Attribution Analysis for Renewable Portfolio Standard (RPS) Programs: Challenges Encountered Evaluating New York's RPS

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ABSTRACT

Over half the states in the U.S. have adopted a Renewable Portfolio Standard (RPS). To date, few have undergone thorough evaluation. To the authors' knowledge, in only one case--the evaluation of New York's RPS--have evaluators attempted to conduct an attribution analysis. This paper explores the challenges encountered by evaluators in efforts to conduct an attribution analysis for the New York RPS and describes the ways in which evaluators addressed these challenges. Key challenges in the New York analysis arose both in *defining* and attempting to *estimate* free ridership and spillover; these core concepts must be viewed through a different lens in the context of a program serving the large-scale renewable energy market compared to a more traditional energy efficiency program. Because of the many challenges evaluators encountered, it was deemed more appropriate to discuss program influence broadly rather than specify a net-to-gross ratio for the New York RPS.

Introduction

A key question in energy program evaluation is to what extent measured program impacts can be attributed to the program being evaluated. It is important for regulators and funding agencies to ensure that the impacts occurring in the market are incremental to that which would occur in the absence of a ratepayer funded program. A variety of terms are used to describe this type of analysis including net impacts analysis, and attribution. In contrast to a typical energy efficiency program attribution analysis, which would focus on measuring energy savings attributable to the program, the analysis for the New York RPS focused on measuring the amount of energy produced from large-scale renewable energy generators in the State that is attributable to the program.

Attribution analysis was incorporated into the planning for a comprehensive market conditions assessment for the New York RPS program completed in 2009 (Summit Blue Consulting 2009). However, due to some unique characteristics of large-scale renewable energy projects and given that attribution was only one of many goals for the evaluation effort, evaluators were limited in their ability to conduct a rigorous analysis of the program's net impacts. Rather, an evaluation of the program's broader influence on market activity was completed. An analysis of program spillover was also completed, as a conservative and viable estimating method was identified.

This paper provides background on the New York RPS, then an overview of attribution analysis methods typically applied in energy program evaluation. It goes on to discuss why traditional analytic approaches used in energy efficiency program evaluation were inappropriate for this analysis, and the reasons why an innovative approach was used. The solutions applied and the results of the research are also presented, providing guidance for future evaluations of similar programs.

New York RPS Program Background

New York's RPS program, administered by the New York State Energy Research and Development Authority (NYSERDA), provides funding to large utility-scale renewable energy projects through the Main Tier component of the program. The program funds smaller "behind the meter"

projects through its Customer Sited Tier. The evaluation focused on large-scale renewable energy project development, as generation from these projects comprises 98% of the RPS program's goal. These projects compete in periodic solicitations to secure long-term contracts to sell Renewable Energy Attributes (also known as Renewable Energy Certificates or "RECS") to NYSERDA. The theory behind the program is that the long-term REC contracts will facilitate a project's ability to secure financing and, thus, get built. The evaluation examined results of the three competitive program solicitations that were conducted between 2005 and 2008.

Notably, the structure and function of New York's RPS is unique. In most other states that have an RPS, they take the form of regulations, but there is no specific "program" aimed at implementing the policy. Obligated entities, typically utilities, are responsible for securing enough RECs to comply with RPS requirements and compliance is monitored by the appropriate state agency. In contrast, in New York, a public authority, NYSERDA, is responsible for securing RECs to fulfill the State's RPS goals and this is done through a competitive procurement within the RPS program. The fact that most RPSs take the form of regulations and not funded "programs" per se is one key reason why there is no precedent for RPS program evaluation, and net impact analysis specifically. In most states RPS-related analysis is limited to compliance monitoring.

Some other states do offer financial incentive programs for large-scale renewable energy project development which would, in fact, be more comparable to New York's RPS program than other states' RPSs. However, to date, few if any of these programs have undergone rigorous program evaluation that includes net impacts analysis.[1] While this paper focuses on the difficulties associated with completing attribution analysis for the New York RPS program, the challenges would apply to large-scale renewable energy financial incentive programs in general.

