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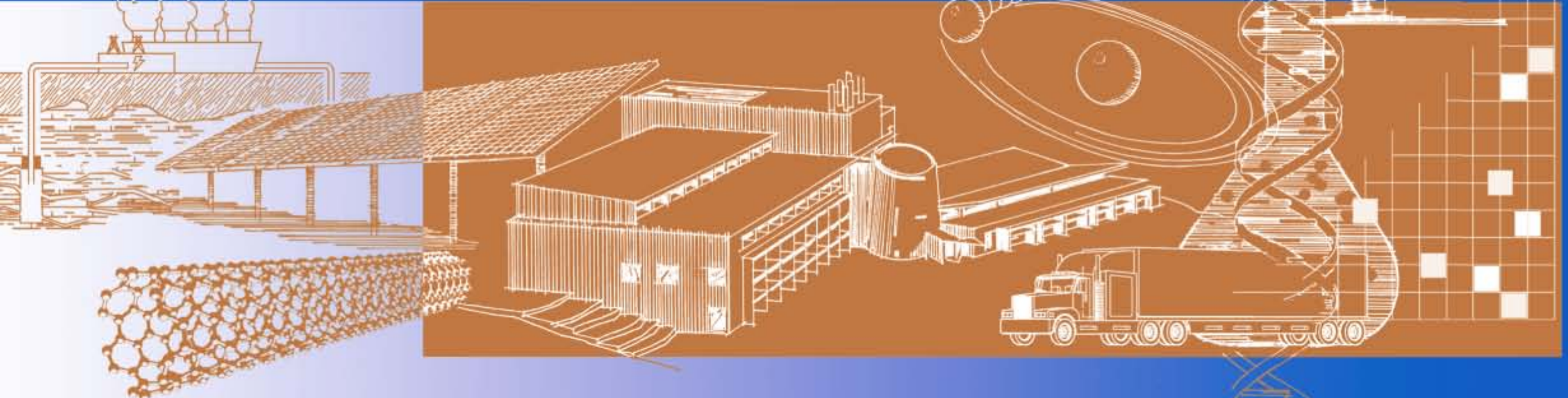
State Clean Energy Policies Analysis: State, Utility, and Municipal Loan Programs

Eric Lantz

Technical Report
NREL/TP-6A2-47376
May 2010



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Prepared under Task No. IGST.9000

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Acknowledgments

The Weatherization and Intergovernmental Program within the U.S. Department of Energy funded this work. The author would like to thank each of the loan program administrators who took time to relay their experiences and insights and to review early versions of this report. In addition, thanks to my colleagues including Jason Coughlin of the National Renewable Energy Laboratory (NREL), Ron Koenig, Sam Booth of NREL, Bethany Speer of NREL, Mark Bolinger of Lawrence Berkeley National Laboratory, and Charles Kubert of the Clean Energy States Alliance for their feedback and review of earlier versions of this paper. Finally, thanks to Mike Meshek of NREL for technical editing assistance. Of course, any remaining omissions or errors are the sole responsibility of the author.

List of Acronyms and Abbreviations

AERLP	(Iowa) Alternate Energy Revolving Loan Program
BEMC	Brunswick Electric Membership Corporation
BREC	Butler Rural Electric Cooperative
BTU	British thermal unit
CO_2	carbon dioxide
CSI	California Solar Initiative
DSIRE	Database of State Incentives for Renewables and Efficiency
EE	energy efficiency
EWEB	Eugene Water & Electric Board
FHFA	Federal Housing Finance Agency
FIRST	Financing Initiative for Renewable and Solar Technology
GHG	greenhouse gas
GO	general obligation
IOU	investor-owned utility
LLC	limited liability company
NO_X	nitrogen oxide
NREL	National Renewable Energy Laboratory
ODOE	Oregon Department of Energy
PACE	property assessed clean energy
PG&E	Pacific Gas and Electric Company
POU	publicly owned utility
PSE&G	Public Service Electric and Gas Company
PV	photovoltaics
RE	renewable energy
RPS	renewable portfolio standards
SCEPA	State Clean Energy Policies Analysis
SELP	Small-scale Energy Loan Program
SO_X	sulfur dioxide

Executive Summary

High initial costs can impede the deployment of residential, commercial, and community-scale clean energy technologies. Financing can reduce first costs by lengthening the period over which installation costs are paid. In addition, by amortizing first costs over an extended period, financing allows reduced expenditures in traditional energy costs (i.e., utility energy bills) to help pay for investments in clean energy technology. State, municipal, and utility sponsored loan programs have emerged to fill the gap between clean energy technology financing needs and private sector lending opportunities.

In general, state, municipal, and utility loan programs offer some attributes that are considered more favorable than are those offered by traditional lending institutions. These types of programs often provide long-term, fixed rate loans, and reduced consumer-transaction costs. They may also offer greater flexibility in addressing loan delinquencies, and they may be designed to provide additional incentives for clean energy technology by providing below-market interest rates. Furthermore, individual programs may rely on underwriting metrics that allow a wider array of individuals and business to qualify for financing. This does not necessarily mean lowering lending standards as public sector entities may be able to rely on alternative mechanisms for securing loans, such as property liens. With such features, loan programs are some of the most common state and local clean energy policy tools.

This report relies on six in-depth interviews with loan program administrators to provide descriptions of existing programs. Findings from the interviews are combined with a review of relevant literature to elicit best practices and lessons learned from existing loan programs. Data collected from each of the loan programs profiled are used to quantify the impacts of these specific loan programs on the commonly cited, overarching state clean energy goals of energy security, economic development, and environmental protection.

The results of this research indicate that technology installed under loan programs rarely supports clean energy production at levels that have a significant impact on the broader energy sector. As a result, loan programs are having only a marginal impact on the broad clean energy goals noted above. However, these findings should not be interpreted to suggest that loan programs are ineffective or unnecessary. Rather, they suggest that, while high initial costs are a barrier to clean energy technology, additional market barriers likely require attention. This is even more likely in the clean energy markets frequently served by state, utility, and local loan programs, which often target the residential, industrial, and commercial business sectors, and which tend to emphasize technology designed for on-site energy use.

This analysis suggests that achieving significant clean energy policy impacts will likely require accessible financing as one element in a comprehensive policy approach. At the same time, loan programs put in place independently can increase their incremental impact by implementing lessons learned through this research. Lessons include:

- **Standardize access:** Loans with clear eligibility requirements and streamlined processing will encourage accessible financing.
- **Reduce consumer-transaction costs:** Many consumers are unaware of clean energy opportunities. By simplifying the process of identifying and implementing viable clean energy improvements, loan programs can reduce consumer education barriers.
- **Increase loan security:** Secure loans are critical in attracting investor capital, reducing interest rates, and improving lending terms.
- **Develop technology-specific terms:** Loan terms designed with specific technology improvements in mind can reduce loan payments to levels that allow customer cost savings in traditional energy expenditures to offset regular loan payments. Under best-case conditions, clean energy improvements can be carried out with no net change in overall energy costs.
- **Minimize administrative costs:** Administrative costs reduce the flow of capital to consumers. Increasing volume by aggregating local programs to the state level can disperse fixed administrative costs among a broader consumer pool. Subcontracting specialty work such as underwriting or energy audits can streamline program administration.
- **Provide provisions for growth:** Demand for clean energy financing sometimes exceeds existing program budgets. Moreover, demand could expand rapidly as technology price thresholds are achieved and consumers become more informed. Programs that are prepared to handle growth in demand for clean energy financing will be better positioned to support widespread deployment.

Those designing clean energy programs may also want to consider provisions that allow for simple transfer of loans to new property owners at the time of sale and provisions that increase the likelihood that technology performance will meet industry standards. Moreover, loan programs designed to operate in conjunction with supporting policies that make clean energy a financially sensible choice are observed to be most successful.

Despite the advantages of state, utility, and municipal loan programs, participation to date has been modest, and they appear to be incapable of driving a large-scale transition to a clean energy future by themselves. Nevertheless, access to clean energy financing remains a critical component of a robust clean energy policy portfolio, and applying lessons derived from existing programs can assist in maximizing the impacts of loan programs. Moreover, providing loan programs in conjunction with a robust policy portfolio that addresses other barriers to clean energy technology will facilitate the transformation of state and local economies to a clean energy future.

