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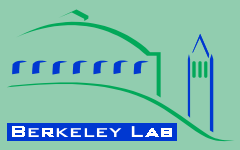

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

Innovation, Renewable Energy, and State Investment: Case Studies of Leading Clean Energy Funds

Ryan Wiser and Mark Bolinger
Environmental Energy Technologies Division

Lewis Milford
Clean Energy Group

Kevin Porter
Exeter Associates, Inc.

Roger Clark
Clean Energy Group

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Disclaimer

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Executive Summary

Study Background

Over the last several years, many U.S. states have established clean energy funds to help support the growth of renewable energy markets. Most often funded by system-benefits charges (SBC), the 15 states that have established such funds are slated to collect nearly $3.5 billion from 1998 to 2012 for renewable energy investments. These clean energy funds are expected to have a sizable impact on the energy future of the states in which the funds are being collected and used. For many of the organizations tapped to administer these funds, however, this is a relatively new role that presents the challenge of using public funds in the most effective and innovative fashion possible. Fortunately, each state is not alone in its efforts; many other U.S. states and a number of countries are undertaking similar efforts.

Early lessons are beginning to be learned by clean energy funds about how to effectively target public funds towards creating and building renewable energy markets. A number of innovative programs have already been developed that show significant leadership by U.S. states in supporting renewable energy. It is important that clean energy fund administrators learn from this emerging experience.

Report Content

This report contributes to that learning by compiling, in a case study format, information on innovative renewable energy programs and administrative practices from U.S. and international clean energy funds. These innovative programs and practices are those that have worked – or that promise to work – effectively for similar organizations in the U.S. and worldwide, and that might therefore merit further investigation, adaptation, or emulation by other clean energy fund administrators.

This report was originally funded by and prepared for the Energy Trust of Oregon (Energy Trust), a nonprofit organization created in part to invest SBC funds into renewable energy projects in Oregon. The Energy Trust was seeking to identify innovative renewable energy programs and administrative practices from other jurisdictions. (The Energy Trust was also interested in identifying the organizational and programmatic "pitfalls" that other funds had experienced; these results will be provided in a separate report.)

Though originally prepared for the Energy Trust, the contents of this report have been altered and updated somewhat to make it broadly applicable to other state clean energy funds. Accordingly, this report is intended as a reference document for clean energy fund administrators, state and federal policymakers, and other renewable energy stakeholders.

The study contains two principal components:

- Chapter 2 summarizes, in a case study format, sixteen **innovative renewable energy program cases** from the U.S. and abroad, funded by clean energy funds. This information is intended to assist state clean energy funds in considering the various programmatic options at their disposal in the near- and longer-term.

- Chapter 3 highlights five **innovative administrative practice cases** from U.S. clean energy fund experience. Because effective program administration and management are critical for the success of any organization, the intent of these administrative cases is to identify how clean energy funds have effectively managed their programs.

Prepared in a case study format, each case provides an overview of the program or administrative issue, and the results and lessons learned from the effort. Each case also lists contact information and data sources such that readers can easily obtain more detailed information.

Our approach in this work was not to describe every innovative program or administrative practice in existence, but rather to focus on a broad selection of innovative efforts that may be useful to clean energy funds broadly (and the Energy Trust specifically). We acknowledge that a certain amount of judgment was required in making these selections. The purpose of this document is therefore not to make prescriptive statements on how to best meet the objectives of any individual clean energy fund. Instead, the intent is to inform clean energy funds and others about the innovative programs and administrative practices that are being put to use in other jurisdictions, and to emphasize descriptive findings. We hope to continue this work and provide additional innovative program cases in the future.

Selection of Innovative Programmatic Cases

The 16 programmatic cases described in this report primarily come from recent activity by U.S. state clean energy funds and international experiences. We sought to identify cases that represent a wide spectrum of program and technology types: large-scale renewable projects, photovoltaics and small wind, biogas systems, the customer-driven green power market, project facilitation, training and infrastructure, and green buildings. Several of the selected cases simultaneously explore the programs of multiple clean energy funds to show how the experience of one state has resulted in program tweaks and improvements in another state. The selected cases include:

- **Production Incentive Auctions to Support Large-Scale Renewables Projects in California and Pennsylvania:** This case summarizes California's production incentive program and the difficulties it has faced, and then focuses on how Pennsylvania has attempted to innovate on California's approach to bring new wind capacity on line quickly and prior to the then-scheduled expiration of the federal production tax credit (PTC) for wind power at the end of 2001.
- **The U.K. NFFO and Ireland AER Competitive Bidding Systems:** This case describes how the incentive structures used in the U.K. and Ireland eliminate "power purchase agreement uncertainty" for large-scale renewable energy projects, which has been a major concern in the U.S.
- **An Open-Ended Renewables RFP in Minnesota Funds Biomass and Innovative Wind Applications:** Chosen in part because it provides an example of an open-RFP process that has funded a diverse set of projects, this case describes the first solicitation and results from Xcel Energy's Renewable Development Fund.
- **Use of Low-Interest, Subordinated Debt to Finance a Wind Project in Pennsylvania:** The innovative offering of low-cost debt described in this case marks a significant departure from standard grant-based project support.

- **The Use of Capital- and Performance-Based Buy-Down Programs for PV in California, Pennsylvania, and Massachusetts:** This case highlights California's successful capital-based buy-down program, and how Pennsylvania and Massachusetts have attempted to build upon the success in California by incorporating performance-based incentives into their programs.
- **Support for PV in Japan and Germany:** Examining the factors that have led to extensive grid-connected PV deployment in Japan and Germany, this case is valuable because both of these countries have a longer history of program experience (dating back to the early 1990s) than the U.S.
- **Using Bulk Purchase Commitments to Foster Sustained Orderly Development and Commercialization of PV:** The efforts of the Sacramento Municipal Utility District, the California Power Authority, the Western Solar Utility Network Cooperative, and the City of Chicago to lower the installed cost of PV systems through bulk purchase and installation programs are described in this case.
- **A Multi-Faceted Approach to Supporting PV in New York:** This case highlights NYSERDA's efforts to target different segments of the PV market, including commercial, industrial, and institutional buildings, the residential PV market, "high-value" PV installations, solar on schools, and PV systems on new Energy Star-labeled homes.
- **A Targeted Approach to Support PV and Small Wind in Montana:** Montana has targeted niche and other high-value applications such as PV-powered livestock watering systems and solar on schools (with a strong educational component); this experience is described in this case.
- **PV (and Small Wind) Pricing Programs that Link Supply with Demand:** This case provides information on the use of "green tags" to support distributed PV and small wind applications in Pennsylvania, the Pacific Northwest, and Switzerland.
- **Quality Assurance for Photovoltaic Systems:** The various approaches that certain states have taken to help ensure the quality and reliability of PV systems are described in this case.
- **Two Different Approaches to Funding Farm-Based Biogas Projects in Wisconsin and California:** This case relates the approaches and experience of two states that are actively supporting the development of a technology that has not received much attention in recent years, but whose fortunes seem to be shifting as the environmental impacts from both conventional electricity generation and agricultural waste continue to mount.
- **Using Customer Credits to Stimulate Green Power Sales in California, Rhode Island, and New York:** This case describes California's pioneering experience in offering a per-kWh incentive to encourage customers to purchase green power, and how Rhode Island and New York have attempted to apply lessons learned from California in the design of their own green power programs.
- **Information, Training, Education, Project Facilitation, and Technical Assistance in Wisconsin:** Wisconsin has taken a somewhat unique approach in raising awareness and shepherding new renewable energy projects to completion through education, marketing, training, and project facilitation (i.e., technical assistance and project "hand holding").
- **Renewable Energy Loan Programs:** This case describes the structure and experience of renewable energy loan programs in Idaho, New York, Ohio, Oregon, Pennsylvania, and Wisconsin.
- **Massachusetts' Green Buildings Program:** This program – by far the largest and most aggressive effort among state clean energy funds at promoting the use of renewable energy in

green buildings – supports feasibility studies and provides design and construction grants for both green schools and green buildings.

Selection of Innovative Administrative Cases

The five administrative cases cover issues such as: collaborative program design, program evaluation, public education and marketing, organizational structure, and solicitation approaches. Selection of the five innovative administrative practice cases was informed by our understanding of the administrative issues that are most pertinent to the Energy Trust, but the issues discussed are broadly relevant to all clean energy funds. In writing these cases, we benefited greatly from our own work with the state funds and our close observations of their activity. The cases include:

- **Massachusetts' Solar-To-Market Initiative: Using a Collaborative Approach to Create PV Programs:** This case describes a novel collaboration between the Massachusetts Renewable Energy Trust and the in-state PV industry that has resulted in a new industry group and a consensus set of PV programs.
- **Wisconsin's Use of Program Evaluation:** Consistent and frequent program evaluation has been a significant component of Wisconsin's renewable energy efforts, and has lead to several real-time changes in program offerings.
- **Public Education, Marketing, and Consumer Action: The Multi-Party Programs of Connecticut and Pennsylvania:** This case describes two of the first large-scale renewable energy education and marketing efforts in the nation, funded and supported not only by state clean energy funds, but also by a variety of other organizations.
- **Organizational Structure: The Sustainable Development Fund of Southeastern Pennsylvania:** This case study focuses on three key elements of organizational structure that have enabled this fund to design and administer innovative and effective programs, despite limited staffing.
- **Competitive Solicitations and Unsolicited Proposals: Examples from Several State Funds on How to Balance and Refine the Process:** This case describes how a number of states have balanced a preference for competitive solicitations with the flexibility to consider unsolicited proposals.

Thematic Findings

While the purpose of this report is not to offer prescriptive findings, but rather to provide a resource document for clean energy funds, state and federal policymakers and other renewable energy stakeholders, several broad themes do emerge from the chapters that follow:

- **Clean Energy Funds Are Aggressively Developing Innovative Programs:** Perhaps the most obvious observation from this study in that a large number of innovative renewable energy programs have already been developed by clean energy funds. It is also evident from the cases described in this study that clean energy fund administrators are learning from their own experiences, and the experiences of others, and that program re-designs have therefore been common in many states.

- **No Single Program Panacea Is Apparent:** The renewable energy market is a diverse and complex one, with a variety of technologies and applications vying for market share. These diverse technologies and markets have driven states to design an equally diverse set of

programs, with incentives targeted to specific renewable energy markets. Moreover, even among the policy approaches used to target individual technologies and applications, frequently no single program stands out as optimal. This suggests that multiple program designs, careful use of professional judgment, and a willingness to experiment with a variety of program options will be keys to the success of a renewable energy fund.

- **Programmatic Goals Should Drive Program Designs:** Experience with clean energy funds illustrates the need to tie program design and fund allocation to the more fundamental mission, goals, and objectives of the fund. For example, with articulate mission statements, goals, and objectives, it may be easier to select among the multiple options for supporting photovoltaic markets. Similarly, allocation of funds across technology types (e.g., lower cost wind vs. higher-cost PV) and incentive structures (e.g., grants vs. loans) must be driven by an initial set of goals and objectives.

- **Discretion and Flexibility in Program Design Can Enhance Success:** Fund managers are continuing to experiment with new program designs and innovations, and knowledge of how best to support renewable energy markets is rapidly being gained. To capitalize on this learning process, flexible program designs and ample use of discretion by fund managers in designing programs and selecting projects appear to be essential.

- **Sustainable Markets for Smaller, Distributed Projects Have Proven Harder to Build:** Several states have successfully encouraged the construction of larger-scale renewable energy projects at reasonably low incentive levels. Customer-sited, distributed renewable projects have typically required far more aggressive funding levels on a per-kWh basis. States continue to experiment with a variety of program types to enhance the success of their efforts towards customer-sited installations, and significant lessons are expected to continue to be learned based on this experimentation.

- **Working Closely With Electricity Suppliers Can Prove Critical to Fund Success**: Electric utilities and other electricity suppliers will continue to have a significant role in the renewable energy market. Utilities will retain responsibility for the interconnection of customer-sited renewable generation. Utilities and other electricity suppliers will also remain the primary purchasers of renewable electricity through long-term power purchase agreements. Experience in several states shows that the success of renewable energy funds will be strongly influenced by the actions of these utilities and competitive electricity suppliers. The interaction between state clean energy fund support for renewable energy projects and the availability of long-term power purchase agreements for renewable generators deserves special attention.

Use of This Document

This study is intended as a summary of some the innovative actions that state clean energy funds are taking to promote renewable energy, and a descriptive reference document to be used by clean energy funds in future program design. It does not provide an exhaustive review of innovative practices in use in the U.S. and abroad. Nor does it offer a roadmap for the types of programs that any individual fund (including the original sponsor, the Energy Trust) *should* pursue. We encourage state clean energy funds and others to not only review the practices

described here, but to also continue to cast a wide net to identify other innovative practices in use or in development in the U.S. and overseas. Using the case study templates provided in this report, Berkeley Lab and the Clean Energy Group will endeavor to summarize additional innovative programs over the coming years. With these experiences in hand, and with clarity of mission, goals, and objectives, state clean energy funds will be well positioned to design an effective and sustainable set of renewable energy programs.

1 Introduction

1.1 Background

Over the last six years, many U.S. states have established clean energy funds to help support the growth of renewable energy markets. Most often funded by system-benefits charges (SBC), but also funded through utility settlements and other methods, the 15 states that have established such funds are slated to collect nearly $3.5 billion from 1998 to 2012 for renewable energy investments. With aggregate annual funding that averages over $200 million per year, these clean energy funds are expected to have a sizable impact on the energy future of the states in which the funds are being collected and used.

For many of the organizations tapped to administer these renewable energy funds, however, this is a new role that presents the challenge of using public funds in the most effective and innovative fashion possible. Not only are many fund administrators new to the job, but the magnitude of the job itself is unprecedented in the United States. While states have historically played an active role in supporting renewable generation through tax incentives and renewable energy purchase mandates, at no time in the past have this many states invested the sizable quantity of public funds now available in the manner now planned. Fortunately, each state is not alone in its efforts; many other U.S. states and a number of other countries have recently embarked on similar efforts.

Early lessons are beginning to be learned by U.S. clean energy funds about how to effectively target public funds towards creating and building renewable energy markets. At the same time, international experience with similar funding mechanisms, as well as other experiences at the state level, also offer a wealth of useful program ideas and lessons learned. A number of innovative programs have already been developed that show significant leadership by U.S. states in supporting renewable energy markets. It is important that clean energy fund administrators learn from each other's emerging experience, and that policymakers and others in the renewable energy community recognize the significance of the ongoing actions of these clean energy funds.

1.2 Report Objectives

This report contributes to that learning by compiling, in a case study format, information on innovative renewable energy programs and administrative practices from U.S. and international clean energy funds. These innovative programs and practices are those that have worked – or that promise to work – effectively for similar organizations in the U.S. and worldwide. These programs and practices might therefore merit further investigation, adaptation, or emulation by other clean energy fund administrators.

This report was originally funded by and prepared for the Energy Trust of Oregon (Energy Trust), a nonprofit organization created in part to invest SBC funds into renewable energy projects in Oregon. The Energy Trust was seeking to identify innovative renewable energy programs and administrative practices from other jurisdictions. (The Energy Trust was also

interested in identifying the organizational and programmatic "pitfalls" that other funds had experienced; these results will be provided in a separate report.)

Though originally prepared for the Energy Trust, the contents of this report have been altered and updated somewhat to make it broadly applicable to other state clean energy funds. Accordingly, this report is intended as a summary of some of the innovative actions that state clean energy funds are taking to promote renewable energy, and therefore serves as a reference document for clean energy fund administrators, state and federal policymakers, and other renewable energy stakeholders.

This report has two major purposes.

- First and foremost, this report summarizes **innovative renewable energy programs** from the U.S. and abroad, based on experience from clean energy funds. This information is intended to assist state clean energy funds in considering the various programmatic options at their disposal in the near- and longer-term.
- Second, the report highlights **innovative administrative practices** from among U.S. clean energy funds. Because effective program administration and management are critical for the success of any organization, the intent of the administrative "innovative practice" summaries is to identify how clean energy funds have effectively managed their programs.

Our approach in this work was not to describe every innovative program or administrative practice in existence, but rather to focus on a broad selection of innovative efforts that may be useful to clean energy funds broadly (and the Energy Trust specifically). We acknowledge that a certain amount of judgment was required in making these selections. The purpose of this document, however, is <u>not</u> to make prescriptive statements on how to best meet the objectives of any individual clean energy fund. Instead, the intent is to inform clean energy funds and others about the innovative programs and administrative practices that are being put to use in other jurisdictions, emphasizing descriptive findings. We hope to continue this work and provide additional innovative program cases in the future.

1.3 Overview of Methods

This report contains 16 innovative renewable energy program cases, and 5 innovative administrative practice cases. Prepared in a case study format, each case provides an overview of the program or administrative issue, and the results and lessons learned from the effort. Each case also lists contact information and data sources such that readers can easily obtain more detailed information.

Innovative program and administrative cases were identified and selected based on our own extensive observations of state and international activity, a review of program documentation, evaluations, and published reports, and our interactions and interviews with both fund administrators and with domestic and international renewable energy experts. Because this report was originally prepared for the Energy Trust of Oregon, we specifically selected certain cases based on the interests of the Energy Trust. Because experience with many of the U.S. programs is limited, we highlight not only programs that have been objectively successful but also

programs that include innovative features for which little experience yet exists. Details on the methods for case selection, as well as our methods more broadly, are provided later in this report.

1.4 Report Content

The remainder of this report is organized as follows:

- **Chapter 2** presents the innovative programmatic cases. Section 2.1 provides a more detailed review of our methodology in selecting innovative programs, while the remaining sections provide details on the 16 programmatic cases that we chose to highlight. Each case contains the same basic information and format: (1) a case summary (broken out onto an initial separate page and intended primarily for those readers seeking only a high-level summary with little detail), (2) a detailed case description and highlights (for those seeking more detail), (3) organization and contact information, and (4) information sources. Each case is intended to be brief, typically 6 pages maximum, with web links, contacts, and information sources clearly identified for easy reference.

- **Chapter 3** presents similar information for our innovative administrative practices. The chapter begins with a brief review of our approach to case selection and data collection. The remaining sections provide summaries of the five administrative cases that we selected as innovative practices.

- **Chapter 4** provides some brief conclusions to the report.

Using the case study templates provided in this report, Berkeley Lab and the Clean Energy Group will endeavor to summarize additional innovative programs over the coming years.

2 Innovative Program Cases

2.1 Approach Overview

This chapter contains 16 innovative renewable energy program cases from the U.S. and abroad that may merit further investigation, adaptation, or emulation by other clean energy funds. We sought to identify cases that represent a wide spectrum of program and technology types. The 16 innovative programmatic cases can be categorized as follows:

- large-scale renewable projects (4 cases),
- photovoltaics (PV) and small wind (7 cases),
- biogas systems (1 case),
- customer-driven green power market (1 case),
- project facilitation, training and infrastructure (2 cases), and
- green buildings (1 case).

These 16 innovative program cases come from the following sources:[1]

- **Recent Activities of U.S. State Clean Energy Funds.** A large number of states have recently created clean energy funds, often during electricity reform processes. These funds have made numerous investments, some of which have already borne fruit, and many of which have only just begun. The majority of our cases come from this source.
- **International Experience.** International markets for renewable energy have often been driven by policies that are unlikely to be directly relevant to U.S. clean energy funds: feed-in tariffs, tax policies, and, more recently, purchase mandates. Capital grants have also been used successfully. However, based on our experience with international renewable energy policies, a review of secondary sources, and select interviews with international renewable energy experts, we identified several cases that either provide longer programmatic history and experience than in the U.S., or that represent innovative activities not currently happening in the U.S.
- **Other Select Efforts.** Though not always funded by clean energy funds per se, certain other state or local programs may provide relevant lessons for state clean energy funds. We therefore include one case that summarizes experience with several energy loan programs, some of which are funded by clean energy funds and others of which are funded in other ways. We also include a case on bulk purchase and installation programs for photovoltaics, drawing on experience from programs and efforts that are not always funded by state clean energy funds.

Because experience with many renewable energy programs remains limited, we highlight both programs that have already shown success, and programs that have been designed in an innovative or creative fashion, but for which experience is too limited to definitively claim success.

[1] We note that we did not exhaustively search for smaller renewable energy programs run by state energy offices.

We also include several cases that simultaneously explore the programs of multiple clean energy funds to show how the experience of one state has resulted in program tweaks and improvements in another state. We expect that these "combination cases" will be of value because they attempt to identify both program successes and possible improvements in fund distribution over time.

The 16 programmatic cases highlighted in this chapter were identified and selected based on our own extensive observations and evaluations of state and international activity, from reviewing program documentation, evaluations, and published reports, and from interactions and interviews with both fund administrators and with domestic and international renewable energy industry participants and experts. Because this report was originally prepared for the Energy Trust of Oregon, the Energy Trust was heavily involved in this iterative process, and helped guide the selection of an appropriate and diverse mix of programs.

A variety of qualitative criteria were used to screen innovative programmatic practices and to ultimately identify the 16 cases. Most of the criteria cannot be quantified in a meaningful way, and therefore we acknowledge a degree of professional judgment and subjectivity in our choices. These qualitative criteria included:

- **Low Incentive Levels per kWh of Electricity Delivered:** We looked for cases that demonstrated a low incentive level per kWh (program and administrative costs) of electricity delivered, and/or that leveraged other funds.
- **High Success Rate of Installations:** We sought cases that have been particularly successful in getting projects in the ground, or getting customers to buy renewable energy.
- **Market Transformation and Replicability:** We sought cases that appeared replicable and sustainable, and that had the possibility of "transforming" the renewable energy market.
- **Addresses Concerns Experienced in Another State:** We sought cases in which a state tried to innovate and improve upon the programs developed in other states.
- **Wide Technology and Program Mix in Final Selection:** As shown earlier, we tried to identify best practices that would cover a wide range of technologies and program types.
- **Incentives and Technologies Are Applicable to the Energy Trust:** We selected cases that demonstrate the use of incentive types that are applicable to the Energy Trust of Oregon, and cases that emphasize the technologies that are targets of the Energy Trust's efforts.[2]

Our approach was not to identify and describe every innovative practice in existence in the U.S. or internationally, but rather to focus on a selection of innovative programs that may be useful to clean energy funds broadly (and the Energy Trust specifically).

While there is clearly some overlap, we also specifically tried to select cases that represent a wide variety of technologies and program types: large-scale renewable projects (e.g., wind), PV and small wind, biogas, customer-driven green power markets, project facilitation, training and infrastructure, and green buildings. Two important implications of this approach deserve mention:

[2] By this measure, this report excludes for example cases that emphasize natural-gas fuel cells, forestry-based biomass resources, and equity investments in renewable energy firms.

- First, our approach does not seek to evaluate the relative merits of one technology over another (e.g., PV versus wind) or one program type over another (e.g., grants to large projects verses directly supporting the green power market). We leave these important decisions to state policymakers, clean energy fund administrators, and other renewable energy stakeholders, and instead focus our efforts on relating these innovative practices in a descriptive fashion.
- Second, it is sometimes challenging to identify a singular innovative practice in certain programmatic areas. This is especially true for distributed generation technologies (PV, small wind, etc.), where a wide range of innovative funding approaches have been used. In the case of solar, we have therefore opted to identify and describe a disproportionately large number of cases to highlight some of the advantages and disadvantages of different program types. Additionally, because the issues associated with small wind are somewhat similar to those for solar, and because most small wind programs have so far been offshoots of PV programs, we chose to describe small wind and PV programs jointly.

After selecting our featured programs, we sought the necessary information to write the case studies that are included in the pages that follow. Data collected about the selected innovative programs came from published papers and reports, program websites, programmatic summaries and documentation written by the funds, and interviews with fund personnel. Based on our research, each case below includes a brief case summary (broken out onto a separate initial page, and intended for those seeking only a high-level summary with little detail), a more detailed case write-up, contact information, and a list of data sources. Because the information provided for each case is not exhaustive, each write-up contains additional web links and contact information from which additional details may be obtained.

2.2 Production Incentive Auctions to Support Large-Scale Renewables Projects in Pennsylvania and California

2.2.1 Case Summary

Case Description

In June 1998, California pioneered the use of production incentives – which encourage project performance by paying on a per-kWh basis – to support large-scale renewable projects. Three production incentive auctions have now been held in the state. For a variety of reasons – most notably a lack of credit-worthy power purchasers, but also including permitting delays and general market uncertainty – more than half of all funded projects (representing more than 80% of total funded capacity) have not yet been built. In late 2000, Pennsylvania tweaked California's production incentive model to suit its own needs in supporting wind power. Though direct comparisons between the two programs are difficult and perhaps even inappropriate given somewhat conflicting program objectives, the design and early results of Pennsylvania's program are encouraging, suggesting that Pennsylvania's approach may be somewhat better suited to bring new wind capacity on line in a short period of time.

This case summarizes California's production incentive program and the difficulties it has faced, and then focuses on how Pennsylvania has attempted to innovate on California's approach to bring new wind capacity on line quickly and prior to the then-expected expiration of the federal production tax credit (PTC) for wind power at the end of 2001.

Innovative Features

- California's market-based program was designed to allow all renewable technologies to compete for funds, and as such has incorporated a relatively high degree of leniency to accommodate the needs of a diverse set of technologies (e.g., long development times for geothermal relative to wind).
- Pennsylvania's program – which focuses solely on wind power and has far lower funding levels – innovates on California's pioneering efforts by providing up-front payment of the production incentive, requiring more stringent bid bonds from developers, and using greater discretion in selecting projects that combine a low level of required incentive with a high probability of project completion.

Results

- In the three auctions held since June 1998, California has awarded $242 million in 5-year production incentives to 81 projects totaling 1,300 MW of new renewables capacity. So far, 36 projects totaling 203 MW have come on line.
- In late 2000, Pennsylvania awarded $6 million to 2 wind projects totaling 67 MW. One 15 MW project came on line within a year (in October 2001), and the other has been delayed by certain local opposition. Both of the Pennsylvania wind projects have secured 20-year power purchase agreements with Exelon Power Team. In July 2002, Pennsylvania issued a second, less-structured $6 million solicitation for wind power (described in Section 3.6).

2.2.2 Detailed Case Description and Highlights

Clean energy fund administrators in the U.S. often face a "chicken and egg" problem when it comes to providing incentives to utility-scale renewable energy projects. On the one hand, these projects typically require not only state financial support but also a long-term power purchase agreement (PPA). Without long-term revenue certainty from *both* sources, renewable developers are often unable to secure suitable financing to develop their projects. On the other hand, state clean energy funds are responsible for only one of the two requirements – state financial support.

Production incentives that pay on a per-kWh basis have become a popular form of state financial support for large-scale renewable energy projects. This is because production incentives encourage maximum energy production and appear not to trigger offsets to the federal production tax credit (PTC) for wind and closed-loop biomass.

Yet experience in California and elsewhere shows that, on their own, production incentives are not a complete panacea, and are often not sufficient to bring projects to fruition. Without a PPA from a credit-worthy buyer that will, when combined with the state incentive, provide sufficient revenue certainty to the project, project completion rates will languish. Therefore, if the goal is to bring new renewables capacity on line quickly, production incentives should be designed carefully. For example, production incentives might be awarded only to projects that have identified, or that are very close to identifying, a willing and credit-worthy buyer of their power. Stringent bind bonds and project milestones can also improve project completion rates.

This case summarizes California's pioneering efforts with its production incentive program, and the difficulties it has faced. The case then turns to a discussion of how Pennsylvania's much smaller production incentive program has been designed to overcome some of the challenges that have faced California's program. Though direct comparisons between the two programs are difficult and perhaps even inappropriate given somewhat conflicting program objectives, the design and early results of Pennsylvania's program are encouraging, suggesting that Pennsylvania's approach may be somewhat better suited to bring new wind power capacity on line in a short period of time.[3]

California

In June of 1998, the California Energy Commission (CEC) pioneered the use of production incentives to support large-scale renewable energy projects when it auctioned off $162 million in 5-year production incentives to 55 projects totaling roughly 550 MW of new renewable capacity. Three of the projects were expected to come on line in 1998, 22 in 1999, 17 in 2000, and the remaining 13 in 2001.[4] As of June 2002, however, 5 of the original 55 projects had withdrawn from the program, while 30 of the remaining 50 projects had come on line, adding roughly 178 MW of new in-state renewables capacity. In other words, 4 years after the first auction, nearly half of the projects (accounting for roughly two-thirds of the capacity) funded in that auction have not been built.

[3] In addition to California and Pennsylvania, other states that have offered production incentives to large projects include Montana, New Jersey, New York, Oregon, and Rhode Island.

[4] Winning bidders were given until the end of 2001 (i.e., 3.5 years) to bring their projects on line, or else risk losing their incentive award.

Since the initial June 1998 auction, the CEC has held 2 additional auctions in response to the state's electricity crisis:

- In November 2000, the CEC auctioned off $40 million of 5-year production incentives in support of 17 projects totaling 471 MW. This auction included a 10% bonus/penalty system to encourage projects to come online prior to the summer of 2001. As of June 2002, 6 of these projects totaling 25 MW have come on line.
- In August 2001, the CEC auctioned another $40 million in support of 9 projects totaling 300 MW. This auction also included a 10% bonus/penalty system to encourage projects to come online prior to the summer of 2002. So far, none of these projects have been built.

In aggregate, then, since June 1998 the CEC has awarded $242 million (through a weighted average 5-year production incentive of 0.8¢/kWh) in support of 81 projects totaling roughly 1,300 MW of new renewables capacity. As of the end of June 2002, 36 projects totaling 203 MW have come on line. This low level of project completion is not overly encouraging, and is due to a variety of factors, including: a notable lack of credit-worthy purchasers of project output (exacerbated by California's electricity crisis); permitting hurdles; and a high degree of market uncertainty – even before the electricity crisis began – that in retrospect contributed to optimistic and aggressive bidding behavior by developers. Each of these three factors is explored in more depth below.

- **Lack of Credit-Worthy Purchasers of Project Output:** The main culprit behind California's struggle to see new renewables projects built is a perverse lack of demand. California's electricity crisis destroyed the green power market and concentrated all power purchasing in the hands of the Department of Water Resources (DWR), which signed only a handful of contracts for renewable energy (representing just 1.5% of the total power the DWR has contracted for over the next decade). With the DWR now facing a power glut, and two of the three major investor-owned utilities in the state struggling to regain an investment-grade credit rating, developers of new projects have largely been unable to secure the long-term contracts they need in order to obtain suitable financing and develop their projects.

  California's experience demonstrates that even with generous production incentives, revenue uncertainty can still plague a project. In addition to providing effective incentives, state funds must remain mindful of the need for projects to secure PPAs with credit-worthy counter-parties. One potential remedy to the problem of revenue uncertainty is to provide incentives directly to utilities or other credit-worthy power purchasers that buy project output rather than to the projects themselves, as discussed in Section 2.3 on the UK's Non-Fossil Fuel Obligation. California is currently planning a slight variation on this theme, whereby the state's investor-owned utilities would be required to contract for renewable power at market prices, and state production incentives would be paid to renewable generators to cover any remaining above-market costs. Oregon's clean energy fund, meanwhile, has recently issued a wind power solicitation with the same structure as that being planned in California. Yet another solution, however, is to use discretion (combined with strong milestones and bid bond requirements) to select projects that have secured (or are close to securing) a long-term PPA, as Pennsylvania has done (discussed below).

- **Permitting Hurdles:** Even projects that are able to secure PPAs may be denied construction permits or be significantly delayed at the permitting stage. For example, 2 of the 4 geothermal projects funded in the CEC's first auction have negotiated PPAs with the Bonneville Power Administration, yet have not been built due to planning opposition from local Native Americans and environmental groups. A lack of familiarity with the issues surrounding renewable energy technologies, typical NIMBY responses, local political considerations, and even inadequate staffing at permitting agencies can all raise permitting hurdles that might stymie a project.

- **Market Uncertainty and Aggressive Bidding:** One must recognize that the CEC's production incentive program, as well as the evolving electricity market environment in which it has been operating, are both unprecedented. At the time of the first auction in June 1998, no one could have predicted the strength (or lack thereof) of the newly competitive electricity market, the degree of demand for green power, the extent of the "green" premium that renewable generators might earn, or the electricity crisis that would eventually destroy the market. Within this first-of-its-kind and constantly changing market environment, both the CEC (in designing its auction) and renewables developers (in bidding into the auction) were forced to operate on the assumption of a stable market.

  In retrospect, of course, this turned out to be a bad assumption, and it is likely that some of the bids in the first auction were based on an overly optimistic assessment of market demand and PPA availability. It is also quite possible that the flexible and lenient design of the first auction may have enabled developers to bid aggressively without fear of substantial recourse. In particular, while the CEC's bid bond requirement (10% of the full 5-year production incentive requested) is intended to discourage blatant "speculative" bidding, the rather lenient refund policy (relative to Pennsylvania, see below), whereby the full bond is refunded once a project files for permits, makes it relatively painless for developers to opt out of successfully bid projects that no longer look as attractive as they once did. Additionally, the CEC's approach to selecting projects based largely on the level of the incentive bid (and not on other factors that might affect project completion) may have helped exacerbate this aggressive bidding phenomenon. While aggressive bidding is not, by itself, troublesome, and in fact may be highly desirable in an auction setting, if a program's ultimate goal is to see renewable energy projects proceed towards construction quickly, then there is a need to balance aggressive or overly optimistic bidding with a certain degree of realism. Requiring more stringent forms of security is one way to accomplish this.

While these are just a few of the reasons that project completion rates have languished in California, it should be noted that the CEC's program was not necessarily designed to bring projects on line rapidly or within an unstable market. Instead, California's program was designed to allow all renewable technologies to compete for funds, and as such incorporated a relatively high degree of leniency to accommodate the needs of a diverse set of technologies. For example, developers funded in the first auction were given 3.5 years to develop their projects – more time than typically needed to develop a wind plant, yet perhaps barely enough time to develop a geothermal project. In this and perhaps several other ways, the CEC's program was designed with the "lowest common denominator" (e.g., longest development time) in mind. The program was also designed to be market-based, with the auctions structured to reward the most

cost-competitive (i.e., lowest bid) projects rather than to guarantee that projects would be built (leaving that decision up to the market). This overall strategy differs markedly from that employed in Pennsylvania, where the program's main objective was to bring wind power projects (i.e., a single technology) on line before the scheduled expiration of the federal production tax credit (PTC) for wind power at the end of 2001 (i.e., a little over a year from the auction date).

Pennsylvania

As part of the PECO/Unicom merger settlement, the Sustainable Development Fund (SDF) in PECO's service territory received $12 million to support the development of new wind power in Pennsylvania. In September 2000, the SDF issued a $6 million "Phase I" competitive solicitation for new wind power, offering 5-year production incentives capped at 1.5¢/kWh (i.e., modeled after California's program). A dozen or so projects totaling roughly 150 MW of new wind capacity responded with bids.

After narrowing the field to just a few projects and consulting with these bidders, however, the SDF determined that it could increase its leverage and the number of MW installed by effectively providing a lump sum payment (contingent on production) payable upon the commercial operation of each project. Through this novel arrangement, the SDF provides the developer with the full projected 5-year incentive amount upon commercial operation, and in return the developer provides the SDF with a letter of credit for that amount. As the wind project "earns" its incentive over time by producing energy, the amount of funds secured by the letter of credit is reduced accordingly until either the project earns the full incentive amount or the 5-year incentive period expires (in which case the project forfeits any remaining un-earned incentives).[5]

Two projects, totaling 67 MW, were announced as winners of the solicitation in early 2001. The 15 MW Mill Run project (awarded $2 million or 1.2¢/kWh) in western Pennsylvania came on line in October 2001, while the 52 MW Waymart project (awarded $4 million or 0.8¢/kWh) near Scranton has been delayed by certain local opposition. Both projects have secured 20-year PPAs from Exelon's wholesale Power Team. Even with the production incentive, the PPAs are priced at above-market rates; Exelon intends to make up the difference through premium green power sales. As such, Exelon has reached an agreement with Community Energy, Inc. to market the wind power at a premium to both commercial and residential retail customers. Community Energy has already sold essentially all of the output of the 15 MW Mill Run project (along with that of the 9 MW Somerset project, described in Section 2.5) mainly to institutional and commercial buyers in the state.