Attribution Methods and Challenges

Two key elements in net impacts analysis are free ridership and spillover. Free ridership describes impacts that would have occurred in the absence of the program as a result of actions participants would have taken on their own. Spillover accounts for those impacts not counted directly by the program but that occur as a result of the program. For example, for an energy efficiency program, this could come in the form of projects that program participants complete at non-program funded facilities using knowledge they gained as a result of program participation. The net impacts of a program, or a program's Net-to-Gross Ratio (NTGR), are typically calculated using the following formula:

$$NTGR: 1 - free\ ridership + spillover$$

Though the concepts are relatively simple, attribution analysis, the evaluation of a program's net impacts, has proven a challenging and controversial component of energy program evaluation (Saxonis 2007; TecMarket Works 2004; Schiller 2007). These hurdles carry over into the evaluation of RPS programs, and RPS programs introduce new challenges as well. Challenges that apply to attribution analysis as a whole are discussed first, followed by those challenges identified as part of the New York RPS analysis.

General Attribution Methods and Challenges

[1] Volume III of the Efficiency Valuation Organization's International Performance Measurement and Verification Protocol (IPMVP) 2007 includes discussion of measurement and verification methods for renewable energy programs. However, the focus is on customer-sited renewable energy applications and not large utility-scale renewable energy incentive programs.

The two primary methods for analyzing net impacts of energy efficiency programs, econometric-based methods and self-reporting survey-based methods, both possess weaknesses, either in their practical application or in the biases associated with them.[2]

Econometric techniques use statistical models to compare energy use data across non-participant and participant groups. For the purposes of analyzing energy efficiency and demand response programs, these methods are thought to provide greater accuracy than survey-based methods, as they include techniques to address selectivity biases and can control for exogenous factors such as changes in the economy over time. However, for programs with a relatively small number of participants or with custom projects, sufficient data sets and valid comparison groups do not exist and econometric-based methods are not suitable (TecMarket Works 2004; Schiller 2007). This is in fact the case for the New York RPS; the most substantial source of generation counted toward RPS program impacts is from a relatively small number of large-scale renewable energy generation projects, not from hundreds or thousands of end-users as is the case in many energy efficiency programs.[3]

Self-report survey-based methods typically include a series of questions that ask respondents directly what actions they would have taken in the absence of the program. A scale of possible responses is usually provided to improve accuracy (i.e., the scale of responses might range from "definitely would have" taken action in the absence of the program, to "definitely would not have" taken action). Additional probing questions are asked of "partial free riders," those who indicate that they would have taken some steps to improve efficiency in the absence of the program, but for whom the program has induced additional action or more extensive energy-related improvements. Numerical estimates are then applied to each respondent based on the responses (TecMarket Works 2004).

A key weakness in using survey-based methods for any energy program attribution analysis lies in the reliance on self-reports. Responses to interview questions will inherently reflect some level of social desirability bias, thus compromising their accuracy. Another key challenge relates to recall of specific decision making many months or years after the fact. This is particularly problematic for large-scale renewable energy projects for which the project development cycle can span several years.

Careful survey design can help address the limitations of using self-reported data. Strategies can include using "consistency check" questions and approaching the attribution topic from multiple angles (i.e., asking directly about what the entity would have done in the absence of the program, in addition to asking about where the project was in the decision-making process when the entity became a participant in the program, etc.), or using questions that require very specific fact-based responses (TecMarket Works 2004).

New York RPS Analysis Methods and Challenges

A self-report survey-based method was used for the evaluation of the New York RPS.[4] Attribution-specific questions were included as part of a comprehensive interview guide that addressed a host of issues relevant to the broader market conditions assessment. As part of the full RPS program evaluation effort, in-depth telephone interviews were conducted with nearly 90 New York renewable energy market stakeholders. The interviews included 18 with participating developers, ten of which have

[2] Other variations on these methods include enhanced self-reporting surveys, in which survey data is supplemented with additional program data review and analysis, and deemed net to gross ratios, in which ratios from evaluations of similar programs are used as proxies for actual program-specific attribution analyses (Schiller 2007).

[3] Fewer than 50 unique participants submitted proposals for New York RPS funding during the period being evaluated.

[4] The use of a self-report survey-based approach is consistent with the approach used in the evaluation of other NYSERDA programs. However, the specific question set used is more limited in its focus on attribution-specific questions than interview guides used for the evaluation of other NYSERDA programs.

secured contracts with NYSERDA through the RPS program. The remaining interviews included those with the financial community, equipment manufacturers, load serving entities, trade associations and NYSERDA program staff.

