# ASSESSMENT OF THE NEW JERSEY RENEWABLE ENERGY MARKET

# VOLUME I

**Submitted To:**

**New Jersey Board of Public Utilities**

**Office of Clean Energy**

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# List of Acronyms

**ACP:** alternative compliance payment

**BE:** Business Enhancement rider

**BGS:** basic generation service

**BPU:** Board of Public Utilities

**BTM:** behind-the-meter

**CORE:** Customer On-Site Renewable Energy program

**CEP:** Board of Public Utilities' Clean Energy Program

**CPI:** consumer price index

**CRA:** Comprehensive Resource Analysis

**DG:** distributed generation

**EDA:** Economic Development Authority

**EDC:** electric distribution company

**EDECA:** Electric Discount and Energy Competition Act

**EIS:** PJM Environmental Information Services

**GATS:** PJM Generation Attribute Trading Systems

**GHG:** greenhouse gases

**IBI:** investment-based incentive

**IRR:** internal rate of return

**ITC:** investment tax credit

**kWh:** kilowatt-hour

**LBNL:** Lawrence Berkeley National Laboratory

**LSE:** load-serving entity

**MACRS:** Modified Accelerated Cost Recovery System (Accelerated Depreciation)

**MSEIA:** Mid-Atlantic Solar Energy Industry Association

**MW or MWh:** megawatt or megawatt-hour

**NJCEP:** New Jersey Clean Energy program

**OCE:** Office of Clean Energy

**PBI:** performance-based incentives

**PSEG:** Public Service Electric & Gas

**PTC:** Production Tax Credit

**PV:** solar photovoltaic

**RE:** renewable energy

**REC:** renewable energy certificate

**RGGI:** Regional Greenhouse Gas Initiative

**ROI:** return on investment

**RPS:** renewable portfolio standard

**RY:** Reporting Year

**SACP:** solar alternative compliance payment

**SBC:** Societal Benefits Charge

**SREC:** solar renewable energy certificate

# E EXECUTIVE SUMMARY

## E.1 Introduction

This Market Assessment Report is the culmination of a comprehensive renewable energy market assessment conducted for the New Jersey Board of Public Utilities' (BPU) Office of Clean Energy (OCE). The assessment had four primary objectives:

1) Assess the renewable energy markets, building upon recent market potential studies;
2) Update baseline studies and estimates used as performance indicators;
3) Assess the costs of and barriers to the development of renewable energy technologies;
4) Provide recommendations regarding the future direction of the programs (i.e., modifying rebate and/or program funding levels, adjusting the form of incentive distribution, etc.).

The study consisted of program-level and market-level assessment elements, which together formed the basis for an overall portfolio level assessment.Several **key themes** and outcomes emerged from this research.

- *First, New Jersey has achieved remarkable success with respect to solar market development*. As a result, New Jersey has the second largest solar market in the nation behind California. New Jersey's commitment to solar shouldcontinue, as it will foster the solar market stability and investor confidence required to meet New Jersey's growing solar RPS requirements. This commitment will keep New Jersey at the forefront of the clean energy economy developing across the country.
- *An increased focus on large non-solar project development must accompany this continued commitment to solar*. Incentives for large projects are more cost-effective and can help lower RPS compliance costs. Programs need to target outreach to optimal development sites through both sector-specific and geographically focused activities.
- *The current portfolio of incentive programs is strong from a design perspective.* The programs are structured to serve a broad range of market sectors and technologies. However, the programs could benefit from enhancements such as the development of clear and concise program guidebooks; increased collection of metered production data; increased staff capacity, particularly for the Renewable Energy Project Grants and Financing and Renewable Energy Business Venture Asssistance programs; and continued refinements (as needed) to technical standards to ensure installation of high quality systems.
- *Critical elements necessary for the developing sustainable renewable energy markets include market stability and predictability, financial certainty and access to favorable financing.* As the Board proceeds with future program and policy planning, evaluating policy decisions based on the extent to which they advance these key market sustainability elements will enhance the likelihood of program success.

These themes resonate throughout the research, analysis, and findings developed during the course of the assessment. Research findings are presented in two volumes. Volume I presents the summary-level findings and recommendations from a comprehensive portfolio level assessment. This summary factors in findings from a detailed market level assessment, and program-specific assessments. Volume II includes detailed assessment reports for New Jersey's renewable energy market, and for each of BPU's renewable energy programs.

# E.2 Methods

The study began with a review of background information on the New Jersey renewable energy market and incentive programs. Program and market-level performance indicators were reviewed, and a revised set of market and program indicators was used as the basis for developing survey and interview guides. During the course of the assessment, 177 market surveys and in-depth interviews were conducted, including a survey of 70 CORE program participants and 50 developer / installer interviews. Additional primary data sources reviewed include relevant regulatory documents, program tracking databases, program marketing materials, and RPS compliance data. A variety of secondary sources from numerous jurisdictions were also used in the assessment. In addition, the research team developed a number of spreadsheets to analyze potential costs under a variety of program mechanisms and market scenarios.

**The research team wishes to highlight several important points for the reader toconsider when reviewing this report.** The findings and recommendations in this report are intended to provide input for program budgeting purposes for the 2009-2012 Societal Benefit Charge (SBC) funding cycle, and high-level decision-making regarding program structure. Detailed program design was outside the scope of the assignment. For the Renewable Energy Project Grants and Financing program in particular, BPU staff should conduct further analysis to determine the best approach for setting actual project funding award amounts in future years. Market conditions will inevitably evolve during the next SBC funding cycle and the analysis in this report is based on the best available data and assumptions the research team could obtain during the 2006-2007 research period.

The portfolio level analysis was conducted to estimate the funding necessary to derive all RECs necessary to meet RPS requirements for the 2009-2012 period from in-state resources. However, New Jersey's RPS does allow electricity suppliers to obtain resources from any part of the PJM control area. Therefore, the findings here present budget values that could be higher than necessary to meet RPS requirements with purchases of out-of-state non-solar RECs. Further, the research team sought to provide equal treatment of all Class I renewable energy technologies. However, due to data availability and the substantial solar requirement included in New Jersey's RPS, the study did place a heavy emphasis on the solar market, which is reflected in this report.

Finally, the report includes data for projects that were "completed" (installed and received program funding) through the end of 2006. A great deal of additional capacity was operational or under construction during the course of this assessment but had not received program funding by the end of 2006 and, therefore, fell outside the period of assessment included in the scope of work for this assignment.

# E.3 New Jersey Renewable Energy Market Background and Development Progress

Defining elements of New Jersey's renewable energy markets include: 1) an RPS that requires 22.5% of the state's electricity to come from renewable sources by 2021 (including 2.12% of electricity from in-state solar resources); 2) a Renewable Energy Credit (REC) based system for RPS compliance, with an Alternative Compliance Payment (ACP) option; 3) substantial financial incentives for project construction.

The combination of policies and financial incentives available in New Jersey has propelled New Jersey to become the second largest solar market in the country, behind California. In addition to rebates, which in the past reduced upfront system costs by half or greater in some cases, New Jersey has a high Solar Alternative Compliance Payment (SACP). The ACP for non-solar resources is $50/MWh, while the SACP is $300/MWh. The SACP is one of the drivers of solar renewable energy credit (SREC) values, as SREC values will approach this value when a shortage of solar supply occurs. The Board uses the SACP level as a policy mechanism that provides solar investors with confidence that the return on investment they need to develop the solar market in New Jersey will be there.

On September 12, 2007, the Board voted on staff recommendations which would increase the SACP and set an eight year rolling SACP schedule. This is part of the Board's process to transition the solar market away from its current reliance rebates, and to increase the role of SREC revenue as a form of performance based incentive for solar projects.

The two primary programs designed to provide funding for renewable energy project construction are the Customer On-site Renewable Energy (CORE) program and the Renewable Energy Project Grants and Financing (REPGF) program. These programs are included in a suite of energy efficiency and renewable energy programs administered by the Board, and referred to as the NJ Clean Energy Program (CEP).

Following are brief summaries of program accomplishments through the end of 2006. Note that for the purposes of maintaining consistency in program evaluation and monitoring methods, programs have been evaluated based on the amount of installed capacity that has *received incentive payment* as of the end of 2006. These projects are described as "completed" throughout the remainder of this report. In some cases, additional capacity has been installed, but has not received payment, and therefore is not included in the values presented in this assessment.

One project of particular note is the Jersey Atlantic Wind project. The 7.5 MW wind project was installed in 2005 with commitments to receive funding through both the CORE program (for the 2.6 MW of capacity serving on-site load), and from the REPGF program (for the 4.8 MW of capacity serving the electric grid). As of the end of 2006, the project had received its first payment under the REPGF program in 2006 ($173,759 of a total grant commitment of $1,696,000), but had not yet received payment from the CORE program. For the purposes of this assessment, 4.8 MW is counted toward the total amount of wind capacity "completed" in 2006 for the REPGF *program evaluation*, though the portion funded through the CORE program will not be counted as completed until 2007, when the project actually received payment from the program. However, because the project is by far the largest wind project installed to date in New Jersey, for the purposes of the *market-wide assessment*, the research team counted the full 7.5 MW of capacity from the project as "completed" in 2006 to provide a more accurate representation of the installed wind capacity which existed by the end of the assessment period.

## CORE Program

The CORE program provides rebates for the installation of PV, wind, biomass and fuel cell[1] projects that are smaller than 1 MW in size that serve on-site electrical load. New Jersey has seen rapid growth in installed solar capacity since the launch of the Board's incentive programs in 2001. Under the CORE program, a combination of the rebate (i.e., $38,000 for a 10 kW system based on incentive available in April, 2007), federal tax incentives and Solar Renewable Energy Certificate (SREC) / Renewable Energy

[1] Fuel cells funded through the program to date have been fueled by natural gas and thus, are not eligible as RPS Class I resources.

Certificate (REC) revenue enable program participants to offset 60% or more of project costs.[2] New Jersey's high rebate value, coupled with the RPS demand for solar resources, and the high SACP are key reasons that solar development has been so much greater in this state than in most other states offering financial incentives for solar.

From its inception in 2001 through the end of 2006, nearly 4,300 applications were processed, and nearly 2,000 incentives were processed during this period. BPU funded nearly 30 MW of renewable energy through the program during this period. The program has achieved all of its objectives related to installed capacity and application processing, with the exception of one. The state did fall short of its goal to complete 6 MW of non-solar capacity in 2005; only 1.9 MW of non-solar (biomass and wind) capacity was completed in that year. Based on the pace of solar development to date, and given the transition that is underway in the funding mechanisms for solar projects, it is likely that the Board will meet its goal to install 90 MW of solar by the end of 2008.

The CORE program has seen more applicants for funding than the budget can accommodate, and as of August, 2007, a queue of over 40 MW of potential PV capacity awaited funding. Because of the oversubscription of the CORE program, as well as the BPU's goal to transition from rebates to a more market-based incentive structure, a comprehensive stakeholder process has been underway for over a year to evaluate options for solar market development. The goal of this process is to create a more market-based system, while providing the SREC price certainty the solar market needs to facilitate development. The Summit Blue team assisted the Board in this market transition stakeholder process by preparing both a qualitative review of market transition options proposed by stakeholders as well as an analysis of estimated ratepayer impacts from the proposed models.

## Renewable Energy Project Grants and Financing Program

The Renewable Energy Project Grants and Financing (REPGF) program supports development of Class I renewable resources larger than 1 MW in size that are designed for the purpose of supplying the grid, rather than offsetting on-site loads. The program is administered in collaboration with the New Jersey Economic Development Authority (EDA). EDA manages the financing aspects of the program while the Board handles the technical components.

As of the end of 2006, two projects had been funded under the program: a 1.6 MW landfill gas project and 4.8 MW of a 7.5 MW wind farm. The program fell short of its key objective for 2005: to install 19 MW of renewable energy capacity. Only 1.6 MW of capacity was funded in 2005. Given REPGF program progress to date, it is unlikely that the Board will achieve its goal of installing 210 MW of non-solar capacity by the end of 2008.

Based on application reviews which indicated that projects did not need substantial financial support in order to move forward, staff renegotiated some award amounts, and then stopped accepting new applications in 2006. However, based on participant feedback, and given the limited amount of non-solar Class I resources that have been developed to date, there are clearly both financial and non-financial development needs for non-solar Class I resources that are going unmet.

[2] For commercial projects with significant tax liability, the incentives and SREC revenue can offset the entire project cost. It should be noted that the return on investment is not immediate, however, as the value of Modified Accelerated Cost Recovery (MACRS), or accelerated depreciation, accrues over time.

A great strength of the program has been its ability to achieve project installations at a relatively low incentive cost per Watt of installed capacity. The average incentive cost of $0.37 per installed Watt is almost 10 times less than the average cost of $3.88 per installed Watt for the CORE program. Therefore, investments made through the REPGF program are a much more cost effective means of increasing installed renewable energy capacity than investments made to date through the CORE program.

## Other BPU Programs and Activities Supporting Renewable Energy Markets

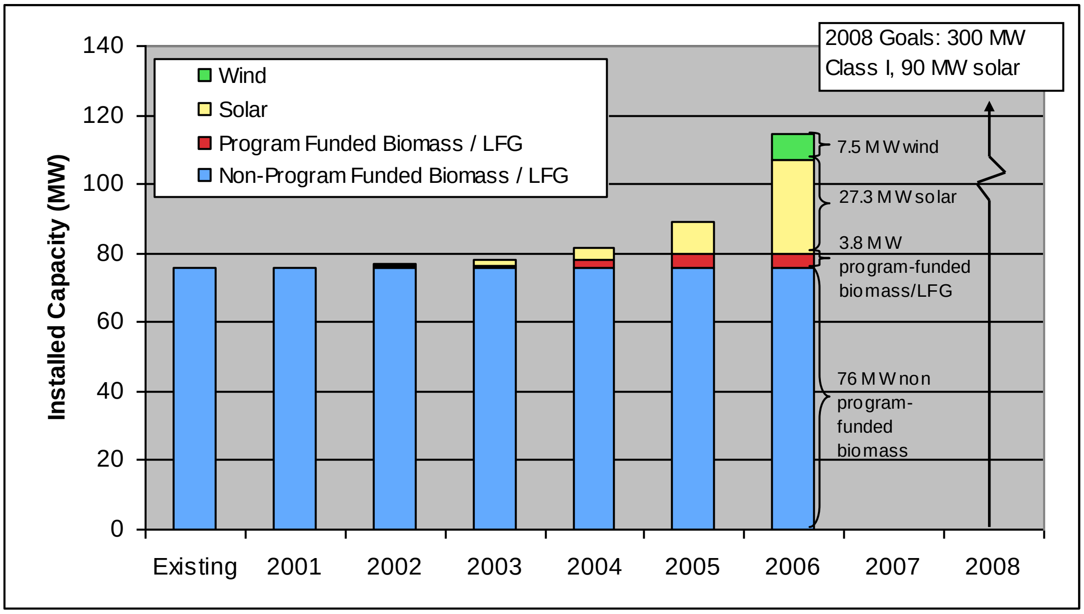
The **Renewable Energy Business Venture Assistance program** (REBVA) is designed to support the development of renewable energy businesses, technologies and market infrastructure, and to leverage public and private funding to advance the technologies and services needed to support a thriving renewable energy industry in New Jersey. A total of 11 projects were funded under the program and its predecessors through the end of 2006.

In 2004, New Jersey launched its own **SREC / Behind the Meter (BTM) REC trading system** to facilitate trade of SRECs for solar RPS compliance. As of March, 2007 a total of 2,034 renewable energy systems were actively participating in the SREC / BTM REC trading system. Of those, 2,022 systems were PV, six were wind and six were biomass. At the time the SREC / REC trading system was introduced, no other trading system existed to serve the region. However, a certificate trading system covering the entire PJM territory is now well established. It tracks REC trade for several states throughout the PJM territory, including for BTM systems, and is capable of accommodating trade of solar and other BTM RECs for New Jersey.

## Class I Renewable Energy Capacity Completed through the End of 2006

As of the end of 2006, CEP funding had facilitated the development of 27.3 MW of solar, 7.5 MW of wind, and 3.8 MW of biomass and landfill gas capacity. In addition, 76 MW of Class I eligible landfill gas capacity also exists in the state, as well as approximately 45 MW of Class II capacity. Class I installed capacity growth by technology, and its relationship to the Board’s goals for 2008, is summarized in Figure E-1.

**Figure E-1. Cumulative Annual Program-Funded Class I Capacity, and Non-Program Funded Biomass / Landfill Gas Capacity, Relative to BPU Goals[3]**




The significant disparity between solar market development and the development of non-solar technologies can be attributed to:

- More complicated siting and technical issues, including a less mature market infrastructure for non-solar projects;
- Lack of easily developable, large-scale non-solar project opportunities;
- Presence of aggressive solar RPS requirement and lack of other specific technology goals;
- Budget allocation (no specific allocation by technology);
- Insufficient staff resources to implement Renewable Energy Project Grants and Financing program and the Business Venture Assistance programs.

## RPS Compliance Status

In-state installed capacity, together with Class I RECs from generators elsewhere in the PJM region have been sufficient to enable New Jersey's electricity suppliers to meet RPS requirements through Reporting Year 2006. A review of economic potential for development of Class I resources, based on a combination of results from the 2004 Navigant study and a 2007 Rutgers study on biomass potential, indicates that enough resources exist within the state to achieve RPS goals through Reporting Year 2021 with in-state resources. New Jersey can also use resources from throughout the PJM territory to comply with RPS requirements for non-solar resources.

[3] Data on the dates which non-program funded landfill gas projects came online was not available to the project team. Therefore, it is assumed that all 76 MW were online prior to 2001.

# E.4 Barriers to Renewable Energy Development and Program Participation

A number of market barriers exist to reaching the RPS targets. Interviews and surveys with program participants, developers and other market participants provided important information on market barriers and the programs' role in addressing them. The most significant market barriers identified are summarized below. Several of the barriers identified here are PV-specific. This is due to the unique importance of PV in the context of the New Jersey RPS and an emphasis on past CORE program participants in our data collection efforts, most of whom have focused on PV. Interviews were also conducted with landfill gas and wind project developers active in the Northeast.[4] The relevance of barriers to specific technologies, or to the market more broadly, is indicated below.

- **First costs: Overall, capital costs are still the biggest factor in the decision to install solar PV systems.** Some developers noted the timing of rebate payment as a major program deficiency, indicating that it can be difficult for project owners or developers to bridge the gap between the time they must pay for equipment and labor, and the time they receive rebate payment. Some project owners or developers must take out loans for the period between project completion and rebate payment and interest payments are non-trivial.

- **Regulatory uncertainty and REC prices:** This was the most frequently cited of any of the barriers discussed with participating developers across all technologies. Developers explained that market uncertainty makes project financing both more difficult to access and more expensive, meaning that higher REC / SREC costs will be passed along to ratepayers. Solar developers have suggested a range of strategies to improve SREC price certainty ranging from requiring long-term contracting for SRECs, to adopting a tariff-based incentive structure where incentives would be paid over time based on system performance. These strategies could apply to the development of non-solar technologies as well.

- **Siting and permitting:** Developers identified the long permitting timeframe, inconsistency in permitting requirements across communities, and NIMBYism as the most significant barriers to non-solar development. One developer noted that there is little reason to develop a wind project in New Jersey when there is so much less public opposition and bureaucracy in surrounding states like Pennsylvania.

- **Access to favorable financing for small solar systems:** While financing is available, conditions are not generally as favorable as they could be since lenders typically do not view the solar equipment as an asset. Developers noted that homeowners without much equity in their homes can have difficulty securing project financing.

- **Program instability:** Solar developers expressed that the Board has changed the rebate levels multiple times without sufficient notice, and that this has resulted in major disruptions to the sales

[4] Interviews were conducted with thirty solar developers who participated in New Jersey's CORE program, and two landfill gas developers who participated in the Renewable Energy Project Grants and Financing program. In addition, two wind developers and one landfill gas developer who do not participate in New Jersey's programs were interviewed.

cycle. A review of program data validate this concern, as large fluctuations in program participation can be seen after the announcement of changes in rebate levels (see Figure 3.8 in Volume II of this report). It is logical that these large and rapid swings in participation would hinder the sales cycle and developers' business planning capabilities. A greater amount of notification time or a more well-defined, transparent long-term plan regarding the schedule of rebate levels would have likely provided for greater program stability. However, given the conditions that arose in the program, rebate level changes were necessary in order to avoid over-spending the program budget. While stronger long-term planning efforts need to be be pursued in the future, it is important to recognize the enormous challenge BPU has faced in its efforts to achieve such large solar installation targets. Like New Jersey, many other states have struggled to balance priorities and identify the most appropriate incentive levels in the midst of changing market conditions.

- **Lack of mature local infrastructure for some technologies:** Technologies such as advanced biomass and offshore wind do not have established sales and distribution networks, and there is a low level of awareness about these technologies among public officials. Developers must build market confidence in these technologies, navigate project siting and permitting challenges, and lay the groundwork for long-term market growth.

# E.5 Strengths and Weaknesses of Portfolio of Renewable Energy Programs

## Strengths of Current Portfolio

The Board has achieved remarkable success in developing the state's solar market and this is due in large part to the policy-making and program design on the part of the Board. The state has some of the strongest net metering and interconnection rules in the country which serve as an excellent model for other states. In addition, the state's RPS solar set-aside, coupled with a Solar Alternative Compliance Payment (SACP) sets the stage for a strong solar market with potential to achieve self-sufficiency more rapidly than in many other states.

From a structural and design perspective, the Board's portfolio of renewable energy programs should be able to address most of the needs of the growing renewable energy market in the state. Furthermore, the CORE program incorporates a number of components intended to ensure high quality system performance (i.e., warranty requirements, system design standards, and post-installation inspections), and thus, efficient use of ratepayer funds.

While there is still a disproportionate emphasis on solar markets, the Board is making substantial progress in some areas of non-solar market development. These have not yet resulted in recognizable non-solar installed capacity growth. These positive activities include the formation of a *wind working group* to address the needs of small and terrestrial (on-shore) wind projects; offering an anemometer loan program; gauging public opinion about offshore wind development; surveying Wind Working Group members to assess the major issues facing wind development in the state; and soliciting proposals for studies related to the impacts of offshore wind development. The Board also facilitated a *biomass supply study*, completed by the Rutgers University, which has provided valuable data on the economic potential for biomass development in the state, as well as the costs and barriers associated with developing advanced biomass studies. The Rutgers biomass study demonstrates how the Board has succeeded in *leveraging the skills of local academic institutions* to help build in-state renewable energy industry expertise.

BPU has also demonstrated strong leadership in its efforts to ensure that New Jersey will remain on track to achieve the state's aggressive solar RPS requirements without imposing unnecessarily high costs on ratepayers. New Jersey's RPS requirements play a fundamental role in defining New Jersey's renewable energy market, and adhering to the provisions set forth in the RPS is one of the most critical things the Board can do to foster regulatory certainty and investor confidence in this growing market. Given the aggressive nature of the solar RPS requirement, the Board has navigated uncharted territory. The final market transition model selected may not be a perfect solution, but it will likely be a major improvement over current conditions, and it results from months of stakeholder input and consideration of a variety of market approaches.

## Weaknesses of Existing Portfolio

The current portfolio of programs is primarily serving the needs of residential, commercial, industrial, and public projects seeking to complete on-site PV or small wind projects through the CORE program. The needs of potential developers seeking to build utility-scale advanced biomass, onshore wind, or offshore wind projects are not well served under the current portfolio, as implemented.

The CORE program, and the solar market specifically, has received the vast majority of budget resources and staff attention for a variety of reasons, including: the RPS solar requirement, BPU budget allocations, insufficient staff resources to implement the REPGF and Renewable Energy Business Venture Assistance programs, and the more complicated siting and technical issues, and less mature market infrastructure for non-solar technologies.

Other weaknesses in the portfolio of programs in general relate to market uncertainty, timing of incentive processing and adequacy of staff support and public outreach. BPU's lengthy process to transition solar incentives to a more market-based structure has been positive in that it has allowed stakeholders to play a very active role in decision-making. However, the process has also raised concerns about the certainty associated with the structure of the Board's programs and the future of New Jersey's SREC prices.

# E.6 Key Findings and Recommendations

The research team identified **four key areas of focus** for the Board as it conducts program and budget planning for 2008 and the next round of Societal Benefit Charge (SBC) funding (2009-2012). These areas of focus and related strategies are discussed below, followed by specific recommendations for program structure, incentive levels and budget allocations for the upcoming SBC funding cycle.

## Key Areas of Focus for BPU Activities Going Forward

1. ***Market Stability and Predictability***. It is critical for the state to uphold its commitment to advancing the renewable energy market in order to instill confidence in investors. Adhering to existing RPS targets and maintaining consistency in market structure will enable the state to build upon the existing market infrastructure that has developed in response to New Jersey's renewable energy market commitments to date. In addition, the Board must improve efforts to provide the public with current information about market status (i.e., comprehensive RPS compliance reports and quarterly market indicator updates), in order to improve the transparency of the market.

2. ***Financial Certainty for Project Investors and Access to Favorable Financing***. In the absence of rebates for large scale solar projects, and for grid-supply projects, financial certainty is critical to foster project development and to reduce the ratepayer impacts of RPS compliance (i.e., higher financing costs result in higher REC/SREC prices, which are passed on by load serving entities (LSEs) to ratepayers through more costly electric bills). Given current market conditions and the significant role that SRECs are playing in the market, it is appropriate to start by facilitating or requiring long-term contracts between REC buyers and sellers, as described in further detail in Section 5.10.2. This concept is simple in theory though challenging to implement. It will require a concerted effort in the near term to develop a system workable for key market stakeholders. In addition, to address the fact that financing will become more difficult for certain projects after the PV rebates are no longer available, a low interest financing option should be considered.

3. ***Targeted Outreach and Use of Incentives to Trigger Growth in Non-Solar Project Development***. New Jersey's renewable energy market development efforts have been heavily weighted toward solar. As a result, the state is not on track to achieve its non-solar development goals. A great strength of the REPGF program has been its ability to achieve project installations at a relatively low incentive cost per Watt of installed capacity. In fact, the program's incentive costs on a $/kW basis were almost 10 times less than the average $/kW cost for the CORE program. Greater emphasis on non-solar project development would help reduce ratepayer impacts associated with RPS compliance since non-solar technologies are generally much more cost effective than PV. Increased efforts to target development at optimal project sites are needed

and can take the form of both sector-specific and geographically focused program outreach and marketing.

4. ***Program Enhancements: Performance-Related Features and Improved Program Implementation.*** While the current portfolio of programs is strong from a design-perspective, the impacts of current programs could be significantly increased by making several modifications to basic program standards and administrative practices. Specifically, the Board should begin basing all SREC creation on metered data. PV systems under 10 kW currently have the choice to base production data on engineering estimates or metered data and most choose to base their production on engineering estimates. Without actual metered data, there is no way to penalize smaller projects for poor performance or to reward other projects for on-going success. In addition, the Board needs to revise minimum technical standards for system installation to make them clearer and simpler to enforce. Finally, program materials must be streamlined to make guidelines and incentives clear and accessible. Materials should be available in one place, and program staff should increase efforts to be responsive to prospective program participants.

## Incentive Level Recommendations by Technology and Market Sector

The Summit Blue team carried out an analysis to forecast the incentives required for each technology and market sector. The calculations were completed with the goal of finding the minimum incentive level that would provide project owners with an attractive investment. Full details of the analysis for each technology-market sector are provided in Volume I, Section 5. The analyses included assumptions about REC income for wind and biomass projects and SREC income for solar PV projects.[5]

The incentive levels resulting from this analysis are recommended for use as “base” or “benchmark” incentive levels. The Summit Blue team *recommends offering incentive “adders” in addition to these base incentive levels to stimulate development of certain technologies* under the REPGF program, and to encourage favorable characteristics for projects participating in the CORE program. For the REPGF program, the incentive levels (plus adders where applicable) would establish the maximum incentive value a project could receive, though the incentive could be administered through a combined grant and financing incentive package in which grants are issued in increments, with a portion of the grant payment based on performance milestones.

Table E-1 shows the recommended incentive levels on a capacity basis ($ per kW of capacity). The incentives are also shown on a performance basis ($ per MWh of generation). The $/MWh values were calculated using estimates of performance for each of the technologies. The performance-based incentives are provided here for information only, so that a comparison can be made between technologies on a per MWh basis. These incentives are not additive – projects would receive either a capacity-based incentive, a performance-base incentive, or some combination to be determined based on final program design by BPU staff. Recommended incentive levels were calculated on a capacity basis only.

[5] A price of $11/MWh in 2008 was used for Class I RECs. It was assumed that the REC price would stay the same for the analysis period. A price of $611 in 2009 was used for SRECs. It was assumed that the SREC price would decrease at the rate of 3% a year.

**Table E-1. Recommended Incentive Levels by Technology and Market Sector**

| System | Program | Class | Capacity Incentive ($/kW) | Performace-Based Equivalent ($/MWh) |
|---|---|---|---|---|
| < 10 kW Solar | CORE: Residential | Residential | $3,500 | $166.48 |
| 10 kW <> 40 kW Solar | CORE: C&I | Comm/Public | $1,500 | $71.35 |
| 40 kW Solar <> 100 kW | | Public | $1,500 | $71.35 |
| > 40 kW Solar | | Comm Private | none | none |
| Small Wind (< 100 kW) | CORE | Resid./Comm. | $3,100 | $129.56 |
| Large Onshore Wind (> 100 kW) | REPGF/CORE | Public | $1,320 | $29.00 |
| | | Private | $930 | $20.00 |
| Offshore Wind | REPGF | Private | $2,745 | $50.25 |
| Biomass Gasification | REPGF/CORE | Public | $2,650 | $48.51 |
| | | Private | $1,656 | $51.74 |
| Wastewater Biogas | REPGF/CORE | Public | $1,380 | $43.11 |
| | | Private | $2,144 | $58.49 |
| Landfill Gas | REPGF/CORE | Public | $1,787 | $48.74 |
| | | Private | $128 | $4.49 |
| Biomass Direct Combustion | REPGF/CORE | Public | $107 | $3.74 |
| | | Private | $191 | $10.49 |

## Recommended Structure and Budgets for Portfolio of BPU Renewable Energy Programs

As noted above, the recommendations presented here are intended to provide input for program budgeting purposes for the 2009-2012 Societal Benefit Charge (SBC) funding cycle, as well as high-level decision-making regarding program structure. Detailed program design was outside the scope of the assignment. Therefore, BPU staff may need to conduct further analysis to determine the best approach for setting funding amounts and distributing funds so that project-specific funding can evolve with changing market conditions. This is particularly important for the Renewable Energy Project Grants and Financing (REPGF) program, as the utility-scale projects funded through this program will make up the largest portion of renewable energy capacity additions that will occur to meet RPS requirements.

### *CORE Program*

Based on a review of how PV system project economics vary by size and market sector, the research team recommends that privately-owned PV systems up to 40 kW be eligible for rebates, and that publicly owned PV systems up to 100 kW be eligible for rebates. Under the new multi-year SACP approach, larger PV systems would not be eligible for rebates. It is recommended that a rebate incentive structure continue for small projects, but an upfront / performance milestone based structure should be considered for larger projects.

In addition to baseline incentive levels, **incentive adders** of $0.25/W should be made available to encourage participants to complete significant energy efficiency improvements, to use parts manufactured in state, to develop projects in the most congested areas of the distribution system, and to pursue other positive project features.

The Board should consider offering a **low interest financing** option to Class I renewable projects serving on-site load, subject to further analysis regarding appropriate target markets. For solar, this may include projects larger than the rebate-eligibility limit. The Board's decision to offer such a financing program should take into consideration the tax environment that exists in 2009. If the solar investment tax credit (ITC) is extended beyond 2008, a state financing program could actually have a negative effect on project economics.[6]

Based on an analysis of project financial needs (described above) and program administrative support needs, the recommended *annual* budget for the CORE program for the 2009-2012 period is $10.6 million. This budget includes the low-interest financing and incentive adder components. This does not include the cost of SRECs that electricity suppliers will procure to meet RPS requirements.

### *Renewable Energy Project Grants and Financing Program*

The Board should implement a **two-tier incentive structure** and facilitate expeditious deployment of more mature technologies, such as landfill gas, by providing them a base ("benchmark") incentive level. Meanwhile, the Board should target development of technologies that are currently less cost-effective and provide these projects with a higher level of financial support (see Volume I Section 5 for further details). The incentive levels recommended would be the benchmark incentive levels, and an adder of 15% would be used for higher priority project funding.

In the past, projects have received a combination of grant and finance-based support. A similar approach is recommended for the future, but using the incentive "benchmark" or "benchmark plus adder" as the maximum incentive value for which an applicant would be eligible. The Board could consider issuing the grant in increments, with a portion paid upfront and the remainder paid based on performance milestones. The Board should update the benchmark and "adder" incentive levels annually based on current market data in an effort to match program incentives to evolving market conditions. The conditions that would trigger a change in incentive levels (i.e., changes in the availability of the federal Production Tax Credit), should be clearly communicated to provide added market certainty. The Board could also consider adding a *competitive solicitation component* to the program, as this would help stimulate competition among

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[6] As set forth in the Energy Policy Act of 2005, the value of the solar ITC will be reduced or eliminated if project owners take advantage of "subsidized energy financing." See Wiser and Bolinger (2006) "Federal Tax Incentives for PV: Potential Implications for Program Design."

projects which could help lower costs and provide an annual snapshot of market conditions. It would also provide focus for program outreach activities.

A ***pre-development assistance*** component should also be added to the REPGF program to help reduce the risks and costs associated with feasibility assessment and non-construction pre-development activities (i.e., siting, permitting, potential delays in the development cycle) associated with utility-scale non-solar projects. Funding and/or technical support should be provided to help developers, with services provided by staff or approved contractors. This support is particularly important for developers working with technologies for which the development path is less well defined than for more mainstream renewable technologies.

Based on an analysis of project financial needs (described above) and program administrative support needs, the recommended *annual* budget for the REPGF program for the 2009-2012 period is $50 million.

### *Renewable Energy Business Venture Assistance Program*

The REBVA program should be continued, maintaining its existing structure, but making significant efforts to boost awareness of the program among potential participants. In addition, the Board should strive to achieve diversity in the technologies supported by the program.

The recommended *annual* budget for the REBVA program for the 2009-2012 period is $7.7 million. The recommended value represents a 50% increase over the 2007 program budget.

### *Community-Based Renewables Development Program*

A community-based renewables program should be added to provide education and outreach activities and funding assistance for communities to plan for the development of renewables. Funds for such a program would go toward geographically targeted education and outreach activities, developing a model plan for community-owned renewable energy projects, and assisting communities in developing their own tailored comprehensive renewable energy development plans. In addition, the program would fund government entities' development of community-specific renewable energy development plans, research into finance options for project ownership, and staff time necessary to develop proposals for permitting and zoning provisions that accommodate renewables development.

Such a program could be developed in collaboration with electricity delivery companies, as there are added distribution system benefits to such strategies. Some EDCs have expressed interest in this model for solar development. The recommended *annual* budget for this program is $5.5 million.

### *Additional Recommendations*

The research team also recommends transitioning from the **SREC / BTM REC trading system** to the PJM GATS for all New Jersey RPS certificate / REC trading. GATS is capable of supporting BTM generators, using GATS would simplify RPS compliance for suppliers, and the Board could reduce administrative expenses. Funds currently spent to administer the SREC / BTM REC trading could be reduced substantially and reallocated to provide support to small generator owners needing assistance with understanding or participating GATS.

New Jersey has allocated funds in the past to establish a **PV manufacturing incentive program** but no such program has been developed to date. The Summit Blue team was tasked with exploring whether New Jersey should introduce such a program. Research completed as part of this assessment indicates that a specific PV manufacturing incentive program would not be the most effective use of New Jersey's clean energy funds. Manufacturers interviewed as part of this assessment said it would be more productive for

New Jersey to focus incentive dollars on project-level incentives rather than on the manufacturing sector. New Jersey should focus on establishing stability in its solar market and demonstrating its long-term commitment to building the market, as interviewees indicated that a major barrier to locating a manufacturing facility in the state is the short-term incentive planning cycle.

Rather than dedicate SBC funds to support a PV manufacturing-specific incentive program, BPU should collaborate with the Economic Development Authority (EDA) to leverage potential economic development benefits associated with renewable energy industry growth. Working together with EDA, the Board should also look for opportunities to target available EDA funds toward businesses in the renewable energy sector.

# E.7 Synopsis

New Jersey's current portfolio of renewable energy programs has achieved remarkable success in developing the rooftop solar market, but has lagged in its efforts to advance the development of large, non-solar resources. This is due to a combination of factors including a strong emphasis on solar in the state's renewable energy policies, past program budgeting, permitting and siting challenges for non-solar projects, and less mature existing infrastructure for non-solar project development.

New Jersey's experience to date should be viewed as an important learning opportunity, and a key lesson is the importance of establishing a long-term plan to foster market stability and certainty. The Board should significantly step up efforts to encourage development of both mature non-solar technologies, such as landfill gas and on-shore wind, as well as technologies needing more development assistance, such as off-shore wind, advanced biomass and biogas technologies. Certain solar applications, including thin-film and building-integrated PV applications could also benefif from greater support. In addition, the Board should provide ongoing support to the growing PV market in New Jersey to ensure that the transition to an SREC-driven project finance structure can succeed. Facilitating long-term SREC/REC contracts with electricity suppliers (LSEs), and providing low interest financing could benefit the industry significantly. In addition, the Board should substantially increase its market monitoring and communications functions. Improved data tracking, reporting and program outreach activities will make the market more transparent and will facilitate development of the full range of Class I renewable technologies in New Jersey.

# 1 INTRODUCTION

This Market Assessment Report is the culmination of a comprehensive renewable energy market assessment conducted for the New Jersey Board of Public Utilities' (BPU) Office of Clean Energy (OCE). The assessment included both program- and market-level evaluative components and had four primary objectives:

1) Assess the renewable energy markets, building upon recent market potential studies.
2) Update baseline studies and estimates used as performance indicators.
3) Assess the costs of and barriers to the development of renewable energy technologies.
4) Provide recommendations regarding the future direction of the programs (i.e., modifying rebate and/or program funding levels, adjusting the form of incentive distribution, etc.).

During the course of the project, the importance of the fourth objective – the development of recommendations regarding the future of program efforts – was emphasized. Thus the Summit Blue team's report includes analysis of potential portfolios of incentives for achieving the Board's renewable energy market development goals, including discussion about how current programs should be modified and new program elements that should be added.