While only one of the two funded projects had come on line by September 2002, the basic design of SDF's production incentive program, as well as the health of the overall electricity market

[5] One of the winning bidders has received a definitive private letter ruling from the IRS that this up-front production incentive will not offset the value of the federal production tax credit. The ruling, however, is based largely on SDF's non-governmental status and the fact that the funds in question came from a utility merger settlement (i.e., private rather than public capital). Since these conditions are case-specific, other clean energy funds would be wise to seek advice from the IRS – or more appropriately encourage funded projects to do so – if they were to consider offering up-front production incentives.

within the region, appears likely to result in faster project completion than in California. Several enabling factors (both internal and external to the program) deserve mention:

- **Stable Demand:** Unlike California, Pennsylvania offers multiple markets in which to sell wind power, making at least one credit-worthy wholesaler (Exelon) more comfortable in entering into long-term PPAs, which are critical to the success of wind projects. Pennsylvania's restructured electricity market has remained relatively stable compared to that of California, and the state's green power market also remains functional. In addition, funded projects are permitted to sell their output into the New Jersey renewables portfolio standard (RPS) if desired. The presence of demand from multiple markets allows developers and market participants to proceed with new projects in an environment of relative certainty.
- **Discretion to Choose the Best Projects:** The SDF employed considerable discretion in selecting projects that were both able to demonstrate low required incentive levels *and* a high probability for project completion by the end of 2001. To evaluate projects based on the latter metric, the SDF asked bidders to provide information demonstrating: financial health, ability to finance a large wind energy project, technical ability to construct and manage a large wind energy project, site control, feasibility of interconnecting the proposed project with the electric grid, wind resource adequacy, ability to secure all required permits within four months of award, and, perhaps most importantly, *progress towards securing a power purchase agreement*. These criteria are more comprehensive than those employed in California – where the CEC selected winning projects from among the pool of qualified bids based solely on the level of incentive requested[6] – and may have contributed to Pennsylvania's success in bringing new wind capacity on line in a short time period. Of course, the small size of Pennsylvania's program ($6 million in support of a single technology) relative to California's program ($242 million in support of a diverse set of technologies) facilitates the use of discretion in evaluating project bids.
- **Bid Bond Milestones:** Pennsylvania's bid bond system differs from California's in one critical respect. Though the level of security provided – at $2,500 per MW of project – is only about 20% as large as California's requirement, the refunding milestones are more stringent: one third of the bid fee is refunded once the project has secured all permits, a second third is refunded once the project has secured financing, and the final third is only returned once the project has commenced commercial operation. This is in contrast to California, where the entire bid bond is refunded at the time the project applies for permits. Again, this difference in bid bond design is perhaps reflective of the different philosophies employed by California and Pennsylvania in designing their respective programs: whereas California has relied largely on market discipline to ensure that projects are built, Pennsylvania has chosen to maintain greater leverage over its funded projects in an effort to encourage rapid completion.
- **Up-Front Incentive:** The "up-front" nature of the incentive leverages its value, due to the time value of money. If one assumes that the wind developer's cost of capital exceeds the SDF's opportunity cost of capital by 10%, this up-front lump sum approach boosts the incentive's leverage by 32% (in this case, enabling an additional 16 MW) compared to a production incentive distributed over 5-years. If the cost of capital differential is 5%, a 15% (or in capacity terms, 9 MW) leverage boost could be expected. It is worth noting that this

[6] Qualified bids are those that satisfactorily included an estimate of energy production over 5 years and a forfeitable bid bond, as well as demonstration of eligibility to bid, site control, and project feasibility.

novel approach has also been recognized by SDF's peers as being innovative and worth emulating: in their latest solicitations for grid-supply projects, both New York and Rhode Island have indicated a willingness to structure an SDF-style up-front production incentive if requested by the successful bidder.[7]

2.2.3 Organization and Contact Information

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

Suzanne Korosec
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512
http://www.energy.ca.gov/
skorosec@energy.state.ca.us
(916) 654-4516

2.2.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Utility-Scale Renewable Energy Projects: A Survey of Clean Energy Fund Support." LBNL-49667. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

CEC Reports: http://www.energy.ca.gov/renewables/documents/index.html

SDF Semi-Annual Reports for 2001: http://www.trfund.com/sdf/sdf_important%20docs.htm

NYSERDA Program Opportunity Notice 672-02: http://www.nyserda.org/672pon.pdf

SDF Funding Opportunity Notice: http://www.trfund.com/sdf/sdf_important%20docs.htm

Personal communication with: Roger Clark (SDF)

Comments provided by: Suzanne Korosec (CEC)

[7] Montana's fund also tried to use a variant to this approach; in this case, the fund was to deliver an up-front payment to a wind project in order to secure a lower and fixed PPA price for the power output. Though the wind project is now on-hold, the payment was to be made after the project was up and running and "accepted" by the utilities involved.

2.3 The U.K. NFFO and Ireland AER Competitive Bidding Systems

2.3.1 Case Summary

Case Description

Until recently, the United Kingdom's (UK) principal form of support for renewable energy was delivered through a competitive bidding process known as the Non-Fossil Fuel Obligation (NFFO). Through this process, renewable generators were able to bid for above-market power purchase agreements (PPA) in five NFFO auctions. The UK's electric companies were required to purchase the output of projects awarded NFFO contracts. Instead of the government paying production incentives to renewable energy generators, however, the utility purchasers were reimbursed for any above-market costs that were incurred. A similar mechanism, called the Alternative Energy Requirement (AER), has been operating since 1995 in Ireland. Because these systems eliminate "power purchase agreement uncertainty," a major concern in the U.S., they are described in this case study.

Innovative Features

- Experience with the NFFO and the AER shows how clean energy funds can work directly with the ultimate purchasers of renewable electricity to offer full revenue certainty, including long-term PPAs, to the lowest-cost renewable projects.
- This approach (or variants of it) deserves consideration as a way of maximizing the chances of project success. Of course, unlike the NFFO and AER, state funds will not be able to *require* utility or competitive electricity supplier participation; instead, incentives will need to be offered to *encourage* such participation.
- Such approaches have not yet been applied extensively by state renewable energy funds, in part because such an approach is challenging to develop once retail competition is introduced and the traditional roles of the utility providers change. States like Wisconsin and Oregon, however, which have not comprehensively restructured their electricity industry, may be particularly well positioned to broker such a deal. In fact, in July 2002, Oregon issued a wind power solicitation structured along these lines; California is planning to implement a related strategy.
- NFFO and AER experience also shows that long-term PPAs, regular competitive solicitations, technology bands, and penalties for non-performance can all play a role in clean energy fund efforts to support large-scale renewable projects.

Results

- The NFFO and the AER have created strong competitive pressures to lower the price of renewable electricity.
- Both sets of programs have also brought new renewable generation on line (approximately 1000 MW in total) and have solved the "PPA dilemma" faced by some U.S. funds.
- The NFFO and AER processes do not merit direct emulation, however. In both cases, incentives for speculative bidding and permitting hurdles have resulted in a large number of failed projects.

2.3.2 Detailed Case Description and Highlights

The Need for a Long-Term PPA

As mentioned in Section 2.2, fund administrators in the U.S. often face a "chicken and egg" problem when it comes to providing incentives to utility-scale renewable energy projects. On the one hand, these projects typically require not only state financial assistance but also a long-term power purchase agreement (PPA). On the other hand, clean energy funds are responsible for only one of the two requirements – state financial assistance.

The limited success of the production incentive auctions in California (described in Section 2.2) therefore comes as little surprise. With the onset of the energy crisis, the winning bidders in the CEC auctions searched in vain for PPAs with credit-worthy buyers that would, when combined with the CEC incentive, provide enough revenue certainty to get their projects built.

Clearly, a proper linkage between fund solicitations and long-term PPAs is crucial to success (Bolinger and Wiser 2002). As detailed in other cases, Pennsylvania and Minnesota have taken limited steps to break this chicken-and-egg problem – in both states the fund administrator selected projects that appeared most likely to garner a PPA. The Energy Trust of Oregon has gone one step further by proactively working with the state's two investor-owned utilities to ensure a PPA for the wind projects it plans to support; California is planning to implement a related strategy. Finally, as discussed in this case, the U.K. Non-Fossil Fuel Obligation (NFFO) and Ireland Alternative Energy Requirement (AER) provide examples of perhaps the most direct way of achieving a PPA and revenue certainty.

The NFFO and AER Structure "Solves" the PPA Conundrum

Until recently, the UK's principal form of support for renewable energy was delivered through a competitive bidding process known as the NFFO (similar mechanisms, not described here, are used in Scotland and Northern Ireland). Through this process, between 1990 and 1998, renewable generators were able to bid for above-market PPAs in five NFFO auctions intended to result in 1500 MW of declared net capacity (DNC) by 2000 (Mitchell 2000).[8] The UK's 12 regional electric companies were required to purchase the output of any project in their region awarded an NFFO contract, and were refunded the difference between the monthly NFFO price and the market price of power (the UK power pool price) via a surcharge on electricity consumption (similar to a system-benefits charge). A similar mechanism has been operating since 1995 in Ireland and continues to this day, with 5 competitive bidding rounds held so far (Gallachoir 2000).

These solicitations were "full cost" auctions that asked renewable developers to bid the PPA price that they would require to come on line. Instead of the state paying this price directly to the developers, however, the utilities were required to enter into these PPAs but were subsequently reimbursed for any above-market costs that were incurred. Clean energy fund support was therefore directed to the purchaser of the electricity – the utilities – rather than to the project developer. Unlike a production incentive, a full cost auction eliminates the risk of not finding a long-term PPA with a credit worthy buyer.

[8] DNC is the amount of baseload capacity required to produce an equivalent amount of energy over a year – 4 MW of wind at a 25% capacity factor equates to 1 MW DNC.

NFFO1 and NFFO2 offered PPAs that expired at the end of 1998, while NFFO3, 4, and 5 offered 15-year contract terms, as has the AER in Ireland. Within each auction there have been separate "bands" for different renewable technologies, and in some rounds there have been sub-bands for small wind projects, therefore ensuring a more diverse set of winning bidders. Winning bidders are those that have the lowest PPA bid prices in their specific band, and winners are offered PPAs at their bid price.

Solicitation Results

The structure of the NFFO and AER solicitations solved one major problem – that of the PPA – and also resulted in deep price reductions over time. For example, the average 15-year PPA price of winning bidders in NFFO3 was 4.2 pence/kWh, while similar bids in NFFO5 were down to 2.7 pence/kWh.

The table below shows results from the five rounds of the NFFO, which resulted in 880 awarded contracts for 3271 MW of renewables declared net capacity (DNC). Note that prices in NFFO1 and 2 are not directly comparable to NFFO3, 4, and 5 because PPA lengths were raised from 8 to 15 years.

	NFFO1	**NFFO2**	**NFFO3**	**NFFO4**	**NFFO5**
period of guaranteed contract	1990-1998	1991-1998	1994-2009	1997-2012	1998-2013
capacity of winning bids (MW, DNC)	152	472	627	843	1177
installed capacity (MW, DNC)	145	172	293	156	55
average price (pence/kWh)	6.5	6.6	4.4	3.5	2.7

Results of the AER, not presented here, show similar trends, though the AER competitions have been far smaller in size (Gallachoir 2000).

Problems Loom: Permitting and Speculative Bidding

While the basic structure of the NFFO and AER has merit, and the results of the solicitations have been widely lauded as encouraging efficient cost reductions, the NFFO and AER processes have also been strongly criticized. This criticism is based on the observation that the majority of winning bidders have been unable to bring their projects on-line. Out of 3271 MW of awarded contracts, only 821 MW has been installed – a success rate of just 25% so far. AER results are similar.

As described by Mitchell (2000), the government's often-stated desire to reduce the average price per kWh for each successive order created tremendous competitive pressures to lower bid prices. Two specific design features of the NFFO and early rounds of the AER contributed to what many believe to be a high degree of speculative bidding:

- **No Penalties for Non-Performance and Lengthy Development Times**: Bid prices have been the primary metric by which winning projects are selected. With no penalties applied to winning bidders that are unable to develop their projects, and with up to 5 years to bring one's project on line, generators were encouraged to bid speculatively based on assumptions of declining technology costs in the future.

- **Permitting Hurdles**: To further increase their chances of securing a contract, developers naturally looked to the strongest wind sites – which in the UK often coincide with prominent features of the landscape. With no requirements that projects have permits before bidding into the NFFO and initial rounds of the AER, numerous projects faced permit denials after winning an NFFO contract.

Though these elements of the NFFO and AER process do not deserve emulation – and in fact the UK NFFO has now been abandoned in favor of a renewables portfolio standard because of the limited success of the NFFO in bringing projects on-line – the concept of working with or through the utility buyer of renewable electricity deserves the attention of U.S. clean energy funds. Such an approach may be especially viable in states that have not opened their electricity market to full retail competition and therefore have not fundamentally altered the role of the utility providers. Of course, unlike the NFFO and AER, state funds will not be able to require utility participation; instead, incentives will need to be offered to encourage such participation.

Several state funds are considering or actually pursuing such a model. In July 2002, the Energy Trust of Oregon (in complicity with the state's two investor-owned utilities) issued a solicitation for wind power whereby the utilities would enter into long-term PPAs for the power at prices reflective of projected market prices, and the Energy Trust would subsidize the project to cover any remaining above-market costs. California is planning to use a similar model as a means of covering the incremental cost of a renewable portfolio standard.

The idea of regular competitive solicitations to allow technologies to mature and technology bands to ensure resource diversity also deserves consideration. It is also useful to note the NFFO's move away from the initial 8-year PPAs to 15-year PPAs in later rounds, and the consequent reduction in bid prices. Learning from the NFFO and AER, it is also apparent that penalties for non-performance and closer consideration of siting and permitting issues should be incorporated in competitive bidding processes. These lessons have apparently been learned in Ireland, where the latest round of the AER required that projects have permits *before* they bid, and that winning bidders maintain a tight schedule for completion (Gallachoir, Chiorean and McKeogh 2002).

2.3.3 Organization and Contact Information

UK NFFO
Renewable Energy Enquiries Bureau
ETSU
Harwell
Didcot
Oxfordshire
OX11 0QJ
nre-enquiry@aeat.co.uk
01235 432450

Ireland AER
Eugene Dillon
Department of Public Enterprise
Sustainable Energy Division
44 Kildare St.
Dublin 2, Ireland
http://www.irlgov.ie/tec/energy/renewable/
EugeneDillon@dpe.ie
(353-1) 604-1061

2.3.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Utility-Scale Renewable Energy Projects: A Survey of Clean Energy Fund Support." LBNL-49667. Berkeley, Calif.: Lawrence Berkeley National Laboratory and Clean Energy Funds Network.

Gallachoir, B. 2000. "Market Mechanisms – Future Policy Options." Workshop RE4: Changing Market for Renewables." The Energy Show 2000.

Gallachoir, B., C. Chiorean and E. McKeogh. 2002. "Conflicts between Electricity Market Liberalization and Wind Energy Policies." Proceedings of Global Wind Power 2002. April 2 - 5 2002 Paris, France.

Haas, R. (ed). 2000. "Promotion Strategies for electricity from Renewable Energy Sources in EU Countries." Joint report financed by the 5th framework program of the European Commission.

Mitchell, C. 2000. "The England and Wales Non-Fossil Fuel Obligation: History and Lessons. Annual Review of Energy and Environment, 25: 285-312.

Moore, C. and J. Ihle. 1999. "Renewable Energy Policy outside the United States." Issue Brief 14. Washington, D.C.: Renewable Energy Policy Project.

Personal communication with: Brian Gallachoir, University College, Cork Ireland, b.ogallachoir@ucc.ie and Catherine Mitchell, Warwick University, catherine.mitchell@warwick.ac.uk

Ireland AER: http://www.irlgov.ie/tec/energy/renewable/

UK NFFO: http://www.dti.gov.uk/renewable/nffo.html

2.4 An Open-Ended Renewables RFP in Minnesota Funds Biomass and Innovative Wind Applications

2.4.1 Case Summary

Case Description
Xcel's Renewable Development Fund (RDF) in Minnesota announced the results of its first solicitation in early 2002. With over $9 million to spend on "commercial" projects, the solicitation sought grant requests from a variety of renewable technologies.

Innovative Features
The outcome of this solicitation in terms of megawatt-hours of renewable energy *actually* delivered will remain unclear for some time. Nonetheless, several interesting features of the solicitation bear mention:

- the solicitation was open and relatively unstructured in an attempt to attract a wide variety of creative and effective project proposals;
- the program administrator specifically gave weight to biomass proposals and innovative, smaller-scale wind applications that might otherwise not compete with larger-scale projects;
- the Fund developed an explicit method to compare the cost-effectiveness of proposals that were received; and
- the Fund selected projects that were deemed to have a reasonable chance of obtaining a long-term power purchase agreement from the local utility to improve chances for project completion.

Results

- The RDF received 28 proposals for commercial projects. The Board ultimately selected 8 projects – three biomass, one hydro, two solar, and two wind. If these projects come to fruition, the total funding of $9.8 million could result in 12 MW of new renewables capacity.
- This is a reasonably high level of funding per MW installed. But it must also be remembered that RDF focused on smaller-scale, innovative projects to ensure a large number of winning bidders and a mix of renewable technologies. The program, for example, has funded several biomass digestion projects, a school-based wind project, and a "cooperative" wind project.

2.4.2 Detailed Case Description and Highlights

The Xcel Fund

The Xcel Renewable Development Fund (RDF) will grow by approximately $9 million per year. The RDF was created from a nuclear waste disposal settlement, and is administered by the Renewable Development Board (which consists of two representatives of Xcel Energy and two representatives from the environmental community).

An Open-Ended Solicitation

On July 16, 2001, Xcel issued its first solicitation for renewable energy grant proposals – future solicitations may use non-grant funding mechanisms. "Grant" contracts may have terms of up to 10 years, allowing both production incentives and traditional up-front grants to qualify. The timeline for the solicitation called for proposals to be submitted by August 20, 2001 and for signed grant contracts to be filed with the Commission by December 21, 2001.

Proposals could fall into one of three categories: (A) commercial technology (minimum of 60% of funds), (B) experimental technology (maximum of 20% of funds), and (C) research and development (maximum of 20% of funds). Because most states plan to primarily target commercially available technologies, we focus on Minnesota's Category A results in this case study.

Category A proposals (i.e., commercial technology) were to be new projects or refurbished existing projects, and eligible technologies included wind, solar, and certain types of hydro and biomass. The solicitation was open to all of these technologies because the RDF wanted to avoid pre-determined technology favoritism and sought a broad range of proposals from which to choose. Projects that would be used to meet Xcel's renewable energy mandate were not eligible for funds under the solicitation.

Evaluation Criteria

Evaluation criteria of Category A proposals fell into four categories: (1) project approach and work plan, (2) project team, (3) economic development impact, and (4) cost-effectiveness. Each proposal was quantitatively scored based on these criteria, with cost-effectiveness being given the highest weight. The Renewable Development Board evaluated, scored, and selected winning proposals, for ultimate approval by the PUC. The Board sought to fund a minimum of 4 projects under Category A and also wanted to fund a diverse mix of renewable resources. Therefore, quantitative scores were not the sole metrics of final project selection. Instead, each proposal was evaluated relative to a "peer group" of other proposals with similar project size and technology type.

The Cost Effectiveness Criterion

The Board recognized that it was important to apply a cost-effectiveness test that was appropriate for the wide range of projects likely to be proposed in terms of size, technology type, and application (electricity used on site versus sold to the grid). The Board initially decided to calculate the amount of renewable energy generated over a 15-year period per dollar of RDF funding. The Board also explored the application of "utility cost ratio", "total resource cost", and "ratepayer impact measure" tests. The Board ultimately used the ratepayer impact test as the

measure of cost effectiveness (it deserves note that the results from this test were found to not differ substantially from the initially-proposed test). The ratepayer impact test is calculated by dividing Xcel's avoided energy cost (derived from the amount of energy proposed to be delivered by the applicant and appropriate on-peak and off-peak avoided cost estimates) by the sum of RDF funds requested, expected utility energy payments to the applicant (e.g., under a power purchase agreement), and utility lost revenue (if self generation is involved). A 15-year present-value estimate was then calculated. Results of this test were given strong weight in the scoring process within each project size and type category.

Treatment of PPAs and Grid Sales

As described in other innovative practice cases, a proper linkage between fund solicitations and long-term power purchase agreements (PPA) is often crucial to success. The Board made clear that its decision to fund a project would not bind Xcel Energy to purchase the electricity from the project under a long term PPA. However, in evaluating proposals, the Board considered the likelihood of each proposal's success in obtaining a PPA.

Each contractor was required to provide an estimate for the annual price schedule it would need for up to a 15-year PPA. For those projects that would need a PPA, the Board used a screening criterion of whether the proposed price schedule would possibly be accepted by Xcel – the Board included two Xcel employees, facilitating the screening process and potentially improving the prospects of ultimately obtaining PPAs. While this allowed some consideration of the PPA in project selection, there remains a significant concern that some (perhaps many) of the funded projects will be unable to obtain a favorable PPA and therefore will be unable to move towards completion. To minimize the risk of wasted funds, projects that rely on a PPA will only receive their RDF funds once the PPA has been negotiated with Xcel and approved by the Minnesota PUC.

Solicitation Results

The RDF received 28 proposals in Category A. After considering the evaluation criteria, the Board selected 8 projects: three biomass, one hydro, two solar, and two wind projects. If these projects come to fruition, the total funding of $9.8 million could result in 12 MW of new renewables capacity in the state. Though this is a reasonably high level of funding per MW installed, it must be remembered that RDF focused on smaller-scale projects to ensure a large number of winning bidders; RDF was also not willing to fund projects that would be used to meet the Xcel renewables mandate.

Each selected project is briefly described below. "5-year incentive equivalent" data are calculated by spreading the RDF funding request over 5 years of expected electricity production (as provided by the fund administrator), ignoring discounting.

- **Greden Dairy & Crop Farm** is a 90-cow dairy farm. The project involves anaerobic digestion of manure waste. The project will have a capacity of 100 kW, with about 325,000 Btu of excess heat that will be used on site. Excess energy will be sold to Xcel at a net metering rate, or used on site to operate a soybean processing facility. The contract award is for $80,000. (5-year incentive equivalent = 1.6¢/kWh).
- **Minnesota Corn Processors** had planned to install a 580 kW reciprocating engine to utilize methane that is currently being flared from its processing facility, with electricity used on

site. The contractor was to develop a report that could be used to show other industrial process facilities how to implement similar projects. The contract award was for $400,000, but the contractor subsequently declined the award. (5-year incentive equivalent = 1.7¢/kWh).

- **AnAerobics** owns and operates a treatment system for a canned vegetable processor. Using a "first-of-its-kind" technology, AnAerobics will simultaneously convert both solid and liquid waste from the processing plant into methane gas and carbon dioxide. 1.7 MW of electricity will be generated, and sold to either Alliant or Xcel. The contract award is for $1,300,000. (5-year incentive equivalent = 1.8¢/kWh).
- **Crown Hydro** is a 3.2 MW, run-of-river hydro facility located in Minneapolis that anticipates selling its electricity production to Xcel. The contract award is for $5,100,000. (5-year incentive equivalent = 5.4¢/kWh).
- **Minnesota Department of Commerce** will administer a 4-year rebate program for grid-connected PV installations of 4 kW and smaller. The rebate amount will be $2,000/kW, with an aggregate program goal of 400 kW of capacity. The contract award is for $1,150,000. (5-year incentive equivalent = 48¢/kWh).
- **Science Museum of Minnesota** is completing design work on an "environmental experiment center." The RDF will help fund an 8 kW rooftop solar system. The contract award is for $100,000. (5-year incentive equivalent = $1.70/kWh).
- **Project Resources Corporation**, together with enXco, will construct six 900 kW wind turbines, two each at three separate locations near distribution substations for a total of 5.4 MW. The development will employ the use of prototype turbines, and the development is to incorporate a new investment program where individuals from the community can purchase shares and earn a return from the project without having turbines located on their land. The contract award is for $900,000. (5-year incentive equivalent = 1¢/kWh).
- **Pipestone, Jasper School System** will construct a 900 kW wind turbine on public school property. The school will use 75% of the electricity produced, and will sell the remaining to Sioux Valley Southwestern Electric. The contract award is for $752,835. (5-year incentive equivalent = 5.8¢/kWh).

Though grant periods for up to 10 years were allowable, the majority of projects requested up-front incentive structures.

Lessons Learned and Next Steps

The Board of the RDF is apparently pleased with the results of the first solicitation. That said, a number of relatively modest changes are being considered to further improve future solicitations. Some of the most relevant possible changes include:

- An even more explicit preference may be given to biomass technologies, while wind projects that involve a novel concept, approach, or application may also be given preference. Further clarification will be provided on other technology eligibility guidelines.
- Maximum $/kW buy-down amounts may be specified, and a maximum funding level for individual projects may be established. These changes are intended to avoid proposal "clutter" and ensure that proposals are consistent with the RDF's objectives.
- To minimize PPA-related problems, a clear price signal may be sent by publishing PPA rates for small wind, distributed generation, and net-metered facilities. The RDF may also provide a maximum price range that Xcel Energy would pay under a negotiated PPA.

- Increased marketing and publicity about the availability of funds under the program to encourage a deeper applicant pool.

2.4.3 Organization and Contact Information

John Lupo
Xcel Energy
414 Nicollet Mall
Minneapolis, MN 55401-1993
http://www.xcelenergy.com/EnergyMarkets/EnergyMarketsRFPmain.asp
john.lupo@xemkt.com
(888) 547-9603

2.4.4 Information Sources

Xcel Renewable Development Fund:
http://www.xcelenergy.com/EnergyMarkets/EnergyMarketsRFPmain.asp

Xcel Energy. 2001. "Xcel Energy Renewable Development Fund Project Selection and Funding." Filing to the Minnesota PUC. Docket No. E02/M-00-1583.

Personal communication with: Bill Grant (board member of the Renewable Development Fund) and John Lupo (administrator of the Renewable Development Fund).

2.5 Use of Low-Interest, Subordinated Debt to Finance a Wind Project in Pennsylvania

2.5.1 Case Summary

Case Description

Four Pennsylvania funds have teamed up to offer $3.6 million in low-interest, subordinated debt to a 9 MW wind project. This offering represents the first use of low-cost debt by a state clean energy fund to support a large-scale wind project in the U.S., and marks a significant departure from standard grant-based project support. This case describes the structure of the incentive and how it has impacted the project, and identifies several caveats to keep in mind.

Innovative Features

Several innovative features of this investment deserve note:

- The subordinated debt reportedly provided a similar amount of value to the project as would have a production incentive that had previously been offered in Pennsylvania. Unlike production incentives, however, subordinated debt allows the Pennsylvania funds to recoup their collective investment (*and* earn a 5% return) over 10 years.
- Because the debt is subordinate to any senior financing, it does not interfere with the project owner's ability to arrange senior financing. Existence of a senior lender experienced in project finance will provide considerable cost savings to the Pennsylvania funds, which intend to piggyback on the senior lender's due diligence and mimic the structure of the senior loan agreement.
- The syndication of Pennsylvania funds allowed each fund to participate at a level with which it is comfortable, while drawing on the financial expertise of the syndicate leader and the senior lender.

Results

- The project came on line in 2001, but has yet to tap into the subordinated debt. This is because the project does not yet have a permanent owner, and the current owners (the development team) have sufficient cash reserves to own and operate the project without financing in the interim.
- It is clear, however, that the existence of the financing played a positive role in the negotiation of a 20-year power purchase agreement with Exelon (the wholesale buyer).
- While these promising early results seem to indicate that the use of subordinated debt to finance large-scale projects could be a model worth emulating, several factors, including implications for the federal production tax credit, must also be considered.

2.5.2 Detailed Case Description and Highlights

To date, production incentives have been the most common form of support that clean energy funds in the United States have offered to large-scale renewable energy projects (e.g., wind farms). While they are an improvement over capital grants in encouraging project performance, production incentives do have one potential shortcoming: once the funds have been awarded, they are "gone" forever and unavailable to support future projects. In an attempt to provide incentives on a more sustainable basis, the four clean energy funds in Pennsylvania have joined together in a syndicated offering of $3.6 million in subordinated debt to the 9 MW Somerset wind project in Pennsylvania. The project began commercial operations in October 2001. This offering represents the first use of low-cost debt to support a large-scale wind project in the U.S. by a state clean energy fund.

Structure

The Sustainable Development Fund (in PECO's service territory) leads the syndication with a $1.5 million contribution, and acts as agent on behalf of the other three clean energy funds in Pennsylvania: The Sustainable Energy Fund of Central Eastern Pennsylvania ($1.15 million), the GPU Sustainable Energy Fund ($0.65 million), and the West Penn Power Sustainable Energy Fund ($0.30 million). The 5% debt, offered for a 10-year term, is intended to be subordinate to any senior financing (i.e., the senior debt provider will have first lien on the project's assets), thereby not interfering with the project owner's ability to raise senior debt.

Status

While the terms of the deal were structured and a commitment letter conditionally awarded in the second quarter of 2001, the Somerset project has yet to tap into the subordinated debt. The developer of the project is unable to take advantage of the federal production tax credit (PTC) itself, and so has been negotiating with prospective purchasers who can. A proposed sale of the project to Entergy was abandoned in December 2001 due to concerns regarding the unclear future of the equipment supplier (Enron Wind). As the developer has sufficient cash reserves to own and operate the project until a buyer is found, no permanent financing (including the Pennsylvania funds' subordinated debt) is needed at this time.

Benefits

It is clear, however, that the existence of the financing played a role in the negotiation of a 20-year power purchase agreement (PPA) with Exelon (the wholesale buyer). The PPA reportedly indicates that the subordinated debt financing reduces the power purchase price by 0.6¢/kWh, and provides a similar amount of value to the project as would a $1 million grant. A $1 million grant equates to about a 1¢/kWh 5-year production incentive offered as a lump sum upon commercial operation (i.e., the structure described for Pennsylvania in Section 2.2). In other words, the use of subordinated debt provides price reductions on par with a production incentive, yet allows the Pennsylvania funds to recoup their collective investment (*and* earn a 5% return) over 10 years, to be recycled in support of new projects.

Furthermore, despite its novelty, the use of subordinated debt does not appear to be significantly more administratively burdensome than a standard production incentive. The Somerset deal is contingent upon the eventual existence of a senior lender, whom the Pennsylvania funds are

counting on to carry much of the burden. Specifically, a senior lender experienced in project finance will perform rigorous due diligence well beyond the capabilities of the Pennsylvania funds; if at the end of this process the senior lender is satisfied, so will be the Pennsylvania funds. Likewise, the funds are hoping to closely mimic the loan agreement negotiated between the senior lender and project owner, potentially changing only the interest rate and term. These features make the use of subordinated debt more feasible than one might otherwise think.

Finally, the syndication enables each fund – which range in total size (i.e., including energy efficiency funds) from $2 million to $4 million per year – to participate at a level with which it is comfortable, while drawing on the financial expertise of the Sustainable Development Fund (the syndicate leader) and, as noted above, the senior lender.

Given the apparent success of subordinated debt financing in reducing the cost of the Somerset project and sustaining the capital base of the Pennsylvania funds, the Sustainable Development Fund is offering, among other financing options, subordinated debt in Phase III ($6 million) of its dedicated wind program funded by the PECO/Unicom merger. There have even been discussions with other funds (e.g., Connecticut) that are interested in participating in future syndications.

Caveats

While these promising early results seem to indicate that the use of subordinated debt to finance large-scale projects could be a model worth emulating, there are several considerations to keep in mind:

- **Attractiveness of Debt-Based Incentives:** First, subordinated debt financing may only be useful to a project if the ultimate project owner requires debt financing. As more and more large corporations diversify into wind project ownership (e.g., FPL, Shell, AEP, Entergy, Cinergy), balance sheet financing – with no external debt requirements – may become more common than project financing. This will diminish the value of debt-based incentives to project owners. Furthermore, without a senior lender, the "piggybacking" strategy adopted by the Pennsylvania funds does not work.

- **Tying Up Project Funds:** Second, under a debt arrangement, funds would be tied-up in a project for some time, only to be returned slowly throughout the debt term (in this case 10 years) via capital and interest repayment. While such repayment could ultimately be expected to result in more MW of renewable electricity installed over time than a one-time production incentive, a state fund with a fixed budget and time horizon will be able to leverage more renewables capacity in year one with a production incentive than with low-interest debt. This is because only a portion of low-interest debt – the portion that is below market – subsidizes the project, whereas a production incentive is pure subsidy. Thus, for a given amount of capacity, it takes a greater amount of low-interest debt to provide the same level of support as a production incentive. Likewise, for a given amount of funds, a production incentive can support a greater amount of capacity than can low-interest debt.

- **Interaction with the PTC:** Third, when funding a wind or closed-loop biomass project, one must consider the effect of the incentive on the PTC. The tax code states that the value of the

PTC is reduced by "the aggregate amount of subsidized energy financing provided (directly or indirectly) under a Federal, State, or local program provided in connection with the project," relative to the project's capital cost. While the terms of the subordinated debt offered to the Somerset project – 5% debt for 10 years – could quite easily be construed as "below-market" or "subsidized" given where interest rates have been trading, the tax code does not offer specific guidance on how to determine whether or not financing is subsidized, and neither the Pennsylvania funds nor the project developers have requested an IRS ruling on this or other matters relating to this project.

Furthermore, it is not clear whether system-benefits charge funds are considered "State" programs. In a private letter ruling, the IRS determined that a production incentive offered by the Sustainable Development Fund to the Waymart project did not constitute a State program. The specific funds in question, however, came from a utility merger settlement (i.e., private capital), as opposed to a system-benefits charge mechanism.[9] To our knowledge, the IRS has not ruled on whether system-benefits charge funds are considered to be public or private funds. If interested in offering below-market subordinated debt, state clean energy funds would be wise to seek advice from the IRS on whether or not system-benefits-charge-derived funds are considered public (i.e., State) or private funds.[10]

Otherwise, if PTC offsets are ultimately triggered, the financial impact of the incentive will be partially or wholly offset by a corresponding reduction in the value of the PTC. For example, if one assumes that the Somerset project was installed at a cost of $1,000/kW, then $3.6 million in subordinated debt represents 40% of total capital costs. If below-market subordinated debt were to trigger PTC offsets, then the value of the subordinated debt to the Somerset project – revealed in the PPA to be 0.6¢/kWh – will be more-than-offset by a 40% reduction in the value of the PTC (commonly considered to be worth 1.5-2¢/kWh in its entirety). In other words, an incentive worth 0.6¢/kWh could trigger a reduction in the PTC of up to 0.8¢/kWh, leaving the project worse off than it was without the incentive.

2.5.3 Organization and Contact Information

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

[9] Note that the subordinated debt offered to Somerset was not funded out of the PECO/Unicom merger settlement, but rather through each fund's regular system-benefits charge funding.

[10] Ed Ing's recent NYSERDA-sponsored analysis of PTC offsets indicates that the source of funds may not even matter if the fund administrator is clearly a State entity (as is NYSERDA): Ing concludes that if NYSERDA were to offer subsidized energy financing, it would definitely offset the value of the PTC, no matter whether the funds were public or private.