One factor that limited the ability to conduct a more rigorous analysis of net impacts was that the in-depth interviews with market participants needed to cover a wide range of topics related to other aspects of the evaluation and market conditions assessment. Recognizing respondents' time constraints, attribution-related questions accounted for only a small portion of the overall interview. The following three questions were asked of both winning and non-winning developers who bid into the RPS program:

1. How valuable were the NYSERDA REC contracts in getting your project(s) financed? (Answer choices: critical; of significant value; of little or no value; and an obstacle to project finance.)
2. In the absence of the NYSERDA REC contract, how would your development plan have been different (examples: would the project have been developed in another state, same size project, timing of construction, etc.)?

3. Does the NYSERDA program affect the renewable energy market in New York as a whole (i.e., REC prices, making New York more favorable for development relative to other states, or in other ways)?

Estimating Free ridership

The reliance on self-reports posed the same basic challenges in this evaluation as it would in any other energy program evaluation. Additional challenges arose due to the fact that multi-million dollar renewable energy project development decisions are, in general, more complex than decision-making related to installing energy efficiency measures. The long and involved project development timeline is another key factor that makes it difficult to analyze the decision-making of large project developers. In addition, it would be impractical to expect large developers to reveal to interviewers the full strategy and circumstances behind their confidential decision making.

Similar challenges have arisen in the evaluation of energy efficiency programs focusing on large customized projects, and non-residential new construction projects, or programs serving government-owned facilities with long decision cycles. Strategies to address the barriers have included the use of in-depth questions regarding project details and specifics about the stages of the participants' decision-making processes (TecMarket Works 2004). However, given the numerous other goals of the New York RPS program evaluation, the interviews could not accommodate such an in-depth focus on attribution analysis.

Recognizing the challenges of relying on interview responses, evaluators considered using the dates upon which projects commence commercial operation as an indication of the role of program funding. One could argue that if a project was operational prior to receiving program funding, the program must not have played a major role in bringing about the project's development. However, timing issues associated with New York's RPS program are such that a project's in-service date does not necessarily reflect its dependence on, or anticipation of program funding. The renewable energy project development timeline is usually at least three years long and involves a great deal of preparation, including gathering multiple years of site-specific resource data (in the case of wind), signing equipment supply agreements with delivery deadlines, and managing long permitting timelines. Under the rules of the RPS program, there is an incentive for bidders to ensure that their project achieves a commercial operation date within a year of receiving the REC contract in order to avoid making additional payments to NYSERDA. Therefore, securing a NYSERDA REC contract may be of significant importance to a project's long-term viability, even if the commercial online date precedes the developer's ability to secure a NYSERDA contract.

Estimating Spillover For the purposes of this analysis, spillover includes all the generation output from RPS supported projects that was not sold to the RPS. Developers participating in the RPS are required to set aside a minimum of 5% of generation for sale to other markets. In several cases, their set aside for sale to other markets was greater than 5% and even as high as 90%.[5] Many developers indicated that the program provides a solid financial foundation for projects and is a key component in facilitating overall project construction. Since the program facilitates the construction of large projects that produce more RECs than the RPS program buys, those RECs that are not purchased by the program can be appropriately counted as spillover.[6]

Project development occurring in New York without NYSERDA REC contracts was considered for inclusion in the spillover definition. In part because of the complex and uncertain project development timeline, some renewable energy projects have been built in New York without first securing an RPS REC contract. These developers may have built the projects in hopes of securing an RPS contract in the future, or they may have developed the project because they had a good site secured in New York, but wish to sell into the more lucrative New England RPS compliance markets (or some combination of these two scenarios). In either case, the existence of the New York RPS program may have played a role in attracting the developer to pursue project development activity in the state in the first place. In addition, Systems Benefit Charge-funded incentive programs, which preceded the RPS, may have provided the project with pre-development assistance that facilitated the developers' initial activities in the State. Because insufficient data were available from which to determine the role of the RPS program in the development of new facilities in the State that do not hold RPS contracts, these facilities were excluded from the spillover definition used for this analysis. As a result, the spillover value estimated was likely conservative.

Analyzing Program Influence

Because of the unique factors associated with estimating free ridership in this analysis, it was deemed most appropriate to broadly discuss program influence, rather than specify a NTG ratio. However, as discussed above, a sound approach for estimating program spillover was identified. Therefore, a spillover estimate was included in this analysis.

Program influence scores were estimated for each of the participating developers that were interviewed based on responses to the set of relevant interview questions presented earlier.[7] The scores were grouped into ranges that reflect high, medium, and low levels of program influence.[8] Grouping the

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[5] In some cases, developers hold back more than the required five percent of project output because they anticipate that they will be able to secure higher REC prices in other markets. In these cases, developers would use the New York RPS program's long-term REC contract only as an anchor to facilitate their project financing.