Another area of focus for the Summit Blue team was New Jersey's solar market transition process. The team was asked to prepare recommendations prior to the end of 2006 regarding the transition from New Jersey's current rebate-focused incentives for the CORE program to a more market-based structure in which the Solar Renewable Energy Certificate (SREC) / Renewable Energy Certificate (REC) market will function as the framework within which incentives are administered. This initial analysis of the solar market was provided in draft form during December 2006.

BPU tasked the Summit Blue team with reviewing the following programs as part of the *program level assessment* component of the project:

- Renewable Energy Project Grants and Financing (REPGF) program
- Customer On-Site Renewable Energy (CORE) program
- SREC and Behind the Meter (BTM) REC trading system[7]
- Renewable Energy Business Venture Assistance (REBVA) program
- Manufacturing Incentive program[8]

[7] New Jersey's REC and SREC trading system is not a "program" in the typical sense of the word. However, since the Board administers this trading system through a subcontractor, and its operation is integral to the outcomes of the Board's overall portfolio of renewable energy initiatives, it was treated as a program for the purposes of this assignment.

[8] This program is not operational. The research team was tasked with exploring the value of launching such a program.

A market potential study completed for BPU in 2004[9] included a significant focus on the technical and economic potential of the renewable energy technologies that are eligible under New Jersey's Class I RPS requirements. As part of that market assessment, all qualifying Class I renewable technologies passed through a screening process and only those demonstrating substantial near-term market potential underwent a rigorous review by the project team. Those technologies included PV, onshore and offshore wind, solid biomass combustion and gasification, landfill gas, and biogas from wastewater treatment. The Summit Blue team focused on those technologies identified in the 2004 study as possessing the greatest *economic* potential for market development in New Jersey. The current market assessment applied findings from the 2004 study regarding the technical potential of each of the technologies and updated, as needed, the assumptions that were used in establishing economic potential for the technologies in question.

During the course of this project, the Summit Blue team prepared three *milestone deliverables*:

- a qualitative review of strategies proposed by market participants for the solar market transition [Preliminary Review of Alternatives for Transitioning the New Jersey Solar Market from Rebates to Market-Based Incentives, March 15, 2007];
- a quantitative assessment of potential ratepayer impacts associated with solar market transition strategies [An Analysis of Potential Ratepayer Impact of Alternatives for Transitioning the New Jersey Solar Market from Rebates to Market-Based Incentives, July 31, 2007]; and
- a preliminary Performance Indicator Report [Summary of New Jersey Renewable Energy program and Market Indicators, May 7, 2007].[10]

These deliverables formed the basis for this comprehensive Market Assessment Services Report. This final project deliverable presents the team's key research findings and recommendations for adapting programs and implementing effective market development strategies going forward.

Several key themes and outcomes emerged from this research.

- *First, New Jersey has achieved remarkable success with respect to solar market development*. As a result, New Jersey has the second largest solar market in the nation behind California. New Jersey's commitment to solar should continue, as it will foster necessary solar market stability and investor confidence as New Jersey's solar RPS requirements continue to ramp up.
- *An increased focus on large non-solar project development must accompany this continued commitment to solar*. Incentives for large projects are more cost-effective and can help lower RPS compliance costs. Programs should target outreach to optimal development sites through both sector-specific and geographically focused activities.
- *The current portfolio of incentive programs is strong from a design perspective.* The programs are structured to serve a broad range of market sectors and technologies. However, the programs could benefit from enhancements such as the development of clear and concise program guidebooks; increased collection of metered production data; increased staff capacity, particularly for the Renewable Energy Project Grants and Financing and Renewable Energy Business Venture

[9] New Jersey Renewable Energy Market Assessment, Final Report to Rutgers University Center for Energy, Economic, and Environmental Policy, Navigant Consulting, August 2, 2004.

[10] The finalized version of this material is presented in the indicators summaries which are included in Volume II of this Market Assessment Services Report.

Asssistance programs; and continued refinements (as needed) to technical standards to ensure installation of high quality systems.

- *Critical elements necessary for the developing sustainable renewable energy markets include market stability and predictability, financial certainty and access to favorable financing.* As the Board proceeds with future program and policy planning, it should evaluate decisions based on the extent to which they advance these key market sustainability elements.

**The research team wishes to highlight several important pointss for the reader to consider when reviewing this report.** The findings and recommendations are intended to provide input for program budgeting purposes for the 2009-2012 Societal Benefit Charge (SBC) funding cycle, and for high-level decision-making regarding program structure. Detailed program design was beyond the scope of the assignment. For the Renewable Energy Project Grants and Financing program in particular, BPU staff should conduct further analysis to determine the best approach for setting actual project funding award amounts, as market conditions will inevitably evolve during the next SBC funding cycle and the analysis in this report is based on the best available data and assumptions the research team could obtain during the 2006-2007 research period.

Also note that the portfolio level analysis was conducted to estimate the funding necessary to derive all RECs necessary to meet RPS requirements for the 2009-2012 period from in-state resources. However, New Jersey's RPS does allow electricity suppliers to obtain resources from any part of the PJM control area. Therefore, the findings present budget values that are likely higher than necessary to meet RPS requirements with purchases of out-of-state RECs. Further, the research team sought to provide equal treatment of all Class I renewable energy technologies. However, due to data availability and the substantial solar requirement included in New Jersey's RPS, the study did place a heavy emphasis on the solar market, which is reflected in this report.

Finally, the report includes data for projects that were completed (installed and received program funding) through the end of 2006. A great deal of additional capacity was operational or under construction during the course of this assessment but had not received program funding by the end of 2006 and, therefore, fell outside the period of assessment included in the scope of work for this assignment.

## 1.1 Project Approach

The team compared market progress to program and market level goals set by the Board based on the RPS requirements and achievable potentials outlined in the 2004 market assessment report. Drawing on findings from the various data collection activities described in Section 3.2, the Summit Blue team explored the development needs, and market barriers associated with relevant technologies and market sectors. Development needs were explored from the perspectives of key market actors, including the following:

- Equipment manufacturers and distributors;
- Distribution companies (utilities);
- Financial institutions and other third party investors;
- REC market facilitators; brokers, aggregators and exchange managers;
- Contractors;
- Regulators;
- Project owners; and

- Electricity ratepayers.

Market barriers explored for each technology-market segment included:

- Technical,
- Financial,
- Political / Organizational,
- Informational, and
- Procedural (i.e., siting and permitting issues).

## 1.2 Organization of Report

This Market Assessment Services Report is organized into two volumes. The first volume includes an overview of the policy context and program progress to date. The highlight of this volume is a presentation of the analytic methods and results of the research team's ***portfolio-level assessment*** of the Board's programs. This first volume is for an audience interested in summary-level findings and recommendations from the comprehensive market assessment activities.

The second volume of the report includes detailed assessment reports for New Jersey's renewable energy market, and for each of the Board's renewable energy programs, as well as a review of renewable energy market development strategies in place in other jurisdictions. Volume II also includes summaries of two reports the research team completed in support of the Board's solar market transition efforts, as well as the list of references for both Volumes. This volume is intended for an audience interested in reviewing detailed data and discussion related to market and program performance, and policy and incentive strategies in place in other jurisdictions.

**Organization of Volume 1:**

- **Section 2** provides background and policy context for the renewable energy market framework and key market-related issues for consideration in New Jersey.

- **Section 3** provides the study methodology.

- **Section 4** provides a high level summary of the research team's findings regarding program performance. Detailed program assessments are included in Volume 2, Section 3.

- **Section 5** is the most substantive component of the report. It describes the research team's analysis of the Board's portfolio of programs and synthesizes the key elements from other analytic efforts completed as part of the market assessment. This section presents findings regarding the current portfolio of programs' status toward meeting market and program-level goals to date, and links development barriers with potential solutions. It also provides recommendations for program structure, goals and objectives, technology incentive levels and program funding levels for the next program funding period (2009-2012).

- **Section 6** concludes Volume I with an overall summary of findings and recommendations from market and program-level assessments. Detailed market and program-level assessments are presented in Volume 2.

**Organization of Volume 2:**

- **Sections 2 and 3** consist of detailed market and program-level assessments which each include discussion of performance indicators.
  - For the market-level discussion, the indicators assessment is followed by a discussion of market barriers by technology.
  - For the program-level assessment, discussion of structural and implementation-related issues is included for each of the three existing programs included in the assessment. Potential for a PV manufacturer incentive program was also included in the program-level assessment.
- **Section 4** reviews renewable energy market development strategies underway in other jurisdictions.
- **Section 5** discusses the scenarios considered by the New Jersey RPS Transition Working Group for transitioning the solar PV market from rebates to market-based incentives. The section consists of summaries of the two reports the research team completed in support of the Board's solar market transition activities.

# 2 BACKGROUND AND POLICY CONTEXT

This section describes the policies and programs that shape the New Jersey renewable energy market and the factors which necessitate the state's current solar market transition. It includes an overview of New Jersey's RPS requirements, the incentive programs which support renewable energy development in the state, and the Board's goals and objectives for renewable energy market growth.

## 2.1 Overview of BPU Renewable Energy Programs

The Electric Discount and Energy Competition Act (EDECA), which passed in 1999, set forth a conceptual framework for a Renewable Portfolio Standard (RPS). The RPS went into effect through administrative rulemaking in 2001. Major revisions to the RPS were considered through a public stakeholder process beginning with the establishment of the Governor's Renewable Energy Task Force in 2002 and a Task Force report in 2003. The Task Force recommended a carve-out of solar from the percentage requirements for Class I renewables, as well as a transition to the use of Renewable Energy Certificates as a compliance mechanism. Subsequent changes to the RPS extended the percentage requirement from their previous endpoint in 2008 to their current endpoint of 2021. These changes were developed in a stakeholder proceeding that culminated with a rulemaking that went into effect in 2006.

Passage of EDECA and the revised RPS laid the foundation for the launch of New Jersey's Clean Energy program administered by the Board. The programs and initiatives that the Board currently supports are summarized in Table 2-1on the following page.

**Table 2-1. BPU Renewable Energy Program Summary**[11]

| Program | Requirements | Technologies | Method of Support |
|---|---|---|---|
| Renewable Energy Project Grants and Financing Program | Supply or offset a minimum of 1 MW of power | Wind, PV, Landfill gas, Digester gas, Methane from sustainable biomass | Open solicitation[12]<br>Grants and long-term financing |
| Customer On-Site Renewable Energy (CORE) Program | RE system to be installed on customer's side of the meter<br>< 1MW<br>Rated capacity must be < 100 % of annual electric use | Wind, Sustainable biomass, Fuel cells using renewable fuels, Solar electric | Rebate program<br>Amounts vary with technologies ($/Watt) and size of installation<br>Incentives for wind and biomass are capped as a % of eligible costs |
| SREC/REC Market Infrastructure and Trading Platform | Grid-connected solar electric system<br>Inspected by NJBPU<br>All systems greater than 10 kW submit metered data; production from systems <10kW based on engineering estimates | SRECs = solar renewable energy certificates<br>REC = certificates from other renewable energy technologies eligible to meet NJ RPS requirements. | Trading platform designed to facilitate transactions that motivate investments in customer-sited renewables, and to enable compliance by regulated entities with the solar RPS. Intended to serve behind-the-meter generators in New Jersey. |
| Renewable Energy Business Venture Assistance Program | Must be conducting research, business development, RE commercialization and/or technology demonstrations. | PV, wind, fuel cells, wave and tidal, RE-generated hydrogen, sustainable biomass | Grants / recoverable grants |
| Manufacturing Incentive Program | Did not move past conceptual stage. | | |

New Jersey has one of the most aggressive RPS policies in the country, and it is one of only a few such policies which includes specific requirements for solar. Based on current and forecast consumption patterns, in order to meet New Jersey's solar RPS requirements, the state will need to have approximately 2,200 MW of solar capacity in place in Reporting Year 2021. The capacity requirement forecast is a function of the RPS percentage requirements and the expected level of retail electric sales. To the extent that actual retail sales differ from forecasted sales, the actual installed capacity required will be different.

[11] In addition to the programs listed here, the Board offers a CleanPower Choice program which enables NJ's residents and businesses to purchase RECs through their monthly electric bill. These REC purchases are not counted toward LSE's RPS requirements. This program was not included in the scope of the market assessment assignment.

[12] Applications were submitted on a rolling basis while this program was active. No applications are currently being accepted due to the fact that the program is undergoing revision.

## 2.2 Renewable Energy Program Funding

The Board's renewable energy programs are funded through revenues from the Societal Benefits Charge (SBC), a non-bypassable charge imposed on all customers of New Jersey's Electric Distribution Companies (EDCs) and gas companies. The SBC fund took effect in 2001 and is managed by the BPU. A total of $745 million will be collected during the 2005-2008 time period, with at least 25% spent on Class I renewables. The funds are held in a Clean Energy Trust Fund.

In an effort to keep pace with the solar-set aside in New Jersey's RPS rules, the state has allocated a substantial portion of its overall Clean Energy program funding to support solar development. In 2006, 87% of the total renewable energy program budget went to the CORE program, the vast majority of which went to funding PV installations. Renewable energy program funding comprised about 42% of the total Clean Energy program budget for 2007.

## Table 2-2. BPU 2007 Renewable Energy Program Budget[13]

**Final 2007 Renewable Energy Program Budget**

| Renewable Energy Programs | | | | | | |
|---|---|---|---|---|---|---|
| (All numbers = 000's) | NJBPU | Estimated | | New | Final | Committed |
| | Approved | 2006 | 2006 | 2007 | 2007 | Expenses |
| Existing Programs | 2006 Budget | Expenses | Carry Over | Funding | Budget | |
| | (a) | (b) | (c) = (a) - (b) | (d) | (e) = (c) + (d) | (f) |
| Customer On-Site Renewable Energy | $147,453 | $86,659 | $60,794 | $74,693 | $135,487 | $121,440 |
| Clean Power Choice | $1,516 | $1,939 | ($423) | $423 | $0 | $36 |
| RE Market Manager Transition Costs | $0 | $0 | $0 | $606 | $606 | $0 |
| **SUB-TOTAL Renewables** | **$148,969** | **$88,598** | **$60,371** | **$75,722** | **$136,093** | **$121,476** |
| **EDA PROGRAMS** | | | | | | |
| Manufacturing Incentive | $0 | $18 | ($18) | $4,018 | $4,000 | |
| Public Entity Financing | $0 | $6 | ($6) | $6 | $0 | |
| Clean Energy Financing for Businesses | $400 | $401 | ($1) | $1 | $0 | |
| RE Project Grants and Financing | $13,100 | $5,993 | $7,107 | $3,293 | $10,400 | $2,000 |
| Renewable Energy Business Venture Financing/REED | $8,000 | $870 | $7,130 | ($2,130) | $5,000 | $4,933 |
| **SUB-TOTAL EDA Programs** | **$21,500** | **$7,288** | **$14,212** | **$5,188** | **$19,400** | **$6,933** |
| **TOTAL Renewable Energy Programs** | **$170,469** | **$95,886** | **$74,583** | **$80,910** | **$155,493** | **$128,409** |
| **2007 Available Renewable Energy Funding** | | | | | **$155,493** | |

(a) = Board approved 2006 budgets
(b) = Estimated 2006 expenses from 7&5 report
(c) = 2006 budget less estimated expenses. Negative carryover occurs where estimated expenses exceed budget.
(d) = Level of new 2007 funding allocated to each program.
(e) = 2006 carryover plus new 2007 Funding.
(f) = committed expenses anticipated to be paid in 2007

**Final 2007 CORE Budget Allocation**

| | Proposed | % of |
|---|---|---|
| **(All numbers = 000's)** | **2007** | **Draft 2007** |
| | **CORE** | **CORE** |
| **Budget Category** | **Allocation** | **Budget** |
| | | |
| < 10 kw- non public | $30,062 | 23% |
| > 10 kw non public | $57,930 | 42% |
| Public - Non - schools | $21,325 | 17% |
| Public - Schools k-12 | $14,615 | 11% |
| Sunlit (HMFA affordable housing) * | $6,000 | 5% |
| Inspections/other admin | $5,555 | 2% |
| Total | **$135,487** | **100%** |
| Available CORE Budget | **$135,487** | |

*HMFA will be limited to a total of $6 million in commitments from 2006 and 2007, and $2 million from the REC pilot program will be reserved for HMFA projects.

The EDECA (N.J. Stat. § 48:3-60) stipulates that every four years the BPU must determine, based on the results of a comprehensive resource assessment, the appropriate level of funding to support Clean Energy programs, including those providing financial incentives for Class I Renewable Energy resources. The act states:

[13] This budget does not include Board oversight and administrative costs. The 2007 budget for Board oversight expenses was approximately $13 million for both energy efficiency and renewable energy programs. This equates to approximately 2.7% of direct incentive spending on renewable energy programs.

> "The board shall make these determinations taking into consideration existing market barriers and environmental benefits, with the objective of transforming markets, capturing lost opportunities, making energy services more affordable for low income customers and eliminating subsidies for programs that can be delivered in the marketplace without electric public utility and gas public utility customer funding."[14]

This declaration and other statements by the BPU establish New Jersey's intent to transition away from the use of SBC funds when the market is ready for such a transition.

## 2.3 CORE Program Status and the Need for Immediate Solar Market Transition

From the launch of the Board's Clean Energy Program (CEP) in 2001 through the end of 2006, CEP incentives had resulted in the installation of over 27 MW of solar capacity in New Jersey. This PV system capacity represents nearly 1,900 customer-sited solar installations. This rapid pace of project development will need to continue. Assuming a 1.5% annual growth rate in retail electric sales, New Jersey will need to have approximately 120 MW of solar installed capacity in-state in order to meet its RPS solar requirement for the 2009 RPS compliance year, and over 2,200 MW of solar capacity will be needed to meet solar RPS requirements for 2021. Note that the actual growth rate may be lower than the 1.5% used for this analysis, as New Jersey's draft Energy Master Plan has a stated goal of reducing projected energy use statewide 20% by 2020.

While the Board's other renewable energy programs also provide financial incentives to renewable energy market participants, the Board is focusing its immediate market transition efforts on the CORE program and the solar industry. This is largely due to the fact that the program's current year budget is fully committed. As of August 10, 2007, there was a queue of over 1,300 project applications, representing over 40 MW of potential PV capacity and over $130 million in rebate funds requested. These PV project funding requests alone nearly match the total funding available for CORE program incentives in 2007.[15] The uncertainty about the future direction of New Jersey's solar market is placing strain on the local solar industry. Industry representatives report that layoffs are beginning to occur, and at least one company has gone out of business as a result of the current market conditions. As the New Jersey solar market proceeds through this transitional phase, and as solar markets expand and contract in other states, changes in the roster of industry players in New Jersey can be expected. It is important to monitor both market entry and exits, and to compare the status of the industry against that which is necessary to fulfill the RPS requirements.

[14] 48:3-60. Societal benefits charge by public utility; Universal Service Fund.

[15] Data is sourced from OCE program records as of August 2, 2007. Funds available for CORE program incentives in 2007 are assumed to include carry over funds from 2006.

# 2.4 Key Elements of the New Jersey Renewable Energy Market

## 2.4.1 Renewable Portfolio Standard (RPS) Requirements

New Jersey's RPS is one of the most aggressive policies of its type in the country, requiring 22.5% of the state's electricity to be sourced from renewables by Reporting Year 2021. As a subset of that total requirement, 2.12% of the state's electricity usage must be sourced from solar by Reporting Year[16] 2021. As noted above, this requirement is projected to equate a need for 2,200 MW of solar installed capacity. The Board has stated that it intends to adopt additional RPS requirements for 2022 and, beyond that they will be equal to or greater than the already established percentages.[17]

The RPS applies to electric power suppliers. The NJ RPS has a tiered system, including two resource classes and an explicit solar energy requirement.[18]

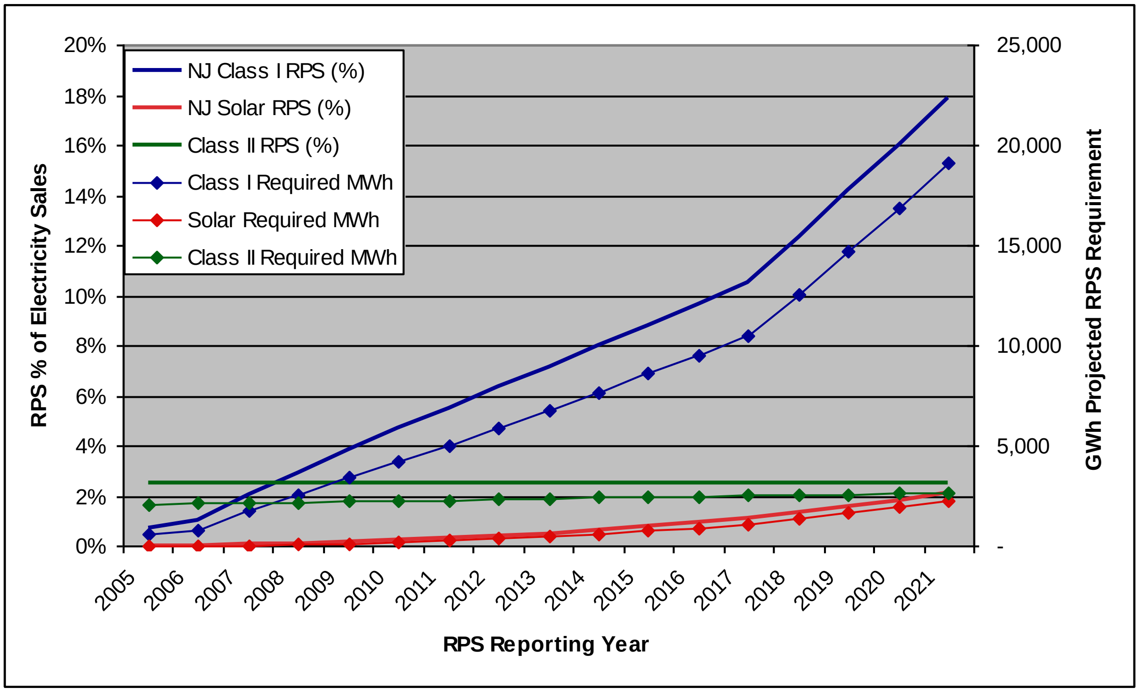
Figure 2-1 shows New Jersey's steadily increasing RPS requirements.

[16] The RPS Reporting Year, extends from June 1 through May 31. Suppliers have a three month true-up period following the end of the Reporting Year to complete all REC / SREC trading for RPS compliance.

[17] RPS Rules Adoptions N.J.A.C. 14:8-2, NJBPU, April 14, 2006. N.J.A.C. 14:8-2.3 (b), page 57.

[18] To qualify as Class I or II energy, the energy must be generated in, or delivered to the PJM region. Energy is delivered to the PJM region if it complies with the energy delivery rules established by PJM Interconnection. If the energy is generated outside of the PJM region and delivered into the PJM region, the energy can be used to meet the RPS if it was generated at a facility that commenced construction on or after January 1, 2003.

**Figure 2-1. New Jersey RPS Requirements by Category**




*Source: Based on RPS requirements detailed in RPS Rules Adoptions N.J.A.C. 14:8-2, NJBPU, April 14, 2006.*

The New Jersey RPS includes a separate solar standard because the BPU believes that solar provides unique and important benefits to the New Jersey electric distribution system. BPU cites the following key reasons for establishing the solar set-aside:

- The specific solar requirement will promote market transformation of solar in New Jersey and ***insulate ratepayers against rising fossil fuel prices and fossil fuel fluctuations***;
- Decentralized, customer sited photovoltaic installations will provide ***localized distributed generation that will delay the need for system upgrades to meet dispersed load growth***; and
- Solar electricity generation ***coincides with annual peak demands*** required to meet summer cooling loads. Solar has the capability to decrease conventional power plant use during peak times, reducing the amount of ground level ozone in New Jersey.[19]

## 2.4.2 RPS Compliance: SRECs, RECs, ACP, SACP

Electric power suppliers must comply with the RPS through the acquisition of RECs and SRECs, or by making Alternative Compliance Payments (ACP) and Solar Alternative Compliance Payments (SACP). A REC represents the environmental attributes of one megawatt-hour (MWh) of renewable energy generation from an eligible facility, and an SREC represents the environmental attributes of one MWh of

[19] Renewable Portfolio Standards (RPS) Rules Adoption. N.J.A.C. 14:8-2, New Jersey Board of Public Utilities, 13 April 2006; p 19-20, BPU response to Comments 21 and 23.

solar generation from an eligible facility. SRECs are issued by the Board of Public Utilities, and are transacted through New Jersey's own SREC trading platform. The SREC trading platform is intended to handle transactions of "behind the meter" (BTM) renewable energy systems. While these systems could technically be traded through the PJM Generation Attribute Trading System (GATS), that system was not in place when New Jersey's RPS went into effect with its REC-based compliance system. GATS has been deemed too complex by some to support SREC trades since such trades often involve parties with little or no technical background. In order to qualify for the issuance of an SREC, electric generation must occur at an in-state facility that is interconnected to a grid that supplies New Jersey.

The BPU or its designee will issue all SREC and Class I RECs that are based on electricity generated on a customer-generator's premises. Customer-generators (including all solar projects) must be eligible for net metering (< 2MW in capacity) to fulfill the requirement that electric generation come from in-state grid-connected supply. PJM-Environmental Information Services (EIS) issues Class I RECs from utility-scale projects (those projects not serving on-site load) and all Class II RECs. PJM-EIS formed the Generation Attribute Tracking System (GATS) to provide the environmental and emissions attributes reporting and tracking services for all states in the PJM region.

## 2.4.3 Alternative Compliance Payment (ACP)

Alternative Compliance Payment (ACP) and Solar ACP (SACP) levels were established in New Jersey through a 2003 Board Order as a tool to:

> "provide(s) a 'back-stop' mechanism that protects suppliers, as well as consumers, from the cost implications of excessive market risk. The ACP and SACP set an upper limit for the cost of RPS compliance; remove the risk of unknown financial penalties for any renewable energy shortfalls; provide protection against the possibility of market power exertion and unforeseen scarcity of renewable energy and REC shortages; and gives suppliers some flexibility in complying with RPS requirements."[20]

The RPS regulations stipulate that the BPU must review the ACP and SACP levels at least annually in collaboration with an ACP Advisory Board.[21]

The ACP and the SACP have remained at their original 2004 levels—$50/MWh ACP, $300/MWh SACP (about $80 more than the current average SRECs trading value)—and will continue to remain at that level through Reporting Year 2008 (ending May 31, 2008). The Board recently concluded a proceeding to determine the SACP level for Reporting Year 2009 and beyond. Further discussion of the role of the SACP and factors to consider in setting ACP / SACP levels is included in Section 4 of the report where a range of renewable energy market development strategies from other jurisdictions are reviewed.

## 2.4.4 RPS Solar Set-Aside

New Jersey's solar development targets are the largest in the country both in terms of percentage of total electricity sales, and in terms of the solar generation they will require by 2020 (Figure 2-2). As a result of the solar set-aside in its RPS, New Jersey possesses additional, unique challenges in meeting its RPS

[20] December 18, 2003 NJBPU Order.

[21] New Jersey RPS Rules: N.J.A.C. 14:4-8.10 (b) and (c).

targets. In order to achieve the rapid and substantial level of solar project development necessary to fulfill the solar RPS requirements, New Jersey must overcome *barriers* that have inhibited solar market development for years. A critical hurdle to overcome is project economics; the solar value proposition will likely need to become viable for a much broader set of individuals and businesses than have participated in the program to date (i.e., future program participants may have lower disposable incomes, and/or be less capable of financing a system). In addition, the solar market must be financially viable for developers, installers, aggregators, brokers, third-party investors, and other potential participants in order to stimulate the level of market activity necessary to achieve RPS goals.[22]

Since New Jersey is one of only a few states possessing a solar set-aside, and New Jersey was among the first states to introduce a solar set-aside, there is little experience on which to draw in determining potential impacts on the broader RPS market and identifying strategies for fulfilling the solar goals in a cost-efficient manner. In addition to New Jersey, five other states (Colorado, Delaware, Maryland, Nevada and Pennsylvania) and the District of Columbia also have specific solar set-asides in their RPS requirements, and a few other states have tiered structures, or structures that allow for weighted credit for certain technologies.[23] In addition, California has established a goal (though not in its RPS) of achieving 3,000 MW of installed PV capacity in the state by 2017.[24] Figure 2-2 shows the expected GWh annual generation equivalent of various states' solar development targets. These estimates were derived by multiplying each state's expected annual retail sales (MWh) by its stated targets in terms of percentage of retail sales.[25]

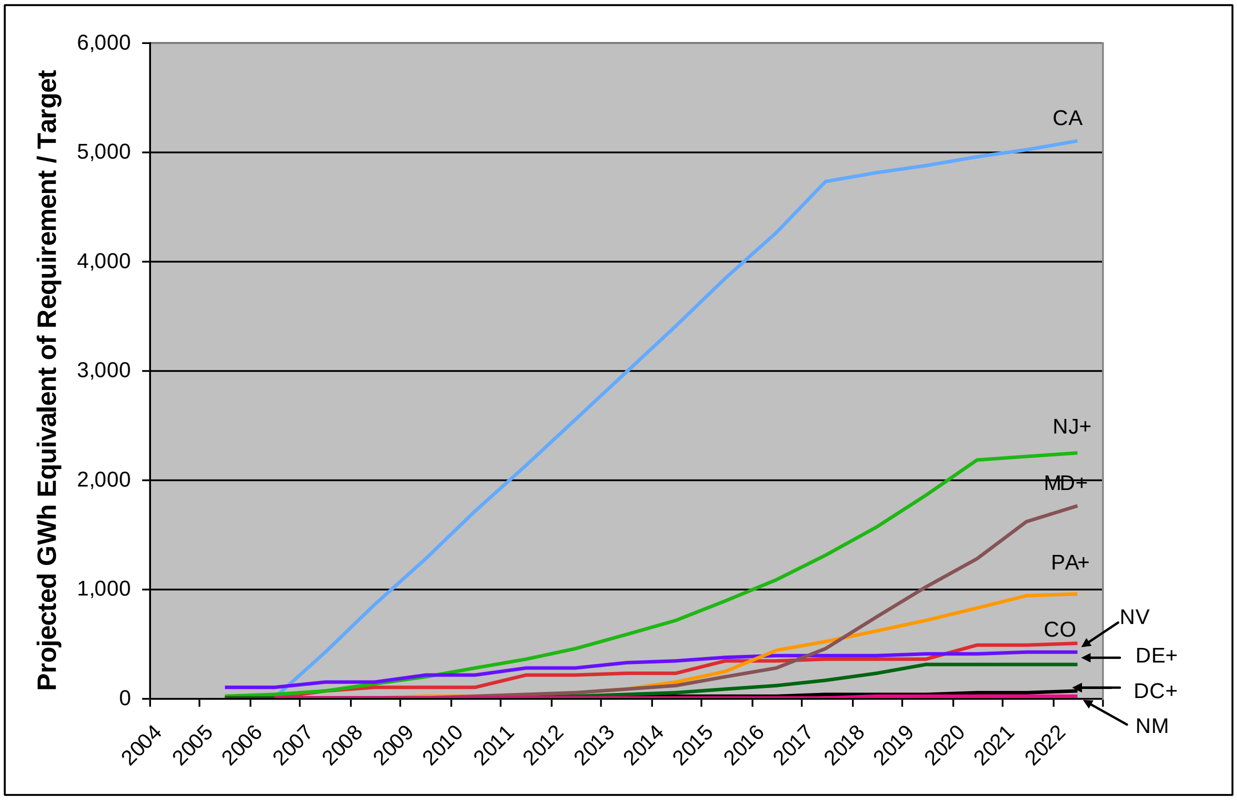
[22] Note that the market structure chosen by New Jersey will affect the number and type of market actors that will emerge in the future. For example, if the "auction-set pricing and standard contract" proposal were to be implemented, there would be much less need for aggregator and broker services than under the alternative proposed "commodity market" structure.

[23] For example if solar receives a multiplier of 2.4 when counted for RPS compliance, and solar receives 300% credit toward RPS compliance in Delaware.

[24] This goal is not included in the state's RPS goals.

[25] EIA 2005 retail sales data was used, along with an assumed 1.5% annual load growth rate.

**Figure 2-2. Comparison of RPS Solar Set-Asides and Development Targets**




Note: States with Solar Alternative Compliance Payments or compliance penalty fees are shown with a "+".

## 2.4.5 Poor Climate for Negotiating Long-Term Contracts

New Jersey's CORE program rebates, combined with the Federal tax incentives, have historically reduced the upfront cost of solar projects substantially, enabling projects to recover the majority of the initial project cost within the first few years of operation. With past New Jersey rebate levels in effect, the portion of project investment supported by third-party financing has been much smaller than what would be necessary in a post-rebate solar market.[26] As an increasing percentage of solar project investment is supported through third-party financing arrangements, long-term contracting will become increasingly important for solar projects. This is due to the fact that the investment community seeks certainty in project revenue streams. And because New Jersey's rebates and grant incentives for non-solar projects have always been lower on a $/W basis than incentives for solar, long term contracts for energy and RECs continue to be important for non-solar projects as well.

Given the dynamic nature of energy and REC markets, renewable energy project revenue streams will inherently vary over time. Without the revenue certainty provided by long-term contracts or other means,

[26] According to the OCE, a wide variety of project financing arrangements have existed under the current rebate incentive system in New Jersey. Finance arrangements have included payment with cash and credit cards, home equity and other forms of equity, power purchase agreements, secured and unsecured loans, government borrowing, and DEP financed infrastructure trust financing.

according to solar industry representatives, the financial community will discount the value of the revenue stream by 50% to 90%.[27] This discounting of future revenue streams makes project financing both more difficult to secure and more expensive (i.e., higher interest rates).

Renewable energy project developers everywhere share in the challenge of addressing investor concerns over the inherent variability in REC values over time. The most common strategy pursued by renewable energy project developers to address concerns about revenue uncertainty is to secure long-term contracting for energy and/or RECs.[28]

A key factor making it difficult for New Jersey solar projects to secure long-term contracts is the three-year contract term for the state's Basic Generation Service (BGS), the default electricity supply option. New Jersey's Electric Distribution Companies (EDCs)[29] procure their BGS supply through an auction process every year. Each year the EDCs procure one third of their load for a three-year period. The winning bidders become BGS suppliers and have to meet all the requirements of being a PJM Load Serving Entity (LSE), including satisfying the RPS requirements. However, because the term of the BGS contracts is only three years, BGS suppliers are typically unwilling to sign contracts for periods longer than three years.[30]

Market uncertainty also contributes to the difficulty of securing long-term contracts for renewable energy projects in New Jersey. Two fundamental elements of uncertainty in the New Jersey REC market include:

1. Until recently, New Jersey had not defined a clear path for supporting solar market development in a post-CORE program rebate environment. The Board considered the issue on September 12, 2007, and a new long-term SACP schedule was specified in a Board Order released in December 2007. A long-term SACP schedule will allow SREC market values to increase to the level needed to provide larger projects with necessary SREC revenues in the absence of rebates. New Jersey's solar market stakeholders highlighted that SREC values will still be market-driven, and thus uncertain, under the new eight-year SACP schedule. The Board acknowledged this concern and addressed staff to convene a stakeholder process to further investigate the issue.

2. New Jersey's RPS rules are subject to change. Under Executive Order 66 (1978),[31] the BPU is required to re-evaluate its rules every five years. In addition, if the Board determines that the RPS is dysfunctional or placing an undue burden on ratepayers, it is within the Board's authority to go through a standard rulemaking process to change the RPS rules.

[27] New Jersey's solar industry representatives note that in the limited cases when lenders support projects that depend on future streams of revenue from the spot market, they discount the expected revenue by 70-90%—effectively nullifying the expected revenue for purposes of lowering the cost of capital. These values were verified through interviews with members of the financial community.

[28] Since all solar projects in New Jersey are net-metered, long-term contracting for energy sales is not necessary.

[29] New Jersey's EDCs include PSEG, Atlantic City Electric Company, Jersey Central P&L, and Rockland Electric Company.

[30] More information on the BGS auction process can be found at http://www.bgs-auction.com/bgs.auction.overview.asp.

[31] Executive Order 66, issued in 1978 by Governor Brendan Byrne, requires all regulations issued after 1978 to sunset five years after adoption of the regulation.

# 2.5 Renewable Energy Project Finance

While elements like public awareness, permitting, and interconnection policies all play an important role in fostering a successful renewable energy market, if project economics are not favorable enough to attract the attention of investors, the level of rapid and sustained market growth needed to achieve New Jersey's RPS will not occur. This is evidenced by the fact that New Jersey has the second largest solar market in the nation, while other states with significantly greater solar resources have seen much lower rates of solar development; New Jersey's combination of rebates, RPS requirements, and its ACP/SACP have provided renewable energy projects, and particularly solar projects, with some of the most favorable economics in the country.

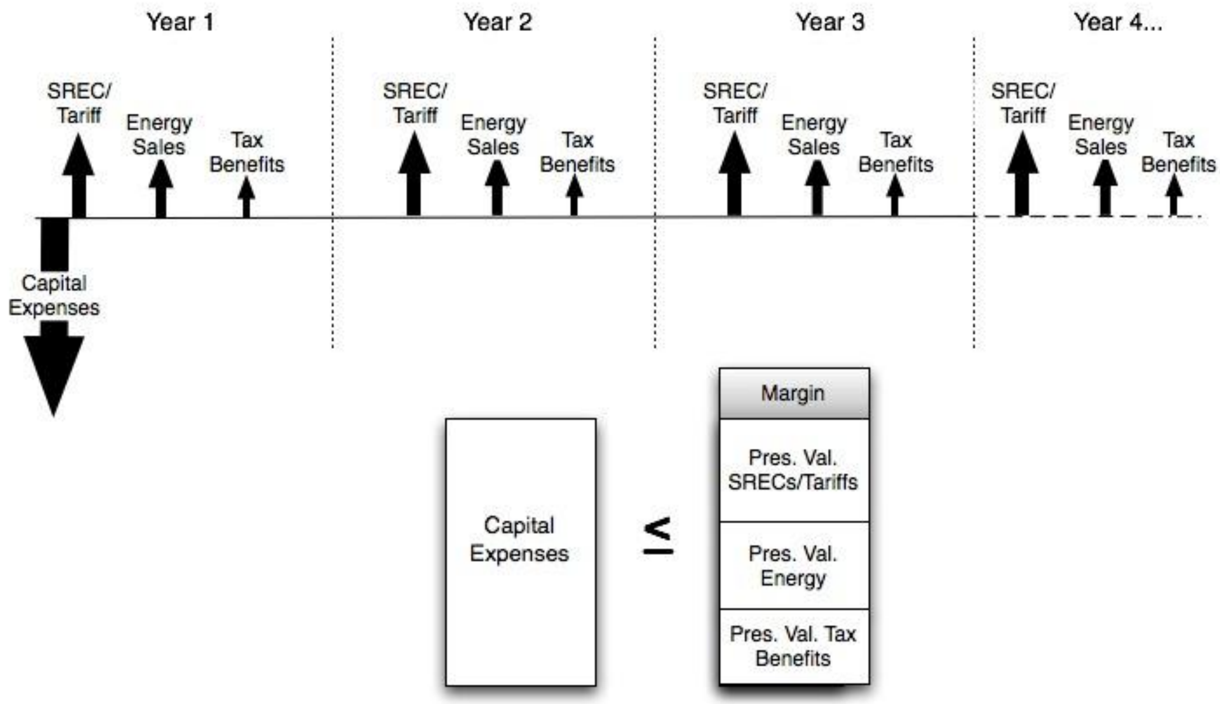
In order to design effective policies and programs, it is critical to understand how market interventions will be perceived in the eyes of investors. This section discusses some basic concepts related to renewable energy project finance. Topics discussed in this section include: PV project economics, risk allocation, and return on investment thresholds.

