Report of the

Energy Efficiency Policy Task Force

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Old Technology to New Technology

- Distributed Power
- Green Power
- Zero Energy Buildings

January, 2002

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Economic Development & Tourism
Hawaii Natural Energy Institute
Hawaii Renewable Energy Alliance
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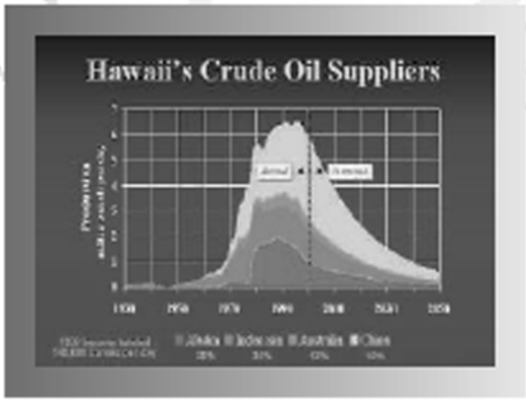
U.S. Department of Energy
U.S. Department of Housing and Urban Development
University of Hawaii

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy



Hawaii's Crude Oil Suppliers

The Final Report

of the

Energy-Efficiency Policy Task Force

to the

2002 State Legislature

January 2002

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Section I. Executive Summary

The Energy Efficiency Policy Task Force was established by Act 163 of the 1998 Legislature with a mandate to "*explore the most cost-effective means for supporting increased energy efficiency and sustainability by:*

1. *Examining alternatives to encourage the efficient use of energy;*
2. *Considering the merits of active participation in the Federal Million Solar Roofs Program; and*
3. *Making recommendations on the most cost-effective means of supporting increased energy efficiency and sustainability."*

The Task Force organized the Energy Efficiency Policy Symposium in November 2000, at which 16 distinguished speakers brought international, national and local perspectives to bear on questions of energy policy. Over the ensuing months, the Task Force held over 35 meetings to review and evaluate alternative mechanisms to the Energy Conservation Income Tax Credits (ECITC) and directed specific economic and fiscal analyses to be performed by Dr. Thomas Loudat, with peer review of Dr. Loudat's work by Dr. Leroy Laney.

Numerous invited guests presented a broad range of perspectives and expert opinions regarding aspects of the ECITC and its alternatives, as well as offering suggestions regarding additional avenues of inquiry.

The Task Force implemented a systematic evaluation of various model scenarios for renewable and energy efficiency technology incentive alternatives, including:

- Revolving Loan Programs
- Emission Fees
- Mandates
- Public Benefit Charges
- Utility Green Power Acquisitions
- Impact Fees

After systematic examination of each alternative, the two criteria specified in Act 163 were used to assess each alternative:

1. Is this mechanism more cost-effective to the State than the current Energy Conservation Income Tax Credit (ECITC)?
2. Does it increase energy efficiency and sustainability, that is, does it reduce reliance on fossil fuels and increase the ratio of indigenous to imported energy use?

The conclusion we reached was that none of the alternative models examined were equally or more cost-effective and more effective at increasing energy efficiency and sustainability. The consensus of the Task Force was that tax credits offer the "most cost-effective means for supporting increased energy efficiency and sustainability" because they:

- Are the most effective means of implementing State energy policy;
- Incentivize energy diversity and energy security;
- Are targeted credits that encourage individual investments rather than consumption;
- Leverage private investment;
- Sustain public/private partnerships;
- Ensure active participation in the Federal Million Solar Roofs (MSR) Program, and;
- Address the objectives of Act 163.

The Task Force further noted that under the current Tax Credit model, Hawaii has led the nation in the number of solar systems registered in MSR Program, and Hawaii's participation in MSR has brought in millions of Federal dollars for solar systems.

Environmental benefits of the Tax Credits for the Solar Water Heating System case have been substantial. Since the inception of the program, over 75,000 households in Hawaii have installed solar water systems directly responsible for displacing more than:

- 4 Million Barrels of Oil
- 2 Million Tons of Carbon Dioxide (CO_2)
- 6,000 Tons of Nitrous Oxide (NO_x)
- 3,600 Tons of Sulfur Dioxide (SO_x)
- 360 Tons of Particulate Matter (PM_{10})

Economic Benefits of the Tax Credits have been similarly impressive. Solar thermal systems serving over 75,000 households have:

- Saved over $240 million for Hawaii residents to spend on other goods and services;
- Created over 700 jobs, and;
- Resulted in $15 million in utility rebates paid (1996-2001) with over $7 million more planned through 2004.

The ECITC operates with extraordinary simplicity and efficiency:

- In FY 1999, the State disbursed tax credits totaling $74 million.
- Of this amount, the energy tax credits amounted to $4.6 million, only 6.2% of the total.

- The energy tax credits claimed constituted only 0.42% of the total income tax revenues.
- No additional bureaucracy or substantive administrative costs are required.

The Task Force concluded its deliberation with the following recommendations:

- Restrict Tax Credits to renewable energy technologies and to those renewables included in the present ECITC only and recommend appropriate credit levels and dollar caps;
- Encourage the Department of Taxation to collect detailed data on Tax Credits to support future analyses and to prepare appropriate administrative rules;
- Encourage the Department of Human Services to use Federal funds from the Low-Income Home Energy Assistance Program to install energy saving devices;
- Provide and support efficiency and renewable energy education programs;
- Support utility energy efficiency and renewable energy programs, and;
- Encourage the Public Utilities Commission to continue to support increased energy efficiency and renewable resources.

Section II. Introduction

Energy is in everything. The First Law of Thermodynamics holds that energy is conserved in the physical sense that it is neither created nor destroyed. Einstein's most famous formulation, $e=mc^2$, directly relates energy to all matter. No human activity occurs without energy conversion.

Hawaii's economic vitality, not surprisingly, is beholden to the predictable availability of affordable energy. Challenges to our prosperity posed by the events of September 11th, by instabilities in Asian financial markets, or by any number of other influences pale in comparison to the consequences of an interruption in abundant supplies of inexpensive energy resources.

Recognizing the crucial importance of energy to the State, the 1976 Legislature enacted Act 189 establishing State income tax credits to encourage private investment in renewable energy systems among other measures, and these incentives have proven successful, beneficial, and cost effective. Codified as §235-12, Hawaii Revised Statutes (HRS), the original act has been amended 10 times, varying credit rates, applicability, and duration. The Energy-Efficiency Policy Task Force, which studied the Energy Conservation Income Tax Credits (ECITC) and prepared the present report, was created by the most recent amendment, Act 163 of the 1998 Legislature. The Task Force was charged "*to explore the most cost-effective means for supporting increased energy efficiency and sustainability.*"

Deliberations of the Task Force were comprehensive and wide-ranging, encompassing both short- and long-term energy efficiency and sustainability strategies. Findings and recommendations contained herein reflect both the experience and diversity of all participants in the deliberative process and the State's national prominence as a leader in energy efficiency improvement.

But past progress and prior accomplishments in energy sustainability confer no license for complacence. Hawaii's greatest natural assets are the abundant forms of natural, renewable energy, which constantly bathe our shores: warm sunlight, steady tradewinds, and dynamic ocean waves. Despite this wealth of resources, Hawaii remains over 93% dependent on imported fossil fuels for our energy needs. In fact, fossil fuel imports now account for a greater majority of Hawaii's energy economy than at any prior time in the past, substantially exceeding that of every other state despite the fact that we are blessed with the greatest renewable energy resource in the nation.

Hawaii's ECITC has helped build the foundation for a gradual replacement of fossil fuels with indigenous renewable energy. The necessary technologies are mature. The time to start is now.

Section III. Purpose of the Energy-Efficiency Policy Task Force

As previously noted, the 1998 Legislature established the Energy-Efficiency Policy Task Force and charged it, with the support of DBEDT, to "*explore the most cost-effective means for supporting increased energy efficiency and sustainability by:*

1. *Examining alternatives to encourage the efficient use of energy;*
2. *Considering the merits of active participation in the Federal Million Solar Roofs Program, and;*
3. *Making recommendations on the most cost-effective means of increased energy efficiency."*

A preliminary report of activities and recommendations of the Task Force was provided in a briefing to the Legislature on January 17, 2002. This report presents the final findings of the Task Force, along with detailed supporting materials.

Section IV. Statutory Policy Goals and Objectives Adopted by the Energy-Efficiency Policy Task Force

In examining alternative approaches to encourage renewable energy investment, and in developing our recommendations for the most cost-effective means of increasing energy efficiency, the Task Force turned to the Hawaii State Planning Act, § 226-18, HRS, as a guide in developing policy recommendations. The State Planning Act identifies the following objectives for the State:

- *Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;*
- *Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;*
- *Greater energy security in the face of threats to Hawaii's energy supplies and systems; and*
- *Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.*

Additionally, the Task Force attended to policy guidance found in the Hawaii State Environmental Policy Act, Chapter 344 HRS, which identifies the following State goals:

- *It shall be the policy of the State, through its programs, authorities, and resources to:*
  - *Enhance the quality of life by:*
    - *Establishing a commitment on the part of each person to protect and enhance Hawaii's environment and reduce the drain on nonrenewable resources.* [§344-3(2)(D)HRS]

- *In pursuance of the state policy to conserve the natural resources and enhance the quality of life, all agencies, in the development of programs, shall, insofar as practicable, consider the following guidelines:*
  - *Energy:*
    - *Encourage the efficient use of energy resources.* [§344-4(7)(A)]

Section V. Actions of the Energy-Efficiency Policy Task Force

In the course of organizational meetings, the Task Force reached an early consensus that input from a broad spectrum of national and local experts in energy policy would be essential in meeting our mandated responsibilities. Accordingly, on November 9, 2000, with multiple sponsorship, the Task Force convened an Energy Efficiency Policy Symposium, which included 16 distinguished speakers (see Appendix A). Included were an American petroleum geologist from Scotland, a professor emeritus from the University of Colorado, representatives from other states with exemplary energy policies, as well as the energy specialist from National Conference of State Legislatures which is just completing its survey of state energy policies. There were also a number of local speakers representing nonprofit organizations (Iolani School, Honolulu Community Action Program, the Consuelo Zobel Alger Foundation), private and business organizations (Off Peak, Hawaiian Electric Company, Hawaii Solar Energy Association), and economists Dr. Tom Loudat and Dr. Leroy Laney. Presentations of the Symposium speakers have been archived and are available for review at the following website: *www.state.hi.us/dbedt/ert/symposium*.

The Task Force augmented information derived from the Symposium by inviting distinguished speakers to provide presentations on diverse topics at regular Task Force meetings. These speakers and topics have included the following:

Department of Budget and Finance:
    Scott Kami, Bonds Administrator; Gordon Wong, Debt Manager
        Discuss use of reimbursable bonds or special purpose revenue bonds to support a loan program for energy-efficiency installations.
    Mary Kagawa, Program Budget Policy Officer
        Discuss use of special funds to support energy programs and offset the impact of tax credits on the general fund.
Department of Health:
    Dr. Bruce Anderson, Director; Gary Gill, Deputy Director
        Discuss increasing the emissions tax, under the Clean Air Act, as an option for funding or offsetting general fund losses due to the energy conservation income tax credit.
Department of Taxation:
    Grant Tanimoto and J.R. Yahiku, Rules Office
        Discuss Department of Taxation's mission and approach to conducting revenue analyses and tax credit impacts.
American Savings Bank:
    Tom Carmichael
        Explore private loan programs to support renewable and energy efficiency technologies.
Tax Foundation of Hawaii:
    Lowell Kalapa, President
        Discuss establishing a low-interest loan program to replace existing tax credits.
Dr. Tom Loudat, Economist:
    Discuss approaches to modeling and evaluation of the energy conservation income tax credit.

Hawaii State Legislature:
  Representative Hermina Morita, Chair, Committee on Energy and Environmental Protection:
    Discuss legislative concerns about the energy conservation income tax credit and the state policy on renewable and energy efficient technologies.
Department of Business, Economic Development, and Tourism:
  Steve Alber, Energy Analyst
    Discuss a system benefit charge and its application for Hawaii programs.

Using information derived from these resources as well as expertise and experience of members themselves, the Task Force proceeded to meet each of the three performance objectives identified in Act 163. Dr. Thomas Loudat performed much of the analysis under subcontract to the Task Force, and his results were peer reviewed by Dr. Leroy Laney. Data collected from government, industry, and documentary sources were entered into mathematical models for analysis, and the sensitivity of key variables was evaluated to establish confidence intervals for important conclusions.

Objective 1. Examine alternatives to encourage the efficient use of energy.

Our deliberations implemented a systematic evaluation of various model scenarios for renewables and energy efficiency incentive alternatives, including:

- Revolving Loan Programs
- Emission Fees
- Mandates
- Public Benefit Charges
- Utility Green Power Acquisitions
- Impact Fees

We evaluated each alternative to the Energy Conservation Income Tax Credit (ECITC) with regard to key funding, administration, employment, and cost elements, and we assessed barriers to implementation of each model. Using results of these evaluations, the models were finally rated in terms of the two substantive criteria for assessment stipulated in Act 163:

1. Is the model more cost-effective to the State than the current ECITC?
2. Does the model increase energy efficiency and sustainability?

For our evaluations, we considered a model to increase efficiency and sustainability if it led to a decreased reliance on fossil fuels and an increase in the ratio of indigenous to imported energy utilization.

Results of our **Objective 1** analyses are presented in summary form in Table 1 and discussed at length in Appendix B.

Objective 2. Consider the merits of active participation in the Federal Million Solar Roofs Program.

The Task Force collected data on Hawaii's participation in the Federal Million Solar Roofs (MSR) program, and using industry figures and conversion formulae based on energy equivalences, we established cost savings, employment, and environmental benefits accruing to the State since the program's inception. The positive impacts of increased environmental and economic benefits we reap as the national leader in this program are enumerated in Section VI.

Objective 3. Make recommendations on the most cost-effective means of increased energy efficiency.

The Task Force recommendations comprise Section VIII of this report.

Section VI. Findings of the Energy-Efficiency Policy Task Force

The Energy Efficiency Policy Symposium convened on November 9, 2000 was designed to be comprehensive, providing perspectives across the spectrum of the public and private sectors. The list of co-sponsors is indicative of the extent of community interest: the Building Industry Association; the Hawaii Natural Energy Institute; the Hawaii Renewable Energy Alliance; the Hawaii Solar Energy Association; Hawaiian Electric Company, Inc.; the Honolulu Community Action Program; the U.S. Department of Energy; the U.S. Department of Housing and Urban Development; the University of Hawaii; and the Department of Business, Economic Development, and Tourism.

Throughout the Symposium the efficacy of the existing energy income tax credits was a recurring theme of the speakers. Repeated emphasis was placed on the merits of tax credits, especially by private businesses and nonprofits in Hawaii that have the most experience with them. However, the Task Force was charged to examine alternative mechanisms of incentive for renewables and energy efficiency, and our purview included all of the major proposed structural and programmatic alternatives to the ECITC. For some of these alternate mechanisms, we relied on the expertise of members of the Task Force who applied their particular knowledge to an assessment of the consequences and expectations of applying a particular model to Hawaii's unique circumstances. For others, we received direct presentations by the principal proponents of a given model. In all cases, impacts and consequences of the incentive mechanism were evaluated in common terms relating to cost, employment, administrative burden, and barriers to implementation. With analyses complete, the two criteria specified by Act 163 as minimum necessities were applied. As summarized in Table I, the only incentive mechanism found to satisfy both criteria was the ECITC.

In the interval following the November, 2000 Symposium, more refined data were collected on economic multipliers and contingent effects of renewable and energy efficient technologies statewide. The Task Force found that there was a need to update the findings of the Solar-Thermal economic analysis performed by Dr. Loudat for the Symposium. In addition, we felt it likely that the broader scope of energy technologies addressable under Act 163 would benefit from detailed mathematical model review. Thus, we again engaged Dr. Loudat's services in the Fall of 2001 to conduct economic analyses of those technologies most relevant to the purposes of our mandate.

Based on historical data provided by the Department of Taxation and Hawaiian Electric Company, Inc. (see Appendix C), a clear relationship exists between the level of incentives and the number of systems bought. Specifically, the higher the effective credit level, the more systems are bought.

In Fiscal Year 1999, the most recent year for which official figures are available, the State of Hawaii disbursed tax credits totaling $74 million. Of this amount, the energy tax credits claimed totaled $4.6 million or 6.2% of the total credit dollars claimed and 0.42% of the total income tax revenues for the year.

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Table 1. Energy Policy - Alternate Model Analysis and Conclusion Summary Matrix

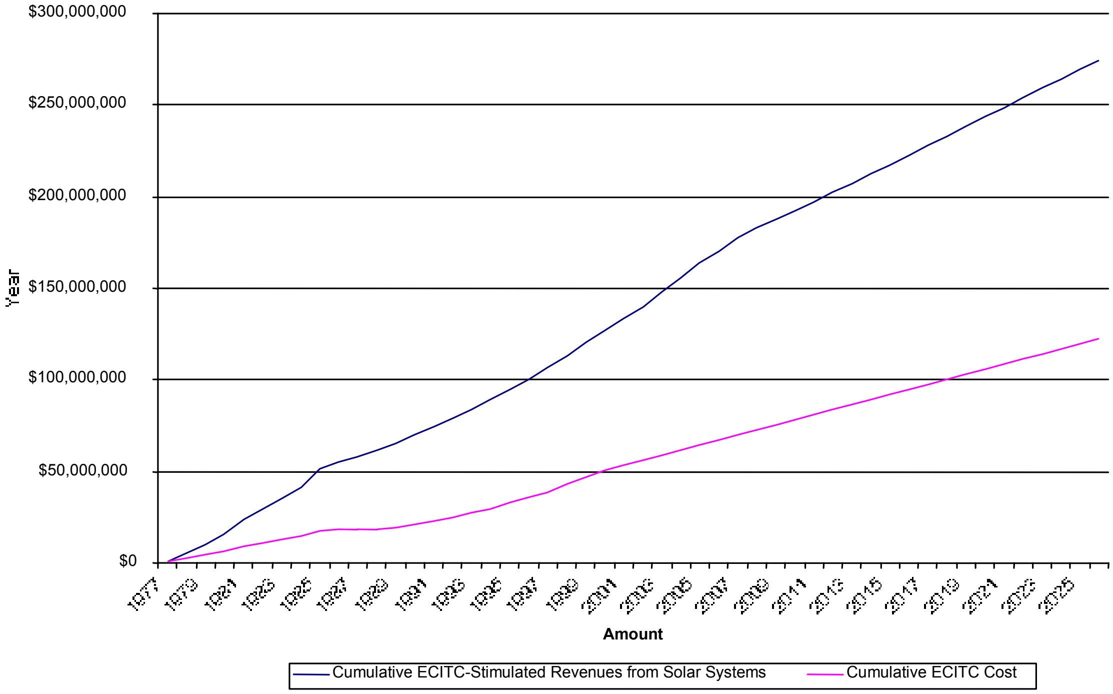
Administration	**Alternate Models**		
Model	**Revolving Loan Program**	**Emission Fees**	**Mandates**
Description	Establish a low or no interest revolving loan program to finance installation of approved technologies.	Assess additional emissions fees on U.S. EPA covered permit sources to finance rebates that exceed current ECITC level plus any utility rebates.	Require renewable energy and energy efficiency measures on all new buildings, renovations (i.e. additions and alterations), and when existing buildings change ownership.
Funding Mechanism	State General Fund currently used for tax credits allocated to secure General Obligation bonds for loans. Loans repaid by borrowers.	Private Sector and indirectly public sector. Fee assessed on fossil fuel generators for defined emissions (e.g. $X/ton per pollutant).	Private and public sectors. Applies to all building projects.
Administration	State agency or publicly funded private, non-profit entity determines loan qualification criteria, develops loan documents, screens loan applicants, makes loans, collects loan payments, and establishes loan delinquency and default policies and procedures.	Emitters pay fees to the DOH. DOH transfers fees to a trust account administered by DBEDT or a non-profit entity. Consumers apply for a rebate. Alternative: Fees retained by emitters for express purpose of supporting renewable energy and energy efficiency projects.	Appropriate government agencies (e.g. State DBEDT and Bureau of Conveyances, County Building Departments) verify inclusion of required measures.
Personnel	Additional government or government funded private sector staffing required.	Additional government or government funded private sector staffing required.	Additional government staffing required.
Barriers	Private use of General Obligation bond funds is strictly limited under Federal law, and funds for private use are capped below practicable levels for a revolving loan. Penalties for breach of loan conditions are severe.	Imposition of new emissions fees (i.e., in addition to the federally mandated emissions fees) will increase the cost of energy services to all Hawaii businesses and individuals, especially those least able to pay higher costs.	Requires training and additional staff for building and real estate industry for compliance. Increases in construction cost and resale cost would result in decreases in sales. May decrease competition for required technologies. May exclude promising technologies.
Conclusions Note: Conclusions are based on the two tests identified in Act 163. A model that satisfies both tests would be considered a viable alternative to tax credits. **Test #1**. More Cost-Effective Means. **Test #2**. Increases Energy Efficiency and Sustainability.	Federal law prohibits proposed use of funds. Even if federal law is changed, administrative costs render model less cost-effective than current model. Without tax credits and utility rebates, system cost would increase 45% and result in a lower adoption level.	Proposed model may result in increased energy efficiency and sustainability. However, administrative costs render this model less cost-effective than the current model.	May result in increased energy efficiency and sustainability but cost to administer renders model less cost-effective than current model. Furthermore, model may forestall construction and home sales. Does not necessarily meet the needs of the consumer.
Recommendations	Not recommended. Test #1: Fail Test #2: Fail State should continue to encourage private financial institutions to provide loans.	Not recommended. Test #1: Fail Test #2: Pass	Not recommended. Test #1: Fail Test #2: Pass

Alternate Models			Existing Model
Public Benefit Charge (PBC)	**Utility Green Power Acquisitions**	**Impact Fees**	**Tax Credits**
Assess a charge on rate-payers based on energy usage to fund renewable energy and energy efficiency rebates.	Require utilities to: a) purchase customer-sited green power at premium rates; and/or b) lease utility-owned systems to customers.	Counties assess an impact fee for any new request for electrical service to offset costs to meet new demand for electricity. The fee increase makes renewables and energy efficiency more attractive financially.	Act 163 provides an income tax credit for solar, wind, heat pumps, and ice storage systems.
Private and public sectors. Rate-payer financed. Charge assessed all utility customers (e.g. < 1 mill/kWh). Becomes a separate line item on customer's bill.	Private and public sectors. Rate-payer financed. Charge assessed all utility customers (e.g. < 1 mill/kWh). Becomes a separate line item on customer's bill.	Private and public sectors. Applies to all projects requesting new electrical service.	General Funds.
Regulated utilities collect ***PBC***, then transfer funds to DBEDT trust account. DBEDT or a private, non-profit entity would develop criteria for rebate eligibility, screen applications, verify installations, and issue rebates.	Utilities would pay a premium for eligible customer-sited green supply-side electricity production and demand-side electricity savings. In addition, a utility would lease eligible technology systems to customer. If utility leased, then the payment would be decreased by the amount of the lease.	County building departments would develop fee schedule for new electrical demand requests, determine fee amount at plan review stage, and impose fee at time permit is issued. Counties would use fees to cover administrative costs.	Taxpayer completes appropriate tax form. Tax Department processes claims.
Additional government or government funded private sector staffing required.	No additional government staffing. New hires required by utility and/or energy services providers.	Possible additional county staff. New hires required for energy service providers.	No additional government staff needed
Requires review and approval by the State Consumer Advocate and PUC because ***PBC*** affects rates. Charge does not apply to unregulated energy services providers, and therefore, penalizes rate-payers unjustly.	Requires review and approval by the State Consumer Advocate and PUC because ***PBC*** affects rates. Charge does not apply to unregulated energy services providers, and therefore, penalizes rate-payers unjustly.	Requires training and possibly additional staff for county building departments. Counties may have own perspective with respect to implementation of state energy policy. Increases in construction cost and resale cost would result in decreases in sales.	Perceived costs. No caps on commercial credits. Sunset dates on credits.
Proposed model may result in increased energy efficiency and sustainability. However, administrative costs render this model less cost-effective than the current model.	Both alternatives of proposed model would result in increased costs to the state and decreased energy efficiency and sustainability.	Proposed model may be more cost-effective to state but increased energy efficiency and sustainability would not be achieved. Impact fees may forestall requests for new electrical service. Also, system price would be higher without tax credit or utility rebate.	Demonstrated to be an effective, efficient, and beneficial model. Ignoring return on investment, current level of tax credits claimed account for 0.42% of annual state income tax revenue to successfully implement state energy policy.
Not recommended. Test #1: Fail Test #2: Pass	Not recommended. Test #1: Fail Test #2: Fail	Not recommended. Test #1: Pass Test #2: Fail	Continue tax credit model but modified. Eliminate non-renewable energy based technologies. Cap commercial credits. Direct Tax Department to track claims by segment, technology and taxpayer class. Remove end date.

The Task Force discussed at length a perception that the ECITC represents a continual drain of State funds, an opportunity cost to Hawaii that decreases funds available for other needed expenditures. Using the solar thermal case, for which the most extensive data are available for review, close analysis reveals that this perception is erroneous. Our more comprehensive inquiry led to the demonstration that for every ECITC dollar spent that stimulates a solar purchase, $1.82 of tax revenue is generated. The principal source of the error in perception is the accounting method used by the Department of Taxation, which considers only expenditures from and reduction of the State general fund in the initial year of operation of the installed solar thermal system.

In fact, tax revenues resulting from the integrated economic multipliers derived from that system *reduce the actual cost to the State to one third the reported amount in year one*. Ultimately, evaluated over the full 25-year life of the system, the installed system generates tax revenue that is nearly two times the initial cost to the State. In total, since the ECITC incentives commenced, they have had a net positive fiscal impact in excess of $150,000,000 (see Figure 1).

Figure 1. Cumulative ECITC Costs and Revenue Impact from ECITC Stimulated Solar Thermal System Purchases



As a result of the valuable information gained from the cost-benefit analyses for solar water heating, the Task Force recommended conducting similar analyses to evaluate the technologies covered under the energy conservation income tax credit with the intent of identifying possible revisions to the law. Therefore, the Task Force directed that the economic analyses provide recommendations on changes in percentages and dollar limits, where possible, for each technology, and evaluate if tax credits should be eliminated or increased for certain technologies.

For this report to the Legislature, the Task Force also recommended a peer review of Dr. Loudat's economic analyses to provide independent evaluation of the methodology applied. The cost-benefit analyses of the tax credits form the crucial bases for our ultimate policy recommendations, and they demand an objective, independent critique.

Dr. Leroy Laney had reviewed Dr. Loudat's earlier study for the November, 2000 symposium. In his critique of that paper, he stated,

> *This reviewer finds the assumptions and conclusions from them to be reasonable and sound. Furthermore, the analysis appears to have been conducted carefully and in great detail.*

Dr. Laney noted in his review that,

> *Research such as the Loudat paper, and the results presented above in the reviewer's own paper, provide evidence that a tax credit contributes net economic and fiscal benefits, and that this tax credit has indeed been effective in stimulating investment in solar systems over and above more conventional private market forces. It is the role of government to eliminate roadblocks, and to provide incentives for solutions, even if those solutions themselves come from the private sector.*

At the completion of his extensive peer review of the assumptions, analyses and conclusions prepared by Dr. Loudat for the present report, Dr. Laney again found the reasoning and arguments sound, stating, "In brief, and in summary, the mandate of this peer review is to critically assess Loudat's own work rather than add to it. This reviewer finds that work to be professional and quite adequate, thorough, and exhaustive."

For the Legislature's consideration, the Task Force presents the following findings in support of tax credits enacted with credit rates and limits as determined by detailed quantitative and qualitative analyses:

1. The Present Tax Credits Make Policy Sense.

It is crucial to note that the ECITC stimulates investment as opposed to consumption at individual and corporate levels. Its effect is felt immediately, locally, and over a 25-year period, and for these reasons, tax credits for renewable energy technologies should remain a central element of State energy policy.

In addition, the credits help to level the playing field for renewable and efficient technologies against the heavily subsidized petroleum industry.

2. The Present Tax Credits Make Economic Sense.

Of all the analyses performed, the Solar Thermal case provided the most complete and extensive insight into the overall economic costs and benefits of the ECITC. Because of the more comprehensive input data available, the Solar Thermal case study is the most detailed, and hence the most instructive.

The State of Hawaii refunded to the 2,500 solar thermal system purchasers in 2001 an estimated $2,765,000. This spending is estimated to lead to the following economic outcomes:

- Support 300 jobs each year the ECITC is at a 35% level and create 64 new jobs per 2,500 new system installations, a job impact that increases the more systems continuously installed. For example, if the annual system installations become 5,000, 600 jobs are supported and 128 new jobs would be created per year.
- Return to the State $5,200,000 in tax revenues per 2,500 system installations over the 25-year life of these systems, a revenue impact which increases the more systems continuously installed. For example, if the annual system installations become 5,000, $10,400,000 in tax revenue is generated over the life of these systems at current ECITC levels.

ECITC benefit/cost ratios, where the ratio numerator is the benefit value equaling the respective result variable life cycle value and the denominator is the ECITC cost, are the following:

- Output/ECITC = 29.5, or stated, for each ECITC dollar spent that stimulates a solar purchase $29.5 of output (sales) are generated. The total output effect for installations from 1996 to 2001 is $582,000,000.
- Employment/ECITC = 0.00003, or stated, for each ECITC dollar spent that stimulates a solar purchase 0.00003 jobs are generated. The total employment effect for installations from 1996 to 2001 is 515 jobs.
- Labor Income/ECITC = 11.25, or stated, for each ECITC dollar spent that stimulates a solar purchase $11.25 labor income is generated. The total labor income effect for installations from 1996 to 2001 period is $221,000,000.
- Tax Revenues/ECITC = 1.82, or stated, for each ECITC dollar spent that stimulates a solar purchase $1.82 tax revenue is generated. The total tax revenue effect for installations from 1996 to 2001 is $37,000,000.

The historical relationship between the effective tax credit and the number of solar systems sold also indicates that the estimated number of solar systems sold would decrease to 287 with the elimination of the ECITC. Such a solar industry size reduction would lead to the following economic results:

- A loss of approximately 256 jobs with new job creation reduced from 64 jobs per year to 7 jobs per year.
- A decrease in tax revenues of $4,700,000 from general excise tax sources and individual and corporate income tax sources due to a reduction from 2,500 to 287 annual system installations. Payroll taxes such as unemployment insurance taxes would also be adversely affected, a tax impact not measured.

- An increase in fiscal costs such as unemployment insurance due to increased unemployment, not measured in this analysis.

Analyses performed for Wind and Photovoltaic systems lacked the range and extent of input data available for the Solar Thermal case. The detailed reports are appended (Appendices D, E, F), and a summary of the findings is shown in Table 2.

Table 2. Summary of ECITC Fiscal and Economic Impacts by Technology Type

	Fiscal Impacts		
Measure	**Solar**	**Wind**	**PV**
ECITC Level & Technology Implementation Impact			
Current ECITC %	35%	20%	35%
% Increase in Sales Due to ECITC	778%	unknown	unknown
ECITC Investment Return to State			
"Investment" Rate of Return to State	18%	6.3%	-8.2%
"Investment" Pay Back in Years	7	10	25
ECITC Break-Even % (1)	80%	28%	8%
Estimated Total Annual Costs & Benefits to the State at the Current ECITC Level			
Total ECITC Cost for Expected Systems	$2,760,486	unknown	unknown
Total Expected Systems Life Cycle Revenues	$5,037,042	unknown	unknown
Tax Revenues Generated per $1 ECITC Cost	1.82	1.85	0.37
	Economic Impacts		
Measure	**Solar**	**Wind**	**PV**
Purchaser Incentives Created by ECITC			
Decrease in PayBack Years	3	1	12
Jobs Created Due to ECITC			
Jobs Created per $1 ECITC Cost	0.000025	0.000015	0.000005
Total Since ECITC Inception	1,561	(2)	(2)
Annual New Jobs at Current ECITC	59	(2)	(2)

Table Notes

(1) The "ECITC Break-Even %" is the ECITC level at which the ECITC cost equals the revenues generated by system purchases stimulated by the ECITC.

(2) There is insufficient historical data to provide the same "job creation" estimates for wind and PV as for solar.

3. Tax Credits Sustain Public/Private Partnerships.

At present the electric utilities offer incentives (rebates) to customers who install efficiency measures to reduce their demand for electricity. These incentive programs will, in the long run, allow the utilities to delay building costly generating plants by using present facilities as efficiently as possible. The delay also will allow for development of improved renewable and electro-technologies with increased efficiencies and performance.

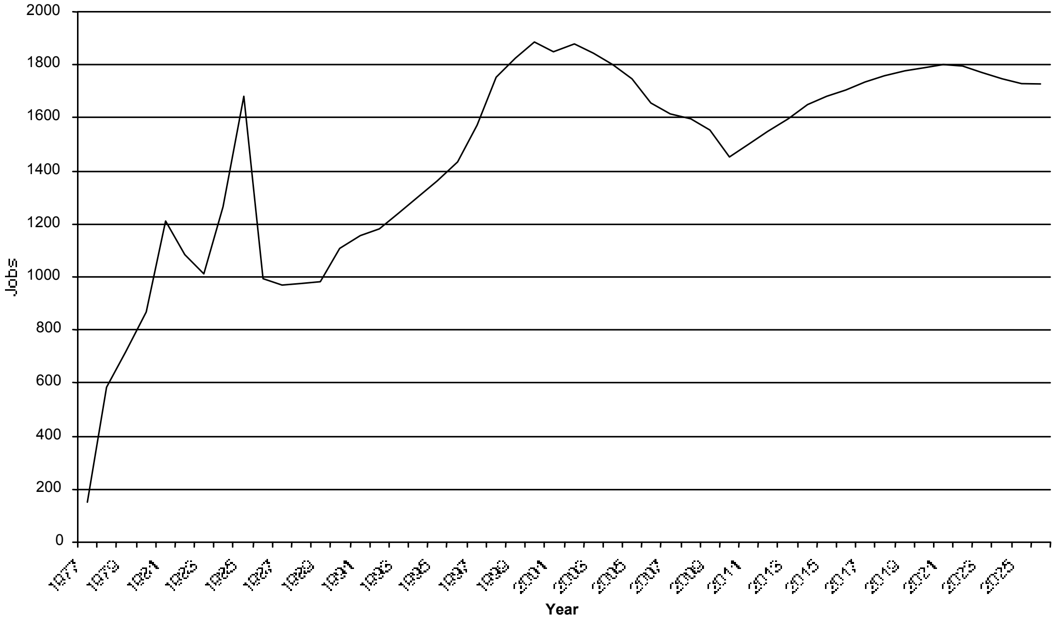
The incentive programs must meet strict regulatory requirements laid out by the Public Utilities Commission (PUC). The utilities are in compliance with the requirements and have allocated millions of dollars to incentivize consumers to be more efficient. It is very important, however, that the utility incentive programs have the complement of the energy tax credits. Without the tax credits, the number of systems installed would be substantially reduced, and the cost effectiveness of the consumer efficiency programs might be called into question. Without an effective customer efficiency program, the public/private partnership will no longer be providing $14 million in funding support for residential energy efficiency programs. (Hawaiian Electric Company's projected program costs for its Residential Demand Side Management Program over a five-year period as filed in its application under the Public Utility Commission Docket 00-0209 allocates $14 million to support this program.)

The incentive programs offer the added benefit of ensuring that renewable and energy-efficient technologies are installed properly with the proper permits and licensed professionals doing the work. With licensed professional and properly permitted installations, the state benefits from the income and general excise taxes collected. Unlicensed installations may mean that workers compensation and appropriate insurance do not cover the installers and the customer's system.

4. Tax Credits Support the Stability of Energy Businesses.

Businesses need a long lead-time to plan and do business. Without a sunset date, renewable and efficient technology businesses can do better business planning. A short term for the tax credits hampers business development because local renewable and efficiency businesses need longer timeframes not only to secure good property and equipment leases, but also to attract qualified and dedicated employees. The solar industry estimates that there are about 700 people employed in the solar industry and its ancillary businesses. Figure 2 shows the total direct and indirect impact of the ECITC, amounting to a current employment equivalency of roughly 1,700 jobs. There are also an estimated 75,000 households with solar installations, making Hawaii the state with the highest per capita installations. Most of the solar water heating installations are replacements for conventional, fossil fuel reliant water heating systems.

Figure 2. Estimated Actual Total Jobs Directly or Indirectly Created by ECITC Stimulated Solar System Purchases to 2001 and Forecast Jobs Post-2001 for a 35% ECITC



5. Low-Income Taxpayers Benefit from the Credits.

The Consuelo Zobel Alger Foundation, providing self-help homes to low-income families with children, works with American Savings Bank to include solar water heating systems. Without the tax credits, the Consuelo Foundation would not be able to install solar water heating systems. The tax credits allow homeowners to install solar systems and benefit from a tax refund. The solar systems reduce homeowners' monthly utility bills, thereby increasing their monthly cash flow to meet mortgage payments.

For example, in a Waianae housing project 75 new homeowners have solar water heating systems. Terrence George, Chief Program Officer, Consuelo Foundation, reported the following in our November 9, 2000, Energy Efficiency Policy Symposium:

> *. . . these are the working poor, who have worked hard to stay off welfare but who barely make enough money to get ahead. They are construction workers, janitors, part-time teachers, secretaries, bus drivers, and nurses' aides. Some were homeless and jobless at previous points in their lives, but all families now have low but steady incomes . . . . For most families, this (tax credits) results in a much-needed income tax refund that they use to improve their homes, save for their children's education, and provide for their families' other needs . . . our solar systems do virtually all the work in heating water for the households . . . . The resultant savings on electricity bills is dramatic . . . . One resident told me that his family's bill dropped from $200 per month to $70 per month.*

The State Department of Taxation prepared a summary of Individual Returns Claiming Energy Tax Credits by Size of Credits and by Adjusted Gross Income (AGI) for 1999 (Appendices G and H). According to the summary, in 1999 the AGI class claiming the most tax credits fell in the $25,000 to $30,000 income group. From a broader equity perspective, energy tax credits are progressive, since lower income tax paying classes claim a disproportionately large share of the credits than higher income tax paying classes (see Appendix H). In 1999 HUD set the Hawaii median income for a family of four at $60,400, and for 2001 the median income for a family of four was $62,400. (The U.S. Department of Health and Human Services set the following levels for poverty thresholds for eligibility for Federal programs for the poor: 1999, $19,210 for a family of 4 and $20,300 for that same family in 2001.)

6. Support of the Tax Credits Will Ensure Continued Active Participation in the Federal Million Solar Roofs Program and Address the Mandate of Act 163.

The Million Solar Roofs (MSR) program has been very successful in the State of Hawaii. As the national leader, we reap the positive impacts of increased environmental and economic benefits. The Federal government has also been a major beneficiary since many of the new solar installations have been on Federal facilities, resulting in twin financial benefits to the Federal budget: lower monthly utility costs for operations and receipt of sizeable utility rebates for the installation of solar systems. Since the inception of MSR to May 2001, the economic, social, and environmental benefits have been impressive (see Table 3).

According to Heather Mulligan, U.S. Department of Energy's Million Solar Roofs Program Manager:

> *The Hawaii Million Solar Roofs Partnerships were very instrumental in helping the Federal Government meet its Million Solar Roofs goal of installing 2000 solar energy systems on Federal buildings by the end of the year 2000. The Military in Hawaii contributed over 1,700 systems to that goal, consisting mostly of solar hot water systems on military housing. To date, HECO, HELCO, and MECO have helped facilitate the installation of over 14,000 solar hot water systems, under the initiative. This is a significant contribution to the overall goal of the initiative to install one million solar energy systems by the year 2010. Many attribute this success to good economics as a result of high energy prices, and the incentives offered by the State and utilities. I have not seen this level of solar hot water market penetration in other locations.*

Table 3. Summary Statistics for the Million Solar Roofs Program in Hawaii

Number of Systems[1]	over 13,000
Customer Savings[2]	
Energy	nearly 500 MWh
Electricity bill reduction	over $61 million
Jobs Created[3]	approximately 150
Environmental Benefits[2]	
Barrels of oil not burned	over 900,000
Carbon dioxide not emitted	nearly 500,000 tons
Federal Systems[4]	nearly 1,800
Other noteworthy items	
Unique Partnership	State, Utilities, Industry, Customers
Utility rebates received	approximately $13 million

Notes

1. Not all systems have been registered with MSR.
2. Savings and Environmental Benefits are based on a minimum 15-year system service life.
3. Jobs created are in addition to approximately 300 direct employment jobs that existed prior to the program inception. Source: Hawaii Solar Energy Association estimates.
4. This quantity is included in the Number of Systems total.

7. At the Recommended Rates and Limits Assessed by Economic Analysis, Tax Credits Will not Place a Burden on State Finances.

Recognizing legitimate concerns that an unlimited income tax credit applied at the proposed rates to large commercial systems might create a significant fiscal risk to the State, the Task Force commissioned an additional statistical analysis to optimize the dollar limit applied to system installations. Using costs and installation number projections from the industry, the distribution of the tax by technology and installation type was used to calculate the annual ECITC on commercial systems at a specific cap level. The model then was used to assess the ECITC cost to the State at different cap levels, both from an historic ECITC cost perspective and from specific commercial cap levels as proposed by the Task Force.

Using a dollar limit of $500,000 on commercial systems, the estimated tax credit cost to the State is approximately equal to the upper range of historical tax credit refunds (see Appendix I). It is the consensus of the Task Force that the mandate of ACT 163 to support increased energy efficiency and sustainability leads compellingly to targeting the upper range, as opposed to the mean, or the lower ranges of historical tax credit refunds.

Thus, the unanimous consensus of the Task Force was that tax credits for renewable technologies deserve continued State support.

Section VII. Recommendations of the Energy-Efficiency Policy Task Force

Guided by many factors, including state fiscal impact studies, review of new and existing technologies, comments and recommendations of numerous guest speakers and by statutory goals and objectives stated in the State Planning Act, the Energy-Efficiency Policy Task Force examined in detail and discussed a number of different policy opportunities. After extensive deliberation the Task Force provides the following recommendations.

The Task Force evaluated a number of different methods to promote renewable and energy efficiency. In recognition of the present fiscal constraints and the demands on the general fund, the Task Force recommendations take into consideration the need to exercise judicious fiscal restraint while balancing state energy policies. Therefore, the Task Force recommendations focus on continued support of renewable resources only. It is the Task Force's recommendation that as state fiscal constraints lessen, the state will revisit its support for increased support for renewable resources as well as energy efficient technologies.

1. **Allow current Energy Conservation Income Tax Credits to sunset in accordance with present law. Enact renewable energy income tax credits applicable only to the renewable technologies presently recognized by the ECITC, effective July 1, 2003, with the following provisions**:

   A. **Provide renewable energy income tax credits for <u>only</u> the following: solar thermal, photovoltaic, and wind energy systems.**

   B. **Provide the credit percentages and dollar caps as outlined in Table 4.**

Table 4. Proposed ECITC Credit percentages and Dollar Caps

Technology	Residential	Multi-Family	Commercial
Solar Thermal	35% or $1,750 whichever is less	35% or $350 per unit, whichever is less	35% or $500,000 whichever is less
Wind	20% or $1,500 whichever is less	20% or $200 per unit, whichever is less	20% or $500,000 whichever is less
Photovoltaic	35% or $5,000 whichever is less	35% or $350 per unit, whichever is less	35% or $500,000 whichever is less

   C. **Provide for tax credits without an expiration date but with the provision that the technologies, the allowable tax credits, and dollar limits be evaluated every 7 years to determine the types of technologies, levels of credit, funding support, and other appropriate evaluations. The periodic review and evaluation should be similar to the impact and cost-benefit analyses conducted to adjust and revise existing legislation governing the tax credits. The Energy Resources Coordinator shall be responsible for**

ensuring that the review, evaluation, and recommendations are accomplished and shall forward recommendations to the Legislature.

D. Provide that any Federal tax credit or utility rebate shall be deducted from the installed cost of the qualifying system before applying the State tax credit.

E. Provide that a taxpayer, individual or corporate, may claim credit for one or more qualifying systems in the same tax year.

2. Encourage the Department of Taxation to collect tax credit data to include at least the following data and to report the data to the Legislature no later than nine months after the previous tax year:

- **Number of qualifying systems by technology type (solar thermal, photovoltaic, and wind), by installation type (residential, multi-unit residential, and commercial), and by credit type (corporate and individual taxpayer).**
- **Total credit cost by technology type, by installation type, and by credit type, with descriptive statistics including mean, median, minimum and maximum values, and the standard deviation.**

3. Encourage the Department of Taxation to prepare administrative rules governing taxpayer claims in which one renewable system installation is owned by multiple taxpayers. The administrative rules shall provide that credits paid to multiple taxpayers, who own and install the system, shall not exceed the dollar limit as though paid to a single taxpayer who owns and installs the renewable energy system. Therefore, one installation with multiple owners shall be restricted to the dollar limit as though it were a single owner of the installation. The Department of Taxation shall determine how the multiple owners shall claim their portion of the dollar limit imposed.

4. Encourage the Department of Human Services to use Federal funds from the Low-Income Home Energy Assistance Program to install energy saving devices.

5. Provide and support efficiency and renewable energy education programs.

6. Support utility energy efficiency and renewable energy programs.

7. Encourage the Public Utilities Commission to continue to support and implement policies for energy efficiency and renewable resources.

8. Solar or wind energy system shall be defined as "any new identifiable facility, equipment, apparatus, or the like that converts solar insolation or wind energy to useful thermal or electrical energy for heating, cooling, or reducing the use of other types of energy dependent upon fossil fuel for their generation."

Section VIII. Conclusions

We are blessed with bountiful natural resources that will supply us through generations of sons and daughters of Hawaii. Every day, we walk in bright sunshine under blue skies, feel the trade winds, and look out over green mountains and a vast ocean. These treasures have blessed us for thousands of years, enriching our lives in many ways, and they hold more bounty to nurture us. We have but to acknowledge the opportunities before us and commit to a vision of Hawaii in the twenty-first century. This vision embraces Hawaii at its brightest and best. It is a vision that commits to values that bring reward, not only for today, but especially for our children's tomorrows.

Hawaii's future lies in harnessing these gifts of abundant natural resources. The State has acknowledged this vision through legislation passed to encourage the installation of renewable and energy efficient technologies. In a continuing effort to improve the State's support for renewables and energy efficiency, this Energy-Efficiency Policy Task Force was created and charged with examining alternatives to fulfill this vision.

The Task Force explored a number of alternatives. Time and again, however, the findings of the Task Force led to the conclusion that the existing tax credits were demonstrably more effective than alternative mechanisms in increasing use of renewable and efficient technologies.

The tax credits were born out of response to the Oil Embargo of 1973 and the ensuing economic disruption to Hawaii's economy. At that time, the tax credits were initially a symbolic gesture of support for an awakening awareness of the value of renewable resources and technologies. The value of the renewable and energy efficiency industries has proven even more important with the impact of world events on Hawaii and the consequent economic tensions created by fluctuating petroleum prices.

In the past two decades, the renewable and energy efficiency industries have matured, but they remain vastly challenged in comparison with a global petroleum industry that enjoys national and international subsidies and price supports. In the energy business, the playing field is far from level. Therefore, the Task Force concluded that it is in the best interest of the State to continue supporting renewable and efficiency technologies and resources. State support of these technologies and resources is particularly crucial today when Hawaii's fragile link to, and heavy dependence on, conventional fuel sources threatens our energy security and economic stability.

Energy security, in particular, now has an added dimension beyond oil price fluctuations and potential supply disruptions. The tragic and unprecedented events of September 11, 2001, raise concerns about the security of Hawaii's critical energy infrastructure, such as centralized power generation, transmission and distribution systems, synthetic natural gas facility, oil refineries, tank farms, and oil and gas pipeline infrastructure. Ensuring that energy security and finding alternatives that enhance the security of these systems is an important consideration for both Hawaii's economy and Hawaii's strategic military presence.

In the final analysis, our long-standing recognition of the multiple downsides of reliance on fossil fuels for our energy needs compels us to action. Establishment of the ECITC 26 years ago was a good first step, but since then we have made only halting progress towards true energy sustainability. The barriers to attaining this goal are formidable, but the consequences of failing to attain it are truly frightening.

The future on whose threshold we stand holds a promise of new technologies, new levels of prosperity, and greater harmony with the environment that nurtures us. We have the tools to reap the benefits of that nurturing environment, but so far, we have lacked the commitment to the vision of energy sustainability that is uniquely ours here in Hawaii. That commitment should be our moral imperative, the gift we leave for our children and grandchildren. Attaining this vision will require a sustained investment, but already the best minds of our generation are inventing ways to make the costs of that investment not only bearable, but transformational. It's time to roll up our sleeves and get to work.