2.5.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Utility-Scale Renewable Energy Projects: A Survey of Clean Energy Fund Support." LBNL-49667. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Ing, E. 2002. "The Effect of NYSERDA's Wind Project Assistance on the Federal Production Tax Credit." http://www.nyserda.org/energyresources/taxcreditpaper.pdf

SDF Semi-Annual Reports for 2001: http://www.trfund.com/sdf/sdf_important%20docs.htm

Personal communication with: Roger Clark (SDF)

2.6 The Use of Capital- and Performance-Based Buy-Down Programs for PV in California, Pennsylvania, and Massachusetts

2.6.1 Case Summary

Case Description

As one of the first states to implement a system-benefits charge funded buy-down program for photovoltaics (PV) and other customer-sited renewable technologies, California has set the standard for other states to follow. Eleven states now offer capital-based buy-down programs in one form or another.

This case study focuses on only three of these programs: California, which has had the most success in stimulating the installation of large amounts of PV capacity, and Pennsylvania and Massachusetts, whose programs are just getting underway yet deserve mention because of their innovative incorporation of performance-based incentives into a standard buy-down program.

Innovative Features

- The California Energy Commission's (CEC) buy-down program, which provides a capital-based incentive of $4.50/W for up to 50% of installed system costs, has met with significant response in recent years. Concerns have been raised, however, that the CEC's program may not provide adequate incentives for system performance, that it has not driven significant PV cost reductions among small systems, that its buy-down payment levels are high, and that it might not lead to sustainable markets for PV once the subsidy is removed.
- Pennsylvania and Massachusetts have designed programs that seek to overcome one of these shortfalls by awarding a portion of the incentive based on system performance. Pennsylvania's program awards $3/W at installation, and then pays both the system owner and installer a smaller performance-based incentive at the end of one year. Massachusetts awards 70% of a $5/W incentive up front, and pays out the remaining 30% based on system performance over three years.
- Massachusetts is also targeting geographically clustered installations in an attempt to minimize programmatic and system costs.

Results

- Over $80 million in support of 21 MW of PV has been reserved under the CEC's program, with 9 MW already installed. 1.1 MW of small wind has also been reserved, with 500 kW installed so far. Furthermore, another 16.5 MW of PV capacity has been reserved under the CPUC's self-generation program ($4.50/W for PV systems between 30kW and 1 MW). This aggregate reserved volume of 37.5 MW of PV is impressive considering the relatively small size of the PV market domestically and abroad, and shows that buy-down programs can significantly increase demand for PV in both the residential and non-residential sectors.
- Modified buy-down programs in Pennsylvania and Massachusetts demonstrate how funds can support PV using performance-based incentives, though it is too early to judge the success of these programs.

2.6.2 Detailed Case Description and Highlights

Buy-down programs, which provide capital grants to "buy down" the initial cost of photovoltaics (PV) and other customer-sited renewable technologies such as small wind, have proven popular among state funds for a variety of reasons: they are relatively straightforward to implement, directly engage the public, impose minimal transactions costs on the system owner, provide a relatively stable incentive over time that encourages PV manufacturers and installers to market their systems and plan for expansion, and have the potential to provide quick and tangible results that may, over time, drive reductions in PV costs. At the same time, some have criticized capital-based buy-down programs as being expensive and doing little to encourage system performance or create sustainable markets once the subsidies decline or disappear.

As one of the first states to implement a system-benefits charge funded buy-down program, California has set the standard for other states to follow, while also providing valuable real-time experience upon which other states have drawn in designing their own programs. At this time, California, Delaware, Illinois, Massachusetts, Minnesota, Montana, New Jersey, New York, Pennsylvania, Rhode Island, and Wisconsin either offer or are in the process of implementing buy-down programs. See Bolinger and Wiser (2002) for information on all of these programs.

In this case study, however, we limit our coverage to just three states: California, which has had considerable success in stimulating the installation of large amounts of PV (and small wind) capacity, and Pennsylvania and Massachusetts, whose programs are just getting underway, yet deserve mention because of their innovative incorporation of performance-based incentives into a standard buy-down program. We begin by examining the successes (and potential shortcomings) of the California Energy Commission's (CEC's) program, and then describe how Pennsylvania and Massachusetts are attempting to innovate on the CEC's approach. We note that the "quality assurance" aspects of these and other PV programs (other than the use of performance-based incentives, which is discussed here) are described separately in Section 2.12.

California

The $54 million allocated to the CEC's Emerging Resources Account over the program's first 4 years (from March 1998-March 2002) was to be used to buy down the capital cost of customer-sited renewable facilities that offset some portion of the customer's load. Qualifying "emerging" technologies include CEC-certified photovoltaic systems, solar thermal electric systems, fuel cells utilizing renewable fuels, and small (<10 kW) wind turbines, though in practice over 90% of all reservations have been for PV. Though eligible systems are not limited in size, at least 60% of the funds must be awarded to systems of 10 kW or smaller, and another 15% is reserved for systems rated at 100 kW or less.

Consistent with the idea that production costs should decline as demand and volume increase, the funds were initially distributed sequentially in five blocks of decreasing value (see table below). Once all the funds in a block were committed, the next block offering a lower subsidy would become available.

Block	1	2	3	4	5
Total Funds (million)	$10.5	$10.5	$10.5	$10.5	$12.0
Max $/W Rebate	$3.0	$2.5	$2.0	$1.5	$1.0
Max Rebate as % of Cost	50%	40%	30%	25%	20%

Source: CEC Guidebook for Emerging Renewable Resources Account

In mid-2001, however, the CEC abandoned this declining block structure and implemented a flat $4.50/W buy-down up to 50% of installed costs (i.e., an increase of $1.50/W over the first and most lucrative block). This abrupt shift was in response to indications that anticipated cost reductions had not occurred (at least among small systems), and concerns over the potential effect that a lower incentive would have on system sales at a time when California needed all the extra generation it could get (i.e., due to the electricity crisis, which peaked in the winter of 2000/2001). At around the same time, funding for the program was increased from $54 million to $100 million, with the vast majority of new funding going to small systems (<10 kW).

The graph below shows the number of system reservations received by the CEC in each quarter of the program's history. Several caveats are in order:

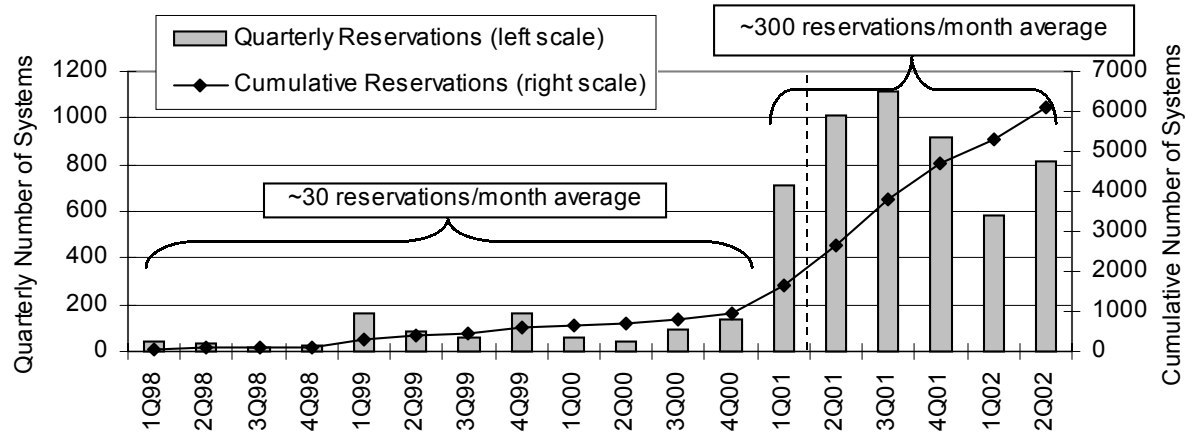
- The data include all eligible technologies, including PV, small wind, and fuel cells using renewable fuels. More than 90% of all reservations, however, are for PV systems.
- The graph combines reservations for small (<10 kW), medium (10 – 100 kW), and large (>100 kW) systems, and is therefore not a good representation of trends in *capacity* reserved under the program, since a few large projects could represent as much capacity as thousands of small projects.[11]
- Funding for medium and large projects was depleted in the fourth quarter of 2001, and will not be restored until the 5-year implementation plan of the Renewable Energy Program is approved by the state legislature. It is likely, therefore, that reservation requests in 2002 include only small systems,[12] with medium and large systems pursuing incentives through the CPUC's self-generation program instead (see next bullet).
- The data represent only the CEC's buy-down program, and not other state or municipal programs. For example, in mid-2001, the California Public Utilities Commission (CPUC) implemented a statewide "Self-Generation Program", which offers, among other incentives, a $4.50/W incentive (up to 50% of system costs) for customer-sited PV installations of between 30 kW and 1 MW. Through June 2002, 112 PV projects totaling 16.5 MW of capacity were actively reserved under the CPUC's program; these projects are not represented by the graph.

According to the CEC, grid-tied PV system installations in California occurred at a rate of 1 system per month prior to the inception of the buy-down program in 1998. Under the buy-down program, reservations had been running at about 30 systems per month on average from 1998 through 2000 (i.e., prior to the electricity crisis). While this represents a 30-fold increase, the pace of reservations during these first 3 years was nevertheless below expectations for the

[11] For example, through the end of 2001, the program had 22 active reservations for large projects totaling more than 7 MW, compared to 3,454 active reservations for small projects totaling about 10 MW.

[12] As there have been only several hundred reservations for medium and large systems since the program's inception (though, again, for a large amount of capacity), the depletion of funding for such systems likely does not drastically alter the appearance of the graph, which is based on the number of projects rather than the amount of capacity.

program: small systems (<10 kW) never made it out of Block 1, while large systems languished in Block 2 after having quickly exhausted Block 1 funding.



Source: CEC Quarterly Reports to Legislature

Since the beginning of 2001, however, system reservations have jumped to almost 300 systems per month on average, presumably the result of:

- the severity of the state's electricity crisis, along with extensive media coverage and state consumer awareness campaigns targeting distributed generation solutions;
- the increase in the buy-down level from $3 to $4.5/Watt;
- the implementation or expansion of several other policies, including a new state solar tax credit, a temporary expansion of net metering per-project size limits from 10 kW to 1 MW, and the elimination of utility standby charges; and
- the increased marketing efforts of solar suppliers.

While the first bullet (above) likely played a large role in motivating the residential sector,[13] it is possible that the commercial sector was motivated more by the second two bullets: the increase in the buy-down level from $2.50/W (remember that commercial systems had migrated to Block 2 prior to the elimination of funding blocks) to $4.50/W, and the complementary expansion of net metering and elimination of standby charges. Increased marketing by solar suppliers also played a role. Though new system reservations showed signs of tapering off during the winter of 2001/2002 (concurrent with the electricity crisis fading from the public's memory),[14] the rebound in the second quarter of 2002 is encouraging, and implies that the crisis may have brought about a fundamental shift in consumer awareness of and attitudes towards PV.

To date, over $80 million in support of 21 MW of PV has been reserved (with 9 MW already installed) under the CEC's buy-down program, while another 16.5 MW remain active in the

[13] The jump in reservations during the first quarter of 2001 was not influenced by the increase in the buy-down level, which, as depicted by the dashed line in the graph, did not occur until April (and was then made retroactive to February).

[14] Again, note that some of the decline in reservation activity at this time may have been due to the depletion of funding for medium and large systems, and the likely migration of any new reservations for such systems over to the CPUC's self-generation program. However, as explained in footnote 13, this impact should be small.

CPUC's Self-Generation Program.[15] Large systems (>10 kW) account for roughly three quarters of the combined 37.5 MW of PV capacity reserved through these two programs, proving that buy-down programs can be an effective medium for supporting large-scale customer-sited systems.[16] These are impressive numbers given the relatively small size of the domestic and global PV markets: roughly 20 MW of PV were installed in the US in 2000 (~300 MW globally), bringing cumulative installed capacity to roughly 140 MW (>1,000 MW globally). The sheer volume of planned installations in California has attracted a number of infrastructure investments to the state; for example, three major PV manufacturers – Sharp, Schott Applied Power, and Shell – have located manufacturing facilities in California to better serve the strong in-state market, and one manufacturer/installer of large systems (PowerLight) reports having tripled the size of its workforce within the past year or so. Thus, in terms of stimulating both the supply and demand sides of the market, California's buy-down program has clearly been a success.

Certain other aspects of California's program, however, leave room for improvement:

- **Small System Underperformance:** Monitoring of selected small (<10 kW) PV systems installed under the CEC's program revealed that – unbeknownst to the system owners – AC output was on average one-quarter to one-third below that expected on the basis of module ratings (based on PVUSA Test Conditions) and inverter efficiencies (RER 2000). This "quality assurance" problem is discussed in more detail in Section 2.12.
- **Minimal Cost Reductions for Small Systems:** The CEC's October 2000 preliminary evaluation of the first two years of California's buy-down program estimates that installed costs for medium and large systems (i.e., those > 10 kW) declined by $2.10/Watt, but *small systems showed virtually no reduction in costs* (RER 2000). Since then, anecdotal evidence suggests that total system costs, at least for small systems, may have actually *increased* as the surge in buy-down activity in 2001 taxed the existing manufacturing and installation infrastructure to its maximum capacity, leading to supply bottlenecks and higher costs.
- **High Incentive Level:** California's buy-down remains high, having been increased by 50% (more for larger systems) in response to both the electricity crisis and evidence that small system costs had not materially declined. An increase of this magnitude, combined with limited PV cost reductions among small systems, calls into question the ability of this program to create a sustainable market for PV in the absence of incentives.

Pennsylvania and Massachusetts have recently announced buy-down programs that attempt to improve upon one aspect of California's program by tying a portion of the incentive payment to system performance. While both of these programs are too young to have any meaningful results, we briefly describe them as potentially useful innovations on California's program.

Pennsylvania

The Sustainable Development Fund's $4 million PV program in PECO's service territory, which debuted in December 2001, provides a $3/W buy-down payment (up to $6,000) to system owners upon inspection and approval of installed systems of between 1 and 5 kW. After the first

[15] Meanwhile, 1.1 MW of small wind systems have been reserved under the CEC's program, with 500 kW on line.
[16] Along with California, New Jersey's experience also demonstrates that very large systems do participate in buy-down programs, contrary to the concerns of some policymakers who fear that buy-down funding devoted to large systems will remain idle.

12 months of operation, the system owner receives a *second* payment of $1/kWh (up to $2,000), and the *installer* receives a payment of $0.10/kWh (up to $250).[17] These delayed, performance-based payments create an incentive for both the owner and installer to ensure that the system is operating at peak performance.

Of course, performance-based incentives (as well as system monitoring) also require that the system be metered separately from the building, rather than through the building's existing meter (as is common practice with net-metered applications). Though likely minimal, this requirement does add some extra cost to the system. Furthermore, the need to verify system output in order to award performance-based incentives adds to the overall administrative cost of the program.

In addition to offering "carrots" to both the owner and installer, Pennsylvania also employs a "stick": to be eligible for the program, the placement and orientation of PV modules must enable the system to produce not less than 70% of the annual output achieved by an optimally placed and oriented system at that site (optimal production is determined using NREL's PVWATTS program in combination with Solar Pathfinder). With only a few staff, the SDF has opted to outsource the administration of this program at a cost of $80,000.

Though innovative, this program has gotten off to a slow start. As of May 2002, only 3 applications had been approved, with another 4 in the works. SDF is having better luck, however, outside of its buy-down program: a total of 168 kW of PV is currently in the pipeline at 2 commercial sites and 2 low-income residential developments. Strong commercial interest is perhaps not surprising given California's experience, which demonstrates that non-residential customers may be very motivated to take advantage of PV incentives.

Massachusetts

Massachusetts recently unveiled its Solar-to-Market Initiative, part of which includes a buy-down program that is partially performance-based. Specifically, 70% of a $5/Watt incentive will be paid up-front, with the remaining 30% paid down quarterly over three years at a rate of $0.38/kWh. The rate of $0.38/kWh is based on an assumed 15% capacity factor over 3 years. If the actual capacity factor exceeds 15%, the system will earn the full performance-based incentive (capped at 30% of $5/W) in less than 3 years, whereas if the actual capacity factor is less than 15%, the system will not earn the full performance-based portion of the incentive.

Another innovative feature of this program is that it will target geographically clustered installations in an attempt to reduce program and system costs through concentrated marketing activities, system standardization, volume purchases, clustered installations, and coordinated interconnection and permitting. This program – which is more a targeted solicitation rather than a standard "open-to-all" buy-down program – could even help shore up weak areas of the grid.

Other elements of the Solar-to-Market Initiative include:

- An "open installations program" (solicitation not yet released), which will resemble the "clustered installations program" described above, except that it will not require clustering

[17] For a 2 kW system, the $1/kWh one-year production incentive roughly equates to an extra $1/W up-front incentive, bringing the aggregate incentive to roughly $4/W. This incentive level places Pennsylvania squarely in the middle of the range among funds offering buy-down incentives, which vary from roughly $2/W to $6/W.

and will provide lower incentive levels for new buildings than for existing (based on the assumption that PV retrofits are more expensive than incorporating systems into new buildings).
- A production and tracking contractor, funded to track and provide documentation of performance for production payments. A total of $300,000 has been budgeted for this effort.
- Installer training and certification, perhaps collaborating with national efforts underway.
- A loan fund to be used by PV companies for technology development and business expansion.

In addition, administrative aspects of the Solar-to-Market Initiative are covered in Section 3.2. As this initiative is still in the solicitation phase, there are no results to report at this time.

2.6.3 Organization and Contact Information

Tim Tutt
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512
http://www.energy.ca.gov/
Ttutt@energy.state.ca.us
(916) 654-4590

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

Sam Nutter
Massachusetts Technology Collaborative
75 North Drive
Westborough, MA 05181
http://www.masstech.org/
nutter@masstech.org
(508) 870-0312

2.6.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Customer-Sited PV: A Survey of Clean Energy Fund Support." LBNL-49668. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Bolinger, M., R. Wiser, L. Milford, M. Stoddard, K. Porter. 2001. "Clean Energy Funds: An Overview of State Support for Renewable Energy." LBNL-47705. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

CEC quarterly reports to the legislature:
http://www.energy.ca.gov/renewables/documents/index.html#legislature

CEC Guidebook for Emerging Renewable Resources Account:
http://www.consumerenergycenter.org/buydown/index.html

Regional Economic Research, Inc. (RER). 2000. "Renewable Energy Program Preliminary Evaluation: Emerging Renewable Resources Account." October 30, 2000. Prepared for the CEC.

Massachusetts Solar-to-Market solicitation: http://www.mtpc.org/massrenew/pvcluster.pdf

SDF buy-down program documents: http://www.trfund.com/sdf/solarpv/index.html

Personal communication with: Nils Bolgen (MTPC) and Roger Clark (SDF)

Comments provided by: Kari Smith (Powerlight)

2.7 Support for PV in Japan and Germany

2.7.1 Case Summary

Case Description

Japan and Germany rank first and third in the world, respectively, in terms of installed photovoltaics (PV) capacity. Most of Japan's capacity has been installed through a residential buy-down program (supplemented, to some degree, with low-interest loans). Germany has used a number of approaches to stimulate PV development, including rebates, low-interest loans, and premium feed-in tariffs that combine a high incentive level and a mandatory purchase requirement by utilities. This case study briefly describes PV support programs in Japan and Germany.

Innovative Features

- The fact that these two countries are currently among the world's largest PV markets is reason enough to take a closer look at their programmatic approaches.
- Both countries have a long track record (i.e., since the early 1990s) of offering a combination of PV support measures that are currently being implemented in the U.S., including capital cost buy-downs and low-interest loans.
- This history provides relevant insights into how such programs perform over periods longer than the few years of experience with such programs in the U.S.

Results

Both Japan and Germany demonstrate that various combinations of low-interest loans and buy-down programs can work over extended periods.

- As of the end of 2000, nearly 320 MW of PV was installed in Japan, while Germany hosted more than 110 MW.
- While the specific mechanics of one of the major drivers of success in Germany – the Renewable Energy Sources Act (feed-in law) – may not be particularly applicable to clean energy funds in the U.S., the overwhelming success of the Act demonstrates that production-based support for PV can work if the per-kWh payment is high enough.
- In addition, Germany's 100,000 Solar Roofs Program demonstrates that loan programs for PV can be successful if the value proposition is otherwise sufficiently attractive (loans for nearly 130 MW of PV have been approved since January 1999).

2.7.2 Detailed Case Description and Highlights

The case studies that we have selected include a large number of cases on different forms of support for photovoltaics (PV) within the United States. It is also potentially useful to look outside of the U.S., however, to examine the approaches of other countries that have had success in promoting this technology. Japan and Germany, with more than 320 MW and 110 MW of installed PV capacity respectively, rank first and third in the world by this metric (with the United States in second place). Both countries have a long track record (i.e., since the early 1990s) of offering a combination of PV support measures that are currently being implemented or considered in the U.S., including capital cost buy-downs, performance incentives, and low-interest loans. This history provides relevant insights into how such programs perform over periods longer than the few years of experience with such programs in the U.S. This case study, therefore, examines the programmatic approaches undertaken to support PV in both Japan and Germany.

Japan

Japan leads the world in installed PV capacity, with over 300 MW in place at the end of 2000. More than 2/3 of that capacity has been installed through a residential capital cost buy-down program that began in 1994 and is administered by the New Energy Foundation (NEF), part of the Ministry of Economy, Trade, and Industry (METI). The program is open to private households, owners or developers of housing complexes, and local governments. Local governments are allowed to pass on the subsidies to their citizens for use *in addition to* any subsidies the citizens receive directly from the NEF. Some governments do this by simply supplementing the NEF's capital cost subsidy, while others have instead used the funds to set up low-cost PV financing programs. Systems are grid-connected and net metered – an attractive proposition given the high price of electricity (average residential rate of $0.22/kWh) in Japan.

The following table summarizes the program's history. As shown, the maximum subsidy per system has declined from 900,000 ¥/kW (up to 50% of installed costs) in 1994 to 120,000 ¥/kW (up to 33% of installed costs) in 2001 (120,000 ¥/kW equates to roughly $1/Watt). Through fiscal year 2001, approximately 300 MW of PV had been installed under the program. This impressive result should be considered within the context of the program's sizable budget – roughly $200 million in fiscal year 2001 alone.

Fiscal Year	Number of Approvals	Installed Capacity	Max Subsidy/ System (%)	Max Subsidy/ System (¥/kW)	Max System Size (kW)	Budget (Billion ¥)
1994	539	1.9	50%	900,000	5	2.0
1995	1,065	3.9	50%	850,000	5	3.27
1996	1,986	7.5	50%	500,000	4	4.06
1997	5,654	19.5	33%	340,000	4	11.11
1998	6,352	24.1	33%	329,000	10	14.7
1999	15,879	57.7	33%	329,000	10	16.07
2000	20,877	74.4	33%	270,000	10	14.5
2001	29,389	114.7	33%	120,000	10	23.5

Source: Haas 2002

Notwithstanding the large budget, the program appears to have been successful at installing progressively larger amounts of capacity even in the face of declining incentive levels, thereby demonstrating that buy-down programs can work over long time periods, and can lead to system cost reductions. The installed price of a residential grid-connected PV system has reportedly declined from nearly $11/W in 1995 to less than $7/W in 2001 (Maycock 2002).

METI announced in September 2000 that it will abandon government subsidies for rooftop PV systems at the end of fiscal year 2002 (March 31, 2003) in an attempt to boost industry competition. What, if anything, will replace the METI buy-down program is unclear. The fact that the federal government increased METI's FY01 budget request for both new renewable energy companies and local government programs suggests that increased industry competition and local government programs may play a large role in the future (http://www.photon-magazine.com/news/news_01-03_ap_japan.htm).

Germany

Support for PV at the national level has progressed through 3 phases: the 1,000 solar roofs program (rebates) from 1990-1995, the 100,000 solar roofs program (soft loans) initiated in 1999, and the Renewable Energy Sources Act (premium tariffs) implemented in April 1, 2000. Each of these phases is discussed below**.**

- **1,000 Solar Roofs Program:** Germany became the first country worldwide to launch a major solar installation initiative when it announced the 1,000 solar roofs program in 1989. This program provided rebates for up to 60% of system costs, and had installed roughly 2,250 systems totaling 5.25 MW by the time of the program's sunset in 1995 (Weiss and Sprau 2002). Lessons learned from this program were applied in Japan (Haas 2000).

- **100,000 Solar Roofs Program:** This program was implemented in January 1999, with an initial goal of installing 300 MW by 2004. Funded with EUR 560 million (~$500 million), the program provides 10-year low interest loans (1.91% in 2001) with no money down and no interest payments for 2 years (Weiss and Sprau 2002). This financing package corresponds to a subsidy of roughly 20% (Reinmüller et. al 2002). Since inception, loans for nearly 130 MW have been approved. The early success of this program, in part due to the introduction of the new Renewable Energy Sources Act in April 2000 (described below), has prompted the German government to advance the 300 MW target date by one year to 2003 (Ecotec 2001).

- **Renewable Energy Sources Act:** This new and improved version of Germany's original feed-in law (which had been in place since January 1991) took effect in April 2000. Under the old feed-in law, PV and wind shared the same tariff, around DEM 0.17/kWh (~$.08/kWh). While this tariff was sufficient to spur massive wind development throughout Germany, it was insufficient to support a similar rate of PV development, given its higher cost. The Renewable Energy Sources Act increased the PV tariff nearly 6-fold to DEM 0.99/kWh (~$0.50/kWh). Starting in 2002, the tariff will decline by 5% each year to encourage cost reductions. The program will remain in place until one year after Germany's installed PV capacity reaches 350 MW, a number that accounts for the 50 MW of existing capacity in place at the time the Act was written, as well as the 300 MW goal of the 100,000

Solar Roofs program (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2000). When that goal is reached, a new support program (as of yet unspecified) will be enacted.

Though at first glance a feed-in law that combines a high incentive level and a mandatory purchase requirement on utilities may not seem particularly relevant to clean energy funds in the U.S., moving beyond labels and thinking about the mechanics suggests otherwise. As is the case with a system-benefits charge, end-use customers in Germany end up paying the cost of the feed-in tariff through higher rates. Furthermore, the new Act contains a provision to equalize the proportional cost of the feed-in tariff among all German customers, thereby increasing the resemblance to a system-benefits charge. While differences between the two approaches remain, the overwhelming success of Germany's feed-in tariff suggests that production-based support for PV – no matter how it is funded – may work if the per-kWh payment is high enough.

In addition to these national programs, municipalities throughout Germany have offered attractive production incentives (reportedly as high as DEM 1-2/kWh, or ~$1/kWh) funded by surcharges on utility bills (Starrs and Schwent 1998). While these state-sponsored programs were primarily intended to fill the gap in national funding from 1995-1999 (Weiss and Sprau 2002), state subsidies have also, at times, been used in combination with the national programs.

2.7.3 Organization and Contact Information

Photovoltaic Power Generation Department
Development Promotion Center
New Energy Foundation
6th Floor, Shuwa Kioi-cho Park Building
3-6 Kioi-cho, Chiyoda-ku
Tokyo 102-8555
www.nef.or.jp
info@nef.or.jp
fax: 03-5275-9831

2.7.4 Information Sources

Ecotec Research and Consulting Ltd. and A. Mourelatou. 2001. "Renewable Energies: Success Stories." Prepared for the European Environment Agency.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. 2000. "Act on Granting Priority to Renewable Energy Sources (Renewable Energy Sources Act)."

Haas, R. 2002. "Building PV Markets: The Impact of Financial Incentives." *Renewable Energy World*, Vol. 5 (4), July-August 2002.

_____, editor. 2000. "Promotion Strategies for Electricity From Renewable Energy Sources in EU Countries." Joint report by the "Green Electricity Cluster." Co-financed under the 5th Framework Programme of the European Commission.

Maycock, P. 2002. "The World PV Market: Production Increases 36%." *Renewable Energy World*, Vol. 5 (4), July-August 2002.

Reinmüller, D., B. Praetorius, O. Langniss. 2002. "Sustainable Energy Policy Concepts." Final Report, International Solar Energy Society.

Starrs, T. and V. Schwent. 1998. "Government Buydowns for the Residential Market." Prepared for the Renewable Energy Policy Project.

Weiss, I. and P. Sprau. 2002. "100,000 Roofs and 99 Pfennig: Germany's PV Financing Schemes and the Market." *Renewable Energy World*, January-February 2002.

Web sites:
http://www.nef.or.jp
http://www.solarbuzz.com/FastFactsJapan.htm
http://www.solarbuzz.com/FastFactsGermany.htm

2.8 Using Bulk Purchase Commitments to Foster Sustained Orderly Development and Commercialization of PV

2.8.1 Case Summary

Case Description

The largest barrier to the widespread adoption of photovoltaics (PV) is its high cost. PV is particularly well suited for mass production and installation that could greatly reduce its costs. However, mass production and installation may only occur if prices decline sufficiently to stimulate increased and sustained demand. Several utilities, cooperatives, and clean energy funds have attempted to overcome this classic chicken-and-egg problem by making bulk purchase and installation commitments. This case study explores the efforts of the Sacramento Municipal Utility District (SMUD), the California Power Authority, the Western Solar Utility Network (WesternSUN) Cooperative, and the City of Chicago.

Innovative Features

- Early experience with buy-down programs for PV has shown that deep PV price reductions, at least for residential systems, are not assured in the near term (See Section 2.6). Lack of sustained markets and manufacturing economies of scale, and a weak installation and servicing infrastructure, are often-blamed culprits. To overcome these challenges, each of the programs described in this study uses innovative bulk purchase and/or installation efforts.
- SMUD offers the longest-running experience, and although recent allegations suggest that its program has not been as successful as some have claimed, SMUD's efforts nonetheless exemplify the strategy known as "sustained orderly development and commercialization," which calls for steady growth in the market rather than haphazard large volume purchases that can actually cause supply shortages and lead to price *increases*.
- Two of the cases we examine, SMUD and the City of Chicago, have used bulk purchase commitments in an attempt to secure not only price reductions, but also local economic development benefits by attracting manufacturing facilities to the area.

Results

- Of the programs examined, SMUD has the most experience to date, installing more than 10 MW of PV since 1993 and reportedly achieving cost reductions of nearly 11% per year on average, to the point where the installed cost of SMUD PV systems comes in at about half that of systems sold elsewhere in California. These claims have recently been challenged.
- The California Power Authority has received guaranteed bids through 2005 that reflect more modest price reductions, but this is perhaps due to the substantial uncertainty over the eventual outcome of the Power Authority's efforts.
- WesternSUN reports being able to secure price discounts with relatively modest purchase commitments, particularly among thin-film PV dealers.
- Spire Solar Chicago has had a difficult time meeting its price targets, due primarily to delays in the construction of its new manufacturing facility.
- While the possible role of clean energy funds in this process requires further thought, this case study illustrates the advantages of bulk purchase and installation programs.

2.8.2 Detailed Case Description and Highlights

The largest barrier to the widespread adoption of photovoltaics (PV) is no doubt its high capital (and levelized $/kWh) cost. Moreover, early experience with standard buy-down programs for PV has shown that, under these programs, sizable and near-term PV price reductions are not assured, at least for residential systems (see Section 2.6). Lack of sustained markets and manufacturing economies of scale, and a weak installation and servicing infrastructure for residential systems, are often-blamed culprits. And yet, as a modular technology, PV is particularly well suited for mass production techniques that could greatly reduce its costs. PV could also benefit from mass installation programs to drive down installation costs. However, mass production will likely only occur if prices decline sufficiently from current levels to stimulate increased and sustained demand, while mass installation also requires healthy demand.

Several utilities, cooperatives, and clean energy funds have attempted to overcome this classic chicken-and-egg problem by making bulk purchase commitments that provide PV manufacturers with the assurance of a future market that they need to expand their manufacturing capabilities and achieve cost reductions. Some of these programs also involve mass installation efforts to drive down installation and servicing costs. This case study explores the use of bulk purchase commitments to reduce PV system costs for the Sacramento Municipal Utility District (SMUD), the California Power Authority, the Western Solar Utility Network (WesternSUN) Cooperative, and the City of Chicago. While the possible role of clean energy funds in this process requires further thought, the programs reported in this case study illustrate the advantages of bulk purchase and installation programs.

The Sacramento Municipal Utility District

With more than 10 MW of PV installed in its service territory since 1993, SMUD is perhaps the most often cited example of using bulk purchase commitments and installation to achieve cost reductions (although recent revelations have tarnished SMUD's image – see final paragraph). SMUD has pursued a strategy known as "sustained orderly development and commercialization" (SODC), which posits that a predictable, reliable, and substantial multi-year purchase commitment will eliminate disruptive boom/bust cycles and allow the PV industry to grow in an orderly fashion. In other words, haphazard large volume purchases by themselves are not the answer, and can in fact cause price *increases* as production constraints are reached. Instead, steady, reliable purchase commitments will allow the PV industry to expand manufacturing capacity and achieve cost reductions. SMUD also centralizes PV installation and servicing to drive down those costs as well.

SMUD's SODC program has evolved over the years.[18] In its first phase, from 1993 to mid-1998, SMUD released yearly solicitations for 500 to 1,000 kW of PV systems. While in retrospect SMUD's PV procurement has been remarkably steady over this period (see table below), reportedly allowing substantial price reductions to occur, annual solicitations may not provide sufficient long-term security for manufacturers to ramp up production. As a result, the second phase of the program involves a 5-year (through mid-2003) 10 MW purchase commitment spanning all system components: modules, inverters, and installation. SMUD expected this

[18] A portion of SMUD's program was undertaken with funding assistance from the Utility Photovoltaic Group (UPVG), which itself was funded by the U.S. Department of Energy.

second phase to bring the fully installed cost of PV to below $3/W in 2003, a level that is often cited as the threshold at which customer-sited PV becomes cost-competitive with retail electricity prices. In addition, SMUD used the long-term contract as a means to secure local economic development benefits. Energy Photovoltaics, Inc., the winner of the PV contract, has opened a thin-film manufacturing facility in Sacramento (the financially troubled CalSolar), while Trace Engineering agreed to locate an inverter assembly facility in Sacramento.

The following table (sourced from a SMUD presentation) shows the reported cost reductions achieved through SMUD's SODC strategy from 1993 to 2000. Figures for 2002 are reportedly based on firm contracts. According to the table, the total turnkey cost of PV systems, including SMUD overhead, has declined by an average annualized 10.8% since 1993, and the installed cost of SMUD's PV systems (~$4-5/W) comes in at about half that of systems sold elsewhere in California under the statewide buy-down program ($8-11/W). If accurate (see final paragraph below), this figure alone strongly illustrates the potential value of bulk purchase and installation programs.

Year	Turn-Key Cost ($/W)	SMUD Added Cost ($/W)	Total Cost ($/W)	Installed Capacity (kW)
1993	7.70	1.08	8.78	495
1994	6.23	0.90	7.13	675
1995	5.98	0.89	6.87	554
1996	5.52	0.85	6.37	461
1997	4.80	0.84	5.64	495
1998	4.60	0.83	5.43	490
1999	4.18	0.74	4.92	1,402
2000	3.85	0.48	4.33	1,541
[2002]	[2.76]	[0.39]	[3.15]	[2,600]

Source: Schwent, 2001

The specific programs that SMUD has employed to create PV demand are perhaps less relevant to this case study than the bulk purchase aspect, but nevertheless deserve mention. The PV Pioneer I program, which began in 1993, targeted residential hosts for PV systems. SMUD owns and operates the systems, which are connected to the utility-side of the meter, and charges each host a $4/month green premium. In 1994, SMUD added the Neighborhood PV Pioneer program to install systems on community buildings such as churches and schools. In 1999, SMUD launched the PV Pioneer II program that enabled customers to purchase PV systems – with the help of SMUD buy-downs – and net meter them. SMUD has also installed large "solarports" (PV-shaded parking lots), central-station projects sited at sub-stations and a mothballed nuclear plant, and building-integrated photovoltaic (BIPV) applications.