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State Clean Energy Policies Analysis Project Background

The State Clean Energy Policies Analysis (SCEPA) project is supported by the Weatherization and Intergovernmental Program within the Department of Energy's Office of Energy Efficiency and Renewable Energy. The SCEPA project seeks to quantify the impacts of existing state policies and to assess the potential applicability of specific policies to other states. The project goal is to provide information on current policy practices and outcomes for the purpose of enabling states to make educated decisions regarding clean energy policies or policy portfolios that are most likely to accomplish their environmental, economic, and security goals. Analysts from the National Renewable Energy Laboratory (NREL) are implementing the project. State officials and policy experts are providing input and review. For more information on the SCEPA project, or to see additional reports from the SCEPA project, visit http://www.nrel.gov/analysis/scepa.html.

This report evaluates the role of state, utility, and municipal loan programs in contributing to state clean energy goals. The loan programs considered here do not include loan guarantee programs and focus on programs targeting high-volume, low-risk financing for technologies that are commercially proven. Such programs are ideally designed to support widespread deployment of high cost technology much in the manner that financing supported the widespread deployment of automobiles. Because the majority of these programs are designed to serve residential, commercial, and industrial energy users, this report focuses primarily on technologies and financing considerations that affect these sectors. Government financing for emerging technologies may be important for proving commercial viability of emerging technologies, but such programs are designed with a wholly different set of considerations and criteria. Financing programs for emerging technologies are not considered in this report.

1. Introduction

Purchasing or installing a clean energy system outright requires a large initial expenditure. High initial costs are often prohibitive for a consumer interested in installing a clean energy system, even when the investment is cost effective over the long term. Financing for clean energy systems increases the accessibility of clean energy technology by dispersing the first cost of systems over extended periods and by allowing individuals, businesses, and communities to apply cost savings in traditional energy expenditures (i.e., on their utility energy bill) towards system installation costs. However, traditional lending institutions may not be familiar with the risks and value created by clean energy investments. Moreover, markets for distributed clean energy technologies have not achieved the scale necessary to entice traditional lenders to develop standardized financing products that exclusively serve the clean energy sector. As a result, individuals seeking to finance clean energy installations are often forced to rely on conventional financing mechanisms, including home-equity lines of credit or unsecured consumer credit (Brown 2009).

Conventional private sector financing tools present two distinct disadvantages with respect to clean energy technology. First, lenders may only qualify, or provide cost-effective lending rates, to individuals with very high credit scores. Second, the payback period for a typical home-equity line of credit is notably shorter than that of many clean energy improvements (Brown 2009). This makes it difficult for the cost savings of the clean energy improvement to cover the debt service requirements of the loan.[1]

Because of these disadvantages, policymakers have implemented state, municipal, and utility loan programs for clean energy technology in localities around the United States. Frequently cited advantages of these programs include increased amounts of available capital, reduced consumer-transaction costs, fixed rate loans with competitive interest rates, the ability to recycle limited government funds by employing a revolving loan fund, and in some cases, loan terms set to the payback period of the installation (Brown 2009, Fuller et al. 2009). Policymakers may also design programs to provide additional incentives for clean energy investments by providing below-market interest rates via direct subsidy or leveraging low cost financing available through the state or locality's bonding authority. Individual programs may rely on simplified credit risk analysis that allows a wider array of individuals and business to qualify for financing.[2]

[1] Loan terms that allow the cost savings of the energy improvement to fully offset loan payments are seen as a significant advantage because they allow clean energy systems to be installed with no net change in monthly energy expenditures.

[2] For some clean energy loan programs, the only requirement is that individuals have sound standing with property tax payments or their utility bills. Arguments for reliance on non-traditional lending standards include these: (1) property values may increase with clean energy improvements; (2) investments under some circumstances can pay for themselves; (3) improvements may be based on government policy that justifies increased risk because of the public value of the program; (4) public entities may be able to rely on alternative mechanisms (e.g., the tax capacity of a specific piece of property) for securing loans.

Existing Programs

State, municipal, and utility loan programs are some of the most common state and local policy tools for clean energy. At the time of this research, there were 128 loan programs, excluding loan guarantee programs, noted in the Database of State Incentives for Renewables and Efficiency (DSIRE) (http://dsireusa.org/). The distribution of these loan programs by state is highlighted in Figure 1.

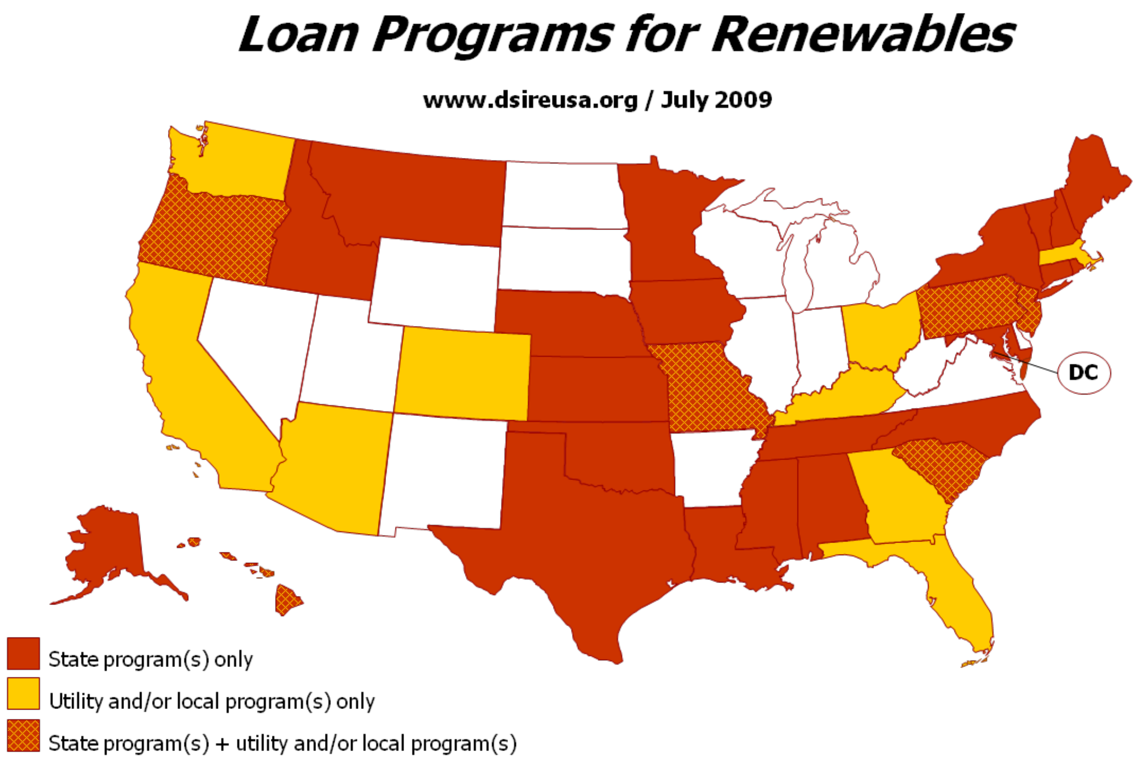

Figure 1. Distribution of loan programs by state

Of the programs in DSIRE, approximately 55% are sponsored by local utilities and 33% are sponsored by the respective state. Local or municipal government entities provide the remaining 12%. These programs are broadly dispersed among states. However, 11 states offer no government or utility-sponsored clean energy financing (DSIRE 2009). Many states and local governing entities are considering a new loan program model whereby loans are funded by the sale of property assessed clean energy (PACE) bonds.[3]

Individual loan programs may apply to a single specific clean energy technology (e.g., solar photovoltaics) or to the full spectrum of renewable energy and energy efficiency technologies. The distribution of programs among technologies is shown in Figure 2. Programs may apply across market sectors, but the majority target individuals, businesses, or institutions that plan to use the electricity or energy generated by the installation on-site (DSIRE 2009).

[3] For more information on PACE programs, see the Berkeley FIRST case study in Section 2 of this report and Speer and Koenig (2010).