## 2.5.1 Renewable Energy Project Economics

The process for developing renewable energy projects depends heavily on the size of the project, the type of financing, and type of ownership structure. However, they all have certain elements in common. The projects are characterized by a large initial capital outlay that must then be recouped through a series of payments over many years.

Figure 2-3 provides a cash-flow schematic for a PV project, though all renewable energy project economics generally share the same fundamental components shown in this schematic. First, a large initial capital cost is incurred, then a series of revenue streams from the incentive or tariff payments, the energy payments (or retail electricity payments offset, in the case of net-metered systems), and the tax advantages accrue to the owner over a period of years.

**Figure 2-3. PV System Project Economics**




The bottom of the figure illustrates that for the project to be successful, the present value of all of the revenue streams—including the incentives—must be larger than the initial capital outlay.[32] The project developer must be able to recover enough revenue from the project quickly enough to make it profitable, or at least economically viable. This is problematic for PV projects in which the upfront costs are high and payback periods for unsubsidized projects can be in the range of 20 years or more. Furthermore, since the market for SRECs is new and thinly traded, the potential revenues available from SRECs in the out-years are seen as uncertain. Therefore, as noted earlier, these future SREC revenue streams are greatly devalued by the investment community.

Project economics vary significantly across the range of prospective owners. For example, corporate entities with large tax burdens are capable of taking advantage of the Modified Accelerated Cost Recovery System (MACRS) and Corporate Tax Credit, which together can dramatically reduce the

[32] For the sake of simplicity—and because they comprise a relatively small portion of the system economics—O&M costs of the system are not shown in the schematic.

effective cost of a PV system.[33] Residential PV system owners can also benefit from a tax credit, representing 30% of the system cost up to $2000.[34] However, public entities and non-profits that are tax-free are normally unable to benefit from any tax incentives.[35] Similarly, the cost per kW of PV systems decreases as the size of the system increases. Because of these variations, each class of project needs to be examined individually. Historically, the majority of systems receiving rebates through the CORE program are private systems under 10 kW. Many of these systems are likely to be owned by residential customer or small business owners with a relatively low tax burden. Therefore, these smaller projects see less benefit from the Federal tax incentives than do larger systems, and they are in greater need of the rebate funds.

Probably the simplest project example is a **residential** PV installation. In this case, the homeowner will typically self-finance the system either with personal savings or through a home-equity loan. Notice that in either case, it is not the value of the solar system that is securing the investment. For this reason, homeowners are able to be more patient about the returns on their investment. Given New Jersey's net metering rules, any electricity generated by the PV system would result in a reduction on the homeowner's electricity bill.[36] All of the risk for performance of the system that is not covered by warranty, and all the merchant risk, fall on the homeowner. In the same way, all of the risk associated with any kind of performance-based incentive—whether SRECs or tariffs—would also fall on the homeowner.

The next level of complexity is an **owner-financed commercial renewable energy system**. In this case, the system size is larger, but the owner (either an individual or a company) is still able to self-finance the system. Again, the financing for the project is either carried on the owner's balance sheet or is secured by some other asset. As with the homeowner, any performance risk or risk for the revenues falls on the owner.

The most general form of ownership is the **project-financed**, or non-recourse financed. In this case, the project capital cost is assembled from a variety of sources. For large power plants (e.g., wind farms), there can be many sources of funding, but for solar projects (and for the sake of simplicity) we will focus here on only two – debt and equity. The equity investors in a project take on the highest risk, but also have the largest upside potential. They get repaid only when the debt has been satisfied, but if the project is producing more revenue than is needed for the debt, they receive all of the excess.

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[33] The MACRS enables corporate entities to recover solar investments through an accelerated 5-year depreciation schedule. The Business Energy Tax Credit also provides commercial and industrial solar project owners with a 30% tax credit. This incentive would have expired at the end of 2007, but was recently extended through 2008 by Section 207 of the Tax Relief and Health Care Act of 2006 (H.R. 6111). Further information on federal tax incentives is available through the Database of State Incentives for Renewable Energy, http://www.dsireusa.org/library/includes/genericfederal.cfm?currentpageid=1&search=federal&state=US&RE=1&EE=0 or see next footnote.

[34] SEIA guide to Federal Tax Incentives for Solar Energy, Version 1.2, May 26, 2006. http://www.seia.org/manualdownload.php

[35] However, public projects can benefit from tax incentives if they negotiate creative ownership arrangements or purchase power agreements with third-party entities.

[36] This net metering benefit has substantial value since each kWh is offset at the retail electricity rate, including any associated fees that are charged on a per kWh basis.

The lenders that service the project finance market essentially lend their money against the revenues that the project will produce.[37] For this reason, they examine the revenue prospects of the deal very closely. They look closely at the various risks that the project will fail to produce the claimed revenue streams. For net-metered projects, the electricity "sales" revenue stream presents a low level of risk revenue.

However, the level of risk associated with the incentives that make the solar project financially successful depends a great deal on the type of incentive program in place. As discussed in the next section, there is great variability in the level of risk borne by the project owner(s) vs. that borne by the entity providing the incentive. The lender must evaluate the creditworthiness of the entity providing incentive revenues as well as the loan recipient, and then discount the value of the expected incentive revenues in calculating funds available for repayment of the loan. Typically, poor creditworthiness will result in a lower debt to equity ratio, which for solar systems means that the project developer or system owner must provide more upfront capital. This dilutes their earnings relative to their risk exposure and may result in an unacceptable situation from their point of view. Obviously if the project is to be built, some resolution must be found.

## 2.6 Risk Allocation

Risk allocation is one of the more important elements of project finance. It is an axiom of modern non-recourse financing that risk should be allocated to the party best able to manage it. So, for example, risk of construction delays would be assigned to the general contractor, and risks associated with equipment failure or design would be assigned to the equipment supplier.

There are three primary categories of risk involved with renewable energy project investment. These categories are summarized in Table 2-3 and described in the following paragraphs.

[37] The lenders are also secured by the plant itself, of course, but as with most foreclosures that is an undesirable last option.

**Table 2-3. Project Risk Categories**

| Risk Categories | Description of Potential Risks |
|---|---|
| **Equipment Risk** | • Poor quality equipment<br>• Poor-quality installation |
| **Performance Risk** | • A "bad" resource year (low insolation level for PV)<br>• Shading of a PV system<br>• Insufficient system maintenance |
| **Merchant Risk** | • Volatility in SREC / REC market pricing<br>• Exposure to spot-market pricing<br>• **Regulatory risk** (a sub-category of merchant risk) resulting from the uncertainty created by the possibility of changes to rules governing market. |

The first category is **equipment risk**. This is the potential for the equipment to not function as designed or to be improperly installed. This is normally covered by warranties offered by the installer and/or the manufacturer.

The second major class of risk is **performance risk**. This is a heading for a number of related causes that prevent the system from delivering the expected amount of energy. A primary one is renewable energy resource availability. In a "bad" solar year in which insolation levels are low, for example, the system will not produce as much energy as planned, and the revenues will be lower than modeled. Other examples of performance-lowering factors might be tree limbs or other greenery that begins to shade the solar panels for part of the day or failure to clean the panels regularly. This class of risk is naturally borne by the system owner, since s/he is best positioned to manage them.

The third class of risk is **merchant risk**. This is a term that describes the salability of the output of the system—power and SRECs—into the market. For net-metered systems, sale of the power is generally not considered an issue.[38] However, the sale of SRECs / RECs may be a larger and more important stream of revenue, and it is exposed to a variety of merchant risks. For example, new markets like those for RECs and SRECs are typically small and thinly traded. As a result, SREC values can be subject to rather wild volatility created by seemingly small disturbances. For example, the system owner may be forced to sell into a "down" market that would negatively impact the revenue stream.

A major factor affecting the merchant risk of RECs / SRECs is **regulatory risk**. Because the market for RECs / SRECs has been artificially created by the state government, any changes to the RPS goals, or the rules for buying and selling RECs / SRECs could cause a major disruption in the market. Some level of regulatory risk is inherently unavoidable in New Jersey and other states.[39] Since renewable energy

[38] Although, like other policies and market rules upon which solar investments depend, net metering policies are potentially subject to change during the investment time horizon for a PV system.

[39] For example, any decision by the New Jersey BPU must be renewed by the succeeding BPU commissioners. Executive Order 66 (1978).

systems have economic lives of up to 20 years or more, it is important to explore policy strategies that help to manage uncertainty surrounding future regulatory risk.

Another factor creating merchant risk is the term of the contract for RECs / SRECs. Ideally, lenders would like to see iron-clad, long-term contracts for the REC / SREC output. However, the entities that need RECs / SRECs to satisfy the RPS, the LSEs, are not typically interested in entering into a contract longer than three years since that is the contract term for the current BGS auction system. *This inability to secure long-term contracts creates uncertainty in the market and discomfort for lenders.*

One of the reasons that risk is so important is the effect that it has on financing. Lenders like to see that their money is well-shielded from risks over which they have no control. As the risk level rises, loans become both more difficult to find and significantly more expensive.

This factor is more evident for large systems where the loans are substantial and the lenders are likely to be more sophisticated about issues of risk. However, it is not absent for smaller and residential systems. Research has confirmed that some residential PV systems are being funded by home equity loans. In this case, the value of the home is used to secure the loan and the lender is indifferent to the associated revenues. However, it is important to note that now the homeowner is shouldering both the performance and the market risk for the PV system.[40]

## 2.6.1 New Jersey Risk Allocation

Under the CORE program as it has existed to date, the up-front rebate offered by the state has reduced a great deal of the financial risk associated with solar projects. New Jersey rebates and Federal tax benefits have offset the majority of the upfront cost of the renewable energy system for commercial and industrial system owners with an appropriate tax appetite.[41] The rebate and federal tax benefits have enabled residential system owners to offset roughly 50% to 64% of the capital cost of the system in the first year.

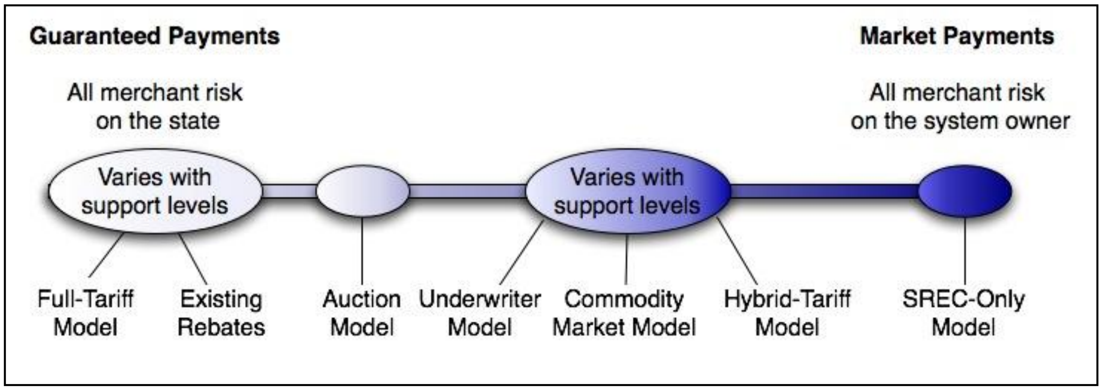
This limited risk profile has enabled rapid industry and market growth. However, in a post-rebate environment, the risk profile of projects is likely to shift dramatically. Project investors will need to absorb more of the project's financial and performance risk. A number of industry experts agree that the financial community is ready and willing to serve the needs of solar project investors, but they note that this absorption of risk by the financial community will come at a very high cost.

In fact, this question of merchant risk is not an "either/or" issue, but rather one that exists on a spectrum, as illustrated in Figure 2-4 below. Different market development / incentive strategies possess very different risk allocation portfolios. Figure 2-4 shows where a range of solar market development scenarios that have been considered by New Jersey sit on a spectrum of risk. As shown, under a system in which guaranteed payments are made to projects based on performance, the state must pay for the entire output of the system regardless of the values those SRECs might have in the marketplace. Therefore, the state carries the merchant risk, but the system owner carries none. On the other end of the spectrum, if solar project finance is wholly supported through SREC revenues, the project owner carries the full merchant risk. SREC values will vary based on market dynamics and no revenue is guaranteed.

[40] The consumer bears the equipment risk if they don't have a strong warranty.

[41] Note that accelerated depreciation benefits accrue over the course of multiple years.

**Figure 2-4. Merchant Risk Spectrum**




# 2.7 Return on Investment Thresholds

A project's risk is intimately tied to its return on investment. If New Jersey investors are to accept the level of risk offered by the New Jersey solar markets, they must see an acceptable level of return on investment. This requirement speaks to a variety of policy decisions, ranging from the structure of the incentive program itself, to the setting of ACP/SACP levels. Anything that reduces the investors' potential upside benefits, or increases their risk, will reduce their willingness to invest.

Current CORE program rebate levels provide projects with roughly a 10-year simple payback. Under this current program structure, up-front rebates reduce the risks to project investors, and thus, investors may be willing to accept lower levels of return on investment or longer loan terms. Based on feedback from the solar industry, this payback threshold is insufficient to stimulate the level of development necessary to meet RPS goals in a post-rebate environment.

Different classes of investors have different risk/return appetites. Industry stakeholders reported that the simple payback threshold is approximately five years for commercial consumers and approximately seven years for residential consumers.[42] These simple payback lengths are equivalent to internal rates of return (IRR) of 19% and 13% respectively, assuming a 20-year economic life and a consistent cost of capital in both cases.[43]

[42] Values based on results of a survey of New Jersey solar industry stakeholders conducted in December 2006. Twenty-nine industry stakeholders completed the survey.

[43] IRR is more commonly used by business investors than simple payback as a means of evaluating investments. IRR calculates the rate of return that exactly accounts for all of the costs and revenues over the expected life of the system. In order to effectively compare two investment opportunities, it is important for all parameters to be equal across the two comparison cases (i.e., cost of capital, interest rate, etc.).

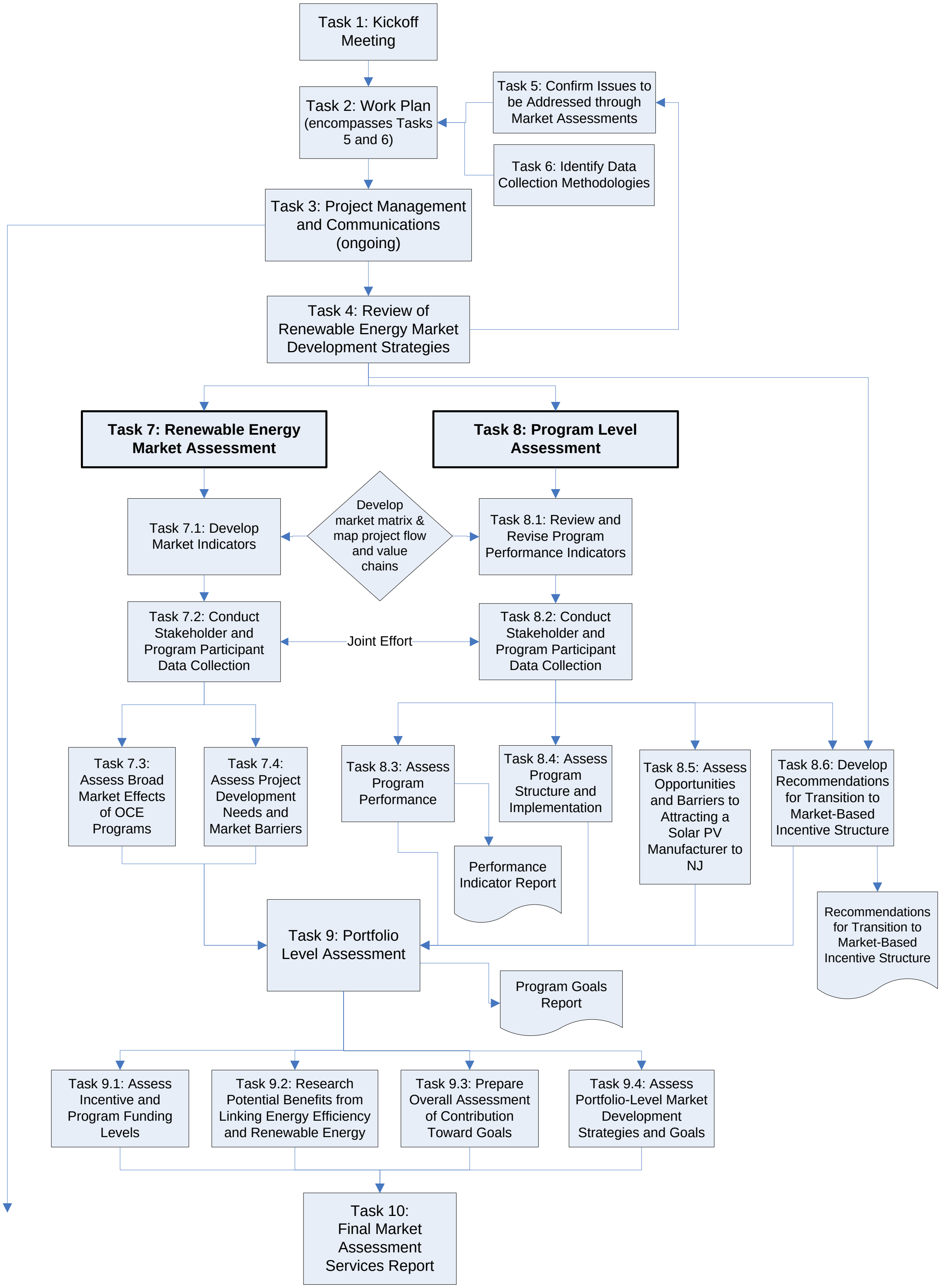
# 3 METHODS

## 3.1 Study Design

The study consisted of program-level and market level assessment tracks, which together formed the basis for an overall portfolio level assessment. The Summit Blue team began with a review of program and market level background information, then developed separate performance indicators for each of the programs included in the assessment as well as for the market-level assessment. Each survey and interview guide was developed to provide data pertaining to both the program and market level performance indicators, as well as a set of additional research questions for which the Board requested input. Survey and interview data, program records, New Jersey regulatory documents, and secondary data sources informed the program and market level assessments. In addition, the team drew on both primary and secondary data to conduct a review of market development strategies from other jurisdictions.

Results from the review of strategies from other jurisdictions, as well as the program and market-level assessments, were analyzed to complete the portfolio level assessment. Key outputs of the portfolio level assessment included recommendations for the structure and incentive format the Board should use to define its portfolio of programs going forward, as well as estimates of SBC funding required for the next funding cycle (2009-2012). The following flow chart provides an overview of the process the Summit Blue team followed to complete the market assessment.

## Figure 3-1. Project Process Flow Chart



# 3.2 Data Collection

Since New Jersey's renewable energy market is unique in a number of ways (i.e., the state has the largest solar RPS requirement in the nation, combined with the highest population density in the nation, and relatively small onshore wind and biomass resources) primary data collection played a critical role in the market assessment. In order to capture a variety of perspectives, a combination of surveys and interviews were used to gather feedback from a wide range of market actors. In all, 177 surveys and interviews were conducted, and nearly half of these were in-depth interviews. Additional primary data sources reviewed included relevant regulatory documents, program data, program marketing materials, and RPS compliance data.

Survey and interview activities were closely coordinated to ensure that each contact with a market actor used a comprehensive set of questions addressing all issues of relevance to the project. Survey instruments and interview guides were provided to the BPU project manager in draft form for comment. A list of market actors surveyed is included in the primary data collection summary table (Table 3-1).

A survey of CORE program participants was a significant data collection effort for the project. The CORE program has the greatest level of activity and participation of any of the programs under review, and its participants were able to provide a wealth of valuable market information used in the assessment. Participant in-depth interviews were also conducted for the REPGF program. Only six projects have been approved for funding through the program. Attempts were made to complete interviews with all six participants but only two completes were achieved.

The next most substantial primary data collection effort was a set of interviews with 42 developers, including 32 who have participated in projects funded through New Jersey's renewable energy incentive programs, and 10 non-participants. In addition, a number of stakeholder interviews were conducted. While some targeted cells in the data collection plan had fewer completions than planned, others had more completions than planned. The overall number of completed surveys and interviews exceeded the targets.

**Table 3-1. Summary of Surveys and Interviews Conducted**

| Market Actor | Data Collection Mode | Sample Source | Targeted Completions | Actual Completes |
|---|---|---|---|---|
| Participating end-use customers (CORE program) | Telephone Surveys | program database | 70 | 70 |
| Participating developers (CORE/SREC/BTM REC)[44] | Telephone Surveys | program database | 30 | 30 |
| Participating developers (Renewable Energy Project Grants and Financing program) | Telephone Surveys | program database | 5 | 2 |
| Non-participating developers | Telephone Surveys | SREC/BTM REC program database, program staff | 10 | 10 |
| Other SREC and REC participants (e.g., aggregators, brokers, LSEs, Platform managers: CPM and PJM-EIS) | Telephone Interviews | SREC/BTM REC database<br>PJM-EIS GATS List | 10 | 12 |
| Equipment manufacturers and distributors | Telephone Interviews | N/A | 10 | 5 |
| Participants on RPS Transition Working Group | Email Survey | Listserv of Working Group Participants | 4 | 20 |
| Representatives from the financial community | Telephone Interviews | N/A | 4 | 4 |
| National and regional industry association and government representatives | Telephone Interviews | N/A | 4 | 4 |
| Representatives from renewable energy funding agencies in other states | Telephone Interviews | Database of Statewide Incentive for Renewable Energy | 6 | 9 |
| BPU program staff | Telephone Interviews | BPU staff | 4 | 4 |

[44] Includes solar and wind installers, as well as biomass project developers.

| Market Actor | Data Collection Mode | Sample Source | Targeted Completions | Actual Completes |
|---|---|---|---|---|
| Distribution company (utility) representatives | Telephone Interviews | BPU staff recommendation regarding appropriate utility staff | 4 | 2 |
| Clean Energy Council (CEC) Representatives | Telephone Interviews | Clean Energy Council | 3 | 3 |
| Economic Development Authority (EDA) | Telephone Interview | EDA | 1 | 1 |
| Department of Environmental Protection (DEP) | Telephone Interview | DEP | 1 | 1 |
| **Total** | | | **171** | **177** |

Additional primary data sources examined for the market assessment include:

- program databases and data files current through the end of 2006[45]
- New Jersey Clean Energy program (NJCEP) website[46]
- New Jersey's Clean Energy program YTD 4th Quarter 2006 data
- Energy Information Administration (EIA) electricity pricing and sales data[47]
- PJM electricity load growth rate for New Jersey
- New Jersey Clean Power Estimator[48]
- Database of State Incentives for Renewable Energy (DSIRE)[49]
- Union of Concerned Scientists' Renewable Electricity Standards Toolkit[50]

For the CORE program indicators, multiple sources of data were used to create the 2001 through 2006 summary tables contained in this assessment. Installed capacity data for program years 2001 through mid-2003 are from the New Jersey Clean Energy program website, as these data were not included in the

45 The CORE program database used in this analysis contains data for projects completed from mid-2003 through the end of 2006 (file date January 5, 2007).

46 NJCEP website. http://www.njcep.com/html/res-installed/renew_ener_sys_instll.html

47 EIA. EIA-861- Average price by state provider. http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html, and EIA. Table 5.6.B. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date through November 2006 and 2005. http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html, and EIA, Electric Power Annual 2005- State Data Tables. 1990-2005 Retail Sales of Electricity by State by Sector by Provider. http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html.

48 New Jersey Clean Power Estimator, http://www.njcep.com/html/estimator.html, Zip code: 08607, Trenton, NJ.

49 www.dsireusa.org

50 http://go.ucsusa.org/cgi-bin/RES/state_standards_search.pl?template=main

program database files provided to the research team. Data for mid-2003 through 2006 is from CORE program data files. For certain indicators (i.e., avoided emissions and generation values), additional data sources and assumptions were used. Data from the New Jersey Clean Energy program YTD 4th Quarter 2006 data sheets were used for 2006 indicator values.

For the REPGF program and REBVA program indicators, a combination of program records and staff input were used as data sources. For market level indicators, a combination of BPU staff summary data files and program-specific data files were used. Unless otherwise noted, data presented in this report is current through the end of 2006, and reflects only projects that had *received payment* as of December 31, 2006.

***Secondary data sources*** were used to supplement the primary data and played an important role in the review of market development strategies from other jurisdictions. Policy studies conducted by the Lawrence Berkeley Lab, National Renewable Energy Lab, the Clean Energy States Alliance, and others played a central role in the secondary research. The team also reviewed other key documents that provided necessary background for conducting the market assessment work and insights into the optimal portfolio of market development strategies for the Board to pursue going forward.

## 3.3 Analytic Assumptions

For annual generation estimates, the capacity factor assumptions highlighted in Table 3-2 were used.

**Table 3-2. Capacity Factors**

| Technology | Capacity Factor | Source |
|---|---|---|
| PV | 12% - 13%[51] | Consistent with Clean Power Estimator calculations and industry estimates |
| Biomass | 70 - 85% depending on the application[52] | EPRI Renewable Energy Technical Assessment Guide, TAG-RE-2002, Final Report, December 2002 |
| Wind | 15% (small on-shore)<br>29% (large on-shore)<br>34% (off shore) | Small and large on-shore based on manufacturer data provided to the Board.[53] Off shore data based on European experience. |
| Fuel Cell | 75% | EPRI Renewable Energy Technical Assessment Guide, TAG-RE-2002, Final Report, December 2002 |
| Small Hydro | 25-50%* | Hydro resources are very sensitive to a siting and seasonal resources, thus Summit Blue has used a range capacity factor |
| MSW | 85% | EIA 2004 Renewable Energy Annual |

** Representative range for this technology*

To estimate the energy generation from the renewable energy systems installed under the CORE program from mid-2003 through 2005, the Summit Blue team estimated the energy produced by each system installed using a capacity factor approach for wind and biomass projects, and the Clean Power Estimator tool for solar projects. Capacity factor assumptions were 15% for wind, 70% for biomass, and 75% for fuel cell projects. For solar projects, the New Jersey Clean Power Estimator was used to predict the annual generation depending on system size, module tilt and orientation, and the number of months during the calendar year in which the system was operational.[54] All systems were assumed to begin generating electricity on the inspection date and continue through 2006.

Projects that were completed during 2001 through mid-2003 were not included in the CORE program database. Therefore, the Summit Blue team estimated electricity generation based on a capacity factor for

[51] There is some debate over the correct capacity factor to assume for solar in New Jersey. Because system orientation and location varies, a range of 12% to 13% is acceptable. A 13% capacity factor was used for estimating annual generation for systems installed through the CORE program from 2001 through mid-2003, a period for which detailed system records were not available. OCE uses a 12% capacity for its own generation estimate. Estimating a capacity factor PV in New Jersey remains challenging until all PV systems are metered.

[52] The following capacity factors were assumed: landfill gas 85%; wastewater biogas 75%; gasification 80%; anaerobic digestion 75%; combustion 85%.

[53] These data were accessed through OCE records for OCE funded projects through the end of 2006.

[54] For solar electric projects with no module orientation or module tilt listed, it was assumed that the orientation was South and the tilt was zero degrees.

solar projects of 13%, a value corresponding to the New Jersey Clean Power Estimator output. Because no installation date for these projects is available, generation is estimated to begin at the start of the year in which the projects received funding. Generation estimates for projects completed in 2006 were taken directly from the New Jersey Clean Energy program YTD 4th Quarter 2006 data sheets.

Electricity cost savings for all CORE projects were estimated using the generation estimates from the methods described above, and attributing residential rates to 38% of projects, and commercial rates to 62% of projects. This is consistent with CORE program data.

The electricity cost savings for both the CORE program projects, and for projects developed under the entire set of renewable energy programs were determined by using the average electricity price for 2001 through 2006 from the EIA (Table 3-3).

**Table 3-3. Average electricity rates in New Jersey**[55]

| Year | Residential Rates ($/kWh) | Commercial Rates ($/kWh) |
|---|---|---|
| 2001 | 0.1021 | 0.0909 |
| 2002 | 0.1038 | 0.0890 |
| 2003 | 0.1067 | 0.0911 |
| 2004 | 0.1123 | 0.0996 |
| 2005 | 0.1174 | 0.1061 |
| 2006 | 0.129 | 0.1189 |

To estimate avoided environmental emissions, the Summit Blue team used data from the NJCEP 4th Quarter 2006 data sheets (Table 3-4).

**Table 3-4. Average Annual Output Emissions Rates**[56]

| Pollutant | Emissions rate (lbs/MWh) |
|---|---|
| NOx | 2.8 |
| SO2 | 6.5 |
| CO2 | 1,520 |
| Hg | 0.0000356 |

[55] EIA. EIA-861- Average price by state provider. http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html for 2003-2005 data and EIA. Table 5.6.B. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date through November 2006 and 2005. http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html for 2006 data.

[56] New Jersey's Clean Energy program YTD 4th Quarter 2006 Data, Sheet 36.

A load growth rate of 1.5% was assumed for the purposes of calculating RPS MWh requirements in future years. This is consistent with PJM's projected demand growth rate for New Jersey. While actual electricity growth rates in the state have been higher than this in recent years, a key goal for New Jersey's Energy Master Planning process is to reduce electricity demand by 20% by 2020. Assuming the goals of the Energy Master Plan, scheduled for release during the Spring of 2008, are implemented, the 1.5% load growth assumption should provide conservative estimates of future RPS requirements.

For the purposes of maintaining consistency in program evaluation and monitoring methods, programs have been evaluated based on the amount of installed capacity that has *received incentive payment* as of the end of 2006. These projects are described as "completed" throughout the remainder of this report. In some cases, additional capacity has been installed, but has not received payment, and therefore is not included in the values presented in this assessment.

One project of particular note is the Jersey Atlantic Wind project. The 7.5 MW wind project was installed in 2005 with commitments to receive funding through both the CORE program (for the 2.635 MW of capacity serving on-site load), and from the Renewable Energy Project Grants and Financing (REPGF) program (for the 4.875 MW of capacity serving the electric grid). As of the end of 2006, the project had received its first payment under the REPGF program in 2006 ($173,759 of a total grant commitment of $1,696,000), but had not yet received payment from the CORE program. For the purposes of this assessment, 4.875 MW is counted toward the total amount of wind capacity "completed" in 2006 for the REPGF program evaluation, though the portion funded through the CORE program will not be counted as completed until 2007, when the project actually receive payment from the program. However, because the project is by far the largest wind project installed to date in New Jersey, for the purposes of the market-wide assessment, the research team counted the full 7.5 MW of capacity from the project as "completed" in 2006 to provide a more accurate representation of the installed wind capacity which existed by the end of the assessment period.

Some discrepancies may exist between the NJCEP website and the values presented in this assessment due to the fact that the NJCEP website does not include fuel cell projects and does include projects that are pending payment. Because fuel cell projects installed under the CORE program do not run on renewable fuels, they are not eligible to contribute to New Jersey Renewable Portfolio Standard (RPS) compliance. Therefore, where applicable, data is shown both including and excluding fuel cell projects.

# 4 Overview of Program and Market Performance

This section provides a high level summary of program performance for the CORE, Renewable Energy Project Grants and Financing (REPGF), Renewable Energy Business Venture Assistance (REBVA), and SREC / Behind the Meter (BTM) REC trading system. In addition, the research team was asked to review the potential for introducing a PV manufacturing incentive program. Discussion of the potential for a manufacturing incentive program is included in this section as well. A detailed market-level assessment is included in Volume 2, Section 2, and a detailed program assessment is included in Volume 2, Section 3.

A summary of key indicator estimates for the two programs resulting in installed capacity development is provided in Table 4-1. All values pertain to completed projects (those that received program payment) as of the end of 2006.

**Table 4-1. Summary of Key Indicator Estimates, CORE and Renewable Energy Project Grants and Financing**[57]

| Indicator | CORE | Project Grants and Financing |
|---|---|---|
| Number of processed applications | 2,813 | 9 |
| Number of completed (paid) projects | 1,898 | 2 |
| Number of days to process applications | | |
| *average from 2001-2006* | 35 days | initial application reviews, 30 days; complete evaluations, 60-120 days |
| *2006 only* | 131 days[58] | N/A |
| Number of completed RE installations (by project size & RE type) | 1,897[59] | |
| *Solar* | 1,880 | 0 |
| *Wind* | 5 | 1 |
| *biomass / landfill gas* | 5 | 1 |
| *(fuel cells)* | 7 | 0 |
| Installed Capacity (MW) | 31.04 including fuel cells; 29.54 excluding fuel cells | 6.5 |
| *Solar* | 27.33 | 0 |
| *Wind* | 0.04 | 4.875 |
| *biomass / landfill gas* | 2.17 | 1.6 |
| *(fuel cells)* | 1.5 | 0 |
| Installed Costs ($/kW, 2006) | | |
| *Solar* | $7,901 | N/A |
| *Wind* | $7,172 | $1,280 |
| *biomass / landfill gas* | $3,232 | $2,420 |
| *(fuel cells)* | $6,193 | N/A |

[57] All data are based on projects completed (paid) through 12/31/06 and are excluding fuel cell data unless otherwise noted. This is due to the fact that fuel cells funded thus far have not been fueled by renewables, and therefore, are not RPS Class I eligible resources.

[58] This substantial increase in the length of time to process applications in 2006 was due to the Board's need to queue applications to avoid making more commitments than could be served by the budget. It does not indicate poor performance on the part of the application processing team. Because the value for 2006 was so much higher than for earlier years it is shown separately here.

[59] One project completed in 2006 is of unknown type. Therefore, the actual total number of projects is 1,898.

| Indicator | CORE | Project Grants and Financing |
|---|---|---|
| Total incentives paid | $126,875,301[60] | $686,984 |
| Annual generation from systems (MWh) | | |
| *Solar* | 26,421 | 0 |
| *Wind* | 49 | 13,967 |
| *biomass / landfill gas* | 13,071 | 12,516 |
| *(fuel cells)* | 9,855 | 0 |
| Total | 49,396 including fuel cells<br>39,541 excluding fuel cells | 26,483 |
| Cumulative avoided $CO_2$ emissions (metric tons) | 49,227[61] | 26,884 |
| Estimated annual electricity cost savings for participants | $4,509,292[62] | N/A |

## 4.1 CORE Program

The CORE program has facilitated impressive growth in solar capacity over the past four years. The program provides incentives for solar, biomass, wind and fuel cell projects that are under 1 MW in size and serve on-site load. A summary of installations completed under the CORE program through the end of 2006 is provided in Figure 4-1.

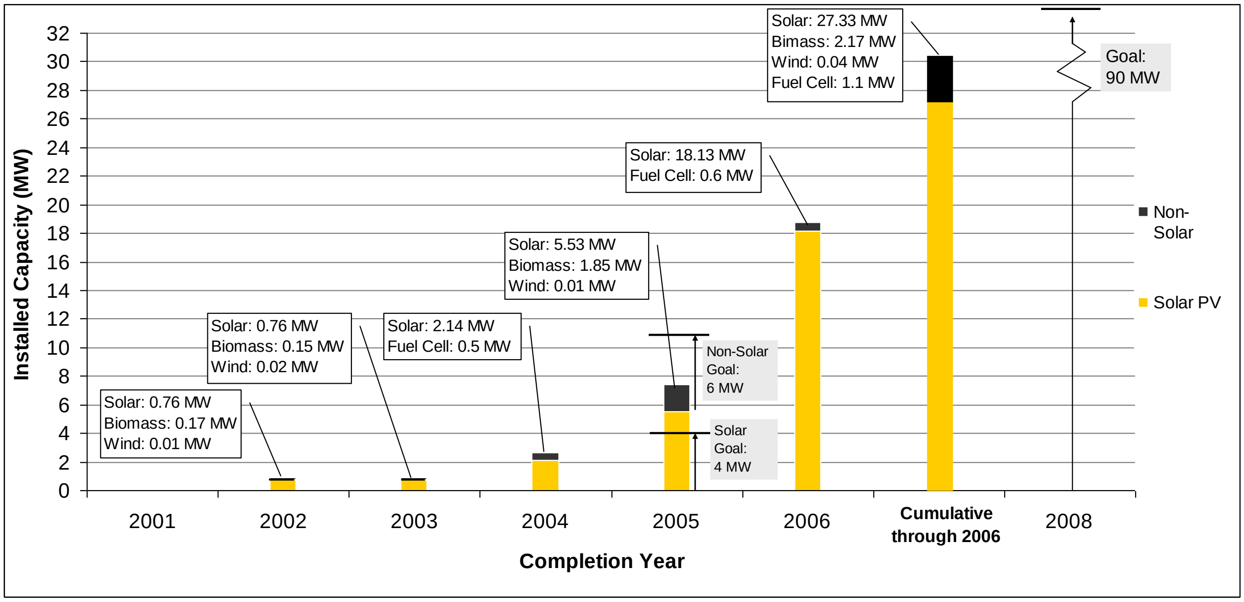
As discussed in Section 3.3, only projects that received funding and are considered by BPU as "completed" as of the end of 2006 are included in the program level assessments. As a result, the Jersey Atlantic Wind project is not included in the figures presented here for the CORE program, though 2.6MW of the 7.5 MW project did receive funding through the CORE program in 2007 and will be included in any future assessment of the program covering the 2007 period.

[60] Figure excludes fuel cells.

[61] Figure excludes fuel cells.

[62] Figure excludes fuel cells.

**Figure 4-1. Summary of CORE Program Project Development Through 2006**




From its inception in 2001 through the end of 2006, nearly 4,300 applications were processed, and nearly 2,000 incentives were processed during this period. The program has achieved all of its objectives related to installed capacity and application processing, with the exception of one. The state did fall short of its goal to complete 6 MW of non-solar capacity in 2005; only 1.9 MW of non-solar (biomass and wind) capacity was completed in that year. Based on the pace of solar development to date, and given the transition that is underway in the funding mechanisms for solar projects, it is likely that the Board will meet its goal to install 90 MW of solar by the end of 2008.