[6] For the purpose of estimating spillover, the analysis factored in only responses from participating projects that had won NYSERDA contracts. This was appropriate given that spillover is defined as the portion of generation from RPS-contracted projects that is not actually sold to the RPS. For the purposes of discussing program influence, responses from all participating developers (both winning and non-winning) were considered. Input from non-participating developers (those that have not bid into any of the RPS solicitations) and other market stakeholders (trade associations, utilities, program staff, etc.) was used for context and for purposes of comparing with responses from participating developers. It was determined that, because these other market participants have, to date, had more limited experience working to get projects built in New York, the focus of the program influence analysis should be on participating developers.

[7] The questions were modified somewhat when asked of non-winning bidders.

[8] Projects with a free ridership score of 60% or greater were placed in the "low influence" category, indicating that the program had a low influence on that project's development. Projects with a free ridership score of 30% to 59% were placed in the "medium influence" category. Projects with a free ridership score of less than 30% were placed in the "high influence" category.

scores into broad ranges of influence and avoiding an attempt specify a single NTG ratio reflects the uncertainty present in the analysis.

Results

Data collected from participating developers indicates that the RPS is a fundamental driver for renewable energy development activity in the State, and that the RPS program is responsible for additional renewable energy generation over and above that which is counted toward RPS compliance. These results are consistent with input collected from respondents across several different categories of market participants, including trade associations, utilities, manufacturers, the financial community, and program staff, all of whom indicated that very little project activity would have occurred or would be occurring in the State in the absence of the RPS program.

Spillover Analysis Results

Based on the analysis of projects holding REC contracts with NYSERDA, a spillover value of 19% was estimated. This means that facilities holding RPS contracts in New York are producing, on average, 19% more RECs (and associated electricity) than they are selling to NYSERDA through the RPS program.[9] The spillover value represents a weighted average in which the percentage of output over and above that sold to NYSERDA is weighted by the bid quantity (MWh) represented by the projects.[10] The spillover result reflects the fact that some of the largest projects participating in the program will sell a significant amount of RECs into markets other than the New York RPS compliance market. Long-term contracts with the New York RPS program provide these projects with a threshold level of financial stability they need to build a large facility, though the program only purchases a portion of the total RECs produced by the projects. Therefore, the RPS program funding is leveraging additional REC production over and above that which it is funding.

Overall Program Influence Results

Program influence by category is summarized in Figure 1.

Among winning bidders, for the large wind category, representing the largest amount of generation, 100% of generation (2,809 GWh of annual generation) was found to be highly influenced by the program.[11] One hundred percent of generation (220 GWh of annual generation) in the biomass category was found to be highly influenced by the program as well. In the category of medium scale wind, the program was found to have a high level of influence on 93% of generation (764 GWh of annual generation). A low level of program influence was found for only 7% of the generation (60 GWh of annual generation) in the medium-scale wind category. A medium level of program influence was found for all of the hydro projects associated with winning bidders.

For non-winning bidders, the large wind category again represented the largest amount of generation (745 GWh of annual generation). One hundred percent of generation in this category was found to be highly influenced by the program. The program had a high level of influence on 43% of medium-scale wind generation (307 GWh of annual generation) and 41% of biomass generation (67

[9] This includes projects from all three procurements. Note that, in the first procurement (RFP 916), projects were allowed to bid up to 100% of their project output, though in the later two solicitations, there was a maximum bid percentage limit of 95%.

[10] The average project that secured an RPS contract actually bid 85% of its output for sale to the New York RPS.