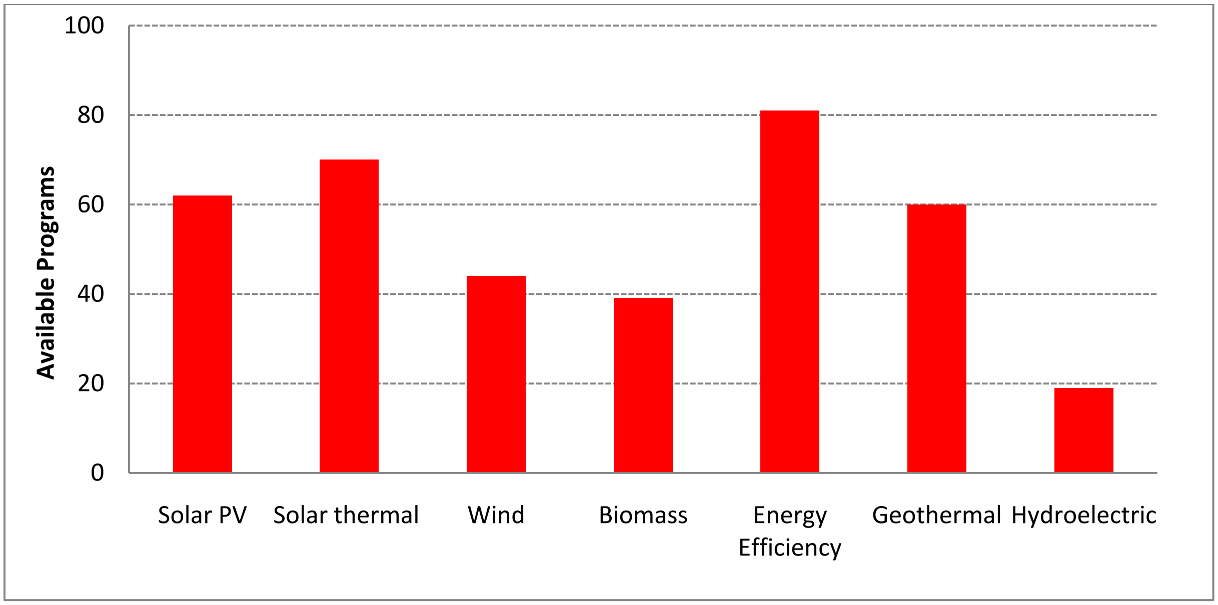

Figure 2. Dispersion of loan programs by technology type (DSIRE 2009)

Existing loan programs vary widely in their terms, maximum lending amounts, and sources of funding. For example, the Butler Rural Electric Cooperative (BREC) serving portions of southwest Ohio provides loans at a 5% interest rate for energy efficiency improvements and geothermal heat pumps. Loans from BREC range from $5,000 to $12,000 with a maximum loan term of eight years. Funds for the program are provided out of BREC's operating budget (Herrman, 2009). In contrast, Oregon's Small-scale Energy Loan Program (SELP) targets the public and private sectors and funds individual residential projects as well as projects that intend to sell into the wholesale energy market. Under this program, one loan has been as high as $20 million, but typically, they are less than $500,000. Terms are generally 5-15 years, and financing is available for all types of renewable energy and energy efficiency projects. Funds are raised by the sale of Oregon general obligation (GO) bonds, and interest rates are fixed to the bond yield plus the cost of administering the program (Estes, 2009).

Prior to the passage of the American Recovery and Reinvestment Act of 2009 (Recovery Act), the subsidized energy financing "haircut" provision that was in place for the federal investment tax credit (ITC) and federal production tax credit (PTC) discouraged some consumers and developers from taking SELP (or other government and utility) loans for solar and wind energy projects. This provision reduced the value of these federal tax credits when projects received financing from sources other than conventional lenders or private investors. The Recovery Act eliminated this provision for the ITC, which applies to solar and small wind projects. And, it allows utility-scale wind energy projects to claim the ITC and therefore to escape the subsidized financing haircut for projects that begin construction before January 1, 2011.

A wide array of entities implement clean energy loan programs with varying policy goals. The success or failure of an individual loan program hinges largely on the targeted market barriers and the intended policy goals. This report highlights lessons learned from the experiences of existing loan programs and evaluates the impacts of these programs on achieving overarching state clean energy goals. The report considers six specific programs in detail as case studies. These specific programs were chosen based on their capacity to reflect the general variability by sponsoring organization as well as differences in policy design and available clean energy resources.

2. Loan Program Case Studies

To gain insights into the value and impacts of existing loan programs, program administrators from six existing loan programs were interviewed. Each interview followed the same general format and included discussion of program design details, loan program impacts, whether the program is considered a success and why, the primary challenges faced by the program, and lessons learned.

This section details the direct results from these interviews and describes specific program details, market impacts, current status, as well as the noted value of the program as perceived by the program administrators. In some cases, program administrators were able to provide program review reports that supplemented the data collected through the interview process. Programs profiled here range from traditional programs that have been in place for many years to recently developed programs. Specific loan programs were chosen based on their ability to represent the diversity of programs in place today. Programs demonstrating diversity by eligible technology, program size, and geography were prioritized.

Utility-Sponsored Programs

Utility-sponsored programs occur with the highest frequency. These programs are often small, with annual budgets on the order of a few hundred thousand dollars. The three cases discussed here illustrate typical programs and structures and were chosen based on their ability to demonstrate the range of activity in utility programs. Many utility-sponsored programs fall within the domain of publicly owned utilities or membership cooperatives. Each of the in-depth program reviews provided here is representative of publicly owned utility (POU) programs. Though investor-owned utility (IOU) programs may be larger, Public Service Electric and Gas (PSE&G), the largest regulated utility in New Jersey, recently expanded its solar loan program by $143 million. IOU programs are often similar in scope and activity.[4]

Eugene Water & Electric Board (EWEB)

Eugene, Oregon's municipal utility, EWEB, has offered loans for solar hot water heaters and solar pool heaters to residential properties since 1990. Under this program, loans up to $4,000 are available for up to 60 months. A successful loan applicant is also eligible for a $600 cash discount for domestic hot water heaters and $1,100 for pool heaters as well as $1,500 in state tax credits. Funding for the program is provided out of EWEB's annual operating budget. EWEB serves approximately 75,000 residential customers, but only residential customers who have electric water or pool heaters are eligible for the program (EWEB representative 2009).[5]

Activity in the eligible population has been modest. In recent years, EWEB has received 25-35 applications per year and in 2007, 26 installations were financed. The program's

[4] The PSE&G solar loan program noted here is unique not only for its size but also because it allows consumers to repay their loans directly with solar renewable energy certificates (SREC). For more information, see the PSE&G Solar Loan Program Web site (http://www.pseg.com/customer/solar/).
[5] Customers who have natural gas water heaters are eligible for incentives through the Energy Trust of Oregon.

reported estimated annual energy savings from 1156 installations occurring over the life of the program is 2.4 million kWh. The default rate for all of EWEB's weatherization and energy loan programs is less than 1% (EWEB representative 2009).

EWEB plans to continue the program at its current level as program activity is fairly constant and existing budgets are not constrained. The program has been fairly straightforward to administer, according to EWEB staff. EWEB has a list of qualified contractors to facilitate high quality installations. Recent interest has been lower than normal, but EWEB noted that this is most likely explained by the current economic conditions (EWEB representative 2009).

Brunswick Electric Membership Corporation (BEMC)

The BEMC serves portions of southeast North Carolina. Since 1989, the utility has offered low interest (5%) loans to its residential members for energy efficiency improvements. In 2009, it expanded its program to include solar hot water heaters. Individual loans are small because of the nature of the technologies covered by the loans. The basic loan is for $2,500, but loans up to $5,000 are available for higher cost projects. Loan payments are amortized over five years, but loans may be paid off early without penalty. Funds are provided out of BEMC's operating budget (BEMC representative 2009).

BEMC designed the application process with maximum ease in mind. Responses to application requests are typically provided within 24 hours. Minimum requirements are home ownership and at least one year of good payment history with BEMC. Simple estimates place the eligible customer base at approximately 60,000 residences (BEMC representative 2009).

Through January 2009, the program provided more than $6 million in loans. Assuming a typical loan of $2,500, as reported by program administrators, an approximate average of 120 loans are provided each year. As of July 2009, all funding was for energy efficiency improvements. Program administrators have not attempted to evaluate the energy savings or changes in demand from these programs (BEMC representative 2009). However, if an average energy efficiency improvement is assumed to save roughly 5% of nationwide average annual household energy use, the annual energy savings from this program is estimated at approximately 3.4 million kWh.[6]

Program administrators assign no single primary value to the program but say it offers them an opportunity for outreach and education, enhances public relations, and provides some degree of reduced energy demand. With these priorities in mind, administrators stated the program has been very successful. The program's annual budget of $300,000 is

[6] A 5% savings in annual household energy consumption is based on the range of energy savings calculated from data reported by the top-rated energy efficiency programs in the country targeting residential retrofit and new home construction (York, Kushler, & Witte 2008). Project-level savings are calculated as 5% of nationwide average household end-use energy consumption (EIA 2009). The energy savings calculated here assume $6 million in total loans, an average loan value of $2,500, and the end use equivalent of approximately 4.7 million BTU or 1,400 kWh (5% of end-use energy consumption) savings per loan per year.

often fully subscribed well before year's end, and as a result, BEMC is seeking additional funds to expand the program and offer financing for a broader array of technologies. Program administrators cite the simple application process, the minimal terms, and low cost of eligible technologies for success of the program. However, administrators caution that a successful program requires strict approval criteria. BEMC staff noted that, using their selection criteria, only two borrowers have defaulted on loans since 1989. Administrators expect the program to continue indefinitely. Additional funding, which is being actively pursued by BEMC, could allow the program to expand to other renewable technologies (BEMC representative 2009).

