Economic Impact Analysis of Property Assessed Clean Energy Programs (PACE)

Research Performed by ECONorthwest for PACENow, April 2011

This report summarizes an analysis by ECONorthwest of the economic impacts of Property Assessed Clean Energy (PACE) programs. The analysis measures the output, employment and tax impacts of purchase activity with the same composition of the project activity of the PACE energy efficiency and renewable energy projects. The analysis is performed using the IMPLAN input-output model system and simulated the implementation of PACE projects in four cities, with computation of both local and national impacts. Significant, positive economic and fiscal impacts are potentially associated with PACE energy efficiency and renewable energy projects.

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Executive Summary

ECONorthwest was engaged by the PACENow coalition to assist them in describing the economic effects of the Property Assessed Clean Energy (PACE) programs. Specifically, this report presents calculations of the direct, indirect, and induced impacts of purchases associated with hypothetical PACE program implementations on various measures of economic activity, including direct, indirect and induced impacts on output and employment, and the associated impacts on local, state and federal tax revenues.

Findings

The analysis suggests that such programs have the potential of generating significant economic and fiscal impacts. Specifically, $4 million in total PACE project spending, across the four cities included in this analysis ($1 million in spending in each city) will on average generate:

- $10 million in gross economic output;
- $1 million in combined Federal, State and Local tax revenue;
- 60 jobs.

As a result, the PACE program projects have the potential to provide stabilizing economic influences that should redound to the

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benefit of involved communities, the regional and national economies and, thereby, to the value of housing collateral of associated mortgages. The channels by which this occurs are through the largely domestic supply-chain linkages of the purchases associated with the project developments themselves, and the net reduction in housing user costs that flows from implementation of cost-beneficial energy-efficiency improvements. We also offer an opinion regarding the likely effect of the senior property tax lien that is associated with the structure of the PACE program. We conclude that, under most likely conditions, the reduction in the cost and volatility of a building's purchased energy requirements should add strength and resilience to home values in a manner that counterbalances the lenders' concern about the lien impairing their mortgage loan collateral.

Study Approach

The analysis performed by ECONorthwest uses hypothetical purchase activity with the same, approximate composition as PACE projects in terms of the economic sectors involved and does not evaluate particular PACE projects. The impacts of project purchases associated with PACE activity are traced to the linkages between PACE purchases and the chain of vendor relationships. Because PACE projects also have the potential to affect household spending, through reductions in energy costs, the impacts of that effect of the PACE projects were also examined.

The measurement of these relationships is performed within an input-output model framework using IMPLAN model and data. The purchase activity is modeled in four, separate cities with local impacts measured at the county or multi-county level. Impact measures are extended to the nation as a whole, thereby producing local, elsewhere-in-the-US, and total US impact measures for the modeled activities.

The remainder of this report presents the analysis that yielded these findings. First, a brief summary of the PACE program is presented to set the context of the analysis. Then, we report the results of tracing the direct, indirect and induced effects of the spending associated with types of energy-efficiency improvements proposed by the PACE program. We also investigate the economic impacts of any enlargement of household spending potential that arises from the reduced need to purchase energy at market prices. Measurement of the economic implications includes an accounting of the tax-revenue effects of each of the two spending impact channels.

In a final section of the report, the measured economic impacts are discussed in the context of the concerns expressed by bank regulators and secondary mortgage market agencies.

Background: The PACE Program

Since 2008, twenty-four (24) states and the District of Columbia have passed laws enabling local government jurisdictions to establish special assessment districts (also called special improvement districts) that allow residential and commercial property owners to finance renewable energy (RE) and energy efficiency (EE) improvements on their properties. The National Renewable Energy Laboratory describes the PACE program in this way:

> *The pivotal innovation of PACE is the creation of EE/RE assessments that are tied directly to the house and repaid via the property owner's tax bill. The assessment, which is secured by a senior lien on the property, does not require an up-front payment. The lien provides strong debt collateral in the event the homeowner – or business owner – defaults on the assessment. Because the assessment and lien are tied directly to the property, they can be transferred upon sale*.[1]

By the first half of 2010, PACE programs had been launched in a handful of communities and early results were promising. The program appears to be effective in overcoming traditional barriers to significant investment in energy efficiency and renewable energy and the associated spending have been linked to construction activity in communities with PACE programs. Sonoma County, California, for example, reportedly experienced more than $20 million in program spending activity by April 2010 and had seen its local construction industry employment rate improve dramatically in comparison to neighboring counties.[2]

In early May 2010, Fannie Mae and Freddie Mac issued short letters suggesting that the PACE program violated standard mortgage provisions.[3] In addition, on July 6, 2010 the Federal Housing Finance Agency (FHFA) and the Office of the Comptroller of the Currency (OCC) issued statements concluding that PACE programs "present significant safety and soundness concerns to the housing finance industry."[4]

As reported by the Lawrence Berkeley National Laboratory's Clean Energy Financing Policy Brief in August 2010, that said, "Typically, the tax liens created by assessments are senior to other obligations, like mortgages, and must be paid first in the event of foreclosure. Fannie Mae, Freddie Mac, the FHFA and other financial regulators reasoned that PACE assessments were, in effect, loans not assessments and so violated standard mortgage provisions requiring priority over any other loan."[5]

These and related developments have halted most PACE programs, according to Mr. David Gabrielson, Executive Director of PACENow.

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[1] Property-Assessed Clean Energy Financing of Renewables and Efficiency. NREL/BR-6A2-47097. July 2010.
[2] Written testimony of Sonoma County Auditor-Controller-Treasurer-Tax Collector Rod Dole before the House Ways and Means Committee, April 14, 2010
[3] Lawrence Berkeley National Laboratory, "Clean Energy Financing Policy Brief", August 11, 2010. http://eetd.lbl.gov/ea/emp/ee-pubs.html
[4] http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf
[5] Lawrence Berkeley National Laboratory, "Clean Energy Financing Policy Brief", August 11, 2010. http://eetd.lbl.gov/ea/emp/ee-pubs.html

The Role of this Analysis

PACE proponents are assembling information in an effort to respond to these interpretations of mortgage policy. This includes elucidating the economic and tax impacts of PACE projects as well as the projects' effects on household budgets and housing values. To the extent that PACE projects can be demonstrated to have the potential to enhance economic activity and associated tax collections, they have the potential to strengthen local, state and national economic and fiscal conditions. In so doing, PACE projects can improve the weakened housing and construction markets.

An additional issue, although not the direct focus of the quantitative research presented here, relates even more directly to the concerns of regulators and agencies regarding the PACE program and mortgage risk. To the extent the EE and RE projects reduce and/or stabilize households' energy budgets, the programs have the potential to be risk reducing, rather than risk enhancing, for mortgage lenders.

Both of these issues are discussed herein. We turn first to measuring the Program's potential economic impacts. There are two dimensions to this analysis. One is the impact of the spending that occurs as the result of installing energy efficiency and renewable energy measures. The second is the impact on the household of changes in the burden in utility bills and, thus, on the effective cash resources of the household to support other household spending.