Section IX. Appendices

Appendix A. Energy-Efficiency Policy Symposium, November 9, 2000, List of Speakers

Appendix B. Evaluations of Renewable and Energy-Efficiency Technology Incentive Alternatives

Appendix C. Tax Credits/Rebates Claimed for Solar Devices Statewide

Appendix D. The Economic and Fiscal Impacts of The Hawaii Solar Water Heating System Energy Conservation Income Tax Credit

Appendix E. The Economic and Fiscal Impacts of The Hawaii Photovoltaic (Solar Electric) Energy Conservation Income Tax Credit

Appendix F. The Economic and Fiscal Impacts of The Hawaii Wind Energy Systems Energy Conservation Income Tax Credit

Appendix G. Individual Returns Claiming Energy Tax Credits by Size of the Credits and by AGI - 1999

Appendix H. Credit Distribution Relative to Tax Return Distribution

Appendix I. Analysis of Alternative Commercial and Multi-Family Dollar Caps on the ECITC

Appendix J. Peer Review of The Economic and Fiscal Impacts of The Hawaii Energy Conservation Income Tax Credit for:

- Solar Water Heating Systems
- Photovoltaic (PV) Energy Systems
- Wind Energy Systems

Appendix A

Energy-Efficiency Policy Symposium
November 9, 2000

Speakers and Presentations:

Jack Zagar: The End of Cheap "Conventional" Oil
Dr. Leroy Laney: A Peer Review of *The Economic and Fiscal Impact of the Hawaii Energy Conservation Income Tax* Credit by Thomas A. Loudat, Ph.D., Revised January 27, 1997
Dr. Thomas Loudat: The Economic and Fiscal Impacts of the Hawaii Energy Conservation Income Tax Credit
Marwan Masri: The California Energy Commission's Renewable Energy Program

Matthew Brown: The National Conference of State Legislature, Renewable Energy Policies in Other States
Robert McGuffey: North Carolina Policies and Program for Energy Efficiency and Renewable Energy
Michael Neary: Arizona Public Policy – Solar and Renewable Energy
Peter Dreyfuss: Federal Policies and Million Solar Roofs
Dr. Albert Bartlett (Professor Emeritus, University of Colorado): Reflections on the Twentieth Anniversary of the Paper, *Forgotten Fundamentals of the Energy Crisis,* Additional and Updated Information
Ruby Hargrave: Honolulu Community Action Program
Terrence George: Solar Water Heating Systems Benefit the Working Poor Three Ways: A Case Study of Consuelo Foundation's Self-Help Housing Initiative in Waianae, Oahu
Cully Judd: Solar in Hawaii
David Waller: Hawaiian Electric Company's Energy $olutions Program: Partnership that Creates and Supports Local Businesses
Ray Starling: Priming the Energy Pump in Hawaii
Glenn Ching: Being Cool at Iolani School

Appendix B

Evaluations of Renewable and Energy-Efficiency Technology Incentive Alternatives

A. Overview

Act 163 Section 3. (a) directed the Task Force "explore the most cost-effective means for supporting increased energy efficiency and sustainability by", among other things, "examining alternatives to encourage the efficient use of energy". The Task Force interpreted the terms of this directive as follows:

> "alternatives" – alternative to the existing Energy Conservation Income Tax Credits (ECITC) model;
> "most cost-effective means" – from the perspective of the State;
> "for supporting" – the State is willing to invest in the implementation of State energy policy;
> "increased energy efficiency and sustainability" – above the level currently attained by the ECITC model.

With these interpretations the Task Force identified and evaluated six alternative models to the ECITC while using the ECITC as the base case model. The models examined are:

- Revolving Loan Program
- Emissions Fees
- Mandates
- Public Benefit Charges
- Utility Green Power Acquisitions
- Impact Fees.

B. Methodology

The Task Force screened the various models by employing methodologies that included qualitative assessments, semi-quantitative assessments and quantitative assessments. A qualitative assessment was performed on all models. If a model passed this screen, then either a semi-quantitative or quantitative assessment was performed, depending on the availability of data. The qualitative assessment involved a common sense approach to satisfying the two fundamental criteria for model viability delineated in Act 163. Those criteria are the model is: 1) more cost-effective and, 2) increases energy efficiency and sustainability, compared to the ECITC base case. If it was apparent that a model did not satisfy both of these criteria, the model was not considered viable, and no further detailed assessment was performed. However, if the model passed the qualitative screen a more detailed assessment was conducted.

What determined whether a model was subjected to a semi-quantitative or full quantitative assessment depended on the availability of input data. The most complete data set available is that for solar water heating systems covered by the ECITC model. This data set allowed for a rigorous detailed analysis of the fiscal and economic impacts of the model to the State. The Task Force established the completeness of this data set as the base line for determining whether a full quantitative assessment could be performed. Models for which data sets were less complete than the base line set were subjected to semi-quantitative assessments based on the best available data.

For the semi-quantitative assessment approach the Task Force evaluated the costs and benefits in terms of more general factors, e.g., would additional government jobs be needed? If so, costs would increase, and vice versa. Would the proposed candidate model provide the same or greater energy efficiency benefit in terms of reducing our dependence on imported fossil energy? This was accomplished by estimating if the proposed candidate model would provide an equivalent or greater incentive, and result in the installation of an equivalent or greater number of renewable and energy efficiency systems. The Task Force believes this type of quasi-quantitative analysis has value, as it can indicate trends.

C. Evaluation

The Task Force, where practical, established standardized evaluation parameters that were applied to each model. Some models were not conducive to such organization for various reasons. The evaluation considered the following elements:

1. Description – a description of the candidate model in sufficient detail to convey an understanding of the objectives of the model and how it would be implemented;
2. Funding mechanism - a discussion of how the model would be funded, e.g., as a charge to ratepayers or taxpayers;
3. Administration – a discussion of the administrative requirements for implementation of the model;
4. Personnel – an assessment of the number of jobs required for implementation with respect to the ECITC model;
5. Barriers – a discussion of potential barriers to the implementation of the candidate models;
6. Conclusions – an assessment of the candidate model with respect to the overall criteria of: (a) cost-effectiveness to the State, and (b) energy efficiency and sustainability goals, and;
7. Recommendations – does the Task Force recommend the candidate model for replacement of the ECITC?

The evaluation of each model follows this section.

Revolving Loan Program Model

Description

The Task Force examined the feasibility of the establishing a revolving loan program to finance installation of approved technologies. The premise of this model is that by addressing the barrier of high initial first cost of renewable and energy efficiency systems, consumers will be provided incentive to make a purchase they would otherwise decline. These technologies provide economic benefits to the purchaser over the life of the systems but their initial costs preclude participation by those who do not have the initial capital. A low- or no-interest revolving loan could address this barrier. The loan program could provide funds directly to issue loans or loan guarantees.

Funding Mechanism

The Task Force invited staff from the Department of Budget and Finance to discuss the concept of using reimbursable general obligation bonds to support a loan program for residential and corporate taxpayers who purchase and install renewable and energy efficient technologies presently covered by the ECITC.

The Department of Budget and Finance reviewed federal regulations regarding use of bond funds and determined that a loan program, in general, for individual and corporate taxpayers for private use would not meet Federal requirements for “public use.” Bonds are a low risk investment exempt from State and Federal taxes. They are low risk because the State pledges payment. To qualify for Federal tax exemption and lower interest rates, the use of the funds must be for “public purpose.”

Federal law, however, provides some flexibility but with a strong caveat of caution: Federal law allows that "10% of a bond issue not to exceed $15M" may not meet the “public purpose” requirement. These non-public purpose, tax-exempt bonds, however, must be closely monitored to ensure compliance with Federal requirements. Therefore, if a $150M bond were issued and $15 M were set aside for a loan program for individual and corporate taxpayers, the funds (initially given out and as they are returned for reinvestment/revolved in new loans) must be monitored to meet federal regulations. Failure to comply with the regulations means the full $150M bond issue will be subject to revocation of tax-exempt status.

Also of concern to the Task Force is the State Constitutional cap on bonds and the present plethora of bond requests to support programs. According to the Department of Budget and Finance:

> *Market perception of the State’s fiscal management practices will impact the State’s credit rating and therefore its cost of borrowing, i.e., the rate of interest on GO bonds and the amount of bonds that the State can issue annually. Market perception is governed in large part by the municipal bond market and bond rating agencies who take into consideration the State’s debt service capacity and economic outlook.*

The Department of Budget and Finance also noted their concern about the number of programs requesting bond financing and the State's caution about bond issues that may jeopardize the State's newly re-established double A rating. It was felt that the administration would not be supportive of using bonds for a loan program.

The Task Force also explored other loan opportunities already in place. The City and County of Hawaii, the County of Hawaii, and the County of Kauai offer Residential Rehabilitation Housing Loans supported out of their federally funded Community Development Block Grant Programs. Depending on the income level of the applicant and the county, the loans have no to low-interest for up to $20,000 to $25,000. The purpose of the Rehabilitation Loan Program is to assist qualified homeowners comply with health and safety building standards. The three counties include solar water heating as part of the housing rehabilitation program.

Administration

The administration of this model by the State would involve the establishment of a lending institution. This State operated lending institution would need to determine loan qualification criteria, develop loan documents, screen loan applicants, issue loans, collect payments, and establish loan delinquency and default policies and procedures. In addition, if the savings from the proposed system were to be applied to the loan payment, the lender would want some assurances that those savings would be realized. This implies some sort of verification process. Alternately, the State could contract these services to existing lending institutions to issue loans or the State might implement the loan program.

Personnel

In either scenario, additional State staff would be required to administer the loan program. More State staff would be needed if the State administered the program directly. Although less State staff would be required if the State out-sourced the program, additional staff is necessary to administer the contract with the lending institution.

Barriers

The Task Force identified a number of barriers to this model. Private use of State general obligation bonds is strictly limited under Federal law and penalties for breach of loan conditions are severe. Failure to comply will mean the ENTIRE bond issue will become taxable.

Additional concerns of the Task Force focused on the number of renewable systems that could be installed with $5M or $15 M bond support. A $5M loan program could provide for about 1000 solar water heating systems; a $15M loan program could support about 3,000 solar water heating system installations. These are below the present number of annual installations. In 1999 the Department of Taxation reported 3,948 claims for tax credits.

To maintain a level of only 3,000 solar water heating systems per year, the State would need to issue $150 million in bonds <u>each year</u> under the federal 10% rule. ($150 million x 10% =

$15 million; $15 million / $5,000 per system = 3,000 systems/year.) This does not account for funds needed for photovoltaic or wind energy systems. Incurring such debt would adversely affect the State's bond rating and make borrowing money for other State programs and projects more expensive. This model assumes that all 3,000 system installations would be financed under this program. This is highly unlikely. Only about 60% of the systems are currently financed by private lending institutions.

Conclusions

In applying the criteria set forth in Act 163 the Task Force finds that from the perspective of the State, a revolving loan program is neither more cost effective nor will it increase energy efficiency and sustainability. The requirement of additional State staff, the cost of borrowing money for the bonds, and potential loan defaults all make this model more costly than the current model.

In view of concerns such as the Federal restrictions on the use of bonds, the Department of Budget and Finance's cautions on using bonds, the added administrative costs of operating a loan program, and the concern for preserving demand-side management programs, a loan program was not more cost-effective that the present ECITC.

Furthermore, historical data demonstrate that the 1,200 systems (3,000 x 40%) not financed would not be installed at all without tax credits. Without tax credits utility rebate programs would no longer be cost-effective, resulting in fewer systems being installed.

Recommendations

For the reasons stated above the Task Force does not recommend adoption of this model. However, the Task Force does encourage the State to consider a loan program as a complement to tax credits. Experience has shown that consumers are very concerned about the first cost for purchasing a solar water heating system. Tax credits remove the consumer concern about first cost, but loans do not. Also, loans have an impact on consumer credit ratings and the ability to secure additional loans. Many consumers are reluctant to obligate themselves to a loan that will affect their monthly cash flow and jeopardize future loan needs. Therefore, tax credits continue to be the most attractive incentive to consumers. The Task Force encourages the State not to adopt a loan program without continuation of tax credits as proposed in this report

Emissions Fees Model

Description

The Task Force explored the feasibility of assessing emissions fees on U.S. Environmental Protection Agency (EPA) covered sources. The concept behind the emissions fees model is that those who pollute should pay fees that are applicable to remedy effects of their pollution.

Dr. Bruce Anderson (Director, DOH) and Gary Gill (Deputy Director, Environmental Health, DOH) participated in the discussion with the Task Force members on this model.

Emissions fees would be imposed on "emitters" by the State to finance rebates at a level sufficient to provide an equivalent benefit to the ECITC. The fees would be structured to include amounts for both the credit at the level required for each technology and utility rebates where applicable.

Funding Mechanism

Fees would be paid by the "emitters" for emission of the recognized pollutants at a rate to be determined. These fees would be in addition to the emissions fees already being paid by the utilities under the federal Clean Air Act. The current fees are $40/ton for sulfur and nitrogen oxides and particulate emissions. A dedicated trust fund would need to be established by the State to hold and disburse collected fees.

Administration

The "emitters" would pay the fees to the DOH, which, in turn, would transfer the monies to a trust fund to be administered by DBEDT or subcontracted to a private, non-profit corporation (Corporation). Consumers would then apply to DBEDT or the Corporation for a rebate for installation of approved renewable and energy efficiency systems. Procedures would be developed to verify installation of systems and for payment of the rebate to the consumer or to the installer.

Personnel

Additional State or State-funded jobs would need to be created in order to administer this type of program, which would increase implementation costs compared to the existing ECITC model.

Barriers

The implementation of emission fees will avoid the use of tax credits and, thus not require a consumer to have a State tax liability in order to participate. However, use of the emission fees approach shifts the burden from the taxpayers to the ratepayers, and would likely result in utility rate increases.

Any rate increases due to the imposition of the emissions fees would adversely affect those least able to afford increase, i.e., low-income ratepayers. However, this concern could be addressed by requiring an additional adjustment in the existing utility low-income cross-subsidy.

The adoption of the emission fees model might jeopardize existing utility rebate programs and result in a smaller market for renewables and energy efficiency systems. The change from the ECITC model with a tax credit and rebates would require revision of the existing utility DSM programs. The time required to gain approval from the PUC on any changes to the DSM programs would need to be considered if this model were to be implemented.

The inter-governmental collection, transfer and accounting of funds is not cost-free. The associated "overhead" costs would need to be factored into the emissions fees structure in order to collect sufficient fees to maintain the current level of activity found under the ECITC model.

Conclusions

An emissions fees approach may have some merits, i.e., the State places a fee on the "emitters", largely fossil fuel generators, to support clean energy and energy efficiency alternatives. The benefits of the emissions fees model appear at least equal to or possibly greater than the ECITC model, as participation would not be limited to taxpayers.

If it were feasible to implement this model under DBEDT or a Corporation, the Task Force felt that the overall implementation costs to the State would be greater. The increased costs, however, would be offset at least in part by reduced costs to the Department of Taxation, which would not have to administer the ECITC.

Recommendations

The Task Force believes: (1) the costs of implementing the emissions fee model by DBEDT would be more costly than the ECITC model. While implementation by a private, non-profit corporation might appear to be less costly, State funds would be required to facilitate its establishment and operation, and (2) the emissions fee model could provide an equal or possibly greater energy efficiency and sustainability benefit to the State. Therefore, the Task Force does not recommend an Emissions Fees model at this time, as it fails to meet the cost-effectiveness criteria.

Mandates Model

Description

Government mandates of renewable energy and energy efficient technologies have been advocated repeatedly as an alternative to the Energy Conservation Income Tax Credits. The Task Force explored this alternative model and came up with the following model description. The State would mandate installation of specific renewable energy and/or energy efficient technologies. Historically, mandates have been limited to solar water heating systems and to new residential dwellings. The Task Force consensus was to expand the technology scope to any that passed prescribed cost-effectiveness tests and to expand the scope in an attempt to increase the adoption rate of technologies. The mandates would apply to three categories: 1) all new buildings; 2) all building renovations; 3) all buildings which change ownership and which have not adopted one of the prescribed technologies.

The Task Force recognized that allowing a variety of renewable energy and energy efficient technologies to be mandated would provide greater flexibility in compliance with the mandates. The Task Force attempted to address concerns that, at the current building rate, the residential new construction market would result in a market size of about one-third of the current market. Hence, the Task Force agreed to include other segments of the building and real estate industry to optimize an increase in adoption of renewable and energy efficient technologies.

Funding Mechanism

Government mandates of renewable and energy efficiency technologies effectively shifts government investment in these technologies via tax credits to required investments by the private sector. Under this model, State energy policy would be financed predominately, but not exclusively, by the private sector. Presumably the mandates also would apply to government buildings as well, so the State would need to conduct an assessment to determine what amount of funds it would need to allocate for mandated projects.

Administration

Administration of this model would require all affected government agencies to verify compliance with the mandates. For private sector buildings, all of the State and county permitting agencies would be affected. In addition, the Bureau of Conveyances would need to ensure the mandates are present and recorded. The Department of Business, Economic Development and Tourism may be called upon to determine which technologies would be appropriate to mandate and to develop analytical tools to apply cost-effective tests. For public buildings, all of the State and county agencies involved in capital projects containing buildings would be affected in addition to all relevant permitting agencies.

Personnel

The Task Force anticipates that this model would require additional governmental staff for both the State and county agencies affected by the mandates. The required positions would be for verifying compliance and for the necessary training for existing staff at all affected agencies.

Barriers

Mandates would increase the cost of new construction and the resale cost of existing buildings in the State. This would result in higher cost of housing and higher cost of doing business in the Hawaii. The increased cost of doing business would be passed on the consumers, who would not necessarily derive any direct benefit from the mandated technologies. In addition to the cost of the mandates, the private sector (e.g. the construction and real estate industries) would need to hire and train additional staff to insure compliance with the mandates. This additional cost also would be reflected in the price of the new buildings and resale of existing buildings. The increased cost of buildings may result in the unintended negative consequences of forestalling new construction and resale of existing buildings. This could lead to a decrease in State revenues. Also, installing specific technologies on some buildings may be inappropriate. Mandates may also result in decreased competition and may exclude promising new technologies that are not covered by mandates.

The Task Force felt that the best index of the feasibility of mandates as an alternative to the ECITC would be to survey the construction industry. Consequently, a directed sampling form was created and transmitted to members of the Building Industry Association. While the survey results are not definitive, they do indicate mixed views on what the State energy policy should be. The results are reproduced in full as follows:

Energy Policy Task Force
Survey for Private Sector

Energy Policy Affects Your Company

Government energy efficiency measures can affect the cost of construction and the end price paid by the customers. Your response to this survey will let the energy Task Force know how the industry feels about mandates and incentives. Individual responses will be kept confidential.

Please fill out the following survey and return it by fax to the Building Industry Association at (808) 842-0129.

Total responses to date: 24

	Support	Do Not Support	Not Certain	Do Not Care
State policy should promote energy efficiency and the use of renewable energy, such as solar energy.	20	2	1	1
State policy should promote energy efficiency and the use of renewable energy, such as solar energy through…				
a. voluntary programs	20	1	1	
b. laws mandating use/installation of these devices	4	9	5	1
Installing energy efficient or renewable energy devices should be a mandatory measure for				
a. new homes built	8	8	7	1
b. resale of existing home	3	11	8	1
c. replacement of broken appliances or water heating systems	8	7	7	1
The State should offer incentives, such as tax credits, to support the installation of energy efficient or renewable energy devices.	22			1

Comments:
Energy efficiency should be a voluntary program-let the market dictate its use. We have enough mandates already.

Do not make it mandatory unless tax incentives are part of the measure.

All government levels should do everything possible to encourage energy savings through consumer incentives ($$)

I don't support government laws that make the price you pay for a new or old house more expensive. The government should be supporting research that is looking for affordable energy efficient alternatives. When the cost of these products becomes competitive with the affordable, not-so-efficient products we now have, the public will choose them over the less efficient products without government mandate.

Never mandatory…only by incentives.

We need to protect our natural environment and resources with the support of State and Federal regulations. Since the cost to build in Hawaii is greater than in other States, laws also need to be compatible with the needs of the building industry and not add additional cost to build without providing incentives or relief in some form. Let's work together to keep Hawaii a special place!

I am afraid to say the State should "support" anything because it always means more State employees and higher taxes with no benefit to anyone!

We need to stop making HECO rich and become energy-rich!

Conclusions

In applying the two criteria of more cost-effective and increased energy efficiency and sustainability, the Task Force has concluded that a mandate model will result in additional cost to the State in the form of additional staff and the additional costs of the installing mandated technologies on government projects, but would increase the installation of prescribed technologies. However, in view of the overwhelming opposition within the building industry to imposition of mandates requiring energy conservation installations, the Task Force felt that further inquiry into this alternative was unnecessary.

Recommendations

The Task Force does not recommend adoption of the mandate model because it does not meet both criteria necessary for replacement of the tax credit model.

Public Benefits Charge Model

Description

A Public Benefits Charge (PBC) [sometimes called a System Benefit Charge] would be collected from ratepayers to finance rebates at a level sufficient to provide an equivalent benefit to the Energy Conservation Income Tax Credit (ECITC). The PBC model emerged as a replacement to DSM programs. As utilities across the nation faced deregulation, they phased out demand-side management (DSM) programs. States recognized the public benefits DSM programs had but were no longer being provided. Hawaii currently has a very aggressive and successful DSM program.

Mr. Steve Alber from DBEDT made a presentation on PBC's to the Task Force. Mr. Alber defined and discussed the purposes, potential bases for charges for PBC's. He also discussed PBC's as they are being implemented in 15 other States and a possible PBC for Hawaii. Mr. Alber was unaware of any States where PBC programs operated in parallel with utility DSM programs. He noted that a PBC of 0.609 to 0.710 mills/kWh could raise $6M to $7M Statewide based on projected electricity sales in 2001.

Funding Mechanism

All ratepayers, including all government agencies, would pay the PBC as a surcharge on their utility bill based on energy usage. The surcharge would most likely be a fraction of a mill per kWh. The exact amount would be determined, in part, by reaching agreement on the total amount of funds to be raised.

Administration

The monies collected by the utility would be transferred to a trust fund to be administered by a State agency or a private, non-profit corporation (Corporation). The trust fund would need to be established by an Act of the State legislature. Consumers then would apply to the designated State agency or the Corporation for a rebate for installation of approved renewable and energy efficiency systems. Policies and procedures would be developed to verify installation of systems and for payment of the rebate to the installer or to the consumer. Upon obtaining this verification, the consumer would then apply for the actual rebate. The State agency or the Corporation would then approve and issue a rebate check. Data collection and management systems would be developed to track customer transactions, administration, marketing and implementation costs. Periodic reports would be prepared and submitted to the appropriate agencies.

Personnel

Additional government or government-funded private sector staff would be required to manage and implement this model.

Barriers

The collection of funds via a Public Benefits Charge Model, like the Emissions Fees Model, would shift the burden from the taxpayers to the ratepayers, and would likely result in utility rate increases. However, the combination of renewables and energy efficiency measures installed as a result of the requisite rate increases may defer new generation requirements.

Any rate increases due to the imposition of the PBC would adversely affect those least able to afford increase, i.e. low-income ratepayers. However, this concern could be addressed by requiring an additional adjustment in the existing utility low-income cross-subsidy.

The adoption of the public benefits charge model would jeopardize the existing utility rebate programs and result in a smaller market for renewables and energy efficiency systems. The change from the ECITC model with a tax credit and rebates would require revision of the existing utility DSM programs. The time required to gain approval from the PUC on any changes to the DSM programs would need to be considered if this model were to be implemented.

Conclusions

The Task Force has concluded that the overall costs to the State to implement this model under a State agency or a Corporation would be much greater than the current tax credit. Specifically, a significant portion of the PBC could be required to cover administrative costs, thus reducing the amount available for rebates to the consumer. These increased costs, however, would be offset at least in part by reduced costs to the Department of Taxation, which would not have to administer the ECITC.

The Task Force felt that the use of a PBC would more suitable where a number of support and incentive programs are envisioned, such as in California. However, even in California, there are second thoughts as to whether their PBC approach is as cost-effective as other potential approaches.

The PBC model appears to offer at least equal or possibly increased energy efficiency than the ECITC model, as the participation base would be broader.

Recommendations

The Task Force does not recommend a PBC model at this time, as it fails to meet the cost-effectiveness criteria. There were also concerns about the overall efficiency of the PBC process, which could lead to less overall renewable energy and energy efficiency systems installed and less avoided fossil fuel use.

Utility Green Power Acquisition Model

Description

Utility green power acquisitions (UGPA) can provide at least two alternatives to the existing ECITC and have some potential advantages over other approaches. The UGPA could include: 1) direct purchase of customer-sited green power at premium rates, 2) and lease of utility-owned systems to customers or lease of the customer's site (including the roofs of buildings) for installation of utility-owned systems.

Alternative 1 - Utility Green Power Purchase

In the Utility Green Power Purchase (UGPP) alternative, the utility pays an appropriate price (usually a premium) to purchase green power from a customer who has installed a system at his site.

Such a program exists in Germany whereby the utilities will purchase electricity from PV installations up to 5 MW in capacity at a minimum of 99 pfennigs per kWh, which is one pfennig (pf) short of a Deutsche Mark (DM). Given the current exchange rate of the DM (2.15 or so per $), that translates to about 46 cents/kWh! If the consumer has a net metering agreement, the payments would be reduced by the amount of the retail value of the electricity. The payments are made for 10 years with the amount being reduced by 5% per year. There is a system subscription limit of 350 MW of installed capacity. Prior to the end of this program, the government is obligated to review and continue support in an appropriate manner. The program appears to be working very well for PV, but does not apply to solar hot water systems.

For Hawaii, an appropriate purchase price for PV might be 50 cents/kWh. For example, if a customer installed a 2 kW system, he might expect 5 peak hours a day or 10 kWh of electricity a day. At 50 cents/kWh, that would be $5/day or $150/month or roughly $1,800 a year. After 10 years, the consumer would have been paid $18,000 or $9/watt. The direct payments would be reduced for net metered systems. For example, if the retail rate were 20 cents/kWh, the payments would be 30 cents/kWh resulting in $3/day, $90/month, $1,080/year and $10,800 for 10 years.

For Solar Hot Water, since electricity is not generated, the utility could make a payment for the amount of electricity demand that has been avoided. For example, the payment might be an average of $50/month over a seven-year period for a family of four. The existing utility rebate would be discontinued and replaced with the monthly payment scheme. Utilities could use green power purchase as incentives that supercede the existing rebates and the ECITC.

Alternative 2 - Utility Green Power Leases

In the Utility Green Power Leases (UGPL) alternative, the utility would install and operate a utility-owned renewable or energy efficiency system at a customer's site. The utility would lease the system to the customer. The lease payment by the customer to the utility would be offset by the retail value of the energy saved (e.g. solar water heating) or produced (e.g. PV or wind energy) by the system. The lease periods and payment would be structured so that the customer receives a net positive benefit. In the case of systems that produce electricity, since those systems are utility-owned, any surplus generated electricity would be distributed to other customers.

A variation to the utility installed, owned and operated electricity-generating equipment on customer premises would be for the utility to pay the customer to lease the roof or other space. In either case, the consumer would not have to invest directly in the equipment. She would also not own the equipment. In the first case, the consumer would receive direct benefits, whereas in the second case, the electricity would be fed directly to the grid.

Funding Mechanism

Under Alternative 1, utility customers would invest in the renewable energy or energy-efficiency technologies and utility ratepayers would finance the premium payments. Under Alternative 2, the utility would make the initial investment and the investment would be recouped through customer lease payments.

Administration

For both alternatives, the utility would need to design, develop, and implement, with PUC approval, a Utility Green Power Acquisition program. The utility would need to develop, among other things, policies and procedures for to accommodate customer participation, and data tracking systems for program expenses and participating customers. In addition, the utility would need to prepare and submit program reports to the PUC. For solar water heating systems, some demand-side management program (DSM) administration features may be applicable. However, PV and wind energy systems would require the development of new program administration features.

Personnel

No additional government or government-funded private sector staff would be required. Additional utility staff would be required for program implementation.

Barriers

The use of UGPA alternatives would shift the burden from the taxpayers to the ratepayers, and would likely result in utility rate increases. Rate increases require review by the State Consumer Advocate and approval by the State PUC. Once approved the increases would apply to all ratepayers, including the State. In addition, the requisite rate increase would not apply to unregulated energy service providers and therefore, penalizes rate-payers unjustly. However, the combination of renewables and energy efficiency measures installed as a result of the requisite rate increased may defer new generation requirements. Any rate increases due to adoption of this model would adversely affect those least able to afford increase, i.e. low-income ratepayers. This concern could be addressed by requiring an additional adjustment in the existing utility low-income cross-subsidy.

The adoption of the UGPA alternatives would likely require a wholesale restructuring of the existing utility rebate programs. The time required to gain approval from the PUC on any changes to the DSM programs would need to be considered if this model were to be implemented.

There will be an additional cost for the utilities to administer green power purchases. This would include installation of second meters at customer sites in most cases, and measurement and reporting of system outputs. However, these costs will be offset, at least in part, by the elimination of the need to issue rebate checks.

Since, under the UGPP scenario, the consumer would need to finance the total amount of the system, this could prove to be a deterrent. One of the advantages of the existing ECITC model is the reduction of the up front costs the consumer must pay or finance. Under the UGPL scenario widespread customer acceptance of utility owned equipment on a customer's roof was considered unlikely by the Task Force.

Conclusions

The UPGA model is predicated on utility rate increases to finance the premium payment for electricity avoided or generated from renewable energy systems under the UGPP scenario, or utility acquisition and installation of renewable energy systems under the UGPL scenario. Those rate increases would apply to the State, as well as all other utility customers. The rate increases required to maintain the current level of activity experienced under the Tax Credit model would result in electricity cost increases to the State of nearly twice that of the tax credits claimed in 1997, the most recent year for which data is available.

The UGPP approach encourages implementation of distributed generation. Much like the utility pays its Independent Power Producers for the electricity they generate, the utility now would pay for generation and delivery of distributed electricity also. Consequently, the UGPP is most applicable to renewable systems that generate electricity. However, with customers confronted with paying 100% of system costs in absence of tax credits and utility rebates, the number of systems and consequently, the level of energy efficiency and sustainability, is expected to decrease.

The UGPL could work for both generators and generation-offset technologies, such as solar hot water heaters. The UGPL approach allows the customer to participate without the up front cost and the utility can participate in the investment opportunity. It assumes that the PUC is prepared to allow the utility to assume the associated responsibility and risks associated with procuring, owning, installing and operating the renewable energy systems. However, even assuming the PUC would approve this model, the level of energy efficiency and sustainability is expected to decrease because of the anticipated reluctance by customers to allow utility-owned equipment to be place on their roofs.

Recommendations

The Task Force does not recommend either of the UGPA models at this time. Both alternative described under this model would result in decreased energy efficiency and sustainability and increased costs to the State.

Impact Fees Model

Description

Impact fees are typically used to cover costs to meet new demand for public infrastructure, such as highways, parks, water, wastewater treatment and electricity. This model involves the assessment by counties of impact fees for all costs associated with providing electricity to new consumers. At certain assessment levels impact fees could create a more equitable market opportunity for renewable energy and energy efficiency technologies without tax credits or utility rebates. The effect of impact fees would be to level the field for alternatives that can't compete in the existing market. (Renewables are competitively disadvantaged in the market place, because the Federal government provides hefty subsidies for fossil fuels.) In essence, if you get the price of the commodity or service right (excluding externalities) to begin with, you will create more open market where the barriers for new products and services are reduced.

A land developer or a consumer would pay an impact fee to include all of the costs associated with meeting his anticipated new electricity demand. The fees would include components for generation, transmission and distribution. Thus, a developer or consumer would be motivated to install energy-generating or energy-saving devices as an alternative to paying the impacts fees. Currently, developers pay impact fees for the extension of utility lines to the property, as well as for transformers, service drops to individual homes, meters, etc. These fees are passed on to the homeowner-consumer, but may be only a portion of the total distribution costs. For example, current HECO practice is to credit the developer for an amount equivalent to five years of the expected revenues due to electricity purchases by future homeowners. More importantly, the developer does not pay an impact fee for transmission and power supply. The net effect of including all of these three components (transmission, distribution and power supply) and eliminating the 5-year credit would increase the impact fees by at least 50%. Given that, a developer/homeowner would give pause to consider alternatives to reduce and/or possibly eliminate the need for new utility service.

Funding Mechanism

Consumers, including government agencies, seeking new electricity service would pay the impact fees to the appropriate county building agency.

Administration

The various county agencies responsible for issuing building permits would develop a fee schedule based on new electricity demand shown on project plans. Plan reviewers would determine the fee amount at the plan review stage and permit applicants would pay the fee at the time the building permit was issued. Since project plans usually change during the course of construction, actual fees would be based on "As-Built" plans that show what electrical loads actually were installed. The counties would use to fees to cover the costs of administering this model.

Personnel

Additional government sector staff would be required. It is anticipated that additional county staff would be required to implement the proposed new impact fees.

Barriers

County staff would require training in the administration of this model. Additionally, the Counties may have their own perspective about being required by the State to implement State energy policy.

Impact fees would be applied primarily to new construction, which represents approximately one-third of the current market for renewables and energy-efficiency technologies. Therefore, the implementation of impact fees would not provide the same level of energy efficiency and sustainability.

This model would increase new building construction as well as renovation costs. Increased building costs may result in the unintended negative consequences of deterring investment by the construction industry. This, in turn, would result in less revenue to the government.

Implementation of impact fees also calls into question the need for continuation of the utility's DSM programs. Specifically, the traditional purpose of DSM has been to reduce demand. However, the cost of DSM is born by all of the ratepayers. If impact fees are imposed, the cost of meeting new demand will be born by those requiring the new demand. Hence, the existing ratepayers remain whole.

There may be an additional cost for the utilities and counties to administer the impact fees. However, utility costs will be offset by the elimination of the existing programs, including phase out of DSM over time. The costs to the State may be reduced, as the Tax Department would not have to administer the ECITC.

Potential changes to the utility DSM programs would require approval by the PUC, which could take a year or more and would need to be considered if impact fees were to be implemented.

Conclusions

Implementation of impact fees is a government-based approach, which could level the field by getting the price for electricity right in the first place. The implementation costs would be less than for the current ECITC model. However, since impact fees would be assessed on new construction, their implementation would provide a reduced energy-efficiency and sustainability benefit.

Use of impact fees would accelerate the education of developers and consumers in the cost of conventionally delivered electricity and alternatives. However, this approach raises serious questions about the objectives of the current utility DSM programs, and whether they should be continued in the future.

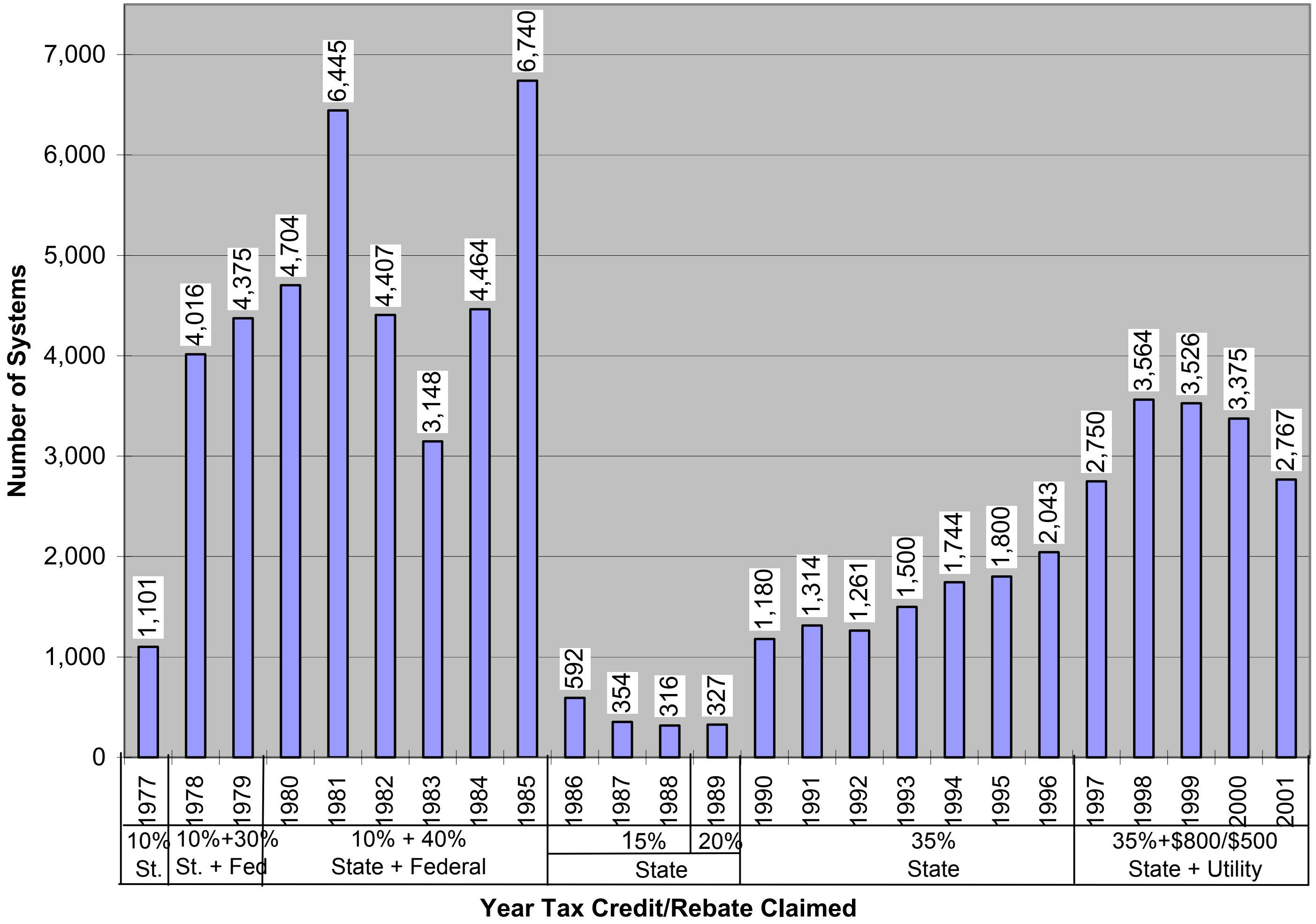
Recommendations

The Task Force does not recommend an impact fees model at this time because it fails to meet the energy-efficiency and sustainability criteria. There were also concerns about the potential impacts of the currently utility DSM programs.

Appendix C

Tax Credits/Rebates Claimed for Solar Devices Statewide

(Sources: State of Hawaii Department of Taxation, HSEA and HECO, HELCO, MECO)



Notes: State tax credit data available for 1977-92 and 1994 only. Data for 1993, 1995, 1996 from HSEA. Data for 1997 forward from HECO, HELCO, MECO Programs only; data for systems installed outside of utility programs in 1997 forward not available.

Appendix D

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII SOLAR WATER HEATING SYSTEM ENERGY CONSERVATION INCOME TAX CREDIT

Prepared by:

Thomas A. Loudat, PhD

Prepared for:

The Hawaii Energy Efficiency Policy Task Force

March 11, 2002

EXECUTIVE SUMMARY

The current effective credit received by a purchaser of a solar water heating system is 43% of the purchase price of a solar water heating system. The effective credit accounts for the State's energy conservation income tax credit (ECITC) of 35% and the ECITC-dependent Demand Side Management (DSM) rebate from the Hawaiian Electric Company (HECO) and its affiliates. At this effective credit level, the estimated number of systems installed based on the historical relationship between the effective credit level and the number of solar water heating systems purchased is 2,497 annually, which is slightly less than the 2,539 actual number of solar water heating systems purchased in 2001.

The State of Hawaii refunded to the 2,539 system purchasers in 2001 an estimated $2,808,000. This spending lead to the following estimated economic outcomes.

- Return to the State $5,123,000 in tax revenues per 2,539 system installations over the 25-year life of these systems, a revenue impact which increases the more systems continuously installed. For example, if the annual system installations become 5,078, $10,246,000 in tax revenue is generated over the life of these systems at current ECITC levels.
- Support 349 jobs each year the ECITC is at a 35% level and create 59 new jobs per 2,539 new system installations, a job impact, which increases the more systems continuously, installed. For example, if the annual system installations become 5,078, 698 jobs are supported and 118 new jobs would be created per year.

The historical relationship between the effective tax credit and the number of solar water heating systems sold also indicates that the estimated number of solar water heating systems sold would decrease to 284 with the elimination of the ECITC. Such a solar industry size reduction would lead to the following economic results.

- A decrease in tax revenues of $4,800,000 from general excise tax and individual and corporate income tax sources due to a reduction from the current 2,539 to 284 annual system installations. Payroll taxes such as unemployment insurance taxes would also be adversely affected, a tax impact not measured.
- A loss of approximately 309 jobs with new job creation reduced from 59 jobs per year to 7 jobs per year.
- An increase in fiscal costs such as unemployment insurance due to increased unemployment, not measured in this analysis.

The positive economic and fiscal impacts are based on a 35% ECITC. These results occur because a solar water heating system is energy savings capital equipment that has a useful life greater than one year. The energy saving capacity of these systems results in decreased oil imports, which leads to consequent economic and fiscal impacts over a system's life cycle. The analysis measures the economic effects created by ECITC stimulated purchases of solar water heating systems and 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 majority of solar water heating systems are installed at single-family residential units although there are commercial-type installations, mostly in multi-family residential unit complexes. Installations trended upward in recent years due to the DSM program instituted by HECO and its affiliates in 1996. The typical solar purchase involves third party project financing. For this purchase situation, the break-even ECITC level is 22.5% for year 1 and 80.4% over the life cycle of a solar water heating system. Stated otherwise, a credit level of 80.4% means that over the life of a solar water heating system, the State would incur a $0 net cost. To incur a $0 net cost in year 1 the credit level would be 22.5%.

It is important to note that the break-even levels noted make no accounting of the value of achieving public policy goals (e.g. energy conservation) via the use of the ECITC, the potential impact on the electric services industry, which installs and services solar water heating systems or negative fiscal impacts if the industry down sizes due to the elimination or reduction of the ECITC. As noted, elimination of the ECTCT would reduce the solar industry by an estimated 88% based on the historical relationship between the effective credit level and solar water heating system purchases, which indicates that a 1% increase (decrease) in the credit level leads to a 5% increase (decrease) in the number of system purchases.

The return to the State based on its ECITC solar "investment" and single-family solar water heating system purchasers are the following.

- For the State of Hawaii:
    - An internal rate of return (IRR) on "investment" of approximately 18.1%.
    - A pay back of the ECITC "investment" cost of 7 years for cash purchases and 8 years for financed purchases.
- For solar purchasers:
    - A pay back of investment cost of 4 years with the ECITC and 7 years without the ECITC.
    - An investment internal rate of return (IRR, cash purchase) of 27.4% with the ECITC, which is more than 100% greater than the 12.4% IRR without the ECITC.

ECITC benefit/cost ratios, where the ratio numerator is the benefit, which equals the respective result variable life cycle value and the denominator is the ECITC cost, are the following.

- Output/ECITC = 28.7: Each ECITC dollar spent stimulates a solar purchase resulting in $28.7 of output (sales). The total output effect for installations from 1996 to 2001 is $565,000,000.
- Employment/ECITC = 0.000025: Each ECITC dollar spent stimulates a solar purchase resulting in the creation of 0.000025 jobs. The total employment effect for installations from 1996 to 2001 is 492 jobs.
- Labor Income/ECITC = 10.94: Each ECITC dollar spent stimulates a solar purchase resulting in the generation of $10.94 of wage and salary income to workers. The total labor income effect for installations from 1996 to 2001 is $215,000,000.

- Tax Revenues/ECITC = 1.82: Each ECITC dollar spent stimulates a solar purchase resulting in the generation of $1.82 tax revenue. The total tax revenue effect for installations from 1996 to 2001 is $36,900,000.

Other important research results are the following for financed, single-family residential units.

- ECITC economic impacts for single system installations in 2001 are the following. (The value in parentheses notes the total economic impact of all system installs in 2001).
  - Economic output increases of $10,800 ($27,500,000) in year 1 and an average of $872 ($2,200,000) per year for years 2-25;
  - 0.14 (349) job(s) are generated in year 1 and 0.023 (59) average jobs per year from years 2-25;
  - $4400 ($11,100,000) wage and salary income is generated in year 1 and an average of $321 ($815,000) from years 2-25.
- ECITC fiscal impacts for installations in a given year are the following. (The value in parentheses notes the total fiscal impact of all system installs in 2001).
  - A net fiscal impact of ECITC stimulated solar purchases in year 1 of negative $380 (-$964,000), which is less than the $1106 ($2,808,000) ECITC amount refunded due to the fact that net revenues generated by solar water heating system purchases are $726 ($1,840,000) in year 1.
  - Net revenues in years 2-25 average $54 ($137,000) per year.
  - A total, life cycle net (of the ECITC cost) fiscal impact to the State of $912 ($2,300,000).
- Viewing the ECITC as a multi-year program beginning in 1990, the year it became 35%, the cumulative economic and fiscal impacts are:
  - Economic output, jobs and labor income per year maximums of $34,000, 0.41 and $11,800, respectively, per residential unit.
  - A cumulative fiscal impact becoming positive 10 years after the inception of the program because of energy-saving effects of past period solar installations. The cumulative fiscal impact peaks at $640 per unit per year while a 35% ECITC remains in existence.
  - From the cumulative perspective, the net fiscal impact of ECITC stimulated solar installs in 2001 is $426, not the negative $380 noted. This positive net fiscal impact is the result of returns from the State's ECITC investment in solar water heating system for the years preceding 2001.
- The overall net job and fiscal impact since the ECITC's inception in 1977 are:
  - The creation of more than 1800 jobs by 2002;
  - Tax revenues less ECITC costs of more than $84,000,000 from 1997-2002 and a forecast $150,000,000 for systems installed through 2001 by 2025.

INTRODUCTION

Solar water heating systems are a renewable energy technology that utilizes solar collectors placed on roofs to heat water. Solar water heating systems decrease reliance on imported oil used to generate electricity or make gas used to heat water because they use less energy than the electric or gas hot water heating systems replaced. As such, their installation and use not only has economic impacts to system purchasers but broader statewide economic impacts as well.

The Hawaiian Electric Company (HECO) currently provides a rebate to solar water heating system purchasers under the Demand Side management (DSM) program. Additionally, the State of Hawaii currently provides a 35% of purchase price less DSM rebate credit to purchasers the year the purchase is made to stimulate solar water heating system use. The 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. Because a solar water heating system is a capital item it has a life greater than one year. Thus, its energy saving capacity and its consequent economic and fiscal impacts extend over its life cycle.

Report Objective

The objective of this research is to assess the economic and fiscal impacts of the Energy Conservation Income Tax Credit (ECITC). This entails estimating the economic effects created by the purchase of a solar water heating system and those foregone due to its purchase. The net impact is the difference between the economic effects and derivative fiscal effects created and those foregone.

Data Sources

The data sources used for the analysis include the following.

- Primary data provided by:
  - Hawaii Electric Company, Ltd. (HECO);
  - Hawaii Solar Energy Association (HSEA)
- Secondary data sources including:
  - Oil price forecasts and data provided by the Energy Information Administration;
  - Tax data published by the IRS, the Hawaii State Department of Taxation and Department of Business Economic Development & Tourism (DBEDT);
  - The "1992 Hawaii State Input/Output Model" published by DBEDT.

Specific cites from these respective sources are found in the Appendix tables.

Methodology

User, lender and State cost and benefit cash flow accounts are formulated for solar and electric systems, the assumed system replaced by solar, for the assumed 25-year life of these systems. Cash flows are estimated for cash and financed purchases for residential single- and multi-family and commercial purchasers.

Benefits and costs for the respective entities are the following.

- User or system purchaser:
    - Costs include system purchase and installation costs, annual maintenance costs and purchase price amortization costs.
    - System benefits are the annual energy cost savings the system provides over its life relative to the system replaced, any tax savings from interest and/or depreciation deductions and DSM rebate and ECITC credit amounts.
- Lender:
    - Costs are the purchase cost of a system and taxes on interest income net of system depreciation.
    - The lender benefit is the interest generated by the loan made to purchase a system and DSM rebate and ECITC credit amounts if used to reduce loan principal for financed system purchases.
- State:
    - Cost is the ECITC the year the credit is taken by the system purchaser and interest and depreciation (if applicable) cost refunds.
    - Benefits are net tax revenues stimulated by the purchase of a solar water heating system.

Based on these cash flows, the economic performance of the investment is measured for each entity. Economic performance variables include:

- Pay back period of the investment;
- Investment net present value;
- Investment internal rate of return (IRR).

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 1992 Hawaii State Input/Output Model. The economic impact variables measured include:

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

The construction multipliers used do not capture the positive multiplier effect of the local manufacture of 25-30% of solar water heating systems sold in Hawaii. Thus, economic multiplier and consequent fiscal effect estimates are conservative.

General excise tax (GET) 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 ECITC cost to the State allow the determination of the net fiscal impact to the State of the ECITC program.

Residential unit results are reported on a per unit basis. Commercial results are reported on a single system basis. If data are available, totals are reported on an annual number of systems installed basis. Other details and assumptions of the methodology utilized for the analysis are presented on report pp. A1-A9. The discussion focus will be on single-family, financed residential systems.

The net fiscal impact measure makes no accounting of the "ECITC cost lag" that occurs due to the timing of the ECITC refund. Specifically, the ECITC refund occurs the tax-year after system installation. In contrast, benefits from system installation and energy savings result in net positive revenues to the State beginning in the previous year. If accounted for, the total net fiscal impact would increase relative to that reported.

RESULTS

Economic Performance

Table 1 shows the economic performance of solar water heating systems per purchaser and purchaser type. It shows that the payback on investment with the ECITC improves by 3 years, from 7 years without the ECITC to 4 years with the ECITC (cash purchase). Table 1 further shows that the purchase of a solar water heating system with the ECITC provides an average annual rate of return (IRR) of 27% (cash purchase) to its purchaser, more than 2 times the rate of return without the ECITC. Relative to benchmark returns from financial instruments, these are favorable rates of return.

The solar water heating system rate of return is due to the annual energy cost savings it provides over its life. In spite of such a favorable economic signal, the number of systems purchased in Hawaii is largely a function of the existence and size of the effective tax credit. This could be for economic reasons given the ECITC improve the economic return to the system purchaser. The ECITC could also be an informational factor (*e.g.* purchasers do not know or become aware of the benefits of a solar water heating system without the ECITC) and/or behavioral factor (*e.g.* purchasers are motivated by ECITC tax savings for reasons related to tax savings themselves and/or support for State energy policy as embodied in the ECITC) affecting purchase decisions. Whatever the reason, the ECITC leads to consumer investment in solar water heating systems.

The Relationship between Credit Levels and Solar Water Heating Systems Purchased

Chart 1 supports the conclusion just noted. It shows the estimated relationship between the size of the effective tax credit and the number of solar water heating systems purchased in Hawaii, which increases with the size of the effective credit.

Using Chart 1 results, the expected annual number of solar water heating system purchases is:

- 284 if there is no credit,

- 1,678 if there is an ECITC of 35% but no DSM rebate, and
- 2,497 if there is an ECITC with the current DSM rebate which provides an effective credit of 43% of the purchase price at the current ECITC and rebate levels.

These results suggest a reduction in the number of systems sold of 2,213 or 88% due to elimination of the ECITC and DSM program.