Commercial systems make up 40% of the installed capacity funded through the program, followed by residential systems (38%), K-12 schools (11%), government (5%), universities (4%), and non-profits (1%). A total of $131,557,613 in rebates had been paid through the program as of the end of 2006.[63] From 2001 through 2006, systems installed through the program are estimated to have generated a total of 49.4 GWh of electricity, avoiding the emission of 49,227 metric tons of carbon dioxide, 211 metric tons of sulfur dioxide, 91 metric tons of nitrous oxides, and 0.001 metric tons of mercury.

Given New Jersey's strong commitment to solar market development, expressed through its aggressive solar RPS requirements, a focus on the solar market was warranted during the past two years to try to "fix the system" without causing too much disruption to the PV development momentum and market infrastructure currently in place. Forming a queue of prospective program participants was a necessary step to ensure that program commitments did not exceed available budget. The formation of such a long queue is an indication of the great demand for solar among consumers in the state, and developers' ability to sell projects. However, developers argue that uncertainty about the future of the program hindered their ability to sell *new* projects (beyond those in the queue) and made difficult business planning decisions. If the Board had implemented lower initial rebate levels, and/or made more gradual downward adjustments

[63] Including fuel cells.

in rebate levels along the way in response to excess demand, this may have helped minimize the sense of urgency that has existed in the New Jersey solar market.

Results from a survey of CORE program participants indicate that the rebate played a pivotal role in their decision to install a renewable energy system. Only 26% of survey respondents said they would have installed the system if the CORE program rebate was just 25% less than they received, and 94% of respondents indicated that the rebate made it possible for the investment to meet their simple payback requirements. The majority (86%) of survey respondents also expressed a preference for a fixed, upfront rebate as opposed to alternative financial incentive structures. CORE program participants were generally satisfied with the level of financial and staff support they received through the program, until the program became oversubscribed and a large queue developed. Current satisfaction with the CORE program is low.

Interviews and surveys with program participants and developers also provided important information on market barriers and the program's role in addressing them. Developers indicated that the top barriers to program participation are regulatory and REC price uncertainty (24%), followed by high first costs (13%), siting and permitting (7%), and access to financing (5%). Forty-nine percent of developers also cited other barriers including program instability, lack of sufficient funding, and general market uncertainty. Developers explained that the Board has changed the rebate levels multiple times without sufficient notice which has significantly disrupted the sales cycle. Some developers cited the stability of New York's incentive program as something New Jersey should emulate. Others pointed to Delaware as an example of a REC system that provides investors with great certainty, though this market has not yet proven its success as it not fully implemented.

A greater amount of notification time leading to changes in rebate levels, or a more well-defined, transparent long-term plan regarding the schedule of rebate levels would have likely provided for greater program stability. However, given the conditions that arose in the program, rebate level changes were necessary in order to avoid over-spending the program budget. While stronger long-term planning efforts should be pursued in the future, it is important to recognize the enormous challenge BPU has faced in its efforts to achieve such large solar installation targets. Like New Jersey, many other states have struggled to balance priorities and identify the most appropriate incentive levels in the midst of changing market conditions. For further discussion of renewable energy market development strategies in place in other jurisdictions, see Volume II, Section 4.

The top barrier reported by participanting end-users was first costs (54%) followed by structural limitations of buildings (30%), specific program requirements (19%), and lack of education and awareness (16%). Six percent of participants reported lack of available financing as a barriers. Other barriers reported by participants included aesthetics (4%), permit availability (4%), uncertainty about contractors (3%), and not remaining in the home/building long enough for project payback (3%).

Related to the upfront cost barrier, some developers noted the timing of rebate payment as a major program deficiency, explaining that it can be difficult for project owners and/or developers to bridge the gap between the point at which they must pay for equipment and labor, and the point at which they receive rebate payment. Some project owners or developers must take out loans for the period between project completion and rebate payment and interest payments are non-trivial.

A few developers explained that financing is available, but that conditions are not generally as favorable as they should be since lenders fail to view the solar equipment as an asset. Developers noted that homeowners without much equity in their homes can have difficulty securing project financing.

With regard to the effects of program outreach and marketing, participating developers gave the program a high score for the extent to which it has influenced public awareness (2.7 out of 3). Many respondents commented that without the program there would be virtually no market for PV in New Jersey. However, several developers indicated that this effect is mainly due to the program's existence rather than its actual marketing and outreach efforts, explaining that the majority of marketing and outreach activities are performed by installers and developers.

## 4.2 Renewable Energy Project Grants and Financing Program

The REPGF program and its predecessor programs, the Grid Supply program and the Renewable Energy Advanced Power Plant program have made funding available for development of renewable energy projects larger than 1 MW that do not serve on-site load. The program is administered in collaboration with the New Jersey Economic Development Authority (EDA). EDA manages the financing aspects of the program while the Board handles the technical components. From 2001 through 2006, only two projects received program funding: the 7.5 MW Jersey Atlantic wind farm owned by Community Energy, and the 1.6 MW Atlantic County landfill gas project. Approximately $687,000 in grant funding was disbursed through the program through the end of 2006. The wind project has only received a relatively small portion ($173,759) of its total approved grant funding ($1,696,000), as the grant is paid in increments based on system performance.

The two funded projects produce approximately 26,483 MWh annually, avoiding the emission of 26,884 metric tons of carbon dioxide, 115 metric tons of sulfur dioxide, 50 metric tons of nitrous oxides, and 0.001 metric tons of mercury. In addition to the two funded projects, three additional landfill gas projects were approved for funding as of the end of 2006, and one biogas project was approved for funding in 2007.

The program fell short of its key objective for 2005: to install 19 MW of renewable energy capacity. Only 1.6 MW of capacity was funded in 2005. The 7.5 MW wind farm did go online during 2005 but did not receive program funding until late 2006. Other 2005 program objectives were to process six applications and to process applications in an expeditious manner. The program received three applications in 2005 and only one was approved. According to program records, the program did achieve objectives for efficient processing of applications. The Board also has a market-level objective to develop 300 MW of Class I renewable energy systems by the end of 2008, including 210 MW of non-solar capacity. Given REPGF program progress, it is not likely that BPU's programs will achieve this goal.

Staffing constraints, program requirements and market barriers have contributed to the REPGF program's difficulties achieving its installed capacity objectives. Staff renegotiated award amounts for some projects based on reviews of applicants' project financials which indicated that applicants did not need financial support in order to facilitate development. And in 2006, staff stopped accepting applications. However, based on participant feedback, and given the limited amount of non-solar Class I resources that have been developed to date, significant barriers still exist for non-solar Class I resource development in New Jersey.

Two project developers that have worked on projects funded or approved for funding through the program were interviewed, as well as one project owner representative and an EDA representative. Program funding levels and timing of grant payment were both cited as substantial barriers. The project developers expressed that increasing the existing funding cap (20% of project costs) to something in the range of 30% or more would result in increased construction of landfill gas and other renewable energy projects. The developers also explained that receiving funds upfront rather than post-completion would help significantly. In contrast to the comments of the developers, one program participant noted that public projects finance with bonds and that availability of upfront funding is not an issue. The participant also explained that his/her funded project would have been completed at the same time and at the same size even in the absence of program funding.

Ten developers not participating in BPU's renewable energy programs were also interviewed. The top barriers to large non-solar project development cited by these developers included siting and permitting (38%), high first costs (13%) and lack of information (13%). These developers explained more bureaucracy and NIMBYism exists in New Jersey than in other states in the region such as Pennsylvania.

All interviewees expressed frustration with New Jersey's heavy emphasis on solar both in its outreach and education efforts, and its program funding. Given the ability of non-solar resources to fulfill RPS requirements at much lower unit costs than solar resources, it is imperative that the Board increase its attention toward the development of these resources.

## 4.3 Business Venture Assistance Program

The goals of this program and its predecessors (the Market Infrastructure Development program and the Renewable Energy Economic Development program) have been to develop renewable energy businesses, technologies and market infrastructure, and to leverage public and private funding to advance the technologies and services needed to support a thriving renewable energy industry in New Jersey. A total of 11 projects have received funding under the program to date, with grant and other incentive funding totaling nearly $5 million through the end of 2006. The program has supported business and technology development activities related to a wide range of technologies including hydrogen, wave power, thin film PV, inverters, and power conditioners. In addition, the program has funded education and training activities and provided a $2.2 million loan to support the development of PJM's Generation Attribute Tracking System (GATS) which tracks REC trade throughout the PJM region in support of RPS compliance and other policies. As of the end of 2006 period of analysis, nine projects that submitted applications for funding in 2005 were still pending approval. The research team has learned that seven of those projects were sent rejections in early 2007, and that two were approved in early February, 2008. No applications are currently being accepted under the program.

Due to the research team's emphasis on solar market-related issues and programs focused on directly supporting development of installed capacity (CORE and REPGF programs), participants in the Business Venture Assistance program were not surveyed or interviewed as part of this assessment. Therefore, the analysis is limited to available program data and is less detailed than that completed for the CORE and REPGF programs.

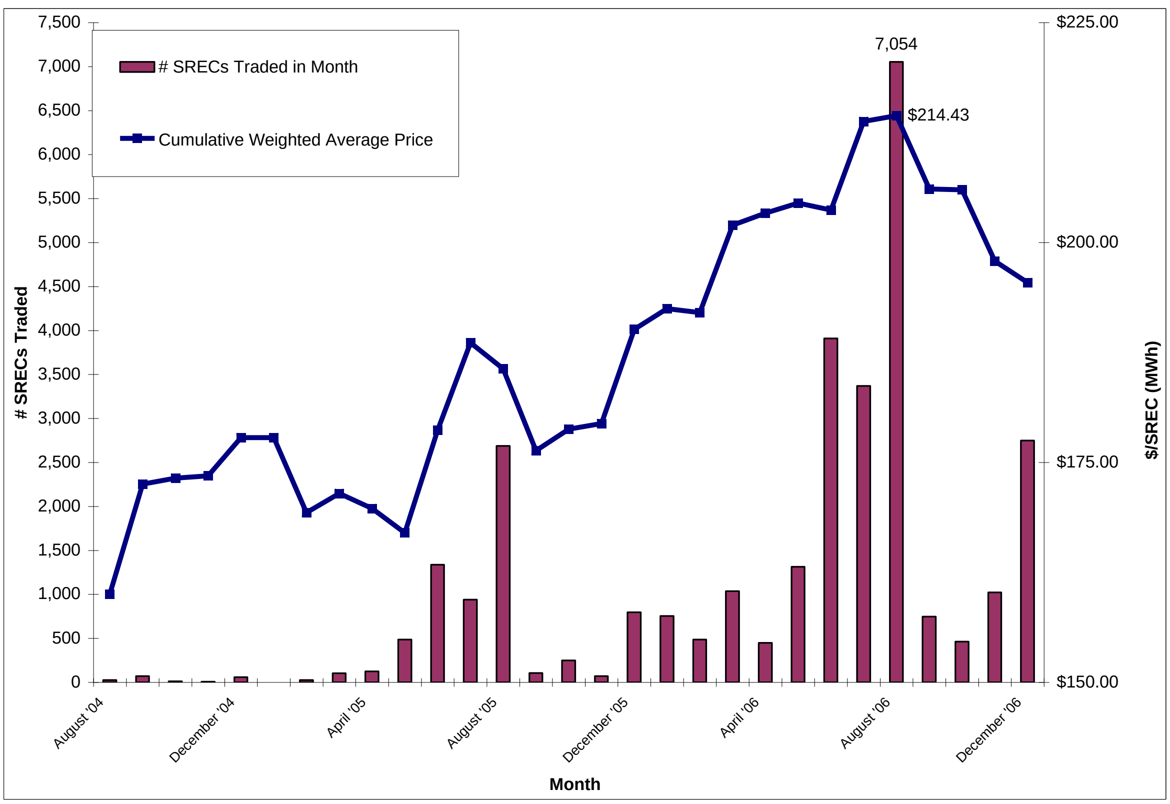
## 4.4 SREC / Behind the Meter (BTM) Trading System

A review of the SREC / BTM REC trading system was included as part of this market assessment though no specific goals have been set by the Board for the system. In particular, the Board was interested in the research team's assessment of the feasibility of transitioning BTM REC trade to the PJM GATS certificate trading system. New Jersey's SREC / BTM REC trading system was introduced in 2004 to verify and track the transfer of SRECs needed to comply with New Jersey's RPS, as no other REC trading system existed in the region at that time. The PJM GATS certificate trading system did not become operational until 2005. The SREC / BTM REC trading system was designed and is administered by Clean Power Markets (CPM). CPM provided customer service to trading system users and provides the Board with periodic summaries of trading activity, including SREC trading values.

As of March 2007 a total of 2,034 renewable energy systems were actively participating in the SREC / BTM REC trading system. Of those, 2,022 systems were PV, six were wind and six were biomass. Fifty-nine account holders represented more than one solar facility. Ninety-three percent of account holders were residential, 5% were commercial and 1% was public entities. A total of 12,747 SREC / BTM RECs were issued during the 2006 Reporting Year, 10,723 were retired, and 10,287 were used for RPS compliance (10,450 required for RPS compliance).

Publishing SREC pricing data helps improve the liquidity of the market and can be important for smaller players in the system that may be less savvy about the value of SRECs. However, some brokers and other market actors interviewed as part of the market assessment downplayed the importance of the SREC pricing reports, claiming that the larger players rely more heavily on broker data. In addition, as noted above, the pricing data is currently reported by the seller without being verified by the buyer. This could present the potential for misreporting which could affect market pricing. A simple step that could be taken to limit the potential for misreporting would be for the reported pricing information to be included in the email notifying the SREC buyer that the transaction has been initiated. The administrator could instruct the buyer to report any inaccuracies in the information. A summary of SREC / BTM REC pricing from August 2004 through December 2006 is provided in Figure 4-2. As shown in the figure, SREC pricing rises substantially in September of 2005 and 2006 at the end of the true-up period for the previous Reporting Year.

**Figure 4-2. SREC Pricing and Volume of Trading**




Source: Clean Power Markets

It appears that Clean Power Markets is performing well in its role as SREC trading system administrator, and that the SREC trading system is functioning smoothly. The majority of CORE program developers interviewed expressed satisfaction with the use of SRECs in New Jersey and the SREC trading system specifically. Developers explained that SRECs are an important component of the value proposition that helps sell projects and make them economically feasible for both residential and commercial customers. Developers believed that the SREC trading system is functioning well and the average overall level of satisfaction with the trading system, including the certification process, trading system structure, and staff support, was 4.2 on a 5-point scale, with 5 being the highest score. In addition, 74% of CORE program survey respondents ranked their satisfaction with the SREC trading system at a 4 or 5 on a 5-point scale, with 5 being the highest score.[64]

Going forward, it will be worthwhile to ensure that all CORE funded projects are participating in the SREC trading system. Only 45% of PV system owners responding to a survey of CORE program participants reported that they have used the SREC trading system to sell their SRECs.[65] While this reflects the fact that RECs associated with a significant portion of participants' systems (24% of respondents) are owned by the project developer, 6% reported that they did not know who owns the RECs associated with their system. Furthermore, the SREC trading system administrator indicated that follow up to encourage REC program participation would be helpful in the future.

Regarding the issue of transitioning SREC / BTM REC trade to the PJM GATS, the research team found that the benefits outweigh the costs of doing so, and recommends such a transition. Transitioning to GATS would simplify the RPS compliance process for suppliers since they could work through one certificate trading system. A transition to GATS would also reduce administrative costs for the Board. Additional benefits of GATS are that it is a robust regional system subject to the scrutiny of many participants and regulators throughout the PJM territory, and use of the system would improve regional compatibility with other markets. There are currently BTM systems trading RECs in GATS, and there are no fees for generators smaller than 10 MW. Furthermore, the GATS administrator has expressed a willingness to support the needs of smaller BTM participants. The primary arguments against transitioning to GATS include issues related to verification of system location and performance, loss of SREC price transparency, and the complexity and potential cost of using GATS. However, since the Board must certify generators as New Jersey RPS Class I / SREC eligible there would be opportunities to apply the Board's own verification procedures and metering requirements. Also, the Board could take alternative steps to monitor SREC pricing, and could provide assistance to smaller system owners to ensure that the complexity of GATS system is not a barrier to REC market participation.

Another key issue related to the SREC system that the research team reported on is whether SRECs should be issued to non-net metered solar projects. Currently, SRECs can only be issued based on output from "customer-generators'" solar systems that are "interconnected to an electric distribution system that supplies New Jersey."[66] Therefore, in order for a solar system to be eligible to receive SRECs it must be net metered and located in New Jersey. There is a 2 MW net metering limit in New Jersey and production from net metered system must not exceed the customer's average electric load on an annual basis. Large utility scale solar projects have much more favorable economics than smaller systems; however, they would still likely require some amount of SREC revenue to be economically viable. While utility-scale PV projects do not provide the same distribution system benefits that are provided by net metered systems, they still provide important emission free electricity that will help New Jersey achieve it sizable solar RPS requirement. Furthermore, enabling large systems to contribute SRECs for RPS compliance will result in lower ratepayer costs than if net metered PV systems only are allowed to contribute to the solar RPS. Given the strong economies of scale associated with large PV projects and the aggressive solar

[64] Thirty-one respondents answered this question out of a total of 70 survey participants.

[65] Sixty-nine respondents answered this question out of a total of 70 survey participants.

[66] N.J.A.C. 14:8-2.9.

RPS requirement in New Jersey's RPS, the research team believes some SREC value should be provided to large projects.

Given the Board's recent move to adopt an eight year rolling Solar Alternative Compliance Payment (SACP) schedule with the SACP starting at over $700 / MWh, it is conceivable that a large solar project could command much higher SREC revenues than are needed to make the project economically viable (resulting in windfall profits), or that large projects could drive the SREC values down below what smaller projects need to be economically viable. However, market forces will set SREC prices, and it is in the interest of ratepayers for SREC prices to be lower. If New Jersey wishes to support smaller projects, rebates and other financial support mechanisms can be used.

## 4.5 PV Manufacturing Incentive Program

New Jersey has allocated funds in the past to establish a PV manufacturing incentive program but no such program has been developed to date. The Summit Blue Team was tasked with exploring whether New Jersey should introduce such a program. Research completed as part of this assessment indicates that a PV manufacturing incentive program would not be the best use of New Jersey's clean energy funds. Incentives required would be very high, there is strong competition from other states with existing solar manufacturing capacity and manufacturing incentive programs, and many major manufacturers have recently invested in or are committed to capacity expansions elsewhere. Furthermore, all four of the manufacturers interviewed as part of this assessment said it would be more productive for New Jersey to focus incentive dollars on project-level incentives rather than on the manufacturing sector. New Jersey should focus on establishing stability in its solar market and demonstrating its long-term commitment to building the market, as interviewees indicated that a major barrier to locating a manufacturing facility in the state is the short-term incentive planning cycle. While a PV manufacturing incentive program is not recommended specifically, it is recommended that the Board collaborate with the Economic Development Authority (EDA) to leverage potential economic development benefits associated with renewable energy industry growth. Working in collaboration with EDA, the Board should also look for opportunities to target available EDA funds toward businesses in the renewable energy sector.

# 5 PORTFOLIO-LEVEL ASSESSMENT

## 5.1 Introduction

This section presents the results of analysis completed for BPU's portfolio of renewable energy programs as a whole. Building on program and market specific analyses presented in detail in other sections of the report, the team examined the portfolio's overall contribution to BPU goals to date. The analyses also consider interactions among economic potential for Class I resource development, market barriers, the needs of potential participants, and available program strategies. Based on these analyses, a recommended portfolio of market development strategies and program budgets for the next SBC funding cycle are presented, along with technology-specific incentive levels. The recommended portfolio is designed to help New Jersey achieve its RPS requirements in a cost-effective manner while diversifying the state's energy supply portfolio and growing the local economy.

## 5.2 Analytic Framework

The analytic framework for the portfolio level analysis consisted of the following steps:

1. Review RPS requirements and economic potential of Class I and solar resources;
2. Review program and market accomplishments to date;
3. Review market development strategies available for application in New Jersey;
4. Match market needs with appropriate strategies;
5. Assess existing portfolio's success in meeting market needs;
6. Rank technology market segments for prioritization of deployment; and
7. Recommend portfolio of programs, operational and capacity development goals, and SBC funding levels.

This section is organized to coincide with the analytic framework outlined above. Later sections of this report provide detailed discussion of some of the components that contribute to this portfolio level analysis. This section of the report provides summary discussion of each of the components of the analytic framework, but is focused on steps 3, 5, and 6.

## 5.3 Existing Renewable Energy Goals and Economic Potential

Existing goals for renewable energy development in New Jersey come from two primary sources. RPS requirements were used as the basis for estimating all market-level capacity development goals.

Additional program-specific and operational goals are outlined in the BPU Strategic Plan for 2005,[67] as well as BPU's 2005 Annual Report and recent program evaluation reports.

## 5.3.1 RPS Requirements

As discussed in Volume 1, Section 2 of this report, New Jersey's RPS requires all electricity suppliers in the state to include in their electric energy portfolio electricity generated from renewable energy sources. These sources are divided into three classes:

1. Solar electric generation produced in-state (generating NJ SRECs)
2. Class I Renewable Energy: solar electric, wind, wave or tidal, geothermal, landfill gas, fuel cell powered by renewable fuel, anaerobic digestion of food waste and sewage sludge, combustion of biomass (e.g., bioenergy, wood)
3. Class II Renewable Energy: hydroelectric less than 30MW capacity, electricity from a resource recovery facility

The required percentages for solar electric and Class I resources increase in every Reporting Year through 2021. The percentage for Class II stays at 2.5% in all years. The total share of renewable energy rises from 3.25% in 2005 to 22.5% in 2021. The final share of energy for each category in 2021 is: solar electric 2.12%, Class I renewables 17.88%, and Class II renewables 2.5%.

Based on current electricity sales and projections for growth in energy use in New Jersey, it is projected that the RPS will require a total of 21,331 GWh to be generated in Reporting Year 2021 from Class I renewables, including solar (this is 20% of total electricity usage in the state[68]). Capacity requirements will depend on the capacity factors of the different types of technologies installed. The solar set aside will require 2,261 GWh of this total to be generated from solar, requiring 2.2 GW of solar capacity to be installed. This is based on a 12% capacity factor for solar PV.[69]

## 5.3.2 Renewable Energy Economic Potential

### Navigant Report

Navigant Consulting performed a renewable energy potential study in 2004 for the whole state of New Jersey.[70] This report provides an assessment of the potential for a variety of grid-sited and customer-sited renewable energy technologies. The summary table below presents technical potential and economic potential for Class I renewable generation by 2020. For some of the technologies, all of the technical

[67] New Jersey Board of Public Utilities Strategic Plan, December – Revision 1 (2005).

[68] This value is based on current projections, and does not include possible impacts of the New Jersey Energy Master Plan, which is not yet final but which is anticipated to include a goal of reduction in load of 20% by 2020.

[69] A 13% capacity factor was used in portions of the CORE program and market level analysis for estimating generation from existing solar for which more accurate data were not available. The 13% capacity factor is consistent, on average, with estimates produced using the Clean Power Estimator tool and the parameters of existing installations. However, a 12% capacity factor was used for solar in the portfolio level analysis. This provides a more conservative estimate of solar development needs.

[70] *New Jersey Renewable Energy Market Assessment*, August 2004, prepared by Navigant Consulting Inc. for The Board of Public Utilities

potential is economic, and for other technologies the economic analysis showed that only some of the technical potential is economically viable.

**Table 5-1. Summary of Technical Potential & Economic Potential for Class I Renewable Energy by 2020**

| Technology | Technical Potential (MW by 2020) | Economic Potential (MW by 2020)* |
|---|---|---|
| Onshore Wind Power | 127 | 127 |
| Offshore Wind Power | 2,500 | 2,250 |
| Solid Biomass Power (combustion and gasification) | 114-240 | 108 |
| Landfill Gas | 64 | 64 |
| Biogas from Wastewater Treatment | 23 | 23 |
| Central Station PV | 300 | 88 |
| Customer-sited PV – Residential | 10,390 | 3,245** |
| Customer-sited PV – Commercial | 7,390 | 2,840** |
| **Total Potential** | **20,975** | **8,745** |

**Economic potential for grid supply technologies based on high incentive and REC price ($45/MWh)*
*** Economic potential for residential and commercial customer-sited PV based on current NJ rebate and SRECs at $100/MWh*

It should be noted that the SREC price of $100, on which the economic potential for customer-sited PV was based for the Navigant potential study, is low when compared to the SREC prices that were forecast in the solar market transition ratepayer impact study completed by Summit Blue.[71] The prices forecast in the Summit Blue report were in the range of $300 to $1,200. Therefore, actual economic potential may be higher for customer-sited PV than the estimates given in the Navigant report, despite the high likelihood that current rebates will stop being available some time before 2020. Conversely, the assumed REC value for non-solar resources, $45/MWh, is higher than the average prices for New Jersey Class I RECs in through 2005.[72]

[71] "An Analysis of Potential Ratepayer Impacts of Alternatives for Transitioning the New Jersey Solar Market from Rebates to Market Based Incentives." Summit Blue Consulting, August 6, 2007.

[72] Wiser, R. C. Namovicz, M. Gielecki, and R. Smith. "Renewables Portfolio Standards: A Factual Introduction to Experience from the United States." Lawrence Berkeley National Laboratory, April, 2007. Based on data from Evolution Market's monthly pricing reports compiled by Lawrence Berkeley National Laboratory. Evolution Markets. It is important to recognize that the Evolution Markets' pricing summary does not reflect all trades occurring in the markets. However, the REC pricing data does provide an indication of the relative value of RECs in different markets.

## Rutgers Biomass Potential Study

A more recent study was done by the New Jersey Agricultural Experiment Station[73] at Rutgers University specifically for biofuels. This study includes, among other things: an assessment of the characteristics and quantity of New Jersey's biofuels resources; the technologies that are capable of producing bioenergy in the form of electric power; and policy recommendations for moving New Jersey into the forefront of bioenergy innovation.

The study found that:

1) New Jersey's estimated practically recoverable biomass resource of 5.2 million dry tons (MDT) could deliver up to 1,075 MW of New Jersey's electricity power demand.
2) Bioenergy will likely require moderately high fuel prices, technology advances, and financial incentives to be commercially competitive.
3) Based on assumptions about population growth and efficiency improvements, the potential exists for bioenergy to grow to over 1,350 MW by 2015.
4) The total energy potential from feedstock that could classify as Class II Renewables could potentially add up to 500 MW (not included in the total above).

Estimated costs for electricity produced from bioenergy are included in the report for 2007, and also projected to 2010 and 2015, for seven categories of generating technologies listed below:

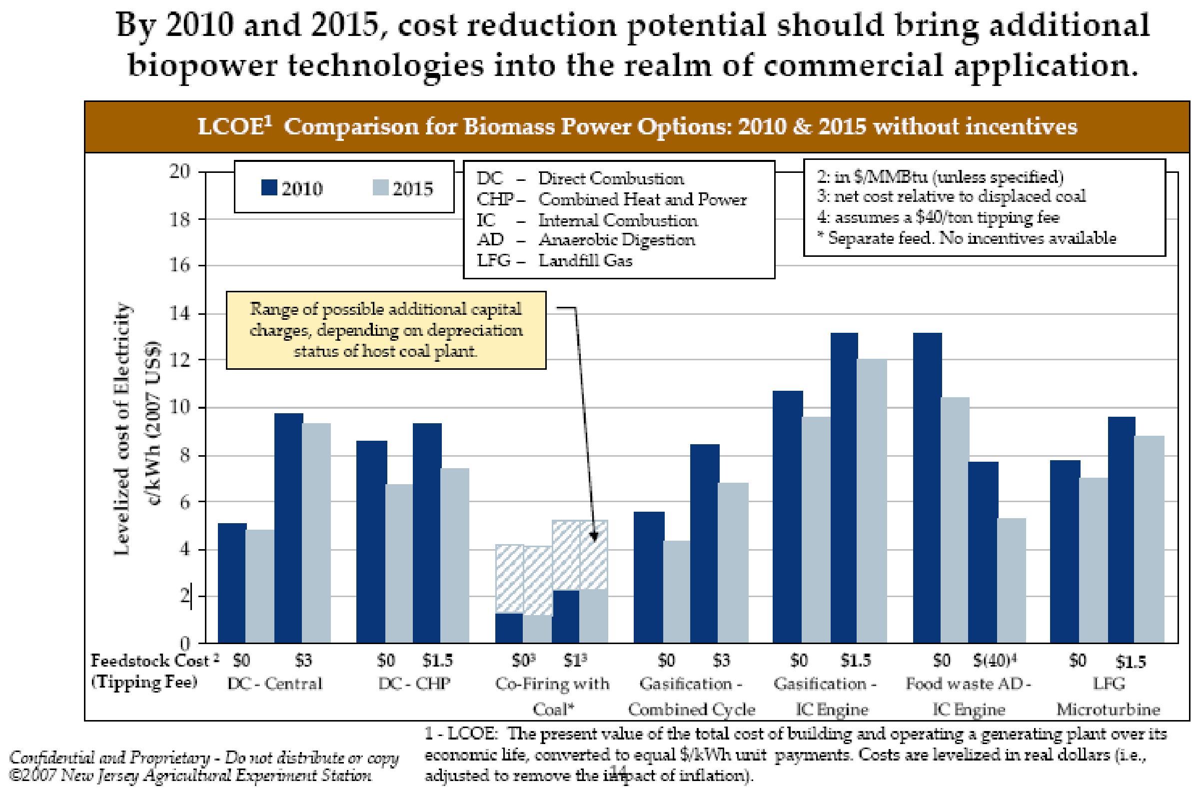
- Direct combustion, central
- Direct combustion, combined heat and power
- Co-firing with coal
- Gasification, combined cycle
- Gasification, internal combustion engine
- Food waste, anaerobic digestion, internal combustion engine
- Landfill gas, micro turbine

Generating costs are calculated based on both low and high feedstock prices. Levelized costs for electricity generation for 2010 and 2015 are shown in the graph below from the Rutgers report. These can be compared to conventional fossil fuel generation costs of 4.5 to 7 ¢/kWh at today's prices (future generating costs are not predicted here but they will most likely have risen by 2015).[74]

[73] *Assessment of Biomass Energy Potential in New Jersey, Draft Report*, April 2007. Prepared by The New Jersey Agricultural Experiment Station for the NJ BPU.

[74] This report was provided by staff at Rutgers University with permission to quote from it for the purpose of this study.

**Figure 5-1. Levelized Cost of Electricity from Biomass by 2015**




The practically recoverable potential for bioenergy given in this report (1,350 MW by 2015) is much higher than in the Navigant report, which gives a total technical potential of 328 MW by 2020 for all biofuels.

This report indicates that both Class I and Class II RPS requirements could be met with a high proportion of bioenergy if its potential is realized, but the costs of most of the technologies are not currently competitive without incentives. If the levelized cost of electricity from different technologies is compared with today's production costs for fossil fuel plants, four technologies are already competitive without incentives:

- Direct combustion (with low feedstock cost)
- Co-firing with coal
- Gasification combined cycle (with low feedstock cost)
- Food waste, anaerobic digestion (with high tipping fee)

## 5.3.3 Revised Development Potential and Relationship to RPS Goals

The table below shows the revised total technical and economic potential for New Jersey Class I renewable generation by 2020 (2015 for Biomass), utilizing data from *both* the Navigant and the Rutgers biomass reports. The only adjustments made to the technical and economic potential presented in Table 5-1 were to reflect the updated biomass technical and economic potential values provided in the 2007 Rutgers assessment.

**Table 5-2. Revised New Jersey Renewable Generation Potential by 2020**

| Technology-Market Sector | Economic Potential MW[3] | Economic Potential MWh[1] | Technical Potential MW | Technical Potential MWh |
|---|---|---|---|---|
| Onshore Wind Power | 127 | 322,631 | 127 | 322,631 |
| Offshore Wind Power | 2,250 | 6,701,400 | 2,500 | 7,446,000 |
| Bioenergy by 2015 (incl. Landfill Gas) | 783[4] | 5,673,414 | 1,350[2] | 9,460,800 |
| Central Station PV | 88 | 100,214 | 300 | 341,640 |
| Customer-sited PV – Residential | 3,245 | 3,411,144 | 10,390 | 10,921,968 |
| Customer-sited PV – Commercial | 2,840 | 3,234,192 | 7,390 | 8,415,732 |
| Total | **9,333** | **19,442,995** | **22,057** | **36,908,771** |

*Notes:*
*1 MWh values based on average capacity factor for each technology.*
*2 Total technical potential for biofuels is based on total MW capacity by 2015 from Rutgers potential study.*
*3 Economic potential for grid supply technologies(except bioenergy) based on high incentive and REC price ($45/MWh) case in Navigant study.*
*4 Economic potential for biofuels based oncategories of "practically recoverable" dry tons of biofuels (Rutgers), associated heat rates, and associated technology efficiencies.*

Note that the majority of the economic potential capacity for renewables development within New Jersey (64%) is residential and commercial solar (i.e., customer-sited PV). Comparing projected requirements for electricity generation defined in the RPS for Class I renewables, and the economic potential figures above, the renewable energy resources within New Jersey will likely fall just short of the amount needed to meet the RPS requirements. A potential 19,976 GWh of economic generating capacity could be developed by 2020, and the Class I RPS requirement is forecast to be approximately 21,331 GWh in Reporting Year 2021. The solar production necessary to meet the solar set aside (expected to be 2,261 GWh/year) must be subtracted from this potential, leaving a total of 17,715 GWh of potential supply available to meet the rest of the Class I renewables goal. However, it should be noted that these are projections, and many of the assumptions, including the RPS requirement, are likely to change during the next twelve years,

Looking at the 2009 to 2012 SBC funding period, the RPS requirements for 2012 are forecast to be 6,895 GWh for Class I resources and 367 GWh for solar. This 2012 Class I requirement represents approximately 30% of the estimated total potential by 2020.

Given the high cost of solar resources relative to non-solar Class I resources, LSEs will likely procure lower cost RECs from generators throughout the PJM region to meet their non-solar Class I RPS requirements. However, because of the substantial transmission and distribution system and economic development benefits of in-state renewables development, the Board should make an effort to maximize in-state development.

# 5.4 Contribution of Program Portfolio Toward Market and Program Goals to Date

## 5.4.1 Summary of Program and Market Performance Relative to BPU Goals

BPU has been highly successful in achieving PV market development and installed capacity growth, and is on track to achieve its PV development goals for 2008. However, the state will likely fall short of its goal of installing 210 MW of non-solar Class I renewables by the end of 2008. The Board has also missed its operational goals for the Renewable Energy Project Grants and Financing program, and Business Venture Assistance program.

Note that progress toward installed capacity goals has been measured based on the amount of capacity that had received funding as of the end of 2006. Additional capacity had been installed and was operational by the end of 2006 but was outside the scope of this assessment.

**Table 5-3. Summary of Program and Market Performance Relative to BPU Objectives**

| Objective | Status[75] | Objective Achieved ? |
|---|---|---|
| *Market Level* | | |
| By 12/31/08, install 300 MW of Class I renewable energy generation capacity in NJ, of which a minimum of 90 MW is from PV. | As of 12/31/06, 39 MW of Class I renewable energy capacity was funded through BPU programs; of which 27 MW was solar PV. A total of 115 MW of Class I resources were installed in the state including non-program-funded landfill gas. | An additional 185 MW of Class I renewable energy by 12/31/08; of which 63 MW must be solar PV and 122 MW must be non-solar resources.[76] |
| By 12/31/08, 6.5% of electricity in NJ should be provided by Class I or Class II renewables (defined in RPS), including 4% from Class I resources, and 120,000 MWh (90 MW) from solar.[77] | As of 12/31/06, NJ-sited renewable resources produced enough electricity to supply a total of 1.05% of the state's electricity load:<br>Class I, 0.64%; Class II 0.37%; Solar, 0.03% | In 2006, Class I generation was 15% of what is needed to meet 2008 goal, Class II generation was 14% of what is needed, and solar generation was 22% of what is needed. |

[75] Excluding 1.5 MW of fuel cells and correlating generation.

[76] This assumes that the 300 MW goal pertains to all installed renewable energy capacity, whether or not a project received funding through a BPU program.

[77] "BPU 2005-2008 and Beyond Strategic Plan"

| Objective | Status[75] | Objective Achieved ? |
|---|---|---|
| ***CORE Program*** | | |
| Process 600 applications in 2005. | 1,219 applications processed in 2005.<br>496 rebate payments issued in 2005. | Yes |
| Install 4 MW of PV systems in 2005. | 5.5 MW of PV capacity was installed in 2005. | Yes |
| Install 6 MW of other (non-solar) RE systems in 2005. | 1.9 MW of biomass and wind capacity were installed in 2005. | No |
| Process initial applications for rebate funding in 30 days. | Initial applications were processed in less than 30 days in 2002-2005. | See status comments |
| Process applications from final application to QC inspection in 14 days. | The average was one day for 2003-2006 due to negative process times recorded in database.[78] | Yes |
| Process rebate checks in 30 days from QC inspection. | The average was 63 days for 2003-2006. | No |
| ***Renewable Energy Project Grants and Financing Program*** | | |
| Process 6 applications in 2005. | None – solicitation on hold. | No |
| Install 19 MW of RE systems in 2005. | 1.6 MW were built in 2005. | No |
| Initial application review completed within 30 days of receipt; evaluation of application by evaluation team done in 90 days; issue grant payments within 30 days of final approvals. | Application reviews were completed in 30 days. Evaluations done by the DEP and EDA took 60 to 120 days. No projects received final approvals in 2005. | Yes |

[78] The elapsed time from receipt of final application to date of inspection has been tracked here because one of the program implementation goals set forth in the 2005 OCE Compliance Filing was "Perform QC inspections within 14 days of receipt of final application." However, program staff report that the program has not implemented any policies or procedures linking the timing of receipt of final application to timing of the inspection. Therefore, many systems have been inspected before the receipt of the final application form and vice versa, accounting for the many instances of negative elapsed time between receipt of final application and inspection. Program staff has taken steps to ensure timely inspection of completed projects, allowing inspections to occur either before or after submittal of final application paperwork. Therefore, the program has adhered to the *intent* of the program performance goal referenced here.

| Objective | Status[75] | Objective Achieved ? |
|---|---|---|
| ***Renewable Energy Business Venture Assistance Program*** | | |
| Approve 10 applications in 2005. | No applications were approved in 2005. 18 proposals were submitted in response to the solicitation and 10 were sent to DEP for review. | No |
| BPU completes initial review of applications in 30 days. | Initial reviews were completed in 30 days. | Yes |
| Evaluation of applications completed by evaluation team in 90 days. | Due to a change in the review team, this goal was not met. | No |
| Approve applications that support 4 different technologies. | Projects funded under the 2003 solicitation included hydrogen, wave, PV and one related to power conditioning for a variety of technology applications. | No |
| Leverage $3 in private capital for every dollar of program funds allocated to the program. | Insufficient data available. | No |
| Locate 5 new renewable energy businesses in New Jersey. | While no projects were funded in 2005, 10 businesses received grants through 2004; all with NJ offices. | No |

### 5.4.2 Progress toward Achieving RPS Requirements

To date New Jersey's electricity suppliers have been able to meet the RPS requirements in all three categories (Class I, Class II and solar). Meeting the RPS solar PV requirement in Reporting Year 2008 is expected for Reporting Year 2009.

