STATE INCENTIVES FOR RENEWABLE ENERGY: CASE STUDIES ON PROGRAM EFFECTIVENESS

Susan Gouchoe
Valerie Everette
Rusty Haynes
North Carolina Solar Center
North Carolina State University
Campus Box 7902
Raleigh, NC 27695
susan_gouchoe@ncsu.edu
valerie_everette@ncsu.edu

ABSTRACT

Over the years, states have provided various financial incentives to promote the use of renewable energy technologies. Such incentives include grants, loans, and rebates, as well as credits or exemptions for income, sales, and property taxes. While existing databases such as the National Database of State Incentives for Renewable Energy (DSIRE, www.dsireusa.org) have documented what incentive programs are available, the effectiveness of such programs is not well understood. Understanding the impact of financial incentives on the deployment of renewable energy technologies and the factors which influence their effectiveness is critical to a variety of stakeholders, particularly for states considering new incentives or interested in improving or discarding existing ones.

The North Carolina Solar Center at NC State University, in collaboration with the National Renewable Energy Laboratory, examined 10 state financial incentive programs in six states using a case study approach in order to clarify the key factors—both internal and external to the program—that influence their effectiveness at stimulating deployment of renewable energy technologies. This paper summarizes lessons learned about the effectiveness of state financial incentive programs and identifies program-specific issues and other key factors influencing program effectiveness.

1. METHODOLOGY

The types of incentives examined were those with the potential to increase significantly the current renewables market either through a reduction in the market price of the technology—tax credits and buy downs—or by lowering the high initial capital outlay through low-interest loans. The scope of the study was limited to programs that support small-scale renewable energy technologies intended for on-site use in residential or small commercial applications. Given this scope, solar and small wind were the primary technologies supported by the incentives examined in this study. Case study programs were as follows:

Tax Credit Programs:
NY Solar Electric Generating Equip. Tax Credit
NC Renewable Energy Tax Credit
OR Business Energy Tax Credit
OR Residential Energy Tax Credit
Buy-Down Programs:
FL Photovoltaics Rebate[1]
IL Renewable Energy Resources Program
NY Residential Photovoltaics Program
Loan Programs:
IA Alternate Energy Revolving Loan
NY Energy $mart Loan
OR Small Scale Energy Loan

Effectiveness can be measured in numerous ways: reduction in technology costs over time, number of renewable energy businesses established during the lifetime of an incentive program, capacity installed, amount of energy produced from projects installed under the program, number of participants, or measurement of performance relative to program goals. However, given the purpose and scope of this project, we use the term *effectiveness* in the

[1] FL rebate program has ended.

context of the role the incentive plays in stimulating deployment and the degree to which the program reduces barriers to deployment. This study does not attempt a rigorous quantitative evaluation of state financial incentives. In many cases, detailed annual data on program usage, funding distributed, or energy saved were not available. Because incentive programs take many shapes, and states vary widely in their socioeconomic, political, and climatic conditions, it was not possible to evaluate similarly structured programs in comparable environments to measure them against one another. Rather, the intention was to evaluate several different programs to identify common themes regarding program effectiveness that can be applied to other existing or proposed incentive programs.

Case studies on the experience and effectiveness of the selected programs were developed by conducting personal and telephone interviews with incentive program administrators, department of revenue and other state officials, equipment distributors and installers, and representatives from advocacy groups and renewable energy associations. Program documents, including incentive applications and program usage data, and other relevant reports were also reviewed.

2. OBSERVATIONS & LESSONS LEARNED

Several overarching themes emerged from interviews with stakeholders in the six case study states regarding issues both internal and external to incentive programs that encourage and discourage the adoption of small-scale renewable energy technologies in their respective states. First, external (non-programmatic) factors will be discussed; illuminating the backdrop against which these incentive programs operate is important in understanding and assessing program performance. Following this discussion, the observations and lessons learned about the effectiveness of the features of the tax credit, buy-down, and low-interest loan programs examined in this study will be presented.