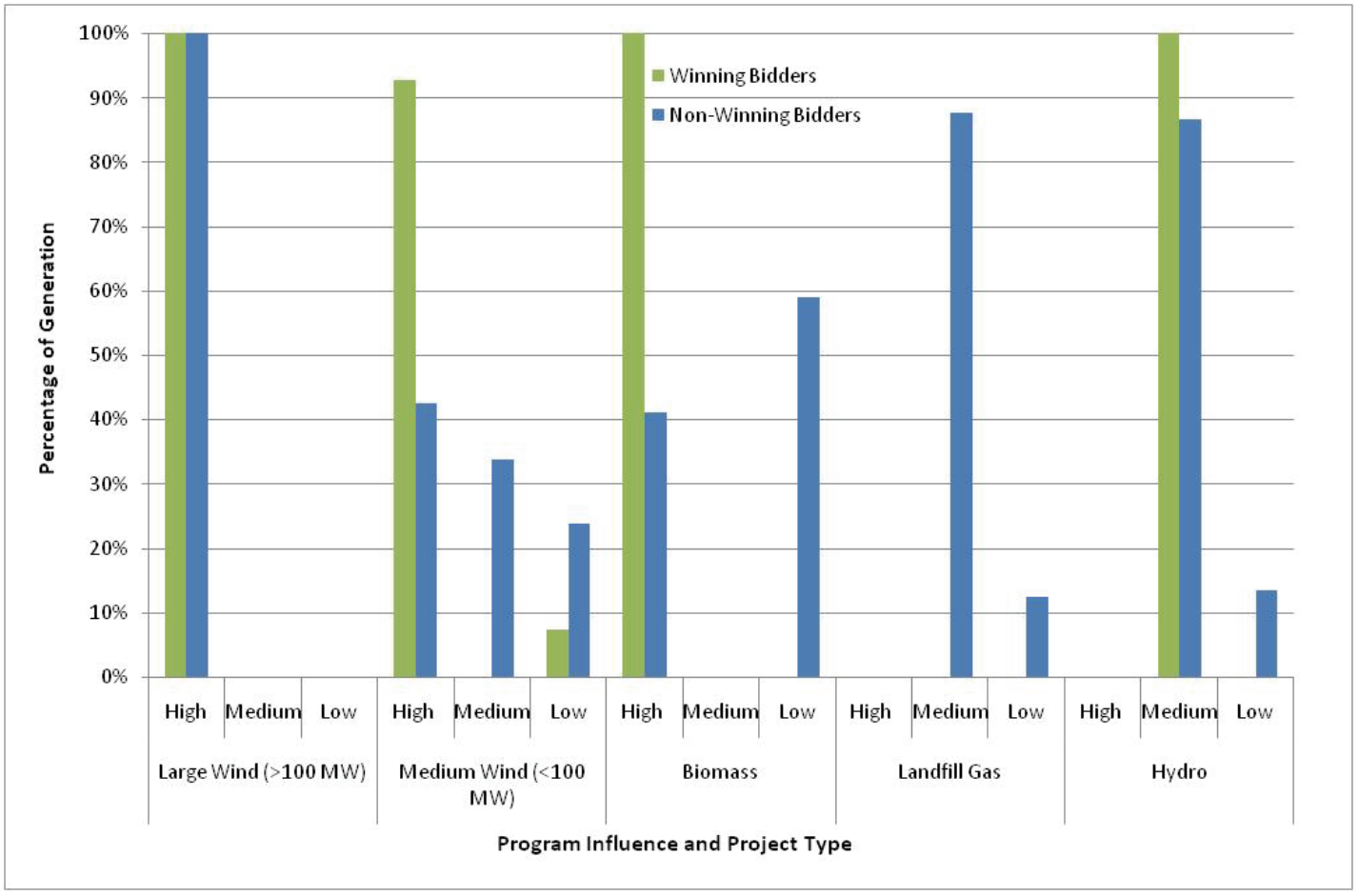
[11] Generation discussed here represents estimates for the full output of projects once operational.

GWh of annual generation). A medium level of program influence was found for 88% of landfill gas (363 GWh of annual generation) and 87% of hydro generation (15 GWh of annual generation), and for 34% of the medium scale wind generation (244 GWh of annual generation) associated with non-winning developers. Low levels of program influence were found for 59% of biomass generation (97 GWh of annual generation) as well as moderate amounts of medium scale wind (24%), landfill gas (12%), and hydro (13%) generation.

Wind and biomass projects are thought to be so highly influenced by the program because their project economics depend on securing a predictable REC revenue stream for at least some portion of the project output. For wind projects, this is largely due to the capital-intensive nature of development for this technology. For many biomass projects, uncertainty about future fuel costs makes the stable REC revenue stream more important. In contrast, hydro upgrade projects completed to date have tended to rely less heavily on REC revenues in order to be developed, and landfill gas projects in New York have been more successful selling RECs into the New England RPS compliance markets.

Program influence by category is summarized in Figure 1.

Figure 1. Program Influence by Category



Source: Summit Blue Consulting

An additional indication of the influence of an RPS in general is the high percentage of New York's technical development potential for wind that has been realized relative to other states that also possess relatively strong wind resources, but lack an RPS (Table 1). The highly competitive nature of the New York RPS program provides further indication that the REC contracts offered under the RPS

program are important drivers in the development of large-scale renewable energy projects in New York. If the REC contracts were not very important to developers, presumably they would bid lower REC prices to improve their odds of winning a contract. In addition, research for the New York RPS evaluation found that developers of renewable energy projects currently operational in New York, but which lack NYSERDA REC contracts, do plan to bid into future NYSERDA RPS solicitations.

