Feasibility of a Property Assessed Clean Energy (PACE) Program for Commercial Buildings in Multnomah County, Oregon

Prepared for the Multnomah County Office of Sustainability
July 2012

ECONorthwest
ECONOMICS • FINANCE • PLANNING

This material is based upon work supported by the Department of Energy under Award Number DE-EE0000926 and was prepared by ECONorthwest, which is solely responsible for its content. The authors, Randall Pozdena and Carl Batten, would like to acknowledge the contributions of:

David Baylon, Ecotope
Kathryn Maghan and Margot Brandenburg, Rockefeller Foundation
Ron Herbst, Deutsche Bank
Cliff Staton, Renewable Funding
David Moore, PFM
Daniel Flemington and Robin Messina, REIS
Phil Degens, Energy Trust of Oregon
Peter White, Johnson Controls
Nick Popenuk, Rob Wyman, Sean Wallace, Tessa Krebs, and Alec Josephson, ECONorthwest

For more information about this report, please contact:

Carl Batten
ECONorthwest
222 SW Columbia St., Suite 1600
Portland, Oregon 97201

503-222-6060
www.econw.com
batten@econw.com

Overview of Commercial PACE

Property Assessed Clean Energy (PACE) loans finance investments in energy-efficiency improvements to buildings and are repaid through property tax or other assessments on the building. They have several important advantages over other sources of funding.

When a building is improved to become more efficient, the improvements must be paid for immediately, but the energy-cost savings accrue over many years. It generally takes several years to recover the initial cost of the improvements. Financing allows the building owner to match the stream of cash outflows to the stream of utility-bill savings and to enjoy small increases in net cash flow during the repayment period and larger increases thereafter.

Matching the streams of cash flows over time also can make more-extensive ("deeper") retrofits feasible for a cash-constrained building owner. The increase in net cash flow makes the building worth more, so lenders generally view loans for cost-effective energy-efficiency improvements as a good risk. But there are three factors that limit the usefulness and availability of traditional loans to building owners for energy improvements.

1. If the building changes ownership, the entire balance on the loan comes due and must be paid off by the seller. The seller incurs the full cost of the improvements, but only realizes their benefits to the extent that the value of lower future utility bills are capitalized into the selling price of the property.

2. If the building owner is unable to continue paying both the mortgage and the loan for the improvements, the mortgage gets paid first. In the case of foreclosure, the balance on the first mortgage will be fully paid before the lender on the energy-efficiency loan gets anything.

3. If the building is leased and the tenants are responsible for utility bills, the owner bears all of the cost of the improvements, but the tenant enjoys the reduced utility bills. The owner can only recover the benefits of the improvements to the extent he can raise the rent higher than it would otherwise be after the current lease expires. From the lender's perspective, the energy-cost savings do not improve the borrower's ability to repay the loan.

For these reasons, traditional loans to finance energy-efficiency improvements are available only to building owners with substantial equity in their buildings and strong cash flow before the improvements. They also can be expensive, unless subsidized, and tax revenues to provide subsidies are limited. Building owners with triple-net leases do not have much incentive to achieve energy efficiency if they can't recapture the cost savings.

PACE loans overcome all three of these limitations of the usefulness or availability of traditional financing arrangements by tying the repayment to the property, not the current property owner. The repayment continues through change in ownership, including foreclosure, and a tenant with a triple-net lease makes the loan payments while enjoying reduced utility bills. Local governments can facilitate energy efficiency without having to fund subsidies.

Summary of Findings

This study describes how a commercial PACE program might be implemented in Multnomah County under current Oregon law, estimates the potential size of the market within the county, examines issues related to PACE financing and program implementation, and estimates the economic and environmental benefits and the economic impacts that would result from the work that would be funded if all buildings identified as good candidates for participation in the next five years were to participate.

Under Oregon law, PACE loans would be repaid through a local improvement district (LID) assessment, rather than through property taxes. This allows greater efficiency in administration, allows monthly payments for borrowers, and avoids complications inherent in Oregon's property tax system (discount for prompt payment, pooling of collected revenues, and compression).

Of the 8,378 eligible buildings located in Multnomah county that are larger than 2,000 square feet, we identified 2,762 as good candidates for PACE loans. Of those, 1,016 are larger than 10,000 square feet, and more likely to participate. Larger buildings typically have a better understanding of their operations and energy costs and historically have been more likely to undertake energy-efficiency retrofit activities. Based on the experience of commercial PACE programs elsewhere, it is likely that the program will start slowly and, after a year or so, participation will accelerate. A slow start does not indicate a lack of success for these programs.

If all 2,762 of the buildings we identified as likely candidates for participation in the program's first five years were to participate, they would produce economic benefits valued at over $70 million dollars. These include over $50 million of net economic benefits to building owners and tenants (the difference between energy cost savings and the cost of retrofits) and over $20 million of economic benefits to society through reduced greenhouse gas emissions. The retrofit activity associated with these buildings' participation would stimulate the local economy by increasing local production of goods and services by over $31 million, increasing personal income by over $16 million, and accounting for 278 person-years of employment.

If only the 1,016 candidate buildings that are larger than 10,000 square feet participated, most of the benefits would still accrue. They would produce economic benefits valued at over $54 million dollars. These include over $38 million of net economic benefits to building owners and tenants (the difference between energy cost savings and the cost of retrofits) and almost $16 million of economic benefits to society through reduced greenhouse gas emissions. The retrofit activity associated with these buildings' participation would stimulate the local economy by increasing local production of goods and services by $28 million, increasing personal income by over $12 million, and accounting for 210 person-years of employment.

Implementation of a Commercial PACE Program

Commercial PACE programs have been established in numerous jurisdictions around the country, but none have been around long enough to provide good information for predicting the likely long-term achievement of a commercial PACE in Multnomah County.

The Lawrence Berkeley National Lab's March 2011 policy brief, "Property Assessed Clean Energy (PACE) Financing: Update in Commercial Programs" reports that at that time, there were 17 programs established around the country and four were operational. Those four programs, in Sonoma and Placer Counties and Palm Desert California and in Boulder County, Colorado, had approved 71 projects for a total of $9.7 million. Since then, more states have passed enabling legislation and additional jurisdictions have established programs. We identified the following operational programs:

- San Francisco, California
- Los Angeles, California
- Berkeley, California
- Sonoma County, California
- Sacramento, California
- Placer County, California
- Palm Desert, California
- Miami-Dade County, Florida
- Edina, Minnesota
- Ann Arbor, Michigan
- New York, New York
- Boulder County, Colorado

How the "Property Assessed" Aspect of PACE Would Work in Multnomah County

Under Oregon Law (HB 2626, passed in 2009) the property assessment would take the form of a Local Improvement District (LID) assessment, rather than a property tax levy. Participating property owners would receive a LID assessment from the County Finance and Risk Management Division, which would be separate from their property tax bill. This would allow assessments to be billed monthly, if desired. It also avoids several complications inherent in Oregon's property tax system. Among those complications are provision for a 3 percent discount for prompt payment of property taxes and "pooling", under which uncollected levy amounts in a county are spread proportionally over all taxing districts in the county. These complications would prevent the collection of the full amount levied, even if all PACE participants paid the full amount due on their property tax bills.

HB2626 does allow for individual PACE liens to be certified to the County Assessor if they become delinquent and then placed on the property's tax bill. This procedure is already used in Multnomah County in the case of delinquent City sewer bills and could be used for other LID assessments as well if they become delinquent. It presumably would be up to the County whether to certify the full remaining balance or only the delinquent amount. Once a lien is certified to the Assessor, two things are essentially guaranteed:

- the full amount due will not be received because of statutory discounts and pooling procedures and
- almost all of the amount due will be received because of pooling procedures

The provision for certifying delinquent liens enhances the credit-worthiness of the debt without the disadvantages of using the property tax system to collect from properties that are not delinquent.