Measuring the PACE Program's Project Spending Impacts

PACE program projects generally involve spending on a variety of energy efficiency and renewable energy improvements to existing housing. The decision to employ the PACE program is made by consumers or developer/builders whose motives are reflective of consumer perspectives of the value of the projects. In this respect, PACE project implementations are no different from other home-improvement investment decisions that are made routinely in the economy, either by owner-occupants or property renovators.[6]

The accepted method of measuring the impact of a purchase such as the PACE or traditional home-improvement projects is to trace the impact of the initial ("direct") purchase decision on the activity of vendors of goods and services affected by the purchase. Input-output models are used to trace these

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[6] The only significant distinction is that the PACE projects are financed through a though a special finance mechanism. Specifically, through arrangements approved by participating tax authorities, the financing is effected by dedication of a property tax increment to support repatriation of the costs of the PACE improvements. A lien is placed on the property to provide security to the financing entity, and to permit the lien to follow the property when it is sold. Although much is made of this distinctive feature of the program, in fact so-called mechanics' liens are commonly placed against property to ensure that unpaid home-improvement contractors, in the worst case, will have a claim against the value of the property.

impacts. Distinctions are made among *direct*, *indirect* and *induced* impacts. (See Appendix B for a brief summary of the input-output model tool that was used to develop the economic impact findings.)

Direct impacts

The renovation of buildings involves the purchase of capital equipment and labor to install such things as photovoltaic systems and insulation products. The expenditure of funds on these activities is associated with increased output by the directly involved enterprises. Each enterprise can be seen as a firm who's production function consists of purchases of labor services from its own employees, and purchases of output of other firms that produce the constituent materials that are used in the provision of the energy production and energy efficiency systems installed at the individual sites.

These activities are said to have *direct* impacts in the form of employment of the associated labor, and addition of value to the inputs purchased from other enterprises. The economic *output* of the installation activity and the *jobs* directly associated with that activity are two key measures of the direct impacts. Economists focus on the economic output measure because it is closest to the incremental contribution to total, gross economic output made by the installation activity. Policy makers concerned with job creation often focus more on the labor activity associated with the activity.

Other dimensions of direct impacts include the taxes as a course of providing the installation activity. The tax impacts take the form of local, state and federal tax payments associated with the incomes of those who own or work at the enterprise that performs the project as well as any payroll taxes, property taxes, sales taxes and other payments to taxing entities to which the provider of the PACE improvements is subject. Local governments and agencies are often interested in this dimension of the direct impacts of the installation activity.

Indirect impacts

The direct purchase activity has *indirect* effects on the economy, in addition to the *direct* effects. These occur because the direct purchases result, in turn, in the purchase of goods and services from other businesses, since virtually no firms provide themselves with every needed input. These indirect, ("supply-chain") impacts take the same, general form as the direct impacts. That is, indirect purchases result in impacts on labor services, create value-added, contribute tax payments, etc. in the course of each vendor providing its products and services to the installation sector. The input-output modeling of the various sectors that constitute the economy are used to trace the indirect effects through all of the myriad links in the supply chain. Each vendor to the direct installation activity has vendors, who, in turn, have vendors, etc. The matrix mathematics of input-output models permits aggregating the impacts on what is, in theory, an infinite chain of vendor relationships.

Induced impacts

The third, and final mechanism by which the initial, direct purchase activity has impacts is through the consumption expenditures of those who enjoy incomes from the direct or indirect activities that occur.

That is, some of their income is spent purchasing goods and services that also result in a cascade of supply chain effects. These so-called *induced* impacts together with the indirect and direct impacts are additive and constitute the total impact of the installation activity. The ratio of the total impacts to the direct impacts on each of the dimensions of impact is often reported as the *multiplier* effect of the direct activity. Thus, multipliers can be measured for jobs, value-added, tax receipts, or any other dimension of the accumulated impacts.

The geography of impacts

The impact analysis implicitly has geographic dimensions. That is, the various vendors associated with providing goods and services in response to the direct, indirect, and induced purchases can be located in the immediate locality, other localities and states, or foreign countries. It is possible, with the latest versions of input-output data, to assemble impacts at the various geographies. American policy makers are generally interested in activity that accretes to labor, business and governments within the boundaries of our nation. Purchases that occur in foreign countries are often considered "leakage" of impacts to these locations.

From the broader view of the world economy, even foreign impacts may ultimately stimulate demand for US goods and services through the international exchange of goods and services and international flows of financial capital. Nonetheless, it is not unreasonable for policy makers to be interested primarily in certain, specific geographies when measuring impacts. In the analysis reported herein, the direct purchases of installation services are assumed to be located in one of four, cities, with the impacts appraised at both the local and the national level. This is done because regions host different suppliers of goods and services, and have different labor market and tax systems. Thus, the aggregation of impacts to the national level can vary with the locus of the initial purchase activity.

The Modeling Tool

The modeling of the impacts of purchases made under PACE program is performed using the IMPLAN ("IMpact Analysis for PLANning") model. IMPLAN was originally developed by the Forest Service of the U.S. Department of Agriculture in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management of the U.S. Department of the Interior in 1993, and is currently licensed and distributed by the Minnesota IMPLAN Group, Inc.

The IMPLAN model is an implementation of an input-output model–a way of representing an economy that was developed by Wassily Leontief, for which he received the Nobel Memorial Prize in Economic Sciences. An input-output model uses tabular (matrix) representations of an economy to measure the effect of changes in one industry on others. It can be used to measure the effects of purchases made by US consumers and governments, and foreign entities. Details on the constituent matrices of input-output model systems and the associated mathematics can be found in many sources.[7].

The IMPLAN model is a highly respected implementation of Leontief's input-output concept, and is generally agreed to be superior to regional impact multiplier systems.[8] IMPLAN is constructed with data assembled for national income accounting purposes, thereby providing a tool that has a robust link to widely accepted data development efforts. In addition, IMPLAN has been subject to detailed scrutiny by experts on regional impact analysis. Most recently, the United States Department of Agriculture (USDA) recognized the IMPLAN modeling framework as "one of the most credible regional impact models used for regional economic impact analysis" and, following a review by experts from seven US agencies, selected IMPLAN as its analysis framework for monitoring job creation associated with the American Recovery and Reinvestment Act (ARRA) of 2009.[9] [10] More information on the features of IMPLAN can be found at Appendix B or www.implan.com.

Application of the IMPLAN model in the case of the PACE program involves the following steps:

1. Development of a representation of PACE projects. This takes the form of a representation of the labor and product purchases that constitute an energy efficiency or renewable energy project.
2. Selection of locales (cities) in which to hypothetically implement the projects. City data is assembled from constituent county data.
3. For each selected city and project, building a model in IMPLAN that emulates the city by linking the constituent counties.
4. Applying the assumed purchase activity to the affected IMPLAN sectors.

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[7] See, for example: Leontief, Wassily W. *Input-Output Economics*. 2nd ed., New York: Oxford University Press, 1986; Miller, Ronald E. and Peter D. Blair. *Input-Output Analysis: Foundations and Extensions*, 2nd edition, Cambridge University Press, 2009: and Ten Raa, Thijs. The Economics of Input-Output Analysis. Cambridge University Press, 2005.

[8] One such system is RIMS III. See, US Department of Commerce, Bureau of Economic Analysis, *Regional multipliers: A user handbook for regional input-output modeling system (RIMS II)*. Third edition. Washington, D.C.: U.S. Government Printing Office. 1997.