2.1 External Factors Impacting Program Effectiveness

Observations and lessons learned about these external factors that indirectly impact the effectiveness of incentive programs are as follows:

1. The case study states experienced varying levels of difficulty with respect to connecting renewable energy systems to the utility grid. In cases where the interconnection process is burdensome and costly, the effectiveness and value of incentive programs that encourage the installation of grid-connected technologies is severely compromised. Utility support and cooperation can enhance program effectiveness by ensuring a smooth interconnection process.

2. A weak infrastructure—including a shortage of qualified installers and inadequately trained building inspectors—can discourage consumers from purchasing renewable energy systems. Increasing demand by offering generous incentives before an adequate distributor and installer infrastructure is in place can frustrate potential participants and delay or discourage installations.

3. Program participants tend to be strongly motivated by non-economic factors. Concerns about environmental issues, a desire to reduce dependence on utilities, and more recently, power reliability and security threats are among the factors reported to be motivating consumers to purchase renewable energy systems. Many participants in the buy-down programs reportedly had a long-standing interest in renewables, and the incentive program inspired them to go through with the purchase.

4. A more comprehensive renewable energy education campaign may be necessary to increase deployment of renewables. An inadequate understanding of the types and benefits of renewables in general is still considered a major barrier to technology adoption. Given the attitudes that appear to play a role in the decision to invest in renewables, marketing campaigns designed to educate and mold attitudes of the general public accordingly are necessary to generate new interest in renewables.

5. A single financial incentive by itself is not likely to ensure significant market penetration of small-scale renewable energy technologies; implementing a set of complementary incentives that may include net metering, low-interest loans, tax credits, property and sales tax exemptions, and/or buy-downs, can have a significant market impact relative to the historic small markets for PV and small wind.

2.2 Tax Credit Programs

Income tax credits are a direct reduction in a person's federal or state liability for some amount of system costs, thereby enhancing after-tax cash flows and promoting investment.

There are currently 18 states offering income tax credits for renewable energy technologies, with ten states offering both personal and corporate tax credits. These programs are administered by state revenue departments or other state agencies. Most of the 18 states consider both solar and wind technologies eligible for the incentive. Credits against income tax range from 10% to 35% of equipment and installation costs for both personal and corporate income

tax credits. Three states have performance-based credits. Maximum incentive amounts range from $1,000 to $10,500 for residential systems, and from $1,000 to no limit for corporate tax credits. Most tax credits are designed to be claimed in the first year of production, allowing for any remaining credit to be carried over to the subsequent five (and in a few cases 10) years. The duration of most tax credits ranges from four to 13 years, while a few have no expiration date. Tax credits programs vary widely with respect to system quality and performance provisions. While most at least call for compliance with government and industry installation and operating standards, some programs require detailed technical information, projected energy savings documentation, or post-installation certification.

The experience of tax credit programs in three states—New York, North Carolina, and Oregon—offers the following lessons regarding program effectiveness:

1. The tax credit is not the primary motivating factor influencing purchasing decisions but often helps "seal the deal". In some cases, interested customers are unaware of the credit when they first contact a dealer, but the incentive plays a significant role in the final decision.

2. The choice of administrative agency may impact the effectiveness of the tax credit. Administering a tax credit through the state energy office rather than through the revenue department may allow better coordination with the design and administration of other energy programs and outreach activities, enable more detailed tracking of program performance data, and foster partnerships with renewables industry in promoting the incentive. States should weigh these benefits against the costs of these administrative activities.

3. The percentage of project costs eligible for a tax credit is considered to be adequate to stimulate interest in purchasing systems in these three states, but caps on eligible costs, low maximum amounts for higher cost technologies, and other credit limitations may reduce the effectiveness of the incentive.

4. Some mechanism for guaranteeing quality is necessary to ensure that states and project owners are investing in systems that perform as designed. Tax credit programs employ various technology and installer requirements, but it is unclear how these provisions impact program effectiveness.

5. Developing mechanisms for non-taxed entities to take advantage of tax credits can stimulate deployment among these sectors. Allowing schools, nonprofits and government agencies to partner with a business that can claim the credit and in return, provide a direct payment to the non-taxed entity may increase the deployment of renewables as a result of the incentive.