The RPS stipulates that only the solar set-aside requirement must be met with in-state generation. New Jersey's electricity LSEs could acquire a large portion of their Class I RECs from elsewhere in the PJM region. However, the Board seeks to generate as many RECs as possible from eligible in-state resources because of the economic development, grid congestion relief, energy independence and other benefits this would provide. In addition, many other states in the PJM region also have RPS policies and there will be heavy competition for the lowest cost resources in the region that would qualify as Class I eligible in New Jersey. Therefore, this analysis has focused on the potential for in-state renewable energy development, and the incentives needed to trigger development of these potential resources.

Looking at how many of the RPS requirements have been generated in state so far, the data show significant challenges ahead. In order to meet the 2008 RPS requirement of 5.5 percent,[79] New Jersey will need 4.8 million MWh of renewable generation.[80] Renewable generation within New Jersey in 2006 was only 0.5 million MWh. Therefore, if New Jersey electricity suppliers were required to meet the 2008 RPS

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[79] Note this is different from the 6.5% OCE generation target for 2008.

[80] The projected load for 2008 (87,887,103 MWh) is based on 2007 retail sales data provided by OCE staff (86,588,279) assuming 1.5% annual load growth.

renewable requirement with renewable energy generated in New Jersey, it would require an additional 4.3 million MWh of generation from qualified sources, which implies an unlikely increase in the rate of growth of renewable capacity in the State.

Table 5-4 provides a summary of the RPS goals and in-state generation through the end of 2006.

**Table 5-4. In-State Generation Compared to RPS Goals**

| Class I | Goal for 2006 (MWh) | Generation to end of 2006 (MWh) | NJ Supply as % of Goal |
|---|---|---|---|
| Solar (minus solar set-aside requirements) | | 12,081 | |
| Wind | | 21,542 | |
| Biomass/LFG | | 489,131 | |
| Total Class I Generation | 829,193 | 522,754 | 66.2% |
| | | | |
| Class II | 2,047,420 | 314,191 | 15.3% |
| | | | |
| Solar Set-Aside | 14,340 | 14,340 | 100% |


| Class I | Goal for 2006 (MWh) | Generation to end of 2006 (MWh) | NJ Supply as % of Goal |
|---|---|---|---|
| Solar (minus solar set-aside requirements) | | 12,081 | |
| Wind | | 21,542 | |
| Biomass/LFG | | 489,131 | |
| Total Class I Generation | 829,193 | 522,754 | 66.2% |
| | | | |
| Class II | 2,047,420 | 314,191 | 15.3% |
| | | | |
| Solar Set-Aside | 14,340 | 14,340 | 100% |


These data show that as of the end of 2006, generators located in New Jersey produced enough electricity to meet all of the solar set aside requirements, 66% of the Class I and 15% of the Class II RPS requirements. In this comparison, the solar MWh are first applied to the solar set-aside requirement, and then the rest are applied to the Class I requirement. It should be noted that 56% of the in-state Class I generation in 2006 was from non-program-funded landfill gas generation.

# 5.5 Policy Options and Program Interventions Available

This section first provides a discussion of the pros and cons of market development strategies available for application in New Jersey.

## 5.5.1 Pros and Cons of Market Development Strategies

As part of a review of renewable energy market development strategies being implemented in other jurisdictions (summarized in Volume 2, Section 4 of this report), the Summit Blue team explored how a range of strategies for renewable energy market development are being implemented elsewhere. In addition, a variety of strategies proposed by New Jersey solar market stakeholders were analyzed in detail as part of the Summit Blue team's services to support the solar market transition process (Volume 2, Section 5). Of the strategies discussed as part of the solar market transition, the full range of strategies deemed relevant to the New Jersey market have been evaluated qualitatively for broad application in advancing the New Jersey renewable energy market.

Note that for the purposes of this portfolio level analysis, the team has considered only the basic elements of the proposed solar market transition models, rather than considering the detailed models as they were proposed by stakeholders. Recognizing that many details could be adjusted to make a particular concept more or less favorable (i.e., length of tariff commitments, or contract terms used in an auction/contract model), and that different combinations of strategies could be used, each of the strategies were considered individually at the conceptual level, assuming that all potential opportunities to make the strategy workable would be pursued by the Board. Because the RPS requirements are so crucial in defining the renewable energy market in New Jersey, and because stability is so essential to maintaining regulatory certainty, changes to the RPS or to compliance mechanisms have not been considered as an option.

The same four categories of criteria used for the qualitative assessment of solar market transition strategies were used for this analysis: *sustained orderly development, transaction costs, ratepayer impacts, and support for other policy goals*. In addition, based on input from the Division of Rate Counsel, market efficiency was used as additional criteria for evaluating options.[81]

The Summit Blue team scored and ranked each of the strategies according to the evaluative criteria. Strategies with direct implications for project finance were considered separately from the more general strategies. Because the strategies vary in their scope and were considered in their conceptual form, the results of the scoring exercise could not provide precise, conclusive results. However, the results do provide input regarding the set of strategies which appear most promising for application in New Jersey. Based on the outcome of the qualitative analysis, the ranking is intended to provide an indication of which strategies possess the *most* versus the *least* overall attributes, rather than as a tool for selecting one *ideal* solution. Combinations of strategies need to be considered together to address the needs of different market sectors (i.e., utility-scale projects versus on-site generation), and to ensure that the ultimate package of incentives provides both market-based elements and some level of revenue certainty. For example, the Board is pursuing a long-term SACP schedule as a means of providing market- and performance-based incentives to solar projects. However, the Board is also in the process of evaluating additional strategies to provide the market with greater revenue certainty, and may choose to pursue one of the other strategies presented here.

Strategies that provide projects with a strong element of long-term revenue certainty ranked most highly. Facilitating long-term contracts ranked at the top of the list of finance-related strategies because it is a conceptually simple, low-cost approach that meets many of the needs of the marketplace. The hybrid tariff approach ranked ahead the full tariff approach because it enables the REC market to continue to play a central role, which will likely foster greater long-term market sustainability. The long-term SACP schedule ranked toward the middle of the list, but potential for applying additional strategies to provide greater revenue certainty are currently being explored through a stakeholder process. If the long-term SACP schedule is implemented in together with another strategy aimed at providing greater revenue certainty, this combination of tactics may produce positive results for the market. Among the general strategies, the top ranked strategies included establishing a clear, long-term plan for program structure and

[81] Economic efficiency was included under the "ratepayer impacts" criteria category for the qualitative assessment of solar market transition models. However, as the Division of Rate Counsel highlighted, another important type of efficiency to examine is the extent to which a model promotes competition and drives down costs.

incentives; sector-specific and geographically-targeted outreach and incentives, and providing consistently updated resource and market data.

**Table 5-5. Summary of Strategy Ranking**

| Strategies Directly Affecting Project Finance | Rating | General Strategies | Rating |
|---|---|---|---|
| Rating system: ■ = greatest number of attributes; ◘ = moderate number of attributes; □ = fewest number of attributes | | | |
| Facilitate / Require Long-Term Contracting | ■ | Establish clear, long term plan for program structures and incentive types | ■ |
| Hybrid Tariff / Performance Based Incentive<br>*(system receives non-energy revenue both from a limited guaranteed incentive and from REC sales)* | ■ | Sector-Specific Targeted Outreach and Incentives | ■ |
| Full Tariff / Performance Based Incentive *(system receives all non-energy revenue from guaranteed incentive payments)* | ■ | Geographically Targeted Outreach and Development Assistance | ■ |
| Auction Set Pricing | ■ | Provide consistently updated resource and market data | ■ |
| Long-Term SACP Schedule | ◘ | Establish Technology-Specific Working Groups | ◘ |
| Project Development Grants / Financing | ◘ | Ongoing Monitoring of program Performance | ◘ |
| Engage EDCs in Project Finance | ◘ | Link energy efficiency with renewable energy incentives | ◘ |
| Rebates | ◘ | Set Technology-Specific Installed Capacity Goals and Funding Allocations | ◘ |
| Establish Long-Term Declining Incentive Schedule | □ | Multi-Year REC Trading Life | ◘ |
| State Tax Credits | □ | Business Development Grants and Financing | □ |
| Guaranteed Floor Value | □ | Standard Contract Terms | □ |
| Compress Project Economics to Short Period | □ | Manufacturer Incentive program | □ |

Additional information and details regarding the strengths and weaknesses of these strategies is provided in a detailed table located in Appendix A of Volume 1.

# 5.6 Market Development Barriers and Potential Intervention Strategies

Many financial and non-financial barriers to renewable energy development exist, and a number of them vary by technology and market sector. Barriers to renewable energy development in New Jersey are discussed in greater detail in the detailed market level assessment (Volume 2, Section 2) of the report, as well as in the detailed CORE and REPGF program assessments (Volume 2, Section 3). Some of these barriers cannot be resolved by BPU program interventions, as they are due to international or national trends, such as the price of materials. However, BPU has the ability to address a number of these barriers by implementing appropriate strategies. Key strategies available for application in New Jersey were summarized in the previous section. In this section, market barriers are translated into specific needs, and matched with appropriate strategies.

Table 5-6 lists general market barriers as well as technology-specific barriers and identifies the market segments that are most affected by the barriers. It should be noted that these segments are defined by the type of project owner. These barriers also affect numerous other market participants including ratepayers, installers, developers, and the financial community. Potential needs / solutions are also presented in the table, as well as an indication of whether the Board's programs as they existed at the time of the analysis are sufficiently addressing the barriers. In cases where some or all of the solutions to the barrier are beyond the scope of the Board, this has been noted. Recommendations for actions the Board can take going forward were derived from this analysis and are presented in Section 6 of this volume of the report.

**Table 5-6. Identification of Market Development Barriers and Needs**

| Barriers | Applicable Market Sectors | Needs | Needs Sufficiently Addressed through Existing Board programs? |
|---|---|---|---|
| Overall Market Barriers | *R= residential*<br>*SC= sm. commercial*<br>*LC= lg. commercial*<br>*I= Industrial*<br>*P= public entities*<br>*U= utility scale / IPP* | Overall Market Needs | Y / N / Beyond Control of Board |
| Uncertainty about the future of BPU's incentive programs | All | Clear, long term plan for BPU program structures and incentive offerings. | N |
| Uncertainty regarding project revenue streams (long-term value of RECs and retail electricity), and difficulty obtaining long-term contracts due to electricity market structure (i.e., 3-year BGS auction cycle) | All | Reliable REC market; long-term contracting opportunities; continued high demand for RECs | N |
| High up-front project costs | R, SC | Lower installed costs; access to favorable financing | Y (solar only) |
| Long development cycles and slow access to funding for non-solar projects | LC, I, P, U | Reduced costs / risks associated with project feasibility and pre-development; transparency of program criteria; improved program staffing and attention to inquiries | N |
| Lengthy process to obtain BPU project funding | All | Improved program implementation | N |
| Difficulties getting questions answered or rules clarified by BPU staff | All | Improved program implementation and increased staffing resources | N |
| Intermittency of output (solar and wind) | All | Storage technologies, opportunities to maximize value during | N / Beyond Control of |

| Barriers | Applicable Market Sectors | Needs | Needs Sufficiently Addressed through Existing Board programs? |
|---|---|---|---|
| | | periods of output | Board |
| Lack of mature local infrastructure for certain technologies / applications (advanced biomass, offshore wind) | LC, I, U | Access to expertise; evidence that New Jersey market is worthy of industry attention | N |
| Siting and permitting, particularly NIMBYism and negative public perceptions about non-solar renewable energy | LC, I, U | Public education and awareness | N |
| Lack of readily available, up to date information on key market indicators such as REC prices, and system performance | LC, I, U | Access to readily available, up to date information on key market indicators | N |
| Transmission grid ill-prepare to handle large additions of large-scale RE | P, U | State sponsored/monitored/mandated improvements to transmission grid | N |
| **Solar Barriers** | | **Solar Needs** | |
| Uncertainty about the future of the solar market in New Jersey | All | Clear, long term plan for BPU program structures and incentive offerings; Reliable REC market | N |
| Delays in the CORE program due to current over commitment of funds | All | Improved program implementation | N |
| Low solar insolation in NJ | All | Explore applications uniquely suited to resource conditions (i.e., thin film technology) | N / Beyond Control of Board |
| Silicon shortage | All | Evidence that New Jersey market is worthy of industry attention | Y |
| High capital and levelized costs | All | Lower installed costs, access to favorable financing | N |
| High upfront costs | R, SC | Same as above, plus state assistance to reduce upfront costs | Y (CORE program) |

| Barriers | Applicable Market Sectors | Needs | Needs Sufficiently Addressed through Existing Board programs? |
|---|---|---|---|
| Lack of readily available, up to date information on key market indicators such as average installed costs, REC prices, and system performance | LC, I, U | Access to readily available, up to date information on key market indicators | N [82] |
| **Onshore Wind Barriers** | | **Onshore Wind Needs** | |
| Lack of strong on-shore wind resources | All | Take full advantage of development opportunities that do exist; Support smaller wind technologies that can operate at lower wind speeds and in built-up areas | N / Beyond Control of Board |
| Permitting problems – NIMBYism | All | Public awareness about the aesthetics / noise, environmental benefits, and safety of wind (i.e., tours of existing installations). Highly visible, well-sited pilot projects. | N |
| Permitting problems - process takes a long time and requirements vary by community | All | Informed public officials, and streamlined permitting process that is consistent across the state | Y (small wind working group, model ordinance) |
| Turbine shortages/cost of steel | All | Project revenues to provide sufficient return on investment; evidence that New Jersey market is worthy of industry attention | N / Beyond Control of Board |
| Uncertainties about federal Production Tax Credit | LC, I, P, U | Reliable REC market; ability to access alternative forms of financial support | Beyond Control of Board |
| Lack of availability of credit worthy offtake agreements for energy and/or RECs | LC, I, P, U | Long-term contracting opportunities with credit worthy entities | N |
| High levelized costs relative to conventional energy, in smaller scale applications | LC, I, P | Lower upfront costs through rebates / grants; access to favorable financing | N (while REPGF program is suspended) |
| **Offshore Wind Barriers** | | **Offshore Wind Needs** | |
| Permitting standards not well developed | U | Clear permitting standards for the NJ coastline | N / Beyond Control of Board |

[82] Solar market participants have expressed that SREC pricing data is too infrequently published, and other data needs exist as well.

| Barriers | Applicable Market Sectors | Needs | Needs Sufficiently Addressed through Existing Board programs? |
|---|---|---|---|
| Permitting involves both state and federal governments - more complicated | U | Reduced risks/costs associated with feasibility and pre-development process | N / Beyond Control of Board |
| New application for wind energy in the U.S. – specialized service providers and equipment suppliers based in Europe | U | Information sharing and collaboration with other states facing similar challenges; funding to kick-start the offshore wind industry in New Jersey; evidence that New Jersey market is worthy of industry attention | Y / N / Beyond Control of Board (pilot initiative is good start but additional steps are needed) |
| Lack of U.S. examples of successful offshore wind applications / NIMBYism | U | Public awareness about offshore wind applications, penetration in European market | N / Beyond Control of Board |
| **Biomass Barriers** | | **Biomass Needs** | |
| High and variable fuel costs due to inconsistent supply and demand, and market immaturity | LC, I, P, U | Financial assistance to make projects commercially viable; More predictable, consistent demand for biomass fuel; better information on fuel supply sources | N / Beyond Control of Board |
| High costs of gathering and managing low-energy density fuel | LC, I, P, U | Fuel sourced from geographically compact area to minimize transport costs; project economics sufficient to accommodate high fuel costs and trigger development | N / Beyond Control of Board |
| Technologies such as gasification better but more expensive and less commercialized | LC, I, P, U | Funding to kick-start demonstration projects in New Jersey; Information sharing across market participants; access to expertise; reduced costs / risks associated with project feasibility and pre-development | N |
| Biomass feed stocks and end products may be subject to different regulatory oversight making project logistics more complex | LC, I, P, U | Provide information resources for these regulations; streamline regulations | N / Beyond Control of Board |
| Lack of information on specific sources of biomass fuel | LC, I, P, U | State-sponsored GIS mapping tool for evaluating resource distribution | Y/N (biomass supply study a good start but more specific data on sources needed) |
| Permitting (emissions) | LC, I, P, U | Clear DEP permitting process and information | Beyond Control of Board |
| **Landfill Gas Barriers** | | **Landfill Gas Needs** | |
| Amount and type of gas varies by site | P, U | Improve generating technologies to use the different types of gas | Beyond Control of Board |

| Barriers | Applicable Market Sectors | Needs | Needs Sufficiently Addressed through Existing Board programs? |
|---|---|---|---|
| Resource limitations: Lack of new sites to cap in NJ; gas emissions decline over time | P, U | Recognition of in-state resource limitations | Beyond Control of Board |

Many (though not all) market development needs can be addressed through program and policy interventions. To reflect that a number of the market development needs identified above are shared across technologies / market segments, these needs were grouped into categories and linked with suitable strategies drawing on the review of strategies summarized in the previous section. Strategies that ranked particularly poorly were not included in Table 5-7. However, since strategies vary in scope and type, it was difficult to directly compare them with one another. Therefore, some strategies that may have ranked toward the bottom of the list were still considered viable and included in the table below.

### Table 5-7. Linking Shared Market Development Needs with Suitable Strategies

| Categories of Market Development Needs | Strategies Suitable to Address Needs |
|---|---|
| ***Project Finance Needs*** | |
| Clear, long term plan for BPU program structures and incentive offerings to provide investor confidence and to enable planning by market participants | • Establish long term plan for program structures and incentives. Specify and clearly communicate conditions under which incentive levels will change and when. |
| Significant, predictable, long-term demand for RECs | • Facilitate / require long-term contracting by LSEs<br>• Tariff / hybrid tariff incentive[83] |
| Revenue certainty | • Facilitate / require long-term contracting by LSEs<br>• Any one of a variety of strategies offering REC price securitization including full / hybrid tariff, auction set pricing with long-term contracting, guaranteed floor price, compressed project economic life. A long-term SACP schedule would also improve revenue certainty but not to the extent of the other strategies listed here. |
| Access to favorable financing | • Establish long term plan for program structures and incentives.<br>• Facilitate / require long-term contracting by LSEs.<br>• Any one of a variety of strategies offering REC price securitization including full / hybrid tariff, auction set pricing with long-term contracting, guaranteed floor price, compressed project economic life. A long-term SACP schedule would also improve revenue certainty.<br>• Encourage utility-financing of renewable energy systems.<br>• Offer state-subsidized below-market loans (project development financing). |
| Reduced costs / risks associated with feasibility / pre-development activities for larger, non-solar technologies | • Project development grants and financing |
| Lower installed costs | • Market structure that enhances potential for competitive forces to drive down project costs (i.e., auction-set pricing, long-term SACP schedule) |

[83] In addition to the specific strategies evaluated, it should be noted that establishing a track record for adherence to the existing RPS requirements should address this barrier.

| Categories of Market Development Needs | Strategies Suitable to Address Needs |
|---|---|
| | • Rebates |
| ***Other Market Development Needs*** | |
| Access to expertise, and improved market infrastructure for technologies with less mature infrastructure in New Jersey | • Establish Technology-Specific Working Groups<br>• Set Technology-Specific Installed Capacity Goals and Funding Allocations<br>• Sector-Specific Targeted Outreach and Incentives<br>• Business Development Grants and Financing |
| Evidence that New Jersey market is worthy of industry attention | • Board establishes a clear, long term plan for BPU program structures and incentive types.<br>• Set Technology-Specific Installed Capacity Goals and Funding Allocations<br>• Build a track-record for adhering to existing RPS requirements |
| Take full advantage of development opportunities that do exist | • Set Technology-Specific Installed Capacity Goals and Funding Allocations<br>• Sector-Specific Targeted Outreach and Incentives<br>• Geographically Targeted Outreach and Development Assistance |
| Public acceptance of non-solar technologies | • Geographically Targeted Outreach and Development Assistance |
| Access to readily available, up to date information on key market indicators and optimal development opportunities (i.e., suitable windy locations, ideal market sectors for on-site generation, etc.) | • Provide consistently updated resource and market data |
| Information sharing and examples of successful, large non-solar projects | • Establish Technology-Specific Working Groups<br>• Set Technology-Specific Installed Capacity Goals and Funding Allocations<br>• Provide consistently updated market data |
| Improved program implementation and increased staffing resources | • Ongoing Monitoring of program Performance<br>• Provide consistently updated market data |

## 5.7 Existing Portfolio's Success in Meeting Market Needs

This section discusses the extent to which BPU's current portfolio of programs is fulfilling the needs of the New Jersey renewable energy marketplace and the likelihood that these current programs will have lasting market impacts. The section includes discussion of which technology-market sectors have been reached by the Board's programs and which sectors have not. The section also addresses the reasons that specific market circumstances exist and specific areas for improvement.

## 5.7.1 Strengths and Weaknesses of Program Portfolio Structure and Implementation

Current BPU renewable energy programs are structured to complement one another and address many of the needs of the New Jersey renewable energy marketplace. The REPGF program assists grid-supply renewable energy projects, the CORE program serves the needs of behind-the-meter renewables projects. Sharing of SREC / behind-the-meter (BTM) REC pricing data and SREC / BTM REC transactions are facilitated through the SREC / BTM REC trading system. The Business Venture Assistance (REBVA) program is intended to assist New Jersey's renewable energy companies with commercialization and growth opportunities. However, in practice, these programs are not fulfilling their potential to provide complementary forms of assistance to serve the range of renewable energy market needs which exist in New Jersey.

### Strengths of Current Portfolio

The Board has achieved remarkable success in developing the state's solar market and this is due in large part to insightful policy-making and program design on the part of the Board. The state has some of the strongest net metering and interconnection rules in the country which serve as an excellent model for other states. In addition, the state's RPS solar set-aside, coupled with a Solar Alternative Compliance Payment (SACP) sets the stage for a strong solar market with potential to achieve self-sufficiency more rapidly than in many other states.

From a structural and design perspective, the Board's portfolio of renewable energy programs should be able to address most of the needs of the growing renewable energy market in the state. Furthermore, the CORE program incorporates a number of components intended to ensure high quality system performance (i.e., warranty requirements, system design standards, and post-installation inspections), and thus, efficient use of ratepayer funds.

While the state's disproportionate emphasis on solar is an important area for improvement, the Board is making substantial progress in some areas of market development which have not yet resulted in recognizable non-solar installed capacity growth. Some very positive activities have taken place to advance wind energy development including the formation of a wind working group to address the needs of small and terrestrial (on-shore) wind projects; offering an anemometer loan program; gauging public opinion about offshore wind development; surveying Wind Working Group members to assess the major issues facing wind development in the state; and soliciting proposals for studies related to the impacts of offshore wind development. The Board also facilitated a biomass supply study which has provided valuable data on the economic potential for biomass development in the state, as well as the costs and barriers associated with developing advanced biomass studies.

The biomass supply study, and several of the wind-related initiatives have been carried out in collaboration with Rutgers University, and the wind working group has involved collaboration with Rowan University as well. Given the research and technical skills New Jersey's academic institutions have to offer, and past evidence of successful contributions to the Board's efforts, these academic collaborations are clearly of great value to the Board. BPU should be commended for taking advantage of these important local resources.

BPU has also demonstrated great leadership in its efforts to ensure that New Jersey will remain on track to achieve the state's aggressive solar RPS requirements without imposing unnecessarily high costs on ratepayers. New Jersey's RPS requirements play a fundamental role in defining New Jersey's renewable energy market, and adhering to the provisions set forth in the RPS is one of the most critical things the

Board can do to foster regulatory certainty and investor confidence. No other state possesses a more substantial solar RPS requirement, so the Board has been navigating uncharted territory. While the final market transition model selected may not be perfect, it will likely be a major improvement over current conditions as a result of months of stakeholder discussion and consideration of a variety of approaches.

## Weaknesses of Existing Portfolio

The current portfolio of programs is primarily serving the needs of residential, commercial, industrial, and public projects seeking to complete on-site PV or small wind projects through the CORE program. The needs of potential developers seeking to build utility-scale advanced biomass, onshore wind, or offshore wind projects are not well served under the current portfolio, as implemented.

As evidenced by data presented in the following section, the CORE program, and the solar market specifically, has received the vast majority of budget resources and staff attention. A variety of factors account for this, including:

a. Presence of aggressive solar RPS requirement and lack of other specific technology goals

   - Within an RPS framework, more expensive resources require additional provisions to ensure their development. It would send an important message to implementation staff and to the market if technology-specific development goals existed for non-solar technologies.

b. Budget allocation / incentive structure

   - In 2006 and 2007, 87% of the total renewable energy program budgets were allocated to the CORE program. While solar development does require much higher levels of financial assistance than non-solar development, the budget allocation does not indicate that a high priority is placed on development of non-solar technologies. The rapid growth and development of the New Jersey solar market in response to large financial incentives and technology-specific demand are evidence that the industry will respond to these market development mechanisms. For large non-solar technologies funded through the REPGF program, the incentive formula is less transparent and there are no clear technology-specific development goals. Therefore, the Board's programs have resulted in little market growth among non-solar technologies.

c. Insufficient staff implementation of REPGF and REBVA programs

   - Feedback from program participants, and the fact that so little non-solar development has occurred, is evidence that the program has not sufficiently met the needs of the market. When staff found that REPGF program applications were financially viable without program assistance, yet projects were not being developed, steps should have been taken to better understand the non-financial barriers that stalled project development. While the Board's renewable energy programs have been substantially under-staffed, recently a market manager took over administrative functions. This will substantially improve program implementation capacity and can provide staff with the opportunity to focus on higher level strategic management issues to ensure the program is implemented effectively in the future.

d. More complicated siting and technical issues, less mature market infrastructure for non-solar projects

   - Aside from their high costs, PV projects are logistically very simple in comparison to development of wind and biomass projects. Both small and large-scale wind suffer from lack of clarity in the permitting process, and public opposition to anticipated aesthetic / noise problems associated with wind projects. Biomass development (other than landfill gas) has suffered from the lack of a mature market infrastructure in New Jersey.

e. Lack of easily developable, plentiful, large-scale non-solar resources

- Part of the problem with large-scale projects in New Jersey is that plentiful resources do not exist for the most widely used and cost-effective renewable technologies in the U.S. today, which are on-shore wind and large hydro. Although New Jersey does have useable waste resources, as detailed in the Rutgers study, it does not currently have an established infrastructure that enables all of the resources to be used. Thus, apart from landfill gas, the *obvious* renewable technologies cannot be widely and easily implemented in the state.

Other weaknesses in the portfolio of programs relate to market uncertainty, timing of incentive payments and adequacy of staff support and public outreach. BPU's lengthy process to transition the solar market to a more market-based structure has been positive in that it has allowed stakeholders to play a very active role in decision-making. However, the process has also raised major concerns about the certainty associated with the structure of the Board's programs and the future of New Jersey's SREC prices. Developers interviewed expressed that market and regulatory uncertainty are major barriers to program participation.

Regarding financing, it appears that the needs of current CORE program participants installing solar are being met, but that conditions are not as favorable as they would be if lenders viewed the renewable energy system as an asset. The majority of CORE program participants pay for their solar installations with cash (34%) or various forms of homeowner financing channels (51%), but there are limitations for homeowners without sufficient equity in their homes. Since the majority of program participants are wealthy (54% had an annual income greater than $100,000), highly educated individuals (66% had attended four years of college or possessed a graduate or professional degree), access to financing has not presented a significant concern to date. However, once the CORE solar rebates become smaller and eventually phase out, and once a broader cross section of the population becomes interested in installing solar, financing needs will increase for residential and small commercial participants. The rise of the Power Purchase Agreement (PPA) model will likely serve the needs of larger commercial behind-the-meter projects, such as solar and small wind systems, but may not be readily available for use in small commercial and residential projects. Also, there are limitations on the benefits to host sites under such an ownership structure (i.e., lack of upside potential if REC or energy values increase), and it is not clear that the PPA model will solve all problems associated with financing all behind-the-meter projects

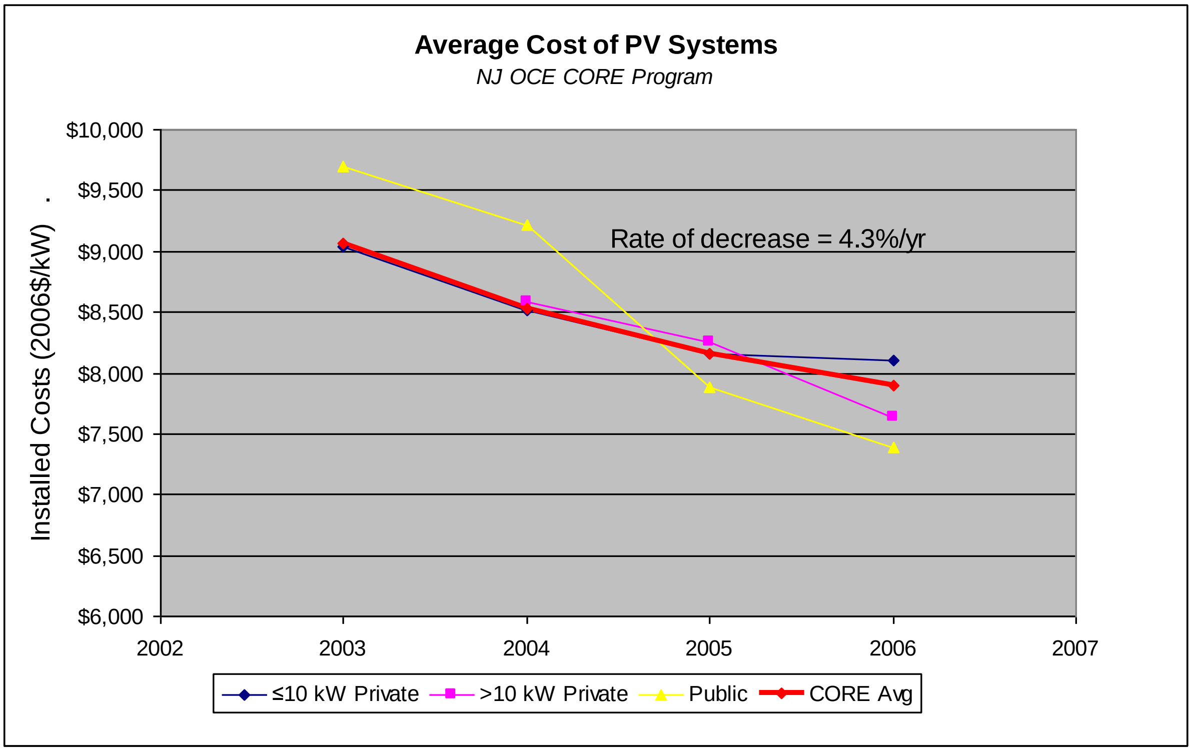
Related to the issue of financing, both solar and landfill gas developers expressed that that time lag between project construction and receipt of incentive payment presents significant added project costs, both for REPGF and CORE projects.

Finally, market actors interviewed as part of the assessment expressed a great deal of concern over the level of staff support available to implement programs. The level and type of program outreach was also identified as an area for improvement. As noted earlier, assistance from the market manager should improve program implementation capacity substantially. A more comprehensive discussion of all of the weaknesses of the portfolio of programs is included in the detailed program-level assessment section of the report.

### 5.7.2 Market Effects of Current Portfolio of Programs

New Jersey's existing portfolio of programs, as implemented, has already had lasting impacts on the *solar* market in the state. Solar installed costs have decreased on average by 4% per year since the start of the CORE program (Figure 5-2).

**Figure 5-2. Average Cost of PV System in CORE Program (2006$/kW)**




The dramatic burst in the construction of solar projects over the last five years has led well over 200 businesses to become active in the New Jersey solar market they serve as aggregators, brokers, installers, or other equipment or service providers. These businesses, which include 100 solar installers, comprise both large corporate entities with presence on the national and international markets, as well as small businesses active only in the New Jersey marketplace.

Since baseline values were not made available, an exact comparison between current and pre-program conditions cannot be made. However, based on a review of the companies listed on BPU's website, some assumptions can be made. A large number of solar installers have emerged specifically to serve the New Jersey market, and many of the national and regional players have opened New Jersey branches to serve the substantial demand in the state. Prior to the introduction of BPU's programs, there was a very small solar installer presence in the state. Many of the broker and aggregator companies likely existed prior to serving the needs of the New Jersey REC market specifically, though additional staff have been added to focus on REC market issues.

Given the growth in RPS demand, continued business growth in service provider capacity will be necessary. Decisions regarding the solar market transition will have a significant impact on the type of growth that occurs, and among which companies. A market based predominantly on SREC revenues as the only form of incentive will bring about substantial growth in the activities of brokers and aggregators. There should continue to be a need for installers serving both residential and larger scale PV customers.

**Table 5-8. Market Participants Registered with BPU**

| Market Participant | Number |
|---|---|
| REC Brokers | 43 |
| REC Aggregators | 58 |
| Load Serving Entities (LSEs) | 36 |
| Solar Installers | 100 |
| Fuel Cell Installers | 14 |
| Biomass Installers | 6 |
| Wind Installers | 22 |

*Source: BPU Solar Market Update, April, 2007, and BPU registered vendor data.*

The existing set of programs, as they have been implemented, will have little lasting impact on the *non-solar* market. As noted earlier, the solar RPS requirements in New Jersey create a market that is inherently largely focused on solar development because it needs to be in order to fulfill RPS requirements. Lasting non-solar market development growth will occur as well, but this will be more due to the increased demand for RECs resulting from New Jersey's RPS, and the RPS policies of other states in the region than to the activities of BPU's programs to date. In addition, the impacts will be more regional in scope than the solar impacts since Class I resources can be sourced from throughout the PJM region, while solar must be generated in-state to be RPS-eligible. This increase in demand for renewables in the region is a positive market effect and it demonstrates the success of New Jersey's RPS. However, BPU can enhance the market effects of the RPS, speed the pace of project development and increase the chances that in-state development will occur if it takes strong steps to provide both financial and technical assistance to non-solar utility scale projects.

### 5.7.3 Market Sectors Served by Portfolio

As of the year 2000, New Jersey had around 3.4 million households and a quarter of a million businesses. It is the most densely populated state in the USA, with 1,135 persons per square mile. The business sector is dominated by the wholesale and manufacturing business groups, which together account for 55% of the business turnover in the state.[84] The following sections discuss the market sectors served by the CORE, REPGF and REBVA programs.

#### Market Sectors Served by the CORE Program

The largest sector in terms of participant numbers for the CORE program was residential, and the second largest was commercial (which also includes industrial projects). The commercial projects (including solar, biomass and fuel cell) were on average far bigger than the residential projects in terms of installed capacity, as would be expected (an average of 7 kW for residential versus 62kW for commercial). Almost all of the other sectors had at least a few participants, and this shows that the program was successful in reaching a broad range of participant types.

[84] Taken from US Census Bureau website (census.gov)

**Table 5-9. CORE Program Participation – All Technologies[85]**

| Customer Type | Percent of Total Applications Received | Percent of Total Incentives Processed | Percent of Total Installed Capacity |
|---|---|---|---|
| Residential | 78% | 85.5% | 38% |
| Commercial | 16% | 10.5% | 40% |
| Government | 2% | 0.6% | 5% |
| School public k-12 | 2% | 1% | 11% |
| Non Profit | 1% | 1.6% | 1% |
| Municipality | 0.3% | - | - |
| School other | 0.3% | 0.3% | - |
| University Public | 0.2% | 0.3% | 2% |
| University Private | 0.1% | 0.1% | 2% |
| Total processed as of 12/31/06 | 100% | 100% | 100% |


| Customer Type | Percent of Total Applications Received | Percent of Total Incentives Processed | Percent of Total Installed Capacity |
|---|---|---|---|
| Residential | 78% | 85.5% | 38% |
| Commercial | 16% | 10.5% | 40% |
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| School public k-12 | 2% | 1% | 11% |
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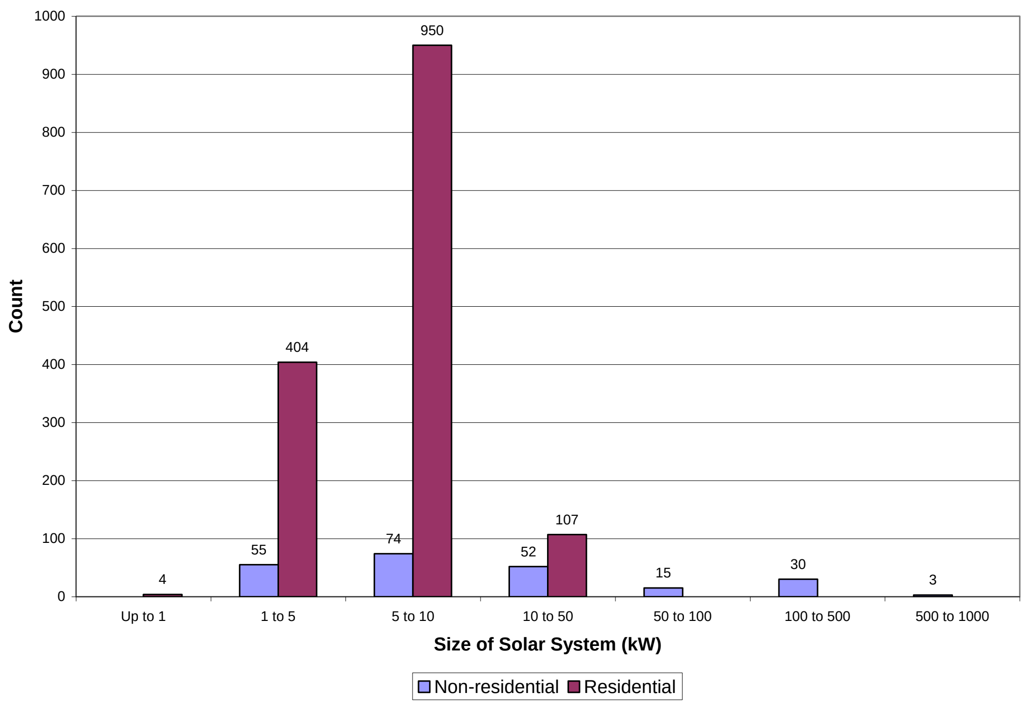
| Municipality | 0.3% | - | - |
| School other | 0.3% | 0.3% | - |
| University Public | 0.2% | 0.3% | 2% |
| University Private | 0.1% | 0.1% | 2% |
| Total processed as of 12/31/06 | 100% | 100% | 100% |


[85] Date presented here excludes fuel cell projects. Industrial projects are included under the "commercial" category. Data obtained from CORE database. The database does not include project records for 2001 through mid-2003. Therefore, the systems installed during that time are not reflected here. Program records which were provided for the 2001 through mid-2003 period do not include data on customer type.