[9] See excerpts from an April 9, 2009 letter to MIG, Inc., from John Kort, Acting Administrator of the USDA Economic Research Service, on behalf of Secretary Vilsack, at www.implan.com.

[10] In the economics profession, there is a lively debate as to whether job creation measured using input-output tools such as IMPLAN under- or overstates the economic impacts of the spending activities modeled using the IMPLAN system. Pessimists are tempted to assert that if spending occurs on Project A, then one should account for the fact that Project B may not be pursued because of the diversion of funds to Project A. This view of the economy as a zero-sum game is clearly incorrect in the aggregate, because we observe economic growth despite constrained investment budgets. In this analysis we implicitly embrace this more realistic view because the PACE program, though enabled by public policy, is implemented by the private sector which faces incentives to only pursue cost-beneficial programs. This pursuit of economically efficient projects is consistent with the notion that selecting productivity-enhancing (and thus, resource sparing) projects enlarges the potential of an economy, in contrast to the implication of the zero-sum game perspective.

5. Build a model in IMPLAN that links the purchase data and local models, one by one, to the national model. Run the models to compute direct, indirect and induced impacts.

The manner of representing the PACE activities in IMPLAN is discussed further below.

Representing PACE Program Purchases in IMPLAN

In order to implement the IMPLAN model in the study of the PACE program, the purchases typically made with PACE projects must be associated with the sectors that are representable within IMPLAN. Recall that there are two, broad classes of PACE program projects:

1. The *energy efficiency* measures focus on reduction in the use of conventionally sourced energy through the use of higher-efficiency devices and products. Such measures include permanent improvements such as energy efficient HVAC systems; attic and wall insulation; duct and home sealing; cool roof systems; solar water heater systems; tankless water heaters; and evaporative coolers.
2. The *renewable energy* projects involve provision of energy to the household by means that are described as "renewable" because of their reliance on sunlight, wind, ocean waves and other, effectively non-depletable resources. Rooftop photovoltaic projects are expected to be the most common form of project associated with the PACE programs.

As the project descriptions above suggest, a diverse family of products constitute the PACE program, making it hazardous to assume a "typical" project. Installation of, say, a particular type of window product, is also difficult to represent in IMPLAN because IMPLAN is able to represent the production functions of a limited number of industrial products, and there is variation in production techniques ad product features across producers of the same, general class product.

In addition, the costs of energy efficiency measures vary widely due to regional climate and the local costs of labor and materials. Adding efficient central air conditioning to a home with existing forced air heat, for example, costs approximately $3,500-$4,000 and takes about two days.[11] Installing double-paned windows can cost as much as $20,000 in a two-story home.[12] According to GreenHomes America, a leading residential energy services company which operates from coast to coast, an average whole home retrofit project would cost the homeowner approximately $10,000.[13] Average labor costs represent 55% of the total and materials costs represent approximately 45%.[14]

Similarly, the costs of renewable energy projects of a given capacity in kilowatts (kW) is also variable due to variations in the availability of the underlying natural resource (e.g., sunlight in the case of photovoltaic devices), the cost of installation labor, variations in the characteristics of the property, etc.

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[11] http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf

[12] Lawrence Berkeley National Laboratory, "Clean Energy Financing Policy Brief", August 11, 2010. http://eetd.lbl.gov/ea/emp/ee-pubs.html

[13] Email correspondence of Mr. Cliff Staten with GreenHomes America Senior VP Michael Rogers, 2/18/11.

[14] *ibid*

According to a December 2010 report by the Lawrence Berkeley National Laboratory, the national average for a 4kW solar photovoltaic system is $30,000.[15] Materials account for 52%, while labor costs associated with marketing, permitting and system installation accounts for approximately 48% of the total.[16]

Because of the variations in the nature of energy efficiency and renewable energy projects, we determined it is not appropriate to characterize a "typical" PACE project. In addition, energy efficiency and renewable energy project activities are not represented at high resolution in the available input-output model data. These models disaggregate the economy into approximately 440 sectors, and it is necessary to represent project spending in terms of these sectors. Therefore, in the analysis that is presented herein, the PACE projects are not specified in detail; rather, we model the impacts in the following fashion:

1. An arbitrary amount of purchases ($1 million in 2011 dollar terms) is used to represent PACE activity in a given locale. Since the inner workings of IMPLAN assume a constant production function (specific to the year the model data represents), taking this approach allows one to scale the impacts to an actual program simply by scaling actual spending to the $1 million placeholder value.
2. It is arbitrarily assumed that 50% of the assumed purchases is associated with photovoltaic (renewable energy) installations, and 50% with energy efficiency projects.
3. Energy efficient project purchases were evenly allocated to the various weatherization and other energy efficiency product sectors represented in IMPLAN. (See Exhibit 1 in Appendix C for the list of IMPLAN and associated North American Industrial Classification System (NAICS) sectoral codes that likely comprise the sectors affected by the energy efficiency and renewable energy project purchases.)
4. No special edits of the IMPLAN model coefficients were made during the modeling. Specifically, the regional purchase coefficients (RPCs) that represent the share of product purchases that are made within the US was left at the average that IMPLAN derives from national income accounting data. For example, solar photovoltaic systems in IMPLAN have an RPC of 75 percent (i.e., less than would be the case with higher US content), because it is not possible to distinguish retail photovoltaic products from other crystalline semiconductor products. This probably yields a somewhat more conservative (low) total domestic impact because an active program like PACE could make special efforts to source products with higher shares of US content.

Geographic Representation in IMPLAN

ECONorthwest and its client agreed that it would be useful to model the consequences of PACE activity in a variety of locales. The selected, four communities are:

1. Columbus, OH (built from Delaware and Franklin Counties)
2. Long Island, NY (built from Nassau and Suffolk Counties)
3. Santa Barbara, CA (represented by Santa Barbara County)
4. San Antonio, TX (represented by Bexar County)

[15] "Tracking the Sun III," December 2010. http://eetd.lel.gov/ea/emp/re-pubs.html
[16] "The Prospect for $1/Watt from Solar" U.S. DOE Workshop Presentation by John Lushetsky, August 10, 2010.

The primary reason for modeling various locales is that vendor relationships vary geographically, with some areas able to source from the immediate locale, while others tending to source from distant US sources, or overseas suppliers. Budgetary considerations limited the number of locales able to be modeled, because representation of each locale requires acquisition of individual databases, in addition to linkages to the national model. However, the four chosen locales are diverse in geography and climate conditions, and are locales of interest to the PACE program.

Findings of the Project Spending Impact Analysis

The findings of the economic impact analysis are presented in detail in Exhibit 2 through Exhibit 10 in the Appendix C. These exhibits report the economic impacts of the hypothetical $1 million in project purchases. In the exhibits, these impacts are reported along the following dimensions:

- **The type of project**. This is defined as a mix of energy efficiency measures or a photovoltaic renewable energy installation;
- **The dimension of the economic impact**. The reported measures are economic output, personal income, jobs and tax revenues;
- **The type of impact**. The direct, indirect, induced and total impacts are reported.
- **The geography of the impact**. Impacts are measured for each of the modeled cities, for the rest-of-the-nation, and the nation as a whole. In the aggregation to the geographic level, a 50% weight is put on energy efficiency and photovoltaic projects, respectively.
- **The type of tax revenue generated**. For compactness, the wide variety of tax types reported by IMPLAN are grouped into four tax base levies–corporate profits and dividends taxes, indirect business taxes, personal taxes, and social insurance levies.
- **The level of government receiving the tax revenues**. These are presented as state and local, and federal subtotals, respectively.