In all cases, two important features of PACE financing are preserved:

- The assessment and lien are tied to the property and not to its current owner, so sale or foreclosure do not cause the assessment to come due in full.
- For buildings with triple-net leases, the tenant who enjoys the benefit of reduced utility bills also bears the burden of paying for the improvements that reduced the utility bills.

In no case would a PACE assessment affect compression, even if it were to be collected through property taxes. Local Improvement Districts are not a part of compression. The Multnomah County Assessor's office stated that when delinquent sewer bills from the City of Portland are certified to the assessor, those do not affect compression, and that delinquent LID assessments would be treated the same way.

The enabling legislation does not specify how the local improvement districts should be defined. Two possibilities seem to make the most sense:

- define a district that includes the entire county, set each property's assessment to zero, and then change the assessments on individual properties as they participate, or
- define a unique one-property district for each property that participates

Defining a district or districts in a way that excludes otherwise-eligible properties from participating seems to make less sense.

Financing for PACE

PACE programs in other jurisdictions obtain the capital to fund their loans in three ways:

- Jurisdictions may issue general-obligation or revenue-anticipation bonds. It seems unlikely that Multnomah County will be eager to use its limited bonding authority on a PACE program.
- Individual property owners may secure funding from the lender of their choice. Owner-arranged financing can help overcome the reluctance of some mortgage holders to consent to a PACE loan, as they are eager to consent if they are the ones making the PACE loan.
- A jurisdiction may establish an arrangement with a financial institution that allows the jurisdiction to make loans one at a time and then packages the notes into securities that are resold to investors. This kind of arrangement can work well for numerous small loans, as in a residential PACE program.

For a commercial PACE program in Multnomah County, it appears that owner-arranged financing would be the most practical arrangement for both the county and for borrowers who need to secure the

consent of their mortgage holder. Offering the existing mortgage holder an opportunity to fund the PACE loan has been shown in other jurisdictions to greatly increase the likelihood of obtaining consent.

Properties that Could Participate

To participate in a commercial PACE program, a property must be located within Multnomah County, paying property taxes (not exempt or delinquent), in commercial use, and able to benefit from cost-effective energy-efficiency measures. Other jurisdictions with commercial PACE programs commonly impose additional restrictions, including:

- the property must be producing income for its owner (even if the owner is a non-profit)
- the existing mortgage holder(s) must consent to the PACE lien
- the property must not have been in default, foreclosure, or delinquent in property tax payments or LID assessments in the last five years or the tenure of the current owner, whichever is less
- the property must not be subject to any involuntary liens of judgments
- the applicant must be the legal owner of the property and all legal owners must sign the application
- there must not be any current or pending litigation regarding property ownership
- single-family residential rental properties are excluded
- multi-family residential properties (especially those with fewer than five units) are excluded from some commercial PACE programs
- If PACE financing for renewable energy generation is being sought, applicants must demonstrate that they have achieved energy efficiency targets before investing in renewables

Multifamily residential buildings were excluded from the market assessment in this study and we expect that few would participate in a commercial PACE program. Some multifamily buildings are essentially single-family units that are attached to each other. Those, and most high-rise condos, which have separate heating and cooling for each unit, would be better suited to a residential PACE program. In almost all non-condo buildings, residents pay their own utility bills, but do not pay LID assessments directly.

Some multifamily residential buildings might be good candidates for PACE financing, though. Those are older buildings with central heating in need of upgrades, high-rise buildings with significant energy costs for common areas, and buildings in need of retrofits to their shell. We did not include multifamily buildings in our market assessment model, because they would require a different approach and data that was not available for this study, but we see no reason to exclude them from the program. Any multifamily buildings the program did pick up would be in addition to the buildings counted in the market assessment in this study.

For non-residential buildings, there are three general types of arrangements between owners and occupants:

- In owner-occupied buildings, the owner is the tenant.
- In buildings with full-service leases, the owner pays the utility bills,

property taxes, and LID assessments out of rent collections.

- In buildings with triple-net leases, the tenant pays utility bills and their share of property taxes and LID assessments separately from rent (building insurance is the third "net").

For both owner-occupied and full-service buildings, the owner of the building enjoys the energy-cost savings and pays the cost of retrofits. These buildings can benefit from any type of financing for retrofits, including PACE. Buildings with triple-net leases benefit only from PACE financing because with traditional financing, the owner pays for the retrofits and the tenant enjoys the lower utility bills. We confirmed with the Building Owners and Managers Association of Oregon (BOMA), which writes the standard lease agreements used by many building owners, that LID assessments are treated the same as property taxes in standard triple-net lease agreements.

Measures that Could be Financed

To qualify for PACE financing, the improvements must be reasonably expected to provide cost savings from energy efficiency in excess of their cost over a period of time shorter than the loan term and without assuming real price increases (beyond inflation) for energy. Although natural gas prices have recently fallen in nominal terms, it is reasonable to expect that energy costs will at least keep pace with inflation and will likely grow faster in the long run. Adopting any particular forecast of real energy-price increases, though, runs the risk of leaving participants with negative net cash flow should energy prices increase less quickly than the forecast.

Qualifying improvements must also be permanently attached to the structure and have a useful life in excess of the repayment period. For example, light fixtures could qualify, but light bulbs would not. For a lighting retrofit that included new fixtures that require different tubes, the cost of the initial set of different tubes could be included as necessary to make the new fixtures work. In general, repair, adjustment, or cleaning of existing equipment would not qualify.

In advance of applying for PACE financing, property owners should be required to obtain an energy audit (and the County should specify standards for the audit and the auditor) and then obtain at least one firm bid to complete the cost-effective improvements identified in the audit. It may be appropriate to require more than one bid, at least for some types of projects.

Applicants may be required to seek all available incentives and rebates applicable to the proposed work and the amount financed under PACE should be net of available incentives, rebates, and tax credits. The County should ensure that the program administrator works with utilities and other programs to ensure that participants are aware of available incentives, rebates, and tax credits and that those are taken into account when determining cost-effectiveness.

The County should specify some amount of measurement and verification requirements for participating projects and the program administrator should ensure that funded projects comply with those requirements. The data collected will allow the County to demonstrate the achievements of the program, to more-effectively market the program to potential future applicants, and to contribute to the

overall body of evidence supporting retrofit activities.

Examples of improvements allowed in other jurisdictions include:

- high-efficiency lighting and associated controls and sensors
- HVAC equipment or controls upgrades
- BAS/BMS/EMS installation or upgrade
- high-efficiency pumps and motors
- high-efficiency chillers, boilers, or cooling towers
- CO_2 sensors and demand-controlled ventilation
- elevator modernization
- window replacement or treatment
- insulation
- roof treatment, included vegetated roofs

Examples of improvements not allowed in other jurisdictions include:

- cooking equipment
- refrigeration equipment that is not attached to the structure
- portable equipment such as photocopiers

Contractors Who Could Participate

In residential PACE programs, it is often useful to provide potential participants with a list of approved contractors. Residential programs typically fund a large number of relatively small, very-similar projects. Commercial programs, on the other hand, typically fund a smaller number of larger, more complex, and unique projects. It is not feasible for the County to evaluate each potential contractor's suitability to perform the full range of potential commercial retrofits in advance, nor is it necessary, as managers of commercial buildings, unlike homeowners, typically have experience evaluating contractors' proposals and managing projects. The County should require that contractors be properly licensed, bonded, and insured. The County also should to set standards for energy audits and require that auditors have appropriate certification.