Economic Return to the State

A 35% ECITC provides a positive economic return to the State. Table 1 shows an average annual return of 18.1% due to the net sum total of economic impacts of solar water heating system purchase stimulated by the ECITC over its 25-year life.

Economic and Fiscal Impacts of the ECITC

Economic impacts are net changes in output, employment and labor income in the general economy. Fiscal impacts are net changes in government expenditures and revenues. Economic and fiscal effects measured in this analysis result from the State government's expenditure on the ECITC. Specifically, the ECITC stimulates the purchase of a solar water heating system creating economic and fiscal effects. Simultaneously, a solar purchase causes economic and fiscal effects to be foregone due to its purchase. Netting the effects foregone from those created results in the economic and fiscal impacts caused by the ECITC. There are also economic and fiscal impacts related to the DSM rebate program the existence of which is assumed contingent upon the existence of the ECITC.

Elimination of the ECITC would lead to other economic and fiscal costs for each system not purchased. These include output, employment and labor income decreases and their consequent impact on State tax revenues, and direct fiscal expenditures to the State in the form of unemployment insurance benefits. Costs could also include other expenditures due to temporary and possible permanent unemployment caused by a size reduction of the solar industry. This analysis does not measure these potential costs due to ECITC elimination.

Expenditure Pattern Changes Caused by the Purchase of a Solar water heating system

Purchase of a solar changes expenditure patterns of the purchaser. Changes result from differences in the purchase and maintenance costs of solar water heating systems and the electric systems assumed replaced (see Tables A2-A3). The most significant change, however, results from differences in operating costs of these systems. Operating costs of solar water heating systems result in an estimated average annual reduction in energy costs for a single-family residential unit of $597 when they replace an electric hot water heating system (see Table A2).

The money saved due to energy savings created by the use of solar water heating systems causes the export of $597 per year per residential unit less from the State for oil purchases and $597 more for alternative consumption or investment expenditures by those accruing the savings. The expenditure pattern of these savings is assumed the same as the average expenditure pattern within the State according to the I/O model. The expenditure pattern change from this energy savings causes the economic and fiscal impacts created by purchase of solar water heating systems.

Net Impact of a Solar Water Heating System

Table 2 shows the "Economic and Fiscal Impacts of ECITC Stimulated Solar water heating system Purchases." First and subsequent year effects and net impacts are distinguished to provide an accounting the year in which the purchaser receives the credit.

Table 2 shows purchase of a solar water heating system has positive economic impacts. Specifically,

- Economic output stimulated by the purchase of a solar water heating system increases a total of $10,800 in year 1 and an average of $872 per year per residential unit for years 2-25;
- 1.4 jobs in year 1 and 0.2 average jobs per year from years 2-25 per 10 solar water heating system installed;
- the generation of $4400 labor income in year 1 and an average of $321 from years 2-25 per residential unit installation.

Table 2 shows a negative net fiscal impact to the State (*i.e.* revenues less than expenditures) per single-family residential unit in year 1 of $380. This net fiscal impact to the State is less than the $1106 ECITC amount refunded per residential unit due to the fact that net revenues generated by solar water heating system purchasers are $726 in year 1. Net revenues in years 2-25 average $54 per year per residential unit. In total, the net fiscal impact to the State over the life of a solar water heating system is $912 per single residential unit.

Break-Even Fiscal Impact

The break-even fiscal impact analysis equals the credit level at which the net fiscal impact is $0. In other words, it is the credit level at which there is no net expenditure required by the State given the ECITC. For year 1, this is the credit level at which the net fiscal impact increases to $0 from its ($380) level at the current ECITC level of 35%. The break-even ECITC level from a single-family residential unit perspective only, for year 1 is 22.5% and 80.4% from a system life cycle perspective (see Table 3).

It is important to note that break-even analysis does not account for ECITC premiums above break-even levels used to achieve public policy as well as economic and fiscal objectives. Such public policy objectives could be increased energy self-sufficiency and/or insurance against oil supply disruptions and/or oil price spikes. Furthermore, any decrease in the current credit level could decrease solar purchases given business and consumer expectations and existent structures based on a 35% credit level. Such a decrease could have negative economic and fiscal impacts related not only to decreased purchases themselves but any industry downsizing, which could result in job loss and consequent unemployment insurance and other such fiscal costs.

Cumulative Economic and Fiscal Impacts

ECITC stimulated solar installations cause a negative fiscal impact the year of the credit refund. Since solar water heating systems have positive economic impacts due to their energy savings, they have positive fiscal impacts after installation. These positive economic and fiscal impacts accumulate annually for ECITC stimulated solar installs for each year subsequent to year 1 of the ECITC. Thus, the impacts of year 1 ECITC stimulated solar installs for example, add to impacts of solar installs in year 2. The impacts of years 1 & 2 ECITC stimulated solar installs, add to impacts of solar installs in year 3, and so on.

Cumulative measures capture the multi-period impacts of the ECITC providing a more complete measure of the economic and fiscal impact of the ECITC in any given year subsequent to its implementation. The period used for this cumulative measure is 1990-2037. The solar ECITC increased to its current 35% level in 1990, which provides a logical start year. Assuming a 35% ECITC for solar water heating systems continues for a future period equivalent to the historic period it has remained at this level, indicates an end 35% ECITC in 2012. Systems installed in 2012 have an expected life of 25 years resulting in an end of ECITC effect period of 2037.

Cumulative Economic Impacts

Chart 2 shows the cumulative impacts for output (sales) per individual residential unit. The cumulative chart for jobs and labor income shows the same profile except with different chart dimensions. Chart 2 shows that the cumulative output (jobs, labor income) effect increases per year to a maximum of $34,000 (0.41, $11,800). This peak is the annual, sustained output (jobs, labor income) level per residential unit install stimulated so long as the solar ECITC remains at 35%. The cumulative output (jobs, labor income) level diminishes as shown in Chart 2 assuming elimination of the ECITC in 2012.

Cumulative Fiscal Impacts

Chart 3 shows cumulative fiscal impacts of ECITC stimulated solar purchases. It shows that at the start of the 1990-2012 period and for 10 subsequent years, the cumulative fiscal impact is negative. This is due to the year 1 ECITC purchaser refund. Thereafter, the cumulative impact becomes positive for the remainder of the period peaking at $640 while a 35% ECITC remains in existence. The cumulative impact becomes positive because of cumulative positive energy-saving effects of past period solar installs with no offsetting current cost to the State to bring about the energy savings. Current costs to the State are ECITC refunds for systems installed in the previous year.

Chart 3 further shows that for 2001, the cumulative fiscal impact to the State due to the ECITC is $426. Stated otherwise, the net fiscal impact to the State of a solar installation in 2001 stimulated by the ECITC accounting for the State’s investment in the ECITC over the 1990-2001 period is $426, not the negative $380 shown in Table 2.

The break-even ECITC in 2001 from an ECITC program from a cumulative perspective is 56.6%. That is, if the ECITC were 56.6% over the 1990-2001 period the net fiscal impact of ECITC stimulated installs in 2001 would be $0.

Economic and Fiscal Impacts Since ECITC Inception

The first year of the ECITC program was 1977. The program has been in continuous existence since this date, though the credit level has changed as shown in Chart 1. During the 1980s there was a Federal credit as well as the ECITC and, as noted, since 1996, the utility DSM program has existed. Both the Federal credit and the DSM program have enhanced the net impact of the ECITC.

Chart 4 shows the cumulative total jobs stimulated by the ECITC since 1977. It shows a cumulative job impact of almost 1,900 jobs by 2002. This represents an average of 76 new jobs per year over the 1997-2002 period.

Chart 5 shows the cumulative net fiscal impact of stimulated solar water heating system purchases since 1977. The net fiscal impact is total tax revenues stimulated by solar water heating system purchases less the ECITC cost. It shows that the cumulative net fiscal impact exceeds $84,000,000 from 1997-2002 and a forecast $150,000,000 for systems installed through 2001 by 2025

Impacts Due to Assumption Changes

The following assumptions provide the basis for results presented in Tables 1 and 2.

- A solar ECITC of 35% and a DSM rebate from HECO;
- Oil prices average $26-27 per barrel as they have for 2001;
- No oil supply disruptions or exogenous price spikes.

Altering any of these assumptions alters the estimated economic and fiscal impacts of the ECITC. The impact changes discussed below are made relative to this assumption set.

Oil Price Trends: High (low) forecast oil price secular changes of 1.3% (-2.1%) per year result in increased (decreased) economic and fiscal economic impacts of 19% (-25%).

Oil Price Spikes: Oil price spikes have timing, size and duration dimensions. If an oil price spike increases oil prices by 50% occurred currently and lasted 2 years, ECITC economic and fiscal impacts would increase by 10% and 25%, respectively. On average, a possible oil price spike impact on economic and fiscal measures will be:

- smaller the later in time the price spike occurs;
- larger the longer the price spike lasts;
- larger the greater the price spike level.

Economic and Fiscal Impacts Not Measured

Tangible economic and fiscal impacts of the ECITC not measured in this analysis include the following.

1. The positive impact of strengthening Hawaii's energy service industry, which simultaneously strengthens Hawaii's actual and potential position as a Pacific energy services, research and development center.

2. The positive impact on business perceptions about investment in Hawaii. This positive impact is reinforced by a consistent State policy, which Hawaii has exhibited since 1990 with respect to the solar credits.

3. The negative impact of fiscal expenditures due to elimination of the ECITC that would occur not measured in this analysis. These include: unemployment compensation benefits, potential welfare benefit expenditures to displaced workers, expenditures for direct State involvement in retraining programs for new jobs or direct subsidies for new job creation, and revenue losses to the State due to private sector expense increases to re-train workers for new jobs and for the creation of new jobs.

4. Positive ECITC fiscal impacts to Hawaii counties in the form of permit fees and increased property tax revenues due to real estate improvements.

5. The option value (*i.e.* the value of having an energy services industry of its current size) lost to the State given industry downsizing due to ECITC elimination.

Intangible ECITC economic and fiscal impacts arise due to positive externalities (side effects) from reduced oil consumption brought about by the ECITC. These include reduced air, land and water pollution and attendant problems including global warming and acid rain. Incorporation of the cost of these negative consequences of burning fossil fuels into the price of oil would significantly increase the energy cost savings estimated in this analysis. The larger the energy cost savings, the larger are the positive ECITC economic and fiscal impacts.

CONCLUSION

ECITC stimulated solar purchases have positive economic and fiscal impacts to the State of Hawaii over the life of these systems. Life cycle impacts include the following.

- An annual $597 per average-size, single-family residential unit per year energy savings when solar systems replace electric systems. This energy savings lasts for the 25-year system life and is the most significant factor resulting in the positive economic and fiscal created by ECITC stimulated purchases.

- Average annual life cycle economic impacts of ECITC stimulated solar purchases expressed on a per system basis include:
    - An increase in economic output of $1,271;
    - The creation of 1 job per 36 systems installed; and
    - $484 in labor income.
- Fiscal impacts of ECITC stimulated solar purchases include the following.
    - An average annual net impact expressed on a per system basis of $37 for an ECITC level of 35%.
    - Break-even fiscal impact credit levels are 22.5% from a year 1 perspective and 80.4% from a life cycle perspective.
    - Viewing the ECITC as a multi-year program with impacts accumulating due to the 25-year life of systems installed in a given year, indicates that the net fiscal impact to the State of systems installed in 2001 is $426 per residential unit, not the negative $380 estimated ECITC refund. This cumulative fiscal impact peaks at a level of $640 per single-family residential unit.

Expressing ECITC impacts in benefit/cost terms where the ratio numerator equals the benefit value for the respective result variable life cycle value and the denominator cost value equals the ECITC cost to the State, best measures the economic and fiscal impacts of the ECITC. These ratios, presented in Table 4 for a single system purchased in a given year, indicate the following.

- Output/ECITC = 28.7, or stated, each ECITC dollar spent that stimulates a solar purchase results in the generation of $28.7 of output.
- Employment/ECITC = 0.000025, or stated, each ECITC dollar spent that stimulates a solar purchase results in the generation of 0.000025 jobs;
- Labor Income/ECITC = 10.94, or stated, each ECITC dollar spent that stimulates a solar purchase results in the generation of $10.94 wage and salary income; and
- Tax Revenues/ECITC = 1.82, or stated, each ECITC dollar spent that stimulates a solar purchase results in the generation of $1.82 tax revenue.

Table 1: The Investment Performance of a Solar Hot Water System

Entity/Scenario	Pay Back	NPV	IRR
System Users			
Single Family Residential Owner Purchase			
Cash Purchase			
w/ ECITC	4	$6,671	27.4%
w/o ECITC	7	$4,726	12.4%
Financed Purchase			
w/ ECITC		$5,402	
w/o ECITC	15	$2,506	10.8%
Per Unit in a Multi-Family Residential Complex			
Cash Purchase			
w/ ECITC	3	$1,285	36.9%
w/o ECITC	5	$1,040	18.5%
Financed Purchase			
w/ ECITC	0	$2,615	
w/o ECITC	3	$2,040	
Lender			
Single Family Residential Owner Purchase			
w/ ECITC	10	$1,267	13.5%
w/o ECITC	10	$2,216	13.5%
Per Unit in a Multi-Family Residential Complex			
w/ ECITC	7	$67	8.7%
w/o ECITC	7	$109	8.7%
State			
Single Family Residential Owner Purchase			
Cash Purchase			
w/ ECITC	7	$1,637	15.1%
w/o ECITC		$2,222	
Financed Purchase			
w/ ECITC	8	$1,386	18.1%
w/o ECITC		$1,782	
Per Unit in a Multi-Family Residential Complex			
Cash Purchase			
w/ ECITC	8	$242	12.1%
w/o ECITC	1	$421	103.5%
Financed Purchase			
w/ ECITC	9	$218	12.3%
w/o ECITC		$389	

Chart 1: The Relationship Between Credit Size and Solar System Purchases

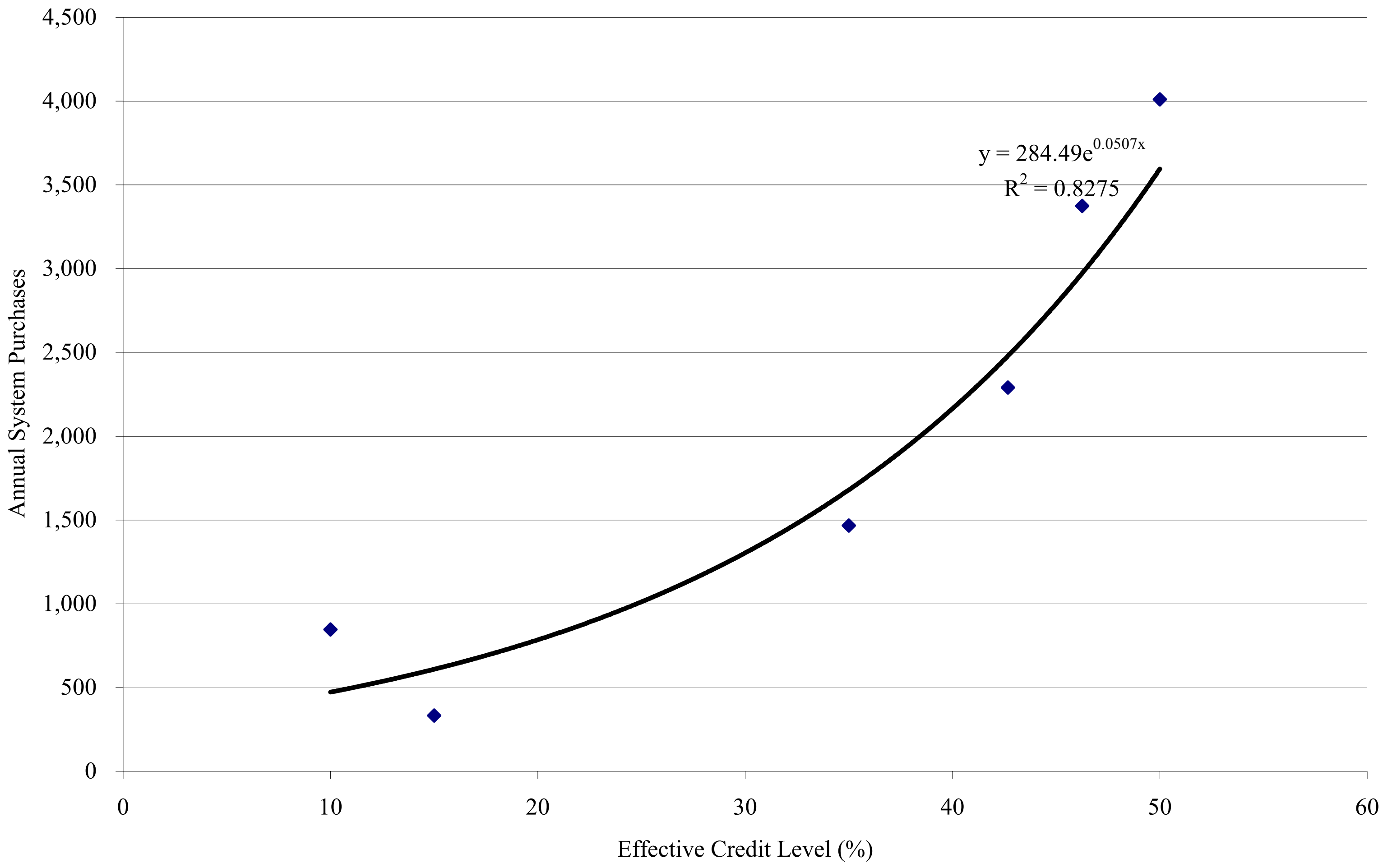


Table 2: The Economic & Fiscal Impacts of ECITC Stimulated Solar Hot Water System Purchases

	Output			Employment			Labor Income				Net Fiscal Impact		
Purchaser/Scenario	**Year 1**	**Yrs 2-25**	**Total**	**Year 1**	**Yrs 2-25**	**Total**	**Year 1**	**Yrs 2-25**	**Total**	**Credit $C**	**Year 1**	**Yrs 2-25**	**Total**
Single Family Residential Owner Purchase													
Cash Purchase													
w/ ECITC	$1,455	$1,341	$33,650	0.010	0.031	0.030	$1,000	$494	$12,855	$1,106	-$979	$89	$1,164
w/o ECITC	-$6,412	$1,341	$25,784	-0.097	0.031	0.025	-$1,856	$494	$10,000	$0	-$394	$89	$1,748
Financed Purchase													
w/ ECITC	$10,829	$872	$31,764	0.137	0.023	0.028	$4,389	$321	$12,096	$1,106	-$380	$54	$912
w/o ECITC	$9,987	$521	$22,484	0.125	0.017	0.022	$4,075	$192	$8,672	$0	$654	$27	$1,308
Per Unit in a Multi-Family Residential Complex													
Cash Purchase													
w/ ECITC	$507	$236	$6,169	0.005	0.005	0.005	$257	$86	$2,313	$245	-$207	$16	$168
w/o ECITC	-$484	$236	$5,179	-0.008	0.005	0.005	-$103	$86	$1,954	$0	-$27	$16	$348
Financed Purchase													
w/ ECITC	$1,548	$178	$5,827	0.020	0.004	0.005	$634	$65	$2,183	$245	-$139	$12	$144
w/o ECITC	$1,405	$141	$4,791	0.018	0.004	0.004	$581	$51	$1,804	$0	$96	$9	$316

Table 3: Solar Hot Water System ECITC Break-Even Analysis

System Purchasers	Current ECITC	Break-Even ECITC Year 1	Break-Even ECITC Life Cycle
Residential Owner Purchase			
Cash Purchase	35.0%	-7.3%	85.3%
Financed Purchase	35.0%	22.5%	80.4%
Commercial Owner Purchase			
Cash Purchase	35.0%	-5.3%	67.83%
Financed Purchase	35.0%	14.3%	64.47%

Chart 2: Cumulative Output Created by ECITC Stimulated Solar Hot Water System Purchases

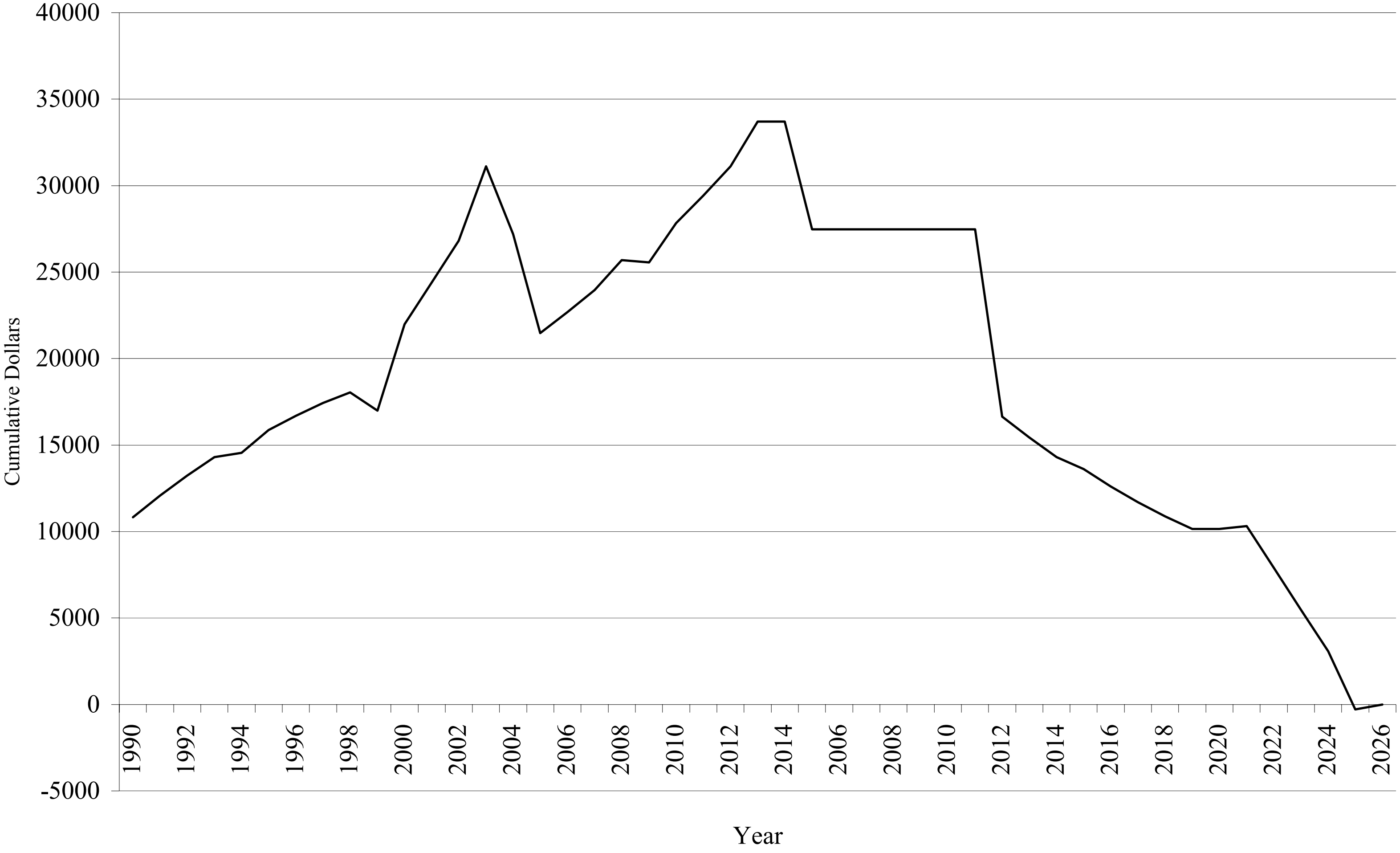


Chart 3: Cumulative Fiscal Impacts of ECITC Stimulated Solar Hot Water System Purchases

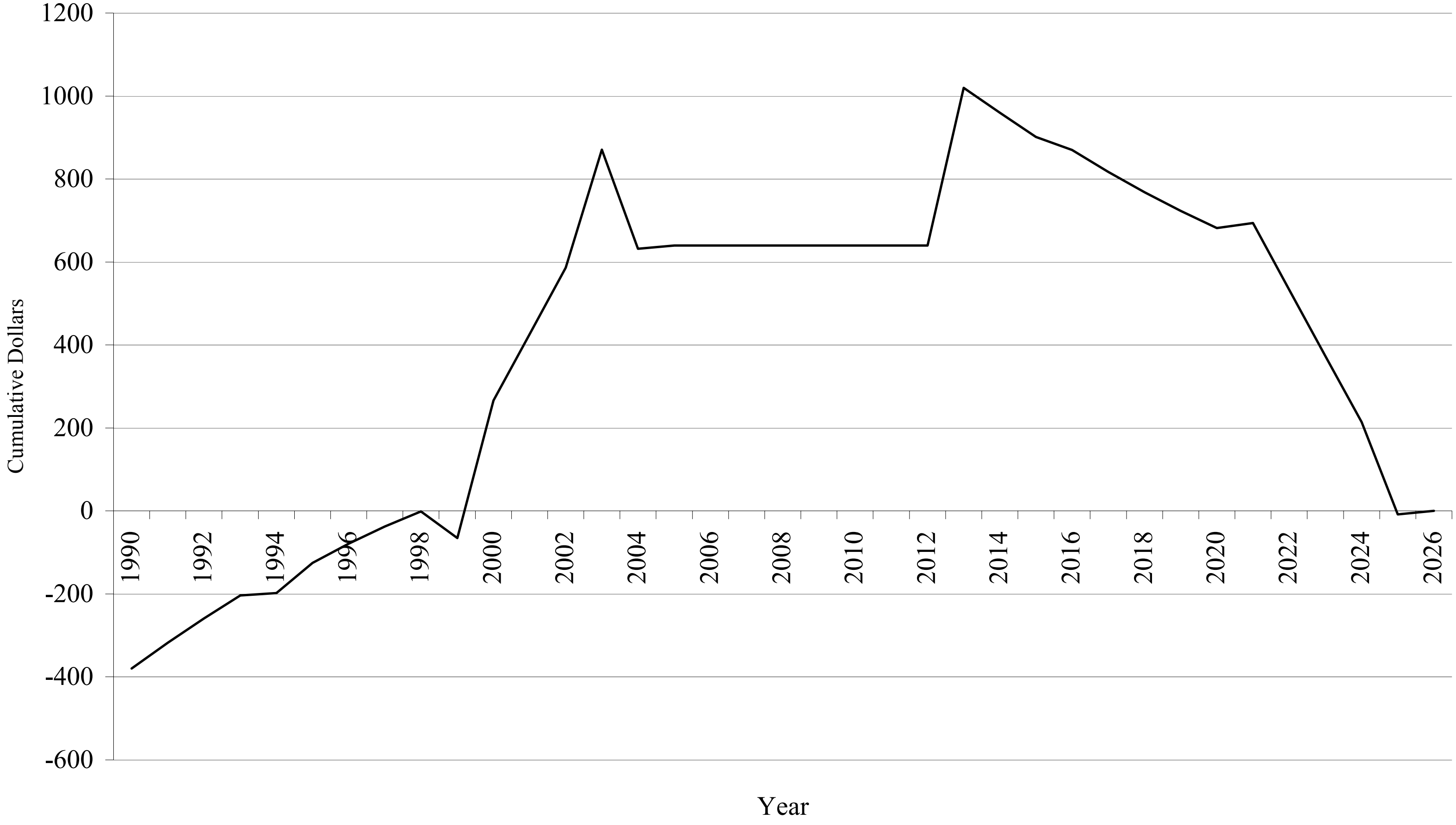


Chart 4: Estimated Total Jobs Directly or Indirectly Created by ECITC Stimulated Solar Hot Water System Purchases Since Program Inception in 1977

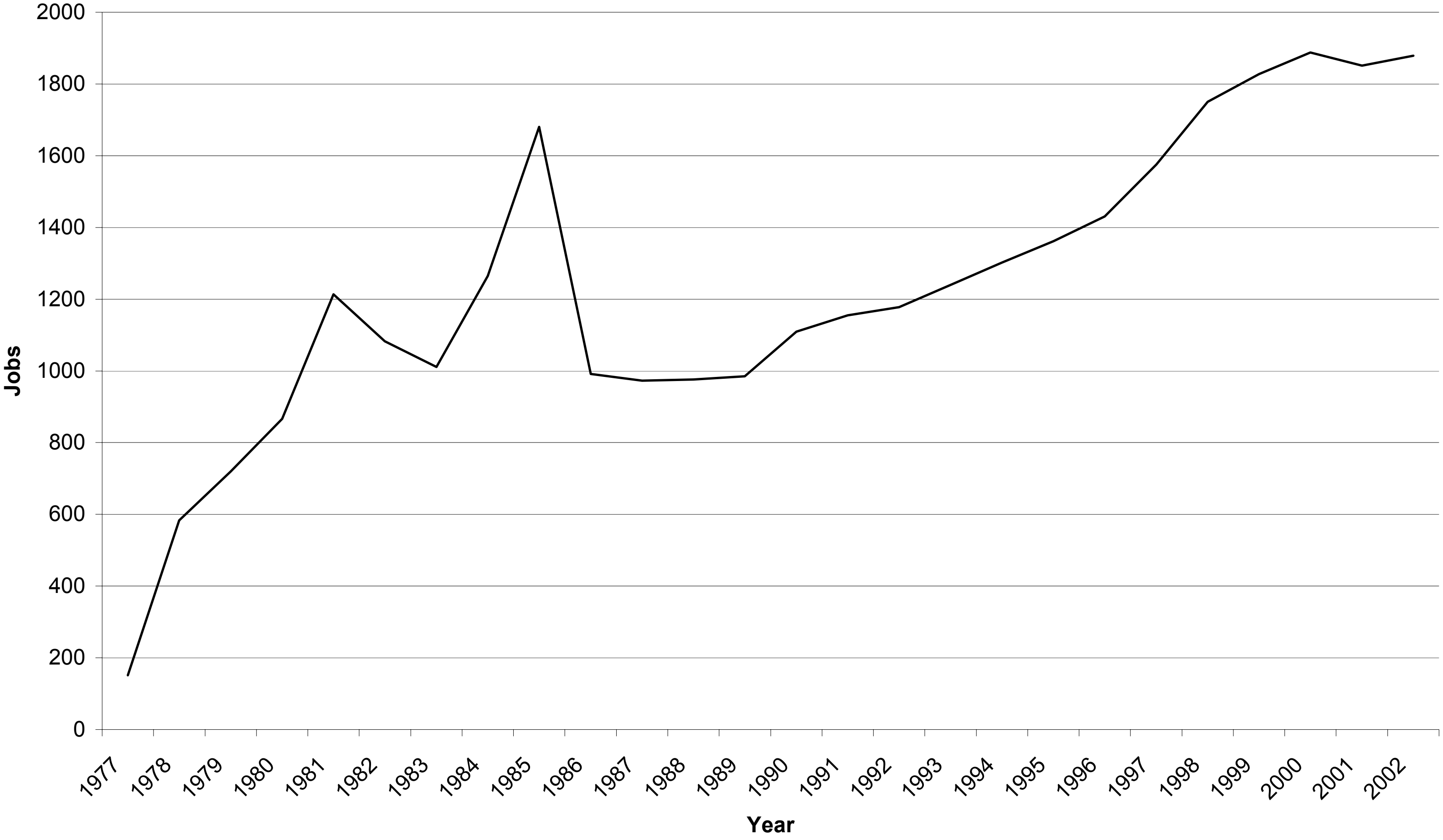


Chart 5: Cumulative ECITC Costs and Revenue Impact from ECITC Stimulated Solar Hot Water System Purchases Since Program Inception in 1977

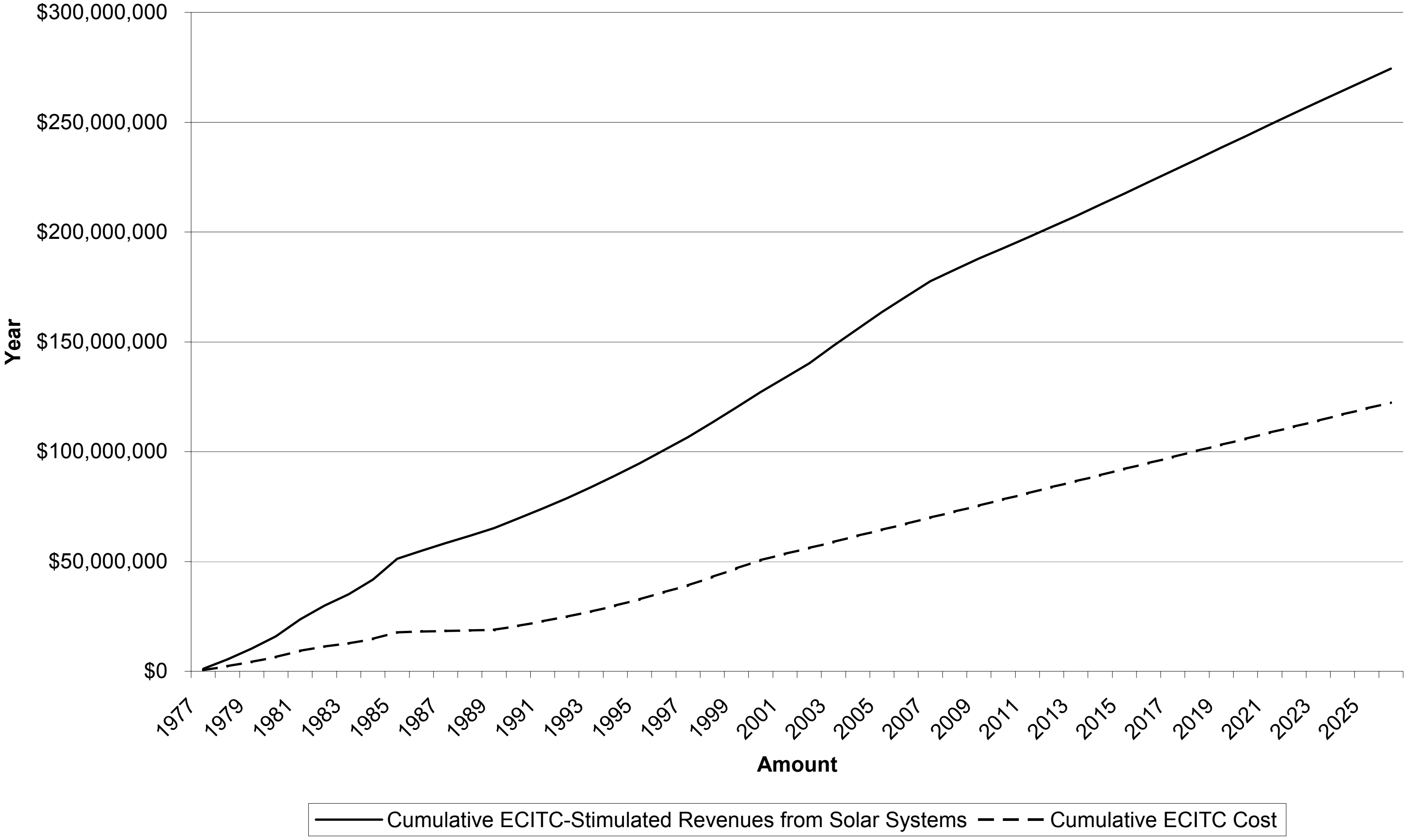


Table 4: Solar Hot Water System ECITC Benefit/Cost Ratios

System Purchasers	Economic Impacts Output	 Employment	 Labor Income	Tax Revenues
Residential Owner Purchase				
Cash Purchase	30.43	0.000027	11.63	2.05
Financed Purchase	28.73	0.000025	10.94	1.82
Commercial Owner Purchase				
Cash Purchase	25.18	0.000021	9.44	1.69
Financed Purchase	23.78	0.000020	8.91	1.59

Table A1: Economic and Fiscal Impacts of an ECITC Stimulated Solar Hot Water System Purchases for Financed, Single-Family Residential Unit Systems

	Effects Created by a Solar System Purchase		Effects Foregone When Electric System Replaced		NET IMPACT	
Item	Year 1	Avg/Yr Years 2-15	Year 1	Years 2-15	Year 1	Avg/Yr Years 2-15
Economic Effects						
Total Output						
Final Demand	$4,998	$198	($145)	($231)	$5,143	$429
Indirect & Induced	$5,593	$207	($93)	($236)	$5,686	$444
Employment	0.1328	0.0134	(0.0045)	(0.0097)	0.1373	0.0231
Total Labor Income	$4,362	$152	($27)	($170)	$4,389	$321
Fiscal Effects						
Total Revenues	$734	$27	($12)	($31)	$746	$58
Total Expenditures						
ECITC Expenditure	$1,106	$0	$0	$0	$1,106	$0
Other Costs	$21	$4	$0	$0	$21	$4
NET FISCAL IMPACT	($392)	$23	($12)	($31)	($380)	$54

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Solar Hot Water System Purchases

Descriptor	Derivative Value	Model Value	Source
Solar System Variables			
Assumed system life (years)			
Residential Single Family		25	Hawaii Solar Industry Association
Commercial (commercial & multi-family are the same)		25	Rolf Christ (assumes tank replacement at 18 years)
Purchase Cost			
Residential - Single Family		$4,541	see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
Commercial		$140,000	Rolf Christ (Solar R Supply)
Notes			
Commercial system assumptions:			
1. units per apartment building.		200	
2. Average daily usage 35 gal/apartment @ 130 degree F (ASRAE handbook).			
3. Solar system uses existing gas water heating system.			
4. System sized to provide 100% of load on an average sun-day (90% year-round savings).			
5. Gas heater efficiency 80%.			
6. 7000 gallons of storage.			
7. Solar collectors rated at 3,2000,000 BTU per day combined.			
8. 500 Solar Zone Map (Sun Shine Map).			
9. If new construction would need to add $15,000 for new back-up heaters (gas).			
Purchase Costs over System Life			
Amortization Costs of Purchase per Unit	Residential	Commercial	prime + 2%
Annual Interest	13.25%	8%	Ron Richmond (only 1 bank does) & Rolf Christ (prime + 2%)
Loan Terms	10	7	average term on actual loans (10/23/00 R. Richmond) & Rolf Christ
Loan Amount per Unit	$2,596	$385	calculated
system cost per unit	$4,541	$700	see above
ECITC value per unit	$1,106	$245	see below
Federal Credit per Unit		$70	see below
DSM rebate	$840	$0	see below
Note: 1. There has not been a single delinquent account on solar systems w/ BoH			Ron Richmond @ HECO
2. Potential for an 8% financing package but is not certain at this time.			Rolf Christ, R&R Services
3. Some individuals use home equity loans to finance system purchases.			Rolf Christ, R&R Services
4. 60% of systems are financed, 40% cash purchased.			Rolf Christ, R&R Services

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Solar Hot Water System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Annual Maintenance Costs			
Residential			
Year 5	$200		PM (preventive maintenance) (12/12/01 Rolf Christ)
Year 10	$400		PM (preventive maintenance) (12/12/01 Rolf Christ)
Year 15	$1,411		controller replacement & tank change (12/12/01 Rolf Christ)
Year 20	$400		PM (preventive maintenance) (12/12/01 Rolf Christ)
Commercial			
Year 1-4 - flush & inspect		$100	Rolf Christ (R&R Services)
Year 5 - open tank & inspect		$300	Rolf Christ (R&R Services)
Year 6-7 - flush & inspect		$100	Rolf Christ (R&R Services)
Year 8 - pump		$600	Rolf Christ (R&R Services)
Year 9 - controller		$170	Rolf Christ (R&R Services)
Year 10-15 - flush & inspect		$100	Rolf Christ (R&R Services)
Year 18 - replace tank		$30,000	Rolf Christ (R&R Services)
Year 19-25 - flush & inspect		$1,000	Rolf Christ (R&R Services)
Year 22 - open tank & inspect		$300	Rolf Christ (R&R Services)
Average Annual Gross Dollar Savings per Unit			
Residential		$597	calculated
Annual KwH savings per installed solar system	3,600		1999 ASHRAE Application HandBook assumes replacing an electric system)
Current cost/kHz	$0.166		current average rates weighted by tariff area
Commercial per Unit		$92	calculated
Total Savings	$18,329		calculated
Annual Savings in Therms/Year	13,140		Rolf Christ (ASHRAE data)
Annual Savings in propane gallons/year	15,938		Rolf Christ (ASHRAE data)
Cost per Gallon	$1.150		Rolf Christ via the Gas Co.
Cost Savings Changes			
Benchmark Price per Barrel Oil	$26.78		2001 average price to date
Alternative real average annual energy cost changes (2001-2020)			
Base case	0.0%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
low	-2.1%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
high	1.3%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html

Note: 1. Price spikes caused by possible oil supply disruptions can be factored into price forecasts.

2. The average unit number per complex from the respective data bases from which annual energy costs are derived are approximately equal.

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Solar Hot Water System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Credit			
Net ECITC Paid by State - per Residential			
Effective Percentage of Purchase Price Paid by State		24%	calculated
Effective Dollar Credit Paid by State		$1,106	calculated (assumed used to reduce loan principal if system financed)
Maximum Credit Amount per Unit	$1,750		State Tax Code
Solar system credit percentage	35%		Tax Code (assumed applied to loan if system financed)
% of purchasers using credit	85%		calculated
2001 estimated system total	2,539		see Table A8
# non-military not using credit	127		HSEA estimated 5% of total system sales not claiming
# military systems (no ECITC)	245		REWH Program-Military Projects as of 10/27/00 & report p. 19 (1572 military systems/total program systems)
Demand side management program	18%	$840	calculated
average rebate on a retrofit	$604		see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
retrofit systems % of total	73%		see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
average rebate on new construction	$236		see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
new construction. systems % of total	27%		see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
Net ECITC Paid by State - Commercial per Unit		$245	
Effective Percentage of Purchase Price Paid by State		35%	calculated
Effective Dollar Credit Paid by State per Unit			calculated
Maximum Credit Amount per Unit	$350		State Tax Code (this is for a multi-family, there is no cap on a commercial system)
Total Credit Value	$49,000		
Solar system credit percentage	35%		Tax Code (assumed applied to loan if system financed)
Demand side management program			
Amount of Rebate		$0	calculated
Effective Rebate as a % of System Cost			calculated
average rebate on a retrofit			see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
retrofit systems % of total			see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
average rebate on new construction			see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
new construction. systems % of total			see Table A-7: Tariff Distribution, Rebate Levels & Per Kwh Data
Federal Tax Credit per Unit		$70	calculated
Total Amount	$14,000		calculated
Credit % of Purchase Price	10%		IRS Code
Note: 1. Commercial solar hot water systems generally replace gas systems.			Rolfe Christ

2. There is no DSM rebate for a solar system when it replaces a gas system. The rebate only applies when a solar system replaces an electric system (Rolfe Christ).

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Solar Hot Water System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.16%	HI State Dept. of Taxation, GET on Gross Sales assuming pyramiding
State Income Taxes on Labor Income		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Ratio of Corporate Income Tax to Labor Income Tax		4.00%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
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 $1 of final demand are the % indicated of total indirect plus induced output			
Total Taxes as a % of Indirect & Induced Output		4.6%	calculated
Ratio of GSP to Output	64.5%		1992 Hawaii State I/O model (value added ÷ total output for total intermediate demand)
Total Taxes as a % of GSP	7%		see "HAWAII STATE TAX REVENUES AS A % OF GSP" worksheet
Tax on Income			
Individual State		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Federal		14.56%	IRS, "Statistics of Income Bulletin," Fall 2000, VOL 17 No 2, 1999 tax rates - all filers.
Corporate State		5.97%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Federal		14.67%	IRS, "Statistics of Income Bulletin," Summer 2000, VOL 20 No 1, 1997 tax rates - F, I & RE
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.13	1992 Hawaii State I/O model ($ economy output per $ other construc.final demand)
employment		26.59	1992 Hawaii State I/O model (total jobs per $ mil.other construc. final demand)
labor income		0.89	1992 Hawaii State I/O model ($ labor income per $ other construc.final demand)
from annual loan amortization			
output (sales)		2.13	1992 HI I/O model ($ economy output per $ banking & credit agencies final demand)
employment		25.47	1992 HI/O model (total jobs per $ mil. Final demand banking & credit)
labor income		0.680	1992 Hawaii State I/O model ($ labor per $ banking & credit final demand)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.02	1992 Hawaii State I/O model ($ output per $ final demand pers. Consump.
employment		27.57	1992 Hawaii State I/O model (total jobs per $ mil. final demand pers. Consump.
labor income		0.734	1992 Hawaii State I/O model ($ labor income per $ final demand pers. Consump.

Table A3: Assumptions for Estimation of Fiscal and Economic Impacts Foregone Due to ECITC Stimulated Solar Hot Water System Purchases

Descriptor	Derivative Value	Model Value	Source
Electric System Variables			
Assumed system life (years)		14	Ron Richmond (w/o maintenance assumed system life)
Note: The hot water heating system most often replaced by a heat pump is an electric system (Ron Richmond at HECO)			
Average Electric System Cost per Unit		$466	calculated
Gross Cost per Unit	$506		energy efficient system installed cost by a licensed plumber (Ron Richmond)
HECO rebate for purchase of energy efficient system	$40		Ron Richmond at HECO
Cost Stream Foregone Due to Purchase of a Solar System			see Table A4
Credit & Taxes			
Effective Tax Credit		0%	calculated
systems tax credit	0%		no current tax credit on gas systems
% of purchasers using credit	100%		assumed

Table A4: Net Economic and Fiscal Impacts Stimulated by the ECITC Per Residential Unit

(Note: These are the economic & fiscal effects due to the purchase of a solar hot water system less the economic and fiscal impacts foregone due to the purchase of an electric system.)