It would be cumbersome to describe here each of the several hundred impact measures provided in the exhibits. Instead, we first report here the range of impacts reported in the summary exhibits, Exhibit 2 and Exhibit 3 in Appendix C. These tables summarize the impacts by the type of project, the type of impact, and the dimension of the economic impact for each of the cities, and for elsewhere-in-the-US and the US as a whole.[17]

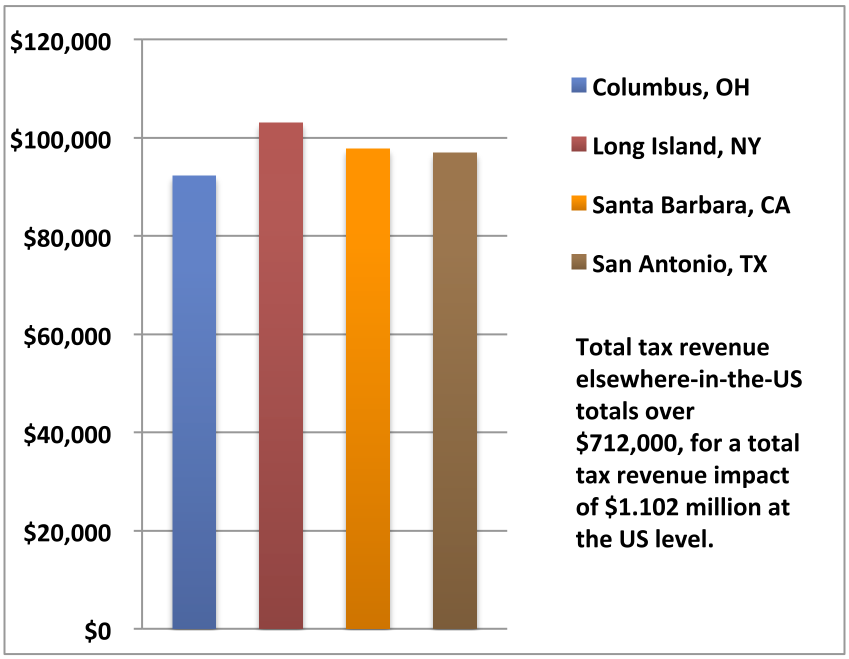
Turning first to solar photovoltaic projects, we find the following impacts for spending $1 million in each of the four cities:

- The impact on total economic output ranges from approximately $718,000 to $872,000 at the individual city level, and is $7.044 million for the rest of the US, and $10.250 million for the US as a whole.
- The impact on personal income ranges from approximately $284,000 to $330,000 at the individual city level, and is $2.066 million for the rest of the US, and $3.325 million for the US as a whole.

[17] Elsewhere-in-the-US and national totals aggregate across the four analyzed cities.

- The impact on jobs ranges from 6 to 8 additional jobs at the individual city level, and is 35 for the rest of the US, and 60 for the US as a whole.
- Tax revenue impacts at the federal level range from $55,000 to $63,000 at the individual city level, and is $426,000 for the rest of the US, and $669,000 for the US as a whole.
- Tax revenue impacts at the state and local level range from $34,000 to $41,000 at the individual city level, and is $287,000 for the rest of the US, and $433,000 for the US as a whole.
- Total tax revenue impact at all levels of government is $1.102 million at the US level.

Figure 1. Total Tax Revenue (Fiscal) Impacts at the City Level, per $1 million in Project Spending per City.



For energy efficiency projects, we find the following impacts for each $1 million in purchases at the city level:

- The impact on total economic output ranges from approximately $717,000 to $939,000 at the individual city level, and is $7.570 million for the rest of the US, and $10.925 million for the US as a whole.
- The impact on personal income ranges from approximately $283,000 to $352,000 at the individual city level, and is $1.943 million for the rest of the US, and $3.232 million for the US as a whole.
- The impact on jobs ranges from 5 to 8 additional jobs at the individual city level, and is 35 for the rest of the US, and 61 for the US as a whole.
- Tax revenue impacts at the federal level range from $60,000 to $66,000 at the individual city level, and is $307,000 for the rest of the US, and $658,000 for the US as a whole.
- Tax revenue impacts at the state and local level range from $35,000 to $41,000 at the individual city level, and is $259,000 for the rest of the US, and $411,000 for the US as a whole.
- Total tax revenue impact at all levels of government is $1.058 million at the US level.

As we have modeled the two project types in IMPLAN, there appears to be a somewhat greater local impact associated with the energy efficiency versus the solar photovoltaic project types. This is consistent with the fact that the specialized products and labor needed to produce photovoltaic products are not likely to be as localized as are the products used in energy efficiency improvements.

When viewed from the jobs impact perspective, the $4 million of PACE-type project spending across the four cities is associated with approximately 60 jobs somewhere in the nation. If one viewed the PACE program as a jobs stimulus program (akin to those pursued at public expense under American Recovery and Reinvestment Act of 2009), the cost per job at $67,000 is quite modest. In fact, of course, in the PACE program the only significant role of government is to authorize a financing mechanism to overcome what some believe to be non-economic impediments to credit access.

If viewed, alternatively, from a fiscal perspective, the $4 million of spending across the four cities ultimately provides over $1 million in tax revenue to local, state or federal taxing entities. If the PACE program is able to identify and stimulate cost-beneficial investments in energy enhancements of housing, government stands to be a major beneficiary of the associated private spending.

Measuring the PACE Program's Household Budget Impacts

In addition to the spending impacts associated with developing PACE-type projects, cost-beneficial PACE projects[18] should also reduce and/or stabilize the cost of energy to the households that occupy the affected housing units. By definition, a cost-beneficial project is one that, over its lifetime, provides the property owner more in the form of avoided energy costs than is spent enhancing the home.[19] Access to alternative energy sources (through so-called renewable energy projects) can also provide, in effect, insurance against the uncertainty about the path of future fossil fuel prices. This insurance effect can be modeled as a financial option that has a positive financial value even if conventional fuel prices are just variable, and do not necessarily trend upward.

Regardless of whether the project persistently lowers the market-energy needs of the household (through energy efficiency projects) or simply provides insurance against uncertainty in market fuel price movements, a cost-beneficial project reduces a household's effective budgetary burden of home

[18] ECONorthwest was not asked to opine on whether typical PACE projects are, in fact, cost-beneficial. However, since private agents are the ones primarily involved in the decision-making, it is reasonable to anticipate that the projects that are successfully adopted are perceived as cost-beneficial by households or contractors developing the projects for sale to consumer households.

[19] The typical financial calculus involved in this determination involves, therefore, comparing the present value at the time the enhancement spending occurs of the stream of expected energy cost savings enjoyed over the lifetime of the energy enhancements. A discount rate is applied to the stream of energy cost savings in this calculation.

ownership.[20] Thus, to the extent that the project results in additional free cash flow in the household (after paying the tax increment used to pay for the PACE improvements), there can be annual increments of economic impact associated with the likely additional spending that the household will perform.