The larger commercial PACE projects will likely employ large, integrated energy service companies (ESCOs). The ESCOs likely will be effective partners for marketing the PACE program to larger buildings and can offer performance guarantees that make obtaining financing easier for building owners. To obtain the full benefits of a commercial PACE offering, though, the County will need to also gain the participation of local contractors who would be employed by medium-sized and smaller buildings.

One limitation suffered by commercial PACE programs that are funded by stimulus grants and/or bonds sold by public agencies is that the projects spending those funds are subject to Davis-Bacon Act provisions (or the State's equivalent), which can result in higher project costs and fewer feasible projects. Owner-arranged financing allows the use of any qualified contractor, which can result in lower costs for some projects, and more feasible projects.

Transferability of PACE Liens

A PACE lien, unlike a lien securing a traditional loan, would remain with the property and transfer automatically to the new owner should the property be sold. The lien would be recorded and potential purchasers would automatically become

aware of it during a title search, if they had not already been informed by the seller. We expect that sellers would explain both the lien and the energy-cost savings resulting from the improvements well before a title search took place, but in any case, it would not come as a surprise to the purchaser after the sale. If a buyer's lender wanted to pay off the PACE loan and incorporate that amount into the new mortgage, they could. The PACE loan would not have a pre-payment penalty.

Issues with First Mortgage Holders

We recommend that the County require the consent of existing mortgage holders as a condition of participation. While some advocates argue that the PACE obligation is not a secured loan subject to the terms of the first mortgage, but rather a local-government assessment like any other taxing or local improvement district, that theory has not been tested in court and may fail, leaving participants in default on their mortgages if they did not obtain consent. If consent is not required, it is likely that bankers will oppose the PACE program and may refuse to make loans under it. On the other hand, if consent is required, experience in other jurisdictions has shown that bankers will support the program and some will actively market PACE loans. Experience elsewhere has also shown that when building owners approach their bank for consent, the bank may seek to finance the PACE loan themselves, in addition to the mortgage.

Lender Education

Large national banks already are aware of commercial PACE and some have staff experienced in evaluating and approving PACE loans. In California, PACE programs have found that some local banks understand and support PACE and others have no interest or resist consenting to PACE loans. Fortunately, small banks are unlikely to hold mortgages on commercial buildings. If Multnomah County does implement a commercial PACE program, it should undertake to identify banks that hold mortgages on commercial buildings in the county and to educate those banks about how the program works and the reduced risk to mortgage holders of PACE financing relative to other types of loans for energy-efficiency improvements.

The County, working with its partners, also should undertake to educate all potential lenders in the area about PACE financing, its advantages to lenders, its advantages to building owners, and how they could market it to their customers.

Administrative Costs and Recovery Mechanism

Administrative costs incurred by the County could be small and could be fully funded by fees charged to participants, though the County would need to spend more than they collect on an annual basis early in the program's life and make it up with fees collected later.

Independent administrators are managing PACE programs around the country and they have staff with experience in all aspects of setting up a program, marketing, working with utilities, working with lenders, working with local-government staff, evaluating applications, and making it all work smoothly. Their staff can be shifted between jurisdictions as workloads change. Using an independent administrator would allow the County to get the program underway more quickly while tying up fewer County resources.

Some independent administrators seek to provide a fully-integrated solution, including

relationships with particular energy service companies and lenders. These integrated solutions can be particularly useful for residential PACE programs, but since there are significant advantages to providing participants with the ability to arrange their own financing and select their own contractor, a fully-integrated solution may not be the best fit for a commercial program.

Oregon law will almost certainly result in lower administrative costs for the County than have been experienced in California for programs that use owner-arranged financing. California's system requires that the local jurisdiction issue a bond and set up a taxing district for each project to get the project onto the property-tax rolls. The bond is then sold to the owner-arranged lender (not offered to the public). This imposes bond counsel and underwriting costs for each project that would not be incurred in Oregon with its LID-based system.

Performance Guarantees

Large energy service companies offer performance guarantees, which guarantee a stated amount of energy savings on large projects. Performance guarantees are of value to building owners and lenders, but can add up to 20 percent to the cost of a project. While we wouldn't discourage participants from using performance guarantees when it suits them, we recommend against requiring them, especially for smaller projects. Requiring performance guarantees on every project would reduce both the number of participants and the energy savings that could be achieved by the program.

Necessity of Credit Enhancement or Debt-Service Reserve Fund

In conversations with independent administrators who manage commercial PACE programs elsewhere, we have been told that unless the County will be selling bonds to finance the program, there is no need for credit enhancement or a debt-service reserve fund. California programs with owner-arranged financing do use debt-service reserve funds (many established with ARRA money), but that is because the way the California law works. The local jurisdiction must issue a bond for each participant (which involves underwriting and bond counsel expenses), sell it to the lender, and then establish a tax district to repay the bond through a property-tax assessment. Oregon's law, making use of local improvement districts, bypasses these complications and does not require that local jurisdictions issue bonds. The provision under Oregon law for a delinquent PACE LID assessment to be certified to the County Assessor and collected through the owner's property tax bill provides the assurance of collection that lenders need without tying up money in a reserve fund.

Accounting Considerations

A ruling is expected from the Financial Accounting Standards Board in October of this year that will clarify whether the value of future assessments under a PACE contract needs to be represented as a liability on the participant's balance sheet. In other jurisdictions with active commercial PACE programs, many participants have been told by their accountants that PACE-related obligations should be treated the same as any other property-tax or LID assessment, that is they should be considered an operating expense in the year in which they are billed and not recorded as a liability. Those accountants

expect the pending ruling to confirm their opinion. The ability to keep their obligation off their balance sheet could be a strong incentive for some building owners to participate in a commercial PACE program.

Notifying Utilities

Under Oregon law, utilities must be notified before a property can participate in a PACE program. This is desirable because it allows utilities to inform the owner about available utility incentives, potentially reducing the amount that would need to be financed under PACE and making the project more cost effective for the owner.

Interaction with Existing Programs and Market Participants

PACE programs typically require that participants make use of all available rebates and incentives or provide a good reason for not doing so. This requirement helps ensure that the PACE program complements existing programs. The State of Oregon currently offers loans through its SELP program and is working on determining whether a SELP loan could be one source for owner-arranged financing under a PACE program. Numerous opportunities exist for joint marketing with existing programs, especially programs directed at encouraging energy efficiency in existing commercial buildings.

Using PACE to Fund Renewable Energy Projects

A commercial PACE program in Multnomah County could finance renewables. From a public policy perspective, reducing waste through energy conservation is a higher priority than producing additional energy and wasting some of it. Commercial PACE programs in other jurisdictions typically require that cost-effective energy conservation measures be implemented before a property can qualify for PACE financing of renewables.

Using PACE to Fund Water Conservation Measures or Seismic Retrofits

Current Oregon law allows the use of PACE for energy conservation and renewable energy projects. It makes no provision for water conservation measures or seismic retrofits. If the law is amended by a future legislature, those measures could be added to the list of qualifying projects.

Rate of PACE Program Growth

Interviews with administrators of commercial PACE programs have led us to conclude that few commercial buildings will have enrolled by the end of the first year. After the first year or so, applications will accelerate. It takes time for building owners, building managers, lenders, contractors, and utilities to become familiar with the existence and advantages of the program. The County could reduce the amount of time required by educating building owners, lenders, contractors, and other market participants.