While these SMUD programs have clearly resulted in the installation of large amounts of PV over the years (i.e., 10 MW), recent events call into question the aggressive system cost reductions for which SMUD's programs have become famous. An article in the September 6 edition of the *The Sacramento Bee* charges that SMUD has fallen well short of its capacity goals and "rocketed past its budget limits" (Dahlberg 2002). Specifically, SMUD's board has been asked to spend $7.6 million on solar programs in 2002 – more than twice the originally requested

$3.2 million – to install 1.2 MW of PV – only about 60% of the original 2 MW goal for 2002. These cost overruns and capacity shortfalls reportedly stem from a number of factors, including:

- double-counting the benefits of the PV program in the budget;
- higher-than-projected solar panel costs, driven in part by the financial problems of CalSolar, which would have been SMUD's cheapest supplier;
- reliance on various grants and subsidies that SMUD did not ultimately receive;
- unauthorized changes in supplier contracts; and
- incorrectly subsidized out-of-service territory systems.

This story, which also involves the early retirement of SMUD's long-time PV program director, is only beginning to unfold. It is clear, however, that given this turn of events, the data that SMUD provides on system costs (see table above) should, at the very least, be viewed with a critical eye.

California Consumer Power and Conservation Financing Authority ("Power Authority")

The California Power Authority was created at the height of California's electricity crisis to finance the construction of new power plants – both renewable and conventional – sufficient to ensure a 15% capacity reserve margin for the state. One of the Power Authority's earliest acts was to issue a Request For Bids (RFB) for PV, fuel cell, and microturbine capacity between 2002 and 2005. Winning bidders to this RFB will be eligible to bid in future Requests for Proposals (RFPs) for specific projects at prices at or below those indicated in their response to the RFB.

While no subsequent RFPs have yet been issued, the prices contained in the responses to the RFB are somewhat indicative of potential cost reductions that can be achieved through bulk purchase commitments. For example, Kyocera and Siemens PV modules offered to the Power Authority in 2002 were priced 30% to 40% below prices quoted at Real Goods, a popular retailer of renewable energy equipment. Furthermore, among those who were responsive to the RFB instructions and provided figures for both price and volume through 2005, eight companies committed a total of 215 MW of crystalline PV modules from 2002-2005 at weighted average price decreases of 2% per year. Likewise, three companies committed a total of 51.5 MW of thin-film PV modules from 2002-2005 at weighted average price decreases of nearly 7% per year. Including the cost of O&M, warranties, etc., the Power Authority calculates that the lowest cost of PV generation bid – before factoring in the impact of state buy-down incentives, tax credits, and any depreciation benefits – was 17¢/kWh in 2002 and 16¢/kWh in 2003. Since the Power Authority does not *guarantee* any individual bidder future business, the guaranteed prices and price reductions contained in these responses are likely to be conservative.[19] Furthermore, the figures quoted are based on equipment costs only; further savings could potentially be realized from bulk installation practices.

Western Solar Utility Network (WesternSUN) Cooperative

WesternSUN buys PV in bulk for about 26 municipal and cooperative utilities in the Northwest. The cooperative purchases complete PV systems directly from manufacturers and resells the systems to members for resale to end-use customers. In 2002, they have committed to buying

[19] Manufacturers may also have built in some margin to allow them to "sharpen their pencils" in response to actual RFPs issued in the future.

100 kW of thin-film PV and roughly another 100 kW of crystalline silicon systems. Applications run the gamut from utility green pricing programs to residential rooftop PV to school systems. While the total annual volume (200 kW) is relatively small compared to that supported by SMUD or (potentially) the Power Authority, WesternSUN's purchase commitment has been growing by 100% every year since it began 3 years ago. WesternSUN reports that price reductions from bulk purchases have been more pronounced for thin-film than for crystalline silicon, perhaps due to strong demand for crystalline silicon and the fact that thin-film PV is still in its infancy and suppliers are looking for markets. An examination of product offerings on WesternSUN's web site suggests that price reductions of 17% below suggested retail for crystalline and 30%-40% for thin-film systems are available to members.

The Chicago Solar Partnership

In 1999, the City of Chicago and ComEd used a $2 million and $6 million purchase commitment, respectively, to lure Spire Corporation – a Massachusetts-based manufacturer of PV assembly line equipment – to build a PV manufacturing facility on a redeveloped brownfield site on the west side of Chicago. Additional incentives are provided by the state's Renewable Energy Resources Program (RERP), which funds 60% of installed PV system costs, as well as an additional $6 million from ComEd not specifically earmarked for Spire systems, but nonetheless available for PV in general. This "brightfield" initiative – the first of its kind – resulted in a new company called Spire Solar Chicago, and a new collaborative called the Chicago Solar Partnership.

Spire Solar Chicago has installed roughly 550 kW since January 2000, mostly on public buildings such as museums and schools within Chicago city limits. While price reductions were built into the $8 million purchase commitments, Spire Solar Chicago has thus far had difficulty meeting them due to a number of factors, including construction delays, incomplete production lines and low production volume, a requirement to use expensive union labor, and strict building codes that have caused some installation delays. These factors have reportedly made it difficult to beat $10 per installed watt. The new manufacturing facility was only recently completed in February 2002, well behind schedule. In the interim, Spire Solar Chicago was operating out of temporary facilities with incomplete production lines and sub-optimal working conditions. Furthermore, the price reductions were based at least partially on a 500 kW PV installation at another brownfield site, which has not yet happened.

While Spire Solar Chicago has faced its share of difficulties, the company remains optimistic that prices will begin to decline now that it has settled into its new production facility and ramped up to full production capacity. In fact, one representative of the company believes that Spire Solar Chicago is probably on a parallel track to where SMUD was after its first three years of supporting PV.

Advantages and Disadvantages of Bulk Purchases

The advantages of system standardization, bulk purchase commitments, and a centralized installation and servicing infrastructure are obvious – reduced prices for installed PV. And yet, several disadvantages of this approach also deserve mention. First, system standardization comes at a cost – PV customers may not have the range of system choices that they would otherwise desire. Second, a bulk purchase commitment requires "picking winners," and the

development of a centralized PV installation and servicing infrastructure may be frowned upon by current PV installers. Finally, identifying an appropriate role for a state clean energy fund in this process requires further thought – the cases summarized here are not directly applicable to a state fund.

2.8.3 Organization and Contact Information

Vince Schwent
Sacramento Municipal Utility District
6301 S Street, MS#A401
Sacramento, CA 95817
www.smud.org/pv/index.html
vschwen@smud.org
(916) 732-6344

Jeanne Clinton
California Power Authority
901 P Street, Suite 142A
Sacramento, CA 95814
www.capowerauthority.ca.gov
jeanne.clinton@dgs.ca.gov
(916) 651-9750

Mike Nelson
WesternSUN Cooperative
2700 W. Commodore Way St
Seattle, WA 98119
www.westernsun.org/WSUNhome.html
miknel@westernsun.org
(206) 719-2297

Mark Burger
Spire Solar Chicago
Chicago Center for Green Technology
445 North Sacramento Boulevard
Chicago, Illinois 60612
www.spiresolarchicago.net
mburger@spirecorp.com
(773) 638-8700

2.8.4 Information Sources

Burger, M., C. Kaufmann, W. Lyons, K. Whitfield. 2002. "Development of the Spire Solar Business Model and the Chicago Solar Partnership." *Proceedings: American Solar Energy Society Conference*. Reno, Nevada.

Dahlberg, C.P. 2002. "Solar Woes Shock SMUD." *The Sacramento Bee*, September 6, 2002.

Osborn, D. 2000. "SMUD: A Utility Helping Create the Solar Century." *Renewable Energy World*, September-October 2000.

Schwent, V. 2001. "SMUD Solar Programs." Presentation to the California PV Alliance Meeting, January 3, 2001.

Personal communication with: Mike Nelson (Western Sun) and Mark Burger (Spire Solar Chicago)

Comments provided by: Jeanne Clinton (California Power Authority)

Websites:
http://www.capowerauthority.ca.gov/DistributedGeneration/SolarRFB.htm
http://www.westernsun.org/aaproducts.html
www.smud.org/pv/index.html

2.9 A Multi-Faceted Approach to Supporting PV in New York

2.9.1 Case Summary

Case Description

The New York State Energy Research and Development Authority (NYSERDA) has chosen not to pursue the "one size fits all" approach to supporting photovoltaics (and small wind) that is embodied by typical buy-down programs. Instead, NYSERDA has adopted a multi-faceted approach targeting different segments of the photovoltaics (PV) market, including commercial, industrial, and institutional buildings, the residential PV market, "high-value" PV installations, solar on schools, and PV systems on new Energy Star-labeled homes. To support these targeted programs, NYSERDA offers not only direct financial support but also technical support for PV (and small wind) systems, installer training and certification, and low-interest loans.

Innovative Features

- In contrast to buy-down programs, NYSERDA's multi-faceted approach allows it to proactively target what it considers the most economical, the most educational, and the most innovative PV (and small wind) applications.
- This approach is intended to allow NYSERDA to fund PV applications that are most likely to have long-term, sustainable demand and impact in the state.
- NYSERDA's goal is to help companies and markets succeed; one way it does this is by tapping into the expertise of the private market by allowing RFP respondents to identify and propose what they see as the best use of funds to create a sustainable market.

Results

- NYSERDA has committed $5.4 million in funding to its initial commercial, industrial, and institutional PV in buildings program, residential PV program, and high-value PV and wind program.
- Were all planned installations to occur (an unlikely event), 1.3 MW of PV and small wind would be installed, at an average subsidy level of $4/W.
- Though several of NYSERDA's PV programs have encountered roadblocks (most notably, interconnection hurdles have plagued the residential PV program), most programs appear likely to surpass their stated installation targets and NYSERDA continues to roll out new and interesting programs that incorporate lessons learned from the past.
- One potential drawback to NYSERDA's solicitation-based approach is that, unlike an open buy-down program, project-specific solicitations (particularly if issued irregularly) may not enable PV manufacturers and installers to plan for the long term, or encourage them to aggressively market their products or services. To address this concern, NYSERDA is considering a system of rolling solicitations, which would accept submissions every 6 months or so, to keep projects in the pipeline at all times.

2.9.2 Detailed Case Description and Highlights

To date, "buy-down" programs that provide subsidies to buy down the capital cost of customer-sited photovoltaic (PV) systems (and other renewable technologies) have dominated PV (and small wind) programs offered by state clean energy funds: of the 14 funds in operation today, only Connecticut, Ohio, and Oregon do not currently offer some form of buy-down program. Buy-down programs encourage a stable market (for as long as the incentives last) and are generally not restrictive in the types of PV applications that are eligible for funding (two notable exceptions are that most buy-down programs will not support off-grid applications, and some buy-down programs do not cover commercial systems), allowing the private market to identify the most attractive *near-term* markets for PV. Arguably, buy-down programs may not, however, always specifically encourage the most economical, the most educational, or the most innovative applications that have the greatest *long-term* merit for achieving sustainable PV demand.

The New York State Energy Research and Development Authority (NYSERDA) has experimented with a different approach, using targeted solicitations to support different segments of the PV market that NYSERDA believes deserve special attention. NYSERDA's multi-faceted approach includes programs targeting PV installations on commercial, industrial, and institutional buildings, the residential PV market, "high-value" PV installations, solar on schools, and PV systems on new Energy Star-labeled homes. To support these targeted programs, NYSERDA offers not only direct financial support, but also technical support for PV (and small wind) systems, installer training and certification, and low-interest loans. This case describes each facet of NYSERDA's overall PV program.

PV on Commercial, Industrial, and Institutional Buildings

In October 1999, NYSERDA solicited proposals for innovative PV technologies and applications on commercial, industrial, institutional, and certain multifamily buildings. Due to the high quality of proposals received, NYSERDA increased the original $1.7 million budget to more than $3 million and ultimately funded 5 companies to install 11 systems with a combined capacity of 679 kW. By October 2000, the program's first installation was complete, a 150 kW Powerlight system installed on the roof of a library in Ithaca. A second 40 kW system has recently been completed but is awaiting interconnection. The slow pace of installations to date has been driven in part by a few sites falling through, requiring the identification of new sites, as well as construction delays in new buildings (i.e., unrelated to PV). In other cases, projects were not scheduled to be built until 2002/2003.

This targeted approach may, arguably, have several advantages over a traditional buy-down program. First, it requires receptive sites to be identified up front, removing one large barrier to project completion (though as mentioned above, several pre-identified sites have fallen through). Second, it allows NYSERDA to select not only the lowest cost systems, but also those that are most visible to the public and provide the most demonstration value. Third, the competitive process may enable NYSERDA to spend fewer funds than they otherwise would have to support the same amount of capacity through a buy-down program. Dividing $3 million by 679 kW yields roughly $4.5/W of NYSERDA support on average.

For all its potential merits, however, some have argued that this approach is inferior to buy-down programs in creating stable long-term markets. Without knowledge of when (if ever) the next solicitation will be issued, or what the terms will be, PV manufacturers and installers have difficulty effectively marketing their products and planning for the long-term. A buy-down program, on the other hand, lays everything on the table up-front, allowing business to progress in an orderly fashion (at least as long as the incentive funding lasts).

NYSERDA plans to issue a new solicitation for PV on commercial, industrial, and institutional buildings later this year. The new program will likely be similar to the last one: it will favor innovative designs such as building-integrated photovoltaics (BIPV), but will continue to weigh the benefits of BIPV against what NYSERDA has found to be its higher costs, due both to high module prices and the fact that more parties are involved in the installation (architects, engineers, etc.). Depending on the budget, NYSERDA may structure the new program to allow rolling submissions (e.g., accepted every 6 months or so) to keep projects in the pipeline at all times. By creating some regularity, this new structure would at least partially address the concerns expressed in the previous paragraph.

Residential PV

NYSERDA has targeted the residential PV market in a more indirect way by funding three PV manufacturers/distributors to (1) develop distribution channels that will enable them to more effectively market their products to residential customers, and (2) provide customer incentives. By leaving the solicitation open-ended in terms of the types of responses it would consider, NYSERDA hoped to effectively tap into the expertise of the private sector, allowing respondents to propose funding approaches that would best suit their needs.

- **Astropower** was awarded $500,000 to develop the *NY Shines* outreach program with the Pace Energy Project, identify PV system dealers and installers to work with, and install up to 150 kW of residential systems (discounted by $3/W). As of May 2002, Astropower had installed 20 systems in New York, with another 30 in the pipeline.
- **SunWize Technologies** was awarded $500,000 to prepare educational materials for customers, identify dealers and installers to work with, and install up to 100 kW of residential systems. In mid-2000, SunWize launched the Solar Connect New York program, a 2-year buy-down program offering $3/Watt up to the lesser of 50% of system costs or $7,500/system. Installed systems are to be monitored for a 2-year period (and NYSERDA withholds 20% of the incentive from SunWize until receiving 2 years of production data). As of May 2002, SunWize had installed 14 systems, with another 39 in the pipeline.
- **Four Seasons Solar** was awarded $250,000 to create PV panels that fit into existing (or new) sunroom frames. The company had expected to install 35 kW in residential sunrooms, but dropped out of the program after experiencing problems integrating panels directly into the roof system.

Were the planned installations to occur, NYSERDA's $1.2 million in funding would have generated 285 kW of PV, with an effective subsidy of $4.2/W. Utility interconnection approvals have reportedly caused many delays, however, leading to reduced expectations for the program as a whole.[20] Nevertheless, NYSERDA estimates that the 2 remaining contractors will spend out

[20] Although the *number* of PV systems likely to be installed by Astropower and SunWize is roughly half of what was initially expected, the average system *size* is roughly twice as large as was initially expected, resulting in a total

their subsidies by the end of the summer of 2002, at which point NYSERDA will roll out a new residential program. The design of the new program has yet to be determined, but will reflect what NYSERDA has learned from the first program.

The main advantage of directly funding PV manufacturers/distributors (e.g., Astropower and SunWize) to develop their own programs is that these entities are typically in an excellent position to market the programs, train installers, and educate consumers. These are all important features in a state like New York that does not already have a strong PV industry infrastructure in place. Furthermore, because they have already made an investment to build the market, manufacturers/distributors have a strong interest in developing programs that work (Gouchoe et al. 2002).

The primary disadvantage of this approach, however, is that it "picks winners": PV manufacturers/distributors other than Astropower and SunWize have been unable to participate in NYSERDA's residential program or offer subsidies to potential customers. Furthermore, the programs developed by Astropower and SunWize are not entirely consistent with one another, potentially creating confusion among potential customers. NYSERDA chose not to initiate a follow-up program open to other manufacturers/distributors because of the severe interconnection roadblocks plaguing the two existing programs (Gouchoe et al. 2002).

High-Value PV (and Wind)

In April 2000, NYSERDA made $1.3 million available to support "high-value" or niche applications for which PV and small wind are particularly well-suited and in which sustainable market for PV may be found. The program is intended to foster markets for customer- and cooperative-owned wind systems, as well as off-grid and dedicated load on-grid PV applications. Three contractors were selected in November 2001.

- **AWS Scientific** was awarded $450,000 to implement a market development and demonstration program for small wind systems. The program provides a 30% buy-down of the installed costs on systems between 1 and 50 kW, and is targeting 200 kW of wind at 9 sites. As of late 2001, AWS had screened more than 90 applicants and visited 22 sites to present an economic analysis, but no systems had yet been installed.
- **Great Brooks Enterprises** was awarded $270,000 to demonstrate the usefulness of off-grid PV and hybrid PV/wind systems. The program is targeting 18 kW of PV and 2 kW of wind at 18 sites. As of mid-2001, Great Brooks had held 4 end-user workshops on hybrid wind/PV systems, published and distributed educational flyers, and installed 9 systems.
- **PowerLight Corporation** was awarded $490,000 to install PV-powered uninterruptible power supply (UPS) systems in 3 buildings. Each system will have 50 kW of PV and batteries capable of sustaining 100 kW of load for at least one hour. Powerlight is working on its first installation at a manufacturing and design center in Brooklyn. In addition to serving as a UPS, this system will offset peak power requirements during the week and use PV to recharge the batteries during the weekend, when consumption and power costs are lower.

amount of capacity installed under the program that will be close to initial expectations (with the exception of Four Season's withdrawal).

If these projects met their overall kW targets, 370 kW of PV and small wind would be installed at a cost to NYSERDA of $1.2 million, for a subsidy value of $3.3/W.

Solar on Schools

In January 2002, NYSERDA accepted proposals for a PV demonstration and teaching initiative at K-12 schools. A contract is currently under negotiation. The program's objectives are to install at least 50 2 kW PV systems on New York State schools by June 2006. NYSERDA will fund up to 90% of the cost of the system, with the schools picking up the remaining 10%. As is typical for solar on schools programs, the contractor must develop an age-appropriate "solar curriculum" that incorporates the operational data from each school's PV system.

PV on Energy Star-Labeled Homes

Attempting to marry energy efficiency with renewable energy, building on previous NYSERDA programs promoting Energy Star-labeled homes, and acknowledging the lower costs of PV in new construction than in retrofits, NYSERDA accepted proposals in January 2002 targeting the construction of Energy Star-labeled homes and Energy Star-labeled homes with PV systems. The program seeks to identify one approved subdivision (minimum of five lots each) in each of the six participating utility service territories for the exclusive construction of Energy Star-labeled homes, at least one of which must incorporate a PV system. Through this program, NYSERDA hopes to demonstrate to all stakeholders (1) the benefits of such homes, including lower utility bills and greater comfort, and (2) the "process," from house plans to closing.

A budget of up to $650,000 is allotted for this project. This includes $400,000 in incentives for PV systems (see below) and PV consultants, $20,000 for appraiser and realtor training, and up to $230,000 for surveys, marketing, and implementation. NYSERDA will provide materials and training on PV systems through a separate NYSERDA PV technical support program (described below), and an additional $135,000 in consumer and home builder incentives is also available.

NYSERDA will provide the following funding for PV installations:

- 1st PV system per subdivision: 100% of installed costs up to the lesser of $10/W or $20,000.
- 2nd PV system per subdivision: 75% of installed costs up to the lesser of $10/W or $15,000.
- 3rd PV system per subdivision: 60% of installed costs up to the lesser of $10/W or $12,000.

This program is just getting underway, with no results to report.

PV (and Wind) Technical Support

In the second half of 2002, NYSERDA plans to solicit bids for PV and wind technical support. This program is intended to support all of NYSERDA's other PV and small wind programs (described above). The winning contractor will help NYSERDA review system designs and inspect installations to determine whether or not they are worthy of incentive funding.

Installer Training and Certification

In the second half of 2002, NYSERDA will begin working with the Institute for Sustainable Power and the North American Board of Certified Energy Practitioners to offer nationally accredited PV installer training and certification.

New York Energy $mart Loan Fund

This loan program buys down the interest rate on loans for energy efficiency projects and renewable energy technologies by 4.5%. NYSERDA originally funded the interest rate reduction by purchasing certificates of deposit from participating lenders and foregoing part of the interest rate, but this approach was recently abandoned because it tied up capital (essentially the principal amount of the loan) for a five-year period. NYSERDA now simply pays a lump sum to the lender to finance the interest rate reduction. Thirty-eight lenders throughout New York State are participating in the program. See Section 2.16 for more information on this program.

2.9.3 Organization and Contact Information

Jennifer Harvey
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399
http://www.nyserda.org/
jlh@nyserda.org
(518) 862-1090

2.9.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Customer-Sited PV: A Survey of Clean Energy Fund Support." LBNL-49668. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Bolinger, M., R. Wiser, L. Milford, M. Stoddard, K. Porter. 2001. "Clean Energy Funds: An Overview of State Support for Renewable Energy." LBNL-47705. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Gouchoe, S., V. Everette, R. Haynes. 2002. "State Financial Incentives for Renewable Energy: Case Studies on Program Effectiveness." North Carolina Solar Center, July 2002 draft.

RFP for Energy Star-Labeled Homes program: http://www.nyserda.org/655rfp.html

RFP for New York Solar Schools program: http://www.nyserda.org/622rfp.html

New York Energy $mart Program Evaluation and Status Report (January 2002): http://www.nyserda.org/02sbcreport.html

Program descriptions on NYSERDA web site: http://www.nyserda.org/programs.html

Personal communication with: Jennifer Harvey (NYSERDA)

2.10 A Targeted Approach to Support PV and Small Wind in Montana

2.10.1 Case Summary

Case Description
Montana's largest investor-owned utility channels about $1 million per year of its system benefits funds to support renewable energy, with a particular emphasis on photovoltaics (PV) and small wind. As with the New York case (see Section 2.9), Montana has chosen to develop a handful of programs targeting different PV and small wind applications. This case study describes these programs.

Innovative Features
Despite limited funding, Montana's programs have been largely successful in installing PV and small wind in targeted applications that the fund administrator believes deserve special attention.

- Part of this success is due to the work of the National Center for Appropriate Technology (NCAT), which administers several major projects on behalf of the utility – this "outsourced" administrative structure is an innovative one that has proven successful.
- Montana's programs are also somewhat unique in that they have targeted niche applications such as PV-powered livestock watering systems, as well as other targeted applications such as solar on schools (with a strong educational component). As with New York, this multi-faceted approach allows Montana's fund to proactively target what it considers to be the most economical, the most educational, and the most innovative PV and small wind applications. This approach may, arguably, lead to a more sustainable market for PV and small wind in the long-term than more blunt buy-down programs, but may do so at the expense of market and business stability in the near term.

Results
In the 2-3 years that they have been operating, Montana's programs have installed roughly 200 kW of PV and small wind capacity at an average award of approximately $5/W.

2.10.2 Detailed Case Description and Highlights

NorthWestern Energy (formerly Montana Power Company) collects about $9 million per year through a system-benefits charge on its distribution customers. Each year, roughly $1 million of these funds are used to support the development of renewable energy technologies. Despite its limited budget and Montana's small population base, NorthWestern's renewable energy programs have had considerable success in helping to install roughly 200 kW of photovoltics (PV) and small wind capacity in the 2-3 years they have been in place.

With just one dedicated staff person, NorthWestern's administrative approach has been to tap into the advice and expertise of an advisory committee, and to outsource the administration of most of its programmatic activities to contractors, including the National Center for Appropriate Technology (NCAT). NCAT is a respected organization in Montana with a long history of providing the economically disadvantaged with appropriate technologies that can improve their lives. To date, using system-benefits charge funds, NCAT has successfully implemented a handful of programs proactively targeting the installation of PV and small wind in specific applications that have been deemed by the administrator to hold particular merit. Each of these programs is described below.

Montana AgSolar Project
PV-powered livestock watering systems are a cost-effective and environmentally beneficial niche market in Montana.

- **Cost-Effective:** When compared to the cost (including labor) of alternatives such as generators, windmills, or line extensions, PV-powered watering systems can look quite attractive, particularly over longer time periods. DC pumps, which use from one-third to one-half as much energy as their AC counterparts, can be powered directly by PV panels, thereby eliminating the need for an inverter and any associated conversion losses. Furthermore, with water storage (e.g., in tanks) cheap and widely available, there is no need for electricity storage (i.e., batteries or grid connection), further reducing the cost of the system. Finally, PV-powered systems work best when they are most needed: in the summer, and on the hottest days when the wind isn't blowing (rendering windmills less effective).
- **Environmentally Beneficial:** In situations where livestock currently drink from a stream, installing a PV-powered watering system away from the stream can provide significant environmental benefits, including reduced pressure on stream banks and streamside vegetation, as well as reduced erosion and nutrient loading. These benefits are particularly important to Montana's sport-fishing/tourism industry, and to the Northwest's trout and salmon habitats in general. In situations where a PV-powered system will replace an existing fossil-fueled system, environmental benefits from not burning fossil fuels (and not having to transport the fuel to remote locations) will accrue.

In the summer of 2000, this project funded six off-grid PV-powered livestock watering systems throughout the state. NorthWestern Energy (Montana Power Company at the time) funded most of the PV hardware costs, while the landowners contributed piping and other non-PV hardware, as well as in-kind services including heavy machinery and labor. Since then, NCAT has worked to publicize these projects by sponsoring hands-on workshops and developing educational materials, including a brochure to help consumers estimate cost-effectiveness, design their own

systems, find qualified vendors and repair technicians, and choose and purchase hardware. NCAT has also conducted market research aimed at expanding the use of solar in the agricultural sector.

Montana's system-benefits charge program has also funded a second proposal for 13 additional sites, roughly half of which were installed last fall by the Rural Sustainability Organization (RSO) based in Drummond, Montana. NorthWestern Energy and NCAT believe there is no pressing need for more subsidized stock watering demonstration projects in Montana. Solar pumping is cost-effective for many ranchers; they just need to hear about it. Given this belief, NCAT has made an effort to encourage rural electric co-ops to start their own promotional programs.

MontanaGreenPower.com Website

In addition to providing extensive programmatic information (including descriptions of many funded projects), this website also provides comprehensive information on renewable energy resources, technologies, and issues in Montana and throughout the Northwest region. This latter aspect is unique among clean energy fund websites, and is both a blessing and a curse: the coverage of local and regional issues is excellent, but the sheer volume of information provided can make finding programmatic information challenging.

Solar Electric Residential Demonstration Project

This program has funded 48 residential PV systems totaling more than 50 kW in three rounds of funding since the spring of 2000. In the first round, 24 homeowners paid $3,000 for a 1 kW grid-connected PV system that cost between $10,000 and $13,000. This high buy-down level – which equates to $7-$10/W – was justified in order to raise awareness of the program and get some systems up and running. This was also the rationale behind using standardized 1 kW "plug and play" systems: to more easily break down barriers (e.g., grid interconnection and net metering) among PV installers (who heretofore had worked almost exclusively with off-grid applications) and the utility. With these goals clearly met (see below), the second and third rounds of funding have featured a reduced buy-down level of $4.50/W and non-standardized systems. Although allowing owners to select their own system and installer in the second and third rounds provided greater flexibility, it did so at an opportunity cost of $1-$2/W, which is the estimated savings realized from standardization under a single contract in the first round.

Though it buys down the capital cost of the system, this is not a traditional buy-down program. Funds are not continuously available to be claimed, but rather are awarded through annual solicitations that are publicized through Montana newspapers as well as radio and television stations. This seems to have been an effective media campaign: over 800 Montanans inquired about the first round of funding, and 133 submitted applications by the deadline. After screening out a few applicants for not meeting siting requirements, the 24 winners were chosen at random. Despite the reduced buy-down level, the response to the 2nd and 3rd rounds has also been enthusiastic. For example, the 3rd round of funding in April 2002 generated 200 inquiries and 21 qualifying applications for 9 system awards (totaling 17 kW).

Since 2001, NCAT has also offered a small wind version of this SBC-funded program, which provides a $1.25/W buy-down for grid-connected wind systems up to 10 kW. The program

closely resembles the Solar Electric Residential Demonstration Project described above in the way funds are distributed and participants are recruited. Through 2 rounds of funding to date, 21 wind systems totaling more than 80 kW have been funded.

Sun4Schools

The Sun4Schools Project completely funds the installation of 2 kW PV systems on local schools. The systems are intended not only to produce power, but also to provide a hands-on learning tool to help educate students and the community. In this latter regard, NCAT has developed a solar curriculum for the schools to use in the classroom, and each system's performance is monitored on the www.MontanaGreenPower.com website. Furthermore, in exchange for receiving fully funded PV systems, each school must showcase its system to the public during open houses and science fairs. So far, twenty 2 kW systems have been installed on school buildings – twelve in 2000 and eight in 2001 – and Montana's program has become one of the more well known solar for schools programs in the country. Other schools have expressed interest, and the program was re-opened in 2002. Because the systems are somewhat standardized, they can be purchased in bulk; NCAT estimates that these systems will produce electricity at $0.24/kWh. While the program appears to have been successful to date, fund administrators think it would have been even more effective with a greater degree of buy-in from the schools: as the saying goes, if you get something for nothing, that is what it is worth to you.

Affordable Solar Project

The goal of the Affordable Solar Project was to demonstrate and evaluate the use of solar technologies at low-income residences. Six residential solar-air collector systems and three solar hot-water systems were installed at electrically heated, low-income homes in Helena, Butte, and Missoula. These systems allow Montana Community Action Agencies and the Human Resources Development Council to evaluate the space- and water-heating savings from these technologies and to train staff for system installation and, in particular, maintenance, which is often a concern when installing renewable energy projects on low-income residences. NCAT also worked with a community action agency to install small solar electric systems (260 W each) on a 21-unit affordable housing complex in Helena. Other low-income projects have included the installation of a 2 kW system on a group home in Lewistown, and ten 1 kW systems being installed on Habitat for Humanity homes.

2.10.3 Organization and Contact Information

Dale Horton
National Center for Appropriate Technology
3040 Continental Drive
Butte, MT 59701
http://www.ncat.org/
daleh@ncat.org
(406) 494-4572

David Ryan
NorthWestern Energy
40 E. Broadway
Butte, MT 59701
http://www.northwesternenergy.com/energy/renewables/renewable_energy.htm
david.ryan@northwestern.com
(406) 497-2322

2.10.4 Information Sources

Bolinger, M., R. Wiser, L. Milford, M. Stoddard, K. Porter. 2001. "Clean Energy Funds: An Overview of State Support for Renewable Energy." LBNL-47705. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Morris, M., J. Balsam, V. Lynne. 2000. "The Montana AgSolar Project: Expanding the Agricultural Uses of Solar Energy in Montana." National Center for Appropriate Technology. http://www.montanagreenpower.com/pdf/agso5-21.pdf

Personal communication with: Dave Ryan (NorthWestern Energy) and Mike Morris (NCAT)

Comments provided by: Dave Ryan (NorthWestern Energy) and Dale Horton (NCAT)

Websites:
www.ncat.org
www.montanagreenpower.com
http://www.northwesternenergy.com/energy/renewables/renewable_energy.htm

2.11 PV (and Small Wind) Pricing Programs that Link Supply with Demand

2.11.1 Case Summary

Case Description

The proliferation of both regulated and competitive green power markets potentially creates new revenue opportunities for photovoltaics (and, potentially, small wind). One such opportunity involves green power marketers purchasing "green tags" that represent the attributes of customer-sited grid-connected PV (and/or small wind) systems. Marketers then lay claim to the photovoltaic (PV) or small wind tags and re-sell them as part of a green power product.

In the United States, two such "PV pricing" programs are just getting underway in Pennsylvania and the Pacific Northwest, while a related model known as the "solar power exchange" has been deployed in Switzerland since 1997. This case study describes each of these three innovative models.

Innovative Features

- PV pricing programs seem to create a true win-win situation: the PV (or small wind) system owner benefits from an additional revenue stream, while the utility or power marketer benefits by procuring relatively cheap solar (or small wind) power and reaping positive public relations from supporting local green power projects.
- These programs can have a synergistic relationship with buy-down programs, and clean energy funds can use their buy-down programs as a vessel through which to work with green power marketers to create additional customer value.
- While clean energy funds in the U.S. and abroad have not yet *directly* supported these types of innovative programs, opportunities to do so may exist.

Results

- The two U.S. programs are just getting underway, with few results to show yet. Both programs have just announced their first PV pricing investments.
- Switzerland's "solar power exchange" model has been quite successful, and is partially responsible for helping Switzerland to claim the highest installed PV capacity per capita of any country in the world.

2.11.2 Detailed Case Description and Highlights

The largest barrier to widespread adoption of photovoltaics (PV) is undeniably its high energy costs: even with aggressive capital cost buy-downs and favorable net metering policies, system payback periods can still exceed 20 years especially for small residential systems. The proliferation of both regulated and competitive green power markets where customers voluntarily pay more to support renewable forms of generation potentially creates new revenue opportunities for PV. One such opportunity involves green power marketers purchasing "green tags" that represent the generation from customer-sited grid-connected PV (or small wind) systems. (Of course, tags may also be purchased from non-customer sited and non-grid connected systems). Marketers then lay claim to the PV or small wind tags and re-sell them as part of a green power product. The PV (or small wind) system owner benefits from an additional revenue stream, while the marketer benefits by procuring relatively cheap solar or wind power and reaping positive public relations from supporting local, distributed, green power projects.

Limited experimentation with this innovative approach by green power marketers in the U.S. has taken place for several years. More recently, two more formal and comprehensive programs have begun in the United States, while a related but somewhat different model known as the "solar power exchange" has been deployed in Switzerland since 1997. This case study describes each of these three models.

The Energy Cooperative Association of Pennsylvania (ECAP)
ECAP is a member-owned heating oil supplier and electricity marketer in the Philadelphia area that offers a Green-e certified product containing 80% biomass, 19% small hydro, and 1% wind (consistent with Green-e standards, 10% of the product is from new renewable resources). ECAP would like to add solar power to their mix, and has launched a "PV pricing" program to enable it to do so. The following example (adapted from ECAP's web site) illustrates how this innovative program works:

- An ECAP member installs a PV system through the Sustainable Development Fund's buy-down program (described in Section 2.6), or a non-member installs the system and joins ECAP. The member agrees to pay 7¢/kWh to serve his *gross* electricity consumption with ECAP's green power product (the customer will already have two meters to enable monitoring of the PV system for the buy-down program).
- Assume that the member's gross electricity consumption averages 750 kWh per month, and the PV system will generate an average of 150 kWh per month (in reality, the system will generate more in the summer and less in the winter). Thus, in an average month the member will consume 600 kWh from the grid, with the remaining 150 kWh being generated on site by the PV system.
- Each month, the member pays PECO (the local wires company) roughly 7¢/kWh for distribution and transition charges on a net usage of 600 kWh. Note that the member avoids these charges on the 150 kWh that was self-generated.
- Each month (during a 2-year contract period), the member pays ECAP 7¢/kWh on 750 kWh of *gross* usage for the green power product.
- Each month (during a 2-year contract period), ECAP pays the member 20¢/kWh for 150 kWh of PV power.

The net result of this somewhat complex transaction is that ECAP pays the member a net price of 13¢/kWh for PV "tags" – the 20¢/kWh that ECAP pays the member less the 7¢/kWh that the member pays ECAP for the green power product. This is cheap PV power that ECAP can blend into its green power product mix. In addition, the member also avoids distribution and transition charges totaling 7¢/kWh on the self-generated portion, bringing total revenue to 20¢/kWh. This total is 6¢/kWh higher than the 14¢/kWh that the member would have received through net metering alone. With both ECAP and its members benefiting, this program seems to create a true "win-win" situation.