This impact can also be measured using the IMPLAN modeling system by assuming a hypothetical quantity of additional, non-utility spending by households. As with the PACE program spending impacts, there are direct, indirect, and induced effects of this spending. In this case, however, the amount measured by this method yields only the gross spending effects; the loss of spending to the utility sector will result in a partial offset to these impacts.[21]

Exhibit 11, on page 31, summarizes the city-level and US total impacts, in present value terms, of a household enjoying energy cost savings of $1,000 per year in 2011 dollars for 25 years. As the exhibit reveals, the gross impacts of even a modest annual cost savings can yield large impacts on output, personal income, jobs, and tax revenues over a 25-year period.

Conclusions: The Implications of the Analysis for Issuers of Mortgages on PACE Project Properties

The background of the PACE program reveals that the program is currently not operational because of concerns of bank regulators and secondary mortgage market entities regarding the security of their access to the collateral value of the property in the event of default. The existence of a senior lien (senior to the mortgage) is always of concern to mortgage issuers, especially in non-recourse states (i.e., states in which the lender may not levy claims against assets other than the mortgaged property itself).[22]

Several aspects of the impact analysis presented here bear upon the position taken by those concerned about such risks. First, to the extent that the PACE program operates in the manner assumed in the analysis in this report, use of the program has the potential to have positive economic impacts on the regional (city) economy, as well as the nation as a whole. Cost-beneficial programs that generate such impacts can contribute to the process of recovery for both the economy in general, and the construction services sector in particular.

[20] Even in the special case where a renewable energy project only provides insurance against future volatility of market fuel prices, the household enjoys budgetary relief. It need not set aside funds against the eventuality of a surprise upward movement in energy costs.

[21] Without knowing the composition of utility and non-utility spending of the affected income groups, the effects of the shift in spending composition can only be estimated in rough terms.

[22] There are 17 such non-recourse states.

Second, to the extent that the projects generate the generous revenues for local, state and federal jurisdictions modeled here, additional stabilization of the general economy can be expected. This is because the difficulties that governments currently have in balancing their budgets is requiring either reductions in public services or increases in taxes, or both. The risk of loss of public services, or reductions in its quality, and the risks of increased taxation on private activity create an environment of uncertainty, in general, and disrupt household location, migration and housing tenure decisions. On some margin, these conditions weaken the strength of the housing market, aggravating lender collateral problems. Cost-beneficial private sector activity that has the effect of enhancing the value of housing services should not be discouraged by lenders, even from the perspective of their own self-interest.

Third, in an environment of uncertain and costly supply of conventional fuels, properties that are distinguished by having energy-sparing or inflation-defensive features will enjoy priority in desirability, and hence, enjoy superior pricing in the marketplace. In a manner similar to the relative price movements of gasoline-consumptive SUVs versus more fuel-efficient vehicles, properties with good energy efficiency characteristics will rise in price in an uncertain commodity price environment.

Finally, although the existence of a lien in a superior position to a mortgage is legitimately worrisome to lenders, the increment in value of the home that is represented by the energy technologies financed by the lien may well move counter-cyclically to other factors affecting home prices and collateral value. If this is the case, then the putative adverse presence of the lien may well be counterbalanced by the superior net resilience of PACE-improved home values. This seems true whether the economy fails to come gracefully out of the recession because of central bank difficulties managing the balance between inflation and real interest rates, or because of rising and/or uncertain energy costs:

- If the monetary expansion results in higher, general inflation levels in the future, households for whom the absolute energy cost of their budgets is below average will be less subject to inflation effects on energy cost components of their budgets than households with larger absolute energy budgets. Moreover, to the extent that the energy features of the home provide a hedge against some portion of general inflation, the value of the home will rise by an amount reflective of the value of that hedge.
- If real interest rates rise instead, those homes with fixed lien payments associated with the PACE program (and, ideally, a fixed-rate mortgage as well) enjoy, in effect, a reduction in the present value of the lien payment obligations. Although higher mortgage rates will not be favorable to home sales or home building, creditors with fixed-rate obligations enjoy an implicit capital gain (much as the holders of low rate mortgages will suffer a capital loss). Abandoning a home with a fixed lien in a rising real interest rate market makes no more sense than abandoning a low-rate mortgage in that environment.
- If energy prices rise independently of other prices (commodity price inflation), the value of the energy-sparing improvements will rise, even if and as the higher energy prices impair economic recovery, incomes and housing demand. By recognizing the value of the energy-sparing features of the home and accommodating borrowers who must take on property tax liens to enjoy these

> features, the lenders are, in effect, putting themselves in a better position than if they had lent the same principal amount to a homeowner who had not acquired protection against energy price movements.

In summary, it is hard to construct a scenario in which the presence of a lien that is associated with value-enhancing and stabilizing housing services adds to the riskiness of a mortgage vs. a loan on a home without the lien and energy features, everything else being equal.

These arguments would be less persuasive, of course, if one did not believe that (a) the housing market recognizes the value of energy-sparing features of homes or that (b) the programs of PACENow and like initiatives will deliver improvements that cost-effectively provide the homeowner with lower energy cost burdens and/or a hedge against rising or uncertain energy prices. ECONorthwest cannot opine on the logic of (b), but has experience in evaluating the relationship between the market prices of homes and their energy features. In 1993, ECONorthwest published a study of an energy-efficient mortgage program that was performed for the Oregon Department of Energy. Using a unique database that contained information on various home insulation and heat source features of homes that sold in Oregon, ECONorthwest established both that the market does recognize the present value of energy cost savings in higher home prices and that the changes in Oregon's building code in 1992 (to reduce energy use by housing) were cost-beneficial.[23]

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[23] See, *Implementing Oregon's Energy Efficient Mortgage Program: Final Report*, ECONorthwest, June 1993. In Part 3 of that report ("Market Response to Energy Saving Features") an econometric analysis was performed using a special database provided by the Appraisers' Comp Service (ACS). At the time, the ACS maintained a database of real estate sales in major markets so that appraisers may obtain comparable sales information for use in appraisals. Uniquely, the database contained information on certain energy-related features of the homes sold including ceiling insulation value, floor insulation value, wall insulation value, type of heating and whether the home had been built to the 1992 code (in addition to many other features of the homes). The sales prices covered a narrow period of September 4, 1992 to June 15, 1993, and comprised approximately 2,780 total observations in two metropolitan areas of Oregon. The econometric analysis revealed that buyers assigned high values to energy-sparing features. The value of those features was such that ECONorthwest concluded on page 48 that "…the 1992 code enhancements are associated with significant enhancements in home value. All of the estimates are far in excess of the estimated costs of the 1992 code described by builders in Part One of this report."

Appendix A: About the Authors

Randall Pozdena, PhD, Senior Economist and Managing Director

Dr. Pozdena leads ECONorthwest's quantitative analysis practice. He joined ECONorthwest as a managing director and head of its Portland office in 1991. He has extensive experience in macro-economic modeling and forecasting, project feasibility analysis, banking and securities markets, real-estate economics, and monetary policy. In this capacity, he has developed and applied project evaluation and pricing tools, and state, regional and sectoral macroeconomic forecasting and economic impact models. Prior to joining ECONorthwest, Pozdena was research Vice President of the Federal Reserve Bank of San Francisco. He directed the Banking and Regional Studies section, which advised on matters relating to financial-market developments, mortgage and housing markets, banking operations and regulation, and the regional economies of the eight western United States. The latter duties involved developing and operating models of states and metropolitan-area economies and analysis of credit flows in the economy. Before his work at the Federal Reserve Bank, Pozdena was a senior economist at SRI International, where he provided consulting on economics, finance, and transportation economics. In addition, he has taught economics and finance at the Graduate School of Business, University of California, Berkeley and at the Graduate School of Administration, University of California, Irvine. He was also associated with the Institute of Transportation Studies at Irvine. Pozdena has been a member of the CFA Institute for over 15 years and a member, and former board member, of the Portland Society of Financial Analysts. He has written over 50 published books and papers, has 21 listings in the Journal of Economic Literature, and over 5,000 search cross-references in Google Research.