Risks to the County

A commercial PACE program could be implemented with no significant risks to the County. The combination of owner-arranged financing and the County's ability to certify delinquent LID assessments for collection through property tax bills eliminates the need for the County to assume any obligation associated with the lending. Since the County would not need to issue bonds, it also eliminates the need for establishing a reserve fund, purchasing credit enhancement, or consuming the County's bonding capacity. If there are

significant defaults, there could be a small effect on revenues distributed to the County from its property tax levies, via pooling, but those would be mostly recovered in future years as the delinquent amounts are eventually collected.

Improvements funded through a commercial PACE program would be owned by the building owner, not the County, and the County would have no obligation to maintain them, even in the event of default.

Several organizations offer independent administration services for commercial PACE programs. The County could negotiate an agreement with one of these organizations to fund the cost of handling applications and processing the paperwork through fees to borrowers, which could then be included in the amount financed. These organizations have experienced staff who can provide services to jurisdictions and applicants around the country as needed. Using an independent administrator would eliminate the risks associated with employing additional County staff to handle the paperwork, especially given uncertainty about the number and complexity of applications the County might receive. An independent administrator also will have liability insurance to cover errors or omissions on their part and their experience will help ensure that lenders' requirements are met.

Analysis of the Potential for Commercial PACE Activity in Multnomah County

Overview

The goal of this analysis is to measure the size of the market potential for PACE-financed energy retrofits in the commercial property market in Multnomah County, Oregon. From the underlying logic of the PACE funding vehicle, it is clear that the candidate population of PACE-compatible buildings must have the characteristics of having cost-effective retrofit opportunities, a building owner who will benefit from the funding facility, and a knowledgeable primary lender. Cost-effective retrofit opportunities are those for which the present value of energy-cost savings exceeds the present value of payments for the retrofit (net of rebates and incentives, but including engineering and financing costs). Measuring these attributes directly is impossible in the setting of a small study. Hence, we rely on proxies of these factors to assess the PACE potential:

1. A building owner with easy access to prime credit already has an incentive to pursue cost-beneficial energy retrofit opportunities. Hence, one aspect of a building that affects the dynamics of PACE implementation is the credit access enjoyed by the building owner. It is difficult to evaluate the credit access of property owners in general, let alone identify those that are strongly credit constrained. However, smaller and less valuable buildings are likely less attractive as security and their owners more likely to be smaller business entities and, therefore, less attractive to commercial lenders.

2. The attractiveness of PACE-financed retrofits is greater if the building has not already enjoyed energy retrofit or control systems upgrades. These prior activities will likely have already "picked the lowest hanging fruit", leaving less building-value enhancement from additional

retrofit activity, which will moderate demand for PACE facilities.

3. Whether a particular retrofit activity is cost-effective or not is key to any retrofit decision, whether PACE-funded or not. Measuring the net present value of energy savings, over the cost of retrofits, is a complicated engineering and financial computation that we cannot emulate precisely in this small study. However, by estimating the current level of energy use by a building, and the value of the building, we can develop rough screens that are indicative of the prospect of cost-saving opportunities and the relative value-enhancement potential.

4. To the extent that the PACE program is facilitated by lender knowledge and participation, larger lenders are likely better able to have the specialized energy conservation and commercial mortgage market expertise simultaneously. Smaller banks could conceivably specialize in PACE facility activity, but the relatively high risk and lower liquidity of primary commercial lending makes such specialization less likely.

Implications for This Analysis

The discussion above has several implications for our approach to measuring PACE potential in Multnomah County. First, we need to identify those buildings in the county that are to be considered commercial properties. For the purposes of evaluating the PACE potential, we define commercial properties as non-residential properties that are subject to property tax and host a non-industrial business activity. Thus, we include properties as follows:

1. Buildings that provide office, warehousing, retail, health care, food service, and services are included as commercial properties. This generally corresponds with the County Assessor's distinction between properties whose value is determined by mass appraisal (comparable sales) valuation versus valuation by analysis of the value of business activity conducted on the property. The County Assessor's building activity characterizations are used to make this determination in a manner consistent with energy efficiency study practice.

2. We need a method of measuring the extent to which properties are likely to already have enjoyed energy efficiency-oriented retrofits. Given the resources of this small study, it is not possible to measure this prior penetration directly, by survey or any other means. There is no information maintained in the Assessor's data, and utility company records regarding this attribute are not available publicly. Data from programs initiated by entities like the Energy Trust of Oregon do not capture privately-initiated, unsubsidized retrofit activity. Thus, we follow the practice of others in relying on evidence from special surveys conducted specifically for the purpose of identifying the relevant characteristics of a representative inventory of buildings, their energy use, and past retrofit activity. These Commercial Building Energy Surveys have been conducted locally (in the Pacific

Northwest) and nationally. These surveys allow us to assess the extent of energy retrofit penetration and to develop relationships that can be used to predict energy usage for the entire commercial property stock in the county.

3. We need a method of assessing the retrofit potential under a PACE program of the as-yet-un-retrofitted properties. This is difficult to do precisely without a detailed engineering and financial-feasibility assessment. However, there is some evidence from prior studies of the adoption of subsidized retrofit programs that can be used to develop threshold characteristics of those properties likely to benefit from energy retrofit under conditions of improved access to financing as offered by programs like PACE. These thresholds are necessarily rough, and dependent on the interplay of retrofit fit costs, and the benefits to the retrofit, which depend upon the size of the building, the amount of energy that is potentially saved, and the impact of that saving on the market competitiveness and profitability of the property. The development of these thresholds is discussed later.

4. Finally, we must assess the share of retrofit potential that will be attracted to and be able to be served by a PACE-type program. We do not believe that the PACE program is needed by building owners that have ready access to credit or self-finance capabilities. This does not mean that they will not use the program, but we believe the necessity of using the program is less clear. Thus, the PACE share of the future retrofit market is defined to some degree by credit constraints. To the extent that the participation of the new or extant mortgage holder is important to facilitating the PACE finance arrangements, the presence in the market of relatively large-scale mortgage lenders may be a relevant criterion. We are unable to obtain information on the share of mortgages held by lender type or name in the county. However, we did seek out the opinion of mortgage credit analysts who offered rough estimates of the scale of market presence of large lenders.

Data and Methodology

In this section, we discuss the specific data and methods used to develop a PACE screening process and apply it to County commercial buildings. The primary data sources are as follows:

1. *Multnomah County Assessor's database*, 2011. This database contains information on all properties in the County, including a descriptor of the primary business activity, the building size in square feet, and the real market value of land and of improvements. These data are used to scale and describe the commercial building population, and link the individual buildings to other measurement procedures. Numerous screens are applied to avoid including buildings not eligible for property-assessed levies (such as non-tax-paying entities), vacant parcels zoned for commercial use, etc.

2. *Pacific Northwest Commercial Building Stock Assessment (CBSA)*, 2009. This survey, updated in 2009 by Ecotope, includes information on the energy use and retrofit activity of 2,061 commercial buildings in Oregon, Washington, and Idaho. The survey was too small to usefully characterize all of the properties by business activity and other characteristics in the county. It also used unconventional business activity descriptors. However, it did provide some cross checks and validation of the relevance of the data from a larger, national study that was used more intensively.

3. *Commercial Buildings Energy Consumption Survey (CBECS)*, 2008. This database was developed by the US Department of Energy. This large survey, though national in scale, contains higher resolution information on building activities and energy retrofit and renovation information than the smaller CBSA survey. The use of weather and regional indicators in the database permit statistical control to local, Portland conditions, and a more comprehensive set of building energy usage characteristics facilitates statistical emulation of energy usage of the commercial properties in the Multnomah County population.