2.3 Buy-Down Programs

Government-funded buy-down programs in the form of rebates or other cash incentives are used to encourage the installation of renewable energy technologies by reducing or "buying-down" initial equipment costs. The term "buy-down" is most often used for reductions in the bottom line cost to purchasers, while "rebate" is used for a payment issued to the purchaser after the system has been installed. In this paper, the term "buy-down" is used to refer to these types of incentives.

There are currently 11 state buy-down programs for renewable energy technologies, all of which have been initiated within the past several years. Nearly all of these programs are funded by public benefits funds and administered by the state's energy office, third-party fund administrator, or individual utilities. All of the buy-down programs fund PV installations, with several states targeting PV exclusively. About half of the programs also support wind technology development. A few programs include solar thermal systems or fuel cells as eligible technologies. Nearly all of the buy-down programs are available to residents and businesses. In addition to these sectors, some states extend eligibility to government entities, institutions, and non-profits. Incentive levels range from $1.50 per watt to $6 per watt, with most states setting either a maximum expenditure of 20% to 60% of system cost or a maximum total dollar amount. In some states, incentive amount varies based on system size or technology. Technical and performance requirements vary widely among programs. In some cases, states initially imposed few requirements but later added quality assurance provisions after some systems were installed improperly. The use of pre-approved contractors, pre-approved equipment, and/or post-installation monitoring is mandated for buy-down recipients in some states. A couple of the buy-down programs initiated within the past year are employing performance-based incentives.

The experience of buy-down programs in three states—Florida, New York, and Illinois—offers the following lessons regarding program effectiveness:

1. Buy-downs can play a significant role in encouraging the deployment of photovoltaic systems. Individuals who have considered installing the technology for a number of years were inspired to make the purchase once the incentive became available.

2. Utility support and cooperation can greatly enhance the effectiveness of a buy-down for grid-connected technologies and are critical to ensure a quick and easy interconnection process. In cases where utilities imposed additional testing and administrative obstacles, installation of photovoltaic systems and buy down participation were sluggish at best.

3. Offering generous buy-downs in the absence of an adequate number of qualified installers frustrates consumers and can discourage them from purchasing systems.

4. Offering buy-downs to support public sector projects can help jump-start participation in and awareness of the incentive program.

5. Incentive amounts, which ranged from $3/W to $6/W in the case study states, are generally considered adequate to stimulate interest in purchasing PV systems without devaluing the product. It is unclear what incentive level is optimal, but experience suggests that a high and sustainable incentive level may be required in the program's early years with levels declining as barriers are eliminated and the market matures.

6. Uncertain funding could disrupt the progress stimulated by the incentive program; once funding is depleted, potential participants may hold off on purchasing PV systems in anticipation of renewed funding.

7. A burdensome and detailed incentive application form can frustrate or deter potential program participants. Program administrators should make applications as quick and easy as possible without compromising the level of technical and financial details necessary to ensure project feasibility.

8. Some mechanism for guaranteeing quality is important to ensure that states and project owners are investing in systems that perform as designed. Buy-down programs employ various technology and installer requirements, but it is unclear how these provisions impact program effectiveness.

2.4 Loan Programs

Government-subsidized loans are used to encourage the installation of renewable energy technologies by helping customers overcome the financial barrier associated with high up-front equipment costs. Interested, but cash-challenged customers who could not otherwise purchase a system outright can buy one with the help of such loans, which typically provide lower interest rates, more favorable terms, and lower transaction costs relative to private lending arrangements.

There are at least 22 active loan programs in 18 states that provide low cost financing for renewables. Some programs are funded by revolving loan funds which were established with petroleum violation ("oil overcharge") escrow funds, while others are funded through annual appropriations, the sale of bonds, or air quality noncompliance penalty fees. More recently established programs are funded by a system benefits charge. Total funding for loan programs varies as well, with some programs operating with as little as $200,000 per year while others lend up to $200 million per year. While the majority of loan programs promote energy efficiency improvements in addition to renewable energy technologies, a handful of states have designed programs specifically for the promotion of renewables. Approximately half of the loan programs apply to homeowners and businesses, while others are available only to government and/or non-profit and institutional entities. Interest rates vary from 1% to over 6%, with some programs setting rates on a case-by-case basis. Loan re-payment terms range from three to 20 years, with some established based on individual project needs. Maximum loan amounts for residential applications are typically in the $10,000 to $25,000 range. Programs financing larger projects cap loan amounts as high as $10 million. Loan applications typically involve a technical description that is evaluated by program administrators. A couple of the recently implemented loan programs require pre-approved contractors and post-installation inspections.

