	0.0416	0.0416	0.0375	0.0416
Labor Income	($753)	$1,302	$1,302	$1,302	$1,302	$1,226	$1,302	$1,302	$1,302	$1,302	$1,302	$1,302	$1,234	$1,302

TABLE 6: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER SHW SYSTEM

Item	14	15	16	17	18	19	20	21	22	23	24	25	Period Number TOTALS	Present Value @ Discount 0.0%
Net Benefits														
PV System Purchaser	$2,036	($410)	$2,036	$2,036	$2,036	$2,036	$1,608	$2,036	$2,036	$2,036	$2,036	$2,036	$42,581	$42,581
State Fiscal Account	$238	$165	$238	$238	$238	$238	$225	$238	$238	$238	$238	$238	$3,481	$3,481
Net Economic Impacts														
Final Demand	$2,036	$1,337	$2,036	$2,036	$2,036	$2,036	$1,914	$2,036	$2,036	$2,036	$2,036	$2,036	$49,512	$49,512
Multiplier Effects														
Indirect & Induced Output	$2,134	$1,619	$2,134	$2,134	$2,134	$2,134	$2,044	$2,134	$2,134	$2,134	$2,134	$2,134	$53,110	$53,110
Employment	0.0416	0.0159	0.0416	0.0416	0.0416	0.0416	0.0371	0.0416	0.0416	0.0416	0.0416	0.0416	0.9468	
Labor Income	$1,302	$868	$1,302	$1,302	$1,302	$1,302	$1,226	$1,302	$1,302	$1,302	$1,302	$1,302	$31,131	$31,131

Table 7: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Residential PV System Purchases (per installed kW)

Item	Install	2001 1	2002 2	2003 3	2004 4	2005 5	2006 6	2007 7	2008 8	2009 9	2010 10	2011 11
PV Purchaser Account												
Costs												
System cash purchase	$5,503											
Amortization costs (cost borrowed)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Annual Costs	$5,503	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits												
ECITC Refund	$1,926	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	π	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions												
State		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings		$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Annual Benefits	$1,926	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
BENEFITS - COSTS	($3,577)	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
(assumed spent on personal consumption expenditures)												
Multiplier Effects of Expenditure												
System Purchase Cost & Maintenance Effects												
Final Demand	$5,503	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	$6,451	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	0.076	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$3,559	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Due to User Benefits - Costs												
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	($3,577)	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	($3,749)	$580	$580	$580	$580	$580	$580	$580	$580	$580	$580	$580
Labor	(0.073)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	($2,287)	$354	$354	$354	$354	$354	$354	$354	$354	$354	$354	$354
Foregone to State												
Final Demand	($1,926)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	($1,961)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	(0.04)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labor income	($1,722)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS												
Final Demand	$0	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	$742	$580	$580	$580	$580	$580	$580	$580	$580	$580	$580	$580
Labor	(0.039)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	($450)	$354	$354	$354	$354	$354	$354	$354	$354	$354	$354	$354
State Fiscal Account												
Costs												
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$1,926	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COST	$1,926	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues												
Taxes on Final Demand & Labor Income												
GET (% of GSP)	$0	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Individual income (x labor income)	($23)	18.19	18.19	18.19	18.19	18.19	18.19	18.2	18.2	18.2	18.2	18.2
Corporate income (% of GSP)	($1)	0.70	0.70	0.70	0.70	0.70	0.70	0.7	0.7	0.7	0.7	0.7
Taxes on Indirect & Induced Output	$26	20.59	20.59	20.59	20.59	20.59	20.59	20.6	20.6	20.6	20.6	20.6
TOTAL BENEFIT	$2	64.67	64.67	64.67	64.67	64.67	64.67	64.7	64.7	64.7	64.7	64.7
NET BENEFIT TO STATE GOVERNMENT	($1,924)	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65

Table 7: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Residential PV System Purchases (per installed kW)

Item	Year and Period Number											
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	12	13	14	15	16	17	18	19	20	21	22	23
PV Purchaser Account												
Costs												
System cash purchase												
Amortization costs (cost borrowed)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs	$0.0	$0	$0.0	$0.0	$742.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Annual Costs	$0	$0	$0	$0	$743	$0	$0	$0	$0	$0	$0	$0
Benefits												
ECITC Refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions												
State	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Annual Benefits	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
BENEFITS - COSTS	$554	$554	$554	$554	($189)	$554	$554	$554	$554	$554	$554	$554
(assumed spent on personal consumption expenditures)												
Multiplier Effects of Expenditure												
System Purchase Cost & Maintenance Effects												
Final Demand	$0	$0	$0	$0	$743	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	$0	$0	$0	$0	$871	$0	$0	$0	$0	$0	$0	$0
Labor	0.0000	0.0000	0.0000	0.0000	0.0103	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$0	$0	$0	$0	$480	$0	$0	$0	$0	$0	$0	$0
Due to User Benefits - Costs												
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	$554	$554	$554	$554	($189)	$554	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	$580	$580	$580	$580	($198)	$580	$580	$580	$580	$580	$580	$580
Labor	0.011	0.011	0.011	0.011	(0.004)	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	$354	$354	$354	$354	($121)	$354	$354	$354	$354	$354	$354	$354
Foregone to State												
Final Demand	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS												
Final Demand	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	$580	$580	$580	$580	$673	$580	$580	$580	$580	$580	$580	$580
Labor	0.011	0.011	0.011	0.011	0.006	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	$354	$354	$354	$354	$360	$354	$354	$354	$354	$354	$354	$354
State Fiscal Account												
Costs												
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues												
Taxes on Final Demand & Labor Income												
GET (% of GSP)	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Individual income (x labor income)	18.2	18.2	18.2	18.2	$18.47	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19
Corporate income (% of GSP)	0.7	0.7	0.7	0.7	$0.72	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70
Taxes on Indirect & Induced Output	20.6	20.6	20.6	20.6	$23.87	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59
TOTAL BENEFIT	64.7	64.7	64.7	64.7	$68	$65	$65	$65	$65	$65	$65	$65
NET BENEFIT TO STATE GOVERNMENT	$65	$65	$65	$65	$68	$65	$65	$65	$65	$65	$65	$65