Though it has been "live" for only a few months and is somewhat dependent on the pace of installations under the Sustainable Development Fund's buy-down program (which, as noted in Section 2.6, has gotten off to a slow start), ECAP's program has reportedly been well received. ECAP has recently signed its first deal (for 2,800 kWh/year) and is close to inking another one involving a 2 kW system. In addition, several solar prospects have told ECAP that this program is what will "make the difference" and enable them to go solar. ECAP hopes that this market-based program will eventually become self-sustaining.

While ECAP's program is not sponsored by the Sustainable Development Fund (SDF) or even directly related to its buy-down program, synergies do exist. By requiring participating systems to meet SDF's rather stringent system specifications and quality assurance mechanisms, ECAP ensures that it is purchasing tags from a quality system. Furthermore, ECAP intends to "piggyback" off of SDF monitoring requirements and meter reads to verify system output. At the same time, SDF's buy-down program looks all the more attractive because of ECAP's PV pricing program.

Had ECAP received direct funding from the SDF, funds targeted at organizational development reportedly would have been most useful. ECAP's biggest resource drain has apparently not been the 20¢/kWh it spends for each kWh, but the time it has spent thinking through the logistics (e.g., how does this work? who reads the meter and how often?), developing a purchase agreement, and promoting the program.

Bonneville Environmental Foundation (BEF)

Building on previous efforts in this area, in April 2002 the BEF announced a new partnership with the Northwest Renewable Energy Cooperative (NWREC), whereby NWREC will sign 5-year agreements with owners of new PV systems to pay the system owners 10¢/kWh for the green tags produced by the PV systems. BEF will in turn purchase the green tags from NWREC and re-sell them to its wholesale customers and on its web site. As many as 30 small PV installations on homes and businesses are included in the first phase of the project.

A similar program is under development for small wind power. Bergey Windpower, the NW Cooperative Development Center, Northwest SEED, and others are in negotiation with NREL for funding to implement a wind power "co-op" model in the Northwest. Under this model, the organizations hope to install 10 small wind systems in distributed applications. Though customer-sited, the systems are to be metered to allow for the sale of the tags. BEF has agreed to

provide critical funding for the project by paying upfront for 10 years worth of green tags for 100 kW of small wind.

These programs are quite similar to that described above for ECAP, in that it will enable BEF to include more PV (and small wind) in its product content at the low cost of 10¢/kWh for PV, while providing PV system owners with an extra 10¢/kWh above what they can earn through net metering. These two programs are slightly different than ECAP's, however, in that BEF buys and sells green tags only (whereas ECAP buys tags and sells delivered electricity), which simplifies the transaction. Furthermore, BEF is working with NWREC to market its PV program, while ECAP is going it alone.

Solar Power Exchanges in Switzerland

Switzerland enjoys the distinction of having the largest amount of installed PV capacity per capita in the world. This success is due, in part, to an innovative program launched by the Swiss utility Elektrizitätswerk der Stadt Zürich (EWZ) in 1997 and now emulated by many other Swiss utilities. Known as the Solarstrom Börse (solar power exchange), this program – like the ECAP and BEF programs described above – channels green power demand in support of new PV systems. Also like the BEF and ECAP efforts, the Solar Power Exchange presents an innovative approach to building PV capacity to serve the green power market. Unlike BEF and ECAP, however, the solar power exchange involves systems installed on the utility's side of the meter, and the utility merely acts as a facilitator, passing its cost of power through to the buyer, reportedly without markup. In this way, the utility is really an intermediary, offering an innovative green power product consisting of solar power to its customers.

The solar power exchange works as follows. The utility (EWZ) issues an RFP for new PV plants, and extends 20-year power purchase agreements (PPAs) to those bidders with the lowest cost of energy (*and* feasible projects, with sites identified, etc.). Developers use the PPAs to finance their projects. The utility actively markets the solar power to its customers at the weighted average cost of the winning bids (i.e., with no markup). Customers sign up to meet a portion of their electricity needs with PV power for a one-year term, and the contract automatically renews each year unless canceled in advance by the customer. When customer demand for PV power exceeds supply, the utility solicits another round of PV bids, and folds the cost of the winning systems into its aggregate weighted average costs charged to all participating customers.

In EWZ's program, system costs have declined in each successive round of bidding, meaning that the weighted average cost charged to all customers has decreased over time. Between the first and third competitive bidding rounds in 1997 and 2000, the weighted average cost charged to all customers has declined by 20%. Falling costs make it easier to attract new and retain existing customers.

At the end of 2000, just four years after the start of the program, 43 PV plants totaling 1.65 MW were participating in EWZ's solar power exchange, and more than 10,000 EWZ customers, representing 3% of the utility's customer base, were buying the power. (As of 2002, 2.5 MW of PV are now supported). The model has also been widely emulated throughout Switzerland: as of September 2000, 100 Swiss utilities were offering solar power from 1,200 PV systems to their

customers, many – but not all – adopting EWZ's solar power exchange model. As a result, more than half of the Swiss population now has access to a solar power exchange (Haas 2002).

The success of this model, which at its core is simply an innovative design for a green pricing program, is notable given the failure of previous subsidy programs to result in significant PV installations within Zurich. In an urban environment dominated by rented apartments, tenants previously had no way to support PV. EWZ's model addressed this problem by installing the PV on the utility side of the meter, and then allowing tenants to buy it at cost.

Operating on the utility side of the meter also avoids potential criticisms that could be levied at the ECAP and BEF programs, which support systems on the customer side of the meter. Specifically, once a PV system owner has sold green tags to ECAP or BEF, can the PV system still be considered green? If not, should the PV system continue to qualify for net metering (if net metering is restricted to renewable technologies)? The solar power exchange avoids this potential complication by siting PV systems on the utility side of the meter.

2.11.3 Organization and Contact Information

Nadia Adawi
The Energy Cooperative
1218 Chestnut St., Suite 1003
Philadelphia, PA 19107
http://www.theenergyco-op.com/
nsadawi@aol.com
(215) 413-2120

Rob Harmon
Bonneville Environmental Foundation
133 SW 2nd Avenue, Suite 410
Portland, OR 97204
http://www.bonenvfdn.org/index.shtm
RobertHarmon@B-E-F.org
(503) 248-1905

2.11.4 Information Sources

Haas, R. 2002. "Building PV Markets: The Impact of Financial Incentives." *Renewable Energy World*, Vol. 5 (4), July-August 2002.

Holt, E. 2000. "The Role of Green Power in Increasing Demand for Solar Electricity." Prepared for the Solar Electric Power Association.

EWZ. 2001. "Annual Report 2000."
http://www.ewz.ch/ewz_asp/english/content/Publications/Geschaeftsbericht_E.pdf

Ruoss, D. and S. Taiana. 2000. "A Green Pricing Model in Switzerland: The Solarstrom Stock Exchange from the Electricity Utility of the City of Zurich." Proceedings of the 2nd World Solar Electric Buildings Conference: Sydney, Australia, March 8-10, 2000.

Personal communication with: Nadia Adawi (ECAP)

Comments provided by: Nadia Adawi (ECAP) and Rob Harmon (BEF)

ECAP web page: http://www.theenergyco-op.com/solar.htm
BEF news release: http://www.bonenvfdn.org/news/releases/041202.shtm
NW SEED Wind Co-op Information: http://www.nwseed.org/nwswtc.asp

2.12 Quality Assurance for Photovoltaic Systems

2.12.1 Case Summary

Case Description

Ensuring that customer-sited photovoltaic (PV) systems perform adequately should be an important goal for clean energy fund managers. Performance issues are especially pertinent for state funds whose PV incentives are tied to installed capacity and not performance. This case summarizes the approaches that certain states have used to help ensure product quality and reliability.

Innovative Features

As discussed in this case, states have used a variety of approaches to attempt to ensure quality installation and reliability. These approaches can be segmented into:

- system requirements (e.g., UL listing of modules and inverters),
- installer requirements (e.g., installer certification and training),
- installation requirements (e.g., to ensure proper orientation),
- warranty requirements (e.g., on parts, labor, and installation),
- performance incentives (e.g., apply incentives based on kWh rather than kW), and
- voluntary training and certification programs.

Results

- Performance and reliability issues with PV, especially for residential systems, clearly exist and are of concern to potential PV buyers.
- This case study shows that states are taking very different approaches to provide quality assurance; some have taken minimal steps in this regard while others have aggressive warranty and installation requirements and/or use per-kWh payments rather than standard per-kW buy-downs. Installer training and certification requirements are also being considered in some states.
- Unfortunately, no single "best practice" has emerged as offering the ideal balance between adequate levels of assurance and reasonable cost.

2.12.2 Detailed Case Description and Highlights

The photovoltaics (PV) industry has long struggled to provide assurance of product quality and performance to its customers. Before 1998, for example, PV modules sold in the U.S. routinely carried 10- to 20-year warranties, but balance of system components and installation had either short warranty coverage or none at all (Starrs and Schwent 2000). Today, standard practice (absent additional state requirements) includes 5-year warranties on inverters, 20-year warranties for modules, and perhaps a 1-year warranty on installation workmanship. A recent survey in California confirms that performance concerns are salient: the two most important concerns noted by residential and commercial electricity customers in California about PV systems were (a) cost and (b) performance and product reliability (Phelps Group and ICF Consulting. 2001).

Moreover, even under California's PV buy-down program, which requires comprehensive 5-year system warranties, monitoring of select residential PV systems revealed that AC output was frequently one-quarter to one-third below that expected based on certified module and inverter efficiencies at standard PVUSA Test Conditions; performance issues were relatively more serious for those systems with battery back-up and those that were owner-installed (RER 2000). Factors that contributed to this underperformance relative to PVUSA Test Conditions included component mismatch, wiring sizes, shading, battery storage, panel orientation, and inverter loading. It was also found that many program participants had no way of monitoring their systems' instantaneous or cumulative performance, and/or had little understanding of what quantity of output to expect. Possible solutions to these issues considered by the CEC include:

- requiring customer-friendly metering of PV system output,
- providing better performance estimates to PV buyers, and
- applying buy-down incentives to a de-rated version of PVUSA Test Condition data.

Performance issues are especially pertinent for state funds whose PV incentives are often tied to installed capacity, not performance, potentially exacerbating the performance problem absent additional requirements. States that have established incentives for PV have therefore also generally established technical and performance requirements. Although a "best practice" among these programs remains elusive, it is clear that a number of approaches are possible.

Efforts taken by states to provide quality assurance can be segmented into 6 categories:

- system requirements,
- installer requirements,
- installation requirements,
- warranty requirements,
- performance incentives, and
- voluntary training and certification programs.

Rather than providing a comprehensive survey of the approaches taken in each state, the discussion below summarizes the standards and requirements of the majority of state clean energy funds to illustrate the issues.

System Requirements
California, New Jersey, Montana, Massachusetts, Delaware and others require that PV components carry UL listings, while Illinois allows 1-year of field-testing to replace UL requirements. Pennsylvania's SDF requires that systems be FSEC-approved or that components be CEC approved, or else components must meet a series of IEEE, UL, and other standards.

Installer Requirements
While California, Massachusetts, and others only require PV installers to carry the appropriate contractor licenses (though in California system owners may be allowed to install their own systems without being licensed), Pennsylvania (and SunWize in New York) goes one step further. Pennsylvania requires the use of a participating contractor from a pre-certified list of contractors that have met financial requirements and that have passed an approved solar proficiency exam. New York and other states are also considering formal installer training and certification requirements, though these have generally not yet been implemented and some states are waiting on the development of a national training and certification program for PV, discussed below.

Installation Requirements
In addition to offering a "carrot" to encourage peak performance, Pennsylvania also employs a "stick": to be eligible for the program, the placement and orientation of PV modules must enable the system to produce not less than 70% of the annual output achieved by an optimally placed and oriented system. New Jersey employs a similar mechanism, with different minimum efficiency levels depending on PV module orientation and whether BIPV systems are used. New Jersey will also inspect 100% of all systems in the first year prior to issuing their rebate incentive. LIPA has the option of such inspections, while Massachusetts and Montana require that sites be screened for orientation and shading.

Warranty Requirements
States have taken different approaches to the duration and type of system and component warranty requirements. For example, California, Delaware, New Jersey, Massachusetts, and Pennsylvania all require systems to carry 5-year warranties, but of varying comprehensiveness. California, New Jersey, and Delaware require full 5-year warranties on entire systems, while Pennsylvania and Massachusetts require a full parts and labor warranty for 2 years, and a more limited parts warranty for an additional 3 years. Montana, meanwhile, has required 20-year module warranties and 5-year inverter warranties. Such requirements have forced manufacturers to strengthen and lengthen their product warranties, providing a good example of how system-benefits charge funded PV programs are pushing the PV industry towards maturity. That said, experience in California suggests that system and warranty requirements alone may be insufficient, motivating the interest of other states to apply additional installer and installation requirements, and/or performance incentives. New York, meanwhile, requires its PV contractors to have at least a 2-year service contract with their customers.

Performance Incentives
As described in Section 2.6, several states have begun to experiment with tying incentive levels to performance, rather than installed capacity; this outcome is in part a reaction to experience in California that has shown some performance problems.

- Pennsylvania's SDF offers an initial $3/W buy-down, as well as a second payment at the end of the first year of production of $1/kWh (up to $2,000) to the system owner. At the same time, the system installer is paid $0.10/kWh (up to $250). These delayed, performance-based payments provide an incentive to both the owner and installer to ensure that the system is operating at high levels. (Note that performance-based incentives require that the system be metered separately from the building, rather than through the building's existing meter, as is common practice with net-metered applications; this adds modestly to the cost of a PV system.)
- Massachusetts has also announced a performance-based buy-down, where 70% of a $5/Watt incentive will be paid after 30 days of successful system operation, with the remaining 30% paid down quarterly over three years based on system performance at a rate of 38¢/kWh (with a capped amount on the total incentive of $5/Watt). The Massachusetts Renewable Energy Trust has issued a solicitation to develop the production tracking and registry system necessary to administer these production payments.
- Wisconsin takes a slightly different approach: their buy-down program offers PV systems $1 per projected annual kWh of generation up to 25% of project costs. While at first glance this appears to be a 1-year production incentive, the fact that it is tied to *projected* rather than *actual* kWh production means that only efficient siting is encouraged.
- Finally, New York requires systems that it has funded to be monitored for 2 years, and holds back a portion of its payments until the systems have operated as designed for 12 months.

Voluntary Training and Certification Programs

Debate in the PV industry has long centered on the need for PV training and certification requirements. While not often *required* by state clean energy funds yet (PA is the exception so far), a number of states have begun to develop *voluntary* installer training programs; these include California, New York, New Jersey, and Wisconsin. Massachusetts, meanwhile, recently issued an RFP for a "needs assessment" of training and certification requirements within the PV industry in the Northeast (this document should be finalized by the end of 2002), and has budgeted funds for training and certifying PV installers.

At the same time, the North American Board of Certified Energy Practitioners, the Interstate Renewable Energy Council, the Institute for Sustainable Power and others have begun a stakeholder process to develop a national PV installer certification program. Such a program has the following goals: (1) ensure the portability of the credential, (2) encourage reciprocity among the states, (3) reduce redundancy and costs in development, (4) reduce costs in administration, and (5) support an open market for certified practitioners. To become certified, an installer would need to meet training and experience prerequisites, pass a written exam, and pass a physical skills exam. (http://www.irecusa.org/certifications/index.html).

Other Options

In addition to these options, other creative approaches to assuring quality being considered include:

- Massachusetts has explored the development of an insurance fund to cover special circumstances, such as if the equipment manufacturer or installer goes out of business.
- California has considered requiring customer-friendly metering such that PV owners can more easily monitor system performance.

2.12.3 Organization and Contact Information

Sam Nutter
Massachusetts Technology Collaborative
75 North Drive
Westborough, MA 05181
http://www.masstech.org/
nutter@masstech.org
(508) 870-0312

Jennifer Harvey
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399
http://www.nyserda.org/
jlh@nyserda.org
(518) 862-1090

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

Elaine Bryant
New Jersey Clean Energy Program
PSE&G (one of several utility contacts)
80 Park Plaza, T7
Newark, NJ 07102
http://www.njcleanenergy.com
robin.bryant@pseg.com
(973) 430-7565

Sue Sebastian
Delaware Department of Admin. Services
149 Transportation Circle
Dover, DE, 19901
ssebastian@state.de.us
(302) 739-5644

Don Wichert
Wisconsin Focus on Energy
Wisconsin Department of Administration
101 East Wilson Street, Madison, WI 53702
http://www.weccusa.org/renewables/
don.wichert@doa.state.wi.us
(608) 266-7312

Tim Tutt
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512
http://www.energy.ca.gov/
Ttutt@energy.state.ca.us
(916) 654-4590

Ray Schott
NCAT – Montana
3040 Continental Drive
Butte, MT 59701
http://www.montanagreenpower.com/
rays@ncat.org
(406) 494-8668

2.12.4 Information Sources

Bolinger, M. and R. Wiser. 2002. "Customer-Sited PV: A Survey of Clean Energy Fund Support." LBNL-49669. Berkeley, Calif.: Lawrence Berkeley National Laboratory and the Clean Energy Funds Network.

Regional Economic Research (RER). 2000. "Renewable Energy Program Preliminary Evaluation: Emerging Renewable Resources Account (Volume IV)." Prepared for the Governor and California State Legislature.

Shirley, L., Fitzpatrick, S. and C. Larson. 2000. "Public Education and Professional Training." Prepared for the Renewable Energy Policy Project.

Starrs, T. and V. Schwent. 2000. “Government Buydowns for the Residential Market.” Prepared for the Renewable Energy Policy Project.

Phelps Group and ICF Consulting. 2001. "Renewable Energy Study." Prepared for the California Energy Commission.

IREC National Certification Effort: http://www.irecusa.org/certifications/index.html

Select websites of the clean energy funds cited in the paper:
California: http://www.energy.ca.gov/renewables/
Massachusetts: http://www.mtpc.org/massrenew/
New York: http://www.nyserda.org/energyresources/renewableprogramlist.html
Pennsylvania SDF: http://www.trfund.com/sdf/
New Jersey: http://www.njcleanenergy.com/html/3renewable/1_home.html
Montana: http://www.montanagreenpower.com/
Wisconsin: http://www.weccusa.org/renewables/

2.13 Two Different Approaches to Funding Farm-Based Biogas Projects in Wisconsin and California

2.13.1 Case Summary

Case Description

California and Wisconsin are the two leading dairy producing states in the nation. Both states are interested in developing biogas projects from livestock manure, but have targeted this renewable energy application differently. California has allocated nearly $10 million in incentives and buy-down grants to demonstrate the energy, economic, and environmental benefits of biogas systems and act as a catalyst for the development of further dairy biogas systems in the state. In contrast, Wisconsin has a more modest financial incentive and is relying more extensively on education and outreach and other regulatory mechanisms to encourage biogas facilities. Some of the differences between the two states' approaches can be attributed to different philosophies about the best way to deploy biogas technologies. However, the two states have distinctly different climates (which dictate different biogas system designs), dissimilar dairy sizes, disparate histories with biogas systems, and very different electricity markets. Consequently, conclusions regarding the appropriateness of either approach should take into account these differences.

Innovative Features

Despite numerous past technical failures, some states are beginning to take an increased interest in dairy biogas projects. The programs in Wisconsin and California can be classified as innovative if for no other reason than they focus on a technology that has not received much attention for a number of years. While these programs have not been in operation long, several specific features of each state's biogas activities may be of relevance:

- The California Energy Commission's (CEC) approach is to demonstrate the energy, economic, and environmental benefits of biogas projects on California dairies by co-funding biogas projects on a representative set of dairies. The CEC engaged a dairy producers' trade association—Western United Resource Development, Inc. (WURD)—to administer a grant program, and empowered an advisory group to help select projects and provide assistance in program direction.
- WURD put a list of qualified biogas vendors on its web site to help incentive applicants with project development.
- Wisconsin has more modest financial incentives than California, but has held two biogas-related conferences, and is working with Wisconsin utilities to offer higher avoided cost rates and streamlined interconnection requirements for biogas facilities.

Results

California is negotiating terms with projects selected in its first biogas solicitation, whereas Wisconsin's program is not even six months old. Therefore, results are relatively sparse.

- WURD received over 30 applications for incentives and has approved nine projects for total funding of nearly $2.5 million. Because biogas system costs turned out to be higher than anticipated, the buy-down grant and production incentive levels were increased from the

levels initially offered (from $1250/kW to $2000/kW). The nine selected projects are expected to amount to about 1.5 MW of total capacity.

- In Wisconsin, one utility—Wisconsin Power & Light—received approval by the Wisconsin Public Service Commission to offer higher buy-back rates for up to 10 MW of biogas facilities. Another Wisconsin utility is considering a similar proposal. The system-benefits charge administrator has funded a couple of dairy biogas projects with limited grant monies, with more applications expected as the state's outreach and education activities continue. In July 2002, a digester gas developer announced an agreement with six Wisconsin farms to install and operate anaerobic digesters that will fuel up to 10 MW of generation capacity.

2.13.2 Detailed Case Description and Highlights

California

During the California electricity crisis in 2000 and 2001, the California General Assembly approved several measures intended to ease the crisis. One of these measures was Senate Bill 5X that Gov. Gray Davis signed into law on April 11, 2001. Among other things, this law created the Dairy Power Production Program and authorized the California Energy Commission (CEC) to expend $9.64 million to encourage the development of anaerobic digestion and gasification ("biogas") electricity generation projects on California dairies. The CEC in turn signed a contract with the Western United Resource Development Corporation (WURD) to administer the program. WURD is a non-profit entity created to administer the CEC program and is associated with the Western United Dairymen, a trade association of dairy farmers and producers in California. The goal of the program is to install over five megawatts of dairy biogas systems capable of generating over 30 million kWh annually by September 30, 2002 (the CEC recently extended this deadline to June 1, 2003). The CEC has estimated that approximately 100 MW of near-term biogas production potential from livestock manure exists in the state, with only 370 kW in place today.

Biogas systems were first introduced to California in the early 1980s. However, inexperienced project developers, overly optimistic expectations, and complicated electricity rate structures resulted in a number of biogas system failures in the state. Due to these failures, the dairy industry in the state has been hesitant in embracing biogas-to-energy systems. Consequently, the CEC's approach has been to focus on using commercially available systems and installers with proven track records to demonstrate the energy, economic, and environmental benefits of biogas projects in California. Another unique aspect of the CEC's approach is an emphasis on biogas systems that are sized to displace retail rate electricity purchased by dairies, rather than on larger systems that would sell electricity at wholesale rates. Recently adopted net metering provisions include biogas systems installed at California dairies. The net effect is that electricity from biogas systems that displaces purchased electricity has a value upwards of 10¢/kWh, whereas wholesale prices for electricity are likely to be significantly below 10¢/kWh.

Applicants could initially request two types of financial assistance: a buy-down grant of up to 50% of the capital cost of the anaerobic digester system but not to exceed $1,250 per kW, or a production incentive of 3.6¢/kWh for five years. The goal is for the applicant to receive about the same amount of funding whether the applicant chooses to receive the funding all at once

under the buy-down grant, or receives the funding over five years via a production incentive. To date, WURD says most of the applicants have chosen the buy-down grant. Applicants can also receive low-interest loans from the California Renewable Energy Loan Guarantee Program to cover the remaining costs.

The grant program is overseen by an advisory board consisting of representatives from the California dairy industry, the California Department of Food and Agriculture, the California Energy Commission, the California State Water Resources Control Board, Sustainable Conservation, the University of California, and the U.S. Environmental Protection Agency's AgSTAR program. A list of qualified vendors is provided on WURD's website to help applicants with their system installations. The web site also provides links to EPA's AgSTAR program, and links to other potential incentives for commercial dairy digester facilities such as energy efficiency incentives. In addition, a separate program to remove or eradicate interconnection barriers—a typical barrier for biogas projects—proceeded under a grant from the CEC Public Interest Energy Research program.

WURD released its initial RFP in July 2001, with a proposal deadline of December 15, 2001. Over 30 applications were filed with a total funding request of more than $27 million. As of July 2002, WURD had approved nine projects with a total incentive value of $2,492,198 (total project costs are approximately $5.8 million). Project details have not been released because WURD is in the process of finalizing the incentive arrangements with the applicants, but in aggregate, the nine projects are expected to contribute roughly 1.5 MW of generating capacity.

WURD and the advisory group evaluated project proposals based on numerous criteria: (1) the projected ability of the projects to generate electricity based on manure management and collection considerations; (2) the financial strength of the applicant; (3) the ability of the applicant to meet all applicable environmental requirements; (4) whether the applicant had adequate insurance arrangements and could indemnify WURD and the CEC; (5) whether the applicant had service agreements for the project; and (6) the commitment of the applicant to get a five-year performance bond. Applicants for the buy-down grant had additional technical and economic feasibility requirements to meet because the applicant would receive the incentive upfront rather than over five years. The additional criteria included overall manure management and collection practices at the dairy, whether the proposed biogas system is commercially proven, and the experience of the project team.

Also in May 2002, the CEC raised the buy-down cap from $1,250/kW to $2,000/kW, and the production incentive from 3.6¢/kWh to 5.7¢/kWh. WURD says the biogas system costs turned out to be higher than anticipated, and the payment caps meant far less than 50% of the system costs would be covered by either the buy-down or the production incentive. The nine winning projects will receive these higher incentive levels. WURD is still accepting applications, but projects must be able to come on-line by June 1, 2003.

The CEC has also recently opened a new funding opportunity for anaerobic digestion projects (including landfill wastes, dairy and swine operations, wastewater treatment, and food processing and manufacturing wastes) through its R&D program. Specifically, the CEC has made $5 million available to support demonstration projects that have high R&D value. This program is intended

to be complementary to the dairy-based solicitation discussed above, which focuses on already-commercial technologies.

Wisconsin

While California is partly interested in biogas generation to help alleviate the state's electricity crisis, Wisconsin is primarily interested in biogas to help manage the longer-term environmental impacts of livestock manure spreading or disposal. Dairy farms with over 1000 animal units (an animal unit is defined as 1000 pounds of animals) must have an approved manure disposal plan filed with the state. For example, a dairy herd of 715 with an average weight of 1400 pounds per cow would have 1000 animal units and therefore need a manure permit. A herd of this size is reportedly also roughly the number of animals needed to achieve the economies of scale necessary to make a biogas system economical.

Wisconsin has taken a slightly different approach than California in targeting these biogas applications by focusing on customer education, information sharing, leveraging other incentive programs and strategies, and overcoming market and regulatory barriers towards the installation of distributed power systems such as biogas systems.

Wisconsin's primary system-benefits-charge-based incentive to farm-based biogas projects comes in the form of an up-front grant, the size of which is calculated using a rather complex formula.[21] Using this formula, a 50kW system operating at a 75% capacity factor would receive an incentive of ~$400/kW, considerably lower than that offered in California. Two equipment installation grants have been provided so far by the program to farm-based biogas project: each has provided small grants of under $15,000 to recover heat from engine-generators. Small technical feasibility study, demonstration project, and business and marketing grants are also available, a limited number of which have been provided to biogas projects.

Rather than issue a sizable RFP for biogas generation and wait for applicants, Wisconsin has conducted extensive outreach through conferences and seminars to find potential biogas projects. Since Wisconsin is still a regulated electricity market, the state has also worked on encouraging favorable buy-back rates for biogas projects from electric utilities and mitigating potential hurdles from interconnecting distributed generators such as biogas projects.

A public-private partnership, termed the Wisconsin BioGas Development Group, was formed and is led by the Wisconsin Department of Agriculture, Trade and Consumer Protection. In April 2002, over 200 people attended a symposium on biogas organized by the group. A second public meeting is scheduled for June 2002, this time covering biomass more broadly, including biogas. The emphasis has been on transferring information to interested dairy producers about biogas systems, and stressing that these biogas systems can help alleviate environmental issues associated with livestock manure as well as provide an important revenue stream.

In addition, the Wisconsin Public Service Commission approved a higher buy-back rate for facilities up to 800 kW in size in Wisconsin Power & Light's (a subsidiary of Alliant Corp.)

[21] Specifically, bioenergy projects (including landfill gas, manure, wastewater treatment, and food processing operations) may receive a grant equal to 2100*(kW*capacity factor)^0.63, with a maximum funding award of $50,000 or 25% of total project costs, whichever is lower.

service territory (eligible technologies include landfill gas and biogas from wastewater treatment facilities, food processing plants, and livestock manure). The buyback rates are 8¢/kWh for power produced on-peak, and 4.9¢/kWh produced off-peak, for an overall average rate of 6¢/kWh. The rates last for five years, after which the price reverts to Wisconsin Power & Light's avoided cost rate. The facilities can be owned by the customer or by the utility. The tariffs will be available for up to three years and can be applied to a total of 10 MW of biogas facilities located in Wisconsin Power & Light's system.

Wisconsin has also focused on streamlining the process for interconnecting small generators such as biogas to the utility system. A consensus is near on a streamlined interconnection process for generators ranging from 1 kilowatt to 15 megawatts, with higher levels of insurance and study requirements for larger generating projects than for smaller generating projects.

An early indication that Wisconsin's outreach efforts are starting to bear fruit came in July 2002 when Environmental Power Corporation, a manufacturer and developer of anaerobic digester gas technology, announced that it had signed letters of intent with six Wisconsin farms to install and operate digesters capable of powering up to 10 MW of generating capacity. The power will be supplied to Wisconsin Public Service Corporation under a 15-year power purchase agreement.

2.13.3 Organization and Contact Information

Kathi Carkhuff
Western United Resource Development Inc.
1315 K St.
Modesto, CA 95354
http://www.wurdco.com/index.htm
kcarkhuff@westernuniteddairymen.com
(209) 527-6453

Larry Krom
Wisconsin Energy Conservation Corp.
211 S. Paterson Street
3rd Floor
Madison, WI 53703
http://www.wisolarelectric.com/
lk@wisolarelectric.com
(608) 249-9322

2.13.4 Information Sources

Alliant Corp. press release, "Biogas Demonstration Project Proposed," December 18, 2001, http://www.alliantenergy.com/news/news.php?issueID=228.

California Energy Commission Biogas R&D Program Opportunity Notice: http://www.energy.ca.gov/contracts/index.html#pier

Western United Resource Development Inc. "Dairy Power Production Program Application." http://www.wurdco.com/DPPP%20Application-Part%201.pdf.

Western United Resource Development Inc. "Money for Methane," Press Releases in 2001 and 2002. http://www.wurdco.com/press_room.htm.

Wisconsin Distributed Generation Interconnection Guidelines, Draft 5.7, May 13, 2002, http://www.renewwisconsin.org/dg/WisconsinInterconnectionGuidelinesDraft5_7.pdf.

Wisconsin Public Service Commission. *Application of Wisconsin Power and Light Co. for Approval of Its Biogas Renewable Energy Distributed Generation Program*, Case No. 6680-EI-110, February 6, 2002, http://psc.wi.gov/pdffiles/ord_notc/4360.PDF.

Wisconsin Focus on Energy Grants Programs: http://www.weccusa.org/renewables/

Personal Communication with: Kathi Carkhuff (Western United Resource Development Inc.), Michael Vickerman (Renew Wisconsin), and Don Wichert (Wisconsin Department of Administration)

Comments provided by: George Simons (CEC)

2.14 Using Customer Credits to Stimulate Green Power Sales in California, Rhode Island, and New York

2.14.1 Case Summary

Case Description
Several clean energy funds have taken an interest in encouraging the development of the green power market. The idea of providing a "customer credit" to green power marketers originated in California. With a customer credit, a state clean energy fund pays the green power purchaser (or more realistically, marketer) a per-customer or per-kWh incentive for each green power sale.

California's program involves a simple ¢/kWh credit (up to a maximum of 1.5¢/kWh) to green power customers for each kWh of eligible renewable energy purchased. Learning from California's experience, Rhode Island and New York have also begun to experiment with *modified* customer credit programs that offer alternative incentive structures. This case describes the program design, results, and lessons learned from all three programs.

Innovative Features
The idea of stimulating voluntary customer demand for renewable energy is innovative in itself. The use of per-kWh or per-customer sign-up bonuses to encourage such demand has only recently developed. Rhode Island and New York observed some of the problems encountered in California, and have created programs that:

- more strongly target new renewable resources,
- allow certificate-based products to qualify for funds,
- provide incentives that allow for sustainable pricing of green power products, and
- use more discretion in the selection of green power providers to fund.

Results

- California's program has distributed $59.4 million and created a market that grew to 160,000 residential and 40,000 non-residential green power customers.
- California's experience in trying to foster green power demand was influenced by both the overall electricity market structure in which it operated as well as the specific design of the customer credit program. The customer credit program operated within a retail electricity market that was fundamentally hostile towards retail choice and price competition. As a result, the customer credit became popular among marketers as one of the few means of offering price discounts, leading to the creation of a green power market that can be characterized as price- rather than value-driven, and therefore unsustainable. The intense focus on price also led to a disproportionate reliance on existing (i.e., cheap) rather than new (i.e., more expensive) renewable resources, which the design of the customer credit did little to discourage. The precise design of California's program, therefore, should not be replicated.
- The modified New York and Rhode Island programs have attempted to address some of these issues, but have been operating for too little time to have clear results.

2.14.2 Detailed Case Description and Highlights

With the introduction of customer choice in electricity markets, several state clean energy funds have taken an interest in encouraging the development of the green power market with the goal of developing, over time, a sustainable market for renewable energy that is not dependent on continued subsidization. While the motivation to help build the green power market is clear, identifying an "innovative practice" from among state experience is more challenging.

This case study reviews experience with "customer credits": the use of state funds to directly encourage customer demand for renewable electricity, or "green" power. Three states have experimented with this approach to date: California, Rhode Island, and New York. Only California's program has been operating long enough to have firm results, and experience in that state demonstrates the challenge of designing a properly targeted incentive. New York and Rhode Island have learned from California's experience and have sought to improve upon the concept. This case study reviews the design, experiences, and lessons learned in each state.

California

California pioneered the use of state clean energy funds to support the development of the green power market, and today remains the state that has pursued this market most aggressively. Funded with $75.6 million in total from 1998-2001, the California Energy Commission's (CEC) customer incentive has offered consumers a per-kWh credit for eligible renewable energy that they purchase through the green power market (capped at $1000 per year for customers larger than 20 kW). The credit was initially established at 1.5¢/kWh, but declined to 1¢/kWh as green power demand increased. Though the intent was for the credit to "buy down" the cost of renewable energy for end-use customers, to ease administrative burdens the credit is disbursed directly to power marketers once they have documented that they have passed the credit on to their customers (typically in the form of lower prices).

By some measures, the customer credit has been a huge success. Through June 2002, $59.4 million had been paid to competitive electric suppliers that were, at the peak of the market, selling renewables to approximately 160,000 residential and 40,000 non-residential customers. The customer credit was the major force behind the development of the green market in California; in fact, the mere existence of competitive electric suppliers offering products to small customers in the initial years of the state's restructuring efforts was largely a result of the CEC program. Because California's competitive market structure left little or no room for marketers to compete with incumbent utilities for customers on the basis of price, most marketers soon turned to the CEC's customer credit as the principal means of offering price discounts to small customers. As a result, virtually all kWh sales to residential and small commercial customers that switched suppliers have been delivered by renewable energy.

Though a pioneering effort, the customer credit has also been criticized:

- **Program Did Not Differentially Target "New" Renewable Sources:** Because it provides an equal credit for new and existing renewable resources, the program offers no incremental incentive for marketers to include new renewables in their products. As a result of this design feature and razor-thin profit margins, the vast majority of green power marketers in the state

sourced their power from existing renewable energy projects, which are typically cheaper than new projects, yet arguably provide fewer net environmental benefits to the state.