		Period Number												
Item	**Install**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Net Benefits														
Heat Pump System Purchaser		$369	$362	$353	$343	($68)	$320	$306	$290	$272	($549)	$1,194	$1,194	$1,194
State Fiscal Account	($444)	$64	$62	$60	$58	$32	$52	$49	$45	$41	($12)	$160	$160	$160
Net Economic Impacts														
Final Demand	$4,501	$642	$620	$595	$566	$334	$497	$456	$409	$356	($104)	$1,194	$1,194	$1,194
Multiplier Effects														
Indirect & Induced Output	$5,036	$650	$628	$602	$574	$358	$504	$463	$416	$362	($64)	$1,220	$1,220	$1,220
Employment	0.1201	0.0171	0.0165	0.0159	0.0151	0.0086	0.0133	0.0123	0.0110	0.0096	(0.0034)	0.0329	0.0329	0.0329
Labor Income	$3,933	$456	$441	$423	$404	$265	$355	$327	$294	$257	($16)	$876	$876	$876

	Period Number													Present Value
Item	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	TOTALS	**@ Discount**
														2.8%
Net Benefits														
Heat Pump System Purchaser	$1,660	($1,627)	$1,194	$1,194	$1,194	$1,194	$394	$1,194	$1,194	$1,194	$1,194	$1,194	$16,755	$11,131
Lender	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($1,094)	($1,245)
State Fiscal Account	$222	($8)	$160	$160	$160	$160	$112	$160	$160	$160	$160	$160	$2,254	$1,386
Net Economic Impacts														
Final Demand	$1,660	($216)	$1,194	$1,194	$1,194	$1,194	$794	$1,194	$1,194	$1,194	$1,194	$1,194	$25,441	$18,945
Multiplier Effects													$0	$0
Indirect & Induced Output	$1,697	($69)	$1,220	$1,220	$1,220	$1,220	$855	$1,220	$1,220	$1,220	$1,220	$1,220	$26,657	$19,945
Employment	0.0458	(0.0073)	0.0329	0.0329	0.0329	0.0329	0.0215	0.0329	0.0329	0.0329	0.0329	0.0329	0.6913	
Labor Income	$1,218	$61	$876	$876	$876	$876	$645	$876	$876	$876	$876	$876	$19,581	$14,710

Table A5: Worksheet Showing Cost & Multiplier Accounting for Solar Hot Water System Purchases with the ECITC for Financed Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
User Account														
Costs														
System Cost	$0													
Amortization costs (cost borrowed)		$483	$483	$483	$483	$483	$483	$483	$483	$483	$483	$0	$0	$0
interest payment		$344	$325	$305	$281	$254	$224	$189	$151	$106	$57	$0	$0	$0
principal payment		$139	$158	$179	$202	$229	$259	$294	$333	$377	$427	$0	$0	$0
Annual system maintenance costs		$0	$0	$0	$0	$200	$0	$0	$0	$0	$400	$0	$0	$0
Annual Costs	$0	$483	$483	$483	$483	$683	$483	$483	$483	$483	$883	$0	$0	$0
Benefits														
Interest deduction on taxes														
State		$21	$19	$18	$17	$15	$13	$11	$9	$6	$3	$0	$0	$0
Federal		$50	$47	$44	$41	$37	$33	$28	$22	$15	$8	$0	$0	$0
Annual energy cost savings		$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597
Annual Benefits	$0	$668	$664	$660	$655	$649	$643	$636	$628	$619	$609	$597	$597	$597
BENEFITS - COSTS	$0	$185	$181	$176	$172	($34)	$160	$153	$145	$136	($274)	$597	$597	$597
(assumed spent on personal consumption expenditures)														
Lender Account														
Costs														
System Retail Cost Payment	$4,541													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income ((interest income - depreciation) x tax rate))														
State		$21	$19	$18	$17	$15	$13	$11	$9	$6	$3	$0	$0	$0
Federal		$50	$48	$45	$41	$37	$33	$28	$22	$16	$8	$0	$0	$0
Annual Costs	$4,541	$71	$67	$63	$58	$52	$46	$39	$31	$22	$12	$0	$0	$0
Benefits														
ECITC Refund	$1,106													
DSM Refund	$840													
Annual interest payment		$344	$325	$305	$281	$254	$224	$189	$151	$106	$57	$0	$0	$0
Annual Benefits	$1,945	$344	$325	$305	$281	$254	$224	$189	$151	$106	$57	$0	$0	$0
BENEFITS - COSTS - i only	($2,596)	$273	$258	$242	$223	$202	$178	$150	$119	$84	$45	$0	$0	$0
BENEFITS - COSTS - i + p	($2,596)	$412	$416	$420	$425	$431	$437	$444	$452	$461	$471	$0	$0	$0

Table A5: Worksheet Showing Cost & Multiplier Accounting for Solar Hot Water System Purchases with the ECITC for Financed Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.8%
User Account															
Costs															
System Cost	$0														
Amortization costs (cost borrowed)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,831	$4,284
interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,236	$2,045
principal payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,596	$2,239
Annual system maintenance costs		$0	$1,411	$0	$0	$0	$0	$400	$0	$0	$0	$0	$0	$2,411	$1,691
Annual Costs	$0	$0	$1,411	$0	$0	$0	$0	$400	$0	$0	$0	$0	$0	$7,242	$5,975
Benefits															
Interest deduction on taxes															
State		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$133	$122
Federal		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$325	$298
Annual energy cost savings		$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$14,927	$10,958
Annual Benefits	$0	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$15,386	$11,377
BENEFITS - COSTS	$0	$597	($813)	$597	$597	$597	$597	$197	$597	$597	$597	$597	$597	$8,145	$5,402
(assumed spent on personal consumption expenditures)															
Lender Account															
Costs															
System Retail Cost Payment	$4,541														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income ((interest income - depreciation) x tax rate))															
State		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$134	$122
Federal		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$328	$300
Annual Costs	$4,541	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,002	$4,963
Benefits															
ECITC Refund	$1,106														
DSM Refund	$840														
Annual interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,236	$2,045
Annual Benefits	$1,945	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,181	$3,990
BENEFITS - COSTS - i only	($2,596)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($821)	($972)
BENEFITS - COSTS - i + p	($2,596)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,774	$1,267

Table A5: Worksheet Showing Cost & Multiplier Accounting for Solar Hot Water System Purchases with the ECITC for Financed Purchases *(continued)*

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Multiplier Effects of Expenditure														
System Cost & Maintenance Effects														
Final Demand	$4,541	$0	$0	$0	$0	$200	$0	$0	$0	$0	$400	$0	$0	$0
Multiplier Effects														
Indirect & Induced Output	$5,131	$0	$0	$0	$0	$226	$0	$0	$0	$0	$452	$0	$0	$0
Labor	0.121	0.0000	0.0000	0.0000	0.0000	0.0053	0.0000	0.0000	0.0000	0.0000	0.0106	0.0000	0.0000	0.0000
Labor income	$4,041	$0	$0	$0	$0	$178	$0	$0	$0	$0	$356	$0	$0	$0
Due to User Benefits - Costs														
Final Demand less DSM	$0	$185	$181	$176	$172	($34)	$160	$153	$145	$136	($274)	$597	$597	$597
Multiplier Effects														
Indirect & Induced Output	$0	$189	$185	$180	$175	($35)	$163	$156	$148	$139	($280)	$610	$610	$610
Labor	0.000	0.005	0.005	0.005	0.005	(0.001)	0.004	0.004	0.004	0.004	(0.008)	0.016	0.016	0.016
Labor income	$0	$135	$133	$130	$126	($25)	$117	$112	$106	$100	($201)	$438	$438	$438
From Lender Activities														
Final Demand		$273	$258	$242	$223	$202	$178	$150	$119	$84	$45	$0	$0	$0
Multiplier Effects														
Indirect & Induced Output	$0	$308	$292	$273	$252	$228	$201	$170	$135	$95	$51	$0	$0	$0
Labor	0.0000	0.0070	0.0066	0.0062	0.0057	0.0051	0.0045	0.0038	0.0030	0.0022	0.0011	0.0000	0.0000	0.0000
Labor income	$0	$186	$176	$164	$152	$137	$121	$102	$81	$57	$31	$0	$0	$0
TOTAL MULTIPLIER EFFECTS														
Final Demand	$4,541	$457	$439	$418	$395	$368	$337	$303	$264	$220	$170	$597	$597	$597
Multiplier Effects														
Indirect & Induced Output	$5,131	$462	$443	$422	$398	$393	$341	$307	$267	$223	$216	$610	$610	$610
Labor	0.121	0.012	0.012	0.011	0.010	0.010	0.009	0.008	0.007	0.006	0.004	0.016	0.016	0.016
Labor income	$4,041	$321	$308	$294	$278	$290	$238	$214	$188	$157	$185	$438	$438	$438
State Fiscal Account														
Costs														
State interest refund	$0	$21	$19	$18	$17	$15	$13	$11	$9	$6	$3	$0	$0	$0
ECITC cost	$1,106													
TOTAL COST	$1,106	$21	$19	$18	$17	$15	$13	$11	$9	$6	$3	$0	$0	$0
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$189	$19.03	$18.26	$17.40	$16.41	$15.30	$14.04	$12.61	$11.00	$9.16	$7.09	$24.84	$24.84	$24.84
Individual income (x labor income)	$241	$19.14	$18.38	$17.52	$16.55	$17.30	$14.19	$12.78	$11.18	$9.37	$11.03	$26.12	$26.12	$26.12
Corporate income (% of GSP)	$10	$0.77	$0.73	$0.70	$0.66	$0.69	$0.57	$0.51	$0.45	$0.37	$0.44	$1.04	$1.04	$1.04
Taxes on Indirect & Induced Output	$235	$21.13	$20.29	$19.33	$18.24	$18.00	$15.62	$14.04	$12.25	$10.22	$9.91	$27.94	$27.94	$27.94
TOTAL BENEFIT	$674	$60	$58	$55	$52	$51	$44	$40	$35	$29	$28	$80	$80	$80
NET BENEFIT TO STATE GOVERNMENT	($431)	$40	$38	$37	$35	$36	$31	$29	$26	$23	$25	$80	$80	$80

Table A5: Worksheet Showing Cost & Multiplier Accounting for Solar Hot Water System Purchases with the ECITC for Financed Purchases *(continued)*

		Year and Period Number														Present Value
Item	Install	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	@ Discount
															2.8%
Multiplier Effects of Expenditure															
System Cost & Maintenance Effects															
Final Demand	$4,541	$0	$1,411	$0	$0	$0	$0	$400	$0	$0	$0	$0	$0		
Multiplier Effects															
Indirect & Induced Output	$5,131	$0	$1,594	$0	$0	$0	$0	$452	$0	$0	$0	$0	$0	$7,403	$6,773
Labor	0.121	0.0000	0.0375	0.0000	0.0000	0.0000	0.0000	0.0106	0.0000	0.0000	0.0000	0.0000	0.0000	0.174	
Labor income	$4,041	$0	$1,255	$0	$0	$0	$0	$356	$0	$0	$0	$0	$0	$5,831	$5,335
Due to User Benefits - Costs															
Final Demand less DSM	$0	$597	($813)	$597	$597	$597	$597	$197	$597	$597	$597	$597	$597		
Multiplier Effects															
Indirect & Induced Output	$0	$610	($831)	$610	$610	$610	$610	$201	$610	$610	$610	$610	$610	$2,630	$2,175
Labor	0.000	0.016	(0.022)	0.016	0.016	0.016	0.016	0.005	0.016	0.016	0.016	0.016	0.016	0.071	
Labor income	$0	$438	($597)	$438	$438	$438	$438	$145	$438	$438	$438	$438	$438	$1,889	$1,562
From Lender Activities															
Final Demand		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,774	$1,623
Multiplier Effects															
Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,005	$1,834
Labor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.045	
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,206	$1,104
TOTAL MULTIPLIER EFFECTS															
Final Demand	$4,541	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$597	$10,899	$9,745
Multiplier Effects															
Indirect & Induced Output	$5,131	$610	$763	$610	$610	$610	$610	$653	$610	$610	$610	$610	$610	$11,807	$10,571
Labor	0.121	0.016	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.290	
Labor income	$4,041	$438	$658	$438	$438	$438	$438	$501	$438	$438	$438	$438	$438	$8,926	$8,000
State Fiscal Account															
Costs															
State interest refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$134	$122
ECITC cost	$1,106													$1,106	$1,106
TOTAL COST	$1,106	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,239	$1,228
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$189	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$24.84	$453	$405
Individual income (x labor income)	$241	$26.12	$39.25	$26.12	$26.12	$26.12	$26.12	$29.84	$26.12	$26.12	$26.12	$26.12	$26.12	$532	$477
Corporate income (% of GSP)	$10	$1.04	$1.57	$1.04	$1.04	$1.04	$1.04	$1.19	$1.04	$1.04	$1.04	$1.04	$1.04	$21	$19
Taxes on Indirect & Induced Output	$235	$27.94	$34.92	$27.94	$27.94	$27.94	$27.94	$29.92	$27.94	$27.94	$27.94	$27.94	$27.94	$541	$484
TOTAL BENEFIT	$674	$80	$101	$80	$80	$80	$80	$86	$80	$80	$80	$80	$80	$1,547	$1,385
NET BENEFIT TO STATE GOVERNMENT	($431)	$80	$101	$80	$80	$80	$80	$86	$80	$80	$80	$80	$80	$308	$158

Table A6: Worksheet Showing Cost & Multiplier Accounting for Electric Hot Water Heating System and Expenditures Foregone Due a Solar Hot Water System Purchase *(continued)*

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
User Account														
Costs														
System Cost	$466													
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		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Costs	$466	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits														
Benefits - Costs of Solar System Foregone	$0	($185)	($181)	($176)	($172)	$34	($160)	($153)	($145)	($136)	$274	($597)	($597)	($597)
Annual Benefits	$0	($185)	($181)	($176)	($172)	$34	($160)	($153)	($145)	($136)	$274	($597)	($597)	($597)
BENEFITS - COSTS	($466)	($185)	($181)	($176)	($172)	$34	($160)	($153)	($145)	($136)	$274	($597)	($597)	($597)
(assumed spent on personal consumption expenditures)														
Lender Account														
Costs														
Gas system retail cost payment	$0													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income ((interest income - depreciation) x tax rate))														
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 Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits														
ECITC Refund	$0													
Annual interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Benefits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BENEFITS - COSTS - i only	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BENEFITS - COSTS - i + p	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Table A6: Worksheet Showing Cost & Multiplier Accounting for Electric Hot Water Heating System and Expenditures Foregone Due a Solar Hot Water System Purchase *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.8%
User Account															
Costs															
System Cost	$466	$466													
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	$0	$0	$0	$0	$0	$0
Annual Costs	$466	$466	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$932	$792
Benefits															
Benefits - Costs of Solar System Foregone	$0	($597)	$813	($597)	($597)	($597)	($597)	($197)	($597)	($597)	($597)	($597)	($597)	($8,145)	($5,402)
Annual Benefits	$0	($597)	$813	($597)	($597)	($597)	($597)	($197)	($597)	($597)	($597)	($597)	($597)	($8,145)	($5,402)
BENEFITS - COSTS	($466)	($1,063)	$813	($597)	($597)	($597)	($597)	($197)	($597)	($597)	($597)	($597)	($597)	($9,077)	($6,195)
(assumed spent on personal consumption expenditures)															
Lender Account															
Costs															
Gas system retail cost payment	$0														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income ((interest income - depreciation) x tax rate))															
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 Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits															
ECITC Refund	$0														
Annual interest payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Benefits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BENEFITS - COSTS - i only	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BENEFITS - COSTS - i + p	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Table A6: Worksheet Showing Cost & Multiplier Accounting for Electric Hot Water Heating System and Expenditures Foregone Due a Solar Hot Water System Purchase *(continued)*

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Multiplier Effects of Expenditure														
System Cost & Maintenance Effects														
Final Demand	$506	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Multiplier Effects														
Indirect & Induced Output	$572	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Labor	0.0135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$450	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Due to User Benefits - Costs														
Final Demand less HECO Rebate	($466)	($185)	($181)	($176)	($172)	$34	($160)	($153)	($145)	($136)	$274	($597)	($597)	($597)
Multiplier Effects														
Indirect & Induced Output	($476)	($189)	($185)	($180)	($175)	$35	($163)	($156)	($148)	($139)	$280	($610)	($610)	($610)
Labor	(0.013)	(0.005)	(0.005)	(0.005)	(0.005)	0.001	(0.004)	(0.004)	(0.004)	(0.004)	0.008	(0.016)	(0.016)	(0.016)
Labor income	($342)	($135)	($133)	($130)	($126)	$25	($117)	($112)	($106)	($100)	$201	($438)	($438)	($438)
From Lender Activities														
Final Demand		$0	$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	$0	$0
Labor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS														
Final Demand	$40	($185)	($181)	($176)	($172)	$34	($160)	($153)	($145)	($136)	$274	($597)	($597)	($597)
Multiplier Effects														
Indirect & Induced Output	$96	($189)	($185)	($180)	($175)	$35	($163)	($156)	($148)	($139)	$280	($610)	($610)	($610)
Labor	0.001	(0.005)	(0.005)	(0.005)	(0.005)	0.001	(0.004)	(0.004)	(0.004)	(0.004)	0.008	(0.016)	(0.016)	(0.016)
Labor income	$108	($135)	($133)	($130)	($126)	$25	($117)	($112)	($106)	($100)	$201	($438)	($438)	($438)
State Fiscal Account														
Costs														
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$2	($8)	($8)	($7)	($7)	$1	($7)	($6)	($6)	($6)	$11	($25)	($25)	($25)
Individual income (x labor income)	$6	($8)	($8)	($8)	($8)	$1	($7)	($7)	($6)	($6)	$12	($26)	($26)	($26)
Corporate income (% of GSP)	$0	($0)	($0)	($0)	($0)	$0	($0)	($0)	($0)	($0)	$0	($1)	($1)	($1)
Taxes on Indirect & Induced Output	$4	($9)	($8)	($8)	($8)	$2	($7)	($7)	($7)	($6)	$13	($28)	($28)	($28)
TOTAL BENEFIT	$13	($25)	($24)	($24)	($23)	$5	($21)	($20)	($19)	($18)	$37	($80)	($80)	($80)
NET BENEFIT TO STATE GOVERNMENT	$13	($25)	($24)	($24)	($23)	$5	($21)	($20)	($19)	($18)	$37	($80)	($80)	($80)

Table A6: Worksheet Showing Cost & Multiplier Accounting for Electric Hot Water Heating System and Expenditures Foregone Due a Solar Hot Water System Purchase *(continued)*

	Year and Period Number														Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.8%
Multiplier Effects of Expenditure															
System Cost & Maintenance Effects															
Final Demand	$506	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$506	$506
Multiplier Effects															
Indirect & Induced Output	$572	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$572	$572
Labor	0.0135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0135	
Labor income	$450	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450	$450
Due to User Benefits - Costs															
Final Demand less HECO Rebate	($466)	($1,063)	$813	($597)	($597)	($597)	($597)	($197)	($597)	($597)	($597)	($597)	($597)	($9,077)	($6,195)
Multiplier Effects															
Indirect & Induced Output	($476)	($1,086)	$831	($610)	($610)	($610)	($610)	($201)	($610)	($610)	($610)	($610)	($610)	($9,276)	($6,331)
Labor	(0.013)	(0.029)	0.022	(0.016)	(0.016)	(0.016)	(0.016)	(0.005)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.250)	
Labor income	($342)	($780)	$597	($438)	($438)	($438)	($438)	($145)	($438)	($438)	($438)	($438)	($438)	($6,661)	($4,546)
From Lender Activities															
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	$0	$0	$0
Labor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Labor income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL MULTIPLIER EFFECTS															
Final Demand	$40	($1,063)	$813	($597)	($597)	($597)	($597)	($197)	($597)	($597)	($597)	($597)	($597)	($8,571)	($5,689)
Multiplier Effects															
Indirect & Induced Output	$96	($1,086)	$831	($610)	($610)	($610)	($610)	($201)	($610)	($610)	($610)	($610)	($610)	($8,704)	($5,759)
Labor	0.001	(0.029)	0.022	(0.016)	(0.016)	(0.016)	(0.016)	(0.005)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.237)	
Labor income	$108	($780)	$597	($438)	($438)	($438)	($438)	($145)	($438)	($438)	($438)	($438)	($438)	($6,211)	($4,096)
State Fiscal Account															
Costs															
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													$0	$0
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$2	($44)	$34	($25)	($25)	($25)	($25)	($8)	($25)	($25)	($25)	($25)	($25)	($357)	($237)
Individual income (x labor income)	$6	($47)	$36	($26)	($26)	($26)	($26)	($9)	($26)	($26)	($26)	($26)	($26)	($370)	($244)
Corporate income (% of GSP)	$0	($2)	$1	($1)	($1)	($1)	($1)	($0)	($1)	($1)	($1)	($1)	($1)	($15)	($10)
Taxes on Indirect & Induced Output	$4	($50)	$38	($28)	($28)	($28)	($28)	($9)	($28)	($28)	($28)	($28)	($28)	($399)	($264)
TOTAL BENEFIT	$13	($142)	$109	($80)	($80)	($80)	($80)	($26)	($80)	($80)	($80)	($80)	($80)	($1,140)	($754)
NET BENEFIT TO STATE GOVERNMENT	$13	($142)	$109	($80)	($80)	($80)	($80)	($26)	($80)	($80)	($80)	($80)	($80)	($1,140)	($754)

Table A7: Tariff Distribution, Rebate Levels & Per Kwh Data

	Individual Tariff Areas				Grand Totals		DSM Rebate Levels		Per Kwh Cost	
Tariff Area	Avg Cost	No.	% of Total	Wt. Cost	Distrib.	Weights	Rebate	Weight	$/kwh	Weight
HECO										
New	$ 3,172	2,496	23.1%	$ 733	15%		$ 750	$ 115		
Retro Fit	$ 4,883	8,300	76.9%	$ 3,754	51%		$ 750	$ 382		
SubTotal		10,797	100%	$ 4,487	66%	$ 2,973			$ 0.1463	$ 0.0969
HELCO										
New	$ 4,361	963	42.8%	$ 1,867	6%		$ 1,000	$ 59		
Retro Fit	$ 4,689	1,286	57.2%	$ 2,682	8%		$ 1,000	$ 79		
SubTotal		2,249	100%	$ 4,549	14%	$ 628			$ 0.2297	$ 0.0317
MECO-Maui										
New	$ 4,285	1,003	30.9%	$ 1,323	6%		$ 1,000	$ 62		
Retro Fit	$ 4,720	2,247	69.1%	$ 3,263	14%		$ 1,000	$ 138		
SubTotal		3,251	100%	$ 4,585	20%	$ 915			$ 0.1868	$ 0.0373
GRAND TOTAL		16,297	100%		100%	**$ 4,541**		$ 840		**$ 0.1659**
New		4,463	27%					$ 236		
Retro Fit		11,834	73%					$ 604		

Sources
HEGO "Program Data" Printout Dated 10/1/2000
"No." of Systems is from Table A8: DSM Solar Systems

Table A8: DSM Solar Systems

	HECO			HELCO			MECO			TOTAL		
1996	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan				0	0	0				0	0	0
Feb				0	4	4				0	4	4
Mar				2	4	6				2	4	6
Apr				5	2	7				5	2	7
May				3	1	4				3	1	4
Jun				3	3	6				3	3	6
Jul	1	2	3	5	4	9				6	6	12
Aug	0	25	25	7	6	13				7	31	38
Sep	3	67	70	5	20	25				8	87	95
Oct	4	69	73	8	19	27	4	18	22	16	106	122
Nov	5	69	74	8	30	38	0	12	12	13	111	124
Dec	3	62	65	10	27	37	5	18	23	18	107	125
TOTAL	**16**	**294**	**310**	**56**	**120**	**176**	**9**	**48**	**57**	**81**	**462**	**543**

	HECO			HELCO			MECO			TOTAL		
1997	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan	4	68	72	8	22	30	4	21	25	16	111	127
Feb	9	125	134	8	21	29	5	15	20	22	161	183
Mar	7	112	119	2	16	18	8	44	52	17	172	189
Apr	15	180	195	5	31	36	8	36	44	28	247	275
May	11	134	145	6	28	34	7	20	27	24	182	206
Jun	7	112	119	6	19	25	6	8	14	19	139	158
Jul	7	92	99	8	15	23	8	31	39	23	138	161
Aug	136	91	227	5	26	31	7	7	14	148	124	272
Sep	31	84	115	14	25	39	11	42	53	56	151	207
Oct	13	279	292	9	21	30	12	42	54	34	342	376
Nov	18	164	182	15	25	40	9	27	36	42	216	258
Dec	17	235	252	20	30	50	3	33	36	40	298	338
TOTAL	**275**	**1,676**	**1,951**	**106**	**279**	**385**	**88**	**326**	**414**	**469**	**2,281**	**2,750**

	HECO			HELCO			MECO			TOTAL		
1998	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan	8	189	197	7	6	13	28	54	82	43	249	292
Feb	11	275	286	18	30	48	13	34	47	42	339	381
Mar	19	197	216	10	13	23	14	36	50	43	246	289
Apr	28	214	242	18	23	41	11	37	48	57	274	331
May	17	155	172	10	9	19	12	43	55	39	207	246
Jun	15	113	128	10	17	27	33	22	55	58	152	210
Jul	15	111	126	15	13	28	16	56	72	46	180	226
Aug	21	138	159	8	16	24	10	44	54	39	198	237
Sep	12	234	246	14	13	27	12	40	52	38	287	325
Oct	99	161	260	18	20	38	9	26	35	126	207	333
Nov	94	119	213	13	4	17	8	46	54	115	169	284
Dec	153	93	246	44	29	73	15	76	91	212	198	410
TOTAL	**492**	**1,999**	**2,491**	**185**	**193**	**378**	**181**	**514**	**695**	**858**	**2,706**	**3,564**

Notes HECO Residential Programs received approval in May 1996.
HELCO Residential Programs received approval in December 1995.
MECO Residential Program received approval in July 1996.

Table A8: DSM Solar Systems *(continued)*

	HECO			HELCO			MECO			TOTAL		
1999	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan	48	149	197	8	6	14	9	70	79	65	225	290
Feb	126	180	306	9	12	21	13	34	47	148	226	374
Mar	92	169	261	24	17	41	14	33	47	130	219	349
Apr	85	159	244	15	6	21	12	32	44	112	197	309
May	88	168	256	22	10	32	10	20	30	120	198	318
Jun	68	193	261	11	9	20	11	30	41	90	232	322
Jul	29	109	138	23	8	31	14	27	41	66	144	210
Aug	29	181	210	16	17	33	4	19	23	49	217	266
Sep	12	105	117	28	22	50	8	44	52	48	171	219
Oct	20	151	171	26	35	61	19	56	75	65	242	307
Nov	9	98	107	17	12	29	18	46	64	44	156	200
Dec	33	127	160	44	59	103	23	76	99	100	262	362
TOTAL	**639**	**1,789**	**2,428**	**243**	**213**	**456**	**155**	**487**	**642**	**1,037**	**2,489**	**3,526**

	HECO			HELCO			MECO			TOTAL		
2000	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan	4	86	90	4	5	9	7	15	22	15	106	121
Feb	175	153	328	5	20	25	18	43	61	198	216	414
Mar	44	66	110	11	18	29	13	28	41	68	112	180
Apr	7	68	75	11	16	27	7	32	39	25	116	141
May	251	301	552	16	15	31	11	34	45	278	350	628
Jun	22	230	252	23	13	36	7	31	38	52	274	326
Jul	64	36	100	12	16	28	19	38	57	95	90	185
Aug	43	109	152	16	17	33	16	52	68	75	178	253
Sep	41	118	159	13	17	30	5	18	23	59	153	212
Oct	16	67	83	17	12	29	20	70	90	53	149	202
Nov	58	107	165	18	18	36	18	34	52	94	159	253
Dec	19	299	318	10	24	34	45	63	108	74	386	460
TOTAL	**744**	**1,640**	**2,384**	**156**	**191**	**347**	**186**	**458**	**644**	**1,086**	**2,289**	**3,375**

	HECO			HELCO			MECO			TOTAL		
2001	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
Jan	18	99	117	20	23	43	12	14	26	50	136	186
Feb	20	53	73	14	18	32	36	43	79	70	114	184
Mar	112	90	202	24	28	52	16	33	49	152	151	303
Apr	16	53	69	12	8	20	15	15	30	43	76	119
May	29	75	104	13	19	32	25	36	61	67	130	197
Jun	19	53	72	12	24	36	34	21	55	65	98	163
Jul	13	63	76	7	25	32	38	81	119	58	169	227
Aug	17	70	87	21	36	57	91	27	118	129	133	262
Sep	14	102	116	23	17	40	13	15	28	50	134	184
Oct	10	77	87	13	17	30	15	32	47	38	126	164
Nov	*28*	*68*	*96*	*21*	*26*	*47*	*33*	*37*	*71*	*80*	*126*	*213*
Dec	*34*	*100*	*134*	*37*	*49*	*86*	*57*	*60*	*116*	*115*	*194*	*337*
TOTAL	**330**	**902**	**1,233**	**217**	**290**	**507**	**384**	**414**	**799**	**917**	**1,587**	**2,539**

	HECO			HELCO			MECO			TOTAL		
	NEW	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**	**NEW**	**EXIST**	**TOTAL**
SUM	**2,496**	**8,300**	**10,797**	**963**	**1,286**	**2,249**	**1,003**	**2,247**	**3,251**	**4,448**	**11,814**	**16,297**

Table Notes

Nov & Dec for 2001 are estimated based on historic seasonality.

Table A9: Solar Hot Water Tax Credits byYear (1977 - 2001)

(Data Source: Hawaii Department of Taxation, "Tax Credits" & HECO)

Year	Solar Tax Credit (%)	Systems Sold
1977	10	1,101
1978	50	4,061
1979	50	4,375
1980	50	4,704
1981	50	6,445
1982	50	4,407
1983	50	3,148
1984	50	4,464
1985	50	6,740
1986	10	592
1987	15	354
1988	15	316
1989	15	327
1990	35	1,180
1991	35	1,314
1992	35	1,261
1993	35	1500
1994	35	1700
1995	35	1850
1996	42.5	2043
1997	50	2,750
1998	50	3,564
1999	50	3,526
2000	46.25	3,375
2001	42.84	2,539
TOTAL	24	67,636
Estimated		
no ECITC & DSM	0	284
ECITC & No DSM	35	1,678
DSM Only Effective Credit	24	978
ECITC & Current DSM	43	2,497

Table A10: Hawaii State Tax Revenues as a % of GSP

Tax	FY 1999 Amount (x1000)
Individual Income	$1,066,711
Corporate income	$42,643
GET	$1,447,278
TOTAL	$2,556,632
GSP	$36,004,300
Ratio GSP/Taxes	7.10%

Sources:
Dept. of Taxation, "Annual Report," & 2000 Data Book

Appendix E

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII PHOTOVOLTAIC (SOLAR ELECTRIC) ENERGY CONSERVATION INCOME TAX CREDIT

Prepared by:

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Prepared for:

The Hawaii Energy Efficiency Policy Task Force

March 11, 2002

PHOTOVOLTAIC (SOLAR ELECTRIC) SYSTEM EXECUTIVE SUMMARY

The current State credit received by a purchaser of a photovoltaic (PV) system is 35% of the purchase price of a system. Under current law, commercial systems have no cap on the credit amount. In contrast, residential systems have a $1750 per system cap. It is uncertain the number or amount of credit refunds for PV systems due to a lack of data. The system sizes analyzed are 30 kW and 2 kW for commercial and residential PV systems, respectively, and 300 kW and 1 MW for large commercial systems. The discussion focuses on small commercial PV systems purchased with financing reported on a per kW and total 30 kW basis (reported in parentheses). Report appendixes provide results for residential and small commercial, and large commercial PV systems.

The State of Hawaii would refund $3087 ($93,000) per kW (per 30 kW) for installation of a 30 kW PV system under current law. This spending would lead to the following estimated economic outcomes.

- Return to the State $1142 ($34,300) in tax revenues per installations over the 25-year life of a system.
- Provide 0.252 (8) jobs the year of the installation and each year equivalent sized systems are installed and create 0.005 (0.15) new jobs per system installation that exist the remaining 24-years of a systems life for each system installed.
- Estimated economic outcomes improve with system size indicating economies of size exist with respect to PV technology. That is, the larger the system sizes the better the economic performance and resultant fiscal effects of a PV system.

Economic and fiscal impacts are based on a 35% ECITC. PV systems are energy savings capital equipment that has a useful life greater than one year. The energy saving capacity of PV systems results in decreased oil imports leaving dollars that would have been exported for oil purchases in Hawaii for local expenditures. This benefit offsets system costs. The analysis measures the economic effects created by ECITC stimulated purchases of PV systems and those foregone due to its purchase. The net impact equals the difference between the economic effects and derivative fiscal effects created and those foregone.

Most installed kW PV capacity to date is for commercial systems. Available information suggests installation activity for both commercial and residential is increasing. Proposed PV installations are assumed to have 100% of total cost financing. All financing is assumed to come from in-state institutions. For this purchase situation for a 30 kW commercial system, the break-even ECITC level is 13.9% for year 1 and 8.0% over the life cycle of a commercial PV system. Stated otherwise, a credit level of 8.0% means that over the life of a commercial PV system, the State would incur a $0 net cost. To incur a $0 net cost in year 1 the credit level would be 13.9%. Large commercial PV systems have higher break-even ECICT levels while residential systems have lower ECITC break-even levels consistent with the existence of PV size economies.

It is important to note that the break-even levels noted make no accounting of the value of achieving public policy goals (e.g. energy conservation, portfolio standards) via the use of the ECITC, the value of oil price or supply shock risk reductions, the potential impact on the electric services industry, which installs and services PV systems, or negative fiscal impacts if ECITC elimination or reduction leads to industry down-sizing. Industry downsizing could occur in a fashion similar to what empirical evidence indicates occurs for solar systems. Specifically, a 1% increase (decrease) in the credit level leads to a 5% increase (decrease) in the number of system purchases. Discussions with industry sources indicates that elimination of the ECITC would significantly diminish if not completely forestall budding new interest and planned development of PV technology in Hawaii.

The ECITC PV "investment" returns to the State and system purchasers are the following.

- For the State of Hawaii there is no rate of return (IRR) or pay back from the ECITC for PV systems. For large commercial PV systems, the State essentially breaks even at the current ECITC level.
- For purchasers:
  - A pay back of investment cost of 15 years with the ECITC and 25 years without the ECITC,
  - An investment IRR (cash purchase) of 18.7% with the ECITC, there is no rate of return to the purchaser without the ECITC except for large commercial systems.

ECITC benefit/cost ratios, where the ratio numerator is the benefit value equaling the respective result variable life cycle value and the denominator is the ECITC cost, are the following.

- Output/ECITC = 8.61: Each ECITC dollar spent stimulates a PV installation resulting in $8.61 of output (sales). The total output effect for a 30 kW PV system is $797,000.
- Employment/ECITC = 0.000006: Each ECITC dollar spent stimulates a solar purchase resulting in the creation of 0.000006 jobs. The total employment effect for a 30 kW PV system is 0.55 jobs.
- Labor Income/ECITC = 3.45: Each ECITC dollar spent stimulates a PV purchase resulting in the generation of $3.95 of wage and salary income to workers. The total labor income effect for a 30 kW PV system is $319,000.
- Tax Revenues/ECITC = 0.37: Each ECITC dollar spent stimulates a PV system purchase resulting in the generation of $0.37 tax revenue. The total tax revenue effect for a 30 kW PV system is $34,000. Large commercial PV systems have tax revenue benefit/cost ratios slightly greater than 1.

Other important research results per kW (30 kW system) are the following.

- Economic:
  - Output increases of $20.100 ($603,000) in year 1 and an average of $269 ($8,000) per year for years 2-25;

    - 0.25 (8) job(s) are generated in year 1 and 0.005 (0.14) average jobs per year from years 2-25;
    - $97 ($249,000) wage and salary income is generated in year 1 and an average of $75 ($2,900) from years 2-25.
    - Large (residential) PVC systems have higher (lower) economic outcomes than these reported.
- Fiscal impacts:
    - A net fiscal impact of ECITC stimulated PV system installations in year 1 of negative $1842 (-$55,000), which is less than the $3087 ($93,000) ECITC amount refunded due to the fact that net revenues generated in year 1 by installation of a PV system are $1200 ($37,000).
    - Net revenues in years 2-25 average -$8 (-$230) per year.
    - A total, life cycle net (of the ECITC cost) fiscal impact to the State of -$2027 (-$61,000).
    - Large (residential) PVC systems have higher (lower) fiscal impact outcomes than these reported.

INTRODUCTION

Photovoltaic (PV) or solar electric systems are a renewable energy technology that utilizes favorably placed panels containing PV cells that convert sun light directly into electricity. Both residential and commercial system installers use the electricity themselves. Systems are "net" metered to reduce their utility power bill if they produce energy in excess of needs. PV system installation and use decrease reliance on imported oil used to generate electricity. As such, their installation and use not only has economic impacts to system purchasers but broader statewide economic impacts as well.

The State of Hawaii currently provides a 35% of the purchase price of a system. Under current law, commercial systems have no cap on the credit amount. In contrast, residential systems have a $1,750 per system cap. It is uncertain the number or amount of credit refunds for PV systems due to a lack of data. The 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. Because a PV system is a capital item it has a life greater than one year. Thus, its energy saving capacity and its consequent economic and fiscal impacts extend over its life cycle.

Report Objective

The objective of this research is to assess the economic and fiscal impacts of Energy Conservation Income Tax Credit (ECITC) stimulated PV system installations. This entails estimating the economic effects created by the purchase of a PV system and those foregone due to its purchase. The net impact is the difference between the economic effects and derivative fiscal effects created and those foregone.

Data Sources

The data sources used for the analysis include the following.

- Primary data provided by:
  - The InterIsland PV Co., a local PV vendor and installer,
  - The PowerLight Co., a California-based PV company;
  - Hawaii PV Energy Association (HSEA) members;
  - HECO.
- Secondary data sources which include:
  - Oil price forecasts and data provided by the Energy Information Administration;
  - Tax data published by the IRS, the Hawaii State Department of Taxation and Department of Business Economic Development & Tourism (DBEDT);
  - The "1992 Hawaii State Input/Output Model" published by DBEDT.

Specific cites from these respective sources are found in the Appendix tables.

Methodology

User, lender and State cost and benefit cash flow accounts are formulated for residential and commercial PV systems. As noted, owners use electricity generated or reverse the electricity meter to reduce their "net" utility electricity use and cost. The utility retail cost of electricity equals the value per kW electricity generated. Cash flows extend for 25 years, the assumed life of a PV system. Cash flows are estimated for cash and financed purchases for residential and commercial purchasers.

Benefits and costs for the respective entities are the following.

- User or system purchaser:
  - Costs include system purchase and installation costs, annual maintenance costs and purchase price amortization costs.
  - System benefits are the annual energy cost savings the system provides over its life, any tax savings from interest and/or depreciation deductions and ECITC credit amounts.
- Lender:
  - Costs are the purchase cost of a system and taxes on interest income.
  - The lender benefit is the interest generated by the loan made to purchase a system ECITC credit amounts if used to reduce loan principal for financed system purchases.
- State:
  - Cost is the ECITC the year the credit is taken by the system purchaser and interest and depreciation (if applicable) tax reductions.
  - Benefits are net tax revenues stimulated by the purchase of a PV system.

Based on these cash flows, the economic performance of the investment is measured for each entity. Economic performance variables include:

- Pay back period of the investment;
- Investment net present value;
- Investment internal rate of return (IRR).

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 1992 Hawaii State Input/Output Model. The economic impact variables measured include:

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

General excise tax (GET) 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 ECITC cost to the State allow the determination of the net fiscal impact to the State of the ECITC program.

System sizes analyzed include:

- Residential (2 kW);
- Small commercial (30 kW); and
- Large commercial (300 kW and 1 MW).

The discussion focuses on commercial PV systems purchased with financing unless otherwise noted. Results are reported on a per kW and total 30 kW basis (reported in parentheses). Data are unavailable to report historic installations. The report appendices provide results for residential and small commercial and large commercial systems.

The net fiscal impact measure makes no accounting of the "ECITC cost lag" that occurs due to the timing of the ECITC refund. Specifically, the ECITC refund occurs the tax-year after system installation. In contrast, benefits from system installation and energy savings result in net positive revenues to the State beginning in the previous year. If accounted for, the total net fiscal impact would increase relative to that reported.

RESULTS

Economic Performance

Tables2 and B1 show the economic performance of PV systems per purchaser and purchaser type, for residential and small commercial and large commercial systems. It shows that the payback on investment for small commercial systems with the ECITC improves by 12 years, from 23 years without the ECITC to 11 years with the ECITC (cash purchase). Table 1 further shows that the purchase of a PV system with the ECITC provides an average annual rate of return (IRR) of 2.2% (cash purchase) to its purchaser, a much improved rate of return relative to the -7.7% rate of return without the ECITC. The analysis shows similar such economic improvements for residential and large commercial systems.

The Relationship between Credit Levels and PV Systems Purchased

The lack of historical purchase data does not allow analysis of the relationship between the number of PV systems purchased and the credit level. If the relationship is the same as that measured between solar system purchases and the credit level one would expect a 5% increase (decrease) in system purchases per 1% increase (decrease) in the credit level. Discussions with industry sources indicates that elimination of the ECITC would significantly diminish if not completely forestall budding new interest and planned development of PV technology in Hawaii.

Economic Return to the State

The State experiences a negative economic return at a 35% ECITC level. Large commercial systems of 1 MW showed the best payback performance to the State of 18 years.

Economic and Fiscal Impacts of the ECITC

Economic impacts are net changes in output, employment and labor income in the general economy. Fiscal impacts are net changes in government expenditures and revenues. Economic and fiscal effects measured in this analysis result from the State government's expenditure on the ECITC. Specifically, the ECITC stimulates the purchase of a PV system creating economic and fiscal effects. Simultaneously, a PV purchase causes economic and fiscal effects to be foregone due to its purchase. Netting the effects foregone from those created results in the economic and fiscal impacts caused by the ECITC.

If the ECITC were eliminated, other economic and fiscal costs could be incurred for each system not purchased because there is no ECITC program. These include output, employment and labor income decreases and their consequent impact on State tax revenues, and direct fiscal expenditures to the State in the form of unemployment insurance benefits. Costs could also include other expenditures due to temporary and possible permanent unemployment caused by a size reduction of the PV industry due to ECITC elimination. These potential costs are not measured in this analysis.

Expenditure Pattern Changes Caused by the Purchase of a PV System

An entity choosing to install a PV system presumably would select this investment from available investments either because it provides the greatest return subject to their constraint set, it is the most cost effective or only source of electricity generation from sources to choose from or it reduces the risk of utility outages. Regardless of the reason for PV system installation, their use reduces reliance on imported fossil fuels over their life cycle since the operation of a PV system uses a local resource, sunlight, as opposed to fossil fuel to generate electricity. The value of this fossil fuel import reduction has a full multiplier impact equivalent to any exogenous dollar (e.g. a tourist dollar) expended in Hawaii.

The estimated average annual imported oil savings per installed kW is $297. This savings created by the use of PV systems causes $297 per installed kW per year less to be exported from the State for oil purchases and $297 more for alternative consumption or investment expenditures. The energy saving amount increases for higher electricity costs (e.g., neighbor islands versus Oahu). Expenditures are assumed to occur within the State. The expenditure pattern changes from this energy savings accounts for the majority of the positive economic and fiscal impacts created by purchase of PV systems.

Net Impact of a PV System

Table 2 shows the "Economic and Fiscal Impacts of ECITC Stimulated PV System Purchases." First and subsequent year effects and net impacts are distinguished to provide an accounting the year in which the purchaser receives the credit.

Table 2 shows purchase of a PV system has positive economic impacts. Specifically,

- Output increases of $20.100 ($603,000) in year 1 and an average of $269 ($8,000) per year for years 2-25;

- 0.25 (8) job(s) are generated in year 1 and 0.005 (0.14) average jobs per year from years 2-25;
- $97 ($249,000) wage and salary income is generated in year 1 and an average of $75 ($2,900) from years 2-25.
- Estimated economic outcomes improve with system size indicating economies of size exist with respect to PV technology. That is, the larger the system sizes the better the economic performance and resultant fiscal effects of a PV system

Table 2 shows a negative net fiscal impact to the State (*i.e.* revenues less than expenditures) per single-family residential unit in year 1 of $1,842 (-%55,000). This net fiscal impact to the State is less than the $3,087 ($93,000) ECITC amount refunded per 30 kW commercial system due to the fact that net revenues generated by PV system purchasers are $1,200 ($37,000) in year 1. Net revenues in year are 2-25 average -$8 per year per installed kW. In total, the net fiscal impact to the State over the life of a PV system is -$2027 (-$61,000) per installed kW (30 kW). Large (residential) PVC systems have higher (lower) net fiscal impact outcomes than these reported

Break-Even Fiscal Impact

The break-even fiscal impact analysis is the credit level at which the net fiscal impact is $0. In other words, it is the credit level at which there is no net expenditure required by the State given the ECITC. For year 1, this is the credit level at which the net fiscal impact increases to $0 from its ($1842) level at the current ECITC level of 35%. The break-even ECITC level for year 1 is 13.9% and 8.0% from a system life cycle perspective (see Table 3). Large commercial PV systems have higher break-even ECITC levels (see Table B3) while residential systems have lower ECITC break-even levels consistent with the existence of PV size economies.

It is important to note that break-even analysis does not account for ECITC premiums above break-even levels used to achieve public policy as well as economic and fiscal objectives. Such public policy objectives could be increased energy self-sufficiency, insurance against oil supply disruptions and/or oil price spikes, and/or stimulation of a renewable technology garnering increased interest, use and development. Furthermore, any decrease in the current credit level could decrease PV purchases given business and consumer expectations and existent structures based on a 35% credit level. Such a decrease could have negative economic and fiscal impacts related not only to decreased purchases themselves but any industry downsizing, which could result in job loss and consequent unemployment insurance and other such fiscal costs.

Impacts Due to Assumption Changes

The results presented in Tables 1 and 2 are based on the following assumptions.

- A PV ECITC of 35% and;
- Oil prices average $26-27 per barrel as they have for 2001;

- No oil supply disruptions or exogenous price spikes.

Altering any of these assumptions alters the estimated economic and fiscal impacts of the ECITC. The impact changes discussed below are made relative to this assumption set.

Oil Price Trends: High (low) forecast oil price secular changes of 1.3% (-2.1%) per year result in increased (decreased) economic and fiscal economic impacts of 16% (-20%) and -5% (7%).

Oil Price Spikes: Oil price spikes have timing, size and duration dimensions. If an oil price spike increases oil prices by 50% occurred currently and lasted 2 years, ECITC economic and fiscal economic impacts would increase by 7% and -3%, respectively. On average, a possible oil price spike impact on economic and fiscal measures will on average be:

- smaller the later in time the price spike occurs;
- larger the longer the price spike lasts;
- larger the greater the price spike level.

Economic and Fiscal Impacts Not Measured

Tangible economic and fiscal impacts of the ECITC not measured in this analysis include the following.

1. The positive impact of strengthening Hawaii's energy service industry, which simultaneously strengthens Hawaii's actual and potential position as a Pacific energy services, research and development center. This would be especially true for PV, a renewable technology garnering new attention, implementation and research at the national level.

2. The positive impact on business perceptions about investment in Hawaii. This positive impact is reinforced by a consistent State policy, which Hawaii has exhibited since 1990 with respect to the PV credits.

3. The negative impact of fiscal expenditures if the ECITC is eliminated the State would incur not measured in this analysis. These include: unemployment compensation benefits, potential welfare benefit expenditures to displaced workers, expenditures for direct State involvement in retraining programs for new jobs or direct subsidies for new job creation, and revenue losses to the State due to private sector expense increases to re-train workers for new jobs and for the creation of new jobs.

4. Positive ECITC fiscal impacts to Hawaii counties in the form of permit fees and increased property tax revenues due to real estate improvements.

5. The option value (*i.e.* the value of having an energy services industry of its current size) lost to the State given industry downsizing if the ECITC is eliminated.

Intangible ECITC economic and fiscal impacts arise due to positive externalities (side effects) from reduced oil consumption brought about by the ECITC. 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. The larger the energy cost savings, the larger are the positive ECITC economic and fiscal impacts.

CONCLUSION

ECITC stimulated PV purchases have positive economic but negative fiscal impacts to the State of Hawaii over the life of these systems. Negative fiscal impacts are negligible for large commercial systems. Life cycle impacts are the following.

- PV system use results in $297 per installed kW fossil fuel import reductions per year. This annual savings lasts for the 25-year system life and is the most significant factor resulting in the positive economic and fiscal created by ECITC stimulated purchases.
- Average annual life cycle economic impacts of ECITC stimulated PV purchases expressed on a per installed kW basis include:
    - An increase in economic output of $1,133;
    - The creation of 0.02 job per 30 kW system installed; and
    - $451 in labor income.
- Fiscal impacts of ECITC stimulated PV purchases are the following.
    - An average annual net impact expressed on a per system basis of -$79 for an ECITC level of 35%.
    - Break-even fiscal impact credit levels are 13.9% from a year 1 perspective and 8.0% from a life cycle perspective.
    - Economic and fiscal impacts improve (diminish) for large commercial (residential) systems relative to reported results due to the existence of PV system size economies.

Expressing ECITC impacts in benefit/cost terms where the ratio numerator is the benefit which equals the respective result variable life cycle value and the denominator is the ECITC cost to the State, best measures the economic and fiscal impacts of the ECITC. These ratios, presented in Tables 4 and B4 for a single system purchased in a given year, indicate the following.

- Output/ECITC = 8.61: Each ECITC dollar spent stimulates a PV installation resulting in $8.61 of output (sales). The total output effect for a 30 kW PV system is $797,000.
- Employment/ECITC = 0.000006: Each ECITC dollar spent stimulates a solar purchase resulting in the creation of 0.000006 jobs. The total employment effect for a 30 kW PV system is 0.55 jobs.

- Labor Income/ECITC = 3.45: Each ECITC dollar spent stimulates a PV purchase resulting in the generation of $3.95 of wage and salary income to workers. The total labor income effect for a 30 kW PV system is $319,000.
- Tax Revenues/ECITC = 0.37: Each ECITC dollar spent stimulates a PV system purchase resulting in the generation of $0.37 tax revenue. The total tax revenue effect for a 30 kW PV system is $34,000. Large commercial PV systems have tax revenue benefit/cost ratios slightly greater than 1.