Alec Josephson, MA, Senior Economist and Director of Economic Impact Analysis

Josephson has been with ECONorthwest since 1992 and has participated in well over 300 economic impact studies using the IMPLAN modeling systems. Josephson's experience spans a wide range of industries, sectors, and programs, including major transportation improvement projects; heavy and light manufacturing activities; renewable energy projects and technologies; agriculture, forestry, mining, and commodities; and economic development projects. Josephson recently completed a comprehensive economic analysis of the impacts from proposed changes to Seattle area transportation resulting from restructuring of the Alaska Way Viaduct, including analysis of tolling and other congestion models, impacts of freight traffic, analysis of the short-term construction impacts and the long-term accessibility and business development impacts. In addition to his work with ECONorthwest, Mr. Josephson is an adjunct professor of economics at Pacific University, where he teaches courses in energy and environmental economics, microeconomics, and macroeconomics. Mr. Josephson and his staff conducted the modeling presented in this report.

Appendix B: The IMPLAN Modeling System[24]

Social Accounting

IMPLAN's Social Accounting Matrices (SAMs) capture the actual dollar amounts of all business transactions taking place in a regional economy as reported each year by businesses and governmental agencies. SAM accounts are a better measure of economic flow than traditional input-output accounts because they include "non-market" transactions. Examples of these transactions would be taxes and unemployment benefits.

Multipliers

Social Accounting Matrices can be constructed to show the effects of a given change on the economy of interest. These are called Multiplier Models. Multiplier Models study the impacts of a user-specified change in the chosen economy for 440 different industries. Because the Multiplier Models are built directly from the region specific Social Accounting Matrices, they will reflect the region's unique structure and trade situation.

Multiplier Models are the framework for building impact analysis questions. Derived mathematically, these models estimate the magnitude and distribution of economic impacts, and measure three types of effects that are displayed in the final report. These are the direct, indirect, and induced changes within the economy. Direct effects are determined by the Event as defined by the user (i.e. a $10 million dollar order is a $10 million dollar direct effect). The indirect effects are determined by the amount of the direct effect spent within the study region on supplies, services, labor and taxes. Finally the induced effect measures the money that is re-spent in the study area as a result of spending from the indirect effect. Each of these steps recognizes an important leakage from the economic study region spent on purchases outside of the defined area. Eventually these leakages will stop the cycle.

Trade Flows Method

Unique to IMPLAN data, 2008 and forward, is a method of tracking regional purchases by estimating trade flows. An updated and improved method for calculating and tracking the movement of commodities between industries within a region, this method tracks over 500 commodities in each study area, and allows more accurate capturing of indirect and induced effects. This new method of capturing regional purchase coefficients also makes it possible for our Version 3 software to perform Multiregional Analysis, so users can see how a change in their local region causes additional affects surrounding areas.

Cost-Effective Modeling

Tremendous amounts of data are required in order to run Social Accounting Matrices and Multiplier Models that will accurately estimate the effects of a given event on an economy. There are numerous

[24] Abstracted from descriptive materials offered by IMPLAN at www.implan.com.

factors that need to be taken into account to fully visualize direct, indirect and induced effects of an event. The expense and labor of developing this data independently are prohibitive. By offering the data in many discreet forms, IMPLAN also allows studies to be localized effectively and only data of interest to be purchased.

Appendix C: Exhibits[25]

[25] The data in all exhibits is from ECONorthwest using IMPLAN modeling and emulation of PACE project purchases as described in the text of the report.

Exhibit 1: IMPLAN and NAICS Sectors Associated with PACE Project Activity

IMPLAN Sector	IMPLAN Description	2007 NAICS Codes
40	Maintenance and repair construction of residential structures	23*
99	Wood windows and doors and millwork manufacturing	32191
128	Synthetic rubber manufacturing	325212
137	Adhesive manufacturing	32552
146	Polystyrene foam product manufacturing	32614
149	Other plastics product manufacturing	32619
168	Mineral wool manufacturing	327993
216	Air conditioning- refrigeration- and warm air heat	333415
243	Semiconductor and related device manufacturing	334413

Exhibit 2: Summary of Economic Impacts of Photovoltaic Projects, per $1 million in Project Purchases

Economic Impacts - Solar Photovoltaics

Impact Area / Type of Impact	Direct	Indirect	Induced	Total
Santa Barbara, CA				
Output	$490,221	$116,918	$173,047	$780,185
Personal Income	$214,608	$45,318	$59,668	$319,593
Jobs	3	1	1	6
San Antonio, TX				
Output	$507,649	$145,867	$218,552	$872,068
Personal Income	$198,656	$57,671	$73,611	$329,937
Jobs	5	1	2	8
Columbus, OH				
Output	$501,674	$132,488	$201,844	$836,006
Personal Income	$202,121	$55,477	$68,120	$325,718
Jobs	4	1	2	7
Long Island, NY				
Output	$438,330	$121,541	$157,729	$717,599
Personal Income	$177,780	$49,051	$57,453	$284,284
Jobs	3	1	1	5
Elsewhere in the United States				
Output	$1,587,757	$2,597,183	$2,859,334	$7,044,273
Personal Income	$409,984	$778,674	$877,716	$2,066,374
Jobs	4	12	18	35
United States Total				
Output	$3,525,630	$3,113,996	$3,610,504	$10,250,130
Personal Income	$1,203,148	$986,190	$1,136,566	$3,325,904
Jobs	20	16	24	60

Exhibit 3: Summary of Fiscal Impacts for Solar Photovoltaics, per $1 million in Project Purchases

Fiscal Impacts - Solar Photovoltaics

Impact Area / Type of Impact		Direct	Indirect	Induced	Total
Santa Barbara, CA					
Federal		$33,390	$17,238	$12,393	$63,021
State and Local		$12,188	$8,920	$13,578	$34,685
	Total All	$45,578	$26,158	$25,971	$97,706
San Antonio, TX					
Federal		$33,990	$13,135	$16,104	$63,228
State and Local		$6,964	$12,005	$14,725	$33,693
	Total All	$40,953	$25,139	$30,829	$96,921
Columbus, OH					
Federal		$29,878	$10,819	$14,317	$55,013
State and Local		$10,491	$11,259	$15,467	$37,217
	Total All	$40,369	$22,078	$29,784	$92,230
Long Island, NY					
Federal		$36,904	$11,239	$13,725	$61,867
State and Local		$15,494	$11,213	$14,451	$41,157
	Total All	$52,398	$22,451	$28,176	$103,024
Elsewhere in the United States					
Federal		$88,116	$149,923	$187,622	$425,660
State and Local		$37,306	$100,785	$148,646	$286,737
	Total All	$125,422	$250,707	$336,268	$712,396
United States Total					
Federal		$222,276	$202,352	$244,160	$668,788
State and Local		$82,442	$144,180	$206,866	$433,488
	Total All	$304,718	$346,532	$451,026	$1,102,276