Table 7: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Residential PV System Purchases (per installed kW)

Item	2024 24	2025 25	2026 26	2027 27	2028 28	2029 29	2030 30	TOTALS	Present Value @ Discount
									0.0%
PV Purchaser Account									
Costs									
System cash purchase									
Amortization costs (cost borrowed)	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$743	$743
Annual Costs	$0	$0	$0	$0	$0	$0	$0	$6,246	$6,246
Benefits									
ECITC Refund	$0	$0	$0	$0	$0	$0	$0	$1,926	$1,926
Federal Tax Credit	$0	$0	$0	$0	$0	$0	$0	$0	#VALUE!
System Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions									
State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings	$554	$554	$554	$554	$554	$554	$554	$16,616	$16,616
Annual Benefits	$554	$554	$554	$554	$554	$554	$554	$18,542	$18,542
BENEFITS - COSTS	$554	$554	$554	$554	$554	$554	$554	$12,296	$12,296
(assumed spent on personal consumption expenditures)									
Multiplier Effects of Expenditure									
System Purchase Cost & Maintenance Effects									
Final Demand	$0	$0	$0	$0	$0	$0	$0		
Multiplier Effects									
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$7,322	$7,322
Labor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.087	
Labor income	$0	$0	$0	$0	$0	$0	$0	$4,039	$4,039
Due to User Benefits - Costs									
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%		
Final Demand	$554	$554	$554	$554	$554	$554	$554	$12,296	$12,296
Multiplier Effects									
Indirect & Induced Output	$580	$580	$580	$580	$580	$580	$580	$12,887	$12,887
Labor	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.251	
Labor income	$354	$354	$354	$354	$354	$354	$354	$7,861	$7,861
Foregone to State									
Final Demand	$0	$0	$0	$0	$0	$0	$0	($1,926)	($1,926)
Multiplier Effects									
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	($1,961)	($1,961)
Labor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.042)	
Labor income	$0	$0	$0	$0	$0	$0	$0	($1,722)	($1,722)
TOTAL MULTIPLIER EFFECTS									
Final Demand	$554	$554	$554	$554	$554	$554	$554	$16,616	$16,616
Multiplier Effects									
Indirect & Induced Output	$580	$580	$580	$580	$580	$580	$580	$18,248	$18,248
Labor	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.296	
Labor income	$354	$354	$354	$354	$354	$354	$354	$10,178	$10,178
State Fiscal Account									
Costs									
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0	$0	$0	$0	$0	$0	$0	$1,926	$1,926
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$1,926	$1,926
Revenues									
Taxes on Final Demand & Labor Income									
GET (% of GSP)	$25	$25	$25	$25	$25	$25	$25	$756	$756
Individual income (x labor income)	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$523	$523
Corporate income (% of GSP)	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$20	$20
Taxes on Indirect & Induced Output	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$647	$647
TOTAL BENEFIT	$65	$65	$65	$65	$65	$65	$65	$1,946	$1,946
NET BENEFIT TO STATE GOVERNMENT	$65	$65	$65	$65	$65	$65	$65	$20	$20

Table 8: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Residential PV Systems Purchases

Item	Install	2001 1	2002 2	2003 3	2004 4	2005 5	2006 6	2007 7	2008 8	2009 9	2010 10	2011 11	2012 12	2013 13	2014 14	2015 15	2016 16
															Year and Period Number		
Purchaser Account																	
BENEFITS - COSTS	$1,926	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	$189
(assumed spent on personal consumption expenditures)																	
Multiplier Effects of Expenditure																	
Due to User Benefits - Costs																	
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	$1,926	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	$189
Multiplier Effects																	
Indirect & Induced Output	$2,019	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	$198
Labor	0.039	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	0.004
Labor income	$1,231	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	$121
TOTAL MULTIPLIER EFFECTS																	
Final Demand	1,926	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	189
Multiplier Effects																	
Indirect & Induced Output	2,019	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	198
Labor	0.03933	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	0.004
Labor income	1,231	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	121
State Fiscal Account																	
Revenues																	
Taxes on Final Demand & Labor Income																	
GET (% of GSP)	88	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	9
Individual income (x labor income)	63	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	6
Corporate income (% of GSP)	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	0
Lease Rents																	
Taxes on Indirect & Induced Output	72	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	7
TOTAL BENEFIT	225	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	22
NET BENEFIT TO STATE GOVERNMENT	$225	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	$22

Table 8: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Residential PV Systems Purchases

Item	2017 17	2018 18	2019 19	2020 20	2021 21	2022 22	2023 23	2024 24	2025 25	2026 26	2027 27	2028 28	2029 29	2030 30	TOTALS	Present Value @ Discount
																0.0%
Purchaser Account																
BENEFITS - COSTS	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($13,947)	($13,947)
(assumed spent on personal consumption expenditures)																
Multiplier Effects of Expenditure																
Due to User Benefits - Costs																
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($13,947)	($13,947)
Multiplier Effects																
Indirect & Induced Output	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($14,617)	($14,617)
Labor	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.285)	
Labor income	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($8,916)	($8,916)
TOTAL MULTIPLIER EFFECTS																
Final Demand	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(13,947)	(13,947)
Multiplier Effects																
Indirect & Induced Output	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(14,617)	(14,617)
Labor	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.285)	
Labor income	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(8,916)	(8,916)
State Fiscal Account																
Revenues																
Taxes on Final Demand & Labor Income																
GET (% of GSP)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(634)	(634)
Individual income (x labor income)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(458)	(458)
Corporate income (% of GSP)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(18)	(18)
Lease Rents																
Taxes on Indirect & Induced Output	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)		
TOTAL BENEFIT	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(1,628)	(1,628)
NET BENEFIT TO STATE GOVERNMENT	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($1,628)	($1,628)