Table 1: The Investment Performance of Residential and Small Commercial PV Systems per kW Installed Capacity

Entity/Scenario	Pay Back	NPV	IRR
System Users			
Residential Owner Purchase			
Cash Purchase			
w/ ECITC	25	($5,159)	
w/o ECITC	25	($6,034)	
Financed Purchase			
w/ ECITC	25	($8,318)	
w/o ECITC	25	($9,477)	
Small Commercial Purchaser			
Cash Purchase			
w/ ECITC	11	$1,654	2.2%
w/o ECITC	23	($1,433)	-7.7%
Financed Purchase			
w/ ECITC	15	$78	18.7%
w/o ECITC	25	($4,012)	
State			
Residential Owner Purchase			
Cash Purchase			
w/ ECITC	25	($549)	-8.2%
w/o ECITC	17	$92	-2.9%
Financed Purchase			
w/ ECITC	21	($1,119)	
w/o ECITC	17	($529)	
Small Commercial Purchaser			
Cash Purchase			
w/ ECITC	25	($1,732)	
w/o ECITC	10	$529	3.9%
Financed Purchase			
w/ ECITC	25	($2,016)	
w/o ECITC	14	$63	6.9%

Table 2: The Economic & Fiscal Impacts of ECITC Stimulated Residential and Small Commercial PV System Purchases

	Output			Employment			Labor Income				Net Fiscal Impact		
Purchaser/Scenario	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Credit $C	Year 1	Yrs 2-25	Total
Residential Owner Purchase per kW													
Cash Purchase													
w/ ECITC	-$15,543	$934	$6,872	-0.238	0.015	0.005	-$4,403	$343	$3,839	$875	-$563	$29	$142
w/o ECITC	-$19,081	$934	$3,334	-0.286	0.015	0.003	-$5,687	$343	$2,554	$0	$195	$29	$900
Financed Purchase													
w/ ECITC	$21,060	-$923	-$1,091	0.260	-0.013	-0.002	$8,854	-$339	$715	$875	$641	-$27	-$5
w/o ECITC	$20,816	-$1,090	-$5,346	0.257	-0.016	-0.0047	$8,763	-$401	-$850	$0	$1,508	-$32	$740
Small Commercial Owner Purchase per kW													
Cash Purchase													
w/ ECITC	$1,841	$1,196	$30,538	0.003	0.019	0.018	$1,699	$437	$12,195	$3,087	-$2,444	$20	-$1,953
w/o ECITC	-$10,643	$1,196	$18,054	-0.167	0.019	0.011	-$2,832	$437	$7,664	$0	$230	$20	$721
Financed Purchase													
w/ ECITC	$20,106	$269	$26,564	0.252	0.005	0.015	$8,315	$97	$10,637	$3,087	-$1,842	-$8	-$2,027
w/o ECITC	$19,246	-$321	$11,552	0.240	-0.004	0.006	$7,993	-$120	$5,114	$0	$1,214	-$26	$600

Table 3: Residential and Small Commercial PV System ECITC Break-Even Analysis

Purchasers	Current ECITC	Break-Even ECITC Year 1	Break-Even ECITC Life Cycle
Residential Owner Purchase			
Cash Purchase	35.0%	14.4%	8.2%
Financed Purchase	35.0%	2.1%	9.8%
Small Commercial Owner Purchase			
Cash Purchase	35.0%	3.0%	9.4%
Financed Purchase	35.0%	13.9%	8.0%

Table 4: Residential and Small Commercial PV ECITC Benefit/Cost Ratios

Solar Purchasers	Economic Impacts Output	Economic Impacts Employment	Economic Impacts Labor Income	Tax Revenues
Residential Owner Purchase				
Cash Purchase	7.85	0.000005	4.39	0.62
Financed Purchase	-1.25	-0.000002	0.82	-0.44
Small Commercial Owner Purchase				
Cash Purchase	9.89	0.000006	3.95	0.52
Financed Purchase	8.61	0.000005	3.45	0.37

Table A1: Economic and Fiscal Impacts per kW of a Small Commercial PV System with Financing

Item	Effects Created by a System Purchase		Impacts Foregone Due to System Purchase		NET IMPACT	
	Year 1	Avg/Yr Years 2-25	Year 1	Avg/Yr Years 2-25	Year 1	Avg/Yr Years 2-25
Economic Effects						
Total Output						
Final Demand	$9,302	$117	($174)	($15)	$9,476	$133
Indirect & Induced	$10,452	$121	($178)	($15)	$10,630	$137
Employment	0.2472	0.0042	(0.0048)	(0.0004)	0.25196	0.00463
Total Labor Income	$8,187	$86	($128)	($11)	$8,315	$97
Fiscal Effects						
Total Revenues	$1,373	$16	($23)	($2)	$1,396	$18
Total Expenditures						
ECITC Expenditure	$3,087	$0			$3,087	$0
Other Costs	$129	$23			$129	$23
NET FISCAL IMPACT	($1,842)	($8)			($1,842)	($8)

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Residential and Small Commercial PV System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		25	Inter-Island Solar
	Commercial	Residential	
Estimated Annual kWh Output per Installed kW System	1,826	1,826	calculated
Average sun hours per day	5.0	5.0	Inter-Island Solar
Days per Year	365	365	given
	Commercial	Residential	
Average Installed Cost (2001 $) per kW	$8,820	$10,596	calculated
Total system cost	$264,600	$21,192	Inter-Island Solar (Hawaii average)
Delivered system capacity (kWh)	30	2	given system capacity for specific cost
Purchase Costs over System Life			
Equity % of purchase	0%		cash and financed systems estimated
Amortization Cost Assumptions			
Annual Interest	8.00%		current prime rate + 2%
Note: For residential purchases, the loan is assumes to be a home equity loan-type.			
Loan Terms (borrow money for purchase)	15		assumed
Assumed accelerated depreciation	5		Inter-Island Solar
Note: There is no depreciation on a residential system.			
Loan Amount per kW	$4,851	$9,721	calculated (system cost less credit value)
system cost per unit	$8,820	$10,596	see above
ECITC value per unit	$3,087	$875	system cost per unit x credit %
Fair Market System Value as of Buyout Date (% of purchase price)			David Kaneshiro at HECO
Federal Credit per Unit	$882	$0	system cost per unit x credit %
% of Loans Originating in-State		100%	assumed
Typical Annual Operations & Maintenance Cost per kW			
	Commercial	Residential	
Inverter at Mid-Point of System Life	$28,500	$2,500	Inter-Island Solar
Lease or Easement Rights Contract (% of revenues)	$78	$7	
Analysis Value	$950		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	$0.162		HECO data
Note: The retail cost per kWh assumes that the distribution of wind systems is the same as that for solar.			
Benchmark Price per Barrel Oil	$26.78		2001 average price to date
	Commercial	Residential	
Annual Savings	$297	$297	calculated
Oil Price Changes			
Alternative real average annual energy cost changes (2001-2025)			
Base case	0.0%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
low	-2.1%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
high	1.3%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Residential and Small Commercial PV System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Credit & Taxes	Commercial	Residential	
Effective Tax Credit with Cap	45%	8%	calculated
Hawaii State tax credit on purchase w/o cap	35%	35%	State
Federal tax credit	10%	0%	Federal
Hawaii ECITC Cap		$1,750	State
Notes			
1. There is no Federal tax credit for residential systems			
2. In some instances, residential system purchases and installation are spread over 2 years to maximize the ECITC credit amount which has a $5,000 annual purchase amount cap. This is not assumed for this analysis.			
Federal Tax Credits			
Production Tax Credit		$0.00	
credit per kWh Delivered	$0.000		
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.16%	HI State Dept. of Taxation, GET on Gross Sales assuming pyramiding
State Income Taxes on Labor Income		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Ratio of Corporate Income Tax to Labor Income Tax		4.00%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
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 inducted transactions from $1 of final demand are the % indicated of total indirect plus induced output.			
Total Taxes as a % of Indirect & Induced Output		4.6%	calculated
Ratio of GSP to Output	64.5%		1992 Hawaii State I/O model (value added ÷ total output for total intermediate demand)
Total Taxes as a % of GSP	7.1%		see "HAWAII STATE TAX REVENUES AS A % OF GSP" worksheet (p. A-11)
Tax on Income			
Individual State		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Federal		14.56%	IRS, "Statistics of Income Bulletin," Fall 2000, VOL 17 No 2, 1999 tax rates - all filers.
Corporate State		5.97%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Federal		14.67%	IRS, "Statistics of Income Bulletin," Summer 2000, VOL 20 No 1, 1997 tax rates - F, I & RE
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.13	1992 Hawaii State I/O model ($ economy output per $ other construc.final demand)
employment		26.59	1992 Hawaii State I/O model (total jobs per $ mil.other construc. final demand)
labor income		0.89	1992 Hawaii State I/O model ($ labor income per $ other construc.final demand)
from annual loan amortization			
output (sales)		2.13	1992 HI I/O model ($ economy output per $ banking & credit agencies final demand)
employment		25.47	1992 HI/O model (total jobs per $ mil. Final demand banking & credit)
labor income		0.680	1992 Hawaii State I/O model ($ labor per $ banking & credit final demand)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.02	1992 Hawaii State I/O model ($ output per $ final demand Personal. Consump.
employment		27.57	1992 Hawaii State I/O model (total jobs per $ mil. final demand Personal. Consump.
labor income		0.734	1992 Hawaii State I/O model ($ labor income per $ final demand Personal. Consump.
system savings assumed to remain in-state		100%	assumed % of equity owned within State

Table A3: Assumptions for Estimation of Fiscal and Economic Impacts Foregone Due to ECITC Stimulated Residential and Small Commercial System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)			NA
Installed Cost per Unit		$0	NA
Purchase Costs over System Life			
Amortization Costs of Purchase per Unit			
Annual Interest	6.00%		NA
Loan Terms (borrow money for purchase)	6		NA
Loan Amount per Unit	$0		NA
system cost per unit	$0		NA
credit value per unit	$0		NA
Notes: same assumption set for heat pumps.			
Typical Annual Maint.Contract Fee per Unit		$0.00	NA
Energy Cost Changes to HECO per kW			
Oil Cost if No Wind Farm		$296.57	see Table A6 for forecast changes for the base case scenario
Avoided Cost Paid to Wind Farm		$296.57	see Table A6 for forecast changes for the base case scenario

Table A4: Net Economic and Fiscal Impact Stimulated by the ECITC per kW Installed for Financed Small Commercial PV Systems

	Period Number													
Item	**Install**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Net Benefits														
PV System Purchaser	$0	$348	$342	$336	$329	$321	($415)	($423)	($433)	($443)	($454)	($466)	($478)	($2,392)
State Fiscal Account	($1,777)	($42)	($43)	($45)	($47)	($48)	($42)	($44)	($47)	($49)	($52)	($55)	($58)	($174)
Net Economic Impacts														
Final Demand	$8,820	$656	$639	$620	$600	$578	($173)	($199)	($226)	($256)	($287)	($322)	($359)	($1,349)
Multiplier Effects														
Indirect & Induced Output	$9,967	$664	$646	$628	$607	$585	($182)	($208)	($236)	($265)	($297)	($332)	($370)	($1,278)
Employment	0.2345	0.0174	0.0170	0.0165	0.0160	0.0154	(0.0053)	(0.0059)	(0.0067)	(0.0074)	(0.0083)	(0.0092)	(0.0102)	(0.0383)
Labor Income	$7,850	$465	$453	$440	$426	$411	($140)	($158)	($177)	($198)	($220)	($244)	($270)	($847)

	Period Number												**Value**
Item	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	TOTALS	**@ Discount**
														$0
Net Benefits														
PV System Purchaser	($507)	($523)	$593	$593	$593	$593	$593	$593	$593	$593	$593	$593	$1,074	$156
Lender	$64	$33	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($1,954)	($2,316)
HECO & Affiliates Impact	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
State Fiscal Account	($64)	($68)	$79	$79	$79	$79	$79	$79	$79	$79	$79	$79	($1,862)	($2,016)
Net Economic Impacts														
Final Demand	($443)	($490)	$593	$593	$593	$593	$593	$593	$593	$593	$593	$593		$12,198
Multiplier Effects														
Indirect & Induced Output	($454)	($501)	$606	$606	$606	$606	$606	$606	$606	$606	$606	$606	$15,034	$13,438
Employment	(0.0123)	(0.0136)	0.0164	0.0164	0.0164	0.0164	0.0164	0.0164	0.0164	0.0164	0.0164	0.0164	0.3632	
Labor Income	($328)	($361)	$435	$435	$435	$435	$435	$435	$435	$435	$435	$435	$11,453	$10,300

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Small Commercial PV System Purchases (per installed kW)

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
PV Purchaser Account														
Costs														
System cash purchase	$0													
Amortization costs (cost borrowed)		$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567
interest payment		$388	$374	$358	$342	$324	$304	$283	$261	$236	$210	$181	$150	$117
principal payment		$179	$193	$208	$225	$243	$263	$284	$306	$331	$357	$386	$417	$450
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	$0.0	$950
Annual Costs	$0	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$567	$1,517
Benefits														
ECITC Refund	$0													
Federal Tax Credit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
System Depreciation		$1,764	$1,764	$1,764	$1,764	$1,764	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions														
State		$129	$128	$127	$126	$125	$18	$17	$16	$14	$13	$11	$9	$7
Federal		$316	$314	$311	$309	$306	$45	$42	$38	$35	$31	$27	$22	$17
Annual cost savings		$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297
Annual Benefits	$0	$741	$738	$735	$731	$727	$359	$355	$350	$345	$340	$334	$328	$321
BENEFITS - COSTS	$0	$174	$171	$168	$164	$161	($207)	($212)	($216)	($221)	($227)	($233)	($239)	($1,196)
(assumed spent on personal consumption expenditures)														
Lender Accounts														
Costs														
System retail cost payment	$8,820													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income														
State		$23	$22	$21	$20	$19	$18	$17	$16	$14	$13	$11	$9	$7
Federal		$57	$55	$53	$50	$47	$45	$42	$38	$35	$31	$27	$22	$17
Annual Costs	$8,820	$80	$77	$74	$71	$67	$63	$58	$54	$49	$43	$37	$31	$24
Benefits														
ECITC Refund	$3,087													
Federal Tax Credit	$882													
Annual interest payment		$388	$374	$358	$342	$324	$304	$283	$261	$236	$210	$181	$150	$117
Annual Benefits	$3,969	$388	$374	$358	$342	$324	$304	$283	$261	$236	$210	$181	$150	$117
BENEFITS - COSTS - i only	($4,851)	$308	$297	$284	$271	$257	$241	$225	$207	$187	$166	$144	$119	$93
BENEFITS - COSTS - i + p	($4,851)	$487	$490	$493	$496	$500	$504	$508	$513	$518	$523	$529	$536	$543

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Small Commercial PV System Purchases (per installed kW) *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
PV Purchaser Account															
Costs															
System cash purchase	$0														
Amortization costs (cost borrowed)		$567	$567	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,501	$7,086
interest payment		$81	$42	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,650	$3,194
principal payment		$486	$525	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,851	$3,892
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	$0.0	$950	$687
Annual Costs	$0	$567	$567	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,451	$7,774
Benefits															
ECITC Refund	$0														
Federal Tax Credit	$0	$0	$0	$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	$8,820	$8,363
Depreciation & and Interest Tax Deductions															
State		$5	$3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$745	$690
Federal		$12	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,829	$1,695
Annual cost savings		$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$7,414	$5,466
Annual Benefits	$0	$313	$305	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$9,988	$7,852
BENEFITS - COSTS	$0	($253)	($262)	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$537	$78
(assumed spent on personal consumption expenditures)															
Lender Accounts															
Costs															
System retail cost payment	$8,820														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income															
State		$5	$3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$218	$191
Federal		$12	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$535	$469
Annual Costs	$8,820	$17	$9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,573	$9,479
Benefits															
ECITC Refund	$3,087														
Federal Tax Credit	$882														
Annual interest payment		$81	$42	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,650	$3,194
Annual Benefits	$3,969	$81	$42	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,619	$7,163
BENEFITS - COSTS - i only	($4,851)	$64	$33	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($1,954)	($2,316)
BENEFITS - COSTS - i + p	($4,851)	$550	$558	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,897	$1,576

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Small Commercial PV System Purchases (per installed kW) *(continued)*

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Multiplier Effects of Expenditure														
System Purchase Cost & Maintenance Effects														
Final Demand	$8,820	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$950
Multiplier Effects														
Indirect & Induced Output	$9,967	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,074
Labor	0.235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0253
Labor income	$7,850	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$846
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	$0	$174	$171	$168	$164	$161	($207)	($212)	($216)	($221)	($227)	($233)	($239)	($1,196)
Multiplier Effects														
Indirect & Induced Output	$0	$178	$175	$172	$168	$164	($212)	($216)	($221)	($226)	($232)	($238)	($244)	($1,222)
Labor	0.000	0.005	0.005	0.005	0.005	0.004	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.033)
Labor income	$0	$128	$126	$123	$121	$118	($152)	($155)	($159)	($163)	($167)	($171)	($176)	($878)
From Lender Activities														
% of Loan Originating In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand		$308	$297	$284	$271	$257	$241	$225	$207	$187	$166	$144	$119	$93
Multiplier Effects														
Indirect & Induced Output	$0	$348	$335	$321	$306	$290	$273	$254	$234	$212	$188	$162	$135	$105
Labor	0.0000	0.0078	0.0076	0.0072	0.0069	0.0065	0.0061	0.0057	0.0053	0.0048	0.0042	0.0037	0.0030	0.0024
Labor income	$0	$209	$202	$193	$184	$175	$164	$153	$141	$127	$113	$98	$81	$63
TOTAL MULTIPLIER EFFECTS														
Final Demand	$8,820	482.00	467.71	452.27	435.60	417.60	34.06	13.06	-9.62	-34.12	-60.57	-89.14	($120.0)	($153.3)
Multiplier Effects														
Indirect & Induced Output	$9,967	485.83	471.47	455.96	439.22	421.13	29.50	8.41	-14.38	-38.99	-65.56	-94.26	($125.3)	($56.1)
Labor	0.235	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	(0.004)	(0.005)
Labor income	$7,850	337.14	327.26	316.59	305.07	292.63	11.98	-2.53	-18.21	-35.14	-53.42	-73.17	($94.5)	$30.8
State Fiscal Account														
Costs														
State interest + depreciation deduction refund	$0	$129	$128	$127	$126	$125	$18	$17	$16	$14	$13	$11	$9	$7
ECITC cost	$3,087													
TOTAL COST	$3,087	$129	$128	$127	$126	$125	$18	$17	$16	$14	$13	$11	$9	$7
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$367	20.05	19.46	18.81	18.12	17.37	1.42	0.5	(0.4)	(1.4)	(2.5)	(3.7)	(5.0)	(6.4)
Individual income (x labor income)	$468	20.10	19.51	18.87	18.19	17.44	0.71	(0.2)	(1.1)	(2.1)	(3.2)	(4.4)	(5.6)	1.8
Corporate income (% of GSP)	$19	0.80	0.78	0.75	0.73	0.70	0.03	(0.0)	(0.0)	(0.1)	(0.1)	(0.2)	(0.2)	0.1
Taxes on Indirect & Induced Output	$456	22.25	21.59	20.88	20.11	19.28	1.35	0.4	(0.7)	(1.8)	(3.0)	(4.3)	(5.7)	(2.6)
TOTAL BENEFIT	$1,310	63.20	61.33	59.32	57.15	54.80	3.51	0.8	(2.2)	(5.4)	(8.8)	(12.6)	(16.6)	(7.0)
NET BENEFIT TO STATE GOVERNMENT	($1,777)	($65)	($66)	($67)	($69)	($70)	($15)	($16)	($18)	($19)	($21)	($23)	($26)	($14)

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Small Commercial PV System Purchases (per installed kW) *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Multiplier Effects of Expenditure															
System Purchase Cost & Maintenance Effects															
Final Demand	$8,820	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
Multiplier Effects															
Indirect & Induced Output	$9,967	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,040	$10,743
Labor	0.235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.260	
Labor income	$7,850	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,695	$8,462
Due to User Benefits - Costs															
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	$0	($253)	($262)	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$537	$78
Multiplier Effects															
Indirect & Induced Output	$0	($259)	($267)	$303	$303	$303	$303	$303	$303	$303	$303	$303	$303	$549	$80
Labor	0.000	(0.007)	(0.007)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.015	
Labor income	$0	($186)	($192)	$218	$218	$218	$218	$218	$218	$218	$218	$218	$218	$394	$57
From Lender Activities															
% of Loan Originating In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand		$64	$33	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,897	$2,535
Multiplier Effects															
Indirect & Induced Output	$0	$73	$38	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,273	$2,865
Labor	0.0000	0.0016	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.074	
Labor income	$0	$44	$23	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,970	$1,724
TOTAL MULTIPLIER EFFECTS															
Final Demand	$8,820	($189.3)	($228.2)	$297	$297	$297	$297	$297	$297	$297	$297	$297	$297	$13,204	$12,120
Multiplier Effects															
Indirect & Induced Output	$9,967	($194.9)	($233.9)	$303	$303	$303	$303	$303	$303	$303	$303	$303	$303	$14,486	$13,358
Labor	0.235	(0.005)	(0.006)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.348	
Labor income	$7,850	($142.4)	($169.3)	$218	$218	$218	$218	$218	$218	$218	$218	$218	$218	$11,059	$10,243
State Fiscal Account															
Costs															
State interest + depreciation deduction refund	$0	$5	$3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$745	$690
ECITC cost	$3,087													$3,087	$3,087
TOTAL COST	$3,087	$5	$3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,832	$3,777
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$367	(7.9)	(9.5)	$12.34	$12.34	$12.34	$12.34	$12.34	$12.34	$12.34	$12.34	$12.34	$12.34	$549	$504
Individual income (x labor income)	$468	(8.5)	(10.1)	$12.97	$12.97	$12.97	$12.97	$12.97	$12.97	$12.97	$12.97	$12.97	$12.97	$659	$611
Corporate income (% of GSP)	$19	(0.3)	(0.4)	$0.52	$0.52	$0.52	$0.52	$0.52	$0.52	$0.52	$0.52	$0.52	$0.52	$26	$24
Taxes on Indirect & Induced Output	$456	(8.9)	(10.7)	$13.88	$13.88	$13.88	$13.88	$13.88	$13.88	$13.88	$13.88	$13.88	$13.88		
TOTAL BENEFIT	$1,310	(25.6)	(30.7)	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$1,898	$1,751
NET BENEFIT TO STATE GOVERNMENT	($1,777)	($30)	($33)	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	($1,934)	($2,027)

Table A6: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Small Commercial PV System Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Purchaser Account														
BENEFITS - COSTS	$0	($174)	($171)	($168)	($164)	($161)	$207	$212	$216	$221	$227	$233	$239	$1,196
(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	$0	($174)	($171)	($168)	($164)	($161)	$207	$212	$216	$221	$227	$233	$239	$1,196
Multiplier Effects														
Indirect & Induced Output	$0	($178)	($175)	($172)	($168)	($164)	$212	$216	$221	$226	$232	$238	$244	$1,222
Labor	0.000	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.033
Labor income	$0	($128)	($126)	($123)	($121)	($118)	$152	$155	$159	$163	$167	$171	$176	$878
TOTAL MULTIPLIER EFFECTS														
Final Demand	0	(174)	(171)	(168)	(164)	(161)	207	212	216	221	227	233	239	1,196
Multiplier Effects														
Indirect & Induced Output	0	(178)	(175)	(172)	(168)	(164)	212	216	221	226	232	238	244	1,222
Labor	0.00000	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.033
Labor income	0	(128)	(126)	(123)	(121)	(118)	152	155	159	163	167	171	176	878
State Fiscal Account														
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	0	(7)	(7)	(7)	(7)	(7)	9	9	9	9	9	10	10	50
Individual income (x labor income)	0	(8)	(7)	(7)	(7)	(7)	9	9	9	10	10	10	10	52
Corporate income (% of GSP)	0	(0)	(0)	(0)	(0)	(0)	0	0	0	0	0	0	0	2
Lease Rents														
Taxes on Indirect & Induced Output	0	(8)	(8)	(8)	(8)	(8)	10	10	10	10	11	11	11	56
TOTAL BENEFIT	0	(23)	(23)	(22)	(22)	(22)	28	28	29	30	30	31	32	160
NET BENEFIT TO STATE GOVERNMENT	$0	($23)	($23)	($22)	($22)	($22)	$28	$28	$29	$30	$30	$31	$32	$160

Table A6: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Small Commercial PV System Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Purchaser Account															
BENEFITS - COSTS	$0	$253	$262	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($537)	($78)
(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%		
Final Demand	$0	$253	$262	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($297)	($537)	($78)
Multiplier Effects															
Indirect & Induced Output	$0	$259	$267	($303)	($303)	($303)	($303)	($303)	($303)	($303)	($303)	($303)	($303)	($549)	($80)
Labor	0.000	0.007	0.007	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.015)	
Labor income	$0	$186	$192	($218)	($218)	($218)	($218)	($218)	($218)	($218)	($218)	($218)	($218)	($394)	($57)
TOTAL MULTIPLIER EFFECTS															
Final Demand	0	253	262	(297)	(297)	(297)	(297)	(297)	(297)	(297)	(297)	(297)	(297)	(537)	(78)
Multiplier Effects															
Indirect & Induced Output	0	259	267	(303)	(303)	(303)	(303)	(303)	(303)	(303)	(303)	(303)	(303)	(549)	(80)
Labor	0.00000	0.007	0.007	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.015)	
Labor income	0	186	192	(218)	(218)	(218)	(218)	(218)	(218)	(218)	(218)	(218)	(218)	(394)	(57)
State Fiscal Account															
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	0	11	11	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(22)	(3)
Individual income (x labor income)	0	11	11	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(23)	(3)
Corporate income (% of GSP)	0	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(0)
Lease Rents															
Taxes on Indirect & Induced Output	0	12	12	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)		
TOTAL BENEFIT	0	34	35	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(72)	(10)
NET BENEFIT TO STATE GOVERNMENT	$0	$34	$35	($40)	($40)	($40)	($40)	($40)	($40)	($40)	($40)	($40)	($40)	($72)	($10)

Table B1: The Investment Performance of Large Commercial PV Systems per kW Installed Capacity on the Big Island

Entity/Scenario	Pay Back	NPV	IRR
System Size			
300 kW System			
Cash Purchase			
w/ ECITC	5	$6,289	16.6%
w/o ECITC	10	$3,489	4.0%
Financed Purchase			
w/ ECITC		$3,294	
w/o ECITC	23	($416)	
1 mW System			
Cash Purchase			
w/ ECITC	4	$6,667	20.0%
w/o ECITC	9	$4,217	6.2%
Financed Purchase			
w/ ECITC		$4,047	
w/o ECITC	20	$801	
State			
300 kW System			
Cash Purchase			
w/ ECITC	21	($345)	-4.6%
w/o ECITC		$1,705	
Financed Purchase			
w/ ECITC	21	($569)	
w/o ECITC		$1,317	
1 mW System			
Cash Purchase			
w/ ECITC	18	$11	-2.9%
w/o ECITC		$1,805	
Financed Purchase			
w/ ECITC	21	($185)	
w/o ECITC		$1,465	

Table B2: The Economic & Fiscal Impacts of ECITC Stimulated Large Commercial PV System Purchases Installed on the Big Island

	Output			Employment			Labor Income				Net Fiscal Impact		
Purchaser/Scenario	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Credit $C	Year 1	Yrs 2-25	Total
300 kW System													
Cash Purchase													
w/ ECITC	$2,637	$1,962	$49,721	0.016	0.031	0.030	$1,892	$713	$19,010	$2,800	-$2,184	$42	-$1,187
w/o ECITC	-$8,686	$1,962	$38,398	-0.138	0.031	0.024	-$2,218	$713	$14,900	$0	$241	$42	$1,238
Financed Purchase													
w/ ECITC	$17,868	$906	$39,613	0.224	0.015	0.023	$7,408	$326	$15,236	$2,800	-$1,588	$24	-$1,010
w/o ECITC	$17,088	$371	$25,996	0.213	0.007	0.0152	$7,116	$130	$10,226	$0	$1,184	$8	$1,373
1 mW System													
Cash Purchase													
w/ ECITC	$2,564	$1,938	$49,067	0.018	0.030	0.030	$1,749	$704	$18,653	$2,450	-$1,903	$43	-$882
w/o ECITC	-$7,344	$1,938	$39,159	-0.117	0.030	0.024	-$1,847	$704	$15,057	$0	$219	$43	$1,240
Financed Purchase													
w/ ECITC	$15,892	$1,014	$40,222	0.199	0.017	0.024	$6,575	$366	$15,350	$2,450	-$1,381	$27	-$727
w/o ECITC	$15,209	$546	$28,307	0.189	0.010	0.017	$6,320	$194	$10,967	$0	$1,045	$13	$1,358

Table B3: Big Island Large Commercial PV System ECITC Break-Even Analysis

Purchasers	Current ECITC	Break-Even ECITC Year 1	Break-Even ECITC Life Cycle
300 kW System			
Cash Purchase	22.8%	3.5%	17.9%
Financed Purchase	22.8%	15.0%	20.2%
1 mW System			
Cash Purchase	22.8%	3.6%	20.5%
Financed Purchase	22.8%	15.1%	22.8%

Table B4: PV ECITC Benefit/Cost Ratios for Large Commercial Systems on the Big Island

Solar Purchasers	Economic Impacts Output	Economic Impacts Employment	Economic Impacts Labor Income	Tax Revenues
300 kW System				
Cash Purchase	17.76	0.000011	6.79	1.04
Financed Purchase	14.15	0.000008	5.44	0.89
1 mW System				
Cash Purchase	20.03	0.000012	7.61	1.19
Financed Purchase	16.42	0.000010	6.27	1.04

Table B5: Economic and Fiscal Impacts per kW for a 300 kW Commercial PV System with Financing

Item	Effects Created by a Wind System Purchase Year 1	Effects Created by a Wind System Purchase Avg/Yr Years 2-25	Impacts Foregone Due to Wind System Purchase Year 1	Impacts Foregone Due to Wind System Purchase Avg/Yr Years 2-25	NET IMPACT Year 1	NET IMPACT Avg/Yr Years 2-25
Economic Effects						
Total Output						
Final Demand	$8,346	$229	($67)	($220)	$8,413	$448
Indirect & Induced	$9,387	$233	($68)	($225)	$9,456	$458
Employment	0.2217	0.0089	(0.0018)	(0.0061)	0.22351	0.01498
Total Labor Income	$7,359	$165	($49)	($161)	$7,408	$326
Fiscal Effects						
Total Revenues	$1,233	$30	($9)	($29)	$1,242	$60
Total Expenditures						
ECITC Expenditure	$2,800	$0			$2,800	$0
Other Costs	$21	$6			$21	$6
NET FISCAL IMPACT	($1,588)	$24			($1,588)	$24

Table B6: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Large Commercial PV System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		25	Inter-Island Solar
	300 kW	1 mW	
Estimated Annual kWh Output per Installed kW System	2,540	2,540	calculated
Average sun hours captured per day	7.0	7.0	Power Lite Co. (John Crouch)
Days per Year	365	365	given
	300 kW	1 mW	
Average Installed Cost (2001 $) per kW	$8,000	$7,000	calculated
Total system cost	$2,400,000	$7,000,000	Power Lite Co. (John Crouch)
Delivered system capacity (kWh)	300	1,000	given system capacity for specific cost
Purchase Costs over System Life			
Equity % of purchase	0%		cash and financed systems estimated
Amortization Cost Assumptions			
Annual Interest	8.00%		current prime rate + 2%
Note: For residential purchases, the loan is assumes to be a home equity loan-type.			
Loan Terms (borrow money for purchase)	15		assumed
Assumed accelerated depreciation	5		Inter-Island Solar
Note: There is no depreciation on a residential system.			
Loan Amount per kW	$4,400	$3,850	calculated (system cost less credit value)
system cost per unit	$8,000	$7,000	see above
ECITC value per unit	$2,800	$2,450	system cost per unit x credit %
Fair Market System Value as of Buyout Date (% of purchase price)			David Kaneshiro at HECO
Federal Credit per Unit	$800	$700	system cost per unit x credit %
% of Loans Originating in-State		100%	assumed
Typical Annual Operations & Maintenance Cost per kW			
	300 kW	1 mW	
Inverter at Mid-Point of System Life	$100,000	$300,000	Power Lite Co. (John Crouch)
Cost per kW	$333	$300	calculated
Analysis Value	$333		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	$0.200		Power Lite Co. (John Crouch)
Note: The retail cost per kWh assumes that the distribution of wind systems is the same as that for solar.			
Benchmark Price per Barrel Oil	$26.78		2001 average price to date
	300 kW	1 mW	
Annual Savings	$508	$508	calculated
Oil Price Changes			
Alternative real average annual energy cost changes (2001-2025)			
Base case	0.0%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
low	-2.1%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
high	1.3%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html

Table B6: Assumptions for Estimation of Fiscal and Economic Impacts of Stimulated Large Commercial PV System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Credit & Taxes	300 kW	1 mW	
Effective Tax Credit with Cap	45%	45%	calculated
Hawaii State tax credit on purchase w/o cap	35%	35%	State
Federal tax credit	10%	10%	Federal
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.16%	HI State Dept. of Taxation, GET on Gross Sales assuming pyramiding
State Income Taxes on Labor Income		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Ratio of Corporate Income Tax to Labor Income Tax		4.00%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
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 $1 of final demand are the % indicated of total indirect plus induced output.			
Total Taxes as a % of Indirect & Induced Output		4.6%	calculated
Ratio of GSP to Output	64.5%		1992 Hawaii State I/O model (value added ÷ total output for total intermediate demand)
Total Taxes as a % of GSP	7.1%		see "HAWAII STATE TAX REVENUES AS A % OF GSP" worksheet (p. A-11)
Tax on Income			
Individual State		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Federal		14.56%	IRS, "Statistics of Income Bulletin," Fall 2000, VOL 17 No 2, 1999 tax rates - all filers.
Corporate State		5.97%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Federal		14.67%	IRS, "Statistics of Income Bulletin," Summer 2000, VOL 20 No 1, 1997 tax rates - F, I & RE
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.13	1992 Hawaii State I/O model ($ economy output per $ other construc.final demand)
employment		26.59	1992 Hawaii State I/O model (total jobs per $ mil.other construc. final demand)
labor income		0.89	1992 Hawaii State I/O model ($ labor income per $ other construc.final demand)
from annual loan amortization			
output (sales)		2.13	1992 HI I/O model ($ economy output per $ banking & credit agencies final demand)
employment		25.47	1992 HI/O model (total jobs per $ mil. Final demand banking & credit)
labor income		0.680	1992 Hawaii State I/O model ($ labor per $ banking & credit final demand)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.02	1992 Hawaii State I/O model ($ output per $ final demand Personal. Consump.
employment		27.57	1992 Hawaii State I/O model (total jobs per $ mil. final demand Personal. Consump.
labor income		0.734	1992 Hawaii State I/O model ($ labor income per $ final demand Personal. Consump.
system savings assumed to remain in-state		100%	assumed % of equity owned within State

Table B7: Assumptions for Estimation of Fiscal and Economic Impacts Foregone Due to ECITC Stimulated Large Commercial PV System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)			NA
Installed Cost per Unit		$0	NA
Purchase Costs over System Life			
Amortization Costs of Purchase per Unit			
Annual Interest	6.00%		NA
Loan Terms (borrow money for purchase)	6		NA
Loan Amount per Unit	$0		NA
system cost per unit	$0		NA
credit value per unit	$0		NA
Notes:			
same assumption set for heat pumps.			
Typical Annual Maint.Contract Fee per Unit		$0.00	NA
Energy Cost Changes to HECO per kW			
Oil Cost if No Wind Farm		$508.08	see Table A6 for forecast changes for the base case scenario
Avoided Cost Paid to Wind Farm		$508.08	see Table A6 for forecast changes for the base case scenario

Appendix F

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII WIND ENERGY SYSTEMS ENERGY CONSERVATION INCOME TAX CREDIT

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Prepared for:

The Hawaii Energy Efficiency Policy Task Force

March 11, 2002

WIND ENERGY SYSTEM EXECUTIVE SUMMARY

The current State credit received by a purchaser of a wind system is 20% of the purchase price of a system. Under current law, commercial systems have no cap on the credit amount. In contrast, residential systems have a $1575 per system cap. Commercial purchasers also receive a Federal production credit of $0.017 per kWh energy produced. It is uncertain the number or amount of credit refunds for wind systems due to a lack of data. The system sizes analyzed are 12.5 MW and 1 kW for commercial and residential wind systems, respectively. Commercial results are reported on a per kW and total per 12.5 MW basis (reported in parentheses). The discussion focuses on commercial windfarms. Report appendixes provide results for residential systems.

The State of Hawaii would refund $281 ($3,500,000) per kW (per 12.5 MW) for installation of a 12.5 MW windfarm under current law. This spending would lead to the following estimated economic outcomes.

- Return to the State $520 ($6,500,000) in tax revenues per installations over the 25-year life of a farm, a revenue impact which increases the more systems continuously installed. For example, if annual system installations become 25 MW per year, $1,040 ($13,000,000) in tax revenue is generated over the life of these farms at current ECITC and cap levels.
- Provide 0.025 (312) jobs the year of the installation and each year equivalent sized systems are installed and create 0.003 (38) new jobs per system installation that exist the remaining 24-years of a windfarm's life for each system installed. This job impact increases the more windfarms continuously installed. For example, if the annual system installations become 25 MW, 0.05 (624) jobs are created the year of the installation and each year equivalent sized windfarms are installed and 0.006 (76) new jobs per windfarm installation that exist the remaining 24-year life of each farm.

The positive economic and fiscal impacts are based on a 20% ECITC. These results occur because windfarms are energy savings capital equipment that has a useful life greater than one year. The energy saving capacity of windfarm systems results in decreased oil imports leaving dollars that would have been exported for oil purchases in Hawaii for local expenditures. This leads to consequent economic and fiscal impacts over a system's life cycle. The analysis measures the economic effects created by ECITC stimulated purchases of wind systems and those foregone due to its purchase. The net impact is the difference between the economic effects and derivative fiscal effects created and those foregone.

There have been no new windfarms installed in Hawaii since 1987. During the past 15 years, the majority of wind systems installed have been in residential applications. Available information suggests that few wind turbines have been installed in commercial applications, or if so, no tax credits have been taken. It is assumed that proposed windfarm installations would have 50% of total cost financing, the remaining installation cost amount coming from equity partners. One-half of the financing is assumed to come from in-state institutions and one-half from out-of-state institutions. For this purchase situation, the break-even ECITC level is 12.4% for year 1 and 28.5% over the life cycle of a windfarm. Stated otherwise, a credit level of 28.5% means that over the life of a windfarm, the State would incur a $0 net cost. To incur a $0 net cost in year 1 the credit level would be 12.4%.

It is important to note that the break-even levels noted make no accounting of the value of achieving public policy goals (e.g. energy conservation, portfolio standards) via the use of the ECITC, the value of oil price or supply shock risk reductions, the potential impact on the electric services industry, which installs and services windfarms, or negative fiscal impacts if ECITC elimination or reduction leads to industry down-sizing. Industry down-sizing could occur in a fashion similar to what empirical evidence indicates occurs for solar systems. Specifically, a 1% increase (decrease) in the credit level leads to a 5% increase (decrease) in the number of system purchases.

The return to the State based on its ECITC windfarm "investment" and system purchasers are the following.

- For the State of Hawaii:
  - An internal rate of return (IRR) on "investment" of approximately 6.3%.
  - A pay back of the ECITC "investment" cost of 10 years,
- For purchasers:
  - A pay back of investment cost of 3 years with the ECITC and 4 years without the ECITC,
  - An investment IRR (cash purchase) of 38% with the ECITC, which is 65% greater than the 23% IRR without the ECITC.

ECITC benefit/cost ratios, where the ratio numerator is the benefit value equaling the respective result variable life cycle value and the denominator is the ECITC cost, are the following.

- Output/ECITC = 30.7: Each ECITC dollar spent stimulates a windfarm installation resulting in $30.7 of output (sales). The total output effect for a 12.5 MW windfarm is $108,000,000.
- Employment/ECITC = 0.000015: Each ECITC dollar spent stimulates a windfarm installation resulting in the creation of 0.000015 jobs. The total employment effect for a 12.5 MW windfarm is 54 jobs.
- Labor Income/ECITC = 9.73: Each ECITC dollar spent stimulates a windfarm installation resulting in the generation of $9.73 of wage and salary income to workers. The total labor income effect for a 12.5 MW windfarm is $34,000,000.
- Tax Revenues/ECITC = 1.85: Each ECITC dollar spent stimulates a windfarm installation resulting in the generation of $1.85 tax revenue. The total tax revenue effect for a 12.5 MW system is $6,500,000.

Other important research results per kW (total 12.5 MW windfarm) are the following.

- Economic:
  - Output increases of $2.100 ($27,000,000) in year 1 and an average of $269 ($3,400,000) per year for years 2-25;
  - 0.025 (315) job(s) are generated in year 1 and 0.003 (43) average jobs per year from years 2-25;
  - $925 ($11,500,000) wage and salary income is generated in year 1 and an average of $75 ($815,000) from years 2-25.
- Fiscal impacts:
  - A net fiscal impact of ECITC stimulated windfarm installations in year 1 of negative $103 (-$1,300,000), which is less than the $281 ($3,500,000) ECITC amount refunded due to the fact that net revenues generated in year 1 by installation of a windfarm are $178 ($2,300,000) in year 1.
  - Net revenues in years 2-25 average $9 ($117,000) per year.
  - A total, life cycle net (of the ECITC cost) fiscal impact to the State of $111 ($1,400,000).

INTRODUCTION

Wind systems are a renewable energy technology that utilizes wind turbines to generate electricity. For residential applications, wind turbines up to 10 kW in capacity would be most appropriate, while for commercial applications, up to 100 kW or more might be appropriate depending on the consumer's electrical load. The goal for each of these applications would generally be to offset a portion up to the consumer's entire load and, in the case of commercial applications larger than 10 kW, sell excess electricity to the utility. Note: With the state's current net metering law, residential and small commercial customers with wind turbines up to 10 kW would be eligible for net metering and would not sell electricity to the utility. In contrast, windfarms consist of a number of wind turbines installed at a single site for the sole purpose selling electricity to the utility. In each of these applications, the wind turbines must be located at sites with suitable wind conditions (i.e., the wind is strong enough) to be economically viable. Regardless of installation type, wind systems decrease reliance on imported oil used to generate electricity. As such, their installation and use not only have economic impacts to system purchasers but broader statewide economic impacts as well.

The State of Hawaii currently provides a 20% of purchase price to purchasers the year the purchase is made to stimulate wind system use. Under current law, commercial systems have no cap on the credit amount. In contrast, residential systems have a $1575 per system cap. Commercial purchasers also receive a Federal production credit of $0.017 per kWh energy produced. The 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. Because a wind system is a capital item it has a life greater than one year. Thus, its energy saving capacity and its consequent economic and fiscal impacts extend over its life cycle.

Report Objective

The objective of this research is to assess the economic and fiscal impacts of the Energy Conservation Income Tax Credit (ECITC) stimulated wind system purchases. This entails estimating the economic effects created by the purchase of a wind system and those foregone due to its purchase. The net impact is the difference between the economic effects and derivative fiscal effects created and those foregone.

Data Sources

The data sources used for the analysis include the following.

- Primary data provided by:
  - Enron and Apollo, companies selling wind systems;
  - Local renewable energy experts Warren Bollmeier, a consultant, and Cully Judd, a local vendor of wind systems.

- Secondary data sources including:
  - Oil price forecasts and data provided by the Energy Information Administration;
  - Tax data published by the IRS, the Hawaii State Department of Taxation and Department of Business Economic Development & Tourism (DBEDT);
  - The "1992 Hawaii State Input/Output Model" published by DBEDT.

Specific cites from these respective sources are found in Appendix tables.

Methodology

User, lender and State cost and benefit cash flow accounts are formulated for residential and commercial wind systems. Commercial windfarms sell their energy at the avoided cost to the utility. Windfarms typically have an annual avoided cost "escalator" built into the contract. Differences between this contracted "escalator" cost and actually oil price increases are passed on to utility customers. Residential wind systems use electricity generated or reverse the electricity meter to reduce their "net" utility electricity use and cost. The utility retail cost of electricity equals the value per kW electricity generated for residential systems. Cash flows extend for 25 years, the assumed life of a wind system. Cash flows are estimated for cash and financed purchases for residential and commercial purchasers.

Benefits and costs for the respective entities are the following.

- User or system purchaser:
  - Costs include system purchase and installation costs, annual maintenance costs and purchase price amortization costs.
  - System benefits are the annual energy cost savings the system provides over its life, any tax savings from interest and/or depreciation deductions and ECITC credit amounts.
  - A secondary benefit (cost) occurs if a (commercial) windfarm's contracted avoided cost "escalator" exceeds (is less than) oil price increases which results in lower (higher) customer electricity rates.
- Lender:
  - Costs are the purchase cost of a system and taxes on interest income.
  - The lender benefit is the interest generated by the loan made to purchase a system and the ECITC credit amounts if used to reduce loan principal for financed system purchases.
- State:
  - Cost is the ECITC the year the credit is taken by the system purchaser and interest and depreciation (if applicable) cost refunds.
  - Benefits are net tax revenues stimulated by the purchase of a wind system.

Based on these cash flows, the economic performance of the investment is measured for each entity. Economic performance variables include:

- Pay back period of the investment;
- Investment net present value;
- Investment internal rate of return (IRR).

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 1992 Hawaii State Input/Output Model. The economic impact variables measured include:

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

General excise tax (GET) 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 ECITC cost to the State allow the determination of the net fiscal impact to the State of the ECITC program.

Residential and commercial results are reported on a per kW installed basis. Installed system capacity is 1 kW and 12.5 MW for residential and commercial systems, respectively. Data are unavailable to report historic installations. The discussion focus is on commercial systems that are 50%/50% cash/financed purchased, a typical situation. The analysis further assumes that 50% of financing and 50% of the net benefits to a windfarm remain in-State. Results and other details and assumptions of the methodology utilized for the analysis are presented on report pp. A1-A17 and B1-B14, for commercial and residential systems, respectively.

The net fiscal impact measure makes no accounting of the “ECITC cost lag” that occurs due to the timing of the ECITC refund. Specifically, the ECITC refund occurs the tax-year after system installation. In contrast, benefits from system installation and energy savings result in <u>net</u> positive revenues to the State beginning in the previous year. If accounted for, the total net fiscal impact would increase relative to that reported.

RESULTS

<u>Economic Performance</u>

Table 3 shows the economic performance of wind systems by installation type (i.e. commercial or residential) and purchase type (i.e. equity or financed purchase). It shows that the payback on investment with the ECITC improves by 1 year, from 4 years without the ECITC to 3 years with the ECITC. Table 1 further shows that the purchase of a wind system <u>with</u> the ECITC provides an average annual rate of return (IRR) of 38% to its purchaser, 65% greater than the rate of return <u>without</u> the ECITC of 23%. Relative to benchmark returns from financial instruments, these are favorable rates of return.

The Relationship between Credit Levels and Wind Systems Purchased

The lack of historical purchase data does not allow analysis of the relationship between the number of wind systems purchased and the credit level. If the relationship is the same as that measured between solar system purchases and the credit level one would expect a 5% increase (decrease) in system purchases per 1% increase (decrease) in the credit level.

Economic Return to the State

A 20% ECITC provides a positive economic return to the State. Table 1 shows that the average annual return due to the net sum total of economic impacts of wind system purchases stimulated by the ECITC over its 25-year life is 6.3%. The payback to the State occurs in 10 years. These results rest on the assumption that 50% of a windfarm's net benefit remains in-State. If 100% of a windfarm's net benefit remains in-State this return increase to 21.5%.

Economic and Fiscal Impacts of the ECITC

Economic impacts are net changes in output, employment and labor income in the general economy. Fiscal impacts are net changes in government expenditures and revenues. Economic and fiscal effects measured in this analysis result from the State government's expenditure on the ECITC. Specifically, the ECITC stimulates the purchase of a wind system creating economic and fiscal effects. Simultaneously, a wind purchase causes economic and fiscal effects to be foregone due to its purchase. Netting the effects foregone from those created and adding the net effects to the utility, gives the estimated economic and fiscal impacts caused by the ECITC.

If the ECITC were eliminated, other economic and fiscal costs could be incurred for each system not purchased if there is no ECITC program. These include output, employment and labor income decreases and their consequent impact on State tax revenues, and direct fiscal expenditures to the State in the form of unemployment insurance benefits. Costs could also include other expenditures due to temporary and possible permanent unemployment caused by a size reduction of the wind industry due to ECITC elimination. These potential costs are not measured in this analysis.

Expenditure Pattern Changes Caused by the Purchase of a Wind System

Installation of a commercial windfarm is an investment decision. The windfarm owner presumably would select this investment from available investments because it provides the greatest return subject to his constraint set. Profits generated from operation of a windfarm are primarily the result of using a local resource, wind, as opposed to fossil fuel to generate electricity. These "wind" profits have a multiplier impact equivalent to any exogenous dollar (e.g. a tourist dollar) expended in Hawaii, if spent in Hawaii. This expenditure is the most significant expenditure impact from a windfarm. The analysis assumes that 50% of any Hawaii windfarm is foreign owned, which reduces the economic and fiscal impacts of "wind" profits in Hawaii.

A secondary expenditure change caused by a commercial windfarm occurs to utility customers. By contract, the utility pays a windfarm its avoided cost which changes annually according to the agreed upon escalator. The typical escalator is 1.5%. Fossil fuel prices greater (less) than this escalator, cause net decreases (increases) in utility costs, which are passed on to customers. A median oil price forecast suggests oil price increases greater than the escalator. This utility customer windfall is assumed expended in Hawaii.

Residential wind systems result in an estimated average annual reduction in energy costs for a single1 kW system of $427. These energy savings dollars cause $427 per year per 1 kW system less to be exported from the State for oil purchases and $427 more for alternative consumption or investment expenditures by those accruing the savings. All such expenditures are assumed to occur within the State. The expenditure pattern change from this energy savings is the primary cause of the economic and fiscal impacts created by residential wind systems.

Net Impact of a Wind System

Table 2 shows the "Economic and Fiscal Impacts of ECITC Stimulated Wind System Purchases." First and subsequent year effects and net impacts are distinguished to provide an accounting the year in which the purchaser receives the credit.

Table 2 shows installation of a 12.5 MW commercial windfarm has positive economic impacts. Expressed on a per kW (12.5MW) basis, these specific results are the following.

- Output increases of $2,100 ($27,000,000) in year 1 and an average of $269 ($3,400,000) per year for years 2-25;
- 0.025 (315) job(s) are generated in year 1 and 0.003 (43) average jobs per year from years 2-25;
- $925 ($11,500,000) wage and salary income is generated in year 1 and an average of $75 ($942,000) from years 2-25.

Table 2 shows a negative net fiscal impact to the State (*i.e.* revenues less than expenditures) per kW (12.5 MW) in year 1 of $103 (-$1,300,000). This net fiscal impact to the State is less than the $281 ($3,500,000) ECITC amount refunded to the purchaser due to the fact that net revenues generated by wind system installation and operation are $178 ($2,200,000) in year 1. Net revenues in years 2-25 average $9 ($112,000) per year. In total, the net fiscal impact to the State over the life of a wind system is $111 ($1,400,000).

Break-Even Fiscal Impact

The break-even fiscal impact analysis is the credit level at which the net fiscal impact is $0. In other words, it is the credit level at which there is no net expenditure required by the State given the ECITC. For year 1, this is the credit level at which the net fiscal impact per kW increases to $0 from its ($103) level at the current ECITC level of 20%. The break-even ECITC level for year 1 is 12.4% and 28.5% from a system life cycle perspective (see Table 3).

It is important to note that break-even analysis does not account for ECITC premiums above break-even levels used to achieve public policy as well as economic and fiscal objectives. Such public policy objectives could be increased energy self-sufficiency and/or insurance against oil supply disruptions and/or oil price spikes. Furthermore, any decrease in the current credit level could decrease wind purchases given business and consumer expectations and existent structures based on a 20% credit level. Such a decrease could have negative economic and fiscal impacts related not only to decreased purchases themselves but any industry downsizing, which could result in job loss and consequent unemployment insurance and other such fiscal costs.

Cumulative Economic and Fiscal Impacts

ECITC stimulated wind installations cause an negative fiscal impact that is the credit refund the tax year claimed. Since wind systems have positive economic impacts due to their energy savings, they have positive fiscal impacts after installation. These positive economic and fiscal impacts accumulate annually for ECITC stimulated wind installs for each year subsequent to year 1 of the ECITC. Thus, the impacts of year 1 ECITC stimulated wind installs for example, add to impacts of wind installs in year 2. The impacts of years 1 & 2 ECITC stimulated wind installs, add to impacts of wind installs in year 3, and so on.

Cumulative measures capture the multi-period impacts of the ECITC providing a more complete measure of the economic and fiscal impact of the ECITC in any given year subsequent to the begin year. The cumulative impact is assessed looking forward in time from the current year for 1 kW of a 12.5 MW commercial windfarm.

Cumulative Economic Impacts

Chart 1 shows the cumulative impacts for output (sales). The cumulative chart for jobs and labor income shows the same profile except with different chart dimensions. Chart 1 shows that the cumulative output (jobs, labor income) effect increases per year to a maximum of $7,000 (0.054, $1,759). This peak would be the annual, sustained output (jobs, labor income) level per kW stimulated so long as there was a wind ECITC of 20%. The cumulative output (jobs, labor income) level would diminish with time with elimination of the ECITC.

Cumulative Fiscal Impacts

Chart 2 shows cumulative fiscal impacts of ECITC stimulated wind purchases. It shows that at the start of the period and for 19 subsequent years (7 years in 100% of a windfarm's net benefit remains in-State), the cumulative fiscal impact is negative. This is due to the year 1 ECITC purchaser refund. Thereafter, the cumulative impact becomes positive and remains so for the remainder of the period peaking at $42 while a 20% ECITC is assumed in existence. The cumulative impact becomes positive because of cumulative positive energy-saving effects of past period wind installs with no offsetting current cost to the State to bring about the energy savings. Current costs to the State are ECITC refunds for systems installed in the current year.

Impacts Due to Assumption Changes

The results presented in Tables 1 and 2 are based on the following assumptions.