4. *Impact Evaluation of Existing Commercial Buildings Program*, 2008-2009. This study, conducted on behalf of the Energy Trust of Oregon, contains data on energy retrofits of various types including data that permits creation of a range of energy savings rates that retrofits offer. This data was not comprehensive enough by building use and size to be able to develop feasibility screens directly, but was used to provide general guidance in constructing estimates of future retrofit activity in the Multnomah County commercial property population.

5. *REIS Multnomah County Commercial Building Sample*. This database is a sample of 350 properties that provides current information on building market value, lease rates, and occupancy. It is a proprietary database, obtained under a non-disclosure agreement that provides private information on building business performance. It can be matched to the Assessor's database through the property address. This small sample is used to provide insight into current market conditions that might bear upon the usefulness of the PACE type facility.

The following steps were followed to form the screening method to be applied to the commercial building population developed from the Assessor's database.

1. *Refine Multnomah County Commercial Building Inventory*. The Assessor's database was used to isolate the commercial buildings from other buildings in the database. Each building record is assigned to a standard, high-level Principle Business Activity (PBA) classification scheme for easier linking to other databases and measurement steps. The result is a database that contains a building ID number, a Primary Business Activity

(PBA) classification number that is consistent with US DOE, NREL, and other national classifications, building construction date, building size (in square feet) and building market value. Eliminating buildings under 2,000 square feet yielded a building population relevant to our study of 8,378 buildings. Table 1 shows the counts of these buildings by building use and size class.

Table 1: Count of Eligible Buildings in Multnomah County

Building Use	Building Size Class (square feet of building floor area)									
	2,001 to 5,000	5,001 to 10,000	10,001 to 25,000	25,001 to 50,000	50,001 to 100,000	100,001 to 200,000	200,001 to 500,000	500,001 to 1,000,000	All Over 2,000	All Over 10,000
Office	575	435	370	173	93	67	53	8	1,774	764
Warehouse	301	610	578	302	189	87	43	5	2,115	1,204
Food sales	0	0	3	12	4	0	0	0	19	19
Outpatient health care	7	1	3	0	1	0	0	0	12	4
Public assembly	30	29	18	5	0	0	0	0	82	23
Food service	422	117	19	5	0	0	0	0	563	24
Inpatient health care	0	0	1	0	0	0	0	0	1	1
Nursing	2	14	39	39	33	12	8	0	147	131
Lodging	10	28	35	38	26	15	7	0	159	121
Strip shopping mall	5	52	55	12	4	1	0	0	129	72
Enclosed mall	6	10	14	9	10	7	2	2	60	44
Retail other than mall	972	560	321	96	41	38	4	0	2,032	500
Service	537	153	53	5	1	0	0	0	749	59
Other	302	106	71	32	14	7	4	0	536	128
All Commercial Uses	3,169	2,115	1,580	728	416	234	121	15	8,378	3,094

Source: Multnomah County Assessor, ECONorthwest

2. *Parameterize and Apply a Model of Building Energy Consumption*. In this step, we applied an econometric technique used by ECONorthwest in energy conservation studies to predict building energy consumption. We applied this model to the national CBECS survey database, which yields coefficients linking building characteristics, PBA classification, heating and cooling degree days, and other regional and building indicators to the energy consumption per square foot of a building. We then apply the resulting parameters to each of the buildings in the county commercial building dataset. We are then able to assign a unique energy consumption measure to every building.

3. *Estimate the Share of Already Retrofit or Renovated Buildings, by PBA and Building Size Class*. The national CBES database contains indicator variables for various types of heating, cooling and lighting system control retrofits and

renovations of lighting, windows, insulation, and other building features for energy efficiency purposes. These data are used to construct the count of measures present by PBA and size class, adjusted for region and heating/ cooling zone. These calculations are used to estimate the share of the county commercial buildings that have been retrofit or renovated, by PBA and building size class, in the Portland region. Depending upon the type of measure, the share ranges from 15 percent to nearly 43 percent of all buildings. Since the PACE program is likely to be most useful in moderate to major retrofit settings, the installation of systems was used to define the share of already retrofit buildings. This share is approximately 15 percent across the range of PBA and building size classes in the Multnomah County population. Table 2 displays the count of buildings by building use and size class that we expect to lack prior significant retrofit activity using this threshold technique.

Table 2: Estimated Count of Eligible Buildings Without Prior, Major Retrofits

Building Use	Building Size Class (square feet of building floor area)									
	2,001 to 5,000	5,001 to 10,000	10,001 to 25,000	25,001 to 50,000	50,001 to 100,000	100,001 to 200,000	200,001 to 500,000	500,001 to 1,000,000	All Over 2,000	All Over 10,000
Office	575	395	311	83	52	10	16	2	1,444	474
Warehouse	232	610	537	268	151	52	31	5	1,886	1,044
Food sales	0	0	3	0	0	0	0	0	3	3
Outpatient health care	5	1	3	0	0	0	0	0	9	3
Public assembly	30	23	15	5	0	0	0	0	73	20
Food service	399	100	19	3	0	0	0	0	521	22
Inpatient health care	0	0	0	0	0	0	0	0	0	0
Nursing	0	0	0	0	22	4	0	0	26	26
Lodging	10	28	35	27	26	13	6	0	145	107
Strip shopping mall	5	52	55	12	4	1	0	0	129	72
Enclosed mall	0	0	0	0	10	0	2	2	14	14
Retail other than mall	972	485	257	77	0	38	2	0	1,831	374
Service	520	153	44	3	1	0	0	0	721	48
Other	302	0	0	32	0	4	2	0	340	38
All Commercial Uses	3,050	1,847	1,279	510	266	122	59	9	7,142	2,245

Source: ECONorthwest

4. *Identify Buildings Likely to Enjoy Future Retrofit*. In this step, the individual buildings in the county population are assigned a score that reflects the relative value of a retrofit to the buildings owners. This indicator, called the Energy-to-Value Ratio (EVR) is the ratio of total energy consumed by the building on an annual basis relative to the real

market value placed on the building by the Assessor. The logic of this ratio is that a building that uses a large quantity of energy per dollar of value has a greater propensity to enjoy significant value enhancement by saving some fraction of this energy. This is only part of the calculus, of course, for determining the economic feasibility of a retrofit. The other significant elements are the effectiveness (conservation rate) and the cost of the retrofit activity. Absent specific information on the effectiveness and cost of the retrofit, it is not possible to refine the EVR to accommodate this side of the equation. This is approximated by defining threshold building sizes and defining a minimum level of the EVR. With little to guide us, we assumed that candidates for PACE retrofits within the next five years will have an above-average EVR for buildings of their size and use. Table 3 shows the estimated count of such buildings by building use and size class.

Table 3: Estimated Count of Eligible Buildings Without Prior, Major Retrofits and With Above Average Energy-to-Value Ratios

Building Use	Building Size Class (square feet of building floor area)									
	2,001 to 5,000	5,001 to 10,000	10,001 to 25,000	25,001 to 50,000	50,001 to 100,000	100,001 to 200,000	200,001 to 500,000	500,001 to 1,000,000	All Over 2,000	All Over 10,000
Office	160	198	184	83	50	10	12	1	698	340
Warehouse	36	52	84	51	30	21	10	2	286	198
Food sales	0	0	2	7	0	0	0	0	9	9
Outpatient health care	0	0	1	0	0	0	0	0	1	1
Public assembly	14	10	7	1	0	0	0	0	32	8
Food service	223	74	9	0	0	0	0	0	306	9
Inpatient health care	0	0	1	0	0	0	0	0	1	1
Nursing	2	8	23	0	22	4	0	0	59	49
Lodging	6	17	19	25	11	8	0	0	86	63
Strip shopping mall	3	42	41	7	2	0	0	0	95	50
Enclosed mall	0	0	1	1	3	2	2	1	10	10
Retail other than mall	386	205	144	46	19	15	2	0	817	226
Service	220	65	21	0	0	0	0	0	306	21
Other	11	14	21	8	0	1	1	0	56	31
All Commercial Uses	1,061	685	558	229	137	61	27	4	2,762	1,016

Source: ECONorthwest

All of these steps contribute to the screening of the County commercial building inventory developed in the first step.