TABLE 9: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER KW INSTALLED FOR RESIDENTIAL PV SYSTEMS

															Period Number		
Item	**Install**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Net Benefits																	
PV System Purchaser	($3,852)	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	($378)
State Fiscal Account	($1,956)	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$46
Net Economic Impacts																	
Final Demand	($275)	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$365
Multiplier Effects																	
Indirect & Induced Output	$453	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$475
Employment	(0.0445)	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0026
Labor Income	($626)	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$239

TABLE 9: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER KW INSTALLED FOR RESIDENTIAL PV SYSTEMS

Item	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	TOTALS	**Present Value @ Discount**
																0.0%
Net Benefits																
PV System Purchaser	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$27,894	$27,894
State Fiscal Account	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$1,841	$1,841
Net Economic Impacts																
Final Demand	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$32,214	$32,214
Multiplier Effects																
Indirect & Induced Output	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$34,596	$34,596
Employment	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.6141	
Labor Income	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$20,150	$20,150

Table 10: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Commercial PV System Purchases (per installed kW)

Item	Install	2001 1	2002 2	2003 3	2004 4	2005 5	2006 6	2007 7	2008 8	2009 9	2010 10	2011 11
PV Purchaser Account												
Costs												
System cash purchase	$3,750											
Amortization costs (cost borrowed)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Annual Costs	$3,750	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits												
ECITC Refund	$1,313	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	$1,125	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System Depreciation		$750	$750	$750	$750	$750	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions												
State		$45	$45	$45	$45	$45	$0	$0	$0	$0	$0	$0
Federal		$178	$178	$178	$178	$178	$0	$0	$0	$0	$0	$0
Annual cost savings		$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Annual Benefits	$2,438	$777	$777	$777	$777	$777	$554	$554	$554	$554	$554	$554
BENEFITS - COSTS	($1,313)	$777	$777	$777	$777	$777	$554	$554	$554	$554	$554	$554
(assumed spent on personal consumption expenditures)												
Multiplier Effects of Expenditure												
System Purchase Cost & Maintenance Effects												
Final Demand	$3,750	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	$4,396	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	0.052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$2,425	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Due to User Benefits - Costs												
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	($1,313)	$777	$777	$777	$777	$777	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	($1,376)	$815	$815	$815	$815	$815	$580	$580	$580	$580	$580	$580
Labor	(0.027)	0.016	0.016	0.016	0.016	0.016	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	($839)	$497	$497	$497	$497	$497	$354	$354	$354	$354	$354	$354
Foregone to State												
Final Demand	($1,313)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects												
Indirect & Induced Output	($1,336)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	(0.03)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labor income	($1,174)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS												
Final Demand	$1,125	$777	$777	$777	$777	$777	$554	$554	$554	$554	$554	$554
Multiplier Effects												
Indirect & Induced Output	$1,684	$815	$815	$815	$815	$815	$580	$580	$580	$580	$580	$580
Labor	(0.004)	0.016	0.016	0.016	0.016	0.016	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	$412	$497	$497	$497	$497	$497	$354	$354	$354	$354	$354	$354
State Fiscal Account												
Costs												
State interest + depreciation deduction refund	$0	$45	$45	$45	$45	$45	$0	$0	$0	$0	$0	$0
ECITC cost	$1,313	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COST	$1,313	$45	$45	$45	$45	$45	$0	$0	$0	$0	$0	$0
Revenues												
Taxes on Final Demand & Labor Income												
GET (% of GSP)	$51	$35	$35	$35	$35	$35	$25	$25	$25	$25	$25	$25
Individual income (x labor income)	$21	25.53	25.53	25.53	25.53	25.53	18.19	18.2	18.2	18.2	18.2	18.2
Corporate income (% of GSP)	$1	0.99	0.99	0.99	0.99	0.99	0.70	0.7	0.7	0.7	0.7	0.7
Taxes on Indirect & Induced Output	$60	28.90	28.90	28.90	28.90	28.90	20.59	20.6	20.6	20.6	20.6	20.6
TOTAL BENEFIT	$133	90.77	90.77	90.77	90.77	90.77	64.67	64.7	64.7	64.7	64.7	64.7
NET BENEFIT TO STATE GOVERNMENT	($1,180)	$46	$46	$46	$46	$46	$65	$65	$65	$65	$65	$65

Table 10: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Commercial PV System Purchases (per installed kW)