- A wind ECITC of 20%;
- Oil prices average $26-27 per barrel as they have for 2001;
- No oil supply disruptions or exogenous price spikes.

Altering any of these assumptions alters the estimated economic and fiscal impacts of the ECITC. The impact changes discussed below are made relative to this assumption set.

Oil Price Trends: High (low) forecast oil price secular changes of 1.3% (-2.1%) per year result in increased (decreased) economic and fiscal economic impacts of 20% (-28%).

Oil Price Spikes: Oil price spikes have timing, size and duration dimensions. If an oil price spike increases oil prices by 50% occurred currently and lasted 2 years, ECITC economic and fiscal economic impacts would increase by 4% and 13%, respectively. On average, a possible oil price spike impact on economic and fiscal measures will on average be:

- Smaller the later in time the price spike occurs;
- Larger the longer the price spike lasts;
- Larger the greater the price spike level.

Economic and Fiscal Impacts Not Measured

Tangible economic and fiscal impacts of the ECITC not measured in this analysis include the following.

1. The positive impact of strengthening Hawaii's energy service industry, which simultaneously strengthens Hawaii's actual and potential position as a Pacific energy services, research and development center.

2. The positive impact on business perceptions about investment in Hawaii. This positive impact is reinforced by a consistent State policy, which Hawaii has exhibited since 1990 with respect to the wind credits.

3. The negative impact on fiscal expenditures due to ECITC elimination the State would incur not measured in this analysis. These include: unemployment compensation benefits, potential welfare benefit expenditures to displaced workers, expenditures for direct State involvement in retraining programs for new jobs or direct subsidies for new job creation, and revenue losses to the State due to private sector expense increases to re-train workers for new jobs and for the creation of new jobs.

4. Positive ECITC fiscal impacts to Hawaii counties in the form of permit fees and increased property tax revenues due to real estate improvements.

5. The option value (*i.e.* the value of having an energy services industry of its current size) lost to the State given industry downsizing if the ECITC is eliminated.

Intangible ECITC economic and fiscal impacts arise due to positive externalities (side effects) from reduced oil consumption brought about by the ECITC. 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. The larger the energy cost savings, the larger are the positive ECITC economic and fiscal impacts.

CONCLUSION

ECITC stimulated wind purchases have positive economic and fiscal impacts to the State of Hawaii over the life of these systems. Life cycle impacts are the following.

- Residential wind systems result in an annual $427 per 1 kW unit annual energy savings. This energy savings lasts for the 25-year system life and is the most significant factor resulting in the positive economic and fiscal created by ECITC stimulated purchases.
- Average annual life cycle economic impacts of ECITC stimulated wind purchases expressed on a per kW per 12.5 MW system basis include:
    - An increase in economic output of $345;
    - The creation of 2.14 job per 12.5 MW windfarm installed; and
    - $109 in labor income.
- Fiscal impacts of ECITC stimulated wind purchases are the following.
    - An average annual net impact expressed on a per kW of a 12.5 MW system basis of $4 for an ECITC level of 20%.
    - Break-even fiscal impact credit levels are 12.4% from a year 1 perspective and 28.5% from a life cycle perspective.

Expressing ECITC impacts in benefit/cost terms where the ratio numerator is the benefit value equaling the respective result variable life cycle value and the denominator cost value is the ECITC cost to the State, best measures the economic and fiscal impacts of the ECITC. These ratios, presented in Table 4 for a single system purchased in a given year, indicate the following.

- Output/ECITC = 30.7: Each ECITC dollar spent stimulates a windfarm installation resulting in $30.7 of output (sales). The total output effect for a 12.5 MW windfarm is $108,000,000.
- Employment/ECITC = 0.000015: Each ECITC dollar spent stimulates a windfarm installation resulting in the creation of 0.000015 jobs. The total employment effect for a 12.5 MW windfarm is 54 jobs.

- <u>Labor Income/ECITC = 9.73</u>: Each ECITC dollar spent stimulates a windfarm installation resulting in the generation of $9.73 of wage and salary income to workers. The total labor income effect for a 12.5 MW windfarm is $34,000,000.
- <u>Tax Revenues/ECITC = 1.85:</u> Each ECITC dollar spent stimulates a windfarm installation resulting in the generation of $1.85 tax revenue. The total tax revenue effect for a 12.5 MW system is $6,500,000.

Table 1: The Investment Performance of Wind Energy Systems (per kW installed)

Entity/Scenario	Pay Back	NPV	IRR
System Users			
Single Family Residential Owner Purchase			
Cash Purchase			
w/ ECITC	15	$1,149	-0.2%
w/o ECITC	18	($184)	-3.2%
Financed Purchase			
w/ ECITC	25	($2,678)	
w/o ECITC	25	($4,968)	
Commercial Purchaser			
50% Cash 50% Financed Purchase			
w/ ECITC	3	$2,208	38%
w/o ECITC	4	$1,881	23%
Cash Purchase			
w/ ECITC	5	$2,390	21%
w/o ECITC	6	$2,109	15%
Financed Purchase			
w/ ECITC		$2,025	
w/o ECITC		$1,653	
State			
Single Family Residential Owner Purchase			
Cash Purchase			
w/ ECITC	18	($28)	-3.0%
w/o ECITC	7	$1,146	12.2%
Financed Purchase			
w/ ECITC	25	($624)	
w/o ECITC	13	$155	8.3%
Commercial Purchaser			
50% Cash 50% Financed Purchase			
w/ ECITC	10	$195	6.3%
w/o ECITC		$262	
Cash Purchase			
w/ ECITC	18	($3)	6.8%
w/o ECITC		$259	
Financed Purchase			
w/ ECITC	20	$1	-5.5%
w/o ECITC		$264	

Table 2: The Economic & Fiscal Impacts of ECITC Stimulated Wind Energy System Purchases

	Output			Employment			Labor Income				Net Fiscal Impact		
Purchaser/Scenario	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Year 1	Yrs 2-25	Total	Credit $C	Year 1	Yrs 2-25	Total
Single Family Residential													
Cash Purchase													
w/ ECITC	-$8,628	$1,142	$18,792	-0.131	0.021	0.015	-$2,499	$421	$7,597	$1,334	-$1,865	$78	$10
w/o ECITC	-$11,180	$1,142	$16,240	-0.169	0.021	0.014	-$3,270	$421	$6,827	$0	-$690	$77	$1,165
Financed Purchase													
w/ ECITC	$14,049	$61	$15,512	0.174	0.003	0.009	$5,863	$20	$6,348	$1,334	-$397	$7	-$232
w/o ECITC	$13,614	-$209	$8,589	0.168	-0.002	0.005	$5,699	-$80	$3,781	$0	$897	-$1	$862
Commercial													
50% Cash 50% Financed Purchase													
w/ ECITC	$2,174	$269	$345	0.025	0.003	0.000	$925	$75	$109	$281	-$103	$9	$111
w/o ECITC	$1,878	$259	$8,098	0.021	0.003	0.004	$820	$73	$2,582	$0	$168	$9	$374
Cash Purchase													
w/ ECITC	$1,087	$306	$8,430	0.010	0.004	0.004	$521	$83	$2,524	$281	-$138	$10	$109
w/o ECITC	$518	$306	$7,861	0.002	0.004	0.004	$315	$83	$2,318	$0	$124	$10	$372
Financed Purchase													
w/ ECITC	$3,261	$231	$8,809	0.040	0.003	0.005	$1,329	$67	$2,946	$281	-$68	$8	$113
w/o ECITC	$3,237	$212	$8,335	0.040	0.003	0.004	$1,325	$63	$2,845	$0	$211	$7	$376

Table 3: Wind Energy System ECITC Break-Even Analysis

System Purchasers	Current ECITC	Break-Even ECITC	
		Year 1	Life Cycle
<u>Residential Owner Purchase</u>			
Cash Purchase	20.0%	-11.8%	20.2%
Financed Purchase	20.0%	13.9%	15.8%
<u>Commercial Owner Purchase</u>			
50/50 Cash/Financed Purchase	20.0%	12.4%	28.5%
Cash Purchase	20.0%	9.5%	28.3%
Financed Purchase	20.0%	15.1%	28.6%

Table Note

The break-even percentage is the level at which ECITC must be for the State to incur a $0 net cost for the program.

Chart 1 : Cumulative Output Created by ECITC Stimulated Wind Energy System Purchases

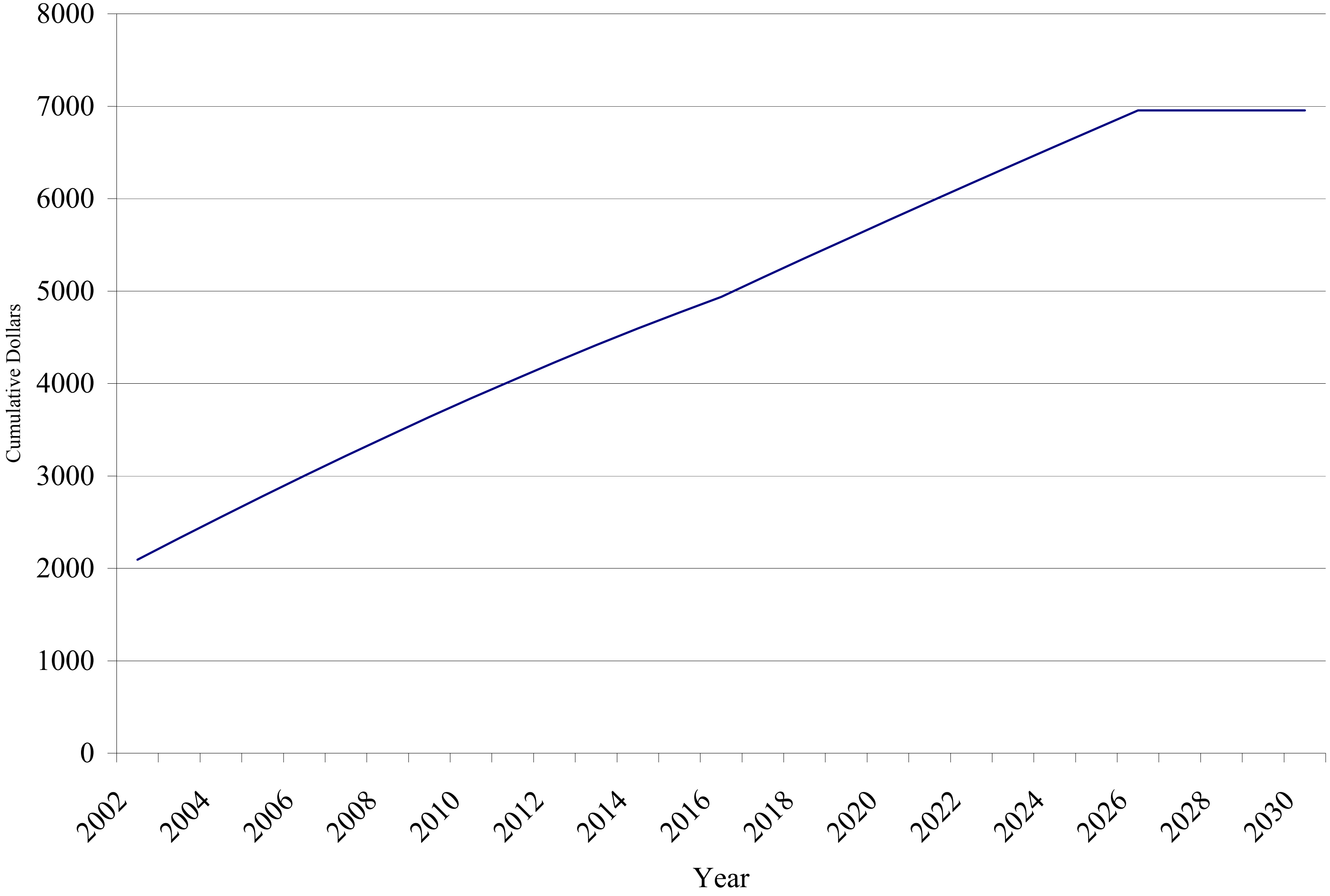


Chart 2: Cumulative Fiscal Impact of ECITC Stimulated Wind Energy System Purchases

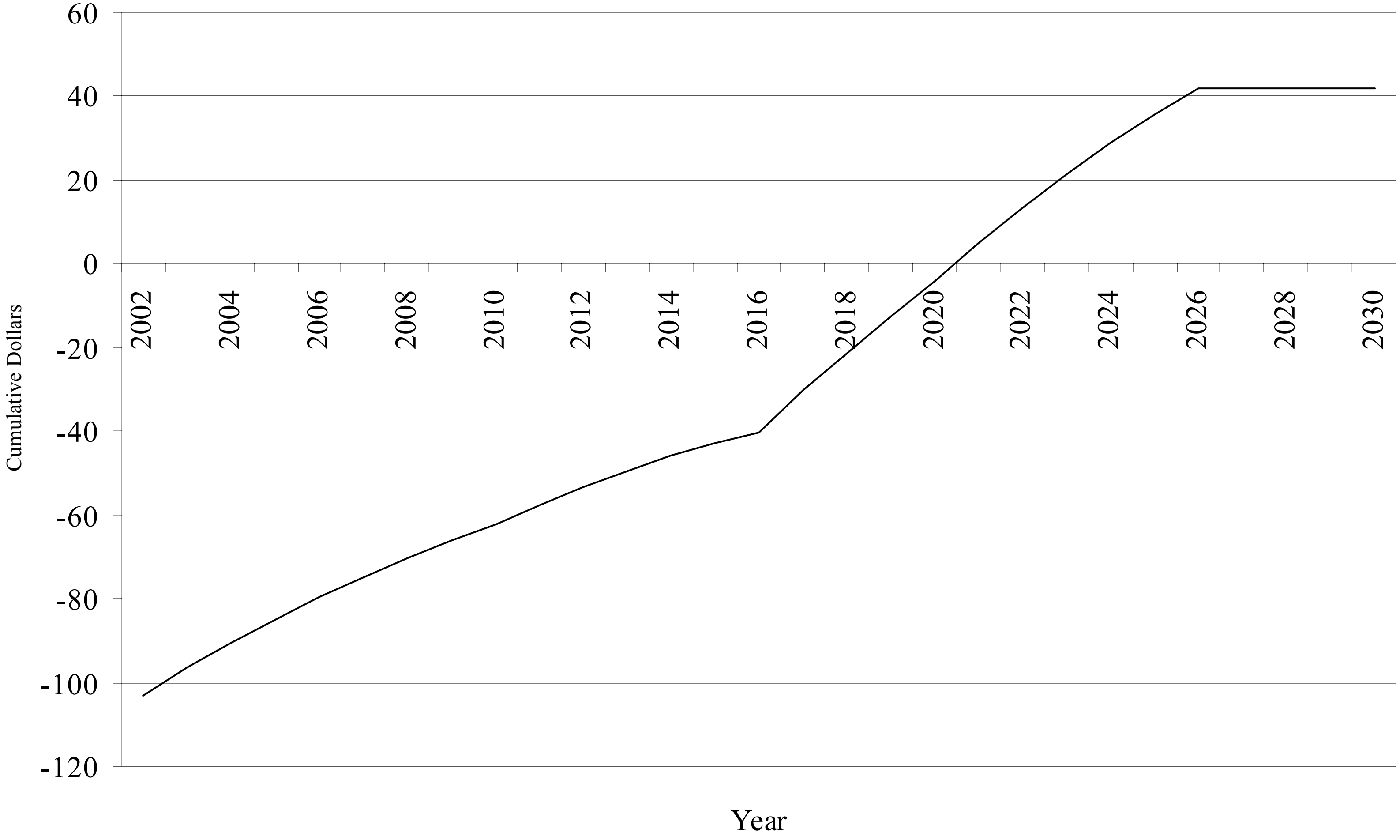


Table 4: Wind Energy System ECITC Benefit/Cost Ratios

	Economic Impacts			
Solar Purchasers	**Output**	**Employment**	**Labor Income**	**Tax Revenues**
Residential Owner Purchase				
Cash Purchase	14.09	0.000011	5.70	1.01
Financed Purchase	11.63	0.000007	4.76	0.83
Commercial Owner Purchase				
50/50 Cash/Financed Purchase	30.66	0.000015	9.73	1.85
Cash Purchase	29.99	0.000014	8.98	1.85
Financed Purchase	31.34	0.000016	10.48	1.85

Table A1: Economic and Fiscal Impacts per kW of a Commercial Wind Farm

	Effects Created by a Wind System Purchase		Impacts on HECO & Affiliates		Impacts Foregone Due to Wind System Purchase		NET IMPACT	
Item	**Year 1**	**Avg/Yr Years 2-25**	**Year 1**	**Avg/Yr Years 2-25**	**Year 1**	**Avg/Yr Years 2-25**	**Year 1**	**Avg/Yr Years 2-25**
Economic Effects								
Total Output								
Final Demand	$1,241	$72	$0	$17	$200	($75)	$1,040	$165
Indirect & Induced	$1,380	$48	$0	$18	$246	($38)	$1,134	$104
Employment	0.0317	0.0017	0.00	0.0007	0.0066	(0.0010)	0.02502	0.00343
Total Labor Income	$1,102	$35	$0	$13	$177	($28)	$925	$75
Fiscal Effects								
Total Revenues	$186	$10	$0	$2	$31	($7)	$156	$19
Total Expenditures								
ECITC Expenditure	$281	$0	$0	$0			$281	$0
Other Costs	$8	$3	$0	$0			$8	$3
NET FISCAL IMPACT	($103)	$7	$0	$2			($103)	$9

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Wind System Purchased by a Commercial Entity

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		25	mid-point (confirmed by Warren Bollmeier)
Enron	30		Enron
Apollo	20		Apollo
Estimated Annual KHz Output per Installed kW System		3,504	calculated
Peak Annual Output	8760		365 days per year * 24 hours x 1 kW/hr
Efficiency Factor	40%		Warren Bollmeier
Average Installed Cost (2001 $) per kW		$1,406	calculated
10 MW System	$17,000,000	$1,700,000	Enron
20 MW System	$37,000,000	$1,850,000	Enron (not used in the per kW cost as atypical per comments by W. Bollmeier)
15 MW System	$25,000,000	$1,666,667	Apollo
Purchase Costs over System Life			
Equity % of purchase	50%		assumed
Amortization Cost Assumptions			
Annual Interest	8.00%		current prime rate + 2%
Loan Terms (borrow money for purchase)	15		Enron & Apollo
Loan Amount per kW	$562		calculated (system cost less credit value)
system cost per unit	$1,406		see above
credit value per unit	$281		system cost per unit x credit %
Fair Market System Value as of Buyout Date (% of purchase price)		0.00%	David Kaneshiro at HECO
% of Loans Originating in-State		50%	assumed
Notes			
1. Enron typical finance/equity	50/50 to 70/30		Enron
2. Apollo typical finance/equity	20/80		Apollo
3. Base case assumption suggested by Warren Bollmeier.	50/50		Warren Bollmeier
w/ equity from in-state.			Warren Bollmeier
4. Lenders are typically out-of-state.			Warren Bollmeier
Typical Annual Operations & Maintenance Cost per kW			
	per kWh	Annual	
Operations & Maintenance Cost	$0.0050	$18	Enron & Warren Bollmeier
Lease or Easement Rights Contract (% of revenues)			
Years 1-10	0	2%	Enron & Warren Bollmeier
Years 10-20	10	3%	Enron & Warren Bollmeier
Years 20-25	20	4%	Enron & Warren Bollmeier
Notes			
1. Assumes a 25 year contract.			
2. Assumes that the land is leased from, the state.			

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Wind System Purchased by a Commercial Entity *(continued)*

Descriptor	**Derivative Value**	**Model Value**	**Source**
Average Annual Gross Imported Oil Savings per Unit	per kWh	Annual	
Avoided Cost per kWh	$0.046	$160	calculated
Price			
On-Peak (7AM-9PM)	$0.051		Enron & Warren Bollmeier
Off-Peak	$0.038		Enron & Warren Bollmeier
Weights			
On-Peak (7AM-9PM)	14		Enron
Off-Peak	10		Enron
Cost Savings Changes			
Benchmark Price per Barrel Oil	$26.78		2001 average price to date
Oil Price Changes			
Alternative real average annual energy cost changes (2001-2025)			
Base case	0.0%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
low	-2.1%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
high	1.3%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
Assumed Real Escalator for Contract Avoided Costs			
Base case	-1.3%		calculated
low	0.7%		calculated
high	-2.5%		calculated
Assumed Nominal Escalator for Contract Avoided Costs	1.5%		Apollo
Notes			
1. Estimated that a 20MW farm on Maui would save MECO 102,000 bbl/yr oil based on 61,320 MHZ/yr output from wind farm & average heat rate of the generators at the Maalaea plant of 10,000 mmbtu/MWH			
2. Current contract structures require that the wind farms are paid the utility's avoided cost. This means that the wind farm essentially gets paid the price of oil as oil prices drive avoided cost.			Warren Bollmeier
3. Long term data suggest a utility increase of twice the "assumed escalator."			Warren Bollmeier
4. "Alternative real average annual energy contract cost changes" are the ("assumed escalator" - "nominal energy cost changes") divided by (1 + "nominal energy cost change")			
5. "Alternative nominal average annual energy cost changes" are the inflation rate for the "base case", and the inflation rate plus the high (low) real oil price forecast change for the high (low) values.			

Table A2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Wind System Purchased by a Commercial Entity *(continued)*

Descriptor	Derivative Value	Model Value	Source
Credit & Taxes			
Effective Wind Tax Credit		20%	what is the wind credit?
Hawaii State tax credit	20%		
Federal Tax Credits			
Production Tax Credit		$59.57	calculated (estimated annual kWh x rate)
credit per kWh Delivered	$0.017		Enron
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.16%	HI State Dept. of Taxation, GET on Gross Sales assuming pyramiding
State Income Taxes on Labor Income		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Ratio of Corporate Income Tax to Labor Income Tax		4.00%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Taxes on Induced and Indirect Output			
Note: It is impossible to determine the mix of transactions from indirect and induced output effects from $1 of final demand. For example, for retail transactions the GET is 4%.			
Total Taxes as a % of Indirect & Induced Output		4.6%	calculated
Ratio of GSP to Output	64.5%		1992 Hawaii State I/O model (value added ÷ total output for total intermediate demand)
Total Taxes as a % of GSP	7.1%		see "HAWAII STATE TAX REVENUES AS A % OF GSP" worksheet (p. A-11)
Tax on Income			
Individual State		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Federal		14.56%	IRS, "Statistics of Income Bulletin," Fall 2000, VOL 17 No 2, 1999 tax rates - all filers.
Corporate State		5.97%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Federal		14.67%	IRS, "Statistics of Income Bulletin," Summer 2000, VOL 20 No 1, 1997 tax rates - F, I & RE
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.13	1992 Hawaii State I/O model ($ economy output per $ other construc.final demand)
employment		26.59	1992 Hawaii State I/O model (total jobs per $ mil.other construc. final demand)
labor income		0.89	1992 Hawaii State I/O model ($ labor income per $ other construc.final demand)
from annual loan amortization			
output (sales)		2.13	1992 HI I/O model ($ economy output per $ banking & credit agencies final demand)
employment		25.47	1992 HI/O model (total jobs per $ mil. Final demand banking & credit)
labor income		0.680	1992 Hawaii State I/O model ($ labor per $ banking & credit final demand)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.02	1992 Hawaii State I/O model ($ output per $ final demand Personal. Consump.
employment		27.57	1992 Hawaii State I/O model (total jobs per $ mil. final demand Personal. Consump.
labor income		0.734	1992 Hawaii State I/O model ($ labor income per $ final demand Personal. Consump.
system savings assumed to remain in-state		50%	assumed % of equity owned within State

Table A3: Asssumptions for Estimation of Fiscal and Economic Impacts Foregone Due to ECITC Stimulated Wind System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)			NA
Inslatted Cost per Unit		$0	NA
Purchase Costs over System Life			
Amortization Costs of Purchase per Unit			
Annual Interest	6.00%		NA
Loan Terms (borrow money for purchase)	6		NA
Loan Amount per Unit	$0		NA
system cost per unit	$0		NA
credit value per unit	$0		NA
Notes: same assumption set for heat pumps.			
Typical Annual Maint.Contract Fee per Unit		$0.00	NA
Energy Cost Changes to HECO per Kw			
Oil Cost if No Wind Farm		$159.72	see Table A6 for forecast changes for the base case scenario
Avoided Cost Paid to Wind Farm		$159.72	see Table A6 for forecast changes for the base case scenario

Table A4: Net Economic and Fiscal Impact Stimulated by the ECITC per kW Installed for Commercial Wind Energy Systems

(Note: These are the economic & fiscal effects due to the purchase of a wind system less the economic and fiscal impacts foregone due to its purchase plus the impacts on HECO and its affiliates.

	Period Number													
Item	**Install**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Net Benefits														
Wind System Purchaser	($1,124)	$323	$318	$313	$309	$304	$299	$294	$289	$284	$276	$271	$266	$261
HECO & Affiliates Impact	$0	$0	$2	$4	$6	$8	$10	$12	$14	$16	$18	$20	$22	$24
State Fiscal Account	($148)	$14	$14	$14	$14	$14	$14	$14	$14	$14	$16	$16	$16	$16
Net Economic Impacts														
Final Demand	$843	$116	$112	$108	$104	$100	$96	$92	$88	$83	$78	$74	$69	$65
Multiplier Effects														
Indirect & Induced Output	$1,014	$120	$120	$121	$121	$121	$121	$120	$120	$120	$118	$118	$117	$116
Employment	0.0219	0.0031	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032	0.0031	0.0031	0.0031	0.0031	0.0031
Labor Income	$838	$87	$87	$87	$87	$88	$87	$87	$87	$87	$86	$86	$85	$84

	Period Number													Present Value
Item	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	TOTALS	@ Discount
														2.73%
Net Benefits														
Wind System Purchaser	$256	$250	$338	$334	$331	$328	$322	$319	$316	$313	$310	$307	$6,406	$4,416
Lender	$7	$4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($262)	($304)
HECO & Affiliates Impact	$25	$27	$29	$31	$32	$34	$36	$37	$39	$41	$42	$44		
State Fiscal Account	$16	$16	$26	$26	$26	$26	$27	$28	$28	$28	$28	$28	$343	$195
Net Economic Impacts														
Final Demand	$60	$54	$71	$67	$64	$60	$56	$53	$49	$46	$43	$39		$2,283
Multiplier Effects														
Indirect & Induced Output	$115	$115	$138	$140	$142	$144	$145	$147	$149	$151	$153	$155	$4,263	$3,369
Employment	0.0030	0.0030	0.0036	0.0037	0.0037	0.0038	0.0038	0.0039	0.0039	0.0040	0.0040	0.0041	0.1073	
Labor Income	$84	$84	$101	$102	$104	$105	$106	$108	$109	$111	$112	$114	$3,205	$2,553

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Commercial Wind Energy System Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Wind Farm Account														
Costs														
System cash purchase	$703													
Amortization costs (cost borrowed)		$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66
interest payment		$45	$43	$42	$40	$38	$35	$33	$30	$27	$24	$21	$17	$14
principal payment		$21	$22	$24	$26	$28	$30	$33	$35	$38	$41	$45	$48	$52
Land Lease Costs		$3	$3	$3	$3	$3	$3	$3	$3	$3	$4	$4	$4	$4
Annual system maintenance costs		$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5
Annual Costs	$703	$86	$86	$86	$86	$86	$86	$86	$86	$86	$87	$87	$87	$87
Benefits														
ECITC Refund	$141													
Federal Production Tax Credit		$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60
System Depreciation		$94	$94	$94	$94	$94	$94	$94	$94	$94	$94	$94	$94	$94
Depreciation & and Interest Tax Deductions														
State		$8	$8	$8	$8	$8	$8	$8	$7	$7	$7	$7	$7	$6
Federal		$20	$20	$20	$20	$19	$19	$19	$18	$18	$17	$17	$16	$16
Annual revenue from sales		$160	$158	$156	$153	$151	$149	$147	$145	$144	$142	$140	$138	$136
Annual Benefits		$248	$245	$243	$241	$238	$236	$233	$231	$228	$226	$223	$220	$218
BENEFITS - COSTS	($562)	$162	$159	$157	$154	$152	$149	$147	$145	$142	$138	$136	$133	$131
(assumed spent on personal consumption expenditures)														
Lender Accounts														
Costs														
System retail cost payment	$703													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income														
State		$3	$3	$2	$2	$2	$2	$2	$2	$2	$1	$1	$1	$1
Federal		$7	$6	$6	$6	$6	$5	$5	$4	$4	$4	$3	$3	$2
Annual Costs	$703	$9	$9	$9	$8	$8	$7	$7	$6	$6	$5	$4	$4	$3
Benefits														
ECITC Refund	$141													
Annual interest payment		$45	$43	$42	$40	$38	$35	$33	$30	$27	$24	$21	$17	$14
Annual Benefits	$141	$45	$43	$42	$40	$38	$35	$33	$30	$27	$24	$21	$17	$14
BENEFITS - COSTS - i only	($562)	$36	$34	$33	$31	$30	$28	$26	$24	$22	$19	$17	$14	$11
BENEFITS - COSTS - i + p	($562)	$56	$57	$57	$58	$58	$58	$59	$59	$60	$61	$61	$62	$63

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Commercial Wind Energy System Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Wind Farm Account															
Costs															
System cash purchase	$703														
Amortization costs (cost borrowed)		$66	$66	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$985	$821
interest payment		$9	$5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$423	$370
principal payment		$56	$61	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$562	$451
Land Lease Costs		$4	$4	$4	$4	$4	$4	$5	$5	$5	$5	$5	$5	$96	$69
Annual system maintenance costs		$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$17.5	$438	$323
Annual Costs	$703	$87	$87	$21	$21	$21	$21	$22	$22	$22	$22	$22	$22	$2,222	$1,916
Benefits															
ECITC Refund	$141														
Federal Production Tax Credit		$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$1,489	$1,098
System Depreciation		$94	$94	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,406	$1,172
Depreciation & and Interest Tax Deductions															
State		$6	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$109	$92
Federal		$15	$14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$268	$226
Annual revenue from sales		$134	$133	$131	$129	$127	$126	$124	$122	$121	$119	$118	$116	$3,418	$2,567
Annual Benefits		$215	$212	$190	$189	$187	$185	$184	$182	$180	$179	$177	$176	$5,285	$3,983
BENEFITS - COSTS	($562)	$128	$125	$169	$167	$166	$164	$161	$159	$158	$156	$155	$153	$3,203	$2,208
(assumed spent on personal consumption expenditures)															
Lender Accounts															
Costs															
System retail cost payment	$703														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income															
State		$1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25	$22
Federal		$1	$1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$62	$54
Annual Costs	$703	$2	$1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$790	$779
Benefits															
ECITC Refund	$141														
Annual interest payment		$9	$5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$423	$370
Annual Benefits	$141	$9	$5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$564	$511
BENEFITS - COSTS - i only	($562)	$7	$4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($226)	($268)
BENEFITS - COSTS - i + p	($562)	$64	$65	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$336	$183

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Commercial Wind Energy System Purchases *(continued)*

		Year and Period Number												
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
Multiplier Effects of Expenditure														
System Purchase Cost & Maintenance Effects														
Final Demand	$1,406	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18
Multiplier Effects														
Indirect & Induced Output	$1,588	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Labor	0.037	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Labor income	$1,251	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16
Due to User Benefits - Costs														
% of Benefits Staying In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Final Demand	($281)	$81	$80	$78	$77	$76	$75	$73	$72	$71	$69	$68	$67	$65
Multiplier Effects														
Indirect & Induced Output	($287)	$41	$41	$40	$39	$39	$38	$38	$37	$36	$35	$35	$34	$33
Labor	(0.008)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Labor income	($206)	$30	$29	$29	$28	$28	$27	$27	$27	$26	$25	$25	$24	$24
From Lender Activities														
% of Loan Originating In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Final Demand		$18	$17	$16	$16	$15	$14	$13	$12	$11	$10	$8	$7	$5
Multiplier Effects														
Indirect & Induced Output	$0	$20	$19	$19	$18	$17	$16	$15	$14	$12	$11	$9	$8	$6
Labor	0.0000	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0001
Labor income	$0	$12	$12	$11	$11	$10	$10	$9	$8	$7	$7	$6	$5	$4
TOTAL MULTIPLIER EFFECTS														
Final Demand	$1,124	$116	$114	$112	$110	$108	$106	$104	$102	$99	$96	$94	$91	$88
Multiplier Effects														
Indirect & Induced Output	$1,301	$79	$78	$76	$75	$73	$72	$70	$69	$67	$65	$63	$61	$59
Labor	0.030	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Labor income	$1,045	$57	$56	$56	$55	$54	$53	$51	$50	$49	$47	$46	$45	$43
State Fiscal Account														
Costs														
State interest + depreciation deduction refund	$0	$8	$8	$8	$8	$8	$8	$8	$7	$7	$7	$7	$7	$6
ECITC cost	$281													
TOTAL COST	$281	$8	$8	$8	$8	$8	$8	$8	$7	$7	$7	$7	$7	$6
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$47	$4.83	$4.75	$4.67	$4.59	$4.51	$4.42	$4.33	$4.23	$4.13	$4.00	$3.90	$3.78	$3.67
Individual income (x labor income)	$62	$3.42	$3.37	$3.31	$3.25	$3.19	$3.13	$3.06	$3.00	$2.92	$2.83	$2.75	$2.66	$2.57
Corporate income (% of GSP)	$2	$0.14	$0.13	$0.13	$0.13	$0.13	$0.13	$0.12	$0.12	$0.12	$0.11	$0.11	$0.11	$0.10
Lease Rents		$3	$3	$3	$3	$3	$3	$3	$3	$3	$4	$4	$4	$4
Taxes on Indirect & Induced Output	$60	$3.61	$3.56	$3.49	$3.43	$3.36	$3.30	$3.22	$3.15	$3.07	$2.96	$2.87	$2.78	$2.68
TOTAL BENEFIT	$171	$15	$15	$15	$14	$14	$14	$14	$13	$13	$14	$14	$13	$13
NET BENEFIT TO STATE GOVERNMENT	($110)	$7	$7	$7	$7	$6	$6	$6	$6	$6	$7	$7	$7	$7

Table A5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Commercial Wind Energy System Purchases *(continued)*

		Year and Period Number													
Item	Install	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 2.7%
Multiplier Effects of Expenditure															
System Purchase Cost & Maintenance Effects															
Final Demand	$1,406	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18		
Multiplier Effects															
Indirect & Induced Output	$1,588	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$2,083	$1,953
Labor	0.037	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.049	
Labor income	$1,251	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$1,641	$1,538
Due to User Benefits - Costs															
% of Benefits Staying In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%		
Final Demand	($281)	$64	$63	$84	$84	$83	$82	$81	$80	$79	$78	$77	$77	$1,602	$1,104
Multiplier Effects															
Indirect & Induced Output	($287)	$33	$32	$43	$43	$42	$42	$41	$41	$40	$40	$40	$39	$675	$420
Labor	(0.008)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.018	
Labor income	($206)	$23	$23	$31	$31	$30	$30	$30	$29	$29	$29	$28	$28	$485	$302
From Lender Activities															
% of Loan Originating In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%		
Final Demand		$4	$2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$168	$147
Multiplier Effects															
Indirect & Induced Output	$0	$4	$2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$190	$166
Labor	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.004	
Labor income	$0	$3	$1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$114	$100
TOTAL MULTIPLIER EFFECTS															
Final Demand	$1,124	$85	$82	$102	$101	$100	$99	$98	$97	$96	$96	$95	$94	$3,613	$2,979
Multiplier Effects															
Indirect & Induced Output	$1,301	$56	$54	$63	$63	$62	$62	$61	$61	$60	$60	$59	$59	$2,926	$2,521
Labor	0.030	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.071	
Labor income	$1,045	$42	$40	$47	$46	$46	$46	$45	$45	$45	$44	$44	$44	$2,239	$1,940
State Fiscal Account															
Costs															
State interest + depreciation deduction refund	$0	$6	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$109	$92
ECITC cost	$281													$281	$281
TOTAL COST	$281	$6	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$390	$373
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$47	$3.54	$3.41	$4.24	$4.21	$4.17	$4.14	$4.08	$4.05	$4.01	$3.98	$3.95	$3.92	$150	$124
Individual income (x labor income)	$62	$2.48	$2.38	$2.78	$2.76	$2.74	$2.72	$2.69	$2.67	$2.66	$2.64	$2.62	$2.61	$133	$116
Corporate income (% of GSP)	$2	$0.10	$0.10	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.10	$0.10	$5	$5
Lease Rents		$4	$4	$4	$4	$4	$4	$5	$5	$5	$5	$5	$5	$96	$69
Taxes on Indirect & Induced Output	$60	$2.57	$2.46	$2.88	$2.86	$2.84	$2.82	$2.79	$2.77	$2.75	$2.74	$2.72	$2.70		
TOTAL BENEFIT	$171	$13	$12	$14	$14	$14	$14	$15	$14	$14	$14	$14	$14	$519	$428
NET BENEFIT TO STATE GOVERNMENT	($110)	$7	$6	$14	$14	$14	$14	$15	$14	$14	$14	$14	$14	$129	$55

Table A6: Worksheet Showing Cost & Multiplier Accounting for Net Energy Cost Windfall to Utility Customers Due to a Wind Farm

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
User Account														
Costs														
System retail cost payment	$0													
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
Avoided Cost Paid to Wind Farm		$160	$158	$156	$153	$151	$149	$147	$145	$144	$142	$140	$138	$136
Annual Costs		$160	$158	$156	$153	$151	$149	$147	$145	$144	$142	$140	$138	$136
Benefits														
ECITC Refund	$0													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
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
Oil Cost if No Wind Farm		$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160
Annual Benefits	$0	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160
BENEFITS - COSTS	$0	$0	$2	$4	$6	$8	$10	$12	$14	$16	$18	$20	$22	$24
(assumed spent on personal consumption expenditures)														
Multiplier Effects of Expenditure														
Due to User Benefits - Costs														
Final Demand	$0	$0	$2	$4	$6	$8	$10	$12	$14	$16	$18	$20	$22	$24
Multiplier Effects														
Indirect & Induced Output	$0	$0	$2	$4	$6	$8	$11	$13	$15	$17	$18	$20	$22	$24
Labor	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
Labor income	$0	$0	$2	$3	$5	$6	$8	$9	$10	$12	$13	$15	$16	$17
TOTAL MULTIPLIER EFFECTS														
Final Demand	$0	$0	$2	$4	$6	$8	$10	$12	$14	$16	$18	$20	$22	$24
Multiplier Effects														
Indirect & Induced Output	$0	$0	$2	$4	$6	$8	$11	$13	$15	$17	$18	$20	$22	$24
Labor	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
Labor income	$0	$0	$2	$3	$5	$6	$8	$9	$10	$12	$13	$15	$16	$17
State Fiscal Account														
Costs														
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1	$1
Individual income (x labor income)	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1	$1
Corporate income (% of GSP)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxes on Indirect & Induced Output	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1	$1
TOTAL BENEFIT	$0	$0	$0	$1	$1	$1	$1	$2	$2	$2	$2	$3	$3	$3
NET BENEFIT TO STATE GOVERNMENT	$0	$0	$0	$1	$1	$1	$1	$2	$2	$2	$2	$3	$3	$3

Table A6: Worksheet Showing Cost & Multiplier Accounting for Net Energy Cost Windfall to Utility Customers Due to a Wind Farm *(continued)*

Item	Install	Year and Period Number 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
															2.7%
User Account															
Costs															
System retail cost payment	$0														
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
Avoided Cost Paid to Wind Farm		$134	$133	$131	$129	$127	$126	$124	$122	$121	$119	$118	$116	$3,418	$2,567
Annual Costs		$134	$133	$131	$129	$127	$126	$124	$122	$121	$119	$118	$116	$3,418	$2,567
Benefits															
ECITC Refund	$0														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
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
Oil Cost if No Wind Farm		$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$3,993	$2,944
Annual Benefits	$0	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$160	$3,993	$2,944
BENEFITS - COSTS	$0	$25	$27	$29	$31	$32	$34	$36	$37	$39	$41	$42	$44	$575	$377
(assumed spent on personal consumption expenditures)															
Multiplier Effects of Expenditure															
Due to User Benefits - Costs															
Final Demand	$0	$25	$27	$29	$31	$32	$34	$36	$37	$39	$41	$42	$44		
Multiplier Effects															
Indirect & Induced Output	$0	$26	$28	$30	$31	$33	$35	$37	$38	$40	$42	$43	$45	$588	$385
Labor	0.0000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.016	
Labor income	$0	$19	$20	$21	$23	$24	$25	$26	$27	$29	$30	$31	$32	$422	$277
TOTAL MULTIPLIER EFFECTS															
Final Demand	$0	$25	$28	$31	$34	$36	$39	$42	$44	$47	$50	$52	$55	$641	$415
Multiplier Effects															
Indirect & Induced Output	$0	$26	$29	$32	$35	$38	$41	$43	$46	$49	$52	$54	$57	$662	$428
Labor	0.0000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.018	
Labor income	$0	$19	$21	$23	$25	$27	$29	$32	$34	$36	$38	$40	$42	$481	$310
State Fiscal Account															
Costs															
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													$0	$0
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$0	$1	$1	$1	$1	$2	$2	$2	$2	$2	$2	$2	$2	$27	$17
Individual income (x labor income)	$0	$1	$1	$1	$2	$2	$2	$2	$2	$2	$2	$2	$2	$29	$19
Corporate income (% of GSP)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1
Taxes on Indirect & Induced Output	$0	$1	$1	$1	$2	$2	$2	$2	$2	$2	$2	$2	$3		
TOTAL BENEFIT	$0	$3	$4	$4	$5	$5	$5	$6	$6	$6	$7	$7	$7	$87	$56
NET BENEFIT TO STATE GOVERNMENT	$0	$3	$4	$4	$5	$5	$5	$6	$6	$6	$7	$7	$7	$87	$56

Table A7: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Commercial Wind Energy Systems Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Wind Farm Account														
BENEFITS - COSTS	$562	($162)	($159)	($157)	($154)	($152)	($149)	($147)	($145)	($142)	($138)	($136)	($133)	($131)
(assumed spent on personal consumption expenditures)														
Multiplier Effects of Expenditure														
Due to User Benefits - Costs														
% of Benefits Staying In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Final Demand	$281	($81)	($80)	($78)	($77)	($76)	($75)	($73)	($72)	($71)	($69)	($68)	($67)	($65)
Multiplier Effects														
Indirect & Induced Output	$287	($41)	($41)	($40)	($39)	($39)	($38)	($38)	($37)	($36)	($35)	($35)	($34)	($33)
Labor	0.008	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Labor income	$206	($30)	($29)	($29)	($28)	($28)	($27)	($27)	($27)	($26)	($25)	($25)	($24)	($24)
TOTAL MULTIPLIER EFFECTS														
Final Demand	$281	($81)	($80)	($78)	($77)	($76)	($75)	($73)	($72)	($71)	($69)	($68)	($67)	($65)
Multiplier Effects														
Indirect & Induced Output	$287	($41)	($41)	($40)	($39)	($39)	($38)	($38)	($37)	($36)	($35)	($35)	($34)	($33)
Labor	0.008	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Labor income	$206	($30)	($29)	($29)	($28)	($28)	($27)	($27)	($27)	($26)	($25)	($25)	($24)	($24)
State Fiscal Account														
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$12	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)
Individual income (x labor income)	$12	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($1)	($1)	($1)
Corporate income (% of GSP)	$0	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)
Lease Rents														
Taxes on Indirect & Induced Output	$13	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)
TOTAL BENEFIT	$38	($7)	($7)	($7)	($7)	($7)	($7)	($6)	($6)	($6)	($6)	($6)	($6)	($6)
NET BENEFIT TO STATE GOVERNMENT	$38	($7)	($7)	($7)	($7)	($7)	($7)	($6)	($6)	($6)	($6)	($6)	($6)	($6)

Table A7: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Commercial Wind Energy Systems Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Wind Farm Account															
BENEFITS - COSTS	$562	($128)	($125)	($169)	($167)	($166)	($164)	($161)	($159)	($158)	($156)	($155)	($153)	($3,203)	($2,208)
(assumed spent on personal consumption expenditures)															
Multiplier Effects of Expenditure															
Due to User Benefits - Costs															
% of Benefits Staying In-State	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%		
Final Demand	$281	($64)	($63)	($84)	($84)	($83)	($82)	($81)	($80)	($79)	($78)	($77)	($77)	($1,602)	($1,104)
Multiplier Effects															
Indirect & Induced Output	$287	($33)	($32)	($43)	($43)	($42)	($42)	($41)	($41)	($40)	($40)	($40)	($39)	($675)	($420)
Labor	0.008	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.018)	
Labor income	$206	($23)	($23)	($31)	($31)	($30)	($30)	($30)	($29)	($29)	($29)	($28)	($28)	($485)	($302)
TOTAL MULTIPLIER EFFECTS															
Final Demand	$281	($64)	($63)	($84)	($84)	($83)	($82)	($81)	($80)	($79)	($78)	($77)	($77)	($1,602)	($1,104)
Multiplier Effects															
Indirect & Induced Output	$287	($33)	($32)	($43)	($43)	($42)	($42)	($41)	($41)	($40)	($40)	($40)	($39)	($675)	($420)
Labor	0.008	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.018)	
Labor income	$206	($23)	($23)	($31)	($31)	($30)	($30)	($30)	($29)	($29)	($29)	($28)	($28)	($485)	($302)
State Fiscal Account															
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$12	($3)	($3)	($4)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($3)	($67)	($46)
Individual income (x labor income)	$12	($1)	($1)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($29)	($18)
Corporate income (% of GSP)	$0	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($1)	($1)
Lease Rents															
Taxes on Indirect & Induced Output	$13	($1)	($1)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)	($2)		
TOTAL BENEFIT	$38	($6)	($5)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($128)	($84)
NET BENEFIT TO STATE GOVERNMENT	$38	($6)	($5)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($7)	($128)	($84)

Table A8: Tariff Distribution, Rebate Levels & Per kWh Data

	Individual Tariff Areas				Grand Totals		DSM Rebate Levels		Per Kwh Cost	
Tariffr Area	Avg Cost	No.	% of Total	Wt. Cost	Distrib.	Weights	Rebate	Weight	$/kwh	Weight
HECO										
New	$ 3,172	2,070	23.0%	$ 730	16%		$ 1,000	$ 163		
Retro Fit	$ 4,883	6,923	77.0%	$ 3,759	54%		$ 500	$ 272		
SubTotal		8,993	100%	$ 4,489	71%	$ 3,177			$ 0.1463	$ 0.1035
HELCO										
New	$ 4,361	700	42.7%	$ 1,861	6%		$ 1,000	$ 55		
Retro Fit	$ 4,689	940	57.3%	$ 2,688	7%		$ 1,000	$ 74		
SubTotal		1,640	100%	$ 4,549	13%	$ 587			$ 0.2297	$ 0.0296
MECO-Maui (3)										
New	$ 4,285	516	26.0%	$ 1,112	4%		$ 1,000	$ 41		
Retro Fit	$ 4,720	1,472	74.0%	$ 3,495	12%		$ 1,000	$ 116		
SubTotal		1,988	100%	$ 4,607	16%	$ 721			$ 0.1868	$ 0.0292
MECO-Molokai (4)										
New	$ 6,028	1	1.2%	$ 71	0%		$ 1,000	$ 0		
Retro Fit	$ 4,847	84	98.8%	$ 4,790	1%		$ 1,000	$ 7		
SubTotal		85		$ 4,861	1%	$ 33			$ 0.5099	$ 0.0034
GRAND TOTAL		12,706	100%		129%	$ 4,518		$ 728		$ 0.1624
New		3,287	26%					$ 259		
Retro Fit		9,419	74%					$ 469		

Sources
HECO "Program Data" Printout Dated 10/1/2000

Table B1: Economic and Fiscal Impacts for a 1 kW Residential Wind Energy System

Item	Effects Created by a Wind System Year 1	Effects Created by a Wind System Avg/Yr Years 2-25	Foregone Impacts Due to Wind System Year 1	Foregone Impacts Due to Wind System Avg/Yr Years 2-25	NET IMPACT Year 1	NET IMPACT Avg/Yr Years 2-25
Economic Effects						
Total Output						
Final Demand	$6,965	$141	$372	$110	$6,593	$29
Indirect & Induced	$7,835	$146	$379	$112	$7,455	$32
Employment	0.1843	0.0053	0.01018	0.0026	0.1741	0.0026
Total Labor Income	$6,134	$102	$271	$80	$5,863	$20
Fiscal Effects						
Total Revenues	$1,029	$19	$50	($2)	$979	$21
Total Expenditures						
ECITC Expenditure	$1,334	$0	$0	$0	$1,334	$0
Other Costs	$42	$14	$0	$0	$42	$14
NET FISCAL IMPACT	($347)	$5	$50	($2)	($397)	$7

Table B2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Residential Unit Wind Energy System Purchases

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)		25	assumed same as commercial systems
Estimated Annual Kwh Output per Installed kW System		2,628	calculated
Peak Annual Output (kWh)	8760		365 days/yr x 24 hrs/day x 1 kW/hr
Expected Efficiency	30%		Warren Bollmeier (less than commercial due to assumed less favorable average sites)
Average Installed Cost (2001 $) for 1 kW System		$6,668	Warent Bollmeier (a Model H-80 system)
Purchase Costs over System Life			
Equity % of purchase	0%		either cash or financed purchases
Amortization Cost Assumptions			
Annual Interest	13.25%		assumed same as solar systems
Loan Terms (borrow money for purchase)	15		assumed same as solar systems
Loan Amount per kW	$5,334		calculated (system cost less credit value)
system cost per unit	$6,668		see above
credit value per unit	$1,334		system cost per unit x credit %
% of Loans Originating in-State		100%	assumed
Typical Annual Operations & Maintenance Cost per kW		$75	Warren Bollmeier
Average Annual Gross Imported Oil Savings per Unit	per kWh	Annual	
Retail Cost per kWh	$0.162	$427	see Table A_ and calculated
Note: The retail cost per kWh assumes that the distribution of wind systems across islands is the same as that for solar.			
Cost Savings Changes			
Benchmark Price per Barrel Oil	$26.78		2001 average price to date
Oil Price Changes			
Alternative real average annual energy cost changes (2001-2025)			
Base case	0.0%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
low	-2.1%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html
high	1.3%		http://www.eia.doe.gov/oiaf/aeo/tbl20.html