- **Program Nurtured an Unsustainable Green Power Market**: The customer credit has, at times, been large enough to make renewable energy cheaper than other electricity supplies, creating a price- rather than value-driven market for renewable energy in which customers *save* money by buying green power. In fact, the CEC's own evaluation of the program showed that 40% of residential customers and 72% of non-residential customers purchasing renewable energy were not even aware that their product mix contained renewable energy (RER 2000).[22] Clearly attracted to these products by attributes other than the products' "green-ness" (e.g., low price), these customers are unlikely to generate a truly sustainable market for renewable energy over the long term (though with the suspension of direct access in the wake of the electricity crisis, it is impossible to say definitively).
- **Program Propped Up a Market with Little Underlying Promise:** Within a year or two of the inception of retail competition (i.e., prior to the electricity crisis), it had become clear that the CEC's customer credit was propping up green power marketers within a broader market that was fundamentally hostile to retail electricity choice. While the CEC could not have predicted these market conditions and certainly had no control over them, it is clear that continuing to offer a customer credit in such an environment is akin to swimming against the tide and will likely not lead to a truly self-sustaining market for green power.

The CEC has acknowledged some of these problems, and in its investment plan for the expenditure of 2002-2006 system-benefits charge funds the agency identifies a number of possible changes to the program: (1) eligibility may be restricted to products that contain a minimum percentage of new renewables, and the CEC would consider creating two credit levels, one for new and one for existing generation; and (2) retail electricity marketers receiving the credit may be required to provide renewable energy educational materials to their customers (CEC 2001).

While the precise design of the California customer credit may not deserve emulation, a redesigned program – especially if applied in a market where the long-term prospects for retail competition and green power sales are bright – may be worthwhile to consider. Such has been the conclusion in Rhode Island and New York, where lessons learned in California were applied to create new and redesigned customer incentive programs.

Rhode Island

Rhode Island is a small state with a renewable energy fund of approximately $2-$3 million per year, currently administered by the Rhode Island Renewable Energy Collaborative (RIREC).[23] After initially unsuccessful attempts to develop renewable energy projects in the state, RIREC decided to shift some of its focus to developing the demand-side of the equation: the green power market.

[22] This is true in spite of a CEC requirement that marketers inform customers on their bills that they are receiving a California publicly funded credit on their purchase of renewable power.

[23] Starting in January 2003, the administration of Rhode Island's renewable energy fund will be transferred from RIREC to the State Energy Office.

In 2001 the Rhode Island PUC gave final approval to a modified customer credit program – funded at $1.365 million – intended to overcome at least some of the problems experienced in California. The design of the Rhode Island program differs from the CEC's in several respects.

- **Sign-Up Incentives Allow Sustainable Pricing:** Rather than per-kWh incentives, Rhode Island's program initially offers retailers $125 per residential or $250 per small commercial customer they are able to switch to green power. After the first 5,000 residential or 1,000 small commercial customers, the incentive levels drop to $75 and $125, respectively. The goal of this design is to buy-down the cost of customer marketing and sign-up, but ideally to not greatly influence product pricing or create incentives for "discount" green power products that would not lead to a sustainable market. Product pricing will be monitored by RIREC. Products that are priced in an "unsustainable" fashion may be denied incentives. Suppliers also must commit to serving green power customers for at least two years, or else may be required to pay damages.
- **Separate Large Customer Program**: The direct credit described above is only available for sales to smaller customers. Larger potential green power customers are targeted through a separate and more flexible $500,000 RFP. Through this RFP, RIREC will fund either large electricity consumers or retail green power marketers to "buy-down" the cost of a green power purchase or sale. Evaluation criteria for selecting winning proposals include the amount of new renewable generation, the "cost-effectiveness" of the funding request, the sustainability of the potential impacts, and the amount of secondary media and promotion promised.
- **New Renewables Requirements:** Qualifying green power products must contain some portion of new renewable resources. In particular, eligible products are those that are Green-e certified or that contain 20% "new" renewable generation.
- **Allowance for Certificates-Based Products:** Eligible products can either be sold through a retail electricity provider or can be sold separately through renewable energy certificates. Allowing certificate offerings to qualify acknowledges the fact that Rhode Island's competitive retail electricity market had not developed yet. Separate product eligibility standards apply to certificates offerings.

In addition to these direct financial incentives, a $350,000 RFP for green power education, market building, and customer aggregation was also released in 2001, as well as a supply RFP targeted at new renewable resources that would serve the Rhode Island green power market.

The success of Rhode Island's efforts remains to be seen. A number of proposals have been received for the programs described above, with several in the funding pipeline and one proposal approved thus far. As a very small state in a larger region, however, the RIREC green power programs are not likely to be sufficient, by themselves, to generate substantial green power interest in the state. The future of the green power market in Rhode Island will therefore continue to be tied to the fate of green power in the larger New England market.

New York

With approximately $14 million per year for renewable energy and a large population over which to spread these funds, New York has a relatively small renewable energy fund. The state also has a somewhat sordid history with electricity reform, and continues to this day to try to attract retail competition to the state.

New York's initial rounds of renewable energy funding focused on the supply side of the renewables market – building renewable energy industry infrastructure and providing incentives for the first large-scale wind projects in the state. What quickly became apparent, however, is that these renewables projects needed a market in which to sell their electricity. With funding now extended through 2006, NYSERDA is beginning to target the demand side of the market.

New York has opted to take a more targeted approach to supporting the green power market than California and Rhode Island. Rather than funding all retail green power marketers on a first-come basis, NYSERDA opted to develop a solicitation to select eligible marketing programs for support. This allowed NYSERDA the discretion to select and fund marketing programs that they believed had the highest degree of likely success and sustainability. It also provides NYSERDA a higher degree of direct involvement in the marketing plans of the green power suppliers, and a closer tracking of project status and results.

Proposals for the first round of green marketing support were due in November 2001. Under this solicitation, green power companies were able to submit proposals in one of two tracks.

- Under Track A, NYSERDA would provide a total of $300,000 to help one or more organizations develop or refine green power marketing programs and concepts. Successful proposals were to present unique and promising concepts for marketing renewable energy that are not yet ready for funding under Track B. Activities that could be funded under Track A include market research and business plan development.
- Under Track B, NYSERDA would provide financial support to firms that are ready to market renewable generation to New York customers. Payments are to be based on satisfying performance targets and product specifications. $3 million was available under this program in its first year, with a $1 million cap for each award. Subsequent funding depends on the first year's marketing efforts and an assessment of New York's overall competitive retail market. A minimum of 75% of support payments shall be based on performance, such as meeting kWh sales targets, in a manner similar to a direct customer credit. For example, one respondent proposed that 20% of requested funding in the first year be awarded based on achieving several milestones relating to the development and implementation of a marketing plan, with the remaining 80% of funds (and all funds in later years) awarded based on demand for new wind farm capacity (e.g., X¢/W).

Rules for product eligibility built on the lessons learned in California. Recognizing the multiple ways of selling and purchasing green power, both retail electricity and certificates-based products were eligible for support. Products were required to contain a minimum of 20% new in-state renewable resources in the first year, and the minimum will grow by 5% each year thereafter. Of the new renewable generation, 75% must be from new solar or wind facilities.

NYSERDA received three Track A and seven Track B proposals. NYSERDA has contracted with one of the Track B companies (Community Energy) and two of the Track A companies (ConEdison Solutions and 1st Rochdale Cooperative), and is in negotiations with a third Track A contractor. Because contracts have only recently been approved or are still in progress, no experience can yet be reported, though Community Energy has a goal of generating 10-20 MW of wind power demand in the first year of its marketing efforts. NYSERDA has tentatively

agreed to issue additional green power solicitations in the upcoming years, similar in spirit to their initial Track B solicitation described above.

2.14.3 Organization and Contact Information

Heather Raitt
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512
http://www.energy.ca.gov/
HRaitt@energy.state.ca.us
(916) 654-4735

John Saintcross
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399
http://www.nyserda.org/
JS1@nyserda.org
(518) 862-1090

David Jacobson
Narragansett Electric - RIREC
55 Bearfoot Road
Northboro, MA 01532
http://www.narragansett.com/bus/programs/programs/renew/
david.jacobson@us.ngrid.com

2.14.4 Information Sources

Bolinger, M., R. Wiser, L. Milford, M. Stoddard, and K. Porter. 2001. "Clean Energy Funds: An Overview of State Support for Renewable Energy." LBNL-47705. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Regional Economic Research (RER). 2000. "Renewable Energy Program Preliminary Evaluation: Emerging Renewable Resources Account (Volume IV)." Prepared for the Governor and California State Legislature.

CEC. 2001. "Investing in Renewable Electricity Generation in California: Report to the Governor and Legislature." P500-0-022. Sacramento, Calif: California Energy Commission.

CEC Guidebook for the Customer Credit Account:
http://www.energy.ca.gov/renewables/documents/500-01-014V4.PDF

CEC Program Activity Reports to the Legislature:

http://www.energy.ca.gov/renewables/documents/index.html#legislature

Rhode Island Solicitations and Programs Overview:
http://www.narragansett.com/bus/programs/programs/renew/

NYSERDA Program Opportunity Notice 599-01 http://www.nyserda.org/599pon.html

Personal communications with: Robert Grace (consultant to RIREC) and John Saintcross (NYSERDA)

Comments provided by: Kate Ringe-Welch and David Jacobson (Narragansett Electric – RIREC), and Heather Raitt and Rasa Keanini (CEC).

2.15 Information, Training, Education, Project Facilitation, and Technical Assistance in Wisconsin

2.15.1 Case Summary

Case Description

Wisconsin has gone to greater lengths than most states to raise awareness and shepherd new renewable energy projects to completion through education, marketing, training, and project facilitation (technical assistance and project "hand holding"). This is especially true if one considers the small overall size of the Wisconsin fund. The Wisconsin fund believes that its efforts in these areas have been essential. This case highlights that experience.

Innovative Features

Wisconsin's program administrator identified a string of eight steps on the road to project success: awareness, information, training, facilitation, technical assistance, financing, finding a contractor, installation. The first five of these have received particular emphasis in Wisconsin.

- Wisconsin's program features a full-time project facilitator that provides free phone consultations through a toll-free call center, offers on-site renewable energy audits and site assessments, and otherwise undertakes whatever "hand-holding" is necessary to bring a project to completion.
- In addition, workshops and educational events provide training for both individuals and businesses.
- This broad range of services support Wisconsin's other program components, including grants for feasibility studies and cash-back rewards on installed projects.

Results

The 4-year pilot program in the Northeastern section of the state has proven the value of providing these services, with both the quantity and quality of potential projects coming through the pipeline increasing over time. As a result, virtually all of the programmatic elements in the area of project facilitation and technical assistance have been carried over into the new statewide program, which is just getting underway.

2.15.2 Detailed Case Description and Highlights

In 1998 the Wisconsin Public Service Corporation asked the Wisconsin Department of Administration (DOA) to administer its renewable energy programs during a 2-year pilot period. The resulting program, called the Demand-Side Applications of Renewable Energy Program (DSARE), was funded at less than $1 million per year. DSARE was subsequently extended through 2002, until a statewide program (funded at roughly $4.5 million/year for renewables) could be implemented.

Both the DSARE program and the new statewide program emphasize customer-sited renewable energy projects, and incorporate both electricity generation and thermal applications. The DOA initially focused on renewable energy market preparation and infrastructure building activities. Using a "shotgun" approach, the DOA targeted many different facets of the market with small competitive grants for marketing, education, business development, and technical assistance. Later phases of the DSARE program also included a "resource acquisition" component, with targeted financial incentives for renewable energy installations.

The new statewide program currently has three main components: (1) information, training, and education; (2) project facilitation and technical assistance; and (3) financial assistance for qualified projects. This case study focuses on the first two components, which are somewhat unique to Wisconsin and could be relevant to state funds that have a goal of transforming the market for renewable energy. Since most of Wisconsin's new statewide programs in the area of project facilitation and technical assistance are similar to those offered through the DSARE pilot program, this case study discusses these program offerings somewhat generically.

Information, Training, and Education

Wisconsin's program strives to be a renewable energy information clearinghouse, having produced fact sheets on renewable technologies, case studies of successful projects, and a "yellow pages" listing of renewable energy businesses in Wisconsin – all accessible from the program's website (http://www.focusonenergy.com). In addition, the program features a toll-free call center to answer consumers' questions and provide referrals to other information sources or renewable energy vendors.

The program also co-funds workshops and training programs for consumers, building professionals, students, and educators. These have been well received: the Midwest Renewable Energy Association (MREA) has been able to fill all spaces at numerous workshops on renewable energy topics ranging from PV installation to masonry stoves; the Energy Center of Wisconsin (ECW) has held many successful daylighting workshops for architects and building professionals; and the Wisconsin Environmental Education Board (WEEB) has solicited a handful of education programs, including renewable energy curriculum development for K-12 schools.

Educating the public about the program itself was accomplished via targeted TV commercials, radio ads, brochures, posters, articles, print ads, a 30-minute video, and public presentations. While the success of this effort was lower than perhaps expected, this marked the first time a professional marketing firm had been hired to promote renewable energy in Wisconsin.

Project Facilitation and Technical Assistance

To overcome the high transaction costs associated with planning and installing renewable energy projects, Wisconsin's program has placed special emphasis on project facilitation and technical assistance. Both an initial baseline survey of renewable energy businesses conducted at the start of the program as well as a follow-up evaluation survey (see Section 3.3 for a description of Wisconsin's program evaluation efforts) showed a strong interest among the renewable energy community in having the fund provide such services.

A professional facilitator was hired at the start of the DSARE program to essentially do whatever was needed to get projects installed. Within this broad charge, specific duties have included: explaining the program to potential customers; tracking leads and making referrals to contractors; providing phone consultations; offering renewable energy audits to homes, farms, and businesses; site assessments; system options; financing advice; business plan development; early project planning; proposal writing assistance; project feasibility assessment; and speaking engagements.

Renewable energy audits are subcontracted out to MREA, which offers free phone consultations to homes and businesses, information about financing, and site visits to assess renewable energy potential (there is a $50 fee for site visits). MREA will answer basic questions, give rough cost estimates, send fact sheets, identify relevant web sites, and provide a list of renewable energy installers and suppliers in Wisconsin. For more in-depth information about specific installation requirements, MREA will make arrangements for a site visit by a consultant (typically a renewable energy vendor). The site visit includes a basic analysis of energy needs, recommendations for energy efficiency measures to be undertaken in tandem with the renewable energy project, identification of siting options, a general cost estimate, and outlining the next steps towards system installation. In exchange for their participation, consultants are paid a monthly stipend plus performance incentives (which in general have not completely covered their costs).

In the non-residential sector, the fund offers Technical Feasibility Study Grants, which are intended to increase the ability of businesses to make informed decisions about renewable electricity by decreasing the technical uncertainties of implementing renewable energy systems. These grants provide cost-sharing assistance of up to $20,000 on a competitive basis for technical assessments of complex renewable energy projects and technologies. Examples of eligible projects include: feasibility, technical, economic, and regulatory evaluation studies for proposed or existing renewable energy systems, as well as design, commissioning, and energy performance contracting support for renewable energy projects. These grants represent a "next step" beyond the feasibility assessment provided by the professional facilitator, and projects can seek assistance from the professional facilitator when preparing proposals.

Results

Interim and final evaluations of various phases of the DSARE pilot program have consistently ranked training, project facilitation, and technical assistance as valuable program components. These evaluation reports have also noted process-related changes that have led to an increase in the quality and quantity of projects in the pipeline. For example, in the first phase of the pilot program, inquiries received by the toll-free call center were typically either unfocused or else

unrealistic (about the project's feasibility, about the level of incentive offered, etc.). The project facilitator noted, however, that once a process for pre-screenings and referrals from subcontractors was in place, the quality of inquiries improved considerably. Now under the statewide program, the call center is fielding 75-100 calls per week on average. The program has also offered financial facilitator assistance to non-residential customers, with little success, and has made changes to that program in response. Renewable energy audits and site assessments have also been fine-tuned over the years, and the new statewide program now offers a team of trained auditors prepared to provide much more specific and useful information than had been provided during the pilot program. Facilitators and other administrators believe that the new statewide program will result in a significant increase in demand for their services, as customers of Wisconsin's wealthier and more progressive urban areas become eligible to participate.

2.15.3 Organization and Contact Information

Don Wichert
Wisconsin Department of Administration
101 East Wilson Street
Madison, WI 53702
http://www.focusonenergy.com/
don.wichert@doa.state.wi.us
(608) 266-7312

2.15.4 Information Sources

Hagler Bailly Services. 2000a. "Wisconsin Focus on Energy: First Interim Report - Final." Prepared by Hagler Bailly Services and Opinion Dynamics.

Hagler Bailly Services. 2000b. "Wisconsin Focus on Energy: Second Interim Report - Final." Prepared by Hagler Bailly Services and Opinion Dynamics.

PA Consulting Group. 2001a. "Focus on Energy I Pilot Study: Final Evaluation of Demand Side Applications of Renewable Energy." Prepared by Opinion Dynamics Corporation.

PA Consulting Group. 2001b. "Focus on Energy II Pilot Study: Interim Evaluation of Demand Side Applications of Renewable Energy." Prepared by Opinion Dynamics Corporation.

Wichert, D. "Including Renewables in Wisconsin's Public Benefits Pilot." Located at: http://www.focusonenergy.com/

_____. "Enhancement of a Renewable Energy Public Benefits Program in Wisconsin." Located at: http://www.focusonenergy.com/

Wisconsin Focus on Energy Web Site: http://www.focusonenergy.com/

Personal communication with (and comments provided by): Don Wichert (Wisconsin DOA)

2.16 Renewable Energy Loan Programs

2.16.1 Case Summary

Case Description

Several states offer loans targeted at renewable technologies. Although financing does not reduce the capital cost of a project, by spreading payments out over a long timeframe, financing can make projects more *affordable*. This case study first reviews experience with the Oregon Energy Loan Program, one of the more durable and innovative loan programs offered in the U.S. for renewable energy technologies. The case then describes the features of renewable energy loan programs in Idaho, New York, Ohio, Pennsylvania, and Wisconsin. These additional states are featured to demonstrate the range of possible loan program designs and to identify innovative design features.

Innovative Features

An increasing number of states are developing loan programs specifically targeted to renewable energy. This case study posits that the ideal renewable energy loan program (from the perspective of gaining broad market acceptance, especially among residential customers) would have four main attributes:

- long repayment term,
- low interest rate,
- low hassle and administrative fees, and
- unsecured.

Loan programs examined here typically offer at least two of these four attributes, with a few programs boasting all four.

Results

- The Oregon Energy Loan Program is one of a few state loan programs able to finance the installation of large-scale renewable energy systems, and is unique in that it does so by issuing either taxable or tax-exempt (even for private projects) bonds.
- Although the program maintains the flexibility to tailor specific bond issuances to a project's needs, the double dipping provisions of the federal production tax credit (PTC) may still limit the value of the program for large-scale wind and closed-loop biomass projects. Several features of Oregon's program also limit its use for smaller loan sizes.
- As currently configured, Oregon's program likely provides the most value to larger renewable facilities that cannot benefit from the PTC (clarity on whether the loan program would offset the PTC would be useful).
- Experience reported from other states suggests that even well designed loan programs may generate little interest if a more fundamental requirement for success – the perceived value proposition of the technology being financed – is weak. In other words, loan programs are found to play a useful role in making projects that are inherently economic or near economic more affordable to a wider range of customers. Experience shows that higher-cost renewable technologies, such as PV, may not avail themselves to otherwise-attractive loan programs unless the loan program is combined with other favorable incentives such as an aggressive buy-down program (see German experience in Section 2.7).

2.16.2 Detailed Case Description and Highlights

Renewable energy technologies typically combine high up-front capital costs with low operating costs. This characteristic requires the project owner to make relatively large initial payments, making renewable energy technologies likely candidates for financing. Although financing does not reduce the capital cost of a project, by spreading payments out over a long timeframe financing can make projects more *affordable,* thereby broadening their appeal to a wider range of consumers. Additionally, if a project is to be financed, reduced-rate financing clearly lowers the *financing* cost of a project. For these reasons, several states and state clean energy funds offer loans targeted at renewable energy technologies (and many more offer loans targeted at energy efficiency). Because no single state has developed a loan program that clearly stands out among the others, this case study reviews experience with several state programs with a specific focus on Oregon's program.

Based on the experience reported below and in Section 2.7 (on the PV experience in Germany and Japan), the ideal renewable energy loan program (especially from the perspective of generating broad market acceptance among residential customers) would have four main attributes:[24]

- **Long term:** The loan would have a term of at least 10 years to reduce monthly payments to affordable levels.
- **Low interest rate:** For residential loans, the interest rate would fall below that on a 30-year mortgage (because mortgage-based financing is an alternative for many homeowners).
- **Low hassle and administrative fees:** Applications, paperwork, and fees would be kept to a minimum, with quick loan approval, especially for smaller loans.
- **Unsecured:** No debt service coverage requirements or liens on property are required (other than the asset being financed).

With these criteria in mind, this case begins with an overview of the Oregon Energy Loan program, which has been operating in the state since 1979. The case then reviews experience in other states in an attempt to identify innovative design concepts and lessons learned from a broader array of programs.

Oregon's Energy Loan Program

Administered by the Oregon Office of Energy (OOE), Oregon's Energy Loan Program funds energy conservation projects, renewable energy projects, projects producing or using alternative fuels, and projects producing new products from recycled materials. The program is funded through the regular issuance of general obligation and private activity bonds that can be structured as either taxable or tax-exempt (either state or both state and federal), depending on a project's needs. In fact, larger private renewable energy projects can often be financed with tax-exempt bonds – a feature unique to Oregon's program. The OOE may issue bonds several times per year, depending on anticipated loan volume. Particularly large loans (the largest so far is $16.7 million, but there is no upper limit) may require a special bond issuance. Loan terms typically range from 15-20 years, and loan interest rates are typically 100 to 150 (maximum)

[24] Note that while these attributes are desirable from the borrower's perspective, they may not be from the lender's perspective, and may even conflict with one another (e.g., unsecured loans typically do not carry low interest rates).

basis points above the bond yield. For example, as of September 2002, loan interest rates ranged from 5.0% to 6.0% depending on the term of the loan, the type of borrower (commercial, state agency, other public, or residential), and the tax status of the bond financing (with tax-free financing at the low end of the range, and taxable financing at the upper end). Large commercial projects must generate, or otherwise have sufficient financial backing to come up with, at least 125% of the revenue necessary to cover the loan. For small projects, the borrowers' overall financial health is the limiting factor. No other financial institution (besides the OOE) is involved.

The OOE program is targeted to larger loan sizes. In fact, it is one of the few state loan programs that are able to finance the installation of large, utility-scale renewable energy systems (for another example, see Section 2.5 on Pennsylvania's use of subordinated debt to finance a wind project). While residential customers are eligible for loans, the program is clearly not geared toward them. Because of the way that the program is funded (through bond tenders), minimum underwriting and other administrative fees make small loans prohibitively expensive. For example, the minimum fixed fee (regardless of loan size) is $500, and a $10,000 loan would generate $610 in fees. While individual projects can be aggregated to share the cost of the fees, doing so could impose significant transaction costs on residential applicants, unless the OOE or some other organization (such as the new Energy Trust) actively facilitates residential aggregations.

While Oregon's Energy Loan Program is geared towards larger projects, it is also not clear that all large renewable energy projects are able to take advantage of it. In the case of tax-free financing, the subsidized nature of the loan may trigger offset provisions that reduce the value of the federal production tax credit (PTC) for wind and closed-loop biomass projects. While OOE staff believe that they can issue taxable bonds that would not trigger PTC offsets, the interest rate on such bonds would not be as attractive as the tax-free rates typically offered under the program, potentially limiting its appeal.[25]

In conclusion, Oregon's Energy Loan Program appears to contain at least two of the attributes of an ideal loan program outlined above: long terms and relatively low interest rates. However, a regressive fee structure and minimum debt service coverage requirements for large commercial projects fail to satisfy the "low hassle and administrative fees" (at least for small residential projects) and "unsecured" criteria. This reality is at least partly reflected in the number and types of systems that have been funded: roughly a dozen residential PV systems (mostly for off-grid applications) and less than a handful of small wind systems have obtained loans, compared to 20 or so commercial hydro projects (with QF contracts), as well as a few digester and landfill gas systems and one large solar project (in Ashland). Overall, the existing program appears best suited for larger renewable facilities that cannot benefit from the federal PTC (e.g., commercial PV, biogas systems, etc.).

[25] Though the 100 basis point range (from 5.0% to 6.0%) between tax-free and taxable financing rates implies that even taxable financing is at an attractive rate (6.0%). Were this rate considered to be below-market, however, even taxable financing could conceivably be construed as "subsidized" and thereby trigger PTC offsets.

Idaho Renewable Energy Loan Program

In 1998, the Energy Division of the Idaho Department of Water Resources expanded its energy loan program to include renewable resources. This revolving loan program is funded with a total of $3 million (for both energy efficiency and renewable energy) from Exxon settlements, which it continually distributes through new loans as existing loans are repaid. Residential loan amounts range from $1,000 to $10,000, while non-residential customers may borrow up to $100,000. The loan interest rate is 4% for a term of 5 years or less. To qualify, most on-grid systems must demonstrate at least a 10-year payback period. Recognizing that PV systems are rarely able to achieve this target, grid-tied residential PV systems are exempt from this requirement, while off-grid systems must be demonstrated to be the least cost alternative. Local financial institutions perform credit checks on all successful applicants, and all loans are secured with some form of collateral. Projects must be installed within 90 days of loan approval.

Idaho's program has been surprisingly successful, given that it only meets two of the four criteria outlined above – i.e., low interest rate and (seemingly) no hassle – and that Idaho does not offer other incentives for renewable energy (other than a tax deduction). To date, the program has made roughly 350 renewable energy loans totaling $1.6 million. Projects have been heavily weighted towards the most cost effective eligible technologies, however. For example, of the 32 PV loans, 31 were for off-grid systems; the program has also funded 151 wood stoves, 141 pellet stoves, 4 small wind systems, 22 geothermal heat pumps, 1 corn stove, and 4 small hydro systems. These results suggest that loan programs may play a useful role in making projects that are inherently economic or near economic more affordable to a wider range of customers. By themselves, however, loan programs appear unlikely to greatly expand markets for grid-tied PV and small wind applications.

New York Energy $mart Loan Fund

This NYSERDA-administered program works with roughly 30 financial institutions (banks, credit unions, etc.) located throughout the state to buy down the loan interest rate by 4.5% for the lesser of 5 years or the duration of the loan. Loan terms (amount, interest rate, duration, etc.) are negotiated between the lender and the borrower; NYSERDA simply buys down the loan interest rate on up to $500,000 of the loan amount for a maximum term of five years. Both energy efficiency and renewable energy projects are eligible, though for renewables only projects supported through other NYSERDA programs qualify (this is a means of quality control).[26]

NYSERDA had originally funded the interest rate reductions by foregoing a portion of the interest on certificates of deposit (CDs) purchased from each lender, but soon realized that this process tied up significant amounts of capital (essentially the principal of the loan) for up to 5 years. NYSERDA now simply pays the lender a lump sum equivalent to the interest rate reduction, and is free to allocate its other capital elsewhere.

Although roughly 30 financial institutions are currently participating in the program, consumers have reportedly had difficulty finding a participating lender willing to finance small-scale

[26] Gouchoe et al. (2002) report that a few PV systems financed through the loan program in its first few months were installed improperly by homeowners. As a result, the loan program administrator made participation in NYSERDA's residential PV program (see Section 2.9) a necessary condition to qualify for the loan program; systems funded under the residential PV program are installed and monitored by professional contractors.

renewable energy projects (Gouchoe et al. 2002). Perhaps as a result, participation rates among renewable energy projects have been low: in the program's first year, only 4 PV systems were financed through the program (compared to 260 energy efficiency projects). With roughly 30 PV systems installed during the same period under the residential PV program, it is clear that homeowners are financing their PV systems in alternative ways. In fact, at least one PV installer has reportedly discouraged customers from using NYSERDA's loan program, due to the somewhat cumbersome application process combined with the relatively poor loan approval rate for small PV systems (Gouchoe et al. 2002).

The Long Island Power Authority Solar Pioneer PV Buy-Down and Loan Program

This program combines a $5/W (originally $3/W, then raised to $6/W for a limited time) buy-down with a 25% state tax credit and a subsidized loan for customer-sited PV. To date, 85 PV systems have been installed, and an additional 211 applications have been submitted to LIPA and are pending installation. Loan interest rates are 6%, reportedly a few percentage points below market rates. Secured loans ranging from $7,500 to $300,000 are offered through a local lending institution for 5, 10, or 15 years. LIPA coordinates with the local bank to administer the loans and, like NYSERDA, pays the bank a lump sum to fund the interest rate buy-down.

Although it offers long-term, low-interest, no-hassle loans – i.e., three of the four supposed ingredients for success – as well as a generous buy-down and state tax credit, LIPA's loan program has had minimal participation to date. Due to low interest rates in general, homeowners are reportedly pursuing other routes to financing their PV systems. LIPA hopes to attract additional lending institutions to participate in the program, but has found it difficult to generate interest among some banks due to the projected number of program participants not exceeding the banks' minimum profitability threshold.

Ohio Energy Efficiency Revolving Loan Fund

Like NYSERDA and LIPA, the Ohio Department of Development (ODOD) Office of Energy Efficiency is collaborating with private lending institutions to provide low-interest loans for eligible projects that use clean, renewable energy sources. The Renewable Energy Financial Assistance Program of the Ohio Energy Efficiency Revolving Loan Fund offers reduced interest rates on loans through linked deposits and participation loans (i.e., NYSERDA's original approach). Loan terms are negotiated directly between the borrower and lender, after which ODOD buys down the interest rate by as much as 50% on amounts up to $25,000 for residential customers and $500,000 for non-residential customers.

While 260 lending institutions are technically eligible to participate in the program, the current low interest rate environment has made bank recruitment a slow process, and so far ODOD has been able to enlist only a handful of banks to participate in the program. This outcome illustrates one potential hazard of partnering with private lending institutions (rather than administering the program in house) – the fate of the program hinges upon their willingness to participate.[27]

One interesting aspect of ODOD's program is its ability to partner with a financing program offered by the Ohio Air Quality Development Authority (OAQDA) for commercial loans.

[27] Of course, the upside is that working with private lending institutions can reduce administrative burdens and lead to a substantial leveraging of program funds.

Projects financed through OAQDA are exempt from real property tax assessment for the life of the loan, Ohio's tangible property tax, and sales and use tax on the purchase of the pollution-reducing equipment (e.g., renewable energy technologies). Projects that partner with both ODOD and OAQDA receive the reduced interest rate (from ODOD) as well as the tax benefits (from OAQDA).

The Sustainable Development Fund (Pennsylvania)

The Sustainable Development Fund (SDF) offers two energy loan programs, one for residential consumers and the other for commercial and industrial customers. Managed by The Reinvestment Fund (which is a commercial lender), the SDF administers the commercial loan program in-house, but has partnered with AFC First Financial Corporation (AFC)[28] to offer residential consumer loans. Each of these programs is described below:

- AFC's home energy loan is available for PV, solar water heating systems, and a variety of energy-efficient home improvements and appliances. This is an unsecured, no-hassle consumer loan ranging from $1,000 to $20,000 for up to 10 years at an interest rate of 12%. While this is a high interest rate compared to other loan programs, it is still below the market rate of traditional unsecured consumer credit (e.g., interest on credit card debt is typically in the range of 15%-20%). Applications can be submitted online, and approval usually occurs in 24 hours or less.
- SDF's commercial loan program will fund energy efficiency and renewable energy investments, as well as clean energy companies in startup or expansion mode, with senior or subordinated debt at interest rates of 5% to 6.5% on loans between $25,000 and $250,000 for a term of 7 to 10 years. Loans are secured by the asset being financed and additional collateral may be required.

In addition to these defined programs, Section 2.5 reports on the SDF's successful efforts in managing a subordinated debt offering to a 9 MW wind project.

Wisconsin Renewable Energy Loan Program

In response to an interim evaluation of the first phase of its Demand Side Applications for Renewable Energy (DSARE) pilot program, the Wisconsin Department of Administration (DOA) added a project financing component to the second phase of the program (for more on Wisconsin's use of external program evaluation, see Section 3.3). This new component included a low-interest loan program offering a 4% interest rate on unsecured loans from $1,000 to $20,000 for terms of three, five, or seven years. As with all other DSARE programs, both electrical (i.e., PV and wind) and thermal (i.e., wood stoves, solar thermal, geothermal heat pumps) renewable applications were eligible.

By the end of June 2001, the program had committed its entire $100,000 budget to 130 loans totaling nearly $500,000 (DSARE funds were used to buy down the interest rate to 4%). The composition of loans is striking: 95% of the loans were for high-efficiency wood burning heating units, while the other 5% were for geothermal heat pumps. There were no loans for electrical applications such as PV or small wind.

[28] AFC is one of six financial institutions in the country participating in Fannie Mae's Energy Loan Program.

This breakdown illustrates a theme running through several of the loan programs we examined: the underlying value proposition of the technology being financed is the primary determinant of whether or not a loan program will be successful. Simply put, wood stove heating is currently economical in Wisconsin, while grid-connected PV generation generally is not (particularly given the relatively low "cash-back" rewards of less than $2/W that Wisconsin currently offers), and no financing program can change that reality. Where the underlying application makes economic sense (e.g., wood stoves in Wisconsin and Idaho, off-grid PV in Idaho, PV compensated by attractive feed-in tariffs in Germany), loan programs have proven moderately popular and can play a useful role in reducing up-front capital needs and making renewable energy affordable to more people. With PV costs still quite high, however, current residential adopters tend to be concentrated among those people for whom economics is not the primary consideration (i.e., typically wealthier individuals who may not require financing).

An evaluation of the DSARE-2 low interest loan program found that participants ranked the low interest rate as the most important program feature, followed by the no-hassle, quick approval process and the ability to choose the loan term. Most participants had learned about the loan program from either their contractor or another contractor. This may reflect the contractor-friendly features of the loan program: loans can finance up to 100% of project costs (this feature also ranked high among participants surveyed in the evaluation), the lending institution makes payment directly to the contractor (by direct deposit if desired) upon completion of the work, and once on the participating contractor list, the contractor's name is distributed to potential customers who inquire about renewable energy loans.

To make the best use of program funds, the evaluation recommended that the DOA reduce the interest rate for all renewable energy systems that had not yet been financed (e.g., PV and small wind), while increasing the interest rate for wood burning systems and geothermal heat pumps. The DOA implemented this change in the third phase of the pilot program (DSARE-3), lowering the interest rate on the former to 1.99% while increasing it on the latter to 4.99% (still an attractive rate). In addition, a 10-year loan term option was added. As of March 2002, the cumulative number of loans made under the program since inception had risen to 250, with the overwhelming majority still concentrated among wood-burning systems.

As Wisconsin shifts from the regional DSARE pilot program to its new statewide program, thermal applications (e.g., wood stoves and geothermal heat pumps) will no longer be eligible for the renewable energy loan program, but will instead be supported in some other manner through energy efficiency programs. Furthermore, to increase the value proposition of PV and small wind, the statewide renewable energy program administrator has recently doubled the "cash-back" rewards for these technologies. Since customers cannot take advantage of *both* cash-back rewards *and* low-interest loans, but rather must choose one or the other, this relative increase in the attractiveness of cash-back rewards may ultimately suppress demand for low-interest loans, at least for PV and small wind.