Item	Year and Period Number										
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	12	13	14	15	16	17	18	19	20	21	22
PV Purchaser Account											
Costs											
System cash purchase											
Amortization costs (cost borrowed)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs	$0.0	$0	$0.0	$0.0	$279.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Annual Costs	$0	$0	$0	$0	$280	$0	$0	$0	$0	$0	$0
Benefits											
ECITC Refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions											
State	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual cost savings	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Annual Benefits	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
BENEFITS - COSTS	$554	$554	$554	$554	$274	$554	$554	$554	$554	$554	$554
(assumed spent on personal consumption expenditures)											
Multiplier Effects of Expenditure											
System Purchase Cost & Maintenance Effects											
Final Demand	$0	$0	$0	$0	$280	$0	$0	$0	$0	$0	$0
Multiplier Effects											
Indirect & Induced Output	$0	$0	$0	$0	$328	$0	$0	$0	$0	$0	$0
Labor	0.0000	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$0	$0	$0	$0	$181	$0	$0	$0	$0	$0	$0
Due to User Benefits - Costs											
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	$554	$554	$554	$554	$274	$554	$554	$554	$554	$554	$554
Multiplier Effects											
Indirect & Induced Output	$580	$580	$580	$580	$287	$580	$580	$580	$580	$580	$580
Labor	0.011	0.011	0.011	0.011	0.006	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	$354	$354	$354	$354	$175	$354	$354	$354	$354	$354	$354
Foregone to State											
Final Demand	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects											
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS											
Final Demand	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554	$554
Multiplier Effects											
Indirect & Induced Output	$580	$580	$580	$580	$615	$580	$580	$580	$580	$580	$580
Labor	0.011	0.011	0.011	0.011	0.009	0.011	0.011	0.011	0.011	0.011	0.011
Labor income	$354	$354	$354	$354	$356	$354	$354	$354	$354	$354	$354
State Fiscal Account											
Costs											
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues											
Taxes on Final Demand & Labor Income											
GET (% of GSP)	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Individual income (x labor income)	18.2	18.2	18.2	18.2	$18.29	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19
Corporate income (% of GSP)	0.7	0.7	0.7	0.7	$0.71	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70
Taxes on Indirect & Induced Output	20.6	20.6	20.6	20.6	$21.82	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59
TOTAL BENEFIT	64.7	64.7	64.7	64.7	$66	$65	$65	$65	$65	$65	$65
NET BENEFIT TO STATE GOVERNMENT	$65	$65	$65	$65	$66	$65	$65	$65	$65	$65	$65

Table 10: Worksheet Showing Cost & Multiplier Accounting for Solar Credit Stimulated Commercial PV System Purchases (per installed kW)

Item	2023 23	2024 24	2025 25	2026 26	2027 27	2028 28	2029 29	2030 30	TOTALS	Present Value @ Discount
										0.0%
PV Purchaser Account										
Costs										
System cash purchase										
Amortization costs (cost borrowed)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
interest payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
principal payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual system maintenance costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$280	$280
Annual Costs	$0	$0	$0	$0	$0	$0	$0	$0	$4,030	$4,030
Benefits										
ECITC Refund	$0	$0	$0	$0	$0	$0	$0	$0	$1,313	$1,313
Federal Tax Credit	$0	$0	$0	$0	$0	$0	$0	$0	$1,125	$1,125
System Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$3,750	$3,750
Depreciation & and Interest Tax Deductions										
State	$0	$0	$0	$0	$0	$0	$0	$0	$225	$225
Federal	$0	$0	$0	$0	$0	$0	$0	$0	$892	$892
Annual cost savings	$554	$554	$554	$554	$554	$554	$554	$554	$16,616	$16,616
Annual Benefits	$554	$554	$554	$554	$554	$554	$554	$554	$20,171	$20,171
BENEFITS - COSTS	$554	$554	$554	$554	$554	$554	$554	$554	$16,142	$16,142
(assumed spent on personal consumption expenditures)										
Multiplier Effects of Expenditure										
System Purchase Cost & Maintenance Effects										
Final Demand	$0	$0	$0	$0	$0	$0	$0	$0		
Multiplier Effects										
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	$4,724	$4,724
Labor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.056	
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$2,606	$2,606
Due to User Benefits - Costs										
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	$554	$554	$554	$554	$554	$554	$554	$554	$16,142	$16,142
Multiplier Effects										
Indirect & Induced Output	$580	$580	$580	$580	$580	$580	$580	$580	$16,917	$16,917
Labor	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.330	
Labor income	$354	$354	$354	$354	$354	$354	$354	$354	$10,319	$10,319
Foregone to State										
Final Demand	$0	$0	$0	$0	$0	$0	$0	$0	($1,313)	($1,313)
Multiplier Effects										
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	($1,336)	($1,336)
Labor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.029)	
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	($1,174)	($1,174)
TOTAL MULTIPLIER EFFECTS										
Final Demand	$554	$554	$554	$554	$554	$554	$554	$554	$18,859	$18,859
Multiplier Effects										
Indirect & Induced Output	$580	$580	$580	$580	$580	$580	$580	$580	$20,305	$20,305
Labor	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.357	
Labor income	$354	$354	$354	$354	$354	$354	$354	$354	$11,752	$11,752
State Fiscal Account										
Costs										
State interest + depreciation deduction refund	$0	$0	$0	$0	$0	$0	$0	$0	$225	$225
ECITC cost	$0	$0	$0	$0	$0	$0	$0	$0	$1,313	$1,313
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$1,538	$1,538
Revenues										
Taxes on Final Demand & Labor Income										
GET (% of GSP)	$25	$25	$25	$25	$25	$25	$25	$25	$858	$858
Individual income (x labor income)	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$18.19	$604	$604
Corporate income (% of GSP)	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$23	$23
Taxes on Indirect & Induced Output	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$20.59	$720	$720
TOTAL BENEFIT	$65	$65	$65	$65	$65	$65	$65	$65	$2,205	$2,205
NET BENEFIT TO STATE GOVERNMENT	$65	$65	$65	$65	$65	$65	$65	$65	$667	$667

Table 11: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Commercial PV Systems Purchases