Table 1. Realization of wind development potential, New York v. non-RPS states

	New York	Kansas	Nebraska	Wyoming	Oklahoma	Idaho
Rank in US for development potential	15	3	6	7	8	13
Development potential (MW)	7,080	121,900	99,100	85,200	82,700	8,290
Wind capacity (MW existing)	707	465	73	349	689	75
Wind capacity (MW under construction)	589	549	81	109	19	71
Realization of development potential (*ratio of development potential to capacity, both existing + under construction*)	**18%**	**1%**	**0%**	**1%**	**1%**	**2%**

Source: AWEA.

Implications for the Evaluation of other Renewable Energy Programs and Policies

In efforts to accomplish the unprecedented growth in renewable energy use that will be necessary to curb climate change impacts, a dramatic increase in renewable energy policies and incentive programs is already underway. To ensure the prudent use of public funds, and the effectiveness of program efforts, careful policy analysis and program evaluation is needed. Energy efficiency program evaluation techniques can be readily applied to renewable energy programs that focus on relatively small, customer-sited, behind-the-meter project development, as such programs ultimately focus on the end-user experience. The International Performance Measurement and Verification Protocol has already been adapted to address strategies for evaluating such programs (Efficiency Valuation Organization 2007).

Programs aimed at triggering the development of large-scale renewable energy generators are less able to fit the mold of standard energy efficiency program evaluation. The challenges encountered in evaluators' attempts to complete a net impacts analysis for the New York RPS program reflect some of the difficulties associated with applying energy efficiency program evaluation techniques to the evaluation of renewable energy programs dealing with the development of large-scale renewable energy generators. As discussed in this paper, some challenges stem from small sample sizes, complex decision-making processes and long development cycles, which make it near impossible to conduct project planning coincident with funding availability. In the future, the Regional Greenhouse Gas Initiative (RGGI) and the likely introduction of federal carbon regulations may make it even more

challenging to identify the factors driving decision-making for renewable energy project development.[12] Additional challenges will inevitably be discovered through future evaluation efforts for similar programs.

Many of the policies driving the development of large-scale renewable energy development do not actually take the form of "programs," and instead exist as RPS legislation, regulation, or other policies. Different analytic methods may be applied in evaluating those policies, though the same issues of precision and accuracy around small sample sizes would likely complicate any policy analysis effort.

Those managing program evaluation efforts for programs focusing on large-scale renewable energy development should be aware that potential barriers may be encountered. Evaluation budgets for such programs should reflect the need for more careful research design than would be required of other energy program evaluations. If program budgets are sufficient, multiple approaches to analyzing net impacts should be used in an effort to triangulate on the most accurate results. If program evaluation budgets are tight and goals for the evaluation are broad, those managing the evaluation efforts may want to opt to allocate scarce funds to accomplish evaluation goals other than net impacts analysis. Alternatively, a broader review of program influence may serve as a sufficient proxy depending on the goals and level of rigor required of the evaluation. In addition, program administrators and evaluators should collaborate to identify the unique aspects of renewable energy program evaluation and strategies for addressing challenges associated with this area of work.

Conclusion

A traditional program attribution analysis was not conducted for the New York RPS program due to unique factors related to the evaluation. Specifically, limited attention could be devoted to the topic of attribution in interviews completed for the evaluation, and barriers stand in the way of securing accurate responses from developers of large-scale renewable energy projects. Rather than estimating an NTG ratio, a more general analysis of program influence was completed, and program spillover effects were estimated. Based on results from interviews with nearly 20 participating developers, as well as input from a broad spectrum of other market participants, it was found that the RPS program is the key driver behind large-scale renewable energy development in the State. Those managing future evaluation efforts for programs focusing on large scale renewable energy development should recognize that additional attention and resources may be required to complete a net impacts assessment. In addition, program administrators and evaluators should collaborate to better understand the unique aspects of evaluation for programs that support large-scale renewable energy development.

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[12] RGGI is a carbon cap and trade scheme in which ten Northeast and Mid-Atlantic states, including New York, participate. RGGI takes effect in 2009. While research indicated that RGGI did not affect decision-making for projects that currently hold New York RPS contracts, it could play a role in future project decision-making.

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