Looking only at solar, the graph below shows the sizes of solar systems installed by residential and non-residential customers. The sizes for both sectors overlap somewhat, but there are a few systems over 500 kW in size in the commercial sector, making the total installed capacity for that sector about the same as the residential sector even though there are far fewer participants.

## Figure 5-3. CORE-Funded Solar PV Projects by Size




Although residential solar should be encouraged as much as possible, these figures show that there is a large amount of untapped potential in the non-residential sector, and that development of larger systems could facilitate more rapid progress toward achieving solar development goals. Non-residential customers usually have more roof space available, fewer planning issues (such as restrictions on putting PV on roofs due to housing covenants) and may have better access to favorable financing (such as business loans) and federal tax incentives. Although there were 918 applications for the CORE program from non-residential customers, this was less than a third of the number of applications from residential customers.

About half of the participants heard about the program either through their contractor or by word of mouth. While the marketing efforts of contractors and past program participants should be supported and encouraged, the fact that so few respondents point to BPU as the source of program information highlights the need for the Board to review and revise current marketing and outreach strategies. For example, a specific marketing campaign aimed at businesses could include business-specific information on the potential benefits of PV, wind, and biomass, such as using the installation to enhance the image of the company as “green.”

Finally, there appears to be a large untapped customer base in the industrial sector. These customers may not be aware of renewables as a viable option when they develop their energy management strategies. They may view renewable energy as too expensive, or think that these technologies would not be able to provide enough energy to make a difference to their operations, as most industrial customers use large amounts of energy. However, there are several success stories from around the country of renewables such as small wind being installed in industrial parks and at factory sites.

### Market Sectors Served by Renewable Energy Project Grants and Financing Program

A total of nine applications were received for the REPGF program between 2002 and 2006. The contracting entities for the six projects that were accepted into the program were all non-commercial authorities such as the Atlantic County Utilities Authority, the Burlington County Department of Resource Conservation, and Ocean County Landfill Corporation.

This mix of participants indicates that prospective program participants from the renewable energy developer industry either are not being reached by marketing and outreach efforts, are not interested in the program, or that there are not enough suitable companies doing this work in New Jersey. The program's goals are to promote competition among technologies, encourage cost effective renewable grid supply technologies and facilitate the development of a thriving, diversified renewable energy market. However, it seems to have reached only the local government sector so far, and there is significant potential to expand the reach of the program.

*Market Sectors Served by the Renewable Energy Business Venture Assistance Program*

The REBVA program is structured to serve the needs of private businesses. Of the applications accepted under the program through the end of 2006, just over 40% were for PV-related business ventures, with 8% of that going to fund thin-film solar applications. Thirty-three percent of accepted applications were for hydrogen-related projects, 17% percent were for educational initiatives, and 8% were for wave / tidal projects. No wind-related projects were funded through the program.

# 5.8 RPS Supply Requirements and Technology Deployment Scenarios

## 5.8.1 Prioritization of Technologies for Deployment

This section presents a ranking of the technology-market sectors according to their ability to deliver on BPU and RPS goals in a cost-effective and timely manner.[86] The ranking criteria that are used take into account the economic potential, market barriers, and technology issues associated with each technology-market sector. For example, a technology-market sector that has relatively *low* economic potential and *high* market barriers will be ranked lower than one with *high* economic potential and *high* market barriers.

The following table shows the criteria used to rank the technology-market sectors.

[86] The Summit Blue team recognizes that solar power plays a unique role in New Jersey's RPS and that it should be viewed within the context of its own set of cost-effectiveness standards.

**Table 5-10. Rating Criteria for Technology-Market Sectors**

| |
|---|
| Cost Effectiveness |
| Permitting and Siting Issues |
| Maturity of Technology and Development Infrastructure |
| New Jersey Generating Potential |
| Market Barriers |
| Interconnect and Transmission Issues |
| Need for Specific Development Funds |

The main technology-market sectors that have potential for development in New Jersey have been ranked according to this scheme and the table below shows the overall score and ranking for each category. The scoring for each criterion was done based on the research carried out in this study and professional judgment. The scoring was based on the implementation needs of each technology, and an estimate of cost-effectiveness without any rebates or other financial incentives. A weighting was applied to each criterion to reflect the importance of the criterion to the ranking as a whole. The criteria are shown in the table below in order of importance, from left to right.

**Table 5-11. Technology-Market Sector Rankings for Prioritization of Deployment**

| Market-Technology Segment | Cost Effective-ness | Permitting and Siting Issues | Maturity of Technology and Development Infrastructure | New Jersey Generating Potential | Market Barriers | Inter-connect and Trans-mission Issues | Need for Specific Develop-ment Funds | Overall Score | Rank |
|---|---|---|---|---|---|---|---|---|---|
| | **Scores (1=lowest, 5=highest)** | | | | | | | | |
| Biomass - Landfill Gas | 4 | 5 | 5 | 2 | 5 | 4 | 5 | 4.27 | **1** |
| Biomass – Wastewater Biogas | 4 | 4 | 5 | 3 | 5 | 4 | 3 | 4.07 | **2** |
| Solar – C&I, Public, Utility | 2 | 5 | 4 | 3 | 2 | 5 | 4 | 3.46 | **3** |
| Biomass – Direct Combustion | 4 | 2 | 4 | 4 | 3 | 3 | 3 | 3.32 | **4** |
| Wind – Offshore | 5 | 2 | 3 | 5 | 3 | 3 | 1 | 3.31 | **5** |
| Solar – Residential | 1 | 5 | 4 | 3 | 2 | 5 | 4 | 3.28 | **6** |
| Wind – Large Onshore | 5 | 1 | 5 | 1 | 3 | 3 | 5 | 3.22 | **7** |
| Biomass – Gasification | 3 | 3 | 2 | 5 | 3 | 3 | 2 | 3.05 | **8** |
| Wind – Small Onshore | 2 | 1 | 5 | 2 | 2 | 5 | 5 | 2.88 | **9** |
| Solar - Central | 2 | 3 | 3 | 3 | 2 | 3 | 4 | 2.76 | **10** |
| Weighting Factor | 0.18 | 0.17 | 0.16 | 0.15 | 0.15 | 0.10 | 0.09 | | |

The ranking exercise indicates which technology-market sectors currently have the best potential for development in terms of cost-effectiveness and ease of implementation. However, it should be noted that these technologies may not be the ones with the best long-term development potential; some of the barriers currently affecting sectors, such as offshore wind, will hopefully be overcome eventually.

The five technology-market sectors with the best potential for development are the following:

1. **Biomass – Landfill Gas:** Landfill gas scores well because it is a well established and mature technology, there are known resources available in state, there are few siting or transmission issues, and the technology has a high capacity factor. However, there is limited generating potential as there are only a limited number of landfill sites to be tapped and the gas emissions decrease over time at each site.
2. **Biomass – Wastewater Biogas:** Wastewater biogas scores well because it is an established technology (although relatively new), there are known resources available in state, these resources will remain available in the future, there are few siting or transmission issues, and the technology has a high capacity factor.
3. **Solar – C&I, Public, Utility:** Commercial solar scores well due to the lack of siting issues, its large generating potential, its lack of interconnect issues, and the maturity of the technology. It scores low on cost-effectiveness, but better than residential solar.
4. **Biomass – Combustion:** Biomass Combustion scores well because there are resources available in state, mostly in the form of lignocellulosic biomass and solid waste, the technology is mature, and there is significant generating potential; however, the biomass waste will need to be transported to the site where the combustion is taking place, which can make the technology less cost-effective and cause issues with siting and interconnection. In addition, volatile fuel pricing keeps this resource from scoring well on market barriers.
5. **Wind – Offshore:** Offshore wind scores well due to the large generating potential and the cost-effectiveness of the technology; however, it scores poorly in terms of the need for specific development funds as it is a new technology to the U.S. and requires significant infrastructure investment to get started, as well as high investments in upfront studies and planning procedures.

## 5.8.2 Generation and Capacity Development Goals

RPS generation goals for the next five years, including the SBC funding cycle of 2009 to 2012, are shown in Table 5-12. These goals are based on sales data for Reporting Year 2007, a 1½ % applied annual growth rate,[87] and the RPS percentage requirements for each corresponding RPS Re porting Year.

[87] 2007 Reporting Year sales data provided by OCE. Load growth estimate from the PJM Load Growth Forecast.

**Table 5-12. Generation Goals through 2012**

| RPS Generation Goals to 2012 (all values in MWh) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Estimated Total NJ Electric Usage | Total Class I (non-solar) RPS Requirement | Incremental Class I (non-solar) Generation Needed per Year | Total Solar RPS Requirement | Incremental Solar Generation Needed per Year | Total RPS Requirement for Class I (solar + non-solar) |
| 2007 | 86,588,279 | 1,729,774 | 1,592,238 | 34,029 | 7,608 | 1,763,803 |
| 2008 | 87,887,103 | 2,498,015 | 806,016 | 71,804 | 37,775 | 2,569,819 |
| 2009 | 89,205,410 | 3,282,759 | 855,669 | 142,729 | 70,925 | 3,425,488 |
| 2010 | 90,543,491 | 4,041,861 | 816,475 | 200,101 | 57,372 | 4,241,963 |
| 2011 | 91,901,643 | 4,766,938 | 805,276 | 280,300 | 80,199 | 5,047,238 |
| 2012 | 93,280,168 | 5,527,783 | 848,068 | 367,524 | 87,224 | 5,895,307 |

In order to achieve these levels of generation with in-state resources, based on the amount of capacity installed as of the end of 2006, there will have to be rapid development of capacity in a wide range of renewable technologies in the next few years.

### 5.8.3 Technology Deployment Approach

As noted earlier, the state of New Jersey is not rich in resources for the most affordable and easily implemented large-scale renewable technologies, which are large hydro and on-shore wind. The state has a high population density, and 26% of the land is classed as urban; however, a considerable amount of the state is farmland (11%), forest (29%), and wetlands (18%).

Data reviewed by the Summit Blue team indicates that the RPS goals are near achievable with in-state generation, but that New Jersey will have to take a unique and innovative approach to reaching them, and not try to use the same approach being taken by other states with fewer development constraints and better renewable energy resources. The two renewable energy potential studies referenced in this report – from Navigant (2003) and Rutgers University (2007) – provide excellent information on which resources exist, and which technologies could be implemented economically. However, further research would be useful. Specifically, research into technologies that are well-suited to the urban and suburban environment that covers so much of the state is essential. Implementation in these areas would be helpful in reducing distribution system congestion problems and would enable the state to take greater advantage of the resources that do exist.

The deployment of renewable energy technologies in the urban and suburban environments poses several problems, including resources that are not ideal (for example, wind becomes more turbulent, roof-top PV can be shaded by neighboring buildings), and opposition from local residents; however, examples of wide-scale urban renewable energy applications exist in several places around the world. For example, small rooftop wind turbines for residential use are now being installed throughout the UK, through a program run by British Gas. There are other small scale bioenergy schemes that can work in an urban environment, such as the anaerobic digestion of food waste from restaurants and residences. These types of schemes have the benefit of a constant, local supply of feedstock.

Research is needed on new technologies that could be deployed in urban / suburban settings throughout the state but which are either not yet commercialized or cost-effective, or are not currently in the U.S. market but have been shown to work in other countries. Commercialization of these types of technologies would be an ideal fit for the REBVA program.

### 5.8.4 Technology Deployment Scenarios

Two possible scenarios of in-state renewable energy capacity development that would meet the 2012 RPS generation goals (both total Class I and the SREC goal) are shown in the Table 5-13. The goal set for both of these scenarios is that new and current (as of 2006) generation should meet the RPS requirements in 2012. Therefore, this analysis shows all the additional generation needed from 2007 to 2012.

This analysis was done primarily to establish a budget estimate for the funding period 2009 to 2012, and also to get a picture of what contribution offshore wind could make in meeting RPS requirements, if the RPS is to be met with in-state generation. These two scenarios are examples of what the generation mix *could* look like by 2012. There are numerous alternative scenarios that could be equally feasible. The scenarios are a starting point for examining the possible mix of renewable technologies that could be developed, based on cost and available potential.

The scenarios were created by choosing a percentage of total potential that will be developed, for each of the technology-market sectors. The total generation for solar was checked to make sure it is higher than the solar set-aside requirement, and the total for all generation was checked to see if it is larger than the total RPS requirement. As the solar potential represents 34% of all generating potential, but solar is the least cost-effective technology, this proportion was not carried through to the final potential amounts.

Note that the research team recommends providing incentives to all privately-owned solar projects up to 40 kW in size, and all publicly-owned solar projects up to 100 kW. The percentage of biomass that could be developed was set much higher, partly because the total potential estimate available to the research team is for biomass developed by 2015 (not 2020 as for other technologies), and also because biomass is more cost-effective than solar. An addition of 15% of total offshore wind potential in the second scenario means that the amount of solar can be reduced considerably in this scenario. The amount of offshore wind was kept relatively small due to the anticipated need to establish the industry infrastructure and supply chains needed (as the industry is currently only developed in Europe) and the time this will take. This percentage of 15% of potential would require a build rate of 45 turbines per year if building starts in 2010.

These scenarios reflect the need for New Jersey to prioritize deployment of large non-solar technologies, consistent with the prioritization scheme presented in Table 5-11. Further, these data show that if a small percentage of the potential for offshore wind development occurs, this will result in a decrease in the total cost of the portfolio of resources needed to meet the RPS. The estimated total costs of incentives (excluding other program costs and pre-development funds) that would be needed for the two scenarios are $238 million for Scenario 1 and $215 million for Scenario 2. (Note: Neither cost includes the administrative and outreach costs associated with the programs through which these incentive funds would be disbursed.) The lower cost for Scenario 2 is largely due to the addition of offshore wind and the reduction of solar PV. Scenario 2 was selected for use in budget planning for the purposes of this assessment.

### Table 5-13. Development Scenarios Used for Assessment of 2012 Goals

| | | Scenario 1 - Good biomass, no offshore, medium wind | | | | Scenario 2 - Good biomass, some offshore, less solar | | | |
|---|---|---|---|---|---|---|---|---|---|
| Technology-market Sector | Typical Size (MW) of unit | % of Total Potential by 2012** | MW Capacity Needed | Number of installations needed | Average Build Rate per Year (start 2008) | % of Total Potential by 2012** | MW Capacity Needed | Number of installations needed | Average Build Rate (# projects per year, start 2009) |
| Solar - Residential | 0.0050 | 8% | 259.6 | 51,920 | 10,384 | 3% | 81.1 | 16,225 | 4,056 |
| Solar - C&I < 40 kW | 0.0100 | 33% | 140.6 | 14,058 | 2,812 | 11% | 46.9 | 4,686 | 1,172 |
| Solar - Public > 40 kW | 0.0500 | 33% | 281.2 | 5,623 | 1,125 | 11% | 93.7 | 1,874 | 469 |
| Solar - C&I > 40 kW | 0.0500 | 33% | 768.5 | 15,370 | 3,074 | 12% | 279.5 | 5,589 | 1,397 |
| Solar - IPP (Central PV) | 1 | 33% | 29.0 | 29 | 6 | 30% | 26.4 | 26 | 7 |
| Wind - Small Onshore | 0.01 | 40% | 5.1 | 508 | 102 | 50% | 6.4 | 635 | 159 |
| Wind – Large Onshore | 1.5 | 40% | 45.7 | 30 | 6 | 50% | 57.2 | 38 | 10 |
| Wind - Offshore | 2.5 | 0% | 0.0 | - | - | 12% | 270.0 | 108 | 27 |
| Biomass - Landfill Gas | 0.5 | 75% | 16.5 | 33 | 7 | 80% | 17.6 | 35 | 9 |
| Biomass - Wastewater Biogas | 0.5 | 75% | 2.3 | 5 | 1 | 75% | 2.3 | 5 | 1 |
| Biomass - Gasification (CC) | 15 | 75% | 228.0 | 15 | 3 | 75% | 228.0 | 15 | 4 |
| Biomass - Anaerobic Digestion | 0.5 | 75% | 18.0 | 36 | 7 | 75% | 18.0 | 36 | 9 |
| Biomass – Direct Combustion | 25 | 75% | 322.5 | 13 | 3 | 80% | 344.0 | 14 | 3 |

**Assume offshore wind building starts in 2010 at the earliest, as marine ecology study will not be done until then.*
*** Potential for biomass is by 2015, and potential for other technologies is by 2020. Thus, a higher percentage of total potential can be developed by 2012 for biomass than for the other technologies.*

# 5.9 Incentive Level Analysis

Summit Blue carried out an analysis of the forecasted incentive required for each technology. The goal of the calculations was to find the minimum incentive level that would make the technology economic at a 12% IRR.

All incentives were calculated on a capacity basis (in $ per kW of capacity), but an estimate of incentives on a performance basis (in $ per MWh of generation) was also calculated. The $/MWh values were calculated using forecasts of performance for each of the technologies. These incentives are not additive – i.e., projects will not get both a capacity-based incentive and a performance-based incentive.

Details of the analysis for each technology-market sector are given below.

## 5.9.1 Assumptions Used in Incentive Analysis

- A starting price of $11/MWh was used for Class I RECs. This was the current price of RECs as of Spring 2007.[88] It was assumed that the REC price would stay the same for the analysis period.
- A target IRR of 12% was used for all technology-market sectors. This value is based on input from the solar industry and the financial community, and it is consistent with the investment target used for evaluating ratepayer impacts of solar market transition scenarios as part of an earlier assignment for BPU.
- For technologies that qualify for a production tax credit, this was added as an income to the pro forma. For biomass, there is a 0.9¢/kWh production tax credit for "open loop" biomass, which is all of the biomass technologies included in the analysis. For wind, there is a $1.9 ¢/kWh production tax credit, and this is assumed to increase at a rate of 2% per year.
- For behind-the-meter applications, a starting price and escalation rate was used to estimate electricity rates over the period of the analysis, and these values were used to calculate avoided electricity costs. For grid supply applications, a wholesale electricity price was used to calculate income from electricity sales, with an associated rate of increase. The values used, shown in the table below, are based on recent pricing in New Jersey. (Note: Current market prices are much higher than the wholesale price that was used in the analyses, and revised analyses would most likely show shorter payback periods and lower rebate levels required to make the projects economic.)

[88] Based on data from Evolution Markets for Class I NJ RECs, April, 2007.

**Table 5-14. Starting Price and Growth Rate for Electricity Costs and Income**

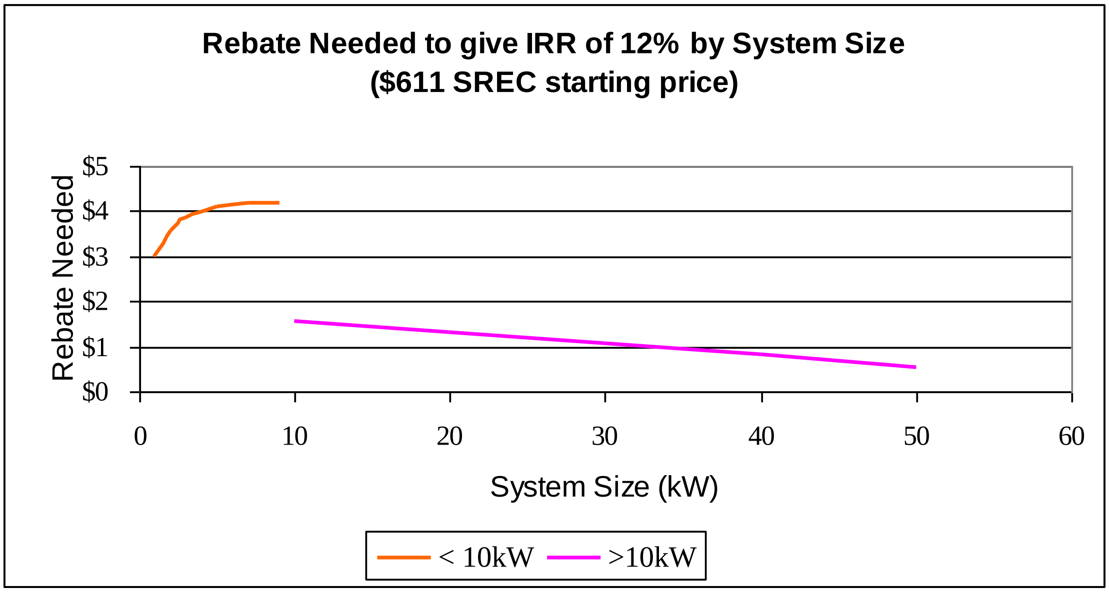
| Sector | Starting Price ($2008/kWh) | Rate of Increase |
|---|---|---|
| Residential | $0.13 | 2.99% |
| Commercial | $0.12 | 3.34% |
| Wholesale | $0.05 | 3.00% |

### 5.9.2 Solar Incentives

To calculate incentives for solar PV, a ratepayer impact model was run for PV systems of different sizes, to evaluate what level of incentive would be needed to give the investor an IRR of 12%. Data from the CORE program database was used to determine the relationship between system size and cost. In general, system costs decrease as system size increases, but for systems less than 10 kW the decrease in cost is very small. For systems larger than 10 kW, project costs decline rather steadily, dipping below $6,000/kW for 100 kW projects. For projects smaller than 10 kW, costs decline only slightly with an increase in project capacity, and the average is just over $8,000/kW.

Figure 5-4, on the following page, shows the value of rebate needed to obtain a 12% IRR for different system sizes. There are two lines – one for systems < 10 kW, and one for systems > 10 kW. The lines show the minimum rebate value needed, to the nearest $0.05. The reason that the < 10 kW line in the figure demonstrates a rapidly increasing need for rebates with increased size, and then a sudden cutoff, is that these small systems are assumed to be in the Residential sector, and the Federal investment tax credit is essentially static for Residential systems. It is 30% of system costs up to $2,000, and that maximum is reached after the first kW of system capacity. Thus, even though the cost per kW decreases with increasing size, the Federal tax obligation increases with size, and the system NPV decreases, indicating a need for a higher incentive. Data for projects done in the public sector are not shown here, but they are generally more expensive than private sector projects because they are not able to make use of tax refunds, as shown in the ratepayer impact model.

### Figure 5-4. Rebates Needed to Give IRR of 12% for PV Systems




Based on the data shown above, Summit Blue recommends the following incentive levels (Table 5-15) for PV systems broken out by project size and market sector. These incentive levels are presented both in the form of a capacity based incentive and in the form of a performance-based incentive equivalent.

### Table 5-15. Recommended Incentives for Solar PV

| System | program | Class | Capacity Incentive ($/kW) | Performance-Based Equivalent ($/MWh) |
|---|---|---|---|---|
| < 10 kW Solar | CORE: Residential | Residential | $3,500.0 | $166.5 |
| 10 kW <> 40 kW Solar | CORE: C&I | Comm or Public | $1,500.0 | $71.4 |
| 40 kW Solar <> 100 kW | | Public | $1,500.0 | $71.4 |
| > 40 kW Solar | | Comm Private | None | None |

In addition to the rebate, two other incentives are recommended for inclusion in the CORE program budget:

- The energy efficiency "adder" which is an offer of an additional $0.25/W for systems installed on buildings that pass a minimum energy efficiency standard such as Home Performance with Energy Star, or the LEED rating. As a conservative (in terms of budgeting) estimate, we assumed that 50% of the kW installed will qualify for the adder, whether residential or commercial.
- A low-interest loan option that would provide an interest rate buy down of 2%. The cost of this was estimated based on a loan interest rate reduction from 8% to 6%, a loan period of 7 years, and capacity costs depending on the technology. For budgeting purposes, it was assumed that 50% of the kW installed will make use of the interest rate buy down. The cost of this financing assistance was calculated to be $684/kW for residential solar and $618/kW for commercial and central solar.

### 5.9.3 Wind Incentives

Wind incentive levels were calculated using a pro-forma model. The three types analyzed were small wind (behind the meter, <100 kW), large onshore wind (> 100 kW onshore), and offshore wind. It was assumed that all systems in the small wind class would be part of the CORE program, and that the large onshore and offshore systems would be part of the REPGF program. It should be noted that there have been cases where some portion of a large onshore wind installation is incentivized under the CORE program (i.e., up to 1 MW of capacity). This can be done if part of the turbine output is used in an on-site building. For the purposes of this analysis, we assumed that this will be an insignificant amount compared to the majority of the capacity and therefore did not analyze this separately.

The timeline for the model was from 2008 to 2027. The incentive level was adjusted until the model produced the target IRR of 12% for each size of wind technology. This adjustment was done twice, to find the incentives required for both public and private systems, as public systems are not eligible for the accelerated depreciation (MACRS) federal tax incentive.

For the pro-forma analyses, a single system size was chosen as a sample system for each category of wind. The input assumptions for the pro-forma analyses are summarized in the table below.

**Table 5-16. Input Assumptions for Wind Incentive Analysis**

| System | Rated Capacity | Net-Metered? | Power Revenues $/kWh | System Costs ($/kW) | O&M Cost as % of Capital Cost | Capacity Factor |
|---|---|---|---|---|---|---|
| Small Wind | 10 kW | Yes | $0.13 | $5,000 | 1% | 15% |
| Large Onshore Wind | 10 MW | No | $0.05 | $2,229 | 3% | 29% |
| Offshore Wind | 100 MW | No | $0.05 | $2,972 | 6% | 34% |

The sources for the system cost data were:

- The high end of the range taken from data provided by the American Wind Energy Association for small wind systems.[89] This value was used instead of the cost data from small wind systems installed to date in New Jersey as the sample size of actual wind projects was deemed too small (4 projects).
- An average of accepted industry standards for onshore and offshore wind, and values from a report released in August 2007, produced for Long Island Power Authority.[90] The LIPA report costs were considerably higher than other cost estimates, especially for offshore wind, and therefore an average was calculated using four different sources.

[89] Small Wind Factsheets: The Economics of Small Wind, AWEA website (www.awea.org/smallwind/toolbox/TOOLS/fs_economics.asp)

[90] Several studies were used to estimate offshore wind costs: *Assessment of Offshore Wind Power Resources* (August 2007), prepared for Long Island Power Authority by Pace Global Energy Services; *Offshore Wind: Europe's Euro 90 Billion Funding Requirement, White Paper*, July 2005, New Energy Finance; *Offshore Wind, Economies of scale, engineering resource and load factors*, December 2003, Garrad Hassan; *New Jersey Offshore Wind Energy: Feasibility Study*, December 2004, Atlantic Renewable Energy Corporation.

The results of the wind pro forma analysis show that small wind is the least economic of the three categories, requiring an incentive about the same as for residential PV. Large onshore wind is the most cost-effective, and offshore wind requires a larger incentive than onshore due to its higher capital costs. Note that the incentive for offshore wind looks high on the basis of $/kW of capacity; but on a $/MWh basis it is about one quarter of the cost of solar, due to the higher capacity factor. In addition, the cost estimate for offshore wind is highly speculative as no offshore wind has been built in the US. The recommended incentives are shown below.

**Table 5-17. Recommended Incentives for Wind**

| System | Program | Class | Capacity Incentive ($/kW) | Performance-Based Equivalent ($/MWh) |
|---|---|---|---|---|
| Small Wind (< 100 Kw) | CORE | Resid./Comm. | $3,100.00 | $129.56 |
| Large Onshore Wind (> 100 kW) | REPGF/CORE | Public | $1,320.00 | $29.00 |
| | | Private | $930.00 | $20.00 |
| Offshore Wind | REPGF | Public | $2,745.00 | $50.25 |
| | | Private | $2,650.00 | $48.51 |

- As with solar, small wind projects installed through the CORE program may qualify for the energy efficiency adder if they are installed on properties with buildings that pass a minimum energy efficiency standard. It was assumed that 50% of the kW installed would qualify for this. Also, the offer of an interest rate buy down of 2% was assumed to be paid for 50% of the kW for small wind projects.
- For large onshore wind projects no adders were included as the technology is not installed behind the meter and is not assumed to need fast tracking as it is a well established technology.
- For offshore wind, a fast track adder of 15% of the incentive amount was added in order to help speed up the development of this technology, as it is a new technology and has a lot of potential.

### 5.9.4 Biomass Incentives

Biomass incentive levels were calculated using the levelized cost of generation presented in the Rutgers biomass potential report. These values include all anticipated production costs and tax incentives, including: permitting costs, cost of interest during construction, cost of equity (15%), cost of debt (8%), depreciation (period of 15 years), a loan period of 10 years, project economic life of 25 years, and the Federal production tax credit for open-loop biomass of 0.9¢/kWh. The Rutgers analysis did not include REC sales.

The levelized cost data were entered into a simple pro forma that included as income the sale of RECs and the wholesale price of electricity ($0.05/kWh). A 12% IRR was targeted and the required incentive level was calculated.

**Table 5-18. Input Assumptions for Biomass Analysis**

| Technology | Description | Rated Capacity | Fuel Cost Included? | Levelized Cost of Electricity Generation | Capacity Factor |
|---|---|---|---|---|---|
| Gasification | Gasification with internal combustion engine, 2007 project, no incentives, \$1.50/mmbtu fuel costs | 1.5 MW | Yes | \$0.150 | 80% |
| Wastewater Biogas | 2007 system, no incentives, feedstock cost \$40/ton | 1 MW | Yes | \$0.150 | 75% |
| Landfill Gas | 2007 system, no incentives, feedstock cost \$1.50/mmbtu | 0.25 MW | Yes | \$0.105 | 85% |
| Combustion | 2007 system, direct combustion central, no incentives, \$3 feedstock cost | 25 MW | Yes | \$0.110 | 85% |

The results of the biomass incentive analysis show that landfill gas is the most cost-effective right now on a \$/MWh basis, followed by combustion, gasification, and then wastewater biogas. The high cost of gasification reflects the fact that this is still an emerging technology. However, the Rutgers report estimates that costs could be as low as 7 cents per kWh by 2015 (without incentives) for gasification with combined cycle technology, due to the much higher efficiency of that technology. To estimate the incentive needed for projects done in the public sector, a 20% increase was added to the cost for private sector projects. This is based on the difference between the pro-forma analyses of public and private projects for large onshore wind and offshore wind. The additional cost for public projects reflects the fact that public entities are not able to take advantage of tax incentives.

**Table 5-19. Recommended Incentives for Biomass Technologies**

| System | Program | Class | Capacity Incentive (\$/kW) | Performance-Based Equivalent (\$/MWh) |
|---|---|---|---|---|
| Gasification | REPGF/CORE | Public | \$1,655.53 | \$51.74 |
| | | Private | \$1,379.61 | \$43.11 |
| Wastewater Biogas | REPGF/CORE | Public | \$2,144.47 | \$58.49 |
| | | Private | \$1,787.06 | \$48.74 |
| Landfill Gas | REPGF/CORE | Public | \$128.16 | \$4.49 |
| | | Private | \$106.80 | \$3.74 |
| Direct Combustion | REPGF/CORE | Public | \$190.65 | \$10.49 |
| | | Private | \$158.87 | \$8.74 |

It was assumed that 5% of capacity for all biomass technologies will be installed through the CORE program, and 95% through the REPGF program. The adders available through the CORE program are the same as for solar and small wind – the interest rate buy down and the energy efficiency adder.

For the capacity installed through REPGF, it was assumed that wastewater biogas and gasification would be given the fast track adder as they are in more need of development assistance than combustion or landfill gas. Therefore, a 15% increase in incentive was added to the cost for those technologies.

### 5.9.5 Assumptions for Distribution of Project Types

In order to use the incentive level recommendations to prepare a budget for BPU's portfolio of renewable energy programs, assumptions were made regarding the potential share of public v. private sector projects. The percentages of public and private for wind and biomass were based on professional judgment. For solar PV, the percentages were based on the CORE participant database.

Based on discussions with program staff, the research team used an assumption that for commercial solar PV, only systems < 40kW will qualify for a rebate in the future. Public sector installations would receive a reduced rebate for systems over 40kW, but below 100kW. While this size cutoff was not included in the Board Order signed on December 6, 2007 (based on Board agenda meeting which took place on September 12, 2007), it reflects the fact that rebates will only be available to smaller systems. The only form of "incentive" received by the larger PV systems would be from SREC revenues (not reflected in these incentive values, but estimated in a separate ratepayer impact analysis), the proposed interest rate buy down available through the CORE program, and the CORE program energy efficiency adder, if the system is building-mounted. While the costs electricity suppliers incur for SREC purchases are built into electricity rates, and thus contribute to the overall ratepayer impacts of the RPS, the focus of this analysis is on the SBC funding needed for the 2009-2012 funding cycle.

The assumed distribution of project types within each program based technology category is shown below. Percentages are shown in terms of percentage of capacity rather than number of systems.

**Table 5-20. Assumed Distribution of Project Types**

| System | Program | Class | % of Capacity |
|---|---|---|---|
| < 10 kW Solar | CORE: Residential | Residential | 100% |
| 10 kW <> 40 kW Solar | CORE: C&I | Comm/Public | 15% |
| 40 kW Solar <> 100 kW | | Public | 3% |
| > 40 kW Solar | | Comm Private | 82% |
| Small Wind (< 100 kW) | CORE | Resid./Comm. | 100% |
| Large Onshore Wind (> 100 kW) | REPGF/CORE | Public | 20% |
| | | Private | 80% |
| Offshore Wind | REPGF | Public | 0% |
| | | Private | 100% |
| Gasification | REPGF/CORE | Public | 50% |
| | | Private | 50% |
| Wastewater Biogas | REPGF/CORE | Public | 50% |
| | | Private | 50% |
| Landfill Gas | REPGF/CORE | Public | 80% |
| | | Private | 20% |
| Combustion | REPGF/CORE | Public | 20% |
| | | Private | 80% |

# 5.10 Recommendations

## 5.10.1 Structure of Portfolio of Programs

It is important to start by highlighting that comprehensive and detailed program design was outside the scope of work for this assignment. Rather, Summit Blue's intent here is to offer recommendations regarding a broad structural framework for BPU's programs for the next SBC funding cycle. We have made some specific observations and recommendations that we believe to be sound based on our analysis, but these recommendations are not intended to replace detailed program design work.

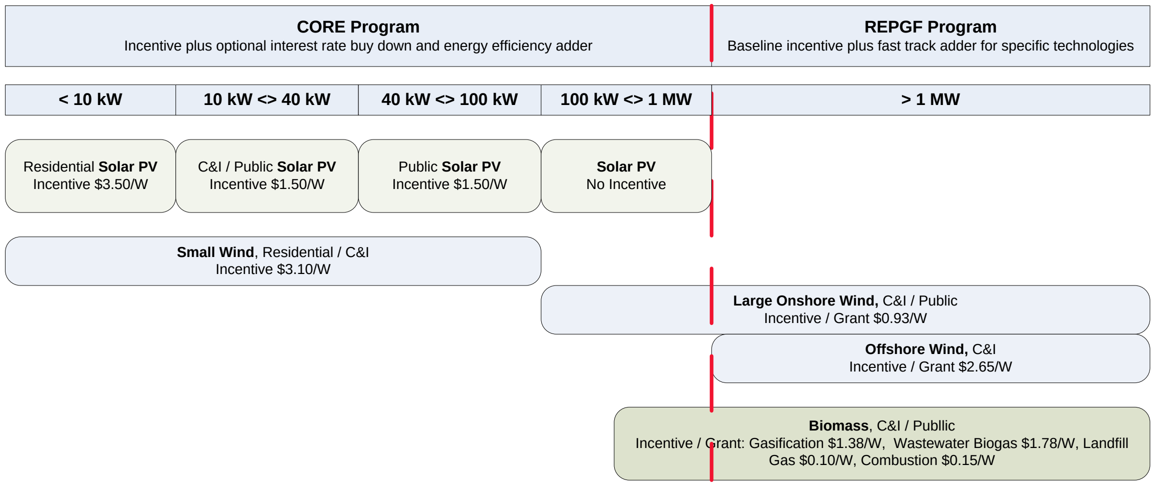
Summit Blue recommends maintaining the current general portfolio structure, but making substantial adjustments to implementation strategies and goals, and adding additional BPU staff / market manager functions to boost the efficiency of the market, improve program outreach, and ensure an appropriate pace of development. This current division between installation-based programs (CORE and REPGF) is appropriate given the varying needs of on-site versus grid supply-scale projects. Furthermore, given the market's need for regulatory certainty and investor confidence, it is important to provide continuity in general program structure and format to the extent possible. This is particularly important given the major solar market transition that is currently underway. Developers highlighted this point with numerous comments about the damaging role of uncertainty in the marketplace.

The Summit Blue team also recommends maintaining the existing use of rebate/grant incentive structures which also incorporate performance-based components (i.e., technical requirements and requiring meter data for SREC creation for CORE projects, and performance-milestone payment schedule for REPGF projects). The recommendation is based largely on practical aspects of the New Jersey marketplace. After a lengthy stakeholder process, the Board recently decided to adopt a long-term SACP schedule with the goal of making SRECs a central component in PV project finance in the state. Given the importance of maintaining regulatory certainty, a near-term shift to a full-tariff approach (in which all of the incentive would be paid on a $/kWh basis and there would be no SREC revenue) could cause another major disruption to the market. While a hybrid-tariff approach (in which some incentive is paid on a $/kWh basis and projects would also receive SREC revenue) could work under the current SREC framework, it seems that other means for providing project owners with necessary revenue certainty and access to favorable financing (i.e., long-term contracting requirements and low/zero interest loans) may be simpler to administer and more practical given the current market circumstances.

The diagram below shows the structure of the two programs that directly incentivize renewable energy projects, the CORE program and the REPGF program. It can be seen that some categories of technologies can be developed through either program and some are confined to one program or the other. In general, this structure gives a good amount of flexibility in implementation for prospective participants. The vertical dashed line shows the distinction between CORE and REPGF. The incentive amounts shown are suggested baseline incentives and it is recommended that participants also receive adders such as the interest rate buy down, the energy efficiency adder, and the fast track adder for specific technologies that the BPU wants to promote.