Butler Rural Electric Cooperative (BREC)
BREC serves portions of southwest Ohio and provides loans for energy efficient heat pumps and geothermal heat pumps; more recently, broader energy efficiency measures were added to the portfolio of eligible technologies. The loan program, which has been in place for over 20 years, targets the residential sector. Loans are funded and administered by BREC. Individual loans range from $500 to $12,000, but for loans over $2,000, a second mortgage is required. The term of the loan is dictated by the amount of the loan, with a maximum period of eight years. Applying for and processing applications is fairly simple. Pre-approval is expected within 24 hours of receipt of the application, and pre-approved applicants need only verify income (Herrman, 2009).

The program has experienced only moderate popularity among the estimated 11,000 eligible residences. Program administrators said there were 24 geothermal heat pump installations in 2008 and 13 in 2007. Activity is well below the current budget of $210,000. Since 1984, 182 members have received financing. Recent activity is up relative to the program average of 7.3 loans per year. Over the life of the program, there has only been one loan default. BREC minimizes damages resulting from loan defaults by placing liens on properties and relying on a strict approval process (Herrman, 2009).

No energy savings estimates were available for systems installed under the program. However, if a geothermal heat pump is assumed to save roughly 4,575 kWh per year, approximately 830,000 kWh are saved per year from all systems installed under the program.[7] Program administrators said that individual contractors and installations could significantly affect the actual energy savings realized by geothermal heat pump installations. For example, improperly setting up the system controls or failing to educate the consumer about energy efficient use of the equipment as well as improper system loop sizing and improperly sizing the field pump can all impact actual geothermal heat pump energy performance. For this reason, administrators note that developing a quality

[7] Average savings from a geothermal heat pump are estimated relative to an air-source heat pump rated to seasonal energy efficiency ratio (SEER) of 13 and assume a 33% increase in efficiency (Hendron et al. 2008). These savings estimates also assume a baseline site heating and cooling load of approximately 13,700 kWh per year (Personal communication Hendron 2009). Results here are calculated by taking the 182 total installations and multiplying by the average annual savings of 4,575 kWh per installation as demonstrated in Hendron et al. (2008). Actual energy savings are expected to vary from this calculated amount due to variable heating and cooling loads, variable efficiencies of prior heating and cooling equipment, and the qualifications of specific installers. Nevertheless, this estimate is believed to be representative of the potential order of magnitude of the energy savings.

control mechanism or certification process is critical to ensuring customers actually obtain energy savings that were forecast (Herrman, 2009).

Despite modest market impacts, the value of the program has been community education, according to administrators. In the early years of the program, no local contractors were capable of installing the systems. Today, four local contractors are capable of completing installations. In addition, interest in the program is high, but many interested individuals believe that, even with financing, they cannot afford the improvements (Herrman, 2009).

State-Sponsored Programs

State-sponsored programs are often larger than utility-sponsored programs in terms of both impacts and dollars loaned. Two long running, successful programs are profiled here.

Oregon Small-Scale Energy Loan Program (SELP)

Since 1980, the Oregon Department of Energy (ODOE) has administered the state's Small-Scale Energy Loan Program (SELP). This program provides long-term fixed rate loans for a wide array of energy conservation and renewable energy projects in the residential, commercial, government, and non-profit sectors.[8] Loan terms are 5-15 years, and loans typically range from \$20,000 to \$500,000 (Estes, 2009).[9]

The program is funded through Oregon general obligation (GO) bonds, and interest rates on the loans are set according to the expected bond yield and the administrative cost of the program. In addition, because of the interest obligations owed on GO bonds, prepayment penalties are in place. SELP is self-sustaining, relying on a portion of interest payments to cover administrative costs, while program applications dictate total funds amounts (Estes, 2009).

The use of GO bonds to fund the program requires that the SELP program have a sizable pool of loans, a few large loans, or both to justify the administrative effort and cost required to carry out a bond offering. Furthermore, this approach requires strict underwriting criteria to reduce the risk that the program will impact the credit rating of GO bonds. Finally, because interest rates are set to cover only return obligations and program administrative costs (i.e., there is no risk premium), ODOE must concentrate on funding entities with exceptional credit scores. This detail makes it difficult for ODOE to compete in the residential sector, where individuals with high credit scores often qualify for lower interest rates on home-equity credit (Estes, 2009).

Through May 2009, \$442 million in funds were committed and 896 projects were funded.[10] Of the funds directed towards renewable energy projects, 41% went to small hydro facilities, 36% to biomass and biofuels facilities, 9% to geothermal projects, and less than 2% to solar and wind energy projects. Interest in SELP financing for solar and wind projects may have been impacted by diminished value or "haircut" of federal tax incentives noted previously, when projects received subsidized energy financing.

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[8] Tribes are also eligible for Oregon's Small-Scale Energy Loan Program.

[9] The largest loan ever provided was \$20 million.

[10] Although 818 loans have been funded, a single loan may have financing for more than one project.

Cumulative estimated energy savings across all funded projects is 16.7 trillion BTU or roughly 5 million MWh (Oregon Department of Energy, 2008).[11] The loan default rate is less than 0.1%. The low default rate is a function of conservative underwriting and ODOE's efforts to work with borrowers having difficulty repaying loans (Estes, 2009). ODOE's loan strategies for addressing delinquent accounts include loan restructuring and forbearance among other options.

As the largest and oldest program profiled in this analysis, SELP offers more empirical information than does any other program profiled. The primary value of SELP was noted to be the provision of fixed rate, long-term loans for projects that are unable to secure financing via traditional mechanisms. It also provides greater flexibility in terms of valuing non-traditional revenue streams, increased patience in dealing with distressed loans, and greater ability to negotiate specific loan amounts and terms.[12] Finally, the SELP program administrator interviewed for this analysis emphasized that loan programs should take on loan risk not venture capital risk (i.e., loans should be well-secured to protect the program's interests as well as those of the applicant) (Estes, 2009).

Iowa Alternate Energy Revolving Loan Program (AERLP)

The Iowa Energy Center administers this statewide program, which provides funding for renewable energy projects sited in Iowa. Initiated by the Iowa legislature in 1996, the program was designed to support the development of all types of renewable energy technologies except geothermal projects, which are excluded from the definition of renewable energy in Iowa statute. The enabling legislation directed specific percentages of the fund to specific technologies and project sizes, program administrators have prioritized use of available funds. However, as the program has evolved, it has become regular practice for administrators to base their project financing decisions on incoming applications and the quality of those projects (Hamam, 2009).

Funds for the program were originally raised over a 3-year period by collections from Iowa's IOUs. As a result, through May 2009, customers of non-rate regulated utilities were ineligible for AERLP loans. In May 2009, however, Senate File (S.F.) 376 [13] authorized an additional $5 million in funds to be raised via the sale of state bonds and amended the original legislation so that non-rate regulated utility customers are now eligible for loans up to $500,000 (Iowa Energy Center, 2009). AERLP is one of the few programs open to projects whose purpose is to sell power into wholesale markets. However, the $1 million cap ($500,000 for non-rate regulated utilities) limits the amount that the AERLP fund can contribute to multi-megawatt utility-scale projects.

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[11] BTU savings reported by ODOE are converted to MWh by assuming a generic power generation heat rate of 10,000 Btu/kWh. Actual savings may vary based on such factors as biofuels production and/or offsetting of direct use gas applications. Again, however, these results are intended only to reflect the order of magnitude impacts from the program.

[12] In some cases, ODOE may agree to fund only a portion of project costs. This allows ODOE to meet their requirements and risk appetite but requires applicants to secure the balance of financing from other sources.