Estimates of the Scale of Candidate PACE Market Penetration

Market penetration is measured as the number of commercial buildings in the county that are good candidates for

participation in the next five years. This time horizon is limited simply to avoid the task of estimating the rate of re-retrofits of buildings that might occur in the future if technology provides greatly enhanced opportunities for energy savings and/or the price of energy rises dramatically relative to retrofit costs, relative to the current conditions.

The number and characteristics of PACE candidate buildings is developed by applying the findings from the analytical steps described in the previous section of this report. It is essentially a progressive screening process and, by necessity, requires application of our own or others' expert judgment at some steps. The market penetration estimation process yielded the following calculations

1. The gross size of the candidate population, derived by applying the share of as-yet-to-be-retrofit buildings estimated from national data to the County data after regional and weather adjustment. Application of this share yields the result in Table 2.

2. The proportion of buildings with an above-average EVR is obtained for each PBA and building size class. This proportion is then applied to the number of gross candidates in each PBA and size class pair. (See Table 3.) There are 2,762 candidates after applying the EVR filter.

3. Building size class filters are applied to refine the candidate PACE building population further to accommodate the factors of retrofit costs and credit access constraints. These are competing considerations, in that the cost of a given type of retrofit, while generally roughly proportional to building size at moderate to large building size, may be prohibitively large for the smallest building classes. There is also likely a large-building screen as well, since our assumption of an unsubsidized PACE process is less likely to offer material, effective financing cost improvements of investor/owners of larger buildings.

   a. Application of a lower-bound building size screen. Discrete choice modeling applied to the historical retrofit data in the CBECS data yields evidence that, under historic conditions, buildings with fewer than 10,000 square feet have significantly lower probabilities of enjoying significant retrofit or renovation than larger buildings. Although the whole purpose of the PACE program is to improve upon those historic conditions (at least in terms of financing) we nonetheless feel that these smallest building classes are less likely to be able to bear the fixed costs of developing financial arrangements and implementing the retrofit. Retrofit costs are approximately proportionate to building size, but the fixed costs of planning and implementing may discourage retrofitting of smaller buildings. It is unclear how much of the lower likelihood of past retrofit activity in smaller buildings is attributable to fixed costs and how much is attributable to difficulty in obtaining financing. The more it is the latter, the more smaller

buildings are likely to participate in PACE, which helps overcome the financing barriers. Table 3 shows that of the 2,762 buildings larger than 2,000 square feet that we expect to be good candidates, 1,016 are larger than 10,000 square feet.

b. Consideration of an upper-bound building-size screen. Historical evidence indicates that retrofit activity increases strongly with building size, likely because of relative ease of access to financing (including self-financing) for cost-effective retrofit programs. Steps 1 and 2 above eliminated 104 of the 135 eligible buildings over 200,000 square feet. The remaining 31 buildings may not have already retrofitted because they do not enjoy the access to capital that their peers do, and so may be good candidates for PACE financing.

4. The application of the final consideration in the screening process is the consideration of the participation of the first mortgage lenders in the program. We believe that the participation of the mortgage lender is critical to the PACE process. Discrete inquiries made of major lender staff indicates that the large lenders with a local presence may hold around 25 percent of commercial mortgages. Most of the rest of the mortgages likely are held by other institutions such as insurance companies, pension funds, or smaller banks.

Of the 8,378 eligible buildings in Multnomah County, we expect that 2,762 buildings are likely candidates for PACE financing in the next five years. Of those, 1,016 are over 10,000 square feet and we are more confident that those will be able to overcome the fixed costs of participation. We expect that about 25 percent (254) of those have first mortgages held by large, knowledgable lenders, and those 254 buildings, along with some unknown number of other buildings that do not have a mortgage, will be the first to participate.

The proportion of eligible buildings that pass our filters varies greatly by building use, and much less by building size. Strip shopping malls, hotels, grocery stores, office buildings, free-standing retail, and nursing homes all exhibit above-average likelihood of being good candidates for PACE-financed retrofits. Buildings between 10,000 and 25,000 feet in size also appear to be more likely than others to participate. Historical retrofit data indicate that buildings in this size class are more likely than smaller buildings to have already retrofit, but less likely than larger buildings, which tend to have better access to capital. Buildings in the 10,000 to 25,000 square foot range may find PACE financing particularly appealing. The percentages of eligible buildings by building use and size class that passed our filters are shown in Table 4. These percentages may be useful for targeting the initial marketing efforts of a PACE program.

Table 4: Estimated Proportion of Eligible Buildings Without Prior, Major Retrofit and With Above-Average Energy-to-Value Ratios

Building Use	Building Size Class (square feet of building floor area)									
	2,001 to 5,000	5,001 to 10,000	10,001 to 25,000	25,001 to 50,000	50,001 to 100,000	100,001 to 200,000	200,001 to 500,000	500,001 to 1,000,000	All Over 2,000	All Over 10,000
Office	28%	46%	50%	48%	54%	15%	23%	13%	39%	45%
Warehouse	12%	9%	15%	17%	16%	24%	23%	40%	14%	16%
Food sales			67%	58%	0%				47%	47%
Outpatient health care	0%	0%	33%		0%				8%	25%
Public assembly	47%	34%	39%	20%					39%	35%
Food service	53%	63%	47%	0%					54%	38%
Inpatient health care			100%						100%	100%
Nursing	100%	57%	59%	0%	67%	33%	0%		40%	37%
Lodging	60%	61%	54%	66%	42%	53%	0%		54%	52%
Strip shopping mall	60%	81%	75%	58%	50%	0%			74%	69%
Enclosed mall	0%	0%	7%	11%	30%	29%	100%	50%	17%	23%
Retail other than mall	40%	37%	45%	48%	46%	39%	50%		40%	45%
Service	41%	42%	40%	0%	0%				41%	36%
Other	4%	13%	30%	25%	0%	14%	25%		10%	24%
All Commercial Uses	33%	32%	35%	31%	33%	26%	22%	27%	33%	33%

Source: ECONorthwest

The 2,762 candidate buildings larger than 2,000 square feet contain 52.6 million square feet of floor space and consume 5.3 quadrillion BTUs of energy per year. The 1,016 candidate buildings larger than 10,000 square feet contain 544.3 million square feet of floor space and consume 4.3 quadrillion BTUs of energy per year. The identified candidate buildings account for about 28 percent of the floor area and about 32 percent of the energy use by commercial buildings over 2,000 square feet in Multnomah County. Table 5 breaks down building area and energy usage of the candidate buildings by building use.