Table B2: Assumptions for Estimation of Fiscal and Economic Impacts of ECITC Stimulated Residential Unit Wind Energy System Purchases *(continued)*

Descriptor	Derivative Value	Model Value	Source
Credit & Taxes			
Effective Wind Tax Credit		20%	calculated
Hawaii State tax credit	20%		Warren Bollmeier
Credit Cap	$1,575		Warren Bollmeier
Taxes			
Taxes on Final Demand or Labor Income (Direct Effects)			
GET on Final Demand (% of final demand)		4.16%	HI State Dept. of Taxation, GET on Gross Sales assuming pyramiding
State Income Taxes on Labor Income		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Ratio of Corporate Income Tax to Labor Income Tax		4.00%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
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 $1 of final demand are the % indicated of total indirect plus induced output.			
Total Taxes as a % of Indirect & Induced Output		4.6%	calculated
Ratio of GSP to Output	64.5%		1992 Hawaii State I/O model (value added ÷ total output for total intermediate demand)
Total Taxes as a % of GSP	7.1%		see "HAWAII STATE TAX REVENUES AS A % OF GSP" worksheet (p. A-11)
Tax on Income			
Individual State		5.96%	Dept. of Taxation, "Hawaii Income Patterns, Individuals - 1998," 1/99, p. 29.
Federal		14.56%	IRS, "Statistics of Income Bulletin," Fall 2000, VOL 17 No 2, 1999 tax rates - all filers.
Corporate State		5.97%	Dept. of Taxation, "Hawaii Income Patterns, Corporations"
Federal		14.67%	IRS, "Statistics of Income Bulletin," Summer 2000, VOL 20 No 1, 1997 tax rates - F, I & RE
Multipliers (Type II)			
on system installation and maintenance			
output (sales)		2.13	1992 Hawaii State I/O model ($ economy output per $ other construc.final demand)
employment		26.59	1992 Hawaii State I/O model (total jobs per $ mil.other construc. final demand)
labor income		0.89	1992 Hawaii State I/O model ($ labor income per $ other construc.final demand)
from annual loan amortization			
output (sales)		2.13	1992 HI I/O model ($ economy output per $ banking & credit agencies final demand)
employment		25.47	1992 HI/O model (total jobs per $ mil. Final demand banking & credit)
labor income		0.680	1992 Hawaii State I/O model ($ labor per $ banking & credit final demand)
from annual system savings			weighted average across all personal consumption expenditure industries
output (sales)		2.02	1992 Hawaii State I/O model ($ output per $ final demand Personal. Consump.
employment		27.57	1992 Hawaii State I/O model (total jobs per $ mil. final demand Personal. Consump.
labor income		0.734	1992 Hawaii State I/O model ($ labor income per $ final demand Personal. Consump.
system savings assumed to remain in-state		100%	assumed % of equity owned within State

Table B3: Assumptions for Estimation of Fiscal and Economic Impacts Foregone Due to ECITC Due to Wind Energy System Purchase

Descriptor	Derivative Value	Model Value	Source
System Variables			
Assumed system life (years)	25		NA
Inslatted Cost per Unit		$0	NA
Purchase Costs over System Life			
Amortization Costs of Purchase per Unit			
Annual Interest	6.00%		NA
Loan Terms (borrow money for purchase)	6		NA
Loan Amount per Unit	$0		NA
system cost per unit	$0		NA
credit value per unit	$0		NA
Notes:			
same assumption set for heat pumps.			
Typical Annual Maint.Contract Fee per Unit		$0.00	NA
Energy Cost Changes to HECO per kWh			
Amount Foregone or Paid to Residence		$426.77	see Table B6 for forecast changes for the base case scenario
Avoided Cost to HECO Year 1	$0.046	$119.79	calculated and forecast
Price			
On-Peak (7AM-9PM)	$0.051		Enron & Warren Baumeier
Off-Peak	$0.038		Enron & Warren Baumeier
Weights			
On-Peak (7AM-9PM)	14		Enron
Off-Peak	10		Enron
Annual kWh Savings	2,628		see Table B2

Table B4: Net Economic and Fiscal Impact Stimulated by the ECITC Per Residential Wind Energy System

	Period Number													
Item	**Install**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Net Benefits														
Wind System Purchaser	$0	($677)	($684)	($692)	($701)	($711)	($723)	($736)	($751)	($768)	($787)	($809)	($833)	($861)
State Fiscal Account	($343)	($53)	($55)	($57)	($59)	($61)	($64)	($67)	($70)	($74)	($78)	($83)	($88)	($95)
Net Economic Impacts														
Final Demand	$6,668	($75)	($94)	($117)	($142)	($171)	($204)	($241)	($283)	($330)	($384)	($445)	($514)	($592)
Multiplier Effects														
Indirect & Induced Output	$7,535	($80)	($100)	($122)	($148)	($177)	($210)	($247)	($290)	($337)	($392)	($453)	($522)	($601)
Employment	0.1773	(0.0032)	(0.0038)	(0.0043)	(0.0050)	(0.0058)	(0.0066)	(0.0076)	(0.0087)	(0.0099)	(0.0113)	(0.0129)	(0.0148)	(0.0168)
Labor Income	$5,935	($71)	($85)	($101)	($119)	($139)	($162)	($188)	($217)	($250)	($288)	($330)	($379)	($433)

	Period Number													**Present Value**
Item	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	TOTALS	**@ Discount 2.73%**
Net Benefits														
Wind System Purchaser	($893)	($928)	$704	$704	$704	$704	$704	$704	$704	$704	$704	$704	($4,520)	($5,355)
State Fiscal Account	($102)	($110)	$105	$105	$105	$105	$105	$105	$105	$105	$105	$105	($404)	($624)
Net Economic Impacts														
Final Demand	($680)	($780)	$779	$779	$779	$779	$779	$779	$779	$779	$779	$779	$9,401	$7,372
Multiplier Effects														
Indirect & Induced Output	($690)	($791)	$804	$804	$804	$804	$804	$804	$804	$804	$804	$804	$10,412	$8,301
Employment	(0.0191)	(0.0217)	0.0214	0.0214	0.0214	0.0214	0.0214	0.0214	0.0214	0.0214	0.0214	0.0214	0.2395	
Labor Income	($495)	($565)	$583	$583	$583	$583	$583	$583	$583	$583	$583	$583	$7,943	$6,415

Table B5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Wind Energy System Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Wind Purchaser Account														
Costs														
System cash purchase	$0													
Amortization costs (cost borrowed)		$836	$836	$836	$836	$836	$836	$836	$836	$836	$836	$836	$836	$836
interest payment		$707	$690	$670	$648	$623	$595	$563	$527	$486	$440	$387	$328	$260
principal payment		$129	$146	$166	$188	$213	$241	$273	$309	$350	$396	$449	$508	$576
Land Lease Costs														
Annual system maintenance costs		$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0
Annual Costs	$0	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911
Benefits														
ECITC Refund	$0													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions														
State		$42	$41	$40	$39	$37	$36	$34	$31	$29	$26	$23	$20	$16
Federal		$104	$101	$98	$95	$91	$87	$83	$77	$71	$65	$57	$48	$38
Annual benefit from sales or avoided cost		$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427
Annual Benefits		$573	$569	$565	$561	$555	$550	$543	$536	$527	$518	$507	$494	$481
BENEFITS - COSTS	$0	($338)	($342)	($346)	($351)	($356)	($362)	($368)	($376)	($384)	($394)	($404)	($417)	($431)
(assumed spent on personal consumption expenditures)														
Lender Accounts														
Costs														
System retail cost payment	$6,668													
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income														
State		$42	$41	$40	$39	$37	$36	$34	$31	$29	$26	$23	$20	$16
Federal		$104	$101	$98	$95	$91	$87	$83	$77	$71	$65	$57	$48	$38
Annual Costs	$6,668	$146	$142	$138	$134	$129	$123	$116	$109	$100	$91	$80	$68	$54
Benefits														
ECITC Refund	$1,334													
Annual interest payment		$707	$690	$670	$648	$623	$595	$563	$527	$486	$440	$387	$328	$260
Annual Benefits	$1,334	$707	$690	$670	$648	$623	$595	$563	$527	$486	$440	$387	$328	$260
BENEFITS - COSTS - i only	($5,334)	$561	$547	$532	$514	$495	$472	$447	$418	$386	$349	$307	$260	$207
BENEFITS - COSTS - i + p	($5,334)	$690	$694	$698	$702	$707	$713	$720	$727	$736	$745	$756	$768	$782

Table B5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Wind Energy System Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Wind Purchaser Account															
Costs															
System cash purchase	$0														
Amortization costs (cost borrowed)		$836	$836	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,542	$10,455
interest payment		$184	$98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,208	$6,268
principal payment		$652	$738	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,334	$4,187
Land Lease Costs															
Annual system maintenance costs		$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$75.0	$1,875	$1,382
Annual Costs	$0	$911	$911	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$14,417	$11,837
Benefits															
ECITC Refund	$0														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation & and Interest Tax Deductions															
State		$11	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$431	$374
Federal		$27	$14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,057	$919
Annual benefit from sales or avoided cost		$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$10,669	$7,866
Annual Benefits		$465	$447	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$12,157	$9,160
BENEFITS - COSTS	$0	($446)	($464)	$352	$352	$352	$352	$352	$352	$352	$352	$352	$352	($2,260)	($2,678)
(assumed spent on personal consumption expenditures)															
Lender Accounts															
Costs															
System retail cost payment	$6,668														
System Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income Tax on Interest Income															
State		$11	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$431	$374
Federal		$27	$14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,057	$919
Annual Costs	$6,668	$38	$20	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,156	$7,962
Benefits															
ECITC Refund	$1,334														
Annual interest payment		$184	$98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,208	$6,268
Annual Benefits	$1,334	$184	$98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,541	$7,601
BENEFITS - COSTS - i only	($5,334)	$146	$78	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$386	($360)
BENEFITS - COSTS - i + p	($5,334)	$798	$816	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,720	$3,827

Table B5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Wind Energy System Purchases *(continued)*

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
Multiplier Effects of Expenditure														
System Purchase Cost & Maintenance Effects														
Final Demand	$6,668	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75
Multiplier Effects														
Indirect & Induced Output	$7,535	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85
Labor	0.177	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
Labor income	$5,935	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67
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	$0	($338)	($342)	($346)	($351)	($356)	($362)	($368)	($376)	($384)	($394)	($404)	($417)	($431)
Multiplier Effects														
Indirect & Induced Output	$0	($346)	($350)	($354)	($358)	($364)	($369)	($376)	($384)	($392)	($402)	($413)	($426)	($440)
Labor	0.000	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Labor income	$0	($248)	($251)	($254)	($257)	($261)	($265)	($270)	($276)	($282)	($289)	($297)	($306)	($316)
From Lender Activities														
% of Loan Originating In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Final Demand		$561	$547	$532	$514	$495	$472	$447	$418	$386	$349	$307	$260	$207
Multiplier Effects														
Indirect & Induced Output	$0	$634	$618	$601	$581	$559	$534	$505	$473	$436	$394	$347	$294	$234
Labor	0.0000	0.0143	0.0139	0.0135	0.0131	0.0126	0.0120	0.0114	0.0107	0.0098	0.0089	0.0078	0.0066	0.0053
Labor income	$0	$381	$372	$362	$350	$336	$321	$304	$284	$262	$237	$209	$177	$141
TOTAL MULTIPLIER EFFECTS														
Final Demand	$6,668	$297	$280	$261	$239	$214	$186	$154	$118	$77	$30	($22)	($82)	($149)
Multiplier Effects														
Indirect & Induced Output	$7,535	$300	$283	$263	$241	$216	$188	$156	$119	$78	$32	($21)	($81)	($149)
Labor	0.177	0.007	0.007	0.006	0.005	0.005	0.004	0.003	0.002	0.001	0.000	(0.001)	(0.003)	(0.005)
Labor income	$5,935	$200	$188	$175	$159	$142	$123	$101	$76	$47	$15	($21)	($62)	($109)
State Fiscal Account														
Costs														
State interest + depreciation deduction refund	$0	$42	$41	$40	$39	$37	$36	$34	$31	$29	$26	$23	$20	$16
ECITC cost	$1,334													
TOTAL COST	$1,334	$42	$41	$40	$39	$37	$36	$34	$31	$29	$26	$23	$20	$16
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$277	$12.37	$11.66	$10.85	$9.94	$8.90	$7.73	$6.40	$4.90	$3.20	$1.27	($1)	($3)	($6)
Individual income (x labor income)	$354	$11.91	$11.20	$10.40	$9.50	$8.47	$7.31	$6.00	$4.51	$2.82	$0.91	($1)	($4)	($6)
Corporate income (% of GSP)	$14	$0.48	$0.45	$0.42	$0.38	$0.34	$0.29	$0.24	$0.18	$0.11	$0.04	($0)	($0)	($0)
Lease Rents		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxes on Indirect & Induced Output	$345	$13.73	$12.94	$12.04	$11.03	$9.89	$8.59	$7.12	$5.46	$3.58	$1.44	($1)	($4)	($7)
TOTAL BENEFIT	$990	$38	$36	$34	$31	$28	$24	$20	$15	$10	$4	($3)	($11)	($20)
NET BENEFIT TO STATE GOVERNMENT	($343)	($4)	($5)	($6)	($8)	($10)	($12)	($14)	($16)	($19)	($23)	($26)	($31)	($35)

Table B5: Worksheet Showing Cost & Multiplier Accounting for ECITC Stimulated Wind Energy System Purchases *(continued)*

	Year and Period Number														Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
Multiplier Effects of Expenditure															
System Purchase Cost & Maintenance Effects															
Final Demand	$6,668	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75		
Multiplier Effects															
Indirect & Induced Output	$7,535	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$85	$9,654	$9,097
Labor	0.177	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.227	
Labor income	$5,935	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$67	$7,603	$7,165
Due to User Benefits - Costs															
% of Benefits Staying In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand	$0	($446)	($464)	$352	$352	$352	$352	$352	$352	$352	$352	$352	$352	($2,260)	($2,678)
Multiplier Effects															
Indirect & Induced Output	$0	($456)	($474)	$360	$360	$360	$360	$360	$360	$360	$360	$360	$360	($2,310)	($2,736)
Labor	0.000	(0.012)	(0.013)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	(0.062)	
Labor income	$0	($328)	($341)	$258	$258	$258	$258	$258	$258	$258	$258	$258	$258	($1,659)	($1,965)
From Lender Activities															
% of Loan Originating In-State	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Final Demand		$146	$78	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,720	$4,974
Multiplier Effects															
Indirect & Induced Output	$0	$165	$88	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,464	$5,621
Labor	0.0000	0.0037	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.146	
Labor income	$0	$99	$53	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,890	$3,382
TOTAL MULTIPLIER EFFECTS															
Final Demand	$6,668	($225)	($312)	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$12,003	$10,347
Multiplier Effects															
Indirect & Induced Output	$7,535	($225)	($312)	$444	$444	$444	$444	$444	$444	$444	$444	$444	$444	$13,064	$11,335
Labor	0.177	(0.007)	(0.009)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.311	
Labor income	$5,935	($161)	($221)	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$9,834	$8,582
State Fiscal Account															
Costs															
State interest + depreciation deduction refund	$0	$11	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$431	$374
ECITC cost	$1,334													$1,334	$1,334
TOTAL COST	$1,334	$11	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,764	$1,708
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$277	($9)	($13)	$17.75	$17.75	$17.75	$17.75	$17.75	$17.75	$17.75	$17.75	$17.75	$17.75	$499	$430
Individual income (x labor income)	$354	($10)	($13)	$19.37	$19.37	$19.37	$19.37	$19.37	$19.37	$19.37	$19.37	$19.37	$19.37	$586	$512
Corporate income (% of GSP)	$14	($0)	($1)	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$23	$20
Lease Rents		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxes on Indirect & Induced Output	$345	($10)	($14)	$20.34	$20.34	$20.34	$20.34	$20.34	$20.34	$20.34	$20.34	$20.34	$20.34		
TOTAL BENEFIT	$990	($30)	($41)	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58	$1,707	$1,481
NET BENEFIT TO STATE GOVERNMENT	($343)	($41)	($47)	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58	($57)	($227)

Table B6: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Residential Wind Energy System Purchases

		Year and Period Number												
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Item	Install	1	2	3	4	5	6	7	8	9	10	11	12	13
System Purchaser Account														
Costs														
ECITC Refund	$0													
Tax Savings on Interest Expense														
Federal		$42	$41	$40	$39	$37	$36	$34	$31	$29	$26	$23	$20	$16
State		$104	$101	$98	$95	$91	$87	$83	$77	$71	$65	$57	$48	$38
Energy Savings/Sales		$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427
Annual Costs	$0	$573	$569	$565	$561	$555	$550	$543	$536	$527	$518	$507	$494	$481
Benefits														
System retail cost payment	$0													
Amortization Costs Not Spent on System														
Principal		$707	$690	$670	$648	$623	$595	$563	$527	$486	$440	$387	$328	$260
Interest		$129	$146	$166	$188	$213	$241	$273	$309	$350	$396	$449	$508	$576
Annual System Maintenance Costs		$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75
Annual Benefits	$0	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911	$911
BENEFITS - COSTS	$0	$338	$342	$346	$351	$356	$362	$368	$376	$384	$394	$404	$417	$431
(assumed spent on personal consumption expenditures)														
Multiplier Effects of Expenditure														
Due to User Benefits - Costs														
Final Demand	$0	$338	$342	$346	$351	$356	$362	$368	$376	$384	$394	$404	$417	$431
Multiplier Effects														
Indirect & Induced Output	$0	$346	$350	$354	$358	$364	$369	$376	$384	$392	$402	$413	$426	$440
Labor	0.0000	0.009	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.012
Labor income	$0	$248	$251	$254	$257	$261	$265	$270	$276	$282	$289	$297	$306	$316
TOTAL MULTIPLIER EFFECTS														
Final Demand	$0	$372	$375	$378	$381	$385	$390	$395	$401	$407	$414	$423	$432	$443
Multiplier Effects														
Indirect & Induced Output	$0	$379	$382	$385	$389	$393	$398	$403	$409	$416	$423	$432	$441	$452
Labor	0.0000	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012
Labor income	$0	$271	$273	$276	$278	$281	$285	$288	$293	$298	$303	$309	$316	$324
State Fiscal Account														
Costs														
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues														
Taxes on Final Demand & Labor Income														
GET (% of GSP)	$0	$15	$16	$16	$16	$16	$16	$16	$17	$17	$17	$18	$18	$18
Individual income (x labor income)	$0	$16	$16	$16	$17	$17	$17	$17	$17	$18	$18	$18	$19	$19
Corporate income (% of GSP)	$0	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
Taxes on Indirect & Induced Output	$0	$17	$18	$18	$18	$18	$18	$18	$19	$19	$19	$20	$20	$21
TOTAL BENEFIT	$0	$50	$50	$50	$51	$51	$52	$53	$54	$54	$55	$57	$58	$59
NET BENEFIT TO STATE GOVERNMENT	$0	$50	$50	$50	$51	$51	$52	$53	$54	$54	$55	$57	$58	$59

Table B6: Worksheet Showing Cost & Multiplier Accounting for Fiscal and Economic Impacts Foregone Due to Residential Wind Energy System Purchases *(continued)*

		Year and Period Number													Present
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS	Value
Item	Install	14	15	16	17	18	19	20	21	22	23	24	25		@ Discount
															2.7%
System Purchaser Account															
Costs															
ECITC Refund	$0														
Tax Savings on Interest Expense															
Federal		$11	$6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$431	$374
State		$27	$14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,057	$919
Energy Savings/Sales		$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$10,669	$7,866
Annual Costs	$0	$465	$447	$427	$427	$427	$427	$427	$427	$427	$427	$427	$427	$12,157	$9,160
Benefits															
System retail cost payment	$0														
Amortization Costs Not Spent on System															
Principal		$184	$98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,208	$6,268
Interest		$652	$738	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,334	$4,187
Annual System Maintenance Costs		$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$1,875	$1,382
Annual Benefits	$0	$911	$911	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$14,417	$11,837
BENEFITS - COSTS	$0	$446	$464	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)	$2,260	$2,678
(assumed spent on personal consumption expenditures)															
Multiplier Effects of Expenditure															
Due to User Benefits - Costs															
Final Demand	$0	$446	$464	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)	($352)		
Multiplier Effects															
Indirect & Induced Output	$0	$456	$474	($360)	($360)	($360)	($360)	($360)	($360)	($360)	($360)	($360)	($360)	$2,310	$2,736
Labor	0.0000	0.012	0.013	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	0.062	
Labor income	$0	$328	$341	($258)	($258)	($258)	($258)	($258)	($258)	($258)	($258)	($258)	($258)	$1,659	$1,965
TOTAL MULTIPLIER EFFECTS															
Final Demand	$0	$455	$470	($350)	($349)	($348)	($347)	($346)	($345)	($344)	($343)	($342)	($341)	$2,668	$3,013
Multiplier Effects															
Indirect & Induced Output	$0	$465	$480	($357)	($356)	($355)	($354)	($353)	($352)	($350)	($349)	($348)	($347)	$2,726	$3,076
Labor	0.0000	0.013	0.013	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	0.073	
Labor income	$0	$334	$345	($256)	($255)	($255)	($254)	($253)	($252)	($251)	($250)	($249)	($248)	$1,950	$2,201
State Fiscal Account															
Costs															
State interest payment refund	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ECITC cost	$0													$0	$0
TOTAL COST	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Revenues															
Taxes on Final Demand & Labor Income															
GET (% of GSP)	$0	$19	$20	($15)	($15)	($14)	($14)	($14)	($14)	($14)	($14)	($14)	($14)	$111	$125
Individual income (x labor income)	$0	$20	$21	($15)	($15)	($15)	($15)	($15)	($15)	($15)	($15)	($15)	($15)	$116	$131
Corporate income (% of GSP)	$0	$1	$1	($1)	($1)	($1)	($1)	($1)	($1)	($1)	($1)	($1)	($1)	$5	$5
Taxes on Indirect & Induced Output	$0	$21	$22	($16)	($16)	($16)	($16)	($16)	($16)	($16)	($16)	($16)	($16)		
TOTAL BENEFIT	$0	$61	$63	($47)	($47)	($47)	($46)	($46)	($46)	($46)	($46)	($46)	($45)	$357	$403
NET BENEFIT TO STATE GOVERNMENT	$0	$61	$63	($47)	($47)	($47)	($46)	($46)	($46)	($46)	($46)	($46)	($45)	$357	$403

Appendix G

Individual Returns Claiming Energy Tax Credits by Size of Credits and by AGI - 1999

AGI Class			Total Individual Returns	Total Tax credits taken		Size of Tax Credits under $2000		$2,000 and Over		percentage of dollars
			no.	no.	amount	no.	amount	no.	amount	
$	Under	$ 5,000	132,785	228	$ 239,936	220	212,804	8	$ 27,132	5.37%
5,000	"	10,000	61,963	193	171,390	192	167,890	1	3,500	3.84%
10,000	"	15,000	50,908	222	187,946	218	176,741	4	11,205	4.21%
15,000	"	20,000	44,164	190	185,257	187	163,880	3	21,377	4.15%
20,000	"	25,000	38,051	217	204,497	213	194,437	4	10,060	4.58%
25,000	"	30,000	35,094	248	246,199	240	224,561	8	21,638	5.51%
30,000	"	35,000	27,748	220	255,770	212	213,601	8	42,169	5.72%
35,000	"	40,000	22,927	198	211,466	195	203,217	3	8,249	4.73%
40,000	"	45,000	20,462	167	199,518	166	196,968	1	2,550	4.47%
45,000	"	50,000	17,285	173	202,848	171	198,848	2	4,000	4.54%
50,000	"	75,000	57,739	756	938,838	739	890,576	17	48,262	21.01%
75,000	"	100,000	27,732	498	637,342	482	597,991	16	39,351	14.26%
100,000	"	150,000	19,412	382	460,013	374	434,025	8	25,988	10.30%
150,000	"	200,000	4,615	122	153,214	119	142,389	3	10,825	3.43%
200,000	and	over	5,852	134	173,857	128	155,781	6	18,076	3.89%
Total			566,737	3,948	$ 4,468,091	3,856	4,173,709	92	$ 294,382	100.00%

Note: **only 31.88 percent of the credits were claimed by households with an AGI of over $75,000**

47.11 percent of credits were filed by households with an AGI of under $50,000

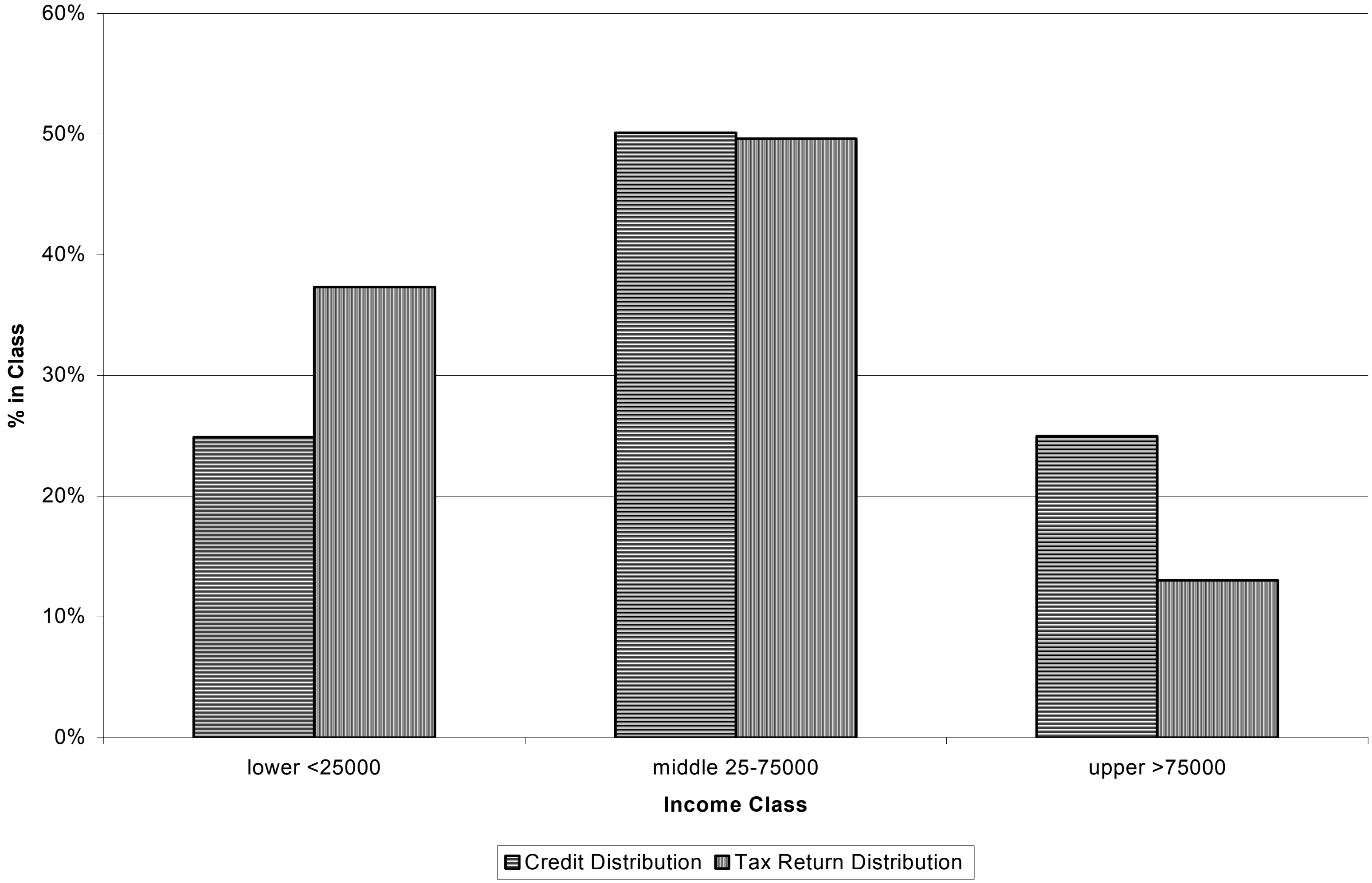
21.01 percent of credits were filed by households with an AGI between $50,000 and $75,000

Corporations claiming energy credit in 1999: number of returns = 17, amount of credits = $94,872

Based on information from Department of Taxation for the 1999 tax year

Appendix H

Credit Distribution Relative to Tax Return Distribution



Appendix I

ANALYSIS OF ALTERNATIVE COMMERCIAL AND MULTI-FAMILY CAPS ON THE ECITC

Spreadsheet Description and Analysis Conclusions

Description

This spreadsheet assesses the distribution of the ECITC by technology and installation type. The distribution, estimated costs and number of systems sold allow calculation of what the annual ECITC cost will be on commercial systems at a specific cap level. The model is then used to assess the ECITC cost at different cap levels from a historical ECITC cost perspective and from specific commercial cap levels considered by the Task Force.

Analysis Conclusions

Estimated ECITC Cost of a $500,000 Commercial Credit Cap

An ECITC cap of $500,000 on commercial and multi-family systems results in an estimated ECITC cost approximately equal to the upper range of the historical ECITC (see Table 2). This cost amount is **$5,090,280**.

Relative ECITC Cost

The ECITC estimated cost for the proposed caps is:	0.08%	of average historic	Totals State Expenditures
	0.45%	of average historic	Income Tax Revenues
	6.06%	of average historic	Total Credits Refunded

Year 1 Fiscal Variability

The year 1 fiscal variability measures percentage differences in the expected ECITC cost for system costs and installation numbers different than shown in Table 1. The table below shows these percentage differences: for a system cost twice (2) and half (0.5) as expensive as shown in Table 1, and relative installation number twice (2) and half (0.5) thats shown in Table 1.

	Installation Cost		
Installation Number	0.5	1	2
0.5	-58%	-50%	-42%
1	-16%	0%	15%
2	69%	100%	131%

It is important to note that variability in installation cost and numbers means that these levels could be greater or less than the levels shown in Table 1. The consensus of the Task Force was that averaging this expected year to year variability will result in the levels of installation costs and numbers shwon in Table 1.

Cap Risks

Cap risk is the risk that commercial and multi-family ECITC caps will forestall installation of large systems. If this occurs, the positive economic and fiscal benefits of use of these renewable technologies will not occur. The "ECITC FISCAL AND ECONOMIC IMPACTS BY TECHNOLOGY TYPE SUMMARY" table summarizes measurable positive economic and fiscal benefits. An example of economic and fiscal benefits not measured would be the value of insurance against fossil-fuel supply disruption or price spike risk these technologies provide.

Table 1: Estimated ECITC Cost by Installation and Technology Type

	Technology Type			
Installation Type	**Solar Thermal**	**Wind**	**Photovoltaic**	**TOTAL ECITC COST**
Residential				
ECITC %	35%	20%	35%	
System Cost (1)	$4,541	$6,668	$21,192	
ECITC Cost if no Cap (3)	$1,106	$1,334	$7,417	
Proposed Cap	$1,750	$1,500	$5,000	
ECITC Cost per System	$1,106	$1,334	$5,000	
Installation Number @ Current Level (2)	2,497	40	100	
Total ECITC Cost	$2,760,486	$53,344	$500,000	$3,313,830
Multi-family				
ECITC %	35%	20%	35%	
System Cost (1)	$140,000	$1,700,000	$882,000	
ECITC Cost if no Cap (3)	$49,000	$340,000	$308,700	
Proposed Cap (4)	$70,000	$500,000	$500,000	
ECITC Cost per System	$49,000	$500,000	$308,700	
Installation Number @ Current Level (2)	3	0	1	
Total ECITC Cost	$147,000	$0	$308,700	$455,700
Commercial				
ECITC %	35%	20%	35%	
System Cost (1)	$140,000	$17,000,000	$882,000	
ECITC Cost if no Cap (3)	$49,000	$3,400,000	$308,700	
Proposed Cap	$250,000	$500,000	$500,000	
ECITC Cost per System	$49,000	$500,000	$308,700	
Installation Number @ Current Level (2)	1	1	2.5	
Total ECITC Cost	$49,000	$500,000	$771,750	$1,320,750
TOTAL ECITC				**$5,090,280**

Table 1 Discussion

The expected technology and installation types that exceed the proposed caps are residential PV and commercial wind. In no other instance is the cap exceeded. This suggests that generally, given expected renewable technology installations and costs, the proposed caps would not be expected to significantly constrain implementation of renewable energy technologies.

Table 2: Cap Analysis

Cap ECITC Cost Relationship **Estimated Cap**	**Historic ECITC Estimated Cost Range**			**Task Force Considered**
	Lower Limit	**Mean**	**Upper Limit**	**Proposed (6)**
ECITC Cost (5)	$4,605,912	$4,794,286	$4,982,661	$5,090,280
ECITC Commercial Cap at ECITC Cost	$243,574	$285,435	$392,381	$500,000
ECITC Cost as a % of Key Fiscal Variables (7)				
	Lower Limit	**Mean**	**Upper Limit**	**Proposed (6)**
Totals State Expenditures	0.07%	0.08%	0.08%	0.08%
Income Tax Revenues	0.41%	0.42%	0.44%	0.45%
Total Credits Refunded	5.48%	5.71%	5.93%	6.06%

Table 2 Discussion

Table 2 shows the estimated ECITC cost for alternative commercial cap levels and the ECITC cost amount relative to "key fiscal variables."

Table 1 & 2 Notes

(1) Cost generated from industry sources for each respective technology. For multi-family and commercial wind systems, the assumed wind size is 1 and 10mW, respectively. For residential PV, the assumed system capacity is 2kW, for commercial and multi-family PV systems the assumed system size is 100kW.

(2) The system sales level for solar residential is estimated based on the historical relationship between the credit level and the number of each of the other technologies and installation types it was estimated via a Delphi Process with Task Force members, a body of experts in the renewable energy technology industry. The value is the estimated average annual number of system installation per year for the next 7 years. Since this is an average, in a specific year, the actual number of systems could be greater or less than this estimated

(3) The estimated ECITC cost for solar residential factors in the DSM rebate provided by the electric utilities when solar systems are

(4) The proposed cap is $350 per unit for solar and PV and $200 for wind for units within a multi-unit complex. The multi-family number of complex at the noted cost is 200.

(5) The "historic ECITC cost range" is the interval within which the ECITC paid by the State would be expected to fall 9.5 out of 10 years on historical experience. This is a common interval estimated for this type of analysis. The data years used were 1997-1999. Earlier years were not used because of differences in the these years relative to previous years. Specifically, previous years: (a) did not include ECITC credit amounts given to corporations; (b) are not years when the utility's DSM program was in effect the first full-year of which was 1997. Years previous to 1990 should be excluded because of significant differences between the population base over time.

(6) Proposed (alternative) is the estimated cost of the ECITC to the State if the proposed (alternative) cap considered by the Task Force on commercial and multi-family installs was in effect.

(7) The value for each "Key Fiscal Indicator" is the average annual, inflation-adjusted amount. These are:

Total State Expenditures	$6,297,089,011
Income Tax Revenues	$1,135,591,973
Total Credits Refunded	$83,985,942

The data source was: http://www.hawaii.gov/dbedt/db00/sec09.html

Appendix J

A Peer Review of

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII ENERGY CONSERVATION INCOME TAX CREDIT FOR SOLAR WATER HEATING SYSTEMS

By
Thomas A. Loudat, Ph.D.
March 11, 2002

Submitted by:

Leroy O. Laney, Ph.D.
Professor of Economics and Finance
Hawaii Pacific University

Executive Summary

The Executive Summary to Loudat's own paper gives an exhaustive overview of his findings. That is not the purpose here. This summary rather is intended to give an overview of the intent and content of this author's peer review paper, to follow.

This peer review is an attempt to summarize and make as transparent as possible the Loudat paper, which contains a great deal of technical detail presented in both prose and tabular form. That detail is one of the Loudat paper's great positive attributes. In fact, due to data availability, this paper is the most in-depth study of the several papers prepared by Loudat that was commissioned by the Hawaii Energy Efficiency Policy Task Force on various alternative energy sources in Hawaii. Only by exhaustive professional research and investigation, conducted and presented objectively, can we get the background necessary to make intelligent policy decisions in an area as critically important as public subsidy of alternative energy sources.

It is the opinion of this reviewer, presented in the attached paper, that Dr. Thomas Loudat has done a very professional and thoughtful job of assessing the desirability of subsidizing solar water heating systems via the Energy Conservation Investment Tax Credit (ECITC). In fact, no comparable study exists to serve as a yardstick against which to gauge it, which makes his paper all the more valuable. Moreover, the necessary assumptions made in his paper are quite reasonable economically, and are actually quite conservative.

Loudat provides conclusive evidence that the existing ECITC, combined with Hawaii Electric Company's (HECO) Demand Side Management (DSM) rebate, provides unequivocal positive benefits to purchasers of solar systems, the State economy, and the State's fiscal situation. Rather than reiterate and detail those benefits here, the reader is referred to Loudat's own Executive Summary and paper.

Yet it bears mention that comparatively, on balance, the solar system ECITC of 35% plus HECO's DSM subsidy yield higher benefit/cost ratios than for either of two other alternative energy systems studied by Loudat in two other papers on wind and photovoltaic energy systems. Benefit/cost ratios for jobs, labor income, and tax revenues are higher for solar water heating systems, and an output benefit/cost ratio is about the same as for wind energy systems.

In brief, and in summary, the mandate of this peer review is to critically assess Loudat's own work rather than add to it. This reviewer finds that work to be professional and quite adequate, thorough, and exhaustive.

Introduction

This peer review of the subject paper has been commissioned by the Energy, Resources, and Technology Division of the State of Hawaii's Department of Business, Economic Development, and Tourism (DBED&T). The overall purpose is to provide an objective critique of Dr. Thomas Loudat's subject paper, which was commissioned by the Hawaii Energy Efficiency Policy Task Force. That paper by Loudat is one of several prepared for the Task Force by the author on the costs and benefits of existing Energy Conservation Income Tax Credits (ECITC). This paper on solar water heating system ECITC effects is the most detailed of any of the papers written by Loudat for the Task Force, mainly because of data availability.

This review paper will proceed to discuss the Loudat paper in the order that it is written. Critical comments will be offered where this author deems them appropriate throughout the paper as various sections are discussed.

Finally, some thoughts on Hawaii's energy policy options will be offered. (The general format of this paper is similar to one prepared by this author for a Symposium sponsored by The Hawaii Energy Efficiency Policy Task Force, held on November 9, 2000 in Honolulu, and the same general outline will be used for each of the other critiques on Loudat's set of current papers.)

An overview critique of the paper is found in the preceding Executive Summary. That Executive Summary is intentionally non-technical, intended for readers who do not wish, or do not have time, to delve into the nuts and bolts of the analysis itself.

Parts of the paper to follow, and most of the Loudat paper itself, are much more detailed and technical in nature. One intent of this peer review is to summarize and make more transparent what is necessarily a complex, detailed, and carefully laid out study. The reader is referred to the study itself for the more technical details. These details are found not only in the body of the Loudat report but in 29 pages of tables and charts. Obviously, it is not possible or even desirable to review these in intricate detail in this peer review.

Overview of the Loudat Solar System Study

The purpose of the Loudat paper is to provide a quantitative assessment of the impact of the State of Hawaii's Energy Conservation Income Tax Credit on investment in solar water heating systems. This is a renewable energy technology that basically consists of solar collectors on roofs of structures to heat water. The incentives for using this technology is that it decreases reliance on imported fossil fuel sources and it uses less energy than the existing hot water systems replaced. Thus, the solar water heating technology has two important potential effects: (1) it has direct economic impacts on those who install the technology, and (2) it has more general statewide economic impacts also.

In order to assess total impacts, an adequate study must assess effects on the purchase decision, the economic effects on the purchaser, and the broader implications for the State economy and State finances. A thorough study must estimate the economic impacts created by the purchase, and also assess the effects foregone due to its purchase. (The net impact is the difference between the economic effects created by the purchase and those foregone, just as the total net impact is the difference in the economic effects of the program itself and the fiscal impacts foregone.) Thus, both microeconomic behavioral and macroeconomic/fiscal impacts come into play. A time element is also involved, because a solar water heating system has a life that extends over a number of years. The Loudat paper recognizes all of these intertwined relationships, and attempts to measure them quantitatively.

Currently, the Hawaiian Electric Company (HECO) gives a rebate to solar water heating system purchases under its Demand Side Management (DSM) program which is in addition to the now provided 35% tax credit that the State of Hawaii gives to purchasers. (The State tax credit is less the DSM rebate.) The State tax credit itself has been in effect since 1977, even though the percentage of the tax credit allowed has varied over time. Upon its introduction in 1977, the credit was 10%. In 1978-1979 the State 10% credit was joined by a Federal 30% tax credit, and the Federal credit was expanded to 40% in 1980, for a combined 50% credit. As oil prices collapsed in the mid-1980s, the Federal credit expired, but the State credit was extended and expanded to 15% over the 1986-1988 period. The State credit was increased to 20% in 1989 and again to 35% in 1990. It has been kept at 35% since 1990. It is fairly obvious that the amount of the credit has been influenced by the level of overall energy prices throughout its existence.

In his empirical work, Loudat uses primary data provided by HECO and the Hawaii Solar Energy Association (HSEA). A number of secondary data sources are also used, including oil price forecasts and data from the Energy Information Administration, as well as tax data from the Internal Revenue Service (IRS) and the Hawaii State Department of Taxation and the Department of Business, Economic Development, and Tourism (DBEDT). The 1992 Hawaii State Input/Output Model published by DBEDT is also cited as a data source and analytical tool. Specific sources are cited in the Appendix tables to the Loudat paper.

Methodology of the Loudat Solar Water Heating System Study

Loudat formulates user, lender, and State cost and benefit cash flows for solar water heating and electric systems, as well as the assumed systems replaced by solar technology, over an assumed solar system life span of 25 years. This seems to be a reasonable life span to include in the study. Cash flows are estimated for cash and financed purchases for residential (single and multi-family) and commercial investors it the solar technology. (Residential results are reported on a per unit basis, and commercial results on a single system basis. If available, totals are reported on an annual number of systems installed basis.) These benefits and costs include those to system purchasers, lenders in a financed as opposed to a cash purchase, and to the State itself. All of these benefits and costs are summarized on page 2 of the main body of the Loudat paper.

Based on these estimated cash flows, the economic performance variables involved in the investment can be measured for each of the above entities. These performance variables include the payback period of the investment and its net present value, and the investment internal rate of return (IRR). Estimated cash flows allow measurement of final demand amounts over the life of the system. Economic multiplier effects are also involved here, and these are estimated using the DBEDT Input/Output Model. Economic impact variables that are measured include indirect and induced output or sales, employment effects, and labor income effects. These may be considered to be on the conservative side, because construction multipliers that are used in the study do not include the positive multiplier effects of the local manufacture of 25-30% of the solar systems sold in Hawaii.

Regarding tax effects, general excise tax (GET) revenues generated by the purchase decision are measured on economic outputs (direct, indirect, and induced). In addition, income tax revenues on labor as well as corporate income over the life of the system are also measured. These measures combined with estimated ECITC costs to the State then allow the calculation of the net fiscal impact of the ECITC program. The reader is referred to pages A1-A9 of the Loudat study for a more complete and detailed tabular presentation of the methodology used. These are difficult to summarize completely here in this critique. Most of the discussion in Loudat's paper itself utilizes single-family, financed residential systems as an example.

Outcomes of the Loudat Solar Water Heating System Study

Economic Performance Results

Loudat begins his results section on page 3 by discussing the economic performance of solar water heating systems per purchaser and by purchase type. These are shown in his Table 1. The payback on the investment with the ECITC improves from 7 years to 4 years under a cash purchase assumption. In addition to this 3 year improvement, with similar assumptions, the IRR average annual rate of return rises to 27%, more than twice the rate of return without the ECITC.

These improvements obviously relate to the annual energy costs savings over the life of the system. Yet Loudat concludes that the number of solar water heating systems actually purchased in Hawaii is still mostly due to the existence and size of the tax credit, despite such favorable economic performance of the systems per se. The ECITC improves the return to the system purchaser, but it also likely serves an information function. Potential investors simply become aware of the benefits because of the existence of the ECITC. The ECITC also may influence investor behavior for reasons related to the tax savings themselves or because of a motivation to support State energy policy as embodied in the ECITC. In other words, the ECITC serves as a market signaling device.

Loudat demonstrates the relation between ECITC credit levels and the number of systems purchased in his Chart 1. This chart shows linear regression results using the effective credit level as the independent variable and annual system purchases as the dependent variable, using an exponential functional form. The regression outcome is quite significant, with almost 83% of the variation in annual purchases explained by the level of the effective tax credit alone.

This regression outcome might be enhanced by reporting other statistics associated with the regression, such as the t-statistic on the independent variable and a Durbin-Watson statistic indicating the presence of autocorrelation in regression residuals, which derives from the unexplained variations in the dependent sales variable. Yet this is probably less necessary in this case than in other regression results because there is only one independent variable. Furthermore, regression results reported elsewhere by this author show that other potential variables that might be hypothesized to explain solar water heating system purchases, such as the level of interest rates for financed purchases and the fluctuations in oil prices, do not turn out to be significant statistically.[1]

In any case, the regression results reported by Loudat in Chart 1 indicate that the expected annual number of solar water heating system sales would be only 284 if there were no tax credit in existence; 1,678 if there is an ECITC of 35% but no

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[1] See Leroy O. Laney, ***A Peer Review of the Economic and Fiscal Impacts of the Hawaii Energy Conservation Income Tax Credit (by Thomas Loudat)***, a paper prepared for a symposium sponsored by the Hawaii Energy Task Force, November 9, 2000.

DSM rebate; and 2,497 if there is an ECITC with the current DSM rebate, or an effective 43% credit. In other words, systems sold would fall by 2,213 or a substantial 88% if there were no ECITC or DSM program in place.

Loudat estimates further that a 35% ECITC provides a substantial positive economic return to the State. His Table 1 shows an 18.1% average annual return over a 25-year life span of a system due to the net sum of total economic impacts.

Economic and Fiscal Impact Results

Economic impacts here are defined as the net changes in output, employment, and labor income for the overall State economy. Fiscal impacts, in turn, are net changes in government spending and revenues. ECITC stimulated purchases of a solar system create both economic and fiscal effects, but at the same time these purchases cause certain economic and fiscal effects to be foregone. A complete analysis must address both. There are also similar economic and fiscal impacts of the DSM program. (Costs might also include other State expenditures due to temporary or permanent unemployment caused by reduction in the size of the solar industry under ECITC elimination, but these are not included in the Loudat study; this is another respect in which his analysis is on the conservative side.)

Investment in a solar water heating system changes the spending pattern of a purchaser. After all, there are differences in the purchase and maintenance costs of solar and the electric systems they replace. These are detailed in Loudat's Tables A2 and A3. Changes in operating costs are the most substantial difference. Loudat estimates that a solar system results in a $597 annual reduction in a single family residential unit costs when they replace an electric hot water heating system. That energy savings means less money leaving the State to pay for exported oil and more money pumped into the economy by those who invest in the solar water heating system.

Loudat shows the effects in his Table 2 and summarizes them on pages 4 and 5 of his report. First year effects are differentiated from the out-years. For example, economic output stimulated by purchase of a solar water heating system comes to a total of $10,800 in year 1 and $872 in years 2-25. As for jobs, 1.4 more jobs are created in year 1 per solar water heating system installed. The labor income effect is an average $4,400 in year 1 and an average $321 per year in years 2-25.

There is a negative net fiscal impact to the State (revenues less expenditures) per single-family unit of $380 in year 1, but an average $54 per year net benefit in year 2-25. This yields a net fiscal benefit over the 25-year life of a system of $912.

These results raise the question of where break-even occurs. That is, at what credit level is the net fiscal impact zero? For example, Loudat estimates that the break-even credit level for a single-family unit in year 1 is 22.4%; it is 80.4% from a system life cycle perspective.

These break-even levels do not take into account for ECITC levels above break-even that help achieve public policy or economic and fiscal objectives. (Public policy objectives might include energy self-sufficiency or insulation against oil supply disruptions or energy price spikes. Economic and fiscal impacts with lower credit levels might include a drop in business or consumer expectations, industry downsizing, job losses, and negative fiscal effects like higher unemployment benefits.)

Cumulative Economic and Fiscal Effects

The State's credit refund is obviously a negative immediate fiscal impact, but the positive economic impacts of energy savings after installation offset this. Positive economic and fiscal impacts accrue annually after year 1, and these will add to subsequent solar installations. Thus, these cumulative effects grow over the life of the system. Cumulative measurements therefore provide a more accurate and complete picture of economic and fiscal impacts after the first year of installation.

Loudat uses the 1990-2037 time period for measurement of these cumulative effects because the current 35% solar water heating ECITC dates to that year. He assumes that in the future the 35% level will remain in effect for as long as it has in the past now, and after 2012 the 25-year assumed life span of a system takes us through 2037.

Cumulative economic and fiscal impacts are illustrated in his report in Charts 1 through 3. For 10 years after the start of the period, the cumulative fiscal impact is negative because of the year 1 ECITC purchaser refund. After that, it becomes positive and remains so for the rest of the period.

His section on cumulative impacts is followed by a discussion on the impacts of assumption changes. Results presented in Tables 1 and 2 assume the 35% solar water heating ECITC and HECO's DSM rebate, oil prices that average $26-27 per barrel over the period, and no oil supply disruptions or price spikes. He investigates scenarios for secular oil price increases and decreases, and oil price spikes that have timing, size, and duration dimensions. The reader is referred to his paper for details, but on average the assumed price spike effects will be smaller the later in the time frame that it occurs, larger the longer it lasts, and larger the greater its magnitude.