2.16.3 Organization and Contact Information

Jeff Keto
Oregon Office of Energy
625 Marion St. N.E.
Salem, Oregon 97301
http://www.energy.state.or.us/
(503) 378-4040

Cheryl Wilson
Idaho Energy Division
1301 North Orchard Street
Boise, Idaho 83706
http://www.idwr.state.id.us/energy/
cwilson@idwr.state.id.us
(208) 327-7890

Jane Powers
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399
http://www.nyserda.org/loanfundfact.html
jap@nyserda.org
(518) 862-1090

Carolyn Jaskot
LIPA
333 Earle Ovington Blvd.
Uniondale, NY 11553
http://www.lipower.org/solar/
cjaskot@keyspanenergy.com
(631) 436-5742

Daniel Flynn (residential)
Carolyn Seward (business and institutional)
Ohio Department of Development
Office of Energy Efficiency
77 S. High Street, 26th Floor
PO Box 1001
Columbus, Ohio 43216-1001
http://www.odod.state.oh.us/cdd/oee/energy_loan_fund.htm
dflynn@odod.state.oh.us, (614) 466-4007
cseward@odod.state.oh.us, (614) 466-4053

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

Don Wichert
Wisconsin Department of Administration
101 East Wilson Street
Madison, WI 53702
http://www.focusonenergy.com/
don.wichert@doa.state.wi.us
(608) 266-7312

2.16.4 Information Sources

Bolinger, M., R. Wiser, L. Milford, M. Stoddard, K. Porter. 2001. "Clean Energy Funds: An Overview of State Support for Renewable Energy." LBNL-47705. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Gouchoe, S., V. Everette, R. Haynes. 2002. "State Financial Incentives for Renewable Energy: Case Studies on Program Effectiveness." North Carolina Solar Center, July 2002 draft.

"Governor's Clean Energy GREEN TEAM Report on Financing Programs for Renewable Energy." California Public Utilities Commission.
http://www.cpuc.ca.gov/word_pdf/REPORT/3824.pdf

PA Consulting Group. 2001b. "Focus on Energy II Pilot Study: Interim Evaluation of Demand Side Applications of Renewable Energy." Prepared by Opinion Dynamics Corporation.

Personal communication with: Jeff Keto (Oregon Office of Energy), Cheryl Wilson (IDWR Energy Division), and Roger Clark (Sustainable Development Fund)

Comments provided by: Jeff Keto and Lisa Schwartz (Oregon Office of Energy), Cheryl Wilson (Idaho Energy Division), Judy Jones (Ohio Office of Energy Efficiency), Carolyn Jaskot (LIPA), and Don Wichert (Wisconsin Department of Administration).

Web sites:
Idaho Renewable Energy Loan Program:
http://www.idwr.state.id.us/energy/Financial/Default.htm
New York Energy $mart Loan Fund Borrower Kit:
http://www.nyserda.org/602borrowerpackage.pdf

Ohio Renewable Energy Financial Assistance Program:
http://www.odod.state.oh.us/cdd/oee/elf_Renewable.htm
Oregon Energy Loan Program: http://www.energy.state.or.us/loan/selphme.htm
Pennsylvania SDF's commercial loan program:
http://www.trfund.com/sdf/pdf_docs/Energy_Loans.pdf
Pennsylvania SDF's Fannie Mae Energy Loan Program (through AFC First Financial Corp.)
http://www.energyloan.net/
Wisconsin's loan program:
http://www.focusonenergy.com/

2.17 Massachusetts' Green Buildings Program

2.17.1 Case Summary

Case Description

Green buildings can provide a niche market for renewable energy technologies. Specifically, renewable energy technologies may be more cost-effective when incorporated into the design of a building rather than when retrofitted on an existing building, and renewable energy systems may provide added value as an educational tool when incorporated into a green building.

Massachusetts is implementing an aggressive program budgeted at about $28 million through 2004 that is aimed at inducing construction of green buildings that incorporate renewable energy technologies. Massachusetts' program supports feasibility studies and provides design and construction grants for both green schools and green buildings.

Innovative Features

- Massachusetts' program is, by far, the largest and most aggressive effort among state clean energy funds at promoting the use of renewable energy in green buildings.
- Funding is available for different stages of building construction, from feasibility studies to design and construction.
- Projects must meet certain criteria to be considered a green school or green building.
- Grants cover only the "incremental" costs of studying, designing, and constructing a building that incorporates eligible renewable energy technologies, and, to a more limited extent, other technologies and measures that improve the energy efficiency of the facility.
- In general, funding for each program element is allocated in multiple rounds, rather than all through one solicitation.
- Leverage with other programs (especially utility-sponsored energy efficiency programs) is essential.

Results

- Operational data are not yet available, as the Green Schools Initiative was launched in October 2001 and the Green Buildings Initiative began in March 2002. However, with several RFPs out on the street, more results will soon become available.
- So far, funding has been awarded to 10 Massachusetts schools under the first Green Schools RFP that closed in January 2002, and another 22 schools have received early stage planning and design assistance. In addition, 7 owners/developers have received Green Buildings Design and Construction grants and an additional 17 owners/developers have been awarded funding to undertake green building feasibility studies. Some of the awardees are described later in the case study.

2.17.2 Detailed Case Description and Highlights

Buildings account for a substantial amount of total electricity consumption in the United States and, since buildings often last for 50-100 years, the energy consumption of buildings can have a major impact on energy use patterns. "Green buildings," which are typically newly constructed or renovated energy efficient buildings that place a high value on demonstrating environmentally friendly building materials and technologies, are one attempt to minimize the environmental impacts of the building sector.

Green buildings typically use energy efficient measures such as high-performance windows and doors; energy efficient heating, cooling, and lighting systems; passive solar design; tight construction; improved landscaping; and natural lighting and ventilation. Water conservation, waste minimization, and the increased use of natural and recycled materials and renewable energy technologies further reduce the environmental impacts of green buildings.

To explore green building practices, the Massachusetts Technology Collaborative (MTC) – the state's renewable energy system-benefits charge administrator – initially provided funding and support for green design charrettes at the New England Aquarium and the Boston Convention and Exhibition Center. Subsequently, MTC decided to launch a more aggressive and structured campaign promoting green building practices that incorporate renewable energy technologies. The current Green Buildings Program is a $28 million program budgeted through 2004 and consisting of two core components: green schools and green buildings. In addition, MTC is planning to target green building practices on affordable housing in the near future.

Massachusetts Green Schools Initiative

The Massachusetts Green Schools Initiative was launched in October 2001 as a cooperative effort with the Massachusetts Department of Education School Building Assistance Program. MTC is adapting criteria from California's Collaborative for High Performance Schools (CHPS) for use in certifying green schools. Although certain criteria must be met, such as using at least 20% less energy than a baseline Massachusetts school, project participants need not meet every high-performance characteristic. Instead, participants can trade off the CHPS high-performance characteristics in a way that suits their project needs and economics. In addition, to ensure leveraged funding, applicants are required to apply for any assistance that may be available from utility energy efficiency programs.

About $13.5 million of funding is allocated in two funding tracks. Track 1 targets schools slated for construction between 2002 and 2004. In early 2002, MTC selected 10 Track 1 schools to receive up to $130,000 each for the incremental planning and design costs of incorporating renewable energy and enhanced energy efficiency technologies, and up to an additional $500,000 each for the incremental construction costs associated with renewable energy technologies and enhanced energy efficiency measures. MTC will pay the lesser of up to 90% of the incremental construction costs or the amount that produces a five-year payback. MTC defines incremental costs as costs in excess of those that would have been incurred absent the renewable energy or energy efficiency attribute being installed. Incremental costs may be proposed in comparison to a code-compliant base case developed by the grantee's design team. These costs can range from

zero (e.g., some lighting designs) to full cost (e.g., rooftop PV). Incremental first costs do not include financing costs. The awardees are listed below:

- **Ashland High School** (Ashland) – $130,000, for investigating the use of fuel cells and solar energy. Ashland subsequently withdrew from the Green Schools Initiative because the town did not approve funding for the new high school.
- **Centerville Elementary School** (Beverly) – $623,300, for designing and installing combined solar energy skylight systems and a wind turbine.
- **North Quincy Street Elementary School** (Brockton) – $130,000, for designing a solar energy system and other energy-efficiency improvements.
- **Falmouth High School** (Falmouth) – $130,000, for researching and designing a fuel cell, a solar system, and a geothermal heat pump.
- **Great Falls Middle School/Turner Falls High School** – $630,000, for design and construction of a rooftop PV system, a heat recovery unit, a high efficiency boiler and energy monitoring equipment.
- **Newton South High School** (Newton) – $130,000, for designing a 60-70 kW solar array and researching a variety of other renewable and energy-efficiency opportunities, including fuel cells.
- **Carlton Elementary School** (Salem) – $630,000, for designing and installing a solar energy system, two small wind turbines and various energy-efficiency measures.
- **Edgerly Early Childhood Development Center** (Somerville) – $630,000, for designing and installing a solar energy system, a small wind turbine, skylights, light shelves, clerestory windows and a sub-metering system that will monitor the school's energy production and use.
- **South Street Elementary School** (Waltham) – $598,900, for designing and installing solar panels, a wind turbine, improved insulation, high efficiency lighting and building commissioning.
- **Williamstown Elementary School** (Williamstown) – $568,300, for designing and installing a 24 kW solar system, a biomass system to supplement the gas-fired boiler, and a solar greenhouse.

An additional $500,000 in construction funding is available to Newton, North Quincy, and Falmouth upon completion of their design work. The other projects have already received their construction awards, as they are further along in the design/construction process.

Criteria used in selecting winning bidders included: (1) qualitative criteria (e.g., evidence of school district support, realistic timelines, significant depth and breadth of planned green attributes, and evidence of strong interest in renewable technologies were essential aspects of successful applications), and (2) distributional goals (e.g., new construction vs. renovation and geographic spread).

Track 2 is aimed at schools that are at an earlier stage of planning and design and are scheduled to be constructed between 2003 and 2005. For Track 2 candidates, MTC will sponsor community workshops and provide up to forty (40) school districts $20,000 grants on a non-competitive basis to fund feasibility studies. As of August 2002, MTC has awarded 22 projects for funding under this solicitation. MTC intends to issue a supplemental Track 2 RFP in the Fall

of 2002 seeking 10 additional school districts to participate in the design and construction portion of the Initiative.

Massachusetts Green Buildings Initiative

The Massachusetts Green Buildings Initiative was launched in March 2002 and funding is available pursuant to three separate grant opportunities: feasibility studies, design and construction assistance, and public education and awareness. For all three categories, a project must qualify as a green building. The preferred benchmark is the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system, although applicants can suggest a comparable alternative. More detail on the three categories is presented below:

Early-Stage Feasibility Study Grants: MTC has budgeted $520,000 overall for early stage feasibility study grants. The grants are awarded competitively in quarterly rounds in 2002 and in 2003, with separate consideration for funding given to public and tax-exempt non-profit organizations, and for private and other taxable non-profit organizations to ensure a wide range of green building types. MTC will provide successful applicants with grants of up to $20,000 for considering renewable energy technologies as part of a green building project. A 100% matching cost share is required of private/taxable organizations, and the projects must be scheduled for either new construction or major renovation within two years of the application date, and be completed within five years of the date of the grant award. Awardees are as follows:

- **Massachusetts Innovation Center** (Fitchburg) – $20,000 to investigate the use of photovoltaics and a ground-coupled heat pump in a renovated, mixed-use development.
- **Cape Cod Community College** (West Barnstable) – $20,000 to investigate the use of fuel cells, photovoltaics, and microturbines in its new information technology center.
- **Division of Fisheries and Wildlife** (Westborough) – $20,000 to investigate the use of a fuel cell and geothermal heat in its new administrative and educational facility.
- **Lawrence Community Works** (Lawrence) – $20,000 to investigate the use of photovoltaics, fuel cells, and biomass power, as well as several energy efficiency measures, in its renovated community center and educational facility.
- **Nature's Classroom** (Adams) – $19,100 to investigate the use of photovoltaics and several energy efficiency measures including solar hot water, passive solar design, and efficient systems in its new educational and residential facility.
- **MassDevelopment** (Adams) – $18,774 to investigate the use of photovoltaics, fuel cells, and biomass power and to conduct energy modeling for an office building renovation.
- **National Marine Life Center** (Buzzards Bay) – $20,000 to investigate wind energy, photovoltaics, and solar hot water and to conduct energy modeling for a renovated veterinary hospital.
- **YWCA, Boston** – $20,000 to investigate photovoltaics, wind, fuel cells, and energy storage techniques in the energy efficient renovation of a high-rise residential facility.
- **Columbus Center Associates** (Boston) – $17,137.87 to investigate the use of photovoltaics and a fuel cell in a new commercial and residential development.
- **Hammes Company** (Falmouth) – $20,000 to investigate the use of several renewable energy technologies, including wind, photovoltaics, fuel cells, and biomass power in a renovated hospital and office facility.

- **Mass. Audubon Society** (Welfleet) – $20,000 to investigate wind, photovoltaics, fuel cells, and solar hot water in a renovated nature center and dormitory.
- **Episcopal City Mission** (Boston) – $20,000 to investigate roof mounted, wall mounted, and sun canopy photovoltaics, as well as solar thermal and solar hot water technologies in a low-income housing complex for the elderly.
- **Rural Development, Inc.** (Franklin County) – $20,000 to investigate the use of photovoltaics in rural, scattered-site affordable housing.
- **Town of Brookline** – $20,000 to investigate the use of photovoltaics, wind, fuel cells, and geothermal energy in a renovated municipal health facility.
- **Boston Housing Authority** – $20,000 to investigate photovoltaics, solar hot water, solar thermal heat, and geothermal heat pumps in a new affordable rental housing development.
- **New England Wildlife Center** (Weymouth) – $20,000 to investigate the use of a fuel cell in a veterinary hospital.
- **Allston-Brighton CDC** (Boston) – $20,000 to investigate the use of photovoltaics, fuel cells, and cogeneration in a new low-income housing development.

Green Buildings Design and Construction Grants: MTC has allocated $13.5 million in this category and will award grants competitively in bi-annual rounds between April 2002 and September 2004. Again, public and tax-exempt non-profit organizations are competitively ranked and considered apart from private and other taxable for-profit organizations. To maximize fund leverage, applicants must also apply for any assistance that may be available from utility energy efficiency programs. MTC will award grants of up to $500,000 per project to support up to 75% of the incremental costs of incorporating renewable energy technologies in green building projects. At least 70% of the grant must be used for the purchase, installation, and commissioning of the renewable energy system that generates electricity. The other 30% can be used for other renewable energy and energy efficiency features. Applications will be ranked by the amount of renewable energy capacity being installed and the amount of renewable energy attributes being generated (30%), cost efficiency (30%), probability of completion (20%), and contribution to objectives such as public visibility, support of economic development, and the potential for replicability (20%). Awardees are as follows:

- **Artists for Humanity** (Boston) – $500,000 to install 45 kW of photovoltaics, a glass curtain wall, and related energy efficiency measures in a renovated educational facility.
- **Cambridge City Hall** – $337,500 to design and install 28 kW of photovoltaics, a ground source heat pump, and energy efficiency measures in a renovation of the City Hall annex.
- **Genzyme Corporation** (Cambridge) – $321,750 to install 2,800 square feet of roof-mounted photovoltaics on its new office building in Cambridge.
- **Trustees of Reservations** (Leominster) – $361,515 to install 4,600 square feet of roof-mounted photovoltaics and a ground coupled heat pump on its new administrative and exhibition facility.
- **Tufts University** (Medford) – $500,000 to design and install 32 kW of roof-mounted and curtain wall photovoltaics on a new residence hall.
- **Woods Hole Research Center** (Falmouth) – $226,308 to install 26.4 kW of photovoltaics, a ground source heat pump, and an energy monitoring system in its new headquarters facility.
- **MATCH School** (Allston) – $385,030 to design and install a 20 kW photovoltaic array with a data acquisition system, to conduct energy modeling, and to finance some energy-

efficiency features, such as high-efficiency lighting, high performance windows, and occupancy sensors for the lighting system.

Public Education and Awareness: MTC has allocated $600,000 through 2006 and is accepting applications on an on-going basis until the funds are exhausted. Grants are limited to $30,000 per project, and potential activities are left to applicants to define. Examples suggested by MTC include workshops for building professionals, public awareness displays and tours, information dissemination activities, and use of the green building as part of an educational curriculum. As of August 2002, no awards had been given out.

2.17.3 Organization and Contact Information

Quincy Vale (green buildings)
Kim Ashton (green schools)
Massachusetts Technology Park Collaborative
Massachusetts Renewable Energy Trust
75 North Drive
Westborough, MA 01581-3340
http://www.mtpc.org/massrenew/
vale@mtpc.org
ashton@mtpc.org
(508) 870-0312

2.17.4 Information Sources

Massachusetts Renewable Energy Trust, *Green Buildings Program*, http://www.mtpc.org/massrenew/gbibrochure.pdf.

_____, Green Buildings Initiative, *Early Stage Feasibility Study Assistance Grant Guidelines, Application and Template Grant Agreement*, Solicitation No. 2002-GB-01, http://www.mtpc.org/massrenew/feasibilitystudy.pdf.

_____, Green Buildings Initiative, *Green Buildings Design and Construction Assistance Guidelines, Application and Template Grant Agreements,* Solicitation No. 2002-GB-02, http://www.mtpc.org/massrenew/designandconstruct.pdf.

_____, Green Buildings Initiative, *Public Education and Awareness Grants Guidelines, Application Process and Application*, Solicitation No. 2002-GB-03, http://www.mtpc.org/massrenew/publiceducation.pdf.

_____, *Green Schools Initiative Design and Construction Assistance, Pilot Program Track I*, Solicitation No. 2002-GS-01, http://www.mtpc.org/massrenew/TrackI.pdf.

_____, *Green Schools Early Stage Planning and Design Assistance, Pilot Program Track II,* Solicitation No. 2002-GS-02, http://www.mtpc.org/massrenew/TrackII.pdf.

_____, *The Renewable Energy Trust: Progress, Challenges and Opportunities*, February 2002, http://www.mtpc.org/massrenew/Report.pdf.

_____, *Track I Grant Recipients*, http://www.mtpc.org/massrenew/TrackIinformation.htm#.

Comments provided by: Kim Ashton, Quincy Vale, Caroline Conway, and Dick Tinson (Massachusetts Technology Collaborative)

3 Innovative Administrative Cases

3.1 Approach Overview

This chapter summarizes a select number of innovative administrative practices from state clean energy funds that may merit further investigation, adaptation, or emulation by other funds. Because effective program administration and management are critical for the success of any organization, the intent of the administrative "innovative practice" summaries are to identify how some clean energy funds have effectively managed renewable energy funds and overcome challenges to success.

Like selecting innovative programmatic practices, selecting innovative administrative practices is clearly a subjective exercise. Our five cases were selected based on our own experience with, understanding of, and discussions with U.S. clean energy funds, and based on the interests of the original manager of this project, the Energy Trust of Oregon. Though we paid close attention to issues that we felt would benefit the Energy Trust of Oregon, the issues discussed in the five cases are broadly relevant to all clean energy funds. The five cases ultimately selected cover issues such as: collaborative program design, program evaluation, public education and marketing, organizational structure, and solicitation approaches.

After selecting our featured cases, we sought the necessary information to write the summaries that are included below. Data collected about the selected innovative administrative cases came from published papers and reports, program websites, programmatic summaries and documentation written by the funds, and interviews with fund personnel. As with the programmatic cases, each administrative case includes a brief case summary (for those readers seeking only a high-level description), a more detailed case write-up, contact information, and a list of data sources and interviews.

3.2 Massachusetts Solar-To-Market Initiative: Using a Collaborative Approach to Create PV Programs

3.2.1 Case Summary

Case Description
The Massachusetts Technology Collaborative (MTC) has created a novel collaboration with the photovoltaics (PV) industry in the state that has resulted in a new industry group and a consensus set of PV programs. MTC has committed $10 million toward the programs. The process could be an effective model to reduce differences within any renewable energy industry and to produce a consensus set of programs that fit the mission of the clean energy fund.

Innovative Features
The situation facing MTC in late 1999 was problematic for both the fund and the PV industry. MTC had not yet developed a PV program, and the organization's strategic direction did not identify PV development as a near-term programmatic objective. Yet various PV proponents had submitted a significant number of unsolicited requests to the Trust for funding assistance. The proposed solution was a collaboration with the following innovative elements:

- MTC provided funding to establish the professionally managed Solar Energy Business Association of New England (SEBANE).
- MTC also provided funding to enable SEBANE to participate in the Solar-to-Market Initiative (SMI) (see below), as well as regulatory proceedings that affect solar and other distributed generation technologies.
- MTC established the Solar-to-Market Initiative (SMI) as a collaborative effort of MTC, SEBANE, and other interested parties to develop a set of programs designed to expand the production and use of solar technologies.
- After completing a "state-of-the-industry" report, SEBANE, its consultants, and MTC staff engaged in a year-long collaborative effort (funded by MTC) to develop a set of joint SMI program recommendations.
- SMI programs are divided into two areas: PV installations and PV business development. This consensus package would not have been produced without MTC funding to bring in consultants to assist in managing the process and in drafting collaborative program designs.

Results
The collaboration has resulted in a $10 million package of consensus PV programs that were approved by the MTC Board in March 2002. Several of the programs have been translated into solicitation documents that were released in early April 2002. The result is a set of programs that supports both PV installations and the development of the PV industry through loans and other program offerings. The conflicting demands of the industry have been addressed through a functioning trade organization that has minimized those conflicts and become a productive collaborative ally of the fund.

3.2.2 Detailed Case Description and Highlights

No PV Programs in Place at Outset of Fund

The Renewable Energy Trust (the Trust) is a renewable energy fund created in 1998 by Massachusetts' restructuring law and administered by MTC. The Trust is funded by a system-benefits charge that will generate about $200 million in the first five years of restructuring. The fund can support various renewable energy technologies and natural gas-fired fuel cells.

Due to a protracted legal challenge, MTC had not established any specific programs to support individual renewable technologies in its first two years of existence. In other words, no competitive solicitations were issued (see Section 3.6 for a discussion of the merits of competitive solicitations vs. unsolicited proposals). Without any clearly defined programs to illustrate the nature of support for specific technologies that MTC would consider, MTC was inundated with unsolicited proposals for funding. In particular, scores of individuals, companies, and institutions requested MTC funding for projects that in total came to over $100 million. The unsolicited proposals included requests for project subsidies, public education, and assistance. Many of these proposals sought financial support for projects involving PV.

Collaborative Industry Proposal – SEBANE and the Solar-to-Market Initiative

Instead of designing PV programs on its own, MTC proposed an alternative: a funded, collaborative approach to bring the industry together with MTC to develop programs with a proposed commitment of approximately $10 million. Through initial informal discussions, MTC and leaders in the PV industry agreed on what they needed for any negotiation to succeed:

- A single industry "spokesperson" who could negotiate on behalf of disparate industry interests and who would be responsible for resolving industry disputes over program design and funding in collaboration with MTC. This industry group, the Solar Energy Business Association of New England (SEBANE), was committed MTC funding to participate in the program design process.
- A set of basic principles that would control program design.
- A commitment of significant MTC funding ($10 million) to provide sufficient incentive for serious negotiations.
- A process for negotiation with milestones and deadlines, which included hiring a consultant (the Peregrine Energy Group) to manage the association and the design process with MTC.

MTC and PV industry leaders memorialized these principles in a Memorandum of Understanding (MOU) that established the Solar-to-Market Initiative (SMI). The MOU contained the following program design principles:

- Promote a better understanding of the benefits and costs of solar technologies among residential, commercial, and industrial consumers in Massachusetts;
- Demonstrate a well-defined path leading to the commercial success of PV in Massachusetts, in which consumers will eventually be willing to pay the full cost of system installation and maintenance;
- Demonstrate the commercial feasibility of incorporating solar-generated electricity as part of a blended green power product for sale in Massachusetts;

- Demonstrate the commercial potential for creating a market for solar renewable energy credits as a result of the state's Renewable Portfolio Standard;
- Expand the use of solar technologies in grid-independent applications that are currently cost-effective in Massachusetts and elsewhere; and
- Lower the cost of solar electric power production in Massachusetts through innovations in both products and processes.

SMI Program Design

One of the first activities undertaken by MTC and SEBANE was to develop a summary report of the status of the PV industry in Massachusetts, including a discussion of the successes and failures of past PV support programs. Using the knowledge from that report, the collaborative designed programs that fall into two main areas: PV installations and PV business development.

PV Installation Programs:

- **Clustered Installation Program:** Financial incentives for the purchase and installation of PV systems in geographically concentrated areas within Massachusetts (see Section 2.6 for a brief description of this program).
- **Open Installation Program:** Financial incentives for the purchase and installation of PV systems throughout Massachusetts, with specific funding set asides for existing residential buildings, existing commercial buildings, and new construction.
- **Production Tracking System Administrator:** To track the production of PV systems installed under the SMI.

PV Business Development Programs:

- **PV Industry Loan Fund:** Debt financing for PV companies based or doing business in Massachusetts.
- **PV Training Needs Assessment:** Assessment of the training needs of PV installers, code officials, and utilities.

The program concepts were outlined in a series of 1- to 2-page descriptions. These descriptions served as the blueprint for the detailed program design work that followed.

Detailed Programs Approved and Solicitations Developed for Funding

Once the detailed program designs were complete, the programs were presented to the MTC Board, which approved them in March 2002. The solicitation documents for the first programs were posted on the MTC web site in early April. During the program design process, the collaborative decided to stagger the implementation of the installation programs: the clustered installation program would start first, followed approximately 6 months later by the open installation program. The business development loan program was introduced in mid June.

3.2.3 Organization and Contact Information

Sam Nutter
Massachusetts Technology Collaborative
75 North Drive
Westborough, MA 05181
http://www.masstech.org/
nutter@masstech.org
(508) 870-0312

3.2.4 Information Sources

SMI Memorandum of Understanding

SMI PV Background Report (Oct. 11, 2001)

Solar to Market Initiative Clustered PV Installations Grants:
Solicitation:
http://www.mtpc.org/massrenew/pvcluster.pdf
Bidder's Conference Presentation:
http://www.mtpc.org/massrenew/pvclusterbc523.pdf

Solar to Market Initiative Needs Assessment for Training and Certification Requirements Within the Photovoltaic Industry:
Solicitation:
http://www.mtpc.org/massrenew/pv5tcna.pdf
Bidder's Conference Q&A:
http://www.mtpc.org/massrenew/2002GP02bqr.pdf

Solar to Market Initiative Production Tracking System Administration Services:
Solicitation:
http://www.mtpc.org/massrenew/pv03pts.pdf
Bidder's Conference Q&A:
http://www.mtpc.org/massrenew/2002GP01v3.pdf

Personal knowledge of process: Lew Milford

Personal communications with: Paul Gromer (Peregrine Energy Group)

Comments provided by: Deanna Ruffer and Sam Nutter (Massachusetts Technology Collaborative) and Paul Gromer (Peregrine Energy Group).

3.3 Wisconsin's Use of Program Evaluation

3.3.1 Case Summary

Case Description

Wisconsin's Department of Administration (DOA) administers a small renewable energy pilot program, and more recently has begun to oversee a $4.5 million per year statewide renewable energy program. Consistent, frequent program evaluation has been a significant component of Wisconsin's renewable energy efforts. This case summarizes those efforts.

Innovative Features

- Program evaluation is often an essential element of successful and responsive energy efficiency programs, but the renewable energy field has historically not emphasized such evaluation studies.
- To date, few of the state clean energy funds have funded comprehensive, independent evaluations or even put into place specific metrics with which to evaluate their programs.
- While some other states (New York, California, etc.) have evaluated their programs, Wisconsin's efforts are among the most significant in this regard.
- Importantly, Wisconsin has also used its evaluations in making real-time changes to its program offerings.

Results

- An independent, third party evaluator was hired to comprehensively assess Wisconsin's pilot and statewide renewable energy programs.
- Four evaluation reports have been prepared for the DOA's pilot renewable energy programs, and an evaluation plan for Wisconsin's statewide renewable energy program has been budgeted ~$400,000 for its first three years.
- The true mark of effective evaluation relates to whether that evaluation is used to tweak, revisit, or eliminate under-performing programs and to create new programs that have greater chances of success. Wisconsin's evaluation efforts have already led to several such changes.

3.3.2 Detailed Case Description and Highlights

Background on the Wisconsin Fund

In 1998 the Wisconsin Public Service Corporation asked the Wisconsin Department of Administration (DOA) to administer its renewable energy programs during a 2-year pilot period. The resulting partnership, called the Demand-Side Applications of Renewable Energy Program (DSARE), was funded at less than $1 million per year, and was subsequently extended through 2002.

The program emphasizes customer-sited renewable energy projects, and incorporates both electricity generation and thermal applications. The DOA initially focused on renewable energy market preparation and infrastructure building activities. Using a "shotgun" approach, the DOA targeted many different facets of the market with small competitive grants for marketing, education, business development, and technical assistance. The program later added a "resource acquisition" component, with targeted financial incentives for renewable energy installations. The DOA felt that the simultaneous support of a wide variety of activities was the most effective way to overcome barriers and create a sustainable network of renewable energy firms.

Subsequently, legislation established a statewide system-benefits charge to be administered by multiple non-profit administrators and overseen by the DOA. Renewable energy funding from the statewide program equals approximately $4.5 million per year and again includes both electricity and thermal applications. This statewide program began in 2002.

Program Evaluation

Consistent, frequent program evaluation has been a significant component of Wisconsin's renewable energy efforts. Though other states (New York, California, etc.) have evaluated their programs as well, Wisconsin's efforts appear to be among the most significant in this regard and have clearly had an impact on program development and led to programmatic refinements.

An independent evaluation firm (Hagler Bailly, later renamed PA Consulting) was hired by the DOA early in its efforts with the DSARE program to assess whether the program was proving effective at preparing and transforming the market. (It deserves note that the same evaluation firm was also involved in the DOA's energy efficiency programs). Evaluation activities were funded separately from the DOA's renewable energy budget, and totaled approximately 10% of overall renewable energy and energy efficiency funds. After preparation of an evaluation plan, four separate evaluation reports were prepared in the first years of the DSARE program. The first two evaluation reports related to the first phase of the DSARE program, and included:

- a baseline, pre-program survey of renewable energy suppliers in Wisconsin (Hagler Bailly Services 2000a), and
- an interim, post-program survey of renewable energy suppliers and building designers (Hagler Bailly Services 2000b).

The second two evaluations were released later, and included:

- a final evaluation of the first phase of DSARE, focusing on the cost-shared grants offered by DOA and renewable energy training workshops (PA Consulting 2001a), and

- an interim evaluation of the second phase of DSARE, focusing in part of DSARE's loan program, daylighting collaborative, project facilitation services, and training and education (PA Consulting 2001b).

In addition to these reports, DOA's evaluator also prepared a detailed survey of homeowners' attitudes towards renewable energy (PA Consulting 2001c).

Important components of the overall evaluation included:
(1) surveys of renewable energy firms,
(2) interviews and surveys of grant recipients, and reviews of grantee reports,
(3) surveys of participants in the training sessions,
(4) interviews with loan recipients,
(5) development and review of project tracking systems, and
(6) interviews with the DOA managers and the implementation team.

Both market impacts and process evaluations were prepared. The evaluation did not compare the DOA program or its effectiveness with similar programs or results in other regions, though this has been identified as a need and will be an element of the statewide evaluation.

Though the state is now phasing out the DSARE pilot program and moving towards statewide implementation of its renewable energy programs, the DOA's programs will maintain a strong evaluation component. The first three years of the statewide renewable energy program will be supported with a renewable energy evaluation budget of ~$400,000. As with the pilot, an independent evaluator, contracted directly by DOA, will carefully evaluate each aspect of the program. The evaluation team will initially compile a complete evaluation plan (see PA Consulting 2002). Because the statewide program will contain many of the same elements as the pilot program, lessons from the earlier DSARE evaluations are also expected to be applicable.

Evaluation Results

The DSARE program was clearly blessed with strong, consistent, and independent evaluation. This is especially apparent when one considers the relative size of the DOA's evaluation budget compared to its overall renewable energy budget. But, the true mark of effective evaluation relates to whether that evaluation is used to tweak, revisit, or eliminate under-performing programs and to create new programs that have greater chances of success.

Based on interviews with the DOA, reviews of the evaluation reports, and changes in the DSARE program over time, it is evident that Wisconsin has taken at least some of the evaluation findings to heart:

- Early baseline surveys of renewable energy firms pointed both to the need for marketing/communications and consumer financing services, and to the fragmented nature of the renewable energy industry in Wisconsin. It is partly a result of these findings that the DOA's initial programs took a flexible, multifaceted approach to supporting the renewable energy market in Wisconsin, and included cost-sharing grants for the development of business and marketing plans, technical assistance, and demonstration projects.
- An interim post-program survey of DSARE's first phase compared results between the October 1999 baseline survey and an August 2000 follow-up survey and revealed

disappointment among small business participants over many aspects of the program, and in particular over assistance with general advertising and communications materials. The evaluator concluded that DSARE should emphasize project facilitation assistance, demonstrations, and financing assistance. Each of these programs has been a major component of phase two of the DSARE program.

- The final evaluation report on phase one of DSARE focused on the program's cost-sharing grants and renewable energy workshops. With respect to the cost-sharing grants, findings included the need for (1) more active project management and guidance from business and marketing consultants, (2) more detailed market characterizations, (3) improved and more detailed grant review procedures, and (4) initial, on-site consulting and project evaluation services. Several of these recommendations have been applied in subsequent rounds of DSARE or will be incorporated into the statewide program. The evaluation also emphasized the need to extract value from the demonstration projects funded by the program, and this finding has led to the development of a demonstration booklet and case studies.
- An interim evaluation of Phase 2 of DSARE places particular emphasis on DSARE's project financing programs, especially its low-interest loan program. DSARE's low-interest loan program was found to be successful, but most applicants were using the loans for wood-burning applications. To broaden the applicant base, the evaluation report recommended the use of higher interest rates for wood-based appliances and lower interest rates for other eligible technologies (e.g., solar, wind, etc.). This recommendation was subsequently incorporated into later rounds of DSARE and the statewide program. The evaluation also continued to emphasize the need for the DOA to select and manage a smaller number of overall program efforts, and the Program Administrator for the statewide renewable energy program is apparently experiencing some of these problems.

In discussing the results and importance of their evaluation efforts, the DOA's renewable energy program manager emphasizes the value of having an independent third party review program objectives and status. Not hamstrung by the minutia of program implementation, an independent evaluator can often think more strategically than program administrators.

3.3.3 Organization and Contact Information

Don Wichert
Wisconsin Department of Administration
101 East Wilson Street
Madison, WI 53702
http://www.focusonenergy.com/
don.wichert@doa.state.wi.us
(608) 266-7312

3.3.4 Information Sources

Hagler Bailly Services. 2000a. "Wisconsin Focus on Energy: First Interim Report - Final." Prepared by Hagler Bailly Services and Opinion Dynamics.

Hagler Bailly Services. 2000b. "Wisconsin Focus on Energy: Second Interim Report - Final." Prepared by Hagler Bailly Services and Opinion Dynamics.

PA Consulting Group. 2001a. "Focus on Energy I Pilot Study: Final Evaluation of Demand Side Applications of Renewable Energy." Prepared by Opinion Dynamics Corporation.

PA Consulting Group. 2001b. "Focus on Energy II Pilot Study: Interim Evaluation of Demand Side Applications of Renewable Energy." Prepared by Opinion Dynamics Corporation.

PA Consulting Group. 2001c. "Focus on Energy Pilot Study: Homeowners' Attitudes Related to Using Renewable Energy in Northeastern Wisconsin." Prepared by Opinion Dynamics.

PA Consulting Group. 2002. "Focus on Energy Statewide Evaluation: Final Strategic Evaluation Pan – Renewables Program Area." Prepared by Adam Serchuk, Primen.

Wisconsin Focus on Energy Web Site: http://www.focusonenergy.com/

Personal communications with (and comments provided by): Don Wichert (Wisconsin Department of Administration)

3.4 Public Education, Marketing, and Consumer Action: The Multi-Party Programs of Connecticut and Pennsylvania

3.4.1 Case Summary

Case Description

A number of state clean energy funds have begun to explore and implement public education and marketing campaigns for renewable energy. While the purpose of these campaigns is clear – to motivate electricity customers to purchase renewable energy – they have often faced mixed and sometimes unclear results.