[13] http://coolice.legis.state.ia.us/Cool-ICE/default.asp?category=billinfo&service=billbook&ga=83&hbill=SF376

By design, AERLP funds contribute up to 50% of total project financing. The balance of financing is coordinated through an existing private sector lender of the applicant's choosing. This cooperative structure allows the Iowa Energy Center to cover technical project qualifications while the private lender covers the financial lending provisions and administers repayment of the loan. If a loan goes into default, the funds administered by the Iowa Energy Center take a secondary position and are paid back only when the private lender has recovered the principal, accrued interest, and collection costs.

According to program administrators, this program structure benefits all parties by leveraging the specialized skills of the financing partners. In addition, including private sector lenders brings legitimacy to the program because it requires project owners to meet traditional underwriting criteria, and securing multiple sources of financing disperses risk (Hamam, 2009).

Individual projects are evaluated and ranked based on feasibility, payback period, and expected loan term. The maximum loan term is 20 years, and project payback must be within the term of the loan. Only projects that receive the highest ranking receive loans. Successful applicants receive a single low-interest loan that is a composite of AERLP funds with a 0% interest rate and external lender funds at the interest rate negotiated by the applicant and the lender. The external lending institution coordinates repayment of AERLP funds, although loan terms are determined by the estimated payback of the facility with a maximum loan period of 20 years. As funds are repaid, new loans can be made. Applications for projects with a total capital cost of less than $50,000 are accepted continually; projects with capital costs greater than $50,000 are processed quarterly (Iowa Energy Center, 2009).

Through March 2009, the program dispersed more than $11.4 million in funds for 88 projects with total construction costs of $145 million. To date, the program has experienced a loan default rate of 2.2%. Loan default losses have been absorbed by the program. Approximately 47% of the funded projects have been utility-scale wind projects, defined as those over 20 kW. Small wind and biomass constitute 17% and 22% of funded projects respectively. Solar (10%), small hydro (1%), and projects that combine multiple technologies (3%) constitute the balance of funded projects. Despite the number of large wind projects, only about 9% of annual energy generation from funded projects is from the large wind facilities. In fact, more than 90% of annual energy production is from biomass facilities.[14] Total estimated clean energy production under the program is reported to be 1.8 million MWh per year (Iowa Energy Center, 2009).

The state legislature considers the AERLP a success because it is fully subscribed, according to program administrators. The expansion in May 2009 doubles available funds for the program, allowing for as much as $10.9 million in base funds to be dispersed. If full subscription persists, the market impacts of the program will grow. Administrators

[14] Total biomass generation is based on biomass electric generating facilities and electricity-equivalent production from facilities that produce ethanol and biodiesel or use wood generated heat. According to program administrators, the majority of biomass energy production is the electricity-generating equivalent from ethanol and biodiesel facilities funded by the program.

are very pleased with the relationships they have developed with the private sector and feel that this system is effective (Hamam, 2009).

Local Government Sponsored Programs

Local government sponsored loan programs make up a small proportion of loan programs. However, the emergence of Berkeley, California's Financing Initiative for Renewable and Solar Technology (FIRST) has greatly increased interest in loan programs sponsored by municipalities.

Berkeley Financing Initiative for Renewable and Solar Technology (FIRST)

The Berkeley FIRST program represents the latest wave of new loan programs. Pioneered as the "Berkeley Model," this financing concept has been applied in a handful of cities and localities around the country and is now referred to as the property assessed clean energy bond or PACE bond model (PACE Now). Under this type of program, clean energy installations are financed through the sale of local bonds and loans are repaid via a line item addition to the annual property tax assessment. In addition to addressing the up-front cost barrier of clean energy installations, this approach potentially offers two primary benefits (Bolinger 2008):

- The security of the loan is tied to the tax capacity of the property rather than to a property owner's credit score. This increases the security of the loan, which can provide lower interest rates, reduce the credit or obligation risk of the municipality, and potentially create a more attractive investment opportunity in the broader capital markets. The latter condition may facilitate the ability of the program to scale up.
- Because the loan is part of the annual property tax assessment, it is transferred to new property owners at the time of sale. Such provisions may reduce concern about the ability to pay for a clean energy improvement prior to home sales.

In Berkeley, the program is in its initial pilot stage and serves the residential and commercial solar photovoltaics (PV) market. According to program administrators, the program is currently limited to solar PV because it is easier to maintain quality control in installation and system design by requiring applicants to secure a PV rebate through the California Solar Initiative (CSI). Without oversight by the CSI, ensuring qualified technicians and adequate installations would be the burden of the loan program. However, other localities using this program model include financing for energy efficiency improvements.

Loans under the Berkeley pilot stage are capped at $37,500 and require minimum financing of $5,000. Interest rates are fixed over the term of the financing but set when the funding is requested. Interest rates are 3.25% above the yield on the 10-year U.S. Treasury Note with a minimum interest rate of 6.75%. Applicants are required to obtain the state rebate for solar PV provided by the California Solar Initiative (Renew Funding LLC).

The pilot round was funded by a municipal bond issuance. Approximately $1.5 million was secured to cover loans for 40 property owners up to the maximum financing amount of $37,500 (Renew Funding LLC). Under the first funding round, 38 residential projects were approved for funding (City of Berkeley Office of Energy and Sustainable Development). The average solar PV residential installation in the Pacific Gas and Electric Company (PG&E) service territory under the California Solar Initiative (CSI) is approximately 4.5 kW. [15] Assuming this average installation is representative of systems that also qualified for a Berkeley FIRST loan and that all approved applications actually install systems, the program will fund roughly 170 kW of solar PV capacity, which converts to approximately 230,000 kWh in annual energy savings when the PV capacity factor is 15%.

Berkeley is evaluating the program's success and justifications for additional funding. Important design characteristics noted by the independent contractor administering the program include choosing eligible technologies or efficiency improvements that minimize administrative burdens, achieving greater scale by expanding to regional or statewide programs, which disperses fixed administrative costs over a larger customer base, and developing underwriting criteria that eliminate potential borrowers with preexisting burdensome debt obligations (Frusha, 2009).[16]

[15] PG&E CSI program statistics are available at http://www.pge.com/myhome/saveenergymoney/solarenergy/csi/csiprogramstatistics/.

[16] Efforts are underway to develop best practices and more rigorous underwriting criteria that may consider loan to lien value ratios, levels of home equity, and a review of involuntary liens.

3. Loan Programs and State Energy Goals

The popularity of loan programs for clean energy technologies suggests that these programs serve a purpose for state and local policymakers. The fact that the funds disbursed through loan programs can be reused or recycled multiple times—unlike a grant or rebate, which represent a onetime distribution of funds—is often seen as an advantage of loan programs. However, the question remains whether these programs contribute meaningfully to overarching state energy goals. This section presents estimates of the impact the programs reviewed above have had on state clean energy goals including energy security, economic development, and environmental protection.

Quantitative analysis of market impacts is complicated by the fact that state and local energy policy is often a patchwork of state, local, and federal policy incentives. As a result, isolating the impact of any single policy is difficult. However, it is possible to examine the markets where individual policies have been promulgated as well as evaluate whether loan programs in conjunction with other clean energy policies are helping achieve broader state and local energy goals.

Energy Security Impacts

Impacts on energy security can be measured by reduced consumption of conventional energy resources and increased diversity of the energy supply. Bolinger (2002, 2008) and Fuller (2009) found that loan programs targeting renewable energy and energy efficiency have not generally resulted in high levels of clean technology deployment. Fuller (2009) reports low participation as a systematic limitation of energy efficiency loan programs and notes that participation was less than 0.1% of the total customer base per year in the localities reviewed. Case studies by Bolinger and Porter (2002) reveal very low program activity when project-level economics are not favorable. This suggests that existing programs are not altering traditional energy consumption patterns at a level that impacts energy security.

To evaluate energy security impacts from the case studies reviewed here, electricity-equivalent production data for each program were compiled from publicly available reports and publications provided by the specific loan programs reviewed in each case study. Electricity-equivalent production includes renewable energy electricity generation, estimated energy savings from energy efficiency improvements, and the electricity equivalent energy contained in biofuels produced at alternative fuel facilities. When public data or reports were not available, estimates were calculated based on internal program analysis or program activity as reported by the administrator or administrators contacted for individual interviews, the types of technologies installed under each program and standard assumptions for the average energy savings resulting from comparable installations.[17] Electricity-equivalent production estimates noted in Table 1 represent the annual electricity-equivalent production from the cumulative or total installations occurring throughout the life of each loan program.

[17] For additional information on the annual energy production impacts of each specific program as well as the specific assumptions and calculations for those programs in which impacts were calculated, see the case studies in Section 2.