Table 5: Building Area and Estimated Annual Energy Usage for Identified Candidate Buildings

Building Use	Building Area (square feet)		Annual Energy Usage (MBTUs)	
	Over 2,000 square feet	Over 10,000 square feet	Over 2,000 square feet	Over 10,000 square feet
Office	17,187,610	15,258,904	2,150,407	1,936,942
Warehouse	12,354,653	11,828,370	466,354	449,557
Food sales	334,759	334,759	84,159	84,159
Outpatient health care	15,101	15,101	1,902	1,902
Public assembly	237,975	111,539	16,365	8,173
Food service	1,383,479	143,924	402,810	23,877
Inpatient health care	22,876	22,876	6,265	6,265
Nursing	2,485,634	2,411,657	362,667	348,247
Lodging	3,049,638	2,884,825	301,280	286,092
Strip shopping mall	1,335,374	1,003,310	254,391	191,894
Enclosed mall	1,179,456	1,179,456	143,584	143,584
Retail other than mall	10,636,041	7,938,011	988,173	733,757
Service	1,407,063	303,896	94,876	21,978
Other	1,006,854	871,653	75,893	69,852
All Candidate Buildings	52,636,513	44,308,280	5,349,127	4,306,280
All Commercial Buildings	184,880,059	158,436,667	16,686,266	14,172,256

Source: ECONorthwest

Economic Impacts of Commercial PACE

Economic impacts take the form of changes in output (production), income, and employment in a local region. If a PACE program results in more retrofit activity than would otherwise take place, it will generate economic impacts in the local area and elsewhere. A variety of activities and products could be funded through PACE loans, but almost all the local economic impacts will derive from spending on the services of contractors, technicians, engineers, auditors, and other specialists. Most of the controls, insulation, light fixtures, heat pumps, windows, and other products will be manufactured elsewhere, resulting in economic impacts elsewhere.

For every million dollars of additional spending on locally-produced retrofit services, we expect that that local output will increase by $1.74 million dollars, local incomes will increase by $760,000 and local employment will increase by 13 jobs during the year the spending occurs. These estimates include the direct impacts of the spending, the indirect impacts (local purchases by those providing the service), and induced impacts (local purchases by those earning income from the provision of the service).

These impacts will be partially offset by the impacts of reduced spending on electricity

and natural gas. Those offsetting impacts will be spread over a much longer period of time and will be much smaller in total because employment and incomes at utilities are more a function of the number of connections than of the amount of energy delivered to each connection. The net cost savings from cost-effective energy-efficiency improvements likely will result in some increased local spending by those to whom the benefits accrue, further mitigating the impacts of reduced spending on energy.

Using data from Energy Trust of Oregon's 2011 commercial program, we estimate that if all 2,762 buildings over 2,000 square feet that were identified in the market assessment as good candidates for PACE were to participate, they would generate $41.7 million of expenditure on retrofit projects. Of that amount we expect that 51.3 percent, or $21.4 million, would be spent locally (based on work we have done for a different project looking at the economic impacts of PACE programs nationwide). Using the multipliers described above, these expenditures would result in the following economic impacts in Multnomah County:

- Output (production of goods and services in the county): $31.3 million
- Income (wages paid to workers in the county): $16.3 million
- Employment (person-years of employment): 278

As noted in the market assessment, we expect buildings larger than 10,000 square feet to be more likely to participate than smaller buildings. Looking at only the 1,016 candidate buildings that are larger than 10,000 square feet, we estimate expenditures of $31.4 million. Per-building expenditures will be larger for larger buildings. These expenditures would result in the following economic impacts in Multnomah County:

- Output (production of goods and services in the county): $28.0 million
- Income (wages paid to workers in the county): $12.3 million
- Employment (person-years of employment): 210

The candidate buildings we identified were ones we expected to retrofit in the next five years, but there is no guarantee that all of them will, or that all of those that do would choose to use PACE financing. It is also possible that additional buildings, including multifamily buildings that we did not model, might choose to participate. Beyond five years, additional buildings are likely to retrofit, as technology improves, as equipment installed in prior retrofits wears out or becomes obsolete, or as energy prices increase. More or fewer participating buildings would result in larger or smaller economic impacts. If PACE-funded retrofits are more extensive ("deeper") on average than the retrofits described in the Energy Trust of Oregon data, economic impacts will be larger than estimated here.

Table 6 summarized the estimated economic impacts.

Table 6: Summary of Economic Impacts

Economic Impacts	All Candidate Buildings	All Over 10,000 Square Feet
Annual Output (production)	$31,300,000	$28,000,000
Annual Personal Income (wages)	$16,300,000	$12,300,000
Jobs (person-years of employment)	278	210

Source: ECONorthwest

Benefit-Cost Analysis

Benefit-cost analysis allows agencies to determine the extent to which a proposed use of public money leaves the public better off. The present value of benefits to the public, including both program participants and non-participants, are compared to the present value of agency costs. The difference between public benefits and agency costs measures the value of the program. The ratio of public benefits to agency costs may be used to rank competing uses of public funds. If an agency's limited budget is spent on projects with higher benefit-cost ratios, the public will be better off.

In the case of a PACE program, the participant's benefits are the present value of their operating cost savings, or the difference between utility-bill reductions and their payments related to the program, including up-front costs, principal, interest, and fees. Non-participant's benefits derive primarily from emissions reductions resulting from consuming less energy. Agency costs are whatever the County spends on administering the program, and if fully recovered through fees, may be zero. If costs will be fully recovered through fees paid by participants who benefit from the program, the benefit cost ratio from the agency's perspective is infinite.

Consumer Benefits

Assuming that only cost-effective energy-conservation measures will be allowed to be funded under the program, every participant will experience net benefits from the program, and those benefits may be shared with building tenants. Participants will enjoy reduced utility bills from the completion of the project through the useful life of the installed measures. They will also have a stream of cash outflows related to participation, mostly in the form of payments to the County for the principal and interest on the amount financed. Some measures will also require expenditures on periodic maintenance to sustain their performance. The difference between these positive and negative cash flows can be estimated for each year and discounted to present value. Since these are private benefits, they should be discounted at a private discount rate representing the after-tax return on the participant's best alternative investment. On average, that might be around 6 percent.

Using data from Energy Trust of Oregon's 2011 commercial program, we estimate that if all 2,762 buildings over 2,000 square feet that were identified in the market assessment as good candidates for PACE were to participate, they would spend $41.7 million on retrofits and produce energy savings of 323.8 million BTUs and $6.1 million of energy-cost savings per year

at 2012 prices. If the annual cost savings persisted for 20 years, and energy costs increased at a nominal rate of 3 percent, the energy-cost savings over 20 years would have a present value, using a private discount rate of 6 percent, of $91.9 million. Subtracting the $41.7 million that would be spent on retrofits to achieve those savings, consumers (building owners and tenants) would receive net benefits with a present value of $50.2 million from participating in the program.

As noted in the market assessment, we expect buildings larger than 10,000 square feet to be more likely to participate than smaller buildings. Looking at only the 1,016 candidate buildings that are larger than 10,000 square feet, we estimate expenditures of $31.4 million, energy savings of 243.6 million BTUs, and and energy-cost savings of $4.1 million per year at 2012 prices. Per-building expenditures and savings will be larger for larger buildings. If the annual cost savings persisted for 20 years, and energy costs increased at a nominal rate of 3 percent, the energy-cost savings over 20 years would have a present value, using a private discount rate of 6 percent, of $70.1 million. Subtracting the $31.4 million that would be spent on retrofits to achieve those savings, consumers (building owners and tenants) would receive net benefits with a present value of $38.7 million from participating in the program.