Two specific renewable energy public education programs in the U.S. have broad coalition funding: The Smart Power Project in Connecticut and the Mid-Atlantic Renewable Energy Coalition (MAREC) program in Pennsylvania. The Smart Power Project is funded at $1.4 million per year, while MAREC has attracted $881,000 of initial funding. This case examines the features, benefits, and challenges of these coalition-based efforts in public education.

Innovative Features

- The Connecticut and Pennsylvania campaigns represent two of the first publicly funded, large-scale renewable energy education and marketing efforts in the nation.
- Each program has been funded and supported not only by state clean energy funds, but also by a variety of other organizations.
- The Smart Power Project has worked to bring together a large number of foundations and community groups, while the MAREC program adds significant participation by the renewable energy industry.
- Both efforts represent innovative, multi-party coalition-based campaigns.

Results

- Neither the Connecticut nor the Pennsylvania campaigns have been operating for enough time to have strong results.
  - The Connecticut campaign has, after a period of planning, issued three grants and is still building its organizational foundation (an executive director has been hired, but board spots are still being filled).
  - The Pennsylvania campaign has completed its first marketing and education phase (including television, radio, print, and direct outreach), with limited immediate results.
- Based on the experiences of both funds, the benefits of a coalition-based campaign include access to additional funding sources and the development of a consistent message.
- Challenges include identifying a common set of goals and interests, reaching agreement on campaign materials, and maintaining the willingness to fund a high-risk and initially low-reward effort.
- The need for close coordination between these campaigns and the marketing efforts of renewable energy suppliers has also become apparent.

3.4.2 Detailed Case Description and Highlights

A number of state clean energy funds have begun to explore and implement public education and marketing campaigns for renewable energy. While the purpose of these campaigns is clear – to motivate residential and nonresidential electricity customers to purchase green power or customer-sited renewable generation – they have often faced mixed and sometimes unclear results. This case describes the use of multi-party education and marketing campaigns in Connecticut and Pennsylvania. While experience in these two states is too limited to claim success or failure, both the structure of the efforts and the preliminary lessons learned should be of value. While not discussed here, we should also note that the Clean Energy Funds Network is seeking to bring state clean energy funds together to work collaboratively towards the development of education and marketing campaign research and materials.

The Smart Power Project

The Smart Power Project is a broad education and marketing program that brings together community and faith-based organizations, business leaders, institutions, and concerned citizens, working with foundations and the Connecticut Clean Energy Fund to help improve Connecticut's air quality through renewable energy purchases. The campaign is designed to overcome the apathy and inertia that often characterize the renewable energy marketplace by linking renewables with community pride in a statewide effort to alleviate the health and environmental problems caused by air pollution from power plants. The goal of The Smart Power Project is to have ten percent of Connecticut's overall electricity supply provided by clean, renewable energy sources by 2010.

This two-year project will involve both a media and public relations campaign on the one hand, and a targeted grassroots and outreach campaign on the other. It will offer technical guidance to large commercial and industrial customers and educational information to small businesses and households about purchasing renewable energy, all with a theme of strong community pride and moving toward solutions to the air quality problems of the state. By identifying and attracting early adopters of renewable energy from the commercial, industrial, small business, municipal, faith-based, and residential (environmentally interested) sectors, those high visibility participants will ultimately attract additional participants, resulting in an expanded interest in renewable energy.

The Smart Power Project has an annual budget of $1.4 million for two years. Half of the support will come from the participating foundations (The Pew Charitable Trusts, The Tremaine Foundation, The John Merck Fund, the Rockefeller Brothers Fund, and Surdna Foundation), with the other half coming from the Connecticut Clean Energy Fund.

In its early stages, The Smart Power Project was administered by Connecticut Innovations (under the name "Connecticut CAREs," for Clean Air through Renewable Energy), with participating funders serving as advisory committee members. An independent nonprofit corporation has now been established and its 501(c)(3) application has been filed. Brian Keane has been appointed as the executive director and a board of directors is being recruited from key sectors to provide the organization with important outreach capabilities and to help maintain broad appeal across the state. The Board will also be critical in securing funding for The Smart Power Project beyond its

initial two-year life. The Smart Power Project has recently issued grants to: Environment Northeast, for a program to build interest in and demand for renewable energy among the commercial and institutional sectors; Clean Water Fund, to develop interest among the 100 organizations that mobilized against polluting power plants; and Eco-Justice, to work with the faith-based communities of Connecticut.

Mid-Atlantic Renewable Energy Coalition

The Mid-Atlantic Renewable Energy Coalition (MAREC) includes renewable energy businesses, energy and environmental government offices, and non-governmental organizations in a public education campaign to increase public awareness of and the demand for clean electricity in the Mid-Atlantic region. Included in the coalition are:

- seven federal and state agencies in the Mid-Atlantic region;
- nineteen renewable energy businesses;
- fifteen non-profit or charitable organizations; and,
- all seven renewable electricity retailers in the Mid-Atlantic region.

MAREC raised a total of $881,000 for the first phase of its *Clean Your Air* campaign. Of this amount, $433,000 came from Pennsylvania's four sustainable development funds, $215,000 came from three private foundations, $118,000 came from nineteen renewable energy businesses, and $115,000 came from government agencies.

The first phase of the *Clean Your Air* campaign includes paid television ads and related cross promotions as well as public service radio and print ads and several direct outreach programs. The campaign has produced a 30-second and a 15-second TV ad, a 30-second radio ad, and three print ads that may be used in various sizes and formats. The ads are designed to capture audience attention and drive the audience to the www.CleanYourAir.org website, which provides information on the key environmental, financial, and technical considerations important to consumers considering buying green power or installing on-site renewable generation.

The paid TV ads began on February 18, 2002 and ran through April 6, 2002 in the Philadelphia and Pittsburgh media markets. In the Philadelphia market, the paid television program reached about 98% of the target audience an average of 24.7 times, with 67.9 million gross impressions. In the Pittsburgh market, the paid television program reached approximately 98% of the target audience an average of 22.8 times, with 25.7 million gross impressions. In addition, public service radio ads ran 3,904 times on 42 different stations, achieving 7,070,800 cumulative audience impressions. These are impressive numbers, and are unprecedented within the region.

MAREC is a multi-year effort managed by PennFuture (www.pennfuture.org) with an executive committee comprised of MAREC members.

Benefits of the Coalition Approach

Based on these early experiences, two of the critical benefits to coalition-based education and marketing campaigns include:

- **Fund Raising Success:** The success of the Connecticut and Pennsylvania campaigns in raising funds for public education has been considerable. Short of very deep pockets, a

broad-based coalition effort such as these two campaigns may be the only way to assemble the campaign budget that is necessary to be effective.

- **A Consistent Message:** Coordination among groups allows the presentation of a uniform, rather than competing, message by those groups, which strengthens the effectiveness of the message. The MAREC www.cleanyourair.org site also integrates the energy education work of Power Scorecard and Green-e through direct links.

Challenges of the Coalition Approach

There are also challenges to such multi-party collaborative approaches:

- **Identifying Common Goals and Interests:** With diverse groups, it can be difficult to balance competing views and interests and agree on the goals of the campaign. Some may want general education, while others may want a harder sell of green power. There may also be conflicts between the various industries that represent different paths to green power (the competitive green power provider versus the seller of renewable energy tags versus those that sell on-site renewable generation).
- **Reaching Agreement on Campaign Materials:** Great care is needed to ensure that too many cooks do not spoil the soup. The right balance between coalition member input and tight creative control is critical.
- **Staying the Course:** Meaningful changes in public understanding and acceptance of clean energy will not be achieved overnight. Other than the need to pay the electric bill, electricity has been an abstraction for most people for a century. Unrealistic goals will discourage coalition members. MAREC found that fewer than 100 people had switched to buying green power as a direct result of the first phase of its campaign. Because raising consumer awareness is a long-term process, it is perhaps short sighted to judge the campaign based on the immediate response to its initial 7-week run of ads. Even so, few member organizations will be willing to continue to spend at the needed levels if this limited rate of "success" does not improve over time.

A Caveat: The Need for Concurrent Supplier Ads

There is a significant difference between an awareness campaign and a marketing campaign. Marketing experts note that, if the goal is to get people to buy green power, an umbrella awareness campaign alone will not be very effective. Concurrent ads by clean energy suppliers marketing their products are needed. Without a strong "seller" identity, the public will have a difficult time understanding why a state clean energy fund is pushing green power. Education and marketing campaigns supported by clean energy funds should therefore be tightly integrated with the efforts of green power marketers and renewable energy suppliers.

3.4.3 Organization and Contact Information

Brian Keane
The Smart Power Project
brian@keanefamily.com
(781) 223-6722

Peter Adels (MAREC)
Citizens for Pennsylvania's Future
adels@pennfuture.org
(215) 569-9695

3.4.4 Information Sources

MAREC – www.cleanyourair.org
Materials provided by The Smart Power Project

Comments provided by: Lyn Rosoff (The Smart Power Project) and Peter Adels (Citizens for Pennsylvania's Future)

3.5 Organizational Structure: The Sustainable Development Fund of Southeastern Pennsylvania

3.5.1 Case Summary

Case Description
The Sustainable Development Fund (SDF) is a modest-sized fund operating in Pennsylvania with a mission to promote: (1) the use of renewable energy and advanced clean energy technologies; (2) the use of energy conservation and energy efficiency; and (3) the start-up, attraction, expansion, and retention of sustainable energy businesses. SDF is known for its effective fund management and its innovative renewable energy program designs. A prerequisite to the development of innovative and effective programs is the creation of a strong organizational structure. This case focuses on three elements of the SDF's organizational structure that have been critical to its success.

Innovative Features
The three main organizational strengths of the SDF structure are:

- SDF's market-driven investment approach,
- SDF's ability to avoid the politicization of funding decisions, and
- SDF's capacity to raise additional capital.

Two limitations, narrow geographic focus and modest initial funding, are also discussed.

Results
- As of May 2002, SDF had approved fifteen investments (primarily loans) totaling $7.3 million.
- A small grant budget is also available for business planning, green building design assistance, start-up activities, and other special work; 22 grants totaling $448,000 have been approved by SDF as of May 2002.
- SDF has successfully managed a production incentive auction for new wind power, has developed a buy-down program for solar photovoltaics that incorporates performance features, has managed an innovative offering of subordinated debt to a 9 MW wind project, and currently manages a $500,000 per year program to enhance green power awareness in the state.
- SDF's strong organizational structure has been critical to these successes.

3.5.2 Detailed Case Description and Highlights

Introduction to the Sustainable Development Fund

The Sustainable Development Fund (SDF) was created by an April 1998 settlement agreement in the PECO Energy restructuring proceeding. The SDF provisions in the agreement fit on a single, double-spaced page, and establish the mission of the fund, define the board, identify the fund manager, and provide for SDF revenue. The funding for SDF originally came from a 1/200th of a cent per kWh charge on PECO's transmission and distribution tariff, which was to generate about $1.6 million per year for the five-year term of the tariff. Funding was to be used for renewable energy, energy efficiency, and other sustainable energy endeavors.

The March 2000 settlement agreement in the subsequent PECO Energy/Unicom merger proceeding, however, provided SDF with a new funding formula, additional funding, and new program responsibilities. The quarterly payments of the first settlement were replaced by a single lump-sum payment of $10 million. In addition, new funding provided for special initiatives in wind ($12 million), solar photovoltaics ($4 million) and public education ($2.5 million). Funding for SDF from the two settlements totals $32 million.

The SDF Board is comprised of seven people representing the major stakeholders in the restructuring proceeding. The interests represented on the Board include PECO Energy, a competing supplier, industrial customers, environmentalists, consumers, as well as a financial expert and a renewable energy technology expert.

SDF is managed by The Reinvestment Fund (TRF), an independent, nonprofit corporation known as a community development financial institution. SDF has a small staff of 4 people: a fund manager, a part-time manager for technology and policy, a senior loan investment officer, and a part-time loan portfolio assistant. In addition, SDF uses other employees of The Reinvestment Fund when needed for such back-office functions as loan processing and public information, and has outsourced the administration of its PV and educational programs to minimize internal administrative burdens.

SDF is known for its effective fund management and its innovative renewable energy program designs. As of May 2002, SDF had approved fifteen investments (primarily loans) totaling $7.3 million. A small grant budget is also available for business planning, green building design assistance, start-up activities, and other special work. Twenty-two grants totaling $448,000 have been approved by SDF as of May 2002. SDF has successfully managed a production incentive auction for new wind power (see Section 2.2), has developed a buy-down program for solar PV that incorporates performance features (see Section 2.6), has managed an innovative offering of subordinated debt to a 9 MW wind project (see Section 2.5), and currently manages a $500,000 per year program to enhance green power awareness in the state (see Section 3.4). A prerequisite to the development of innovative and effective programs is the creation of a strong organizational structure. This case focuses on three elements of the SDF's organizational structure that have been critical to its success.

Strength #1: Adopting a Market-Driven Investment Approach

The SDF offers grants-based programs as well as company- or project-based loans, near-equity, and equity investments. What TRF management brings to SDF is a market-driven investment approach that is very different from that of a government agency or regulated utility. TRF raises its capital from investors who must be paid back, not from taxpayers or ratepayers who expect no direct financial return (but who do expect social benefits to be generated). Under the TRF model, new capital is raised when investors see good performance and the value of making new investments, not because the votes are there for a funding increase. TRF's definition of success is to move markets to support TRF's social missions, not to simply give away a lot of money for a handful of demonstration projects.

That said, SDF is very different from a typical financial institution. While shaped by the discipline of the market, SDF has a definite mission to promote certain sustainable energy technologies in that market. SDF staff must therefore deal with the tension between SDF's mission and the marketplace. For each project, SDF has to decide where that project falls along that mission/market continuum. If, at the end of the day, SDF's portfolio is no different in risk and return than that of an energy-focused venture capital firm, then SDF has failed to push hard enough on its mission of advancing sustainable energy technologies and businesses. SDF is therefore willing to engage in sub-market loans, for example, as well as limited grant-based investments. On the other hand, if the SDF portfolio consists of nothing but demonstration projects that die once the grant dollars end, then no market transformation has been accomplished.

Importantly, this philosophy drives SDF's investment- and grants-oriented programs. Even in its grants programs, SDF is constantly seeking replicable projects and the creation of sustainable markets. As highlighted in other cases, SDF is not afraid of taking innovative steps to pursue this mission.

This "market-driven" approach is a direct outcome of the selection of an experienced community development financial institution as the manager of SDF. SDF's market-driven investment approach stands in contrast to many of the other clean energy funds from around the country.

Strength #2: Avoiding Politicization of SDF decisions

Any clean energy fund with a substantial amount of money and a board that consists of different political groups runs the risk of having its decisions become a political exercise rather than a business decision. SDF has avoided the politicization of funding decisions by carefully dividing management and decision-making responsibilities between the Board, the staff, and the TRF investment committees.

The SDF Board, with its seven representatives of various interest groups, has important but limited power. The SDF Board reviews and approves an Annual Program Plan (which in general terms defines the types of projects that will be eligible for funding) and the Annual Operating Budget (which defines staff and other expenses). The SDF Board reviews all potential investments for mission fit, but does not approve or disapprove specific investments (as explained below, this is the job of the TRF investment committees). The SDF Board does have

the responsibility of reviewing and authorizing all SDF grants, both from the core fund and from the special initiatives.

The SDF staff drafts the Annual Program Plan and the Annual Operating Budget for approval by the Board. Staff prepares the written "mission fit" analysis for all investments. Staff also prepares recommendations for all grant decisions and negotiates and executes the grant agreements. Staff thus has a major role in driving all Board actions.

Because it is TRF that has the fiduciary responsibility for the SDF dollars, it is the TRF investment committees, not the SDF Board, that review and approve all investment requests. TRF has three committees (a loan committee, a near-equity committee, and an equity committee) that SDF uses, depending on the proposed structure of the financial deal. Each of these committees is made up of financial experts appointed by TRF. The SDF Board and the Pennsylvania Public Utility Commission are prevented from challenging individual investment decisions, though each has the authority to review the SDF portfolio as a whole and to pass judgment on whether TRF is managing SDF properly.

This sharing of responsibility is detailed in the SDF bylaws, but the issue arose during the settlement negotiations when the TRF's founder and CEO warned of the history of these social funds being run off the rails by political fights and insisted that TRF investment decisions be made by apolitical investment committees rather than by the SDF Board.

Strength #3: Raising Additional Capital

In addition to its strength as a lender, TRF brings SDF the model and the capability of raising capital beyond the payments from PECO Energy. Since 1985, TRF has raised over $150 million from approximately 900 investors. Individuals, organizations, foundations, and private banks that support TRF's social mission loan this capital to TRF at below-market rates. Once SDF has established a track record and a portfolio with its initial PECO Energy fund, it plans to go to the TRF investors to raise additional capital. Given the modest initial funding of SDF, it is critical that it be able to attract additional capital. Fundraising is expected to begin in the near future, and may offer a model for other clean energy funds with the ability to raise outside capital.

One aspect of raising additional capital that SDF has already accomplished is co-investing with the three other Pennsylvania sustainable energy funds on projects (see Section 2.5 for a discussion of the joint investment of these funds in a subordinated debt offering to a wind project). SDF is also currently exploring joint investments with other state funds for Pennsylvania wind projects.

Limitations

SDF has faced two important limitations that may not be problematic to many funds, but that must be recognized:

- **Narrow Geographic Focus:** Because it was created out of a single utility settlement proceeding, SDF's investments are focused primarily on the service territory of PECO Energy. In Pennsylvania, similar sustainable energy funds were also created for the electric utility service territories of PPL, GPU (Met Ed and Penelec), and West Penn (Allegheny

Power). While SDF has made co-investments with the other Pennsylvania funds, it must be able to show that each investment "benefits" the PECO Energy service territory in some fashion. This geographic constraint has prevented SDF from supporting some projects because of an inadequate link to the area.

- **Modest Funding:** SDF has limited funds to spend on renewable energy and energy efficiency investments. There may be some benefits to this modest funding. For example, SDF has been able to avoid some of the disputes that have plagued clean energy funds in other states, which because of their size have not been able to fly under the political radar as SDF has done for the most part. Nonetheless, funding limits seriously constrain the operations of the fund. This is one reason that SDF, following the TRF model, will seek to secure additional private investment in the near future.

3.5.3 Organization and Contact Information

Robert Sanders
Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
sandersr@trfund.com
(215) 925-1130

3.5.4 Information Sources

SDF website – various documents: http://www.trfund.com/sdf/sdf_important docs.htm

Personal communication with: Robert Sanders (SDF)

3.6 Competitive Solicitations and Unsolicited Proposals: Examples from Several State Funds on How to Balance and Refine the Process

3.6.1 Case Summary

Case Description

How can the state clean energy funds balance a preference for competitive solicitations with the flexibility to consider unsolicited applications? How other funds have successfully balanced these approaches is a key administrative practice. Fund managers in most states have developed a range of competitive solicitations, from highly structured to more open competitive solicitations. Funds have also developed guidelines for unsolicited applications. Examples of how these administrative processes work are discussed in this case study.

Innovative Features

- While openly stating its preference for making funding decisions through formal solicitation processes, the Massachusetts Technology Collaborative (MTC), which administers the Commonwealth's Renewable Energy Trust (RET), has acknowledged that from time to time there are extraordinary opportunities where the best interest of the Commonwealth ratepayers may warrant consideration of unsolicited proposals. As a result, MTC has developed a set of published guidelines for reviewing and recommending funding decisions related to proposals received that do not comply with formal solicitations.
- For competitive solicitations, the range of offerings and features varies from state to state. Some innovative features of these solicitations include:
  - A highly structured wind production incentive in Pennsylvania (Phase I).
  - A less-structured wind incentive offering in Pennsylvania where a wide range of debt and other project financing options are encouraged (PA Phase III).
  - A less-structured solicitation where the fund did not rule out direct subsidy support for projects, but heavily favored more creative financing offerings by project proponents (CT fuel cell RFP).
  - A structured series of solicitations that offered to pay for both feasibility studies and up to 25% of the capital costs of the project installation (MTC premium power (i.e. fuel cell) RFPs).

Results

While no single ideal practice seems to have emerged from state experience so far, the examples offered in this case study suggest that highly structured competitive solicitations, less-structured solicitations, and a willingness to accept certain unsolicited applications all have merit in certain circumstances.

- The MTC guidelines for unsolicited proposals have brought more order to the evaluation and discretionary funding process.
- The PA Phase I structured solicitation produced several wind projects.
- The PA Phase III finance offering was issued in July 2002, with proposals due in September.
- The CT fuel cell "bonus" financing produced 31 project proposals.

- The MTC fuel cell feasibility study program has provided a valuable opportunity for a variety of organizations to explore their interest in and the viability of fuel cell applications. It has also provided MTC with the opportunity to better understand the costs and technical requirements for such projects. The capital cost buy-down program has not produced significant program results as of yet. Some program managers believe that it would have been more beneficial to phase the feasibility and capital costs programs, rather than issuing the solicitations simultaneously. However, in Connecticut's fuel cell program, greater outreach with targeted efforts to reach specific industry sectors resulted in more high-quality applicants; this approach might also have produced greater results in Massachusetts.

3.6.2 Detailed Case Description and Highlights

How clean energy funds have successfully balanced the desire for competitive solicitations with the flexibility of unsolicited proposals is a key administrative practice. The benefits of defined competitive solicitations should be clear: (1) they help focus fund activities and, as a result, can assist the fund in achieving its goals in a more orderly and prudent fashion, (2) they encourage competition for funds, potentially lowering costs while increasing quality and likelihood of success, (3) they result in an open and less politically sensitive proposal selection process, and (4) they reduce administrative burdens and complications. Nonetheless, some funds have found that unsolicited proposals should also be accepted for new endeavors, for non-grant awards, and to encourage a breadth of innovative proposals. Other funds have found that some of the benefits of unsolicited proposals can be generated through less structured competitive solicitations.

Fund managers in most states have therefore developed a range of competitive solicitations, from highly structured (the Pennsylvania wind energy production incentive) to more open competitive solicitations (fuel cell solicitations in Connecticut and Massachusetts). Some funds have also developed guidelines for unsolicited applications. Examples of how these administrative processes work in specific states are discussed below. While no single ideal practice seems to have emerged from state experience so far, the examples offered below suggest that highly structured competitive solicitations, less-structured solicitations, and a willingness to accept some unsolicited applications all have merit in certain circumstances.

Unsolicited Proposals: Guidelines and Process in Massachusetts

Massachusetts has had perhaps the most experience with an initial, open-ended process that had serious shortcomings and that evolved into a preference for competitive solicitations with an accompanying recognition of (and procedure for considering) the potential merits of unsolicited proposals. During its first two years of existence, the Massachusetts Technology Collaborative (MTC) did not have any specific programs in place, and as a result received more than 150 unsolicited proposals totaling over $200 million. Unable to address this high volume of proposals effectively, MTC established two main directions for its programs: (1) it developed distinct program areas (green power, premium power (which has now been rolled into the green power program), green buildings, and, most recently, industry support) involving formal competitive solicitations (RFPs), and (2) it established formal procedures for considering unsolicited proposals. This change reflects the belief that unsolicited proposals may have merit, but that competitive solicitations are preferred and hold a number of advantages.

Specifically, MTC has established guidelines for the review of unsolicited proposals, which are published on its web site. These guidelines contain several criteria by which an unsolicited proposal will be judged:

- the impact of the proposal on the renewable marketplace;
- the visibility of the project;
- the financial assuredness of the proposal;
- the potential for securing private financing;
- the time-sensitive nature of the proposal; and
- any emergency or disaster relief element of the proposal.

Initially, MTC established a standing committee of staff and advisers to review unsolicited proposals. Over time it was determined that this committee was administratively burdensome and was not the appropriate procedure to allow MTC to effectively recognize and respond to extraordinary opportunities for which the procedures had been established. As a result, MTC is testing more of a triage approach to considering such proposals. Keys to the effectiveness of this approach appear to be: (1) establishing a single point of initial contact; (2) expediting identification and assignment of the proposal review to the appropriate individuals – which can include both internal and external resources; and (3) articulating and preserving MTC's flexibility in terms of the time involved and process used for the initial review.

Unsolicited proposals are to initially be in the form of short, concept papers. If the unsolicited proposal merits further consideration, the proposing party is directed to prepare a formal proposal package. The content of the formal proposal package, the time frame for submittal, and the process that will be used for review will be determined by the standing committee and communicated to the proposer at the time of notification of merit. Staff decisions to reject a project are final, while decisions to proceed are subject to normal board approval of project funding.

Other funds have developed a range of competitive solicitations that run the gamut from highly structured to highly unstructured. Below we briefly discuss a reasonably structured offering in Pennsylvania, and then discuss less structured alternatives used in Pennsylvania, Massachusetts, and Connecticut.

Competitive Solicitation: Structured Wind Incentive for Project Finance (PA Phase I)

In the fall of 2000, the Pennsylvania Sustainable Development Fund (SDF) released a $6 million Phase I competitive solicitation for a structured wind production incentive of up to 1.5¢/kWh for the first five years of operation. The solicitation was highly structured with dates certain for obtaining permits and financing, and for producing electricity from the facilities. A structured solicitation of this nature was used, in part, because, the solicitation was designed to get projects on line before the scheduled expiration of the federal production tax credit (PTC) at the end of 2001. The application for funding contained extremely detailed questions so that SDF staff could judge the merits of the projects without undue delay. The materials provide an excellent starting point for a state fund that wants to develop wind projects in a short time frame. More details on this solicitation can be found in Section 2.2.

Competitive Solicitations: Negotiable Options for Project Finance (PA Phase III)
Following on the heels of the successful use of low-cost subordinated debt financing for another Pennsylvania wind project (Phase II, described in Section 2.5), the SDF opted to pursue a wider set of possible financial tools for the remaining $6 million of dedicated wind funds (Phase III). In July 2002, the SDF issued an RFP for new wind projects that allowed respondents to choose from among the following types of incentives: subordinated debt or other debt financing, production incentives, green power price insurance or guarantees, credit enhancement (e.g., through letters of credit), and equity investment. The wide range of eligible incentives reflects the outcome of collaborative discussions with the wind industry to determine its preferences (which will be further revealed through actual project proposals and incentive requests). Though more open than the Phase I solicitation in terms of the types of incentives offered, the Phase III application still contains detailed questions in the realm of due diligence to enable the SDF to move swiftly in choosing projects that are most likely to come on line prior to the scheduled expiration of the PTC at the end of 2003.

Competitive Solicitations: Preference for Non-Subsidies
The Connecticut Clean Energy Fund (CCEF) issued an open-ended competitive solicitation to provide up to $5 million per year to fund both commercial and demonstration fuel cell projects in the state. Instead of simply offering a defined fixed production incentive or capital cost subsidy payment, however, CCEF proposed a wider and more flexible set of financing options, including debt financing, leasing, renewable energy credits, air emissions credits, efficiency credits, and arrangements that would provide CCEF a return on its investment. While proposals seeking direct subsidies were not explicitly forbidden, CCEF heavily favored (through the award of "bonus points") proposals willing to negotiate non-subsidy financing arrangements. The solicitation received a strong response: more than 31 projects are considered eligible for funding. Most contain some form of private funding or co-funding to reduce the level of CCEF contribution. As of May 2002, final selection decisions have not been announced; however, it appears that this unstructured solicitation garnered a number of good, innovative proposals that might not have been generated if a highly structured solicitation process had been used.

Competitive Solicitations: Analytical Costs and Explicit Capital Cost Buy-Down
MTC developed two competitive fuel cell solicitations: (1) MTC would pay for the analytical costs of determining the economic and engineering costs of a fuel cell installation, and (2) MTC would pay up to 25% or $2 million of the capital costs of a fuel cell system used for premium power applications.

As of June 2002, MTC had made installation grants totaling $1.9 million for two fuel cell projects: a Nuvera fuel cell system at a telecommunications center and a Fuel Cell Energy system at a Coast Guard facility. MTC also awarded or has commitments to award feasibility study grant awards totaling $400,000 to study the feasibility of fuel cells for premium power at several institutions, including a research laboratory, a financial institution, a multi-family residential complex, and an internet data center. MTC also rejected four applications for fuel cell feasibility studies at two schools, an assisted living community and a telephone company.

The notion of providing competitive offerings for analytical expenses has proven to be problematic – fewer interested institutions than anticipated have applied for funding at MTC.

These results can be attributed to different factors. Based on our review of all these programs, it does not appear that the lack of response to the MTC analytical offering should be read to mean that institutions do not want funding for analytical expenses. Experience with high capital cost installations suggests that institutions lack the skill and expertise to evaluate installations, and that information barriers are an obstacle to more widespread adoption of clean energy technologies. Therefore, providing a cost share for analytical costs is worth considering in any program.

One difference between the results from the CCEF solicitation and that of the MTC may be the fact that CCEF engaged in significant targeted, industry-specific outreach efforts to inform institutions of the availability of funding, and worked with them intensively, including developing financial packages, to develop projects. As a result, many institutions applied for financial support in Connecticut. Conversely, in the first round of solicitations, MTC did not engage in any industry-specific outreach effort.

In contrast to this conclusion about the role of more intensive outreach, program directors at MTC believe that the results from this program can be attributed to how the analytical and capital cost solicitations were phased. They believe the capital solicitation should have been phased to follow the feasibility projects. This would have allowed MTC to insist that a specific level of analytical work be done, either using funds available from MTC or through other previously completed work, prior to considering funding of capital investments. Without this type of a prerequisite, it was difficult for MTC to fully evaluate the technical, financial and managerial merits of proposals for capital cost funding.

These differences in interpretation do not affect the main conclusions reached here: (1) targeted outreach to specific industries, each of which has different power needs, and (2) the availability of funding to engage in project analysis are both critical to the success of any fuel cell funding program.

Finally, both Massachusetts and Connecticut have expressed an interest in working together to improve the quantity and quality of fuel cell projects for both programs. Such collaborative efforts are also an important way to improve administration of these programs.

3.6.3 Organization and Contact Information

Subhash Chandra
Connecticut Clean Energy Fund
999 West Street
Rocky Hill, CT 06067
www.ctcleanenergy.com
subhash.chandra@ctinnovations.com
(860) 563-0015

Deanna Ruffer
Massachusetts Renewable Energy Trust
75 North Drive
Westborough, MA 01581
http://www.mtpc.org/massrenew/
ruffer@masstech.org
(508) 870-0312

Roger Clark
The Sustainable Development Fund
Cast Iron Building, Suite 300 North
718 Arch Street
Philadelphia, PA 19106-1591
http://www.trfund.com/sdf
clarkr@trfund.com
(215) 925-1130

3.6.4 Information Sources

MTC unsolicited proposals guidelines: http://www.mtpc.org/massrenew/submit.htm

PA SDF Phase I wind production incentive solicitation and instructions:
http://www.trfund.com/sdf/pdf_docs/Wind_Phase_I_Instructions.pdf

PA SDF Phase I wind production incentive application:
http://www.trfund.com/sdf/pdf_docs/Wind_Phase_I_Application.pdf

PA SDF Phase III wind production incentive solicitation and instructions:
http://www.trfund.com/sdf/pdf_docs/Wind_Phase_III_Instructions.pdf

PA SDF Phase III wind production incentive application:
http://www.trfund.com/sdf/pdf_docs/Wind_Phase_III_Application.pdf

Connecticut fuel cell solicitation:
http://www.ctcleanenergy.com/rfp/Full%20RFP%20Document.pdf

MTC Premium Power Installation Grants solicitation:
http://www.mtpc.org/massrenew/solicitations/PP%20Installation%20Solicitation%20v9.pdf

MTC Premium Power Planning Grants solicitation:
http://www.mtpc.org/massrenew/solicitations/PP%20Planning%20Solicitation%20v71.pdf

Personal communications with: various fund officials

Comments provided by: Deanna Ruffer (Massachusetts Technology Collaborative)

4 Conclusions

This study summarizes some of the innovative actions that state clean energy funds are taking to promote renewable energy. It may be best used as a *descriptive* reference document by clean energy funds as they consider future programs and program designs. We have consciously shied away from offering *prescriptive* findings and conclusions. That said, a number of broad themes worth mentioning have emerged from our review of 16 programmatic and 5 administrative practices:

- **Clean Energy Funds Are Aggressively Developing Innovative Programs:** Perhaps the most obvious observation from this study in that a large number of innovative renewable energy programs have already been developed by clean energy funds. These programs demonstrate the leadership some U.S. states are showing in their support for renewable energy markets. It is also evident from the cases described in this study that clean energy fund administrators are learning from their own experiences, and the experiences of others, and that program designs are therefore in constant flux in many states.

- **No Single Program Panacea Is Apparent:** The renewable energy market is a diverse and complex one, with a variety of technologies and applications vying for market share. These diverse technologies and markets have driven states to design an equally diverse set of programs, each using incentives that are targeted to specific renewable energy markets and applications. Moreover, even among the policy approaches used to target individual technologies and applications, frequently no single program stands out as optimal. This may in part be due to limited experience with different program options. This experience suggests that multiple program designs, careful use of professional judgment, and a willingness to experiment with a variety of program options will be keys to the success of a renewable energy fund.

- **Programmatic Goals Should Drive Program Designs:** Experience with clean energy funds illustrates the need to tie program design and fund allocation to the more fundamental mission, goals, and objectives of the fund. With clearly articulated mission statements, goals, and objectives, for example, it may be easier to select among the multiple options for supporting photovoltaic markets. Similarly, allocation of funds across technology types (e.g., wind vs. PV) and incentive structures (e.g., grants vs. loans) must be driven by an initial set of goals and objectives. Clearly articulated goals may also ease the task of establishing appropriate metrics to measure a fund's success.

- **Discretion and Flexibility in Program Design Can Enhance Success:** Clean energy fund managers are continuing to experiment with new program designs and innovations, and knowledge of how best to support renewable energy markets is rapidly being gained. To capitalize on this learning process, flexible program designs and ample use of discretion by fund managers in designing programs and selecting projects appear to be essential. Seeking input (and buy-in) from outside advisory groups and stakeholders can be vital to this process.

- **Markets for Smaller, Distributed Projects Have Proven Harder to Build:** Several states have successfully encouraged the construction of larger-scale renewable energy projects at

reasonably low incentive levels. Customer-sited, distributed renewable projects have typically required far more aggressive funding levels on a per-kWh basis. States continue to experiment with a variety of program types to enhance the success of their efforts towards customer-sited installations. As a result, we have included perhaps a disproportionately large number of programmatic practices targeted at small, distributed projects (see Sections 2.6 through 2.12), in order to provide readers a sense of the diversity of the programs that clean energy funds have developed in this area.

- **Working Closely with Utilities Can Prove Critical to Fund Success**: Electric utilities and competitive electricity suppliers play a significant role in the renewable energy market. Utilities will retain responsibility for the interconnection of customer-sited renewable generation. Utilities and other electricity suppliers will also remain the primary purchasers of renewable electricity through long-term, power purchase agreements. Experience in Pennsylvania and California (Section 2.2), Minnesota (Section 2.4), and the United Kingdom (Section 2.3) shows that the success of renewable energy funds will be strongly influenced by the willingness of utilities and competitive electricity suppliers to sign long-term power purchase agreements with renewable energy projects. The interaction between state clean energy fund support for renewable energy projects and the availability of long-term power purchase agreements for renewable generators therefore deserves special attention.

Finally, we note again that this study does not provide an exhaustive review of innovative practices in use in the U.S. and abroad. We therefore encourage clean energy funds, policymakers, and other renewable energy stakeholders to not only review the practices described here, but to also continue to cast a wide net to identify other innovative practices in use or in development in the U.S. and overseas. With these experiences in hand, and with clarity of mission, goals, and objectives, clean energy funds will be well positioned to design an effective and sustainable set of renewable energy programs.