Electricity-equivalent production data were then compared with the local territory electricity consumption by deriving the percentage of total retail electricity sales offset by the program for a given locality. Locality specific electricity consumption was approximated by state level electricity retail sales data from the U.S. Energy Information Administration (http://www.eia.doe.gov/), which were adjusted, where necessary, on a per capita or per household basis for the respective utility service territory or locality served by the loan program.

Table 1. Funded Projects and their Clean Energy Production Relative to Local Electricity Consumption

Program	**FIRST (Berkeley, CA)**	**AERLP (IA)[a]**	**BEMC (NC)[b]**	**BREC (OH)[c]**	**EWEB (Eugene, OR)[d]**	**SELP (OR)[e]**
Targeted Sector	Residential, Commercial	Residential, Commercial, Industrial	Residential	Residential	Residential	All
Projects Funded	38	88	2,400	182	1156	896
Estimated Annual Electricity Equivalents (MWh)	230	1,800,000	3,400	830	2,400	1,700,000
Percentage of Respective Territory Annual Electricity Consumption (MWh)[f]	< 1%	4%	<1%	<1%	<1%	3%

[a] The Iowa Alternate Energy Revolving Loan Program (AERLP) includes large biofuel plants and their electricity-equivalent energy production. Projects are cumulative since 1996.

[b] The Brunswick Electric Membership Corporation has funded more than $6 million in energy efficiency (EE) improvements but has not yet funded a solar hot water heater. Energy savings are approximate and based on estimated loans provided for EE projects and assuming a 5% savings over average U.S. household energy use (http://www.eia.doe.gov/). A 5% savings in annual household energy consumption is based on the range of energy savings calculated from the top-rated EE programs in the country targeting residential retrofit and new home construction (York, Kushler, & Witte 2008).

[c] Butler Rural Electric Cooperative, geothermal heat pump loan program

[d] Eugene Water & Electric Board, solar hot water program

[e] The Small-scale Energy Loan Program (SELP) includes estimated energy savings from efficiency and renewable energy projects as well as the electricity-equivalent energy production from at least one large-scale biofuel plant.

[f] Respective territory consumption is based on annual state electricity consumption, estimated utility residential customers, and average household electricity consumption where applicable.

Case studies conducted for this analysis produced findings consistent with those noted above in other research. In general, participation—as a percentage of total customers and as a percentage of respective electricity demand—is low even when cumulative participation is considered. Annual contribution, from all systems receiving financing over the life of the program, to the local electricity supply is often less than 1% (see Table 1). Moreover, programs that do see moderately higher energy production include installations dating back more than 10 years and in some cases more than 20 years, and both programs that produce energy at levels greater than 1% of their respective territory's annual electricity consumption include the electricity-equivalent energy production of the biofuels produced from alternative fuel facilities.

Thus loan programs—even those in place many years—appear not to greatly impact general energy use where they have been implemented, and as a result are not greatly impacting energy security. However, this should not be construed to suggest that loan programs are not important policy tools. Rather, this result is more likely a function of the narrow purpose that loan programs serve (i.e., eliminate first cost barriers). Low participation across all programs considered here suggests that energy security interests may be better served by combining loan programs with a portfolio of clean energy policies.

Economic Development Impacts

Economic development impacts from clean energy improvements are a direct function of project-level investment. As noted above, loan programs reviewed here are somewhat limited in scale due to the size of the clean energy markets for which they are generally designed. As a result, their economic development impacts are also limited. The most notable economic development impact of these programs at the utility service territory and local level is the creation of and support for a local network of system installers. The Butler Rural Electric Cooperative went from having not a single local contractor capable of installing a geothermal heat pump to having four qualified local installers. Similarly, EWEB's solar hot water program provides a moderate level of business to a handful of local installers.

Beyond the benefit of local installer networks, direct investment in communities supports related indirect and induced economic activity. Though much is ultimately directed to equipment purchases and often leaves the locality, direct investment from such programs is notable. The BEMC loan program puts $300,000 into the BEMC service territory annually and has resulted in more than $6 million in investment since the program's commencement (BEMC 2009). If fully dispersed, the Berkeley FIRST program represents a $1.5 million investment from the pilot program alone (City of Berkeley Office of Energy and Sustainable Development). Larger programs like Iowa's AERLP have leveraged funds to support $145 million of renewable energy projects since 1996 (Iowa Energy Center, 2009). On average, the AERLP has supported approximately $11 million of annual investment in the state. Assuming the program continues to be fully subscribed, the additional $5 million in available funds could double the annual investment from the program. In Oregon, SELP has created more than $440 million dollars of direct investment in renewable energy projects since 1980 (Estes, 2009). This translates into an average of $15 million each year.[18]

Ultimately, loan programs can stimulate economic development to the extent that they result in direct investment. Relative to the total economic activity of a given state, the investment generated by these loan programs may appear trivial. However, in many communities, investments that sustain a handful of local companies are significant. Similarly, the broader state-level loan programs support investment on the order of millions of dollars per year. At their current scale, these programs may not directly employ large portions of the population, but they can contribute to a diverse state economy.

Environmental Impacts

The impact of loan programs on environmental factors such as greenhouse gas emissions, mercury, and SO_2 emissions is a function of program activity, the emissions rate of the conventional power generation resources that are displaced by clean energy installations, and the lifecycle emissions impact of technologies that are deployed. Ignoring renewable energy equipment production and disposal impacts as well as the fact that some loan programs have funded biofuel projects, for which emissions impacts are less clear, Table 2 is indicative of the scale of impact existing programs are having on the environmental metrics noted above.

[18] Values listed are gross disbursement amounts from projects installed under the noted loan programs. To the extent that financing covers only a portion of total installed costs, actual local investment is even greater. In contrast, to the extent these projects would have been installed without the financing provided by individual programs, their net impact is somewhat less than the total disbursement. A complete, net impacts analysis of this investment was beyond the scope of this report.

Table 2. Estimated Emissions Reductions from State, Utility, and Local Loan Programs[a]

	FIRST	AERLP	BEMC[b]	BREC	EWEB	SELP[c]
GHG Emissions (tons of CO2 Equivalents)	100	2,000,000	3,000	800	1,000	800,000
Nitrogen Oxides (tons)	0	4,000	5	2	1	800
Sulfur Dioxide (tons)	0	6,000	20	9	1	900
Mercury (pounds)	0	100	0	0	0	10

[a] Because of uncertainty in the estimates, results are reported to one significant figure.

[b] The BEMC program includes impacts from only energy efficiency improvements.

[c] Although the Oregon SELP program has power generation statistics comparable to Iowa's AERLP program, non-baseload GHG emissions rates in Oregon as reported by eGRID 2007 1.1 are much lower than in Iowa. As a result, the clean energy generation has a proportionally lower impact.

Source: Emissions reductions are calculated from state-specific non-baseload emissions rates as reported by eGRID 2007 1.1

Emissions reductions estimates used each program's annual electricity-equivalent production levels listed in Table 1. Energy produced or saved by these projects is assumed to reduce emissions at the non-baseload emissions rate as defined by the Environmental Protection Agency's eGRID database, version 1.1, for the state where projects are sited.

The non-baseload emission rate was used to estimate environmental impacts, because clean energy resources (either renewables or efficiency) typically do not reduce baseload generation due to their current level of market penetration and variable output levels. Instead, they displace non-baseload generation or generators operating on the margin. Although applying the non-baseload emissions rate generally leads to more accurate results than using a grid-wide average emissions rate, a more detailed analysis would evaluate the actual change in generation at the margin when clean energy assets are installed rather than simply applying the average non-baseload emissions rate. However, such detailed analysis was beyond the scope of this effort. Moreover, non-baseload emissions rates provide a sufficient indication of the scale of impact that these programs are having. Generally, environmental impacts are quite modest but in line with the overall clean energy production impacts of the programs reviewed here.

Qualitative Evaluation of Loan Programs

Generalizing and comparing the value of loan programs is very difficult for a number of reasons; loan programs are diverse, and they can target very specific or very general sectors and technologies (e.g., Berkeley FIRST vs. Oregon SELP). Also, the limited scale and funding available through existing programs limits the actual realized program impacts. Nevertheless, loan programs have specific strengths and weaknesses. This qualitative evaluation is intended to (1) highlight areas where loan programs are expected to have the greatest impact and (2) reflect the impacts loan programs can have under a wider array of circumstances.

Impacts noted in Table 3 are based on the short-term (i.e., one- to three-year), direct impacts of the programs studied and are derived from this research on program impacts noted above as well as the interviews and literature review conducted for this report. Qualitative assessments were further supplemented by discussions with internal, NREL, state policy and loan program analysts evaluating the impacts of similar programs.