Emissions Benefits

Reducing energy consumption results in reduced emissions, particularly of carbon dioxide (CO_2). The value of reduced emissions may be computed by first determining the size of the reduction in CO_2 emissions and then applying a value per metric ton of CO_2. Each therm of natural gas (a therm is a measure of natural gas that corresponds to 100 cubic feet of gas under standardized conditions) that isn't burned results in 11.7 fewer pounds (0.0053 fewer metric tons) of CO_2 being emitted into the atmosphere. Energy may be measured in British Thermal Units (BTUs). One BTU is the amount of energy needed to increase the temperature of one pound of water by one degree fahrenheit. Each therm of natural gas is equivalent to 100,000 BTU, so 0.053 metric tons of CO_2 are emitted for every million BTU of energy from natural gas.

In the Pacific Northwest, electricity is generated from a variety of sources, including hydropower, coal, wind, and natural gas. It is not appropriate to use the average CO_2 emissions per kilowatt-hour (kWh) from all these sources, though. Natural gas-powered combustion turbine generators can be switched on and off almost instantly, so reductions in demand for electricity from conservation will result in changes in output from those generators, while the other sources run based on stream flows, maintenance schedules, or when the wind is blowing. When natural gas is used as a direct source of heat, the amount of gas needed to produce a million BTUs is approximately one third the amount needed to produce enough electricity to produce a million BTUs. This is because energy is lost in generating electricity, in transmitting the electricity through wires, and in converting the electricity to heat or motion. About 1.378 pounds of CO_2 are emitted for every kWH of energy consumed as electricity from natural gas. This is equivalent to 0.000625 metric tons per kWh or 0.1832 metric tons of CO_2 per million BTUs.

The value to society of reduced CO_2 emissions may be estimated by applying the method recommended by the US Office

of Management and Budget for estimating the long-term social cost of carbon in benefit-cost analyses. This method applies different values per metric ton of CO_2 emitted in different years and discounts the stream of values at a social discount rate of 3.0 percent. For one metric ton of CO_2 that is emitted each year from 2013 to 2032, assuming an average measure life of 20 years, the present value of social costs of carbon is $421.99 in 2007 dollars, or $454.06 in 2012 dollars.

Applying these values to the energy savings we estimated by applying data from the Energy Trust of Oregon's 2011 commercial program to the 2,762 candidate buildings we identified in the market assessment, we estimate that CO_2 emissions would be reduced by 46 thousand metric tons per year, with a present value to society of $20.9 million dollars, assuming 20 years of benefits and a 3 percent social discount rate.

If one looks only at the 1,016 candidate buildings that are larger than 10,000 square feet, CO_2 emissions would be reduced by 36 thousand metric tons per year, with a present value to society of $16.2 million, again assuming 20 years of benefits and a 3 percent social discount rate.

Summary of Benefits

Table 7 summarizes the economic benefits described above for all identified candidate buildings and for all candidate buildings that are larger than 10,000 square feet.

These benefits would be partially offset by the costs of administering the program, which will be small compared to the benefits. Without knowing the details of how the program would be administered or what the level of marketing and outreach efforts would be undertaken by the County, we can't estimate program costs or predict how much of the program costs would be borne by participants through fees.

The candidate buildings we identified were ones we expected to retrofit in the next five years, but there is no guarantee that all of them will, or that all of those that do would choose to use PACE financing. It is also possible that additional buildings, including multifamily buildings that we did not model, might choose to participate. Beyond five years, additional buildings are likely to retrofit, as technology improves, as equipment installed in prior retrofits wears out or becomes obsolete, or as energy prices increase. More or fewer participating buildings would result in larger or smaller net benefits. If PACE-funded retrofits are more extensive ("deeper") on average than the retrofits described in the Energy Trust of Oregon data, emissions benefits and energy savings benefits will be larger than estimated here.

Table 7: Summary of Private and Public (Emissions) Benefits

Private Benefits	All Candidate Buildings	All Over 10,000 Square Feet
Annual Energy Cost Savings	$6,128,406	$4,675,806
Present Value of Energy Cost Savings	$91,916,146	$70,129,510
Expenditure on Retrofits	($41,734,959)	($31,418,501)
Net Private Benefits	**$50,181,187**	**$38,711,008**

Emissions Benefits	All Candidate Buildings	All Over 10,000 Square Feet
Metric Tons CO_2 from Electricity	40,684	31,964
Metric Tons CO_2 from Gas	5,404	3,674
Metric Tons of CO_2 per Year	46,088	35,637
Value per Metric Ton 2013-2032	$454	$454
Present Value over 20 Years	**$20,926,596**	**$16,181,409**

Source: ECONorthwest

References

Buonicore, A.J. (2012). *Emerging Best Practice for Underwriting Commercially-Attractive Energy Efficiency Loans*. Building Energy Performance Assessment News.

Cadmus Group (2009). *Northwest Commercial Building Stock Assessment*. Northwest Energy Efficiency Alliance.

Clinton Climate Initiative and BOMA International (undated). *Energy Efficiency Building Retrofit Toolkit*.

Clinton Climate Initiative, Renewable Funding, and Lawrence Berkeley National Lab (2011). *Property Assessed Clean Energy (PACE) Financing: Update on Commercial Programs*.

Data Instincts (2009). *Sonoma County Energy Independence Program Snapshot of Program Interest--Commercial Property Owners*. Sonoma County, CA.

ECONorthwest (2011). *Economic Impact Analysis of Property Assessed Clean Energy Programs (PACE)*. PACENow.

ECONorthwest (2012). *Economic Impacts from Energy Trust of Oregon's 2011 Program Activities*. Energy Trust of Oregon.

Energy Upgrade California (2011). *Available Credit Enhancements for PACE Financings in the City of Los Angeles*. Los Angeles County, CA.

Energy Upgrade California (2011). *Building Upgrades Eligible for PACE Financing*. Los Angeles County, CA.

Energy Upgrade California (2011). *Property Eligibility for PACE Financing*. Los Angeles County, CA.

Fuller, M., C. Kunkel, and D. Kammen (2009). *Guide to Energy Efficiency and Renewable Energy Financing Districts for Local Governments*. University of California at Berkeley Renewable and Appropriate Energy Laboratory.

GreenFinanceSF (2011). *Commercial Program Overview*. City and County of San Francisco, CA.

GreenFinanceSF (2011). *Program Handbook*. City and County of San Francisco, CA.

Horowitz, M.J. and A. Coyle (undated). *Econometric Methods for Estimating Energy Star Impacts in the Commercial Building Sector*.

KEEMA-XENERGY, Inc. (2004). *Assessment of the Commercial Building Stock in the Pacific Northwest*. Northwest Energy Efficiency Alliance.

Qiu, L.Y. (2012). *Do Energy Efficient Technologies Still Save Energy after Rebound Effects? An Econometric Analysis of Electricity Demand in the Commercial Building Sector*. Stanford University.

SBW Consulting, Inc. (2011). *Impact Evaluation of Existing Commercial Buildings Program, Program Years 2008-2009*. Energy Trust of Oregon.

Sonoma County, CA. (2012). *Property Assessed Clean Energy (PACE) Replication Guidance Package for Local Governments*. Sonoma County, CA.

Stellar Processes and Ecotope (2011). *Energy Efficiency and Conservation Measure Resource Assessment for the Years 2010-2030*. Energy Trust of Oregon.

Supple, D. and O. Nix (2010). *Unlocking the Building Retrofit Market: Commercial PACE Financing*. Johnson Controls.

US Department of Energy (undated). *Commercial Property Assessed Clean Energy (PACE) Primer* (Revised).

US Office of Management and Budget (2010). *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*.

White, P. (2012). *PACE for Commercial and Industrial Buildings--2012*. Johnson Controls.

Zions First National Bank and Orrick, Herrington and Sutcliffe (undated). *Financing Feasibility Analysis for Property Assessed Clean Energy (PACE) Programs.* Sonoma County, CA.