It is important to note that while the incentive amounts shown are capacity based, these incentive values are intended primarily for program budgeting purposes and are not meant to indicate the method in which incentives should be disbursed. A performance based incentive structure is preferable, particularly for larger scale projects where the administrative burdens would be minimal. Therefore, as discussed in the following sections, a performance-based incentive structure is recommended for the REPGF program in which a portion of the incentive payment is made upfront and the remainder are made based on actual performance. For the CORE program, a continued rebate structure is warranted, particularly for the small projects (i.e., under 10 kW), though a combination upfront / performance milestone payment structure would be ideal for larger CORE-funded projects.

**Figure 5-5. Diagram of Program Structure for Technology-Market Sectors in the CORE and REPGF Programs**




Key structural components of the recommended portfolio of programs are described below.

## CORE Program

The Board authorized the continuation of rebates for smaller solar projects, but will discontinue rebates for larger solar projects. The Board Order issued in December indicates that details regarding funding levels and eligibility will be determined as part of the Comprehensive Resource Analysis (CRA) proceeding. Though staff made recommendations which included a 10 kW size cutoff, the research team recommends a 40 kW cutoff for private projects and a 100 kW cutoff for public projects. The only source of incentive for larger projects would be SREC revenues, which are likely to increase as a result of the new eight-year SACP schedule and the RPS targets that increase annually.

The research team recommends that the CORE program continue to serve the development needs of PV, biomass, wind and fuel cell (RPS-eligible) resources producing electricity for on-site use. Solar projects will have a much smaller size limitation than non-solar projects due to the recent Board decision calling for a transition to SREC-driven project finance for larger systems. Project funding should still be made available to non-solar projects for up to 1 MW of installed capacity, and the funding should continue to be limited to the amount of the project used to serve on-site load.

Given the relatively small size of many of the projects funded through the CORE program, a continued rebate structure seems appropriate for small systems (i.e., less than 10 kW), and perhaps a combination upfront/performance milestone payment structure for larger systems. While a fully performance-based incentive payment structure is ideal in terms of ensuring system function and maintenance over time, many small project owners depend on an upfront infusion of funds and may have trouble obtaining favorable financing in the absence of a rebate to bring down the upfront system cost. Furthermore, BPU does already incorporate several performance-related components into the program's project approval process which should result in systems that function well over the long-term. However, there are several opportunities for a system to become non-functional despite all the standards projects must meet in order to receive program funding. For example, a project owner may neglect to replace an inverter when it fails, or a building could change ownership. An important step the BPU could take to effectively implement performance-based incentives for CORE-funded systems, without increasing the administrative burdens associated with implementing the CORE program is to require that SREC/REC creation for all behind-the-meter systems be based on actual metered data.

Summit Blue recommends the continued use of various performance-related components to ensure that only high quality installations are funded through the program. The CORE PV application form already specifies a number of basic efficiency and safety requirements, including post installation inspections, and a requirement that module orientation result in system out of 80% of the default output from PV Watts. The Board should consider simplifying the design parameters, perhaps specifying a range of acceptable module orientations (i.e., 45-60 degrees off of magnetic south), and specifically prohibiting module shading. Similar minimum performance requirements should be established for all technologies installed through the CORE program. Systems that cannot meet minimum standards should either be denied rebate funds, or should receive a discounted incentive. The Board should consider using software which could calculate expected system performance that may vary based on project location, module orientation and shading) and basing an upfront incentive payment on the expected system performance.

The Board should consider adopting the incentives levels presented in Section 5.9, as they are were calculated to provide projects with a 12% IRR and should stimulate sufficient growth in installed capacity. The recommended incentive levels also account for the differing needs of residential, public/non-profit and commercial projects. The SBC funding request to accommodate these rebates should be based on the total projected needs for solar development through the next SBC funding cycle. However, the Board should plan to review and implement any necessary adjustments to incentive levels on an annual basis.

In addition to the offering rebates, offering low-interest / zero interest financing to all net-metered Class I renewable energy projects, either in partnership with the New Jersey Economic Development Authority or a private bank should stimulate higher market adoption rates. This will address concerns expressed by developers that project owners have to carry a substantial debt burden for the period between system installation and rebate payment, and that projects are receiving less than ideal financing conditions since banks don't view solar as an as set. It will also prepare the Board for the likelihood that a broader population of New Jersey consumers (that may be less wealthy than earlier participants) will likely become interested in program participation over time.

### Renewable Energy Project Grants and Financing Program

The REPGF program should continue to serve the needs of >1 MW grid supply projects (those that are not serving on-site loads). The research team recommends using a system of "benchmark incentives" plus "adders." In the case where a technology has already been widely deployed and the risks are well know, the benchmark incentive should be used. The initial benchmark value should be based on the outcomes of the incentive analysis presented in this report, but should be updated annually based on market data. The incentive would be calculated as the benchmark incentive value ($/kW) times the capacity of the project. A substantial portion of the incentive should be paid upfront (i.e., 50%), and additional payments should be paid after the project achieves performance milestones (i.e., after 6 to 12 months of operation).

In the case where a technology has not been widely deployed and the risks are greater, or if a technology looks particularly promising for implementation in New Jersey, the project would receive the benchmark incentive plus an adder of 15%. For example, biomass gasification and offshore wind development are both less mature technology applications and should receive an extra incentive to help overcome the many challenges faced by early-market technologies.

In the past, projects have received a combination of grant and finance-based support. It is recommended that a similar approach be used in the future, but using the incentive "benchmark" or "benchmark plus adder" as the maximum incentive value for which an applicant would be eligible. As noted above, the Board should update the benchmark and "adder" incentive levels annually based on updated market data in an effort to match program incentives to evolving market conditions. The Board should consider making grant payments in increments, with part paid upfront, and additional payments paid based on actual performance milestones. The Board should also consider adding a competitive solicitation component to the program, as this would help stimulate competition among projects which could help lower costs and provide an annual snapshot of market conditions. It would also provide focus for program outreach activities, and may improve program delivery efficiency. Whatever policy the Board adopts, it needs to be clearly communicated in a readily available program handbook and policies, and described during public workshops.

A ***pre-development assistance*** component should also be added to the REPGF program to help reduce the risks and costs associated with feasibility assessment and non-construction pre-development activities (i.e., siting, permitting, potential delays in the development cycle) associated with utility-scale non-solar projects.

## Business Venture Assistance Program

A more limited analysis of this program was conducted than for the other programs due to issues of data availability and project resources. However, based on a review of available program data the research team recommends that BPU continue offering assistance for the commercialization and growth of New Jersey's renewable energy businesses through the Business Venture Assistance program, in collaboration with the New Jersey EDA. Use of a combination of grants and unsecured loans should continue.

## SREC / REC Trading System

The research team recommends transitioning from the SREC / REC trading system to the PJM GATS for all New Jersey RPS certificate / REC trading. GATS is capable of supporting BTM generators, using GATS would simplify RPS compliance for suppliers, and the Board could reduce administrative expenses. Funds currently spent to administer the SREC / BTM REC trading could be reduced substantially and reallocated to provide support to small generator owners needing assistance with understanding or participating GATS.

## Community-Based Renewables Development Program

The addition of a community-based renewables program would provide education and outreach activities, and funding assistance for communities to plan for the development of renewables. Funds for such a program would go toward:

1) BPU / market manager staff (or outsourced resources) who would conduct geographically targeted education and outreach activities, provide information about direct project funding

resources available through the CORE and REPGF programs, develop a model plan for community-owned renewable energy projects; and assist communities in developing their own comprehensive renewable energy development plans;

2) Government entities to fund the development of community-specific renewable energy development plans, research finance options for project ownership, and staff time necessary to develop proposals for permitting and zoning provisions that accommodate renewables development.

This program would address a number of market needs including those of:

- Public entities seeking to own projects (i.e., and alternative to the PPA model);
- Individuals and small business owners for whom full project ownership does not make sense, but who might want to contribute to a larger project in their community; and
- Communities with limited resources available to fully explore and plan for renewable energy development opportunities.

Adding a community-based renewables development program would ensure that planning, coordination and accountability would exist for communities- a key channel for market development activities. In addition, the community based renewables development program proposed here would provide concrete and far-reaching outcomes by assisting communities with the production of comprehensive renewable energy development plans. These plans would address barriers like siting and permitting, and would identify ideal locations within the community for community-owned, IPP or large commercial renewable energy project development.

## 5.10.2 Program Implementation and Policy-Related Recommendations

This section provides over-arching recommendations related to program implementation and policies. Detailed program-level recommendations are included in Volume 2, Section 3.

### Marketing and Outreach Targeted by Market Sector and Geography

The research team recommends adding new components to the existing programs to target outreach and assistance both by ***market sector*** and ***geography***. A key way to foster sustained orderly development is to lead with highly visible and numerous examples of projects possessing solid business cases. For example, on-site advanced biomass and fuel cell applications are uniquely suited to large industrial sites with continuous operations, and many such potential development sites exist in New Jersey. This sector would be well-suited to sector-specific targeted outreach and assistance.

In addition, small wind development could be geographically targeted to those communities well-positioned to become renewable energy leaders, for example those communities with the highest number of subscriptions through the CleanPower Choice program, that have adopted a model wind zoning ordinance, and possess viable sites for small or large onshore wind development. These added program components would require additional staff / market manager funding, but should not require additional incentive funds. Rather, these targeted activities would help guide the distribution of funds to high-value locations, and ensure that BPU staff is being proactive in advancing the development of both solar and non-solar resources.

## Facilitate Long-Term Contracting with Suppliers

The Board should carefully explore options for facilitating / requiring long-term contracting for RECs by suppliers or utilities. Long-term contracts between suppliers and generators will improve market efficiency, investor confidence and access to favorable financing, while lowering ratepayer costs. The 3-year BGS auction cycle currently provides no incentive for suppliers to enter into longer term contracts. However, according to the New Jersey Department of the Public Advocate, Division of Rate Counsel's interpretation, it is within the Board's power to require suppliers to enter into long-term contracts with renewable generators.

Other states have used a variety of methods to facilitate long-term contracting, many of which are based on a mandate that suppliers / utilities enter into long-term contracts with generators. Connecticut and Maryland require long-term contracting between generators and suppliers for certain amounts or types of supply. Through New York's Main Tier RPS program,NYSERDA enters into ten year REC contracts with generators. California's regulatory authority carefully monitors the utilities' plans for RPS compliance, a key piece of which is ensuring that the utility holds long-term contracts for a certain portion of its RPS supply. Other states also require that suppliers demonstrate plans for future RPS compliance. The simplest and most appropriate approach may be to require that suppliers enter into long-term contracts for a certain portion of their expected RPS compliance obligation. However, a more detailed assessment of potential approaches is warranted and Summit Blue recommends that the Board conduct such an assessment.

## Improve Monitoring / Communication of Market Data

Increased monitoring and communication of market data by BPU would improve market efficiency and provide great value to ratepayers. New Jersey market participants need access to frequently updated data on key market indicators, and the balance between supply of and demand for RPS eligible resources. Specifically, BPU / Market Manager functions related to outreach and data monitoring / communication should include:

- Proactive marketing of BPU program resources to key market sectors and communities.
- Web-based summaries of key market and program indicators updated quarterly (or more frequently as appropriate). The Board could use the certification process for RPS eligibility as an opportunity to gather data from generators. Additional ongoing data collection activities should be conducted to gather data from a range of market participants. In addition, program records and the current SREC trading platform provide useful market data that should be summarized and communicated publicly on a quarterly schedule.
- Prepare publicly available, comprehensive annual reports on RPS compliance including the previous year's compliance status (sources / types of RECs and extent to which ACP /

SACP were used) and anticipated compliance issues for the coming year.[91] Establish a streamlined RPS website that includes clear, up to date information on RPS rules and related activities, a list of LSEs needing to comply with the RPS, and a list of generators certified by the Board to supply RECs for RPS compliance in the state.

## 5.10.3 Operational Goals and Objectives

Recommendations for ***operational goals*** and objectives, by program, are summarized in Table 5-21, along with recommended means for tracking progress toward these objectives.

### Table 5-21. Summary of Recommended Operational Goals and Objectives

| Goals | Customer Onsite Renewable Energy Program | Renewable Energy Project Grants and Financing Program | Business Venture Assistance Program | Community Renewables Program |
|---|---|---|---|---|
| | Objectives | | | |
| Clearly communicate program incentive offerings, requirements and approval processes | Complete a comprehensive program handbook[92]<br><br>High program participant satisfaction ratings for quality and availability of information (collected via survey / interview) | | | |
| Proactive pursuit of optimal development opportunities for each technology / market segment | By 12/31/08, identify optimal / under-developed technology / market segments and establish plan for reaching them | | Fund at least one project in 2008 that focuses on reducing development barriers for non-solar technologies | By 12/31/08, identify communities with strong RE development potential and establish a plan for engaging them |
| Provide adequate support to program applicants and existing participants | High program participant satisfaction ratings for amount and quality of support received (collected via survey / interview) | | | |
| Facilitate streamlined, efficient project approval processes | Establish and adhere to realistic and reasonable approval timeframes (to be set by BPU management) | | | |
| Provide logistical, technical and financial support across the full range of Class I | Participant feedback in '09 indicating that program support has shortened length of development cycle | Participant feedback in '09 indicating that program support has shortened length of development cycle | Participant feedback in '09 indicating that program support has shortened length of development cycle | Participant feedback in '09 indicating that program support has facilitated substantial renewable energy |

[91] California, Massachusetts, and several other states provide comprehensive reporting on RPS compliance, and require utilities / suppliers to submit plans for complying with the RPS.

[92] A program handbook would function as a single source for all relevant, up to date program policies and procedure.

| Goals | Customer Onsite Renewable Energy Program | Renewable Energy Project Grants and Financing Program | Business Venture Assistance Program | Community Renewables Program |
|---|---|---|---|---|
| | Objectives | | | |
| technology / market segments | and increased feasibility of non-solar projects (collected via survey / interview)<br><br>Fund at least 10 non-solar projects in 2008 | and increased feasibility of non-solar projects (collected via survey / interview)<br><br>Fund 4 non-landfill gas projects totaling at least 15 MW in 2008 | and increased feasibility of non-solar projects (collected via survey / interview) | development in at least 3 communities. (collected via survey / interview) |
| Streamline and improve consistency of permitting requirements | Establish model ordinance for wind development<br><br>Convene biomass working group to identify specific permitting needs<br>Maintain active wind working group. | Establish model ordinance for wind development<br><br>Convene biomass working group to identify specific permitting needs<br><br>Convene wind working group to address offshore wind development issues<br><br>Ensure clear biomass permitting protocols exist, working with DEP | N/A | Conduct workshops with local officials in identified target communities to educate them on permitting issues and availability of model wind ordinance. |
| Increase public awareness and acceptance of renewables | Complete highly visible projectsin each target community by 2010.<br><br>Review BPU website quarterly to ensure material is current and it highlights non-solar projects<br><br>Conduct speaking engagements at key trade association and community events | Improvements in public opinion on offshore wind in future surveys conducted in 2009 (compare with results from survey conducted in 6/06); and 2011. | N/A | Conduct quarterly educational workshops for residents and local officials in target communities.<br><br>Conduct speaking engagements at key trade association and community events in target communities. |

### 5.10.4 Proposed Incentive and Program Funding Levels

In this section, the Summit Blue team presents in this section recommended funding levels for each technology market sector and for the proposed portfolio of programs for the 2009-2012 SBC funding cycle. This portfolio is designed to balance the needs of the technology-market sectors, overcome market barriers, and meet the evolving needs of the New Jersey renewable energy marketplace.

*Proposed Incentive Levels by Technology Market Sector*

Residential solar would still receive the highest incentive, but small and offshore wind is fairly close in value. Table 5-22 shows the recommended incentive levels on a capacity basis ($ per kW of capacity). The incentives are also shown on a performance basis ($ per MWh of generation). The $/MWh values were calculated using estimates of performance for each of the technologies. The performance-based incentives are provided here for information only, so that a comparison can be made between technologies on a per MWh basis. These incentives are not additive – projects would receive either a capacity-based incentive, a performance-base incentive, or some combination to be determined based on final program design by BPU staff. Recommended incentive levels were calculated on a capacity basis only.

**Table 5-22. Recommended Incentives for Technology-Market Sectors**

| System | Program | Class | Capacity Incentive ($/kW) | Performance-Based Equivalent ($/MWh) |
|---|---|---|---|---|
| < 10 kW Solar | CORE: Residential | Residential | $3,500 | $166.48 |
| 10 kW <> 40 kW Solar | CORE: C&I | Comm/Public | $1,500 | $71.35 |
| 40 kW <> 100 kW Solar | | Public | $1,500 | $71.35 |
| > 40 kW Solar | | Comm Private | none | none |
| Small Wind (< 100 kW) | CORE | Resid./Comm | $3,100 | $129.56 |
| Large Onshore Wind (> 100 kW) | REPGF/CORE | Public | $1,320 | $29.00 |
| | | Private | $930 | $20.00 |
| Offshore Wind | REPGF | Public | $2,745 | $50.25 |
| | | Private | $2,650 | $48.51 |
| Biomass Gasification | REPGF/CORE | Public | $1,656 | $51.74 |
| | | Private | $1,380 | $43.11 |
| Wastewater Biogas | REPGF/CORE | Public | $2,144 | $58.49 |
| | | Private | $1,787 | $48.74 |
| Landfill Gas | REPGF/CORE | Public | $128 | $4.49 |
| | | Private | $107 | $3.74 |
| Biomass Direct Combustion | REPGF/CORE | Public | $191 | $10.49 |
| | | Private | $159 | $8.74 |

*Note that these values are the baseline incentives and do not include the energy efficiency adder, the interest rate buy down, or the fast track adder for REPGF.*

## Proposed Funding Levels for Programs

Based on the recommended incentive levels, previous funding levels, and an estimated mix of technology-market sectors that will provide the needed capacity to meet the RPS goals by 2012, the Summit Blue team recommends the following funding levels for the 2009 to 2012 funding period.

## Table 5-23. Recommended Budget for Funding Period 2009-2012 (total 4-year budget)

| All values in 2007 $ (thousands) | Total Recommended Budget | Admin (Payroll, Overheads, facilities, legal, etc.) | Marketing & Promotions | Market Research, Evaluation & Program Development | Direct Payments: Capacity Incentives/ Implement. Contractors | Associated MW of Capacity |
|---|---|---|---|---|---|---|
| **BPU RENEWABLE PROGRAMS** | | | | | | |
| Customer On-Site Renewable Energy (CORE) | | | | | | |
| CORE - Solar PV | $34,505 | $941 | $1,412 | $784 | $31,368 | 502 |
| CORE - Small Wind | $1,316 | $36 | $54 | $30 | $1,197 | 6 |
| CORE – Biomass | $6,550 | $179 | $268 | $149 | $5,955 | 30 |
| *Subtotal CORE Budget (2009-2012)* | *$42,371* | | | | | |
| *CORE **Annual** Budget* | *$10,593* | | | | | |
| | | | | | | |
| CleanPower Choice | $4,738 | $132 | $540 | $62 | $4,005 | |
| ***Sub-Total: BPU Renewable Programs*** | ***$47,109*** | ***$1,287*** | ***$2,273*** | ***$1,025*** | ***$42,524*** | |
| **EDA RENEWABLE PROGRAMS** | | | | | | |
| RE Project Grants and Financing | | | | | | |
| REPGF – Large Onshore Wind | $3,482 | $95 | $142 | $79 | $3,165 | 57 |
| REPGF - Offshore Wind | $49,348 | $1,346 | $2,019 | $1,122 | $44,862 | 270 |
| REPGF - Biomass | $126,002 | $3,436 | $5,155 | $2,864 | $114,547 | 579 |
| Pre-Development Financing | $22,000 | $600 | $900 | $500 | $20,000 | |
| *Subtotal REPGF Budget (2009-2012)* | *$200,831* | | | | | |
| *REPGF **Annual** Budget* | *$50,208* | | | | | |
| | | | | | | |
| Renewable Energy Business Venture Assistance | $30,800 | $840 | $1,260 | $700 | $28,000 | |
| *REBVA **Annual** Budget* | *$7,700* | | | | | |
| | | | | | | |
| ***Sub-Total: EDA Renewable Programs*** | ***$231,631*** | ***$6,317*** | ***$9,476*** | ***$5,264*** | ***$210,574*** | |
| **ADDITIONAL PROGRAMS / AREAS OF FOCUS** | | | | | | |
| Community-based Renewables Development Program | $22,000 | $600 | $900 | $500 | $20,000 | |
| Data Management and Communication (RPS reports, quarterly indicators) | $1,540 | $42 | $63 | $35 | $1,400 | |
| Industry Outreach and Partnerships (academic and business, working groups, etc.) | $4,400 | $120 | $180 | $100 | $4,000 | |
| ***Additional Programs / Areas of Focus*** | ***$27,940*** | ***$762*** | ***$1,143*** | ***$635*** | ***$25,400*** | |
| **TOTAL Renewable Energy Programs** | **$306,680** | **$8,367** | **$12,892** | **$6,924** | **$278,497** | |
| **Budget per Year** | **$76,670** | **$2,092** | **$3,223** | **$1,731** | **$69,624** | |

The incentive payments through CORE and REPGF were based on technology deployment Scenario 2 – “Good biomass, some offshore, less solar,” shown in Table 5-13. This was the cheaper of the two options and it includes offshore wind. It should be noted that this budget is for the period 2009 to 2012, and that the amount of new renewable energy required to meet the RPS is based on the total RPS requirement minus the generation in 2006. i.e., if capacity is built in 2007 and 2008 then this will not need to be paid for in the 2009 to 2012 budgeting period. However, it is not possible at this time to estimate how much will be built in 2007 and 2008, and as it appears that large scale renewables (which make up most of this scenario) are getting off to a slow start, it seems reasonable to assume that most of the renewable energy build will occur in the 2009 to 2012 period. The incentive amounts assigned to each technology category in the CORE and REPGF programs are given in detail to highlight the need to distribute funds more equally across technologies, despite solar needing the highest incentive level per kW of installed capacity.

Assumptions used in the development of this budget include:

- Five percent of total biomass development will be through the CORE program, and the other 95% through REPGF;
- Clean Power Choice budget is a 3% increase over the budget for 2006 to adjust for inflation;[93]
- The Renewable Energy Business Venture Assistance program budget is based on a 50% increase over the 2007 budget;
- The Community Based Renewables Development program is based on an estimate that the program would fund 5 projects per year at $1M for each project;
- The Data Management and Communication budget is based on an estimate of 3 full time employees at $110,000 each per year, including salaries and overhead; and
- The Industry Outreach and Partnerships program budget is based on $1M allocation per year to pay for networking and outreach events.

The budget presented here, viewed on an annual basis, represents roughly a 52% reduction below the 2007 budget for the portfolio of renewable energy programs (adjusted for inflation), which was $155.5 million.[94] This is despite increases in funding for the REBVA and REPGF programs, and despite adding the new Community-based Renewables Development program. A dramatic increase in the REPGF program budget (approximately a five-fold increase over the 2007 program budget) was seen as essential given the need for an increase in non-solar utility scale project development, and given that the expenditures under this program are much more cost effective on a $/kW of installed capacity basis than are expenditures made under the CORE program. The fact that the total recommended budget is lower reflects the decreased need for direct funding for solar PV due to the phasing out of rebates for systems greater than 40kW in

[93] This program was not reviewed as part of this market assessment.

[94] This 2007 budget reference does not include $13 million spent on OCE program oversight, which is distributed across both renewable energy and energy efficiency-related programs. Therefore, the proposed budget represents and even greater reduction compared to current budget levels.

size, as well as the elimination of funds budgeted for programs that weren't operational and are not recommended for inclusion in the portfolio, such as a PV manufacturer incentive program.

In general, this budget seeks to add funding for essential work not directly related to installation of capacity, such as market research, education and outreach, and commercialization of new technologies. It is assumed that any monies invested in research, education and outreach, and marketing will produce substantial long-term benefits, such as reduced barriers to large non-solar project development.

# 5.11 Summary of Portfolio Findings and Recommendations

## 5.11.1 Findings

- Based on current projections of energy use in New Jersey through 2020, RPS requirements will require a total of 21,331 GWh/yr to be generated by Reporting Year 2021 from Class I renewables. The requirement for capacity will depend on the mix of technologies installed and their capacity factors.

- The solar set aside will require approximately 2,261 GWh/yr to be generated by Reporting Year 2021, requiring 2.2 GW of solar capacity to be installed.

- New Jersey possesses approximately 94% of the projected RPS goal for 2020 in economic potential for in-state generation.

- To date New Jersey's electricity suppliers have been able to meet the RPS requirements in all three categories (Class I, Class II and solar). Meeting the RPS solar PV requirement in Reporting Year 2008 seems reasonable. However, a substantial shortfall is expected for Reporting Year 2009.

- Overall barriers to market development include: uncertainty about the future of the BPU incentive programs; uncertainty regarding project revenue streams (long-term value of RECs and retail electricity), and difficulty obtaining long-term contracts due to electricity market structure (i.e., 3-year BGS auction cycle); high up-front project costs; long development cycles and slow access to funding for non-solar projects; lengthy process to obtain BPU project funding; difficulties getting questions answered or rules clarified by BPU staff; intermittency of output; lack of mature local infrastructure for certain types of technologies / applications; NIMBYism and negative public conceptions about non-solar renewable energy; lack of readily available, up to date information on key market indicators such as average installed costs, REC prices, and system performance; and a transmission system that is not well prepared to handle large additions of large-scale renewable energy.

- Key strategies for addressing these barriers include: facilitating long-term contracting; establishing a clear, long-term plan for BPU program structures and incentive types; sector-specific and geographically-targeted outreach and incentives; providing consistently updated resource and market data; and establishing technology-specific working groups, etc.

- In a ranking of technologies for prioritization of deployment, the top five technologies included landfill gas, wastewater biogas and direct combustion biomass, and commercial and industrial PV and offshore wind.

- Key strengths of the portfolio of programs to date have been: BPU's ability to foster valuable partnerships with academic institutions; recent activities to address barriers in the wind sector (established wind working group, anemometer loan program, surveyed market actors and the public); and the ability of the CORE program's funding resources, along with New Jersey's RPS-mandated demand, and favorable net metering and interconnection policies, to trigger rapid growth in solar installed capacity.

- The greatest weakness of the existing portfolio as implemented to date is its inability to trigger development of large, non-solar resources. The disproportionately large amount of solar development relative to non-solar resources can be attributed to: the presence of an aggressive solar RPS requirement and lack of other specific technology goals; budget allocation / incentive structure; insufficient staff implementation of REPGF and REBVA programs; more complicated siting / approval / technical issues, less mature market infrastructure for non-solar projects; and lack of easily developable, plentiful, large-scale non-solar resources.

- Both feedback from market participants and analysis by the Summit Blue team indicate that the renewable energy market would benefit from the availability of more substantial and more frequently updated information on key market indicators, including installed cost, installed capacity by technology (both in-state, total number certified as New Jersey Class I eligible within the PJM GATS, and capacity factors by technology (based on actual metered data)).

### 5.11.2 Recommendations[95]

- Maintain the existing portfolio of programs (CORE, REPGF, and REBVA program), adding geographic and sector-specific marketing and outreach components.
- Introduce targeted initiatives (both geographic and sector-specific) to help expedite the pace of development and facilitate project development at optimal locations.
- Launch a community-based renewable energy development program to assist communities in preparing comprehensive renewable energy development plans, and addressing key barriers to development.
- Target outreach efforts to reach sectors that are ideal for on-site renewable energy applications, such as large industrials, and facilitate wind and biomass working groups to facilitate industry networking and growth.
- Establish technology-specific installed capacity goals for 2012 using the scenarios provided in this report for guidance.

[95] Recognizing that this portfolio level assessment will likely be read separately from the rest of the document, a variety of key recommendations from the detailed program reviews are included here, though they were not included in the main body of the portfolio-level assessment.

- Increase the level of support (both financial and non-financial) for the development of large non-solar resources.

## SBC and Program Funding

- To the extent possible, establish a long-term plan for program funding levels, making clear any mechanisms/criteria that would change the funding levels (i.e., major changes in Federal incentives and/or equipment pricing that would affect ability to of projects meet IRR targets within existing funding framework), and at what times these changes would take place. Ample notice should be given to all market players, prior to implementing any changes in funding levels (i.e., six to nine months).
- Consider proposing a 4-year SBC budget of $306 million ($76.6 million annually). This is based on an assessment of the distribution of resources that should be allocated to meet RPS requirements, and the incentives and program support mechanisms necessary to facilitate necessary project development. The recommended annual budget is 52% lower than the 2007 budget for renewable energy programs.

## BPU Staffing and Broad Industry Development Support

- Ensure adequate staffing resources are available to serve the needs of those who are interested in, applying to, or participating in BPU programs. Also provide one or more staff people dedicated to managing and communicating relevant market data (such as thorough RPS compliance and forecast reports, and publicly available web-based presentation of indicators updated quarterly).
- Establish a long-term plan for BPU's market support structure to enable industry to plan for the future.
- Introduce substantial Information Technology system improvements to facilitate efficient tracking and communication of program records and key performance indicators. Also, ensure data are made publicly available in a user-friendly format, and updated on a quarterly, or real-time basis (i.e., maintain an interactive dashboard for tracking key indicators).
- Strive to maintain consistency in program structure and market rules over time to minimize regulatory uncertainty and to enable industry to adequately plan for future delivery of products and services.
- Clearly communicate program guidelines and rules in one easy to access document.[96] Ensure that rules are adhered to by all parties. Periodic updates to the handbook should be kept to a minimum and clearly communicated to the industry.
- Focus on advancing technology applications that are well-suited to the unique resource challenges facing New Jersey, and specifically set targets for the commercialization of technologies that will work in an urban environment.

[96] The California Solar Initiative's "CSI Handbook" could be used as a model.

- Facilitate and encourage PV and small wind installer training, to ensure that poor quality installations do not sour public opinion of the ratepayers' investment in PV and small wind development.
- Immediately pursue a plan to facilitate improved REC revenue certainty, including exploring options for removing/minimizing barriers to long-term contracting.
- Allow non-net metered solar projects to receive SRECs and contribute to RPS compliance.
- As a condition of certifying a facility as New Jersey Class 1 (or solar) RPS-eligible, require metered data to be used as the basis for creating RECs / SRECs
- Consider implementing energy efficiency requirements for participants wanting to receive a rebate, for the on-site technologies.
- Transition all behind the meter REC reporting and transactions to GATS, and provide support to assist the owners of these systems in their GATS participation.

# 6 SUMMARY OF FINDINGS AND RECOMMENDATIONS BY ASSESSMENT TOPIC AREA

Major findings and recommendations pertaining to the detailed market and program-level assessments, which are part of the Volume II of this report, are included in this section. All findings and recommendations are based on the detailed analyses described in the two volumes and appendices of the report.

## 6.1 Market Level Assessment

### Findings

- As of December 31, 2006, 39 MW[97] of Class I renewable energy generation capacity was installed with the assistance of BPU program funding;[98] of which 27 MW was solar PV. In order for the Board to achieve its goal of installing 300 MW of Class I resources, an additional 185 MW of Class I renewable energy must be installed by December 31, 2008, of which 63 MW must be solar PV and 122 MW must be non-solar technologies.

- As of December 31, 2006, New Jersey's Class I and Class II renewable energy systems generated enough electricity to supply 1.05% of the state's electricity demand (0.64% Class I, 0.37% Class II and 0.04% solar). In order for BPU to achieve its goal, it must install enough eligible RE capacity to generate an additional 3 million MWh of Class I generation, 1.8 million MWh of Class II generation, and 88,000 MWh of solar generation by December 31, 2008.

- Past CORE participants have tended to be wealthy (54% had an annual income greater than $100,000) and many paid cash for their PV systems (33%). Developers agreed that access to financing is not currently a significant barrier, but that in the future the demographic of consumers interested in participation may have more trouble financing their systems. Developers also highlighted that lenders do not view a PV system as an

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97 Based on CORE program records as of December 5, 2006.

98 Note that the REPGF program grant for the 7.5 MW Jersey Atlantic Wind / Community Energy wind farm was calculated based on 4.875 MW of installed capacity. 2.635 MW received funding under the CORE program in early 2007. Since only funded capacity is counted in this market assessment, and to properly attribute capacity development across programs, only 4.875 MW of the wind farm has been attributed to the REPGF program, and 2.625 MW should be attributed to the CORE program in a future market assessment. However, since the full 7.5 MW project has been operational since the end of 2005, its total capacity and output have been counted in the market level assessment (using 2006 as the starting year since that was the year in which the project received its first incentive payment).

asset in analyzing a borrower's home equity, and suggested that BPU offer a PV-focused financing program that recognizing PV as an asset.

- Barriers to PV development include: uncertainty about the future of the solar market in New Jersey, and in particular, the future of the CORE program; intermittency and marginal amount of insolation; a silicon shortage; high upfront cost and inability to value system as an asset for purposes of project finance; intermittency of the solar resource; need for stronger support for installer training.

- Barriers to biomass development include: the expense of fuel transport resulting from the fact that the fuel has low energy and volumetric density; the challenge of managing fuel supply needs due to inconsistencies in composition and moisture content of biomass fuel; an immature market for biomass supply, which results in unpredictable fuel costs and complicates project economics; and the length of the permitting and siting process.

- Barriers to landfill gas development include: difficulty in predicting a landfill's fuel supply resource (because the fuel resource depends on what was disposed at the landfill, and it declines over time at a rate that can be difficult to predict); and limited number of remaining landfills suitable for power generation.

- Barriers to wind energy development include: a lack of onshore wind resource; siting and permitting; large upfront and levelized costs; intermittency and unpredictability of wind resource; uncertainty regarding long-term availability of production tax credit

- One of the largest overall barriers to all renewable energy development is the uncertainty associated with renewable energy market incentives and future REC values.

- Given the current market structure, economic, logistical and political factors would make it difficult for BPU to coordinate with distribution companies to identify the best locations for distributed generation.

- A variety of options exist to link BPU's programs with efforts to increase energy efficiency at participating facilities including a requirement that all program participants complete an energy audit, or incentive adders to encourage participants to complete energy saving measures.

## Recommendations

Recommendations were developed to address barriers identified through the market level assessment. Findings and recommendations from the market-level assessment were used as inputs to the portfolio-level analysis. Therefore, key recommendations related to market-level findings are presented as part of the portfolio level assessment. A brief summary of market-level recommendations follow.

- To address the barrier of market uncertainty, establish an incentive system that lenders and equity owners can count on over a reasonable period into the future. This will resolve the issue of attracting financing to the state and will ameliorate the high capital costs associated with PV. In addition, New Jersey should clearly communicate its long-term commitment to developing the renewable energy market to avoid disillusionment and antipathy towards the state's incentive programs as the state transitions to a more stable long-term system for market development.

- To address the barrier of high upfront costs, and the likely difficulty residential and other small system owners will have in securing favorable financing once rebates are phased out, offer low or zero-interest financing services through the CORE program to help participants deal the with lag in timing of incentive payment and to broaden the scope of potential program participants to include those in lower income brackets than current participants.

- In order to increase the chances of meeting RPS requirements at a minimal cost to ratepayers, New Jersey should significantly increase efforts to encourage the development of utility-scale wind and biomass resources in addition to maintaining its commitment to PV market development.

# 6.2 Program Level Assessment

## 6.2.1 CORE Program

### Findings

- As of the end of 2006, approximately 30 MW of renewable energy capacity had been installed under the CORE program. The goal for New Jersey is to install 300 MW of Class I renewable energy generation capacity by December 31, 2008, including 90 MW of solar capacity and 210 of non-solar capacity. Therefore, the CORE program has contributed approximately 10% toward achieving the overall Class I installed capacity goal, and 30% toward achieving the solar goal.

- Program participants installed 5.5 MW of solar electric system capacity during 2005, surpassing BPU's 4 MW goal for solar electric installation in 2005 by about 38%. The goal of installing 6 MW of other renewable energy systems in 2005 was not reached. Under the CORE program, only 1.9 MW of non-solar renewable energy systems, biomass and wind, were installed in 2005. Therefore, about 32% of the non-solar renewable energy system installed capacity target was achieved in 2005.

- A total of nearly 4,300 applications were processed as of the end of 2006, and nearly 2,000 incentives were processed during this period. Commercial systems make up 40% of the installed capacity funded through the program, followed by residential systems (38%), K-12 schools (11%), government (5%), universities (4%), and non-profits (1%). A total of $131,557,613 in rebates had been paid through the program as of the end of 2006.[99] From 2001 through 2006, systems installed through the program are estimated to have generated a total of 49.4 GWh of electricity, avoiding the emission of 49,227 metric tons of carbon dioxide, 211 metric tons of sulfur dioxide, 91 metric tons of nitrous oxides, and 0.001 metric tons of mercury.

[99] Including fuel cells.

- Both program participants and developers expressed dissatisfaction with the current state of the program, though many were satisfied with the program prior to the point when demand for funding exceeded the program's budget.

- Only 26% of survey respondents said they would still have installed the system if the CORE program rebate was 25% less than they received. Also, 89% of customers were "very satisfied" or "satisfied" with the project financial incentive level.

- The majority (about 86%) of customers in the CORE program preferred a fixed, up-front rebate to alternative financial incentive structures.

- While the program has been shown to make solar an attractive investment from a long-term financial perspective, many respondents pointed out that the rebate amount does not lower installed costs because those costs all must be borne long before the rebate is issued.

- CORE program participants emphasized the importance of incentive program stability.

- Primary barriers to program participation included uncertainty regarding long-term SREC market values, durability of the RPS requirement, and instability of the CORE program.

## Recommendations

- In its December 2007 Order, the Board indicated it supports the continuation of a rebate program for smaller PV projects and that a solar rebate program will be continued through the next Societal Benefit Charge (SBC) funding cycle. Staff recommended a size cutoff of 10 kW for PV rebate eligibility. However, based on a review of project economics by size, the research team recommends a size cutoff of 40 kW for private projects and a 100 kW cutoff for public projects. Under the new multi-year SACP approach, larger PV systems would not be eligible for rebates. It is recommended that a rebate incentive structure continue for small solar and for non-solar technologies up to 1 MW that serve on-site load. While many developers expressed support for a feed-in tariff or performance-based incentive approach, and this is an approach worth considering further, a rebate approach seems reasonable given the path the Board has begun to lay out with its recent Board Order introducing a multi-year SACP schedule. In addition, rebates are easy to administer and will reduce upfront system costs for program participants. Program participants (86%) also indicated that a rebate is the preferred form of financial incentive.

- The program should incorporate several **performance-related components**:

    - Step up efforts related to on-going **monitoring of system performance**

    - Revise minimum technical requirements for system installation to clearly specify a range acceptable for module orientation for PV systems and appropriate minimum system design requirements for non-solar projects.