The experience of low-interest loan programs in three states—Iowa, New York, and Oregon—offers the following lessons regarding program effectiveness:

1. Low-interest loans can play an important supporting role in the deployment of renewable energy technologies but do not appear to be a significant driver in market development. Loans are most effective when coordinated with incentives that reduce up-front costs or with those that mandate the use of renewables.

2. Offering an interest rate significantly lower than the market rate and requiring minimal fees may be necessary to attract interest in loan programs.

3. Loan programs that partner with private lending institutions benefit by leveraging funds from private sources, but lenders are often reluctant to issue small loans, limiting the program's effectiveness in encouraging small-scale renewables deployment. Outreach and educational activities targeting the banking industry are critical to program success for these programs.

4. Educating and partnering with renewable energy businesses and advocacy organizations can leverage marketing activities and bolster interest in the program. As

programs mature and evolve, it is necessary to supply equipment dealers and installers with updated promotional materials, including examples portraying the advantages of low-interest financing, and information about participating banks.

5. Some mechanism for guaranteeing quality is necessary to ensure that states and project owners are investing in systems that perform as designed. Loan programs employ various technology and installer requirements, but it is unclear how these provisions impact program effectiveness.

3. CONCLUSIONS & RECOMMENDATIONS

Developing sustainable markets for renewable energy technologies is a complex and challenging task. States have adopted an assortment of approaches to reduce financial barriers to the deployment of renewables. Incentive programs examined in this study have had mixed success, with performance influenced by a variety of factors both internal and external to the program itself. Although the aggregate impacts of the incentives in the cases study states have been modest, it is important to note that some programs, particularly the relatively new buy-down programs, have played significant roles in increasing the number of grid-connected photovoltaics installed in their respective states. It has become clear that a smooth interconnection process it critical for success of these programs. Low-interest loans can play an important supporting role when coordinated with other significant incentives. Tax credits, if combined with outreach and education efforts and other complementary incentives such as net metering, can also help drive the market for renewables. Clearly, states can not expect any one of these incentives by itself to remove all the barriers to renewable energy technology development.

This study provides some potent examples of program design and implementation elements that have enhanced and limited program effectiveness. Although the unique socioeconomic, political, climatic, and infrastructure conditions at play within each state make a simple and uniform approach to incentive programs unworkable, the principles outlined below may offer guidance to states as they create new programs or modify existing ones. These principles reaffirm recommendations made by other reviews of financial incentives over the past three decades. Policy makers should consider setting the following conditions for incentive programs:

1. Work with other state programs and relevant stakeholder groups to educate the public about renewable energy technologies and to market the incentive program.

2. Offer a generous incentive level with stable, long-term funding which decreases over time as the market matures.

3. Design an easy and concise application process without compromising quality assurance.

4. Establish a consistent but cost-effective quality assurance mechanism to protect consumers by guaranteeing adequate system performance.

5. Incorporate incentives into an overall infrastructure development strategy.

6. Develop a coordinated package of incentives.

7. Allow flexibility for program modifications.

8. Track the details of program usage, costs, and energy savings/production to enable program evaluation and improvement.

Financial incentives are an important tool that can help individuals and businesses overcome the barrier of high initial equipment costs for these technologies, but to be effective, these incentives should be considered as one component in a comprehensive approach to creating a sustainable market. Without other supportive policies, including education and outreach programs, a standardized and quick interconnection process for grid-connected systems, and complementary financial incentives such as tax incentives, net metering and low-interest financing, the effectiveness of financial incentive programs in stimulating market development will be compromised. Addressing these needs and challenges requires partnerships and alliances among program administrators, advocates, equipment dealers and installers, lending institutions, utilities, public utilities commissions, and others who have authority over the financing or installation process.

4. ACKNOWLEDGMENTS

This study was funded by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. The authors wish to thank Larry Goldstein of the National Renewable Energy Laboratory who provided support and guidance for this project.