Item	Install	2001 1	2002 2	2003 3	2004 4	2005 5	2006 6	2007 7	2008 8	2009 9	2010 10	2011 11	2012 12	2013 13	2014 14	2015 15	2016 16
															Year and Period Number		
Purchaser Account																	
BENEFITS - COSTS	$1,313	($777)	($777)	($777)	($777)	($777)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($274)
(assumed spent on personal consumption expenditures)																	
Multiplier Effects of Expenditure																	
Due to User Benefits - Costs																	
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand	$1,313	($777)	($777)	($777)	($777)	($777)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($274)
Multiplier Effects																	
Indirect & Induced Output	$1,376	($815)	($815)	($815)	($815)	($815)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($287)
Labor	0.027	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.006)
Labor income	$839	($497)	($497)	($497)	($497)	($497)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($175)
TOTAL MULTIPLIER EFFECTS																	
Final Demand	1,313	(777)	(777)	(777)	(777)	(777)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(274)
Multiplier Effects																	
Indirect & Induced Output	1,376	(815)	(815)	(815)	(815)	(815)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(287)
Labor	0.02680	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.006)
Labor income	839	(497)	(497)	(497)	(497)	(497)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(175)
State Fiscal Account																	
Revenues																	
Taxes on Final Demand & Labor Income																	
GET (% of GSP)	60	(35)	(35)	(35)	(35)	(35)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(12)
Individual income (x labor income)	43	(26)	(26)	(26)	(26)	(26)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(9)
Corporate income (% of GSP)	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(0)
Lease Rents																	
Taxes on Indirect & Induced Output	49	(29)	(29)	(29)	(29)	(29)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(10)
TOTAL BENEFIT	153	(91)	(91)	(91)	(91)	(91)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(32)
NET BENEFIT TO STATE GOVERNMENT	$153	($91)	($91)	($91)	($91)	($91)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($32)

Table 11: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Commercial PV Systems Purchases

Item	2017 17	2018 18	2019 19	2020 20	2021 21	2022 22	2023 23	2024 24	2025 25	2026 26	2027 27	2028 28	2029 29	2030 30	TOTALS	Present Value @ Discount
																0.0%
Purchaser Account																
BENEFITS - COSTS	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($16,142)	($16,142)
(assumed spent on personal consumption expenditures)																
Multiplier Effects of Expenditure																
Due to User Benefits - Costs																
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($554)	($16,142)	($16,142)
Multiplier Effects																
Indirect & Induced Output	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($580)	($16,917)	($16,917)
Labor	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.330)	
Labor income	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($354)	($10,319)	($10,319)
TOTAL MULTIPLIER EFFECTS																
Final Demand	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(554)	(16,142)	(16,142)
Multiplier Effects																
Indirect & Induced Output	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(580)	(16,917)	(16,917)
Labor	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.330)	
Labor income	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(354)	(10,319)	(10,319)
State Fiscal Account																
Revenues																
Taxes on Final Demand & Labor Income																
GET (% of GSP)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(734)	(734)
Individual income (x labor income)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(530)	(530)
Corporate income (% of GSP)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(21)	(21)
Lease Rents																
Taxes on Indirect & Induced Output	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)		
TOTAL BENEFIT	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(65)	(1,885)	(1,885)
NET BENEFIT TO STATE GOVERNMENT	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($65)	($1,885)	($1,885)

TABLE 12: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER KW INSTALLED FOR COMMERCIAL PV SYSTEMS

Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
																Period Number	
Net Benefits																	
PV System Purchaser	($2,625)	$1,555	$1,555	$1,555	$1,555	$1,555	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$548
State Fiscal Account	($1,333)	$136	$136	$136	$136	$136	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$98
Net Economic Impacts																	
Final Demand	($188)	$1,555	$1,555	$1,555	$1,555	$1,555	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$828
Multiplier Effects																	
Indirect & Induced Output	$309	$1,630	$1,630	$1,630	$1,630	$1,630	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$903
Employment	(0.0304)	0.0317	0.0317	0.0317	0.0317	0.0317	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0151
Labor Income	($427)	$994	$994	$994	$994	$994	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$531

TABLE 12: NET ECONOMIC AND FISCAL IMPACT STIMULATED BY THE SOLAR CREDIT PER KW INSTALLED FOR COMMERCIAL PV SYSTEMS

Item	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Period Number TOTALS	Present Value @ Discount 0.0%
Net Benefits																
PV System Purchaser	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$32,283	$32,283
State Fiscal Account	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$129	$2,552	$2,552
Net Economic Impacts																
Final Demand	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$1,108	$35,000	$35,000
Multiplier Effects																
Indirect & Induced Output	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$1,161	$37,222	$37,222
Employment	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.6863	
Labor Income	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$708	$22,071	$22,071