Economic and Fiscal Impacts Unmeasured in the Study

Loudat ends his analysis before concluding comments by detailing impacts not measured in the study. These include the following:

- Positive impacts of a stronger Hawaii energy service sector, which in turn strengthen the State's position as a Pacific energy, research and development center.
- Positive impacts of altered business assumptions about investment in Hawaii.
- Negative impacts on fiscal outlays if the State eliminated the solar ECITC. These might include unemployment and welfare benefits, investment in retraining programs or job training subsidies, and revenue losses from private sector retraining.
- Positive benefits to the Counties from permit fees and property tax revenues.
- Lost opportunities to the State if an eliminated ECITC results in industry downsizing.
- Lost intangibles without an ECITC from reduced oil consumption, such as less air, land and water pollution, and possibly more ancillary problems from global warming and acid rain.

Some of these impacts could alter outcomes significantly. Yet it seems quite reasonable to cut off the analysis without incorporating alterations in these assumptions. Their incorporation in some quantitative form would complicate the study far beyond its present form, and would require further, more speculative, assumptions to be made. Any study such as this must face a decision about where to cut off the impact analysis, and it is only rational to draw the line at some point.

Loudat's Conclusions

Loudat's concluding section summarizes what are clearly positive impacts to the State of ECITC stimulated purchases of solar water heating systems. Life cycle economic impacts include:

- An average annual energy savings of $597 per average-size, single family residential unit for 25 years.
- Increased average annual economic output of $1,271 per system.
- Creation annually of one job per 36 systems installed.
- Creation of $484 in labor income annually per system.

Fiscal impacts include:

- An average annual net impact per system of $37 at the 35% ECITC level.
- A net fiscal impact to the State for a system installed in 2001 of $426 per residential unit per year (as opposed to the negative $380 ECITC refund). The cumulative fiscal impact peaks at $640 per single-family residential unit.

In benefit/cost ratio terms per system per year:

- Output/ECITC dollar = 28.7
- Jobs/ECITC dollar = 0.000025
- Labor income/ECITC dollar = 10.94
- Tax revenues/ECITC dollar = 1.82

Comparatively, these benefit/cost ratios indicate that the solar water heating system ECITC of 35% plus the HECO DSM subsidy yield higher benefit/cost ratios, on balance, than either of two other alternative energy systems studied by Loudat – wind systems or photovoltaic systems – analyzed in two other papers. (Only the output effect here of 28.7 is just slightly lower than the wind output benefit/cost ratio of 30.7.)

Summary Critique of the Loudat Solar System Paper

As any economist who has ever conducted an analysis such as that presented in the Loudat study knows, conclusions are often very sensitive to the assumptions made. Yet, the analyst is forced to make many such assumptions in order to proceed with the analysis.

Still, this reviewer finds the assumptions and conclusions from them to be quite reasonable and sound. Furthermore, the analysis appears to have been conducted carefully and thoughtfully by one who is a recognized expert in the field, and the work has been done in very great detail.

As always, other analyses, with other assumptions, might reach somewhat different conclusions. Yet in the absence of other work, the burden of proof is still upon those who challenge the results of the current paper. Conclusions found in this Loudat paper are similar to those found in an earlier work, commissioned by the Hawaii Solar Energy Association. This more recent analysis might be considered more objective in that it was conducted under the auspices of the Hawaii Energy Task Force. Yet this peer reviewer also conducted a peer review of that earlier work and found it to be quite professional and accurate also.

Further Thoughts on Hawaii's Energy Policy Options

It does not take a petroleum geologist to recognize that fossil fuel will not last forever as an energy source. Yet it will outlast the lives of those on earth today consuming it. This raises policy issues that are often encountered in intergenerational planning – that is, how to force those making decisions today to recognize the longer term impacts and make decisions that adequately reflect the welfare of posterity. (Energy policy is of course not the only economic area in which this is a problem; as a totally different area, consider various aspects of debates about the Social Security System.)

Before a resource like fossil fuel is depleted, it will necessarily rise in price and generally become less available. Hawaii is particularly vulnerable because it is so small and so isolated. In addition, the relatively small size of Hawaii's economy makes it less able to afford higher energy costs.

Yet Hawaii has unique opportunities in the area of renewable non-oil energy sources because it has relatively more of them than most other places in the world. It has an opportunity to become a center for the study and development of alternative energy sources. This in itself could benefit and diversify the local economy by attracting researchers from around the world and developing new industries in what is now a relatively undiversified economy.

This series of papers by Loudat, reviewed by the current author, addresses these alternative energy source issues directly and professionally.

Moreover, Hawaii is far more dependent on oil as a source of its energy needs than any other U.S. state. Other states can rely more heavily on sources such as hydroelectric power, coal, nuclear energy, and natural gas. Oil accounts for about 40 percent of the energy needs of the overall U.S. economy, but it accounts for an overwhelming 90 percent of the needs of Hawaii, with biomass combustion accounting for most of the remaining amount.[2] And the certain demise of the sugar plantations means that bagasse, the remnant of sugar cane processing used for fuel, will be in increasingly short supply.

In turn, about 60 percent of Hawaii's oil consumption is for liquid fuels to power cars, buses, airplanes, and ships. Jet fuel alone accounts for almost 40 percent of our oil consumption. That gets the residents of this isolated island state to the Mainland and other destinations. But more importantly, it brings tourists here. An estimated one-third of Hawaii's jobs are tied in some way to the visitor industry, and tourism will undoubtedly remain Hawaii's most important export industry for the foreseeable future. There is no substitute for jet fuel derived from oil.

Perhaps even more relevant in gauging Hawaii's dependence on oil -- and the state's vulnerability to potential disruptions in oil supplies -- is the fact that it must be shipped over very long distances to be consumed here. The nearest supplier is thousands of miles away.

There is no time like the present for sober reflection on Hawaii's dependence on oil. Military conflict in that part of the world that supplies most of the world's oil -- perhaps not in Afghanistan but in neighboring countries such as Iran, Iraq, and other even more important oil-producing countries in that region of the world – highlights once again the international economy's vulnerability to oil supply disruptions and price spikes. Hawaii should take particular note, for several reasons.

- Our own transportation costs will be higher. Hawaii residents cannot drive as far as those on the Mainland, but gasoline prices here traditionally run among the highest in the nation anyway.
- Costs of imported items will be higher, and practically everything we consume comes from outside the state.
- Hawaii businesses will have to pay higher prices for running and lighting their facilities.
- Hawaii is especially vulnerable via the tourism linkage. Higher airfares will mean more expensive Hawaii vacations and perhaps fewer tourists.
- Finally, the most critical impact may come from the income effects on a slowing U.S. economy that will also feel the impact of higher oil prices. At

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[2] For discussion, see Richard E. Rocheleau and Heidi K. Wild, "Should we become less dependent on oil?" in *The Price of Paradise, Volume II,* pp. 265-271.

the current juncture, Hawaii looks overwhelmingly to the U.S. Mainland for its externally driven growth. Gone are the days when Japan, another energy-vulnerable economy, provided the main impetus to our local growth. Over the last year, Hawaii has been feeling the effects of a recessionary U.S. economy acutely, just because much of its growth in recent years can be attributed to injections from the Mainland.

Yet, at the same time Hawaii is vulnerable to oil, it is blessed with more renewable energy resources than most other economies. Among these are wind, sunlight, geothermal heat, flowing water, and ocean resources. Many of these have been tried in the past, but they have not replaced oil mainly because of the costs associated with their production have not been overcome.

Hawaii has more than its share of sunlight, a resource that we exploit via tourism and in other non-energy generation ways also. Solar technology is commercially available and environmentally friendly. Sunlight can generate electricity directly through photovoltaic cells, or it can heat a fluid for conventional power generation. Photovoltaics may make more sense for small systems that are removed from the utility grid, but costs of generation are again high. So electricity generation from the sun often encounters the same cost hurdle as other renewable sources, but solar heated hot water makes the most sense.

The implications for public policy emerging from all this seem to be the following:

- Oil dependent Hawaii should continue to aggressively pursue other energy sources. Higher cost generation now may give way to lower costs in the future as new technologies emerge.
- Subsidy of alternative energy sources is not free, either via tax credits or by other means. But as Hawaii’s economy emerges from the lackluster 1990s into a period of what we still hope will be sustained higher growth, higher tax revenues may make such subsidy much more affordable.
- Potentially higher oil prices make potential benefits of this subsidy greater than before, perhaps much greater. Periods of low oil prices, breed complacency about alternative sources. Yet concern comes back with a vengeance as oil prices rise again.
- Finally, research such as these Loudat papers provide evidence that a tax credit contributes net economic and fiscal benefits, and that this tax credit has indeed been effective in stimulating investment in solar water heating systems over and above more conventional private market forces. The ultimate solutions for greater use of alternative energy sources naturally have to come from the private sector. But it is certainly a legitimate role for government to provide incentives that encourage their use, at least in the initial stages. This paper shows that the 35% ECITC credit provides that incentive in the case of solar water heating systems.

A Peer Review of

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII ENERGY CONSERVATION INCOME TAX CREDIT FOR PHOTOVOLTAIC (PV) ENERGY SYSTEMS

By
Thomas A. Loudat, Ph.D.
March 11, 2002

Submitted by:

Leroy O. Laney, Ph.D.
Professor of Economics and Finance
Hawaii Pacific University

Executive Summary

The Executive Summary to Loudat's own paper gives a more complete overview of his findings. That is not the purpose here. This summary rather is intended to give an overview of the intent and content of this author's peer review paper, to follow.

This peer review is an attempt to summarize and make as transparent as possible the Loudat paper, which contains much technical detail presented in both prose and tabular form. That thoroughness is one of the Loudat paper's great positive attributes. Only by exhaustive professional research and investigation, conducted and presented objectively, can we get the background necessary to make intelligent policy decisions in an area as critically important as public subsidy of alternative energy sources.

It is the opinion of this reviewer, presented in the attached paper, that Dr. Thomas Loudat has done a very professional and thoughtful job of assessing the desirability of subsidizing photovoltaic energy generation via the Energy Conservation Investment Tax Credit (ECITC). In fact, no comparable study exists to serve as a yardstick against which to gauge it, which makes his paper all the more valuable. Moreover, the necessary assumptions made in his paper are quite reasonable economically, and are actually quite conservative.

Loudat provides conclusive evidence that the existing ECITC provides positive benefits to investors in photovoltaic systems, the State economy, and the State's fiscal situation. Rather than reiterate and detail those benefits here, the reader is referred to Loudat's own Executive Summary and paper.

In a comparative context, it bears mention that benefit/cost ratios on output, jobs, labor income, and tax revenues computed by Loudat for photovoltaic systems are inferior to those computed for alternative energy systems in two other papers, on solar and wind systems.

In brief, and to summarize, the mandate of this peer review is to critically assess Loudat's own work rather than add to it. This reviewer finds that work to be professional and quite adequate, thorough, and exhaustive.

Introduction

This peer review of the subject paper has been commissioned by the Energy, Resources, and Technology Division of the State of Hawaii's Department of Business, Economic Development, and Tourism (DBED&T). The overall purpose is to provide an objective critique of Dr. Thomas Loudat's subject paper, which was commissioned by the Hawaii Energy Efficiency Policy Task Force. That paper by Loudat is one of several prepared for the Task Force by the author on the costs and benefits of existing Energy Conservation Income Tax Credits (ECITC).

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Finally, some thoughts on Hawaii's energy policy options will be offered. (The general format of this paper is similar to one prepared by this author for a Symposium sponsored by The Hawaii Energy Task Force, held on November 9, 2000 in Honolulu, and the same general outline will be used for each of the other critiques on Loudat's set of current papers.)

An overview critique of the paper is found in the preceding Executive Summary. That Executive Summary is intentionally non-technical, intended for readers who do not wish or do not have time to delve into the detail of the analysis itself.

Parts of the paper to follow, and most of the Loudat paper itself, are much more detailed and technical in nature. One intent of this peer review is to summarize and make more transparent what is necessarily a complex, detailed, and carefully laid out study. The reader is referred to the study itself for the more technical details. These details are found not only in the body of the Loudat report but in 15 pages of tables. Obviously, it is not possible or even desirable to review these in intricate detail in this peer review.

Overview of the Loudat Photovoltaic Study

The purpose of the Loudat paper is to provide a quantitative assessment of the impact of the State of Hawaii's Energy Conservation Income Tax Credit on investment in photovoltaic (PV) systems. This is a renewable energy technology that uses favorably placed panels containing PV cells that convert sunlight directly into electricity. Both residential and commercial installers can use the electricity themselves. If a system produces energy in excess of their needs, there exists a net metering arrangement that reduces their utility power bill. The incentives for using this technology is that it decreases reliance on imported fossil fuel sources to generate electricity. Thus, the PV technology has two important potential effects: (1) it has direct economic impacts on those who install the technology, and (2) it has more general statewide economic impacts also.

The State of Hawaii now provides 35% subsidy on the purchase price of a PV system. While commercial systems have no cap on the value of the credit amount, residential systems have a $1,750 cap per system installed. Lack of data makes the number and amount of credit refunds uncertain.

Yet in order to assess total impacts, an adequate study must assess effects on the investment decision, the economic effects on the purchaser, and the broader implications for the State economy and State finances. A thorough study must estimate the economic impacts created by the purchase, and also assess the effects foregone due to its purchase. (The net impact is the difference between the economic effects created by the purchase and those foregone, just as the total net impact is the difference in the economic effects of the program itself and the fiscal impacts foregone.) Thus, both microeconomic behavioral and macroeconomic/fiscal impacts come into play. A time element is also involved, because a PV system has a life that extends over a number of years. The Loudat paper recognizes all of these intertwined relationships, and attempts to measure them quantitatively.

In his empirical work, Loudat uses primary data provided by Inter Island Solar Supply (a local PV vendor and installer), the Powerlight Company (a California-based PV company), Hawaii PV Energy Association (HSEA) members, and Hawaii Electric Company (HECO). A number of secondary data sources are also used, including oil price forecasts and data from the Energy Information Administration, as well as tax data from the Internal Revenue Service (IRS) and the Hawaii State Department of Taxation and the Department of Business, Economic Development, and Tourism (DBEDT). The 1992 Hawaii State Input/Output Model published and maintained by DBEDT is also cited as a data source and analytical tool.

Methodology of the Loudat Photovoltaic Energy Study

Loudat formulates user, lender, and State cost and benefit cash flows for residential and commercial PV systems over an assumed life span of 25 years. This seems to be a reasonable life span to include in the study. Cash flows are estimated for cash and financed purchases for residential and commercial investors it the PV technology. As mentioned above, investors use the electricity generated directly or reverse the meter to lower their net electricity use and cost. The utility retail cost of electricity is set equal to the value per kW electricity generated. These benefits and costs include those to system purchasers, lenders in a financed as opposed to a cash purchase, and to the State itself. All of these benefits and costs are summarized on page 2 of the main body of the Loudat paper.

Based on these estimated cash flows, the economic performance variables involved in the investment can be measured for each of the above entities. These performance variables include the payback period of the investment and its net present value, and the investment internal rate of return (IRR).
Estimated cash flows allow measurement of final demand amounts over the life of the system. Economic multiplier effects are also involved here, and these are estimated using the DBEDT Input/Output Model.
Economic impact variables that are measured include indirect and induced output or sales, employment effects, and labor income effects.

Regarding tax effects, general excise tax (GET) revenues generated by the purchase decision are measured on economic outputs (direct, indirect, and induced). In addition, income tax revenues on labor as well as corporate income over the life of the system are also measured. These measures combined with estimated ECITC costs to the State then allow the calculation of the net fiscal impact of the ECITC program.

Residential unit results are reported on a per kW installed basis for a 2 kW system. Commercial results are reported on a per kW basis and a total 30 kW basis. (Data are not available to report past historic installations.) The report discussion focuses on commercial PV systems that are purchased with financing, unless otherwise noted. The report appendix provides results for residential systems.

Outcomes of the Loudat Photovoltaic Energy Study

Economic Performance Results

Loudat begins his results section on page 3 by discussing the economic performance of PV systems per purchaser and by purchase type. These are shown in his Table 1. The payback on the investment for commercial systems with the ECITC improves by 12 years, from 23 years without the ECITC to 11 years with the ECITC (cash purchase). Table 1 also shows that purchase of a PV system with the ECITC yields an annual rate of return (IRR) of 2.2% (cash purchase) to an investor, which is a much higher IRR than the comparable minus 7.7% IRR without the ECITC.

Absence of historical purchase data prevents analysis of the relationship between the number of PV systems purchased and the credit level – something that was possible, for example, in Loudat's study on solar water heating systems. Yet if the relationship is the same as that measured between solar system purchases and the credit level, Loudat concludes that one would expect a 5% increase in system purchases for every 1% increase in the credit level.

The State experiences a negative economic return at the 35% ECITC level. For financed residential purchases, there occurs an ECITC payback in 21 years, and that is the only situation in which there is a payback. Loudat concludes that the inferior economic results for PV systems can be traced to a relatively low level of energy savings given system costs, as compared to renewable alternative energy technologies.

Economic and Fiscal Impact Results

Economic impacts here are defined as the net changes in output, employment, and labor income for the overall State economy. Fiscal impacts, in turn, are net changes in government spending and revenues. ECITC stimulated purchases of a PV system create both economic and fiscal effects, but at the same time these purchases cause certain economic and fiscal effects to be foregone. A complete analysis must address both.

If the ECITC were eliminated, other economic and fiscal costs might be incurred for each system not purchased because of the nonexistence of the ECITC. These include output, employment, and labor income declines and their related impacts on State tax revenues. There would also be direct fiscal outlays for the State, such as unemployment insurance benefits. Costs also might include temporary and perhaps permanent unemployment related to reduction in the size of the PV industry, all related to ECITC elimination. Because these potential costs are not measured in the Loudat study, findings might be considered to be on the conservative side.

Investment in a PV system changes the spending pattern of a purchaser. Any entity that installs a PV system would presumably select that investment from available alternatives due to a higher return, or because it is the most cost effective or only source of electricity generation in available choices, or it lower the exposure to utility outages. Yet regardless of the motive for a PV investment, its use reduces reliance on fossil fuels over the life of the system. PV systems use sunlight as a renewable local resource, as opposed imported fossil fuel, to generate electricity.

Loudat estimates that that the annual imported oil savings per installed kW is $297. Thus, this savings means that much less money flows out of the State economy to purchase fossil fuels, and that money can be spent or invested here. (It is assumed that all of this alternative spending occurs within the State economy, not outside of it.) It is this spending pattern change that is the main cause of the positive economic and fiscal impacts the come about due to investment in a PV system.

Net impacts of a PV system purchase are shown in Table 2 of the report, and they are summarized on pages 4 and 5 of the report discussion. First year effects are differentiated from the out-years. Economic output increases, job stimulation, and wage and salary income generation are addressed separately, and the reader is referred to that section of the report for detailed numbers.

There is a negative net fiscal impact to the State (revenues less expenditures) per single-family unit of $1,842 in year 1. This net fiscal impact is less than the $3,087 ECITC amount refunded per 30 kW commercial system because net revenues generated by PV system purchasers are $1,200 in year 1. Net revenues in years 2-25 average minus $8 annually per installed kW. Overall, the net fiscal impact to the State over the life of a PV system is minus $2,027 per installed kW.

These results raise the question of where break-even occurs, or the credit level at which the net fiscal impact is zero. For year 1, this is the credit level at which the net fiscal impact increases to $0 from its level at the current 35% ECITC subsidy. The break-even ECITC level for year 1 is found to be 13.9%, and 8% from a system life cycle perspective.

These break-even levels do not take into account for ECITC levels above break-even that help achieve public policy or economic and fiscal objectives. (Public policy objectives might include energy self-sufficiency or insulation against oil supply disruptions or energy price spikes. Economic and fiscal impacts with lower credit levels might include a drop in business or consumer expectations, industry downsizing, job losses, and negative fiscal effects like higher unemployment benefits.)

Changed assumptions can affect the results reported in Tables 1 and 2, where a 35% PV ECITC, average oil prices of $26-27 per barrel, and no oil price spikes are assumed. Loudat conducts a sensitivity analysis that is discussed on page 5 of his report, which addressed effects of changing some of these assumptions. The reader is again referred to the report itself for the results.

Economic and Fiscal Impacts Unmeasured in the Study

Loudat ends his analysis before concluding comments by carefully detailing impacts not measured in the study, a step that he takes in his other papers on ECITC effects on alternative energy generation as well. These include the following:

- Positive impacts of a stronger Hawaii energy service sector, which in turn strengthen the State's position as a Pacific energy, research and development center.
- Positive impacts of altered business assumptions about investment in Hawaii.
- Negative impacts on fiscal outlays if the State eliminated the PV ECITC. These might include unemployment and welfare benefits, investment in retraining programs or job training subsidies, and revenue losses from private sector retraining.
- Positive benefits to the Counties from permit fees and property tax revenues.
- Lost opportunities to the State if an eliminated ECITC results in industry downsizing.
- Lost intangibles without an ECITC from reduced oil consumption, such as less air, land and water pollution, and possibly more ancillary problems from global warming and acid rain.

Some of these impacts could alter outcomes significantly. Yet, as in his other reports, it seems quite reasonable to cut off the analysis without incorporating alterations in these assumptions. Their incorporation in some quantitative form would complicate the study far beyond its present form, and would require further, more speculative, assumptions to be made. Any study such as this must face a decision about where to cut off the impact analysis, and it is only rational to draw the line at some point.

Loudat’s Conclusions

Loudat’s concluding section summarizes impacts to the State of ECITC stimulated purchases of PV systems. In the case of PV systems, there are positive economic impacts but negative fiscal impacts over the life cycle of the systems. These impacts include:

- An average annual fossil fuel energy savings of $297 per installed kW, for 25 years, the main source of positive economic and fiscal impacts of the PV ECITC.
- Increased average annual economic output of $1,133 per system.
- Creation annually of 0.02 jobs per 30 kW system installed.
- Creation of $451 in labor income annually per system.

Fiscal impacts include:

- An average annual net impact per system of minus $79 at the 35% ECITC level.
- Break-even fiscal impact credit levels of 13.9% for year 1, and 8.0% over the life cycle of the system.

In benefit/cost ratio terms, where the numerator is the benefit over the life cycle and the denominator is the dollar value of ECITC costs to the State:

- Output/ECITC dollar = 8.61
- Jobs/ECITC dollar = 0.000006
- Labor income/ECITC dollar = 3.45
- Tax revenues/ECITC dollar = 0.37

Reference to two of Loudat’s other reports on alternative energy systems – on solar and wind systems -- shows that these estimated benefit/cost outcomes are not as positive as those found in those other papers.

Summary Critique of the Loudat Photovoltaic Energy Paper

As any economist who has ever conducted an analysis such as that presented in the Loudat study knows, conclusions are often very sensitive to the assumptions made. Yet, the analyst is forced to make many such assumptions in order to proceed with the analysis.

Still, this reviewer finds the assumptions and conclusions from them to be quite reasonable and sound. Furthermore, the analysis appears to have been conducted carefully and thoughtfully by one who is a recognized expert in the field, and the work has been done in very great detail.

As always, other analyses, with other assumptions, might reach somewhat different conclusions. Yet in the absence of other work, the burden of proof is still upon those who challenge the results of the current paper.

Further Thoughts on Hawaii's Energy Policy Options

It does not take a petroleum geologist to recognize that fossil fuel will not last forever as an energy source. Yet it will outlast the lives of those on earth today consuming it. This raises policy issues that are often encountered in intergenerational planning – that is, how to force those making policy decisions today to recognize the longer term impacts and make decisions that adequately reflect the welfare of posterity. (Energy policy is of course not the only economic area in which this is a problem; as a totally different area, consider various aspects of debates about the Social Security System.)

Before a resource like fossil fuel is depleted, it will necessarily rise in price and generally become less available. Hawaii is particularly vulnerable because it is so small and so isolated. In addition, the relatively small size of Hawaii's economy makes it less able to afford higher energy costs.

Yet Hawaii has unique opportunities in the area of renewable non-oil energy sources because it has relatively more of them than most other places in the world. It has an opportunity to become a center for the study and development of alternative energy sources. This in itself could benefit and diversify the local economy by attracting researchers from around the world and developing new industries in what is now a relatively undiversified economy.

This series of papers by Loudat, reviewed by the current author, addresses these alternative energy source issues directly and professionally.

Moreover, Hawaii is far more dependent on oil as a source of its energy needs than any other U.S. state. Other states can rely more heavily on sources such as hydroelectric power, coal, nuclear energy, and natural gas. Oil accounts for about

40 percent of the energy needs of the overall U.S. economy, but it accounts for an overwhelming 90 percent of the needs of Hawaii, with biomass combustion accounting for most of the remaining amount.[3] And the certain demise of the sugar plantations means that bagasse, the remnant of sugar cane processing used for fuel, will be in increasingly short supply.

In turn, about 60 percent of Hawaii's oil consumption is for liquid fuels to power cars, buses, airplanes, and ships. Jet fuel alone accounts for almost 40 percent of our oil consumption. That gets the residents of this isolated island state to the Mainland and other destinations. But more importantly, it brings tourists here. An estimated one-third of Hawaii's jobs are tied in some way to the visitor industry, and tourism will undoubtedly remain Hawaii's most important export industry for the foreseeable future. There is no substitute for jet fuel derived from oil.

Perhaps even more relevant in gauging Hawaii's dependence on oil -- and the state's vulnerability to potential disruptions in oil supplies -- is the fact that it must be shipped over very long distances to be consumed here. The nearest supplier is thousands of miles away.

There is no time like the present for sober reflection on Hawaii's dependence on oil. Military conflict in that part of the world that supplies most of the world's oil -- perhaps not in Afghanistan but in neighboring countries such as Iran, Iraq, and other even more important oil-producing countries in that region of the world – highlights once again the international economy's vulnerability to oil supply disruptions and price spikes. Hawaii should take particular note, for several reasons:

- Our own transportation costs will be higher. Hawaii residents cannot drive as far as those on the Mainland, but gasoline prices here traditionally run among the highest in the nation anyway.
- Costs of imported items will be higher, and practically everything we consume comes from outside the state.
- Hawaii businesses will have to pay higher prices for running and lighting their facilities.
- Hawaii is especially vulnerable via the tourism linkage. Higher airfares will mean more expensive Hawaii vacations and perhaps fewer tourists.
- Finally, the most critical impact may come from the income effects on a slowing U.S. economy that will also feel the impact of higher oil prices. At the current juncture, Hawaii looks overwhelmingly to the U.S. Mainland for its externally driven growth. Gone are the days when Japan, another energy-vulnerable economy, provided the main impetus to our local growth. Over the last year, Hawaii has been feel the effects of a recessionary U.S. economy acutely, just because much of its growth in recent years can be attributed to injections from the Mainland.

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[3] For discussion, see Richard E. Rocheleau and Heidi K. Wild, "Should we become less dependent on oil?" in *The Price of Paradise, Volume II,* pp. 265-271.

Yet, at the same time Hawaii is vulnerable to oil, it is blessed with more renewable energy resources than most other economies. Among these are wind, sunlight, geothermal heat, flowing water, and ocean resources. Many of these have been tried in the past, but they have not replaced oil mainly because of the costs associated with their production have not been overcome.

Hawaii has more than its share of sunlight, a resource that we exploit via tourism and in other non-energy generation ways also. Solar technology is commercially available and environmentally friendly. Sunlight can generate electricity directly through photovoltaic cells, or it can heat a fluid for conventional power generation. Photovoltaics may make more sense for small systems that are removed from the utility grid. Electricity generation from the sun sometimes encounters the same hurdles as other renewable sources, but solar heated hot water makes more sense.

The implications for public policy emerging from all this seem to be the following:

- Oil dependent Hawaii should continue to aggressively pursue other energy sources. Higher cost generation now may give way to lower costs in the future as new technologies emerge.
- Subsidy of alternative energy sources is not free, either via tax credits or by other means. But as Hawaii’s economy emerges from the lackluster 1990s into a period of what we still hope will be sustained higher growth, higher tax revenues may make such subsidy much more affordable.
- Potentially higher oil prices make potential benefits of this subsidy greater than before, perhaps much greater. Periods of low oil prices, breed complacency about alternative sources. Yet concern comes back with a vengeance as oil prices rise again.
- Finally, research such as these Loudat papers provide evidence that a tax credit contributes net economic and fiscal benefits, and that this tax credit has indeed been effective in stimulating investment over and above more conventional private market forces. It is the role of government to eliminate roadblocks, and to provide incentives for solutions, even if those solutions themselves come from the private sector.

A Peer Review of

THE ECONOMIC AND FISCAL IMPACTS OF THE HAWAII ENERGY CONSERVATION INCOME TAX CREDIT FOR WIND ENERGY SYSTEMS

By
Thomas A. Loudat, Ph.D.
March 11, 2002

Submitted by:

Leroy O. Laney, Ph.D.
Professor of Economics and Finance
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Executive Summary

The Executive Summary to Loudat's own paper gives a very complete and thorough overview of his findings. That is not the purpose here. This summary rather is intended to give an overview of the intent and content of this author's peer review paper, to follow.

This peer review is an attempt to summarize and make as transparent as possible the Loudat paper, which contains a great deal of technical detail presented in both prose and tabular form. That detail is one of the Loudat paper's great positive attributes. Only by exhaustive professional research and investigation, conducted and presented objectively, can we get the background necessary to make intelligent policy decisions in an area as critically important as public subsidy of alternative energy sources.

It is the opinion of this reviewer, presented in the attached paper, that Dr. Thomas Loudat has done a very professional and thoughtful job of assessing the desirability of subsidizing wind systems via the Energy Conservation Investment Tax Credit (ECITC). In fact, no comparable study exists to serve as a yardstick against which to gauge it, which makes his paper all the more valuable. Moreover, the necessary assumptions made in his paper are quite reasonable economically. Rather than reiterate and detail those benefits and costs here, the reader is referred to Loudat's own Executive Summary and paper.

It might be mentioned that, compared to ECITC benefit/cost ratios computed in two other similar papers by Loudat on solar water heating and photovoltaic energy systems, output and tax revenue benefit/cost ratios reported in this paper compare favorably to those computed for solar systems, but jobs and labor income are slightly lower than for solar. All such benefit/cost ratios for wind energy systems are superior to those for photovoltaic energy systems.

In brief, and in overall summary, the mandate of this peer review is to critically assess Loudat's own work rather than add to it. This reviewer finds that work to be professional and quite adequate, thorough, and exhaustive.

Introduction

This peer review of the subject paper has been commissioned by the Energy, Resources, and Technology Division of the State of Hawaii's Department of Business, Economic Development, and Tourism (DBED&T). The overall purpose is to provide an objective critique of Dr. Thomas Loudat's subject paper, which was commissioned by the Hawaii Energy Efficiency Policy Task Force. That paper by Loudat is one of several prepared for the Task Force by the author on the costs and benefits of existing Energy Conservation Income Tax Credits (ECITC). This paper on the windfarm ECITC effects is quite detailed and thorough.

This review paper will proceed to discuss the Loudat paper in the order that it is written. Critical comments will be offered where this author deems them appropriate throughout the paper as various sections are discussed.

Finally, some thoughts on Hawaii's energy policy options will be offered. (The general format of this paper is similar to one prepared by this author for a Symposium sponsored by The Hawaii Energy Efficiency Policy Task Force, held on November 9, 2000 in Honolulu, and the same general outline will be used for each of the other critiques on Loudat's set of current papers.)

An overview critique of the paper is found in the preceding Executive Summary. That Executive Summary is intentionally non-technical, intended for readers who do not wish or do not have time to delve into the rather intricate complexities of the analysis itself.

Parts of the paper to follow, and most of the Loudat paper itself, are much more detailed and technical in nature. One intent of this peer review is to summarize and make more transparent what is necessarily a complex, detailed, and carefully laid out study. The reader is referred to the study itself for the more technical details. These details are found not only in the body of the Loudat report but in 35 pages of tables and charts. Obviously, it is not possible or even desirable to review these in deep detail in this peer review.

Overview of the Loudat Windfarm Study

The purpose of the Loudat paper is to provide a quantitative assessment of the impact of the State of Hawaii's Energy Conservation Income Tax Credit on investment in wind systems. This is a renewable energy technology that basically uses wind turbines to generate electricity. Wind energy systems must be located at sites with appropriate wind conditions to efficiently generate power, and this is especially true of commercial windfarm systems. But irrespective of the wind system type, these systems do lower reliance on imported fossil fuels to generate electricity. Because of this, wind system installation and use not only has economic impacts for purchasers of such systems, they also have broader implications for the overall economy.

The State of Hawaii now provides a 20% subsidy on the purchase price of systems, delivered via an income tax break, to investors in the year in which the wind system in purchased. Commercial systems have no cap on the credit amount, but residential systems are subject to a $1,575 per system cap. Commercial investors also receive a Federal production credit of $0.017 per kWh produced.

In order to assess total impacts, an adequate study must assess effects on the purchase decision, the economic effects on the purchaser, and the broader implications for the State economy and State finances. A thorough study must estimate the economic impacts created by the purchase, and also assess the effects foregone due to its purchase. (The net impact is the difference between the economic effects created by the purchase and those foregone, just as the total net impact is the difference in the economic effects of the program itself and the fiscal impacts foregone.) Thus, both microeconomic behavioral and macroeconomic/fiscal impacts come into play. A time element is also involved, because a wind system has a life that extends over a number of years. The Loudat paper recognizes all of these intertwined relationships, and attempts to measure them quantitatively.

In his empirical work, Loudat uses primary data provided by Enron and Apollo, two companies selling wind systems. This is supplemented by data provided by Warren Bollmeier, a local renewable energy expert, and Cully Judd, a local vendor of wind systems. A number of secondary data sources are also used, including oil price forecasts and data from the Energy Information Administration, as well as tax data from the Internal Revenue Service (IRS) and the Hawaii State Department of Taxation and the Department of Business, Economic Development, and Tourism (DBEDT). The 1992 Hawaii State Input/Output Model published by DBEDT is also cited as a data source and analytical tool. Specific sources are cited in the Appendix tables to the Loudat paper.

Methodology of the Loudat Wind System Study

Loudat formulates user, lender, and State cost and benefit cash flows for residential and commercial wind systems, over an assumed solar system life span of 25 years. This seems to be a reasonable life span to include in the study.

Commercial windfarms sell their energy at the avoided cost to the utility. Residential wind systems use electricity generated or reverse the electricity meter to lower their net utility generated electricity use and cost. The net benefits and costs involved include those to system purchasers, lenders in a financed as opposed to a cash purchase, and to the State itself. All of these benefits and costs are summarized on page 2 of the main body of the Loudat paper.

Based on these estimated cash flows, the economic performance variables involved in the investment can be measured for each of the above entities. These performance variables include the payback period of the investment and its net present value, and the investment internal rate of return (IRR).
Estimated cash flows allow measurement of final demand amounts over the life of the system. Economic multiplier effects are also involved here, and these are estimated using the DBEDT Input/Output Model.
Economic impact variables that are measured include indirect and induced output or sales, employment effects, and labor income effects.

Regarding tax effects, general excise tax (GET) revenues generated by the purchase decision are measured on economic outputs (direct, indirect, and induced). In addition, income tax revenues on labor as well as corporate income over the life of the system are also measured. These measures combined with estimated ECITC costs to the State then allow the calculation of the net fiscal impact of the ECITC program.

Residential and commercial results are reported on a per kW installed basis. Installed system capacity is 1 kW for residential systems and 12.5 MW for commercial systems. There is no available data on past historical system installations. Loudat's discussion in the paper focuses on commercial systems that are 50% cash, 50% financed purchases, which he states is a typical situation. The reader is referred to pages A1-A17 and B1-B14 in the Appendix to Loudat report for more complete results and other details, as well as assumptions in the methodology that the analysis uses.

Outcomes of the Loudat Wind System Study

Economic Performance Results

Loudat begins his results section on page 3 by discussing the economic performance of wind systems per purchaser (residential or commercial) and by purchase type (equity or financed purchase). These are shown in his Table 1. The payback on the investment with the ECITC improves from 4 years to 3 years. In addition to this 1 year improvement, with similar assumptions, the IRR average annual rate of return rises to 38%, significantly greater than the rate of return without the ECITC of 23%. Compared to typical returns from conventional financial instruments, these are quite favorable rates of return.

Absence of adequate historical data prevents an estimation of the relationship between number of wind systems purchased and the credit level, something that is possible in the Loudat investigation of solar water heating systems ECITC credits, for example. Yet if the relationship is the same as that estimated between solar system purchases and the credit level, Loudat states that he would expect a 5% increase in systems purchased for each 1% in the credit level. That is, the credit level elasticity would be 5.

Loudat finds that a 20% wind system ECITC yields positive returns to the State. His Table 1 indicates that the average annual return from the net sum total of economic impacts over the 25-year life of the wind system is 6.3%. Payback to the State occurs in 10 years.

Economic and Fiscal Impact Results

Economic impacts here are defined as the net changes in output, employment, and labor income for the overall State economy. Fiscal impacts, in turn, are net changes in government spending and revenues. ECITC stimulated purchases of a wind energy system create both economic and fiscal effects, but at the same time these purchases cause certain economic and fiscal effects to be foregone. A complete analysis must address both. There are also net changes in returns to the utility that result from a wind system purchase. Netting the effects foregone from those created and then adding the net effects to the utility yields the total estimated economic and fiscal impacts caused by the ECITC.

If the ECITC were to be eliminated, other economic and fiscal costs would be incurred for each wind system not purchased if there were no ECITC program. These include output, employment, and labor income declines and a consequent impact on State tax revenues. Also, there would be direct fiscal impacts on State spending due to unemployment benefits, and perhaps other expenditures due to temporary and possible permanent caused by a reduction in size of the wind industry that results from ECITC elimination. These potential costs are not measured by Loudat, which makes his results a conservative estimate.

Investment in a wind system changes the spending pattern of a purchaser. After all, there are differences in the purchase and maintenance costs of wind systems and the electric systems they replace. The windfarm owner presumably chooses his investment from a menu of all available investments because that investment has the highest rate of return. Profits from operating a windfarm result from using a local resource, wind, to replace imported fossil fuels. Such “profits” are subject to multiplier effects similar to any exogenous dollar injection into the local economy, depending on whether all of it is spent in Hawaii. This impact is the primary expenditure impact of a windfarm. Loudat’s analysis assumes that 50% of any windfarm is owned by interest outside the State, which lowers the economic and fiscal impacts of “wind profits” in Hawaii.

Yet a second expenditure change comes from the utility. Changes in fuel and purchased energy costs are passed through to HECO’s customers via the energy cost adjustment clause. If fossil fuel prices exceed this escalator, the utility’s customers will benefit because the windfarm payment rate will escalate at a slower rate than the avoided cost. If oil prices rise slower than the escalator, the utility’s customers will be paying more than the avoided cost. Any savings are assumed to be spent in Hawaii.

Loudat estimates that residential wind systems result in an average annual reduction in energy costs for a single 1 kW system of $427. Thus, $427 per year per 1 kW system less money leaves the State to pay for imported oil, and $427 more is spent here. (The energy savings means less money leaving the State to pay for oil and more money pumped into the economy by those who invest in the wind system, which is all assumed to be spent in Hawaii.) This expenditure pattern change is the main reason for the economic and fiscal impacts created by residential wind systems.

Loudat shows these effects in his Table 2 and summarizes them on pages 4 and 5 of his report. First year effects are differentiated from the out-years. For example, economic output stimulated by purchase of a wind system, per kW, comes to a total of $2,100 in year 1 and an average annual $269 in years 2-25. As for jobs, 0.025 more jobs are created in year 1 per wind system installed (and an average 0.003 jobs per year over the life of the system). The labor wage and salary income effect is $925 in year 1 and an average $75 per year in years 2-25.

Table 2 also shows a negative net fiscal impact to the State (revenues less expenditures) per kW of $103 in year 1, but an average $9 per year net benefit in year 2-25. This yields a net fiscal benefit over the 25-year life of a system of $111.

These results raise the question of where break-even occurs. That is, at what credit level is the net fiscal impact zero? For example, Loudat estimates that the break-even credit level in year 1 is 12.4%; it is 28.5% from a system life cycle perspective.

These break-even levels do not take into account for ECITC levels above break-even that help achieve public policy or economic and fiscal objectives. (Public policy objectives might include energy self-sufficiency or insulation against oil supply disruptions or energy price spikes. Economic and fiscal impacts with lower credit levels might include a drop in business or consumer expectations, industry downsizing, job losses, and negative fiscal effects like higher unemployment benefits.)

Cumulative Economic and Fiscal Effects

The State's credit refund is obviously a negative immediate fiscal impact, but the positive economic impacts of energy savings after installation offset this. Positive economic and fiscal impacts accrue annually after year 1, and these will add to subsequent wind system installations. Thus, these cumulative effects grow over the life of the system. Cumulative measurements therefore provide a more accurate and complete picture of economic and fiscal impacts after the first year of installation.

Cumulative economic and fiscal impacts are illustrated in his report in Charts 1 and 2. Chart 1 shows that the cumulative output effect increases per year to a maximum of $7,000. This peak is the annual sustained output level per kW that would be stimulated so long as there is a 20% ECITC. Correspondingly, jobs maximize at .054 and labor income effects at $1,759.

Chart 2 shows that at the start of the period and for 20 following years, the cumulative fiscal impact is negative, all due to the year ECITC purchase refund. After that, the cumulative fiscal impact becomes positive for the remainder of the time frame, peaking at $42 assuming a continued 20% ECITC. That cumulative impact becomes positive because of the cumulative positive energy-saving effects of past period wind installations with no offsetting current cost to the State in order to bring forth energy savings.

His section on cumulative impacts is followed by a discussion on the impacts of assumption changes. Results presented in Tables 1 and 2 assume the 20% wind ECITC, oil prices that average $26-27 per barrel over the period, and no oil supply disruptions or price spikes. He investigates scenarios for secular oil price increases and decreases, and oil price spikes that have timing, size, and duration dimensions. The reader is referred to his paper for details, but on average the assumed price spike effects will be smaller the later in the time frame that it occurs, larger the longer it lasts, and larger the greater its level.

Economic and Fiscal Impacts Unmeasured in the Study

Loudat ends his analysis before concluding comments by detailing impacts not measured in the study. These include the following:

- Positive impacts of a stronger Hawaii energy service sector, which in turn strengthen the State's position as a Pacific energy, research and development center.
- Positive impacts of altered business assumptions about investment in Hawaii.
- Negative impacts on fiscal outlays if the State eliminated the solar ECITC. These might include unemployment and welfare benefits, investment in retraining programs or job training subsidies, and revenue losses from private sector retraining.
- Positive benefits to the Counties from permit fees and property tax revenues.
- Lost opportunities to the State if an eliminated ECITC results in industry downsizing.
- Lost intangibles without an ECITC from reduced oil consumption, such as less air, land and water pollution, and possibly more ancillary problems from global warming and acid rain.

Some of these impacts could alter outcomes. Yet it seems quite reasonable to cut off the analysis without incorporating alterations in these assumptions. Their incorporation in some quantitative form would complicate the study far beyond its present form, and would require further, more speculative, assumptions to be made. Any study such as this must face a decision about where to cut off the impact analysis, and it is only rational to draw the line at some point.

Loudat's Wind System Conclusions

Loudat's concluding section summarizes the positive impacts to the State of ECITC stimulated purchases of wind systems. Life cycle economic impacts include:

- An average annual energy savings of $427 per 1 kW unit annual energy savings, for 25 years.
- Increased average annual economic output of $345 per kW per 12.5 MW system.
- Corresponding job creation of 2.14 jobs.
- Corresponding Creation of $109 in labor income.

Fiscal impacts include:

- An average annual net impact per kW of a 12.5 MW system basis of $4 for a 20% ECITC level.
- Break-even fiscal impact credit levels of 12.4% from a year 1 perspective and 28.5% from a life-cycle perspective.

In benefit/cost ratio terms per system per year, where the numerator is benefit value that equals the respective result variable life-cycle value and the denominator cost value is ECITC cost to the State:

- Output/ECITC dollar = 30.7
- Jobs/ECITC dollar = 0.000015
- Labor income/ECITC dollar = 9.73
- Tax revenues/ECITC dollar = 1.85

On balance, referring to two other papers by Loudat on solar and photovoltaic systems, these benefit/cost ratios are not as impressive as for solar systems, but are superior to those for photovoltaic systems. The output and tax revenue benefit/cost ratio above are actually slightly higher than for solar systems, while jobs and labor income are lower.

Summary Critique of the Loudat Wind System Paper

As any economist who has ever conducted an analysis such as that presented in the Loudat study knows, conclusions are often very sensitive to the assumptions made. Yet, the analyst is forced to make many such assumptions in order to proceed with the analysis.

Still, this reviewer finds the assumptions and conclusions from them to be quite reasonable and sound. Furthermore, the analysis appears to have been conducted carefully and thoughtfully by one who is a recognized expert in the field, and the work has been done in very great detail.

As always, other analyses, with other assumptions, might reach somewhat different conclusions. Yet in the absence of other work, the burden of proof is still upon those who challenge the results of the current paper.

Further Thoughts on Hawaii's Energy Policy Options

It does not take a petroleum geologist to recognize that fossil fuel will not last forever as an energy source. Yet it will outlast the lives of those on earth today consuming it. This raises policy issues that are often encountered in intergenerational planning – that is, how to force those making policy decisions today to recognize the longer term impacts and make decisions that adequately reflect the welfare of posterity. (Energy policy is of course not the only economic area in which this is a problem; as a totally different area, consider various aspects of debates about the Social Security System.)

Before a resource like fossil fuel is depleted, it will necessarily rise in price and generally become less available. Hawaii is particularly vulnerable because it is so small and so isolated. In addition, the relatively small size of Hawaii's economy makes it less able to afford higher energy costs.

Yet Hawaii has unique opportunities in the area of renewable non-oil energy sources because it has relatively more of them than most other places in the world. It has an opportunity to become a center for the study and development of alternative energy sources. This in itself could benefit and diversify the local economy by attracting researchers from around the world and developing new industries in what is now a relatively undiversified economy.

This series of papers by Loudat, reviewed by the current author, addresses these alternative energy source issues directly and professionally.

Moreover, Hawaii is far more dependent on oil as a source of its energy needs than any other U.S. state. Other states can rely more heavily on sources such as hydroelectric power, coal, nuclear energy, and natural gas. Oil accounts for about

40 percent of the energy needs of the overall U.S. economy, but it accounts for an overwhelming 90 percent of the needs of Hawaii, with biomass combustion accounting for most of the remaining amount.[4] And the certain demise of the sugar plantations means that bagasse, the remnant of sugar cane processing used for fuel, will be in increasingly short supply.

In turn, about 60 percent of Hawaii's oil consumption is for liquid fuels to power cars, buses, airplanes, and ships. Jet fuel alone accounts for almost 40 percent of our oil consumption. That gets the residents of this isolated island state to the Mainland and other destinations. But more importantly, it brings tourists here. An estimated one-third of Hawaii's jobs are tied in some way to the visitor industry, and tourism will undoubtedly remain Hawaii's most important export industry for the foreseeable future. There is no substitute for jet fuel derived from oil.

Perhaps even more relevant in gauging Hawaii's dependence on oil -- and the state's vulnerability to potential disruptions in oil supplies -- is the fact that it must be shipped over very long distances to be consumed here. The nearest supplier is thousands of miles away.

There is no time like the present for sober reflection on Hawaii's dependence on oil. Military conflict in that part of the world that supplies most of the world's oil -- perhaps not in Afghanistan but in neighboring countries such as Iran, Iraq, and other even more important oil-producing countries in that region of the world – highlights once again the international economy's vulnerability to oil supply disruptions and price spikes. Hawaii should take particular note, for several reasons.

- Our own transportation costs will be higher. Hawaii residents cannot drive as far as those on the Mainland, but gasoline prices here traditionally run among the highest in the nation anyway.
- Costs of imported items will be higher, and practically everything we consume comes from outside the state.
- Hawaii businesses will have to pay higher prices for running and lighting their facilities.
- Hawaii is especially vulnerable via the tourism linkage. Higher airfares will mean more expensive Hawaii vacations and perhaps fewer tourists.
- Finally, the most critical impact may come from the income effects on a slowing U.S. economy that will also feel the impact of higher oil prices. At the current juncture, Hawaii looks overwhelmingly to the U.S. Mainland for its externally driven growth. Gone are the days when Japan, another energy-vulnerable economy, provided the main impetus to our local growth. Over the last year, Hawaii has been feeling the effects of a recessionary U.S. economy acutely, just because much of its growth in recent years can be attributed to injections from the Mainland.

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[4] For discussion, see Richard E. Rocheleau and Heidi K. Wild, "Should we become less dependent on oil?" in *The Price of Paradise, Volume II,* pp. 265-271.

Yet, at the same time Hawaii is vulnerable to oil, it is blessed with more renewable energy resources than most other economies. Among these are wind, sunlight, geothermal heat, flowing water, and ocean resources. Many of these have been tried in the past, but they have not replaced oil mainly because of the costs associated with their production have not been overcome.

Hawaii has more than its share of sunlight, a resource that we exploit via tourism and in other non-energy generation ways also. Solar technology is commercially available and environmentally friendly. Sunlight can generate electricity directly through photovoltaic cells, or it can heat a fluid for conventional power generation. Photovoltaics may make more sense for small systems that are removed from the utility grid, but costs of generation are sometimes high. So electricity generation from the sun often encounters the same cost hurdle as other renewable sources, but solar heated hot water makes more sense. Even though wind-generated power only works when the wind blows, being in the center of the Pacific trade wind belt gives Hawaii a comparative advantage that many other regions do not have.

The implications for public policy emerging from all this seem to be the following:

- Oil dependent Hawaii should continue to aggressively pursue other energy sources. Higher cost generation now may give way to lower costs in the future as new technologies emerge.
- Subsidy of alternative energy sources is not free, either via tax credits or by other means. But as Hawaii's economy emerges from the lackluster 1990s into a period of what we still hope will be sustained higher growth, higher tax revenues may make such subsidy much more affordable.
- Potentially higher oil prices make potential benefits of this subsidy greater than before, perhaps much greater. Periods of low oil prices, breed complacency about alternative sources. Yet concern comes back with a vengeance as oil prices rise again.
- Finally, research such as these Loudat papers provide evidence that tax credits generally contribute net economic and fiscal benefits, and that these tax credits have indeed been effective in stimulating investment in wind systems over and above more conventional private market forces. The ultimate solutions for greater use of alternative energy sources naturally have to come from the private sector. But it is certainly a legitimate role for government to provide incentives that encourage their use, at least in the initial stages.