Exhibit 4: Summary of Economic Impacts of Energy Efficiency Programs, per $1 million in Project Purchases

Economic Impacts - EE Measures

Impact Area / Type of Impact	Direct	Indirect	Induced	Total
Santa Barbara, CA				
Output	$513,252	$123,023	$174,721	$810,996
Personal Income	$215,490	$46,942	$60,245	$322,677
Jobs	3	1	1	6
San Antonio, TX				
Output	$513,521	$145,532	$219,473	$878,525
Personal Income	$199,952	$57,372	$73,921	$331,244
Jobs	5	1	2	8
Columbus, OH				
Output	$565,830	$155,640	$217,883	$939,353
Personal Income	$215,850	$62,958	$73,534	$352,342
Jobs	4	1	2	8
Long Island, NY				
Output	$442,063	$113,635	$161,223	$716,921
Personal Income	$180,828	$44,978	$57,298	$283,104
Jobs	3	1	1	5
Elsewhere in the United States				
Output	$1,772,714	$3,070,827	$2,735,981	$7,579,521
Personal Income	$367,042	$736,774	$839,779	$1,943,594
Jobs	6	11	17	35
United States Total				
Output	$3,807,378	$3,608,656	$3,509,280	$10,925,314
Personal Income	$1,179,160	$949,024	$1,104,776	$3,232,960
Jobs	21	16	24	61

Exhibit 5: Summary of Fiscal Impacts of Energy Efficiency Measures, per $1 million in Project Purchases

Fiscal Impacts - EE Measures

Impact Area / Type of Impact		Direct	Indirect	Induced	Total
Santa Barbara, CA					
Federal		$33,515	$17,551	$12,513	$63,578
State and Local		$12,119	$9,146	$13,709	$34,973
	Total All	$45,633	$26,697	$26,222	$98,551
San Antonio, TX					
Federal		$36,421	$12,584	$16,715	$65,720
State and Local		$8,334	$11,458	$15,287	$35,079
	Total All	$44,755	$24,042	$32,002	$100,798
Columbus, OH					
Federal		$32,427	$12,301	$15,454	$60,181
State and Local		$11,852	$12,613	$16,695	$41,159
	Total All	$44,279	$24,913	$32,149	$101,340
Long Island, NY					
Federal		$37,245	$10,333	$13,688	$61,265
State and Local		$15,578	$10,439	$14,413	$40,429
	Total All	$52,823	$20,771	$28,101	$101,694
Elsewhere in the United States					
Federal		$72,768	$145,060	$178,967	$396,795
State and Local		$17,150	$101,554	$140,997	$259,701
	Total All	$89,918	$246,614	$319,964	$656,495
United States Total					
Federal		$212,374	$197,828	$237,336	$647,538
State and Local		$65,032	$145,208	$201,100	$411,340
	Total All	$277,406	$343,036	$438,436	$1,058,878

Exhibit 6: Summary of Impacts, Columbus Ohio, per $1 million in Project Purchases

Solar Photovoltaics

Type of Impact	Direct	Indirect	Induced	Total
Output	$501,674	$132,488	$201,844	$836,006
Personal Income	$202,121	$55,477	$68,120	$325,718
Jobs	4.3	1.2	1.7	7.2

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$1,831	$829	$1,818	$4,478
Indirect Business	$534	$1,804	$2,378	$4,715
Personal	$9,924	$2,589	$3,164	$15,676
Social Insurance	$17,590	$5,597	$6,958	$30,144
Total Federal	$29,878	$10,819	$14,317	$55,013
State and Local				
Corporate Profits and Dividends	$1,949	$883	$1,935	$4,766
Indirect Business	$2,589	$8,752	$11,539	$22,880
Personal	$5,391	$1,406	$1,719	$8,515
Social Insurance	$564	$219	$275	$1,057
Total State and Local	$10,491	$11,259	$15,467	$37,217
Total All	$40,369	$22,078	$29,784	$92,230

Energy Efficiency

Type of Impact	Direct	Indirect	Induced	Total
Output	$565,830	$155,640	$217,883	$939,353
Personal Income	$215,850	$62,958	$73,534	$352,342
Jobs	4.5	1.3	1.8	7.6

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$2,225	$1,004	$1,963	$5,192
Indirect Business	$645	$1,999	$2,566	$5,210
Personal	$10,560	$2,937	$3,415	$16,912
Social Insurance	$18,997	$6,361	$7,511	$32,868
Total Federal	$32,427	$12,301	$15,454	$60,181
State and Local				
Corporate Profits and Dividends	$2,368	$1,069	$2,089	$5,525
Indirect Business	$3,129	$9,701	$12,455	$25,284
Personal	$5,736	$1,595	$1,855	$9,186
Social Insurance	$620	$249	$297	$1,165
Total State and Local	$11,852	$12,613	$16,695	$41,159
Total All	$44,279	$24,913	$32,149	$101,340

Exhibit 7: Summary of Impacts, Long Island, NY, per $1 million in Project Purchases

Solar Photovoltaics

Type of Impact	Direct	Indirect	Induced	Total
Output	$438,330	$121,541	$157,729	$717,599
Personal Income	$177,780	$49,051	$57,453	$284,284
Jobs	3.0	0.8	1.1	5.0

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$1,279	$556	$1,002	$2,836
Indirect Business	$360	$856	$1,086	$2,301
Personal	$16,486	$4,537	$5,298	$26,320
Social Insurance	$18,780	$5,291	$6,340	$30,411
Total Federal	$36,904	$11,239	$13,725	$61,867
State and Local				
Corporate Profits and Dividends	$2,174	$945	$1,705	$4,823
Indirect Business	$3,135	$7,458	$9,455	$20,048
Personal	$9,489	$2,611	$3,050	$15,150
Social Insurance	$697	$199	$241	$1,137
Total State and Local	$15,494	$11,213	$14,451	$41,157
Total All	$52,398	$22,451	$28,176	$103,024

Energy Efficiency

Type of Impact	Direct	Indirect	Induced	Total
Output	$442,063	$113,635	$161,223	$716,921
Personal Income	$180,828	$44,978	$57,298	$283,104
Jobs	3.1	0.8	1.1	4.9

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$1,324	$530	$1,000	$2,854
Indirect Business	$341	$799	$1,083	$2,222
Personal	$16,805	$4,161	$5,283	$26,248
Social Insurance	$18,776	$4,844	$6,323	$29,942
Total Federal	$37,245	$10,333	$13,688	$61,265
State and Local				
Corporate Profits and Dividends	$2,252	$902	$1,701	$4,854
Indirect Business	$2,965	$6,961	$9,430	$19,355
Personal	$9,672	$2,395	$3,042	$15,109
Social Insurance	$690	$182	$241	$1,112
Total State and Local	$15,578	$10,439	$14,413	$40,429
Total All	$52,823	$20,771	$28,101	$101,694

Exhibit 8: Summary of Impacts, San Antonio, Texas, per $1 million in Project Purchases