APPENDIX 2

Analysis of Residential Photovoltaic Adoption on O'ahu

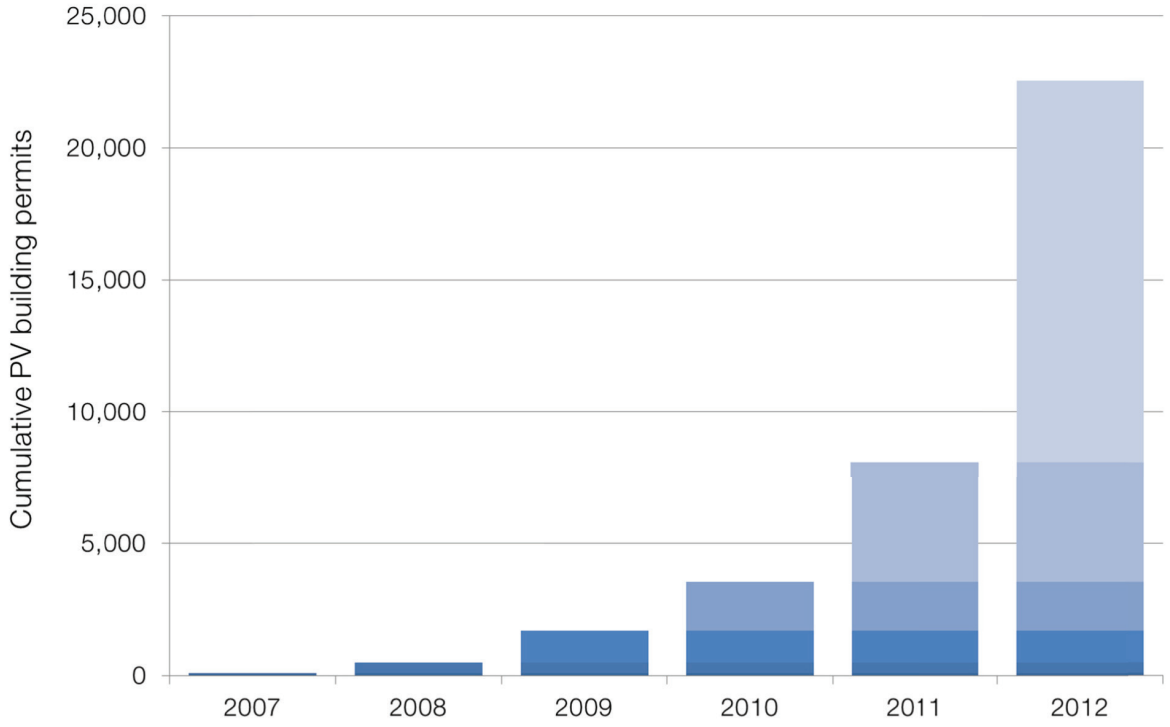
January 2013

Summary

The adoption of photovoltaic (PV) energy on O'ahu—particularly residential systems—has grown exponentially between 2007 and 2012. Uptake of PV systems is accelerating most quickly (by percentage) in zip codes with lower median incomes, owing largely to a decrease in system cost and new third-party ownership models.

Methodology

Blue Planet Foundation analyzed eleven years of O'ahu building permit data to better understand the rate of adoption of residential PV and how adoption was changing regionally. Daily building permit data from January 1, 2002 through December 31, 2012 was compiled from the Honolulu Department of Planning and Permitting website[1]. Permits that were issued for PV in the occupancy category "R-3 Dwelling" were included in the analysis[2]. Some residences had multiple building permits for PV work; duplicate permits were removed only if they contained the same building owner name, the same tax map key (TMK), and the same solar contractor. After

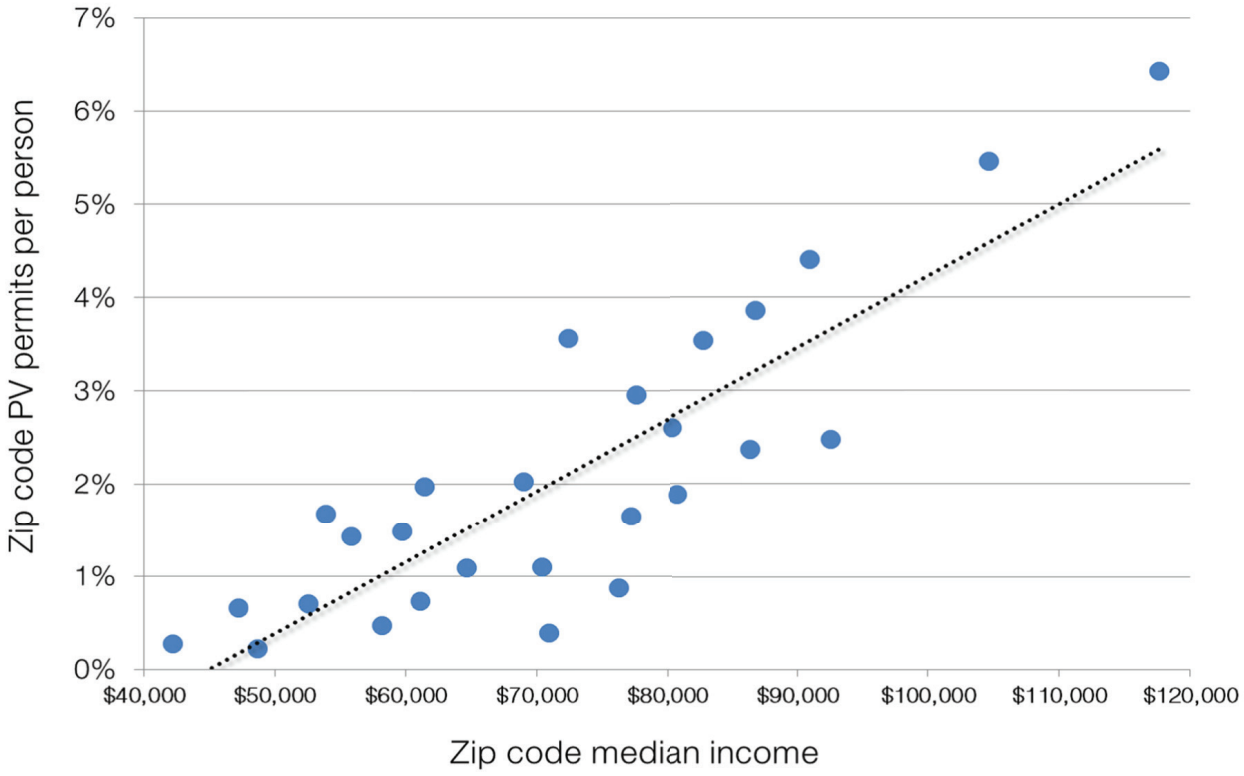


[1] http://www.honoluludpp.org/ReportsNotices/DailyBulletins.aspx
[2] Due to challenges in converting the numerous permits to an accessible format, some data was lost. It is estimated that this loss is less than 2% of the overall photovoltaic permit information.

reducing the list based on the above selection, a total of 22,062 permits were examined[3]. Each permit contained the date of issuance, job address[4], TMK, type of work, accepted value of the work, type of occupancy, and the contractor.