Policy impacts are loosely categorized as low, moderate, and high, where low is defined as a marginal or negligible impact and high represents a capacity to drive immediate non-trivial impacts. While it is recognized that these labels are only loosely descriptive, the inherent nature of this qualitative exercise coupled with the diversity of program design variables available to policymakers does not lend itself to explicitly defined categorizations. Moreover, one should use care when interpreting the results of this table; it is not intended to reflect specific program impacts but simply to provide insights into the potential policy goals that are most likely to be impacted by loan programs of the scale reviewed in this analysis. To the extent that a loan program supports market activity that ultimately leads to widespread uptake of clean energy technology, impacts may be greater. However, such an effect is indirect and not captured in this analysis.

Table 3. Qualitative Overview of State, Local, and Utility Loan Program Impacts on High-Level Clean Energy Policy Drivers

<table>
<tr><th>Overarching Clean Energy Driver</th><th>Potential Policy Goals</th><th>Short-term Policy Impacts</th></tr>
<tr><td rowspan="8">Environment</td><td>Achieve clean air benefits (SO_X, NO_X, mercury, particulates)</td><td rowspan="8">Low</td></tr>
<tr><td>Reduce GHG emissions</td></tr>
<tr><td>Reduce water consumption</td></tr>
<tr><td>Reduce water pollution (heat and mercury)</td></tr>
<tr><td>Reduced fuel extraction impacts</td></tr>
<tr><td>Preserve sensitive areas</td></tr>
<tr><td>Protect wildlife and endangered species</td></tr>
<tr><td>Manage waste stream (farm, forestry, municipal wastes)</td></tr>
<tr><td colspan="3">Comments: State and local loan programs generally do not provide sufficient capital to drive large-scale alteration of energy generation. Existing programs tend to have little direct impact on environmental goals. However, for customers who do participate, these programs reduce individual impacts. In addition, policymakers can design programs to direct funds towards technologies that target specific “low-hanging fruit” in individual industries (e.g., agriculture, forestry, or municipal waste stream management). Loan programs that target the utility-scale generation sector are most likely to have the greatest environmental impact over the near term. However, because utility-scale projects are much more capital intensive, these programs require an order-of-magnitude increase in funding.</td></tr>
<tr><td rowspan="8">Economic Development</td><td>Create jobs</td><td rowspan="3">Low</td></tr>
<tr><td>Contribute to state economic development</td></tr>
<tr><td>Revitalize rural areas</td></tr>
<tr><td>Achieve electricity price stability</td><td rowspan="3">Moderate</td></tr>
<tr><td>Minimize electricity costs</td></tr>
<tr><td>Attract new investment</td></tr>
<tr><td>Minimize ratepayer impacts</td><td rowspan="2">High</td></tr>
<tr><td>Develop local or community-owned assets</td></tr>
<tr><td colspan="3">Comments: Renewable energy technologies face a broad set of market barriers, and the entire energy sector is only one piece in a large and diverse economy. Existing programs have resulted in only modest installations. Today’s programs have created a set of local installers, but broad economic development impacts are limited. Nevertheless, for individuals who do participate, energy price stability may be an important benefit. A supportive policy environment demonstrated by a wide set of RE policies including loan programs can be attractive for business pursuing RE opportunities. Programs that target distributed-energy technologies can enhance opportunities for local or community ownership of energy assets.</td></tr>
</table>

<table>
<tr><td rowspan="8">Energy Security</td><td>Provide abundant energy</td><td rowspan="4">Low</td></tr>
<tr><td>Provide affordable energy</td></tr>
<tr><td>Reduce transfer of wealth outside the United States</td></tr>
<tr><td>Become a net exporter of energy</td></tr>
<tr><td>Diversify energy resources</td><td rowspan="3">Moderate</td></tr>
<tr><td>Create resilient grid systems</td></tr>
<tr><td>Reduce peak demand</td></tr>
<tr><td>Encourage distributed energy generation</td><td>High</td></tr>
<tr><td colspan="3">Comments: Existing loan programs for RE are quite limited in their impact on broader state and local energy generation and consumption trends. Programs that target electricity and natural gas use likely have limited direct impact on imports of petroleum. Nevertheless, incremental additions of distributed energy technologies may diversify the set of proven technologies, provide some measure of enhanced grid resiliency, and reduce the need for new peaking capacity resources.</td></tr>
<tr><td rowspan="10">Clean Energy Deployment</td><td>Reduce fossil fuel consumption</td><td rowspan="4">Low</td></tr>
<tr><td>Advance technologies</td></tr>
<tr><td>Stimulate innovation</td></tr>
<tr><td>Reduce baseload needs</td></tr>
<tr><td>Reduce technical and policy barriers</td><td rowspan="3">Moderate</td></tr>
<tr><td>Achieve rapid RE market expansion/development</td></tr>
<tr><td>Achieve cost reductions at scale</td></tr>
<tr><td>Learn by doing</td><td rowspan="3">High</td></tr>
<tr><td>Meet RPS/Quota Targets</td></tr>
<tr><td>Stimulate early adoption</td></tr>
<tr><td colspan="3">Comments: Because loan programs are designed to facilitate deployment of technologies that are market ready, their impact on technology development is limited. They do diversify the portfolio of proven technologies, provide opportunities to assess and learn additional technical and market barriers, increase the production scale of emerging technologies, and facilitate early adoption or meet technology specific requirements within existing policies.</td></tr>
</table>

Additional Attributes of Loan Programs

Loan programs serve goals beyond direct energy security, economic development, and environmental protection. Program administrators, especially those who manage smaller programs, frequently noted an outreach benefit and an opportunity to educate consumers about energy related issues. Loan programs also generally support emerging markets for commercial technology by providing opportunities for traditional lenders to become more familiar with, and therefore comfortable with, clean energy technologies.

4. Best Practices

Clean energy policy often focuses on cost barriers, and loan programs represent one component of the cost-related policy portfolio. However, loan programs serve a narrow function, and their direct impact on high-level state clean energy policy drivers is limited by consumer interest and participation in the clean energy markets that these programs frequently target. To achieve the scale at which clean energy markets can affect state clean energy goals, a comprehensive policy portfolio that both simplifies access to clean energy technologies and includes provisions designed to make clean energy improvements practical for wide segments of the general population is generally necessary. However, loan programs put in place independently can enhance their impact on high-level clean energy policy drivers by applying lessons learned from existing programs. Lessons elicited from the experiences of program administers contacted to collect the case study data, as well as a literature review carried out as part of this research include:

- **Standardize access:** Clear requirements and a standardized process for determining loan eligibility within a specific program help to simplify access to financing for individuals and businesses that qualify. A standardized process clearly defines what is needed to determine credit worthiness, and it provides applicants with a comprehensive understanding of the cost of securing financing. Those developing eligibility requirements may also benefit from implementing provisions to protect consumers from burdensome debt. Metrics such as debt-to-income ratio can address this issue, which may be particularly pertinent for programs that do not rely on borrowers' credit scores to determine eligibility.
- **Reduce consumer-transaction costs:** The average consumer has limited knowledge about the specific value of an individual clean energy improvement. Modest returns that accrue slowly discourage interested consumers from educating themselves about viable opportunities. However, many cost-effective clean energy improvements exist for a wide array of property owners. Assisting homeowners in identifying their potential could greatly improve use of and participation in loan program opportunities. The most successful state energy efficiency programs generally offer a comprehensive energy analysis to identify the most cost-effective improvements for a given applicant (York, Kushler, & Witte, 2008, Brown 2009).[19]
- **Increase loan security:** Loans that are more secure offer better terms and lower interest rates. Increased security can also increase one's ability to attract outside investors in the broader capital markets. Increased security is likely to be fundamental to significant scaling of loan programs. At the most basic level, loan administrators can enhance overall security by targeting technologies with debt risk rather than those with venture capital risk. Alternatively, PACE bond programs increase security by placing liens on borrower's properties, but mortgage holders and the Federal Housing

[19] Evidence suggests that emphasizing barriers other than interest rates (i.e., transaction costs) may be beneficial as two of the most popular energy efficiency loan programs in North America have financing costs of approximately 5-9% (Brown 2009).

Finance Agency (FHFA) have expressed concern over such models.[20] Iowa's AERLP has increased security by offering lenders thorough project-specific, technical review.