Solar Photovoltaics

Type of Impact	Direct	Indirect	Induced	Total
Output	$507,649	$145,867	$218,552	$872,068
Personal Income	$198,656	$57,671	$73,611	$329,937
Jobs	4.5	1.3	1.8	7.7

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$2,388	$1,075	$2,043	$5,506
Indirect Business	$610	$1,566	$1,891	$4,067
Personal	$11,903	$3,747	$4,305	$19,955
Social Insurance	$19,089	$6,747	$7,865	$33,701
Total Federal	$33,990	$13,135	$16,104	$63,228
State and Local				
Corporate Profits and Dividends	$818	$368	$700	$1,886
Indirect Business	$4,300	$11,030	$13,323	$28,652
Personal	$1,564	$492	$566	$2,621
Social Insurance	$283	$115	$137	$534
Total State and Local	$6,964	$12,005	$14,725	$33,693
Total All	$40,953	$25,139	$30,829	$96,921

Energy Efficiency

Type of Impact	Direct	Indirect	Induced	Total
Output	$513,521	$145,532	$219,473	$878,525
Personal Income	$199,952	$57,372	$73,921	$331,244
Jobs	4.5	1.3	1.8	7.7

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$2,845	$1,058	$2,121	$6,023
Indirect Business	$767	$1,493	$1,963	$4,222
Personal	$12,659	$3,600	$4,469	$20,727
Social Insurance	$20,151	$6,434	$8,163	$34,748
Total Federal	$36,421	$12,584	$16,715	$65,720
State and Local				
Corporate Profits and Dividends	$974	$362	$727	$2,063
Indirect Business	$5,403	$10,514	$13,832	$29,748
Personal	$1,663	$473	$587	$2,723
Social Insurance	$295	$109	$142	$546
Total State and Local	$8,334	$11,458	$15,287	$35,079
Total All	$44,755	$24,042	$32,002	$100,798

Exhibit 9: Summary of Impacts, Santa Barbara, California, per $1 million in Project Purchases

Solar Photovoltaics

Type of Impact	Direct	Indirect	Induced	Total
Output	$490,221	$116,918	$173,047	$780,185
Personal Income	$214,608	$45,318	$59,668	$319,593
Jobs	3.4	0.9	1.4	5.6

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$1,094	$150	$892	$2,135
Indirect Business	$412	$3,574	$1,431	$5,416
Personal	$13,958	$2,572	$3,779	$20,308
Social Insurance	$17,927	$10,944	$6,292	$35,162
Total Federal	$33,390	$17,238	$12,393	$63,021
State and Local				
Corporate Profits and Dividends	$1,352	$507	$1,102	$2,961
Indirect Business	$2,945	$6,710	$10,233	$19,887
Personal	$7,218	$1,486	$1,955	$10,658
Social Insurance	$673	$218	$289	$1,180
Total State and Local	$12,188	$8,920	$13,578	$34,685
Total All	$45,578	$26,158	$25,971	$97,706

Energy Efficiency

Type of Impact	Direct	Indirect	Induced	Total
Output	$513,252	$123,023	$174,721	$810,996
Personal Income	$215,490	$46,942	$60,245	$322,677
Jobs	3.4	0.9	1.4	5.7

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$1,083	$177	$900	$2,160
Indirect Business	$400	$3,592	$1,445	$5,436
Personal	$14,014	$2,675	$3,816	$20,504
Social Insurance	$18,019	$11,107	$6,353	$35,479
Total Federal	$33,515	$17,551	$12,513	$63,578
State and Local				
Corporate Profits and Dividends	$1,338	$541	$1,113	$2,991
Indirect Business	$2,858	$6,841	$10,332	$20,030
Personal	$7,246	$1,539	$1,973	$10,758
Social Insurance	$678	$225	$292	$1,195
Total State and Local	$12,119	$9,146	$13,709	$34,973
Total All	$45,633	$26,697	$26,222	$98,551

Exhibit 10: Summary of Impacts, United States (aggregate), per $1 million in Project Purchases per City

Solar Photovoltaics

Type of Impact	Direct	Indirect	Induced	Total
Output	$3,525,630	$3,113,996	$3,610,504	$10,250,130
Personal Income	$1,203,148	$986,190	$1,136,566	$3,325,904
Jobs	19.6	16.0	24.4	60.0

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$20,048	$19,414	$27,984	$67,446
Indirect Business	$7,214	$17,650	$26,040	$50,904
Personal	$73,692	$59,976	$69,150	$202,818
Social Insurance	$121,322	$105,312	$120,986	$347,620
Total Federal	$222,276	$202,352	$244,160	$668,788
State and Local				
Corporate Profits and Dividends	$17,330	$16,778	$24,188	$58,296
Indirect Business	$45,408	$111,096	$163,900	$320,404
Personal	$17,102	$13,922	$16,048	$47,072
Social Insurance	$2,602	$2,384	$2,730	$7,716
Total State and Local	$82,442	$144,180	$206,866	$433,488
Total All	$304,718	$346,532	$451,026	$1,102,276

Energy Efficiency

Type of Impact	Direct	Indirect	Induced	Total
Output	$3,807,378	$3,608,656	$3,509,280	$10,925,314
Personal Income	$1,179,160	$949,024	$1,104,776	$3,232,960
Jobs	21.4	15.8	23.6	60.8

Type of Tax	Direct	Indirect	Induced	Total
Federal				
Corporate Profits	$17,460	$22,090	$27,204	$66,754
Indirect Business	$4,870	$17,546	$25,312	$47,728
Personal	$72,308	$57,784	$67,216	$197,308
Social Insurance	$117,736	$100,408	$117,604	$335,748
Total Federal	$212,374	$197,828	$237,336	$647,538
State and Local				
Corporate Profits and Dividends	$15,094	$19,092	$23,514	$57,700
Indirect Business	$30,656	$110,454	$159,330	$300,440
Personal	$16,780	$13,410	$15,602	$45,792
Social Insurance	$2,502	$2,252	$2,654	$7,408
Total State and Local	$65,032	$145,208	$201,100	$411,340
Total All	$277,406	$343,036	$438,436	$1,058,878

Exhibit 11: Economic Impacts of $1,000 in Annual Household Energy Costs for 25 Years (in Present Value)

Impact Area	Output	Personal Income	Jobs (Full- and Part-time)	Federal Taxes	State and Local Taxes
Santa Barbara, CA	$19,484	$6,648	0.15	$1,383	$1,515
San Antonio, TX	$21,730	$7,197	0.18	$1,441	$1,358
Columbus, OH	$19,979	$6,578	0.17	$1,548	$1,404
Long Island, NY	$21,007	$7,400	0.15	$1,769	$1,879
United States (est.)	$306,914	$98,453	1.97	$19,119	$12,722

The impacts are the present value effects of $1,000 in energy cost savings per year for 25 years. To reduce this stream of savings to a single number for comparability with project purchase impacts, the so-called *present value* of the savings is calculated. For the present value calculation, it is assumed that the appropriate real (inflation adjusted) discount rate is 3 percent, and that energy costs rise at a rate that is one percentage point higher than other prices. The US totals are estimated outside of IMPLAN using total US spending relative to the city totals observed in the program purchase modeling. These impacts should be considered gross impacts, since the potentially offsetting impacts of reduced utility activity are not captured in these measures.