Residential photovoltaic adoption on O'ahu

The building permit history shows the surge in adoption of PV on O'ahu, particularly in 2011 and 2012 (Figure 1). This trend is attributable to a number of factors, including the availability of state and federal tax credits, the availability of net energy metering, the decrease in PV equipment cost, increased competition in the Hawai'i solar industry, new financing tools, and third-party owned systems, among other drivers. While exact price data is challenging to compile, nationwide prices for installed residential PV dropped nearly 40% between 2007 and 2012[5]. Companies such as SolarCity and Sunrun offer third party owned residential PV programs that enable homeowners to pay no money upfront and enter into a contract to purchase electricity from the third-party provider on a monthly basis, similar to utility payments. Such programs have made residential PV more accessible to homeowners with less discretionary income and limited access to more traditional financing products.



[3] This figure may include permits that were issued but the work was not completed. There are anecdotal reports that recently some solar contractors will seek permits for homes before the job has been sold. Given the effort involved in applying for a permit, it is likely that this is a relatively small percentage of the overall permits for photovoltaic. Further, this number obviously does not include photovoltaic installations which flout the building permit law.

[4] Most permits contained street addresses only. Blue Planet used a variety of means to complete the address with the correct city and zip code information.

[5] Barbose, Galen, N. Darghouth, R. Wiser. *Tracking the Sun V*. Lawrence Berkeley National Laboratory. November 2012 (LBNL-5919E).

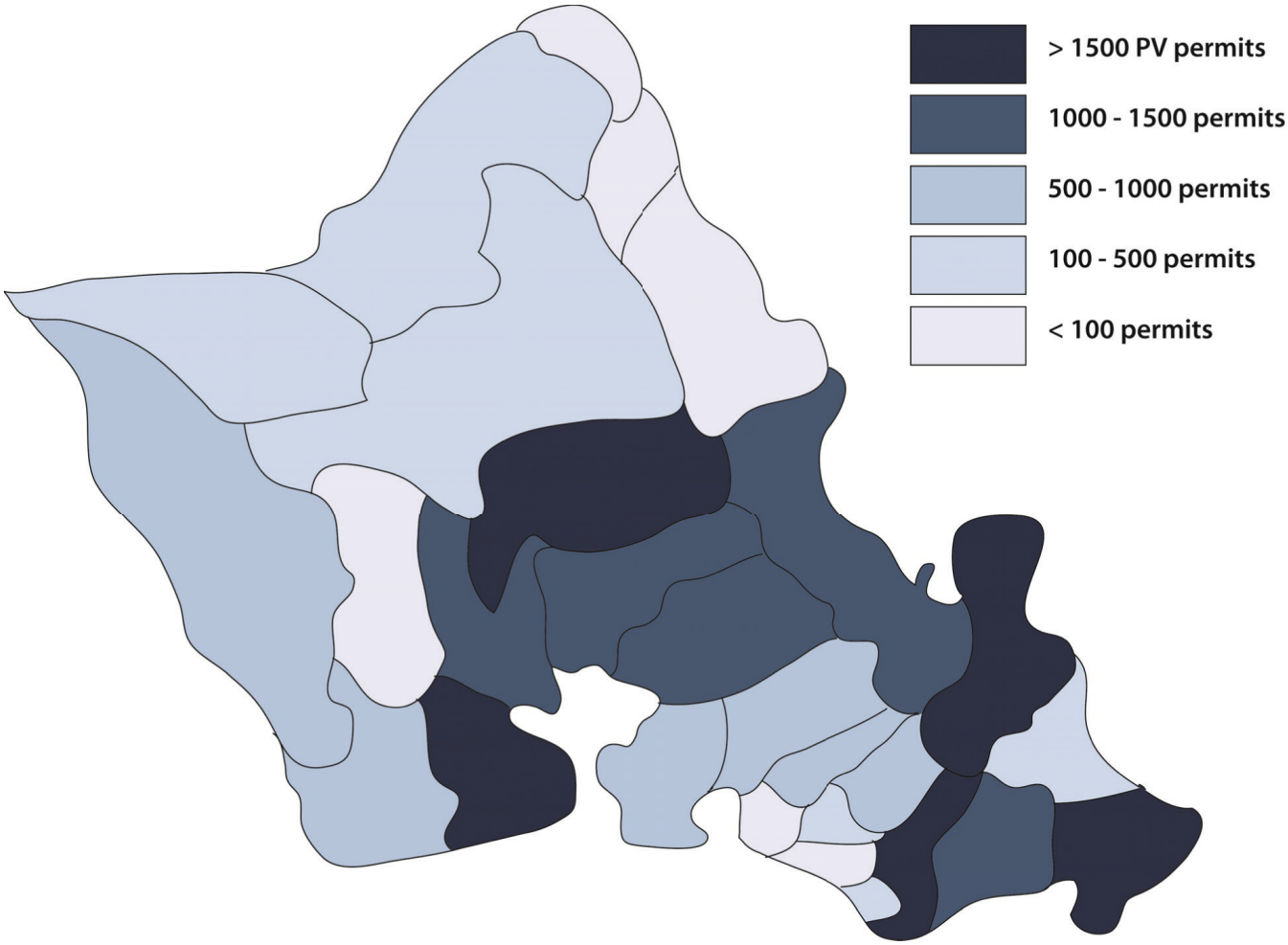


Figure 3. Total number of residential PV permits by zip code, 2002 - 2012

Shifting photovoltaic adoption demographic

While early adoption of residential PV is more prevalent in wealthier neighborhoods, data suggests that the trend is shifting somewhat. Neighborhoods with lower median incomes have been installing PV at a greater pace in the past year. Figure 2 shows the relationship between the approximate residential PV density by zip code median household income. Residential PV density is estimated by calculating the number of PV building permits (for the 2002 through 2012 period) as a percentage of the 2010 population[6] for each zip code. Zip codes with the highest median income (Hawai'i Kai, Kahala, Mililani, Kailua) have the greatest number of total residential PV permits, as illustrated in Figure 3.