    - Require all systems to be metered and require use of metered data as the basis for SREC creation (this could be phased in over a two year period).

  - In the web site listing of CORE program installers indicate which installers have received **North American Board of Certified Energy Practitioners (NABCEP) certification**. This should encourage more installers to obtain certification, thus improving confidence in the quality of installations. Also, BPU should consider sponsoring NABCEP training courses to make it easier for installers to gain the skills needed to perform high-quality installations.[100]

- An **annual budget** of $10.6 million is recommended for the upcoming SBC funding cycle (2009-2012). Recommended incentive levels are presented in the following program and portfolio-level assessments.

  - The **incentive levels** and recommended program budget are based on analysis which considered New Jersey's renewable energy development needs, by technology, in order to stay on track to achieve RPS requirements through the next SBC funding cycle. The analysis also factored in project costs and barriers, and an IRR target of 12% was used. Discussion of the basis for these recommended incentive levels is provided in the portfolio level assessment, Volume 1, Section 5.

  - In addition to baseline rebate levels, projects **incentive adders** of $0.25/W should be made available if the applicant: a) is an ENERGY STAR rated home, a LEED certified building, or a residence or commercial project demonstrating that significant energy efficiency measures have been completed at the site; b) major system components used in a project were manufactured in New Jersey. Adders could be offered for projects with other positive project features as well, such as being located in a congested area of the distribution system, or in an area targeted for smart growth initiatives.

- All participating buildings should be **required to complete an energy audit** before the applicant receives a rebate. Applicants would not be required to implement recommended measures, but if they do, they may be eligible for an incentive adder. The goal is to ensure that all program participants are aware of the cost effective benefits of energy efficiency, and to facilitate cross-marketing of BPU's energy efficiency and renewable energy programs.

- Consider offering a low interest financing option to Class I renewable projects serving on-site load, subject to further analysis regarding appropriate target markets. For solar, this may include projects larger than the 40 kW rebate-eligibility limit. Feedback from market participants indicated that uncertainty associated with SREC / REC values will make project finance more expensive, that it can be difficult for program participants to bridge the gap in timing between paying for a system and receiving a rebate payment. In addition, the majority of past program participants have been wealthy individuals and it would be beneficial to make the program accessible to a broader population of potential

[100] Installer training has been a strong focus for the New York State Energy Research and Development Authority (NYSERDA) in its efforts to establish a successful solar market and to ensure that incentive funds are spent on high-quality system installations.

participants. While other strategies (i.e., long-term contracting requirements) should be explored as well, a financing program is something concrete that BPU can offer near-term. NYSERDA's Energy $mart loan program can serve as a model for developing a financing program in partnership with banks serving New Jersey's communities. The Board's decision to offer such a financing program should take into consideration the tax environment that exists in 2009. If the solar investment tax credit (ITC) is extended beyond 2008, a state financing program could actually have a negative effect on project economics.[101]

- **Encourage development of more non-solar projects in the CORE program**. This could be accomplished by:

    - providing additional Web site educational information and resources focusing on non-solar technologies;

    - performing more targeted marketing to entities most likely to be able to install non-solar technologies (i.e., larger commercial or institutional entities);

    - splitting the budgets into solar and non-solar categories to more clearly reflect the BPU's goal to develop both solar and non-solar technologies;

    - educating local officials about small wind and biomass technology applications and/or developing model ordinances to minimize siting and permitting barriers;

    - establishing a biomass working group and continuing the efforts of the wind working group to bring industry players together to address barriers specific to these energy resources;

    - communicating with representatives from other northeastern states that are taking similar steps to reduce barriers to wind and solar project development;[102] and

    - prioritizing the completion of a few highly visible pilot projects that can be used as models for success.

- Establish a Policies and Procedures Guidebook for the CORE program with clear, concise, comprehensive and easy-to-navigate information about the program. Make the handbook available on the Web site and update the handbook when changes occur.

[101] As set forth in the Energy Policy Act of 2005, the value of the solar ITC will be reduced or eliminated if project owners take advantage of "subsidized energy financing." See Wiser and Bolinger (2006) "Federal Tax Incentives for PV: Potential Implications for Program Design."

[102] Massachusetts has been very active in addressing barriers to both biomass and small wind resources. The state Division of Energy Resources facilitates a biomass energy working group, and is addressing many barriers to small wind by working directly with communities through its "Community Wind" program.

- Take steps to establish program certainty and longevity, and to emphasize the state's long-term commitment to developing market for on-site renewable energy systems.

- Increase program transparency. Clearly communicate any changes in rebate levels or program eligibility requirements well in advance of the point when changes are scheduled to take effect, and make an effort to minimize any changes. Also, streamline program website to make it easier to navigate, using less text and more bulleted points where appropriate.

- Set realistic goals for program processes (i.e., approving applications and sending rebate checks) and meet them to build confidence among market participants.

- Recognizing that high upfront costs have been a barrier for program participants to date, work to educate the public and the investment community about the value and long-term nature of revenues from the SREC market. Through clear, consistent messaging and maintenance of appropriate SACP levels, BPU can facilitate a shift away from a dependence on a rebate incentive structure.

- Improve program data management practices. Efforts should be made to improve upon the consistency and quality of data entry, and the Board should compile one database with program records from all program years. The database provided to the research team lacked data for projects installed during the 2001 through mid-2003 timeframe.

## 6.2.2 Renewable Energy Project Grants and Financing Assessment

### Findings

- As of December 2006, approximately 6.5 MW of renewable energy capacity has been completed (installed and paid) under the REPGFP program, and the incentives for 1.6 MW of this was completed (paid) in 2005.[103] The goal for the REPGFP was to install 19 MW in 2005.

- The program missed its goal to install 19 MW of capacity in 2005. Only 1.6 MW of capacity were built in that year.

- The program missed its target for the number of applications received in 2005, though it did achieve its goal for timing of application review.

[103] Note that the REPGF program grant for the 7.5 MW Jersey Atlantic Wind / Community Energy wind farm was calculated based on 4.875 MW of installed capacity. 2.635 MW received funding under the CORE program in early 2007. Since only funded capacity is counted in this market assessment, and to properly attribute capacity development across programs, only 4.875 MW of the wind farm has been attributed to the REPGF program, and 2.625 MW should be attributed to the CORE program in a future market assessment. However, since the full 7.5 MW project has been operational since the end of 2005, its total capacity and output have been counted in the market level assessment (using 2006 as the starting year since that was the year in which the project received its first incentive payment).

- Program participant satisfaction has been low. Primary concerns expressed included the slow pace and complexity of the application process and the lack of direct contact with and responsiveness from BPU staff. Participants also expressed that the program's website should more clearly articulate the program's offerings, processes, and application review criteria, and that BPU's financial incentives should be marketed more to public entities than they have been in the past.

- A great strength of the program has been its ability to achieve project installations at a relatively low incentive cost per Watt of installed capacity. The average incentive cost of $0.37 per installed Watt is almost 10 times less than the average cost of $3.88 per installed Watt for the CORE program. Therefore, investments made through the REPGF program are a much more cost effective means of increasing installed renewable energy capacity than investments made to date through the CORE program.

- Program activity came to a halt when BPU determined that applicant projects could be economically viable without the program incentive. However, as evidenced by the lack of grid-supply renewable energy project development since the program became dormant, either the projects were not actually economically viable without the program's incentives, or they face other non-financial barriers. Clearly, the needs and barriers of grid-supply renewable energy projects are not being sufficiently addressed, and the lost opportunity this represents warrants further attention and action.

- Program funding levels and timing of grant payment were both cited as substantial barriers. The project developers expressed that increasing the existing funding cap (20% of project costs) to something in the range of 30% or more would result in increased construction of landfill gas and other renewable energy projects. The developers also explained that receiving funds upfront, contingent on project completion, rather than post-completion would help significantly.

- Ten developers not participating in BPU programs were also interviewed. The top barriers to large non-solar project development cited by these developers included siting and permitting (38%), high first costs (13%) and lack of information (13%). These developers explained more bureaucracy and NIMBYism exists in New Jersey than in other states in the region such as Pennsylvania.

- Interviewees expressed frustration with New Jersey's heavy emphasis on solar both in its outreach and education efforts, and its program funding. Given the ability of non-solar resources to fulfill RPS requirements at much lower unit costs than solar resources, it is imperative that BPU increase its attention toward the development of these resources.

## Recommendations

Based on a review of program records and interviews with program participants, the following set of recommendations was developed.

- Implement a **two-tier incentive level**. Facilitate expeditious deployment of more mature technologies, such as landfill gas, by providing them a base ("benchmark") incentive level. Meanwhile, target development of technologies that are currently less cost-effective and provide these projects with a higher level of financial support (see Volume I Section 5 for further details). The incentive levels recommended below would be the benchmark incentive levels and an adder of 15% would be used for higher priority project funding.

- The Board should update the benchmark and "adder" incentive levels annually based on current market data in an effort to match program incentives to evolving market conditions. The Board should also consider adding a competitive solicitation component to the program, as this would help stimulate competition among projects which could help lower costs and provide an annual snapshot of market conditions. It would also provide focus for program outreach activities, and may improve program efficiency.
- An annual program budget of $50.2 million is recommended. This is based on analysis that estimated the need for incentive levels summarized in the detailed program and market level assessments.
- The incentive levels and recommended program budget are based on analysis which considered New Jersey's renewable energy development needs, by technology, in order to stay on track to achieve RPS requirements with in-state resources through the next SBC funding cycle. The analysis also factored in project costs and barriers, and an IRR target of 12% was used. Discussion of the basis for these recommended incentive levels is provided in the portfolio level assessment, Volume 1, Section 5.
- Whatever specific program design the Board decides upon, the Board should clearly communicate all policies and procedures in a program handbook posted to the BPU website.
- A **pre-development assistance** component should also be added to the REPGF program to help reduce the risks and costs associated with feasibility assessment and non-construction pre-development activities (i.e., siting, permitting, potential delays in the development cycle) associated with utility-scale non-solar projects. This funding component is included in the budget recommendation noted above. Funding and/or technical support should be provided to help developers. This support is particularly important for developers working with less mature technologies for which the development path is less well defined than for more mainstream renewables. A large portion of this budget should be directed specifically at offshore wind, as there is such a great amount of potential for that technology.
- **Streamline the application process and program materials**. Provide step-by-step directions for applicants, and clearly define the requirements for acceptance in the program. Communicate incentive levels to applicants upfront so developers know what to expect from the program.
- Provide sufficient **program staff resources** to promptly and effectively respond to applicant inquiries, and to shorten the approval process. Set and clearly communicate a target for the maximum length of time the process should take so that expectations are clear both for program staff and applicants.
- **Eliminate the incentive cap** (i.e., percent of total project costs that can be covered by the program incentive) and instead base incentives on the recommended incentive levels set forth in this report. The recommended incentive levels were based on an analysis of project incentive needs to achieve a 12% IRR. Assumptions should be updated in the future to reflect changing market conditions. However, project funding should not be limited by an incentive cap if the goal is to trigger significant development of large projects. Large-scale projects are very cost-effective compared to the small scale projects

installed through the CORE program, and substantial development of these larger-scale projects will help minimize the ratepayer impacts associated with achieving New Jersey's RPS requirements.

- Actively **target specific technologies**, especially those requiring the most help to be implemented, such as offshore wind, biomass/solid waste gasification, biomass/solid waste direct combustion, food waste anaerobic digestion, and utility-scale PV.
- Support the development of **technology-focused networking / working groups** focusing on biomass, and potentially some emerging technologies as well, to foster the transfer of information and market development ideas across businesses facing similar challenges in the marketplace.
- Research the status of projects that were applied for, but were turned down for funding due to the assumption that they did not require financial support. If these projects were not developed in the absence of program support, representatives from the projects may be able to provide valuable insights into non-financial development barriers that the program should address in the future.[104]

### 6.2.3 Renewable Energy Business Venture Assistance Program

#### Findings

- A total of 11 projects have received funding under the program to date, with grant and other incentive funding totaling nearly $5 million through the end of 2006.
- The program has supported business and technology development activities related to a wide range of technologies including hydrogen, wave power, thin film PV, inverters, and power conditioners. In addition, the program has funded education and training activities and provided a $2.2 million loan to support the development of PJM's Generation Attribute Tracking System (GATS) which tracks REC trade throughout the PJM region in support of RPS compliance and other policies. As of the end of 2006 period of analysis, nine projects that submitted applications for funding in 2005 were still pending approval. The research team has learned that seven of those projects were sent rejections in early 2007, and that two were approved in early February, 2008.
- Nine projects that submitted applications for funding in 2005 are still pending approval. No applications are currently being accepted under the program.
- While the program was active, it was successful in supporting the development of several emerging renewable energy technologies, or technologies that support renewable energy installations.

[104] Project applicants that were denied funding were not interviewed as part of the assessment both due to lack of data, and lack of sufficient resources given the emphasis on the CORE participant survey and in-depth developer interviews.

- Based on the number of applications received and approved since the program's inception, it appears that there is substantial industry interest in the program, across the range of renewable energy technologies, and that the program is being marketed sufficiently.

## Recommendations

- An annual program budget of $7.7 million is recommended. The recommended program budget is based on a 50% increase over the 2007 budget.

- Consider actively promoting the technologies that are not yet commercialized and that would make best use of the renewable energy resources that exist within New Jersey's borders. This would help to spread the funding out more evenly across the different renewable energy market sectors, leading to a healthier overall renewable energy market with the emphasis on solar reduced. These could include: thin film PV, renewable energy storage (both large and small scale), smart grid technologies (to enable renewables to be used to reduce congestion or stress on the grid), wave and tidal, architectural wind (rooftop mounted), and gasification of various waste materials. (Note: This is a small sample of potential technologies.)

- Prioritize projects that involve commercialization of technologies for mass market sales and distribution.

- Fund technologies that can be implemented as utility-scale installations, and the supporting technologies that are needed to tie these into the grid. These are the most cost-effective in the long run when the larger goal of meeting the RPS is considered.

- Actively market the program to companies that are in the fields most pertinent to attaining the goal of a vibrant renewable energy industry.

- Complete a thorough evaluation of the projects that have been funded so far and make changes to the program based on this experience. As this program does not directly monitor renewable energy generation, it is important to monitor its progress in other ways (i.e., by tracking indicators) while the program is running. Otherwise, there is a danger that the projects funded will not be the most productive ones for the New Jersey market.[105]

- Explore opportunities for leveraging R&D funding opportunities and technology transfer resources already available through the U.S. DOE and other entities. This could involve providing links to the websites of other funding agencies, sponsoring participation of emerging New Jersey businesses at DOE-sponsored events or conferences, as well as potentially providing added incentives for projects that are able secure funding from multiple sources.

[105] A thorough evaluation of funded projects was not completed as part of this assessment due to a lack of available data, and due to the fact that evaluation resources were focused more heavily on the CORE program.

### 6.2.4 SREC / Behind the Meter REC program and Market Infrastructure

#### Findings

- Wind and biomass facilities represent less than one percent of registered New Jersey SREC program participants.

- Publishing SREC pricing data helps improve the liquidity of the market and can be important for smaller players in the system that may be less savvy about the value of SRECs. However, some brokers and other market actors interviewed as part of the market assessment downplayed the importance of the SREC pricing reports, claiming that the larger players rely more heavily on broker data.

- Only 45% of PV system owners responding to a survey of CORE program participants reported that they have used the SREC trading system to sell their SRECs.[106] However, a significant number of solar system owners either assigned away the rights to their SRECs as part of a third party ownership arrangement or in exchange for lower installed costs, or used an aggregator to market their SRECs.

- Both CORE program participants and developers are satisfied with the SREC trading system including the certification process, trading system structure, and administrative staff support.

- SREC pricing has trended upward over the past three Reporting Years. SREC trading volume and pricing increases greatly in August, the end of the true-up period for each Reporting Year.

- Based on CORE program participant survey results, it appears that a large majority of end-use customers participating in the CORE program are aware of the SREC program, but there is still room for improvement in area of SREC program awareness.

#### Recommendations

- Transition to metering system output for all systems receiving SRECs for RPS compliance. Any metering protocols introduced as part of the Energy Master Plan process should address the need to meter all PV systems.

- Simple steps should be taken to limit the potential for misreporting of SREC pricing on the part of SREC sellers.

- The Market Manager or SREC program Administrator should encourage SREC participation by those who fail to register initially and those registered system owners who remain inactive in the program.

[106] Sixty-nine respondents answered this question.

- New Jersey should begin transacting Behind the Meter (BTM) RECs through PJM GATS. Since GATS is perceived to be overly complex for BTM system owners, BPU should hire a firm to provide assistance to BTM systems participating in GATS.

- New Jersey should take steps to allow large systems (too large to be net-metered) to receive SRECs and count toward the solar RPS requirement. To mitigate the impacts that lower SREC prices would have on small system owners, BPU should provide additional financial incentives to smaller market participants.

### 6.2.5 Manufacturing Incentive program

#### Findings

- New Jersey is not well-positioned to benefit from offering an incentive program to attract solar manufacturing to the state. The incentives required are very high, there is strong competition from other states with existing solar manufacturing, and many major manufacturers have recently invested or are committed to capacity expansions elsewhere.

#### Recommendations

- Focus on establishing stability in New Jersey's solar market.

- Support improvements in the developer infrastructure—particularly installers.

- Provide promotion incentives, marketing and sales assistance to nearby manufacturers of solar equipment to provide a less expensive product to New Jersey and help locate sales leads, perhaps working with the local utilities.

- Improve upon recruitment efforts and make solar manufacturers aware of existing economic development benefits and incentives offered by the state through the Economic Development Authority (EDA). The Board should work with the EDA to target available funds toward businesses in the renewable energy sector.

## 6.3 Renewable Energy Market Development Strategies from Other Jurisdictions

#### Findings

- It takes a combination of policies, incentive offerings, market conditions, and resource availability to make a favorable market for renewable energy development.

- Performance-based incentive (PBI) programs reward top-performing systems while avoiding wasting funds on under-performing systems. However, PBIs have a higher administrative burden than rebate programs because payments must be made over time.[107]

- The majority of state-level renewable energy incentive programs use a capacity-based incentive structure in which all, or the majority, of the incentive is paid upfront. Some states are opting for program structures which pay participants the majority of their incentive upfront, but also take steps to maximize system performance. Simple mechanisms, like system design and performance standards and performance monitoring, can deliver many of the performance benefits of a PBI while remaining administratively simple and addressing the upfront cost barrier.

- Tariffs have been the primary policy mechanism used to drive renewable energy development in Europe. Recent European studies comparing the economic efficiency of feed-in tariffs to those of RPS policies have found that feed-in tariffs result in lower overall ratepayer costs due to the fact that such programs avoid investment uncertainty and the associated risk premiums.

- Across the U.S., the majority of existing solar project development to date has been self-financed, but third party financing is emerging as a viable option in some states.

- Several states have recently set aggressive RPS policies, with ultimate targets in the range of 20% by 2020.[108] However, details such as geographic, vintage, and technology requirements of an RPS are more important in determining the policy's overall impact than its percentage targets.

- Seven states (Colorado, Delaware, Maryland, Nevada, New Jersey, New Mexico, and Pennsylvania) and the District of Columbia have solar set-aside requirements in their RPS policies. California has also set a clear goal for solar development. New Jersey's solar-set-aside represents the largest commitment of any of the jurisdictions in terms of percentage of retail electricity sales and in terms of the equivalent electricity production from solar resources.

- REC ownership has recently become a major issue in states like California because of the potentially high value RECs can hold. Of the states researched, those in which recipients of solar project financial incentives retain REC ownership include California, Delaware and Massachusetts. In New York, Oregon and Wisconsin, the funding agency takes ownership of the RECs at some point during the funded systems' operational life.

[107] For further discussion of the relative strengths and weaknesses of additional incentive models, including discussion of the value of guaranteed long-term revenue streams and the risk premiums associated with uncertain revenue streams, refer to section 7 of this report.

[108] This is Minnesota's RPS requirement for Xcel.

# 6.4 Findings and Recommendations for Solar Market Transition Analysis

## Findings

- In the absence of rebates or any other form of guaranteed financial support, solar project economics would require a much greater SREC revenue stream than projects in other states and regions where rebates or other financial incentives reduce a project's financial risk. By approving a long-term SACP schedule with substantial increases in the SACP level, the Board is taking steps to enable SREC values to increase to the levels required by solar investors in the absence of rebates.

- If the New Jersey RPS goals are to be met, efforts must be made to provide financial certainty for project investors. Some possible mechanisms to accomplish this include improving long-term contracting conditions, continuing upfront rebates, or introducing an underwriter system.

- Depending on the design details applied, all of the potential market transition strategies discussed could provide a theoretically viable means of addressing revenue uncertainty concerns if structured appropriately.

- The tariff system was estimated to have the lowest ratepayer impacts of any of the transition models included in the initial ratepayer impact assessment. The SREC-Only model was estimated to have the highest ratepayer impacts in the initial assessment. When the OCE Straw Proposal was modeled, using some different parameters, the estimated ratepayer impact was lower than any other model.[109]

- The solar market needs market transition to occur as quickly as possible to avoid further damage to solar business infrastructure in the state, and to minimize any solar RPS shortfall for Reporting Year 2009.

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[109] The table below shows a comparison of the paramaters for the Straw Proposal model and the other models. Note that for the OCE Straw proposal the IRR was calculated based on the selected Year 1 SREC value and Qualification Life. For the analysis of the other models the IRR was selected and the qualification life was set to 15 years, and based on these assumptions the Year 1 SREC value was determined.

| | OCE Straw Proposal | | | | Solar Transition Models | | | |
|---|---|---|---|---|---|---|---|---|
| Project Type | Qual. Life | SREC Yr 1 | IRR | Discount Rate | Qual. Life | SREC Yr 1 | IRR | Discount Rate |
| ≤10 kW Private | 10 | $525.00 | 5% | 10% | 15 | Varies | 6% | 9% |
| >10 kW Private | 8 | $525.00 | 8% | 10% | 15 | Varies | 12% | 9% |
| >10 kW Public | 10 | $525.00 | 11% | 10% | 15 | Varies | 8% | 9% |

- Many developers explained that if banks allowed customers to finance a solar renewable energy system based on the value of solar as an asset, instead of the customer's credit history, more residents and businesses would be able to finance solar renewable energy systems.

### Recommendations

- While the long-term SACP schedule will help build investor confidence, additional steps should be taken to provide securitization of SREC values. Stakeholders are most supportive of pursing the tariff or auction models. There is also support for introducing long-term contracting requirements for electricity suppliers/providers.

## 6.5 Conclusions

New Jersey's current portfolio of renewable energy programs has achieved remarkable success in developing the solar market, but has lagged in its efforts to advance the development of large, non-solar resources. This is due to a combination of factors including a strong emphasis on solar in the state's renewable energy policies, past program budgeting, permitting and siting challenges for non-solar projects, and less mature existing infrastructure for non-solar project development. The Board should significantly step up efforts to encourage development of both mature non-solar technologies, such as landfill gas and on-shore wind, as well as technologies needing more development assistance, such as off-shore wind, advanced biomass and biogas technologies, and thin-film and building-integrated PV applications. In addition, the Board should provide ongoing support to the growing PV market in New Jersey to ensure that the transition to an SREC-driven project finance structure can succeed. Facilitating long-term SREC/REC contracts with electricity suppliers (LSEs), and providing low interest financing should benefit the industry significantly. In addition, the Board should substantially increase its market monitoring and communications functions. Improved data tracking, reporting and program outreach activities will make the market more transparent, and will provide the industry with the information it needs to make wise investments, and to understand how the BPU's programs can benefit the full range of market participants.

# APPENDIX 1:

# Strengths and Weaknesses of Market Development Strategies

## Appendix A. Strengths and Weaknesses of Market Development Strategies

| Strategy | Strengths | Weaknesses |
|---|---|---|
| ***Strategies Providing Direct Project Financial Support*** | | |
| Rebates<br>*(Performance Based Upfront Incentives are preferred)*<br>*Examples: Majority of states with renewable energy funding in US, Japan* | • Administratively simple<br>• Provides project owners with upfront capital which enables more projects to be built, and may enable self-finance of projects<br>• Lower upfront and finance costs should result in lower REC trading values<br>• If covering only a portion of project costs, competitive forces can still act to bring down system costs.<br>• Can base rebate value on expected performance, building some performance basis into incentive structure. | • Incentive payment not contingent on actual performance, so less incentive to maintain system over time, and less incentive for installers to ensure quality installation and use of highest quality equipment.<br>• Administratively set incentive levels may result in over / under-subsidization, and inefficient use of ratepayer funds.<br>• Does not maximize potential for competitive forces to drive down solar project / REC costs. |
| Guaranteed Floor Price for RECs ("Underwriter")<br>*Examples: Massachusetts Green Power Partnership (limited funding for competitively selected grid-supply projects), "Underwriter" model proposed for solar market transition.* | • Provides revenue certainty, improving investor confidence<br>• Increases access to capital, and lower risk premium embedded in project financing.<br>• Provides growth opportunity for market infrastructure<br>• Provides some level of ability of "market forces" to determine SREC pricing within boundaries of floor and ceiling values | • Difficult to identify willing / appropriate entity to capitalize. [However, one model would be to have BPU or EDA play this role, setting budget limit for program and supporting only a limited number of projects (similar to Massachusetts Green Power Partnership model).]<br>• Administratively-set floor values may result in over / under1-subsidization, and inefficient use of ratepayer funds.<br>• Does not address upfront project cost barrier most prominent for small systems.<br>• Does not maximize potential for competitive forces to drive down solar project / REC costs.<br>• Supporters of this strategy were unable to estimate the pool of reserves required to cover potential calls. |

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Raise Alternative Compliance Payment Levels and Set a Long-Term ACP Schedule<br>*Examples: OCE SACP Straw Proposal – Board Order* | • Improves investor confidence in REC revenue stream.<br>• Improves long-term market transparency and enables market participants to plan for the future.<br>• Avoids administrative costs and burdens associated with administering incentives directly to projects.<br>• Enables market forces to determine REC pricing. | • Since REC prices are determined by market forces, REC price certainty is limited. On its own, this mechanism may not provide enough investor confidence to stimulate sufficient level of project development.<br>• Administratively-set ACP levels may result in over / under-subsidization and inefficient use of ratepayer funds.<br>• Does not address upfront project cost barrier most prominent for small systems.<br>• Increases potential ratepayer impacts in shortfall situation.<br>• Does not maximize potential for competitive forces to drive down solar project / REC costs. |
| Auction-Set Pricing<br>*Annual auction sets REC prices used to set REC prices for contracts between generators and LSEs for a relatively long term (ideally 10+ years). In some cases, this model could be used as the basis for pricing all RECs in the market.*<br>*Examples: Model proposed by Division of Rate Counsel in SACP straw proposal comments, Auction-Set Pricing Model proposed for solar market transition, UK's former Non-Fossil Fuel Obligation program* | • Maximizes potential for competitive forces to drive down solar project / REC costs.<br>• Provides transparency in REC market pricing<br>• If combined with long-term contracting requirement for LSEs (as proposed by Rate Counsel), could provide powerful stimulus for project development.<br>• Reduced transaction costs associated with sale / purchase of RECs for project owners and LSEs. | • SREC pricing likely to be driven by largest, most sophisticated players making resulting SREC pricing insufficient for small project owners<br>• If no requirements for projects to have permits before bidding, and no-penalties for non-performance or delayed construction, problems could arise in cases where projects development is dependent on auction contract.<br>• Substantial administrative burden<br>• Potential for gaming, though mechanisms could be put in place to minimize this.<br>• Does not address upfront project cost barrier most prominent for small systems.<br>• Annual occurrence may reduce ability for dynamic market corrections between auction events |

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Full Tariff / Production Incentive<br>*Guaranteed $/kWh payments from EDC. Tariff levels set high enough to provide full project ROI. RECs go to EDC.*<br>*Examples: Germany, Spain, Denmark, Ontario, Prince Edward Island* | • Provides projects with certainty that full target ROI will be achieved.<br>• Can be tailored to match the needs of different project types, and to provide added incentives for development of projects that advance specific policy goals<br>• Reduces transaction costs by having EDCs sell RECs to LSEs (rather than many individual generator directly from tariff-funded projects (using EDCs as intermediary)<br>• Low ratepayer costs relative to other models because lowers risk premiums embedded in project financing. | • Limits development of infrastructure (i.e., brokers / aggregators) necessary to sustain market once program expires.<br>• May limit third-party owner arrangements (since payment would presumably go directly to electricity account holder).<br>• Requires BPU action to re-set tariff level periodically and to monitor dynamic supply / demand balance to determine when to cease new tariff commitments.<br>• Does not address upfront project cost barrier.<br>• Reduces upside potential for project owners and other intermediaries (brokers, aggregators, capital firms) because no potential for high REC values. May reduce level of interest in market by private investors relative to other models. |
| Hybrid Tariff / Production Incentive<br>*Projects receive market support both through tariff + REC revenue streams, tariff level set to make up ROI not expected to be provided by REC revenues*<br>*Examples: California Solar Initiative, alternative version in Washington PBI (Washington program funded by utilities who in turn receive state tax incentives)* | • Provides revenue certainty, improving investor confidence<br>• Enables SREC market activity to continue, building market infrastructure that will eventually be needed for a self-sustaining market when no incentives are in place<br>• Lowers SREC trading values making NJ SRECs better- aligned with regional solar REC values<br>• Can be tailored to match the needs of different project types, and to provide added incentives for development of projects that advance specific policy goals<br>• Provides simple solution to limit "windfall profits" of past rebate-funded projects | • May still be difficult to obtain project financing if program's limited revenue certainty fails to sufficiently boost investor confidence.<br>• Results in both administrative costs of tariff, as well as middleman costs to facilitate SREC trades.<br>• May limit third-party owner arrangements.<br>• Requires BPU action to re-set tariff level periodically and to monitor dynamic supply / demand balance to determine when to cease new tariff commitments.<br>• Does not address upfront project cost barrier. |

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Facilitate / Require Long-Term REC Contracting by LSEs and other Entities<br>*Examples: Connecticut's Project 100, Maryland's requirement that solar REC contracts between suppliers and system owners must be for 15 years*[110] | • Long-term contracting enables projects to obtain financing at favorable rates, reducing ratepayer impacts and increasing the pace of project development.<br>• Efficient model because contract pricing determined by market forces, and competitive forces will drive down project costs / REC prices.<br>• No incentive payments necessary, so no administrative costs. | • BPU's authority to require LSEs to enter into long-term contracts is unclear. [Though one option is for the state to enter into long-term contracts directly with generators, like NYSERDA does under its Main Tier central procurement approach. This is also similar to Massachusetts' Green Power Partnership, though that only assists a limited number of projects.] |
| Project Development Grants and Financing *(Pre-Development / Feasibility Study / Design and Construction / Low or Zero interest loans)*<br>*Examples: Massachusetts Large Onsite Renewables program; Connecticut's Onsite Renewables program, NYSERDA Energy $mart program, Pennsylvania Energy Harvest program* | • Provides projects with access to capital under favorable terms. In the case of loans, the funds are recoverable, therefore reducing ratepayer impacts.<br>• Pre-development grants reduce the risks associated with early project planning, and can leverage substantial investment in large capacity projects that will require a low level of financial assistance over the long term. These grants can provide great value for the ratepayer funds invested.<br>• Can be targeted to appropriate project types to provide added support only to the technology-market segments with the greatest needs. | • Administrative burdens and budget planning challenges associated with managing loans. |
| Engaging EDCs in Project Finance<br>*Examples: PSE&G Proposal for New Jersey Solar Market* | • Engages entity that's in a good position to provide capital at favorable rates.<br>• Increases project owners' access to favorable financing.<br>• Provides EDCs with positive PR. | • EDCs may look for high cost recovery rates. |

[110] Maryland's electricity suppliers purchasing RECs directly from solar energy system owners must enter into a contract for at least 15 years (Source: www.dsireusa.org).

| Strategy | Strengths | Weaknesses |
|---|---|---|
| State Tax Credits<br>*Examples: Oregon Energy Trust, Washington- utility tax credits is source of funding for PBI program.* | • Like federal tax incentives, improves project economics.<br>• Incentives draw on tax base rather than SBC funds or electricity rate impacts which may be helpful if political opposition to SBC funding / electricity rate increases. | • May be difficult to gain passage of tax policy provisions. |
| Establish Long-Term Incentive Schedule / Budget<br>*Examples: California Solar Initiative incentive block structure* | • Improves investor confidence in market which should lower risk premiums embedded in project financing.<br>• Improves long-term market transparency and enables market participants to plan for the future. | • Potential for over-under subsidization since it is difficult to predict market needs far into the future [However, mechanisms could be included to adjust incentive levels at predictable intervals and in predictable ways, as is the plan for the California Solar Initiative.] |
| Compressed Project Economics (i.e., limit # of years a project can sell RECs used for New Jersey RPS compliance)<br>*Minimize number of years projects can produce RECs for RPS compliance in New Jersey*<br>*Source: Qualification life proposed as part of OCE SACP Straw Proposal; 5-year economic life proposed as part of Auction-Set Pricing Model* | • Increases investor confidence by enabling projects to earn a return on investment more quickly<br>• Should result in lower risk premiums embedded in project financing. | • If "qualification life" is set too short, requires extremely high REC values in order for projects to be economically viable.<br>• Would require adjustments to ACP in order to accommodate higher REC prices required.<br>• Challenges of determining how to credit production after end of projects' economic life. Ideally, would ensure that production would still be counted toward RPS compliance, but administrative complexities are likely to result. |
| ***Strategies to Improve General Conditions for Market Participants and Expedite Development*** | | |
| Establish clear, long-term plan for BPU program structure and incentive types<br>*Examples: California Solar Initiative, Tariff programs in Europe and Canada* | • Improves investor confidence<br>• Enables market participants to plan for the future which should increase the likelihood that businesses will locate in New Jersey and / or prioritize the New Jersey market for product distribution. | • None identified |

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Sector-Specific Outreach and Incentives<br>*Examples: Massachusetts Green Schools Initiative, Massachusetts Community Wind Collaborative, Massachusetts' and Connecticut's Clean Energy Communities programs* | • Increases pace of development among projects with optimal development conditions (either for economic or educational purposes)<br>• Helps to address barriers unique to a particular sector or community.<br>• Establishes positive examples for use in building the business case for future project recruitment | • None identified |
| Geographically Targeted Outreach and Development Assistance<br>*Examples: Massachusetts Community Wind Collaborative, Massachusetts' and Connecticut's Clean Energy Communities programs* | • Focused education / outreach activities (i.e., public forums and workshops for local officials) in areas best suited to development of high priority resources should expedite development and establish example projects.<br>• In the case of biomass, this could help reduce fuel management / transport costs, and provide momentum for development of supply infrastructure.<br>• Could focus efforts on areas with significant grid congestion or that are the focus of other policy goals. | • None identified |
| Set Technology-Specific Installed Capacity Goals and Funding Allocations<br>*Examples: California Solar Initiative* | • Sends message about state's commitment to particular technology which can attract necessary equipment suppliers and service providers. | • Being too rigid with goals and funding allocations can limit flexibility of program to respond to changes in the market. |
| Business Development Grants and Financing<br>*Examples: New Jersey Business Venture Assistance program* | • Could provide the boost needed to build market infrastructure for large non-solar renewable energy market.<br>• Could leverage incentives already available through NJ EDA's Edison Innovation Fund. BPU targeted marketing of EDA existing programs alone would be a valuable investment. | • Potential weakness: Since NJ EDA already offers many economic development benefits to businesses entering or seeking to expand technology operations in the state, it would be important to leverage and not replicate what is already being offered. |

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Establish Technology-Specific Working Groups<br>*Examples: New Jersey Small Wind Working Group, Massachusetts Biomass Working Group* | • Promotes information sharing and networking.<br>• Provides BPU with consistent feedback on evolving market issues and communications channels for outreach to market participants working with technologies that are high priorities for development.<br>• Demonstrates BPU commitment to addressing barriers and expediting development of most cost-effective technologies. | • Administrative burdens associated with managing working group activities. |
| Multi-Year REC Trading Life<br>*Examples: D.C., Delaware, Maryland and Pennsylvania*[111] | • Increases flexibility of market participants.<br>• Reduces the risk that generators will be left with RECs that have no value in an over-supply situation.<br>• Provides better planning time horizon for generators. | • Would increase complexity of market monitoring to manage supply / demand balance.<br>• Provides potential for generators to withhold RECs from market in an over-supply situation, driving up REC values and increasing ratepayer impacts. |
| Manufacturer Incentive program<br>*Examples: NYSERDA, Pennsylvania, Washington* | • Attracting a renewable energy manufacturer to the state would bring local economic development benefits and may lower the cost of equipment / development. | • Hard to compete with other states offering manufacturing incentives along with other favorable factors. Many manufacturers choose to expand on existing facilities, and there is limited existing renewables manufacturing in the state.<br>• Research indicates that more jobs are in the services end of the market and there may be limited<br>• Manufacturers noted in interviews that long-term market demand and other factors are more important in decision-making for plant location. |

[111] Pennsylvania offers REC banking which is structured to have a similar effect as a multi-year REC life.

| Strategy | Strengths | Weaknesses |
|---|---|---|
| Standard Contract Terms<br>*All REC transactions must adhere to standard contract terms.*<br>*Example: Component of Auction-Set Pricing Model proposed for solar market transition.* | • Reduces transaction costs for buyers and sellers, resulting in lower costs of compliance for ratepayers<br>• Increases transparency of transactions | • Limits flexibility of contractual relationships<br>• Administratively burdensome to enforce compliance<br>• BPU costs of developing and updating to keep pace with changing market needs |
| Ongoing Monitoring of program Performance | • Provides means of holding program staff accountable for performance and to identify areas where program interventions, incentive levels or goals are mismatched with evolving needs of the market.<br>• Costs of evaluation are easily offset by resulting benefits. | • None identified |
| Provide consistently updated resource and market data | • Increases transparency of market and reduces transaction costs for market participants, facilitating more efficient market.<br>• Provides regular feedback mechanism to facilitate monitoring of program / market performance. | • Difficulty obtaining data (i.e., installed costs) if BPU is not playing a direct role in project funding.<br>• Administrative costs / burdens in tracking data (tracking system could be minimized if make initial investment |
| Link renewable energy and energy efficiency funding | • Lower electrical load reduces the amount of renewable energy required to meet RPS requirements, resulting in lower ratepayer impacts.<br>• Lower electrical bills help offset rate increases associated with RPS compliance.<br>• Improves greenhouse gas benefits associated with program activities<br>• Takes advantage of opportunity to influence behavior of households / businesses already interested in sustainable energy. | • Can be difficult to monitor and enforce requirements.<br>• If requirements perceived as onerous, can deter some from program participation. |