- **Develop technology-specific loan terms:** Clean energy technologies vary widely in applications and payback periods. Long-term loans are critical for technologies with long payback periods as a longer amortization period increases the likelihood that cost savings on traditional energy bills can offset loan payments. At the same time, applying shorter loan terms to technologies with short payback periods minimizes the likelihood that consumers will be paying for technology after its useful life.
- **Minimize administrative costs:** Administrative costs represent a burden on limited state and local government funds. Programs may be able to gain efficiencies by aggregating across broader geographic areas to increase volume and loan portfolio diversity. Such practice can help disperse fixed administrative costs across a broader customer pool. Alternatively, loan administrators may increase efficiency by subcontracting specialized skills like energy audits or loan underwriting to private sector partners.
- **Provide provisions for growth:** Demand for clean energy financing already exceeds available funding in a portion of the programs reviewed here. Moreover, market, technology, and policy conditions evolve rapidly, and the demand for clean energy financing could grow a great deal as specific cost thresholds are achieved. Programs designed with the capacity to handle significant growth are likely to be better positioned to support widespread deployment of clean energy technology.

Those designing loan programs may also want to provide for the transfer of the loan when a property is sold. This is valuable for technology improvements that pay off over the long term because it allows an increasingly mobile society access to the long-term benefits of such technology improvements.[21] As well, provisions to encourage high-quality installations that perform as expected can support high levels of consumer satisfaction and the realization of program goals. Such provisions may require use of licensed or certified installers. In many localities, loan programs may be able to leverage quality assurance provisions in other state or local incentive programs by requiring that individuals who qualify for a loan program also qualify for state and local incentives that have their own quality assurance guidelines.

Complementary Policies

Expanding loan programs to include the aforementioned characteristics can facilitate deployment of cost-effective technologies. However, even under these circumstances, additional policy support may be required to justify investments in clean energy technologies. Complementary policy measures may provide the financial incentives

[20] In July 2009, the FHFA issued a letter expressing concern over PACE bond programs and their impacts on mortgage lenders whose liens are superseded by PACE bonds. PACE bond advocates argue that such criticism is not justified because municipalities have long relied on property tax based financing to raise funds for public works projects (e.g., sidewalks and sewers). Nevertheless, this issue remains unresolved at the time of this writing. Moreover, until investors are educated about the security of new financial products like PACE bonds, it is unclear how or if the increased security offered by PACE bonds will be valued.

[21] While this attribute of PACE bond programs is frequently touted, there remains some level of uncertainty as to how the market will actually respond to this feature. Potential buyers may be able to use the additional property tax expense as a lever in price negotiations.

needed to make investment in a broader array of clean energy technology cost effective, provide a clear process by which clean energy technologies can be connected to the grid, and provide increased levels of consumer knowledge of the value of clean energy investments.

Renewable Portfolio Standards (RPS)

An RPS guarantees a market for clean energy technology. “Carve outs” or technology set-asides within an RPS ensure that there is a market for specific clean energy technologies. Implementing an RPS puts incentives in place to justify investments in clean energy technology. A loan program can complement an RPS by facilitating long-term fixed rate financing for clean energy improvements that are mandated by an RPS.

Rebates, Tax Incentives, and Feed-in Tariffs

Programs that seek to deploy large amounts of clean energy technology tend to be most successful when they are designed so that the targeted technologies are economically attractive for potential borrowers. For this reason, any policy that reduces the lifetime cost of a clean energy system is likely to enhance the viability of a loan program. Rebates, tax incentives, and feed-in tariffs can be an important part of a state or local policy portfolio that includes loans or financing for clean energy installations. In addition, feed-in tariffs may provide additional benefits in that they provide a direct, quantifiable cash flow over the life of the project. Rebate or other incentive programs often have built-in regulatory and quality assurance prerequisites, which allow the loan program to focus on coordinating project financing.

Net Metering and Time of Use Rates

Net metering can add value to residential and commercial-scale clean energy systems. The combination of net metering and time-of-use rates benefits technologies whose energy production correlates with peak power demands (e.g., solar power). Such policies allow more clean energy investments to be cost effective. This enhances the potential for loan programs to support deployment.

Interconnection Standards

Interconnection standards provide a streamlined process for tying clean energy systems into the utility grid. Interconnection standards provide market uniformity and help to protect consumers and utilities from potential risks.

Subsidized Energy Audits

One mechanism for supporting reduced consumer-transaction costs is subsidized energy audits. An energy audit provides consumers with a much greater understanding of the potential risks and payoffs from specific clean energy investments. It also helps to direct public dollars used to incentivize and finance clean energy investments towards the most economically efficient opportunities.

Alternative Policies

A publicly administered loan program is not the only option for states and localities interested in facilitating financing of clean energy installations. Under many circumstances, private lenders with institutionalized financial knowledge may be in a better position to design, implement, and administer loan programs for clean energy investments. A state that chooses to partner with private industry can direct state policy at barriers that are not finance-related and can create incentives to attract private capital to the clean energy sector. Regardless of the source of financing, expanding clean energy markets typically requires a comprehensive suite of programs. The alternatives described below are either derived from activities occurring in localities outside of those considered here or may represent a single independent component of the specific programs reviewed here.

Interest Rate Buy downs

Interest rate "buy downs" provide low cost financing by using public funds to buy down or pay off a portion of the interest on a typical private sector loan. This approach may be preferable when a policymaker desires to reduce the cost of financing but does not want full responsibility for underwriting and administering a full loan program. In its pure form, an interest rate buy down is effectively a cost incentive coupled with lending from the private sector. Unless an interest rate buy down is coupled with complementary policies or addresses the challenges associated with existing programs, it is likely to have impacts that are similar to those of existing programs.

Loan Guarantees

Low interest rates are associated with low-risk investments. With loan guarantees, the risk for a potential funder of clean energy loans decreases as it is transferred from the borrower to the guarantor (local, state, or federal). Assuming proper underwriting criteria are in place, government loan guarantees can leverage larger amounts of private capital. This can reduce financing costs for consumers interested in installing clean energy systems. Loan guarantees can complement government and utility-loan programs, or they can be used to encourage increased interest from private sector lenders.

Project-Level Analysis and Review

Rather than providing direct finance programs or policy, states may provide subsidized technical analysis for customers interested in clean energy projects. Project-level technical analysis can educate consumers and reduce investor risk. This can facilitate the acquisition of private sector lending. However, it does not ensure that a customer will receive adequate financing.

5. Conclusions

Loan programs are popular policy tools to support clean energy technologies. However, participation rates have been modest, and, they appear to be incapable of driving a large-scale transition to a clean energy future by themselves. Nevertheless, policymakers can enhance today's loan programs by developing the capacity to inform consumers of viable investment opportunities, offering reduced barriers to lending, increasing the security of clean energy loans, and including loan products that allow traditional energy cost savings to offset the cost of monthly loan payments, all while continuing to strive for administrative efficiencies. Providing a loan program with such enhancements in conjunction with a policy portfolio that addresses other barriers to clean energy technologies will facilitate the transformation of state and local economies to a clean energy future.

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REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
May 2010	Technical Report	

4. TITLE AND SUBTITLE State Clean Energy Policies Analysis: State, Utility, and Municipal Loan Programs	5a. CONTRACT NUMBER DE-AC36-08-GO28308
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) E. Lantz	5d. PROJECT NUMBER NREL/TP-6A2-47376
	5e. TASK NUMBER IGST.9000
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Renewable Energy Laboratory 1617 Cole Blvd. Golden, CO 80401-3393	8. PERFORMING ORGANIZATION REPORT NUMBER NREL/TP-6A2-47376
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S) NREL
	11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

13. SUPPLEMENTARY NOTES

14. ABSTRACT *(Maximum 200 Words)*
High initial costs can impede the deployment of clean energy technologies. Financing can reduce these costs. And, state, municipal, and utility-sponsored loan programs have emerged to fill the gap between clean energy technology financing needs and private sector lending. In general, public loan programs are more favorable to clean energy technologies than are those offered by traditional lending institutions; however, public loan programs address only the high up-front costs of clean energy systems, and the technology installed under these loan programs rarely supports clean energy production at levels that have a notable impact on the broader energy sector. This report discusses ways to increase the impact of these loan programs and suggests related policy design considerations.

15. SUBJECT TERMS
clean energy technologies; clean energy technology; barriers; up-front costs; installation costs; financing; loans; loan programs; state loans; municipal loans programs; state; local; clean energy goals; clean energy policy tools

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
Unclassified	Unclassified	Unclassified	UL		19b. TELEPHONE NUMBER *(Include area code)*

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

F1147-E(10/2008)