The rate of change of PV adoption by zip code was analyzed by examining the 2012 permits versus the previous ten years. While the wealthier zip codes are still adopting more residential PV in terms of total number of installations, less wealthy zip codes (Wai'anae, Hau'ula, Waimānalo, Lā'ie, Waialua) are adopting PV at a higher rate in terms of percentage change. While this is due in part to the smaller overall number of PV permits in these zip codes from the

[6] U.S. Census Bureau, 2010 data.

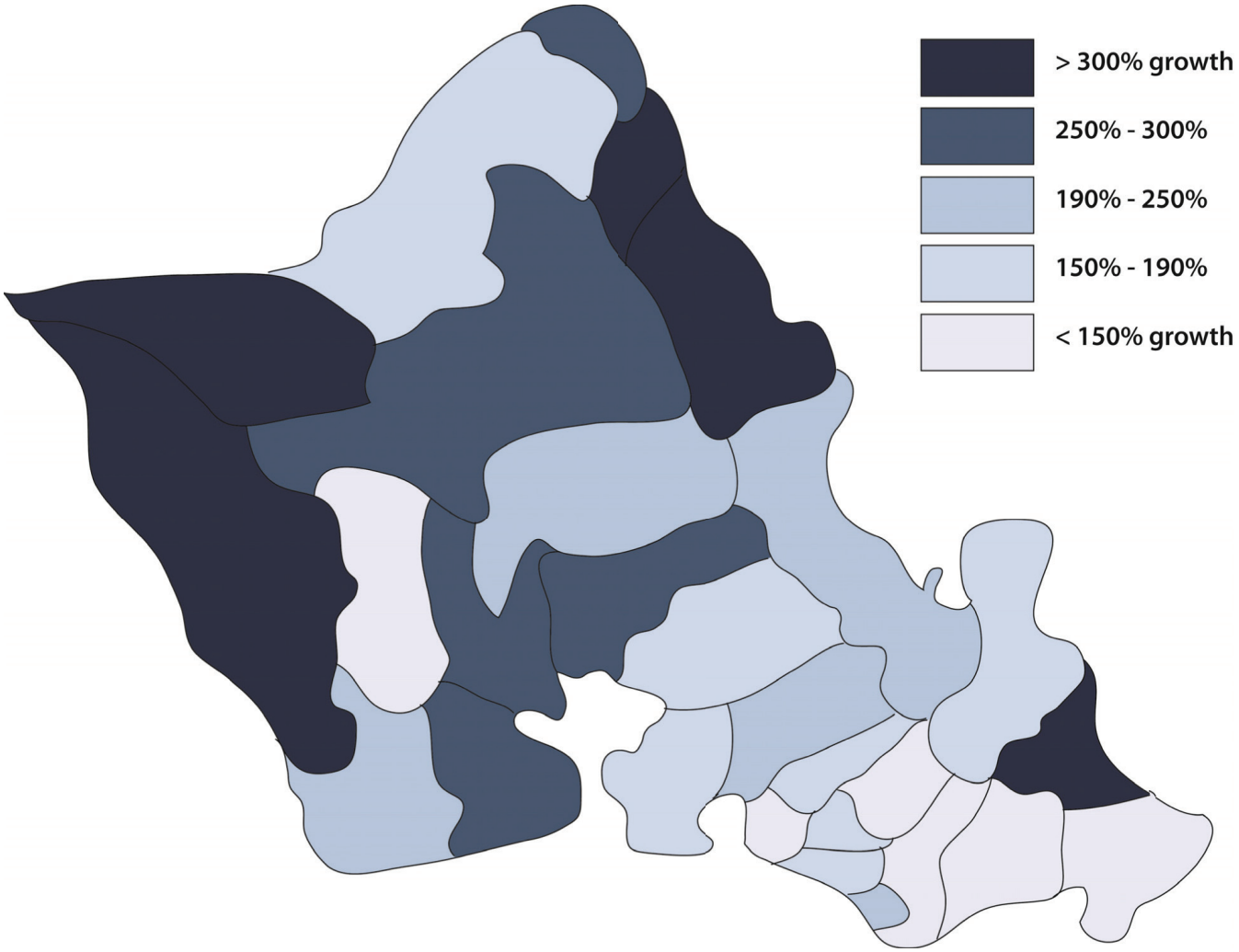


Figure 4. Percent change in number of residential PV permits in 2012 versus 2002 - 2011 by zip code

2002 to 2011 time period, the consistency of increased uptake across these zip codes suggests that PV is becoming more accessible in regions with lower median household incomes. For example, Waiʻanae (with a median household income of $55,836) saw a 300% increase in PV permits in 2012 compared with the previous decade (173 total permits between 2002 and 2011; 521 permits in 2012 alone).

The adoption of residential PV on Oʻahu has seen astounding growth in the past few years. While wealthier neighborhoods have been leading in the overall uptake of PV systems, adoption of PV is growing fastest in neighborhoods with less wealth. Hawaiʻi's renewable energy tax credit—coupled with new third party owned PV programs—have enabled an broadening range of Oʻahu homeowners to reduce energy costs and participate in a clean energy solution.