Free Ridership and Spillover: A Regulatory Dilemma

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ABSTRACT

Techniques for the measurement of free ridership have improved in recent years, but estimates still frequently suffer from a fairly high degree of uncertainty. The measurement of spillover has been even less certain. Can regulators rely on this data to help guide decisions on program design, budgets, program performance and energy policy? Currently there is a wide variance across the nation regarding how regulators view and utilize free rider and spillover data. There have been many studies addressing free ridership and spillover but relatively few have examined these factors in tandem, including exploring their combined impact on a program's benefit to cost ratio (B/C), and as tools for better understanding the marketplace, especially consumer behavior.

This paper critically examines recent free rider and spillover results from energy efficiency programs administered by the New York State Energy Research and Development Authority (NYSERDA). Based on recent NYSERDA program results, the free rider rates for commercial and industrial (C&I) programs ranged from 10-67 percent and the spillover rates ranged from 19 to 168 percent. For residential programs, the statistics are only somewhat less dramatic with free ridership ranging from 2-28 percent and spillover from 5 to 48 percent. Impacts of this magnitude can have a major influence on calculating net energy impacts and ultimately a program's B/C ratio. These results strongly suggest that a better understanding of free ridership and spillover is critical for the regulatory, evaluation and program design communities. This paper places free rider and spillover measurement in a historical context, compares the NYSERDA results to results from other states and concludes with challenging, but practical, recommendations.

Introduction

Free Ridership, Spillover and Net to Gross Defined

There is general consensus that a free rider is a program participant that would have, at least to some degree, taken the same action promoted by the program even if there were no program. From a benefit cost perspective, program benefits attributable to free riders represent a cost, but not corresponding program benefits.

Spillover reflects benefits attributable to an energy program, but without requiring program incentives and not directly credited to the program. There are two major categories of spillover-participant and non-participant. Participant spillover is attributable to program participants that implement measures that were not incentivized by the program. For example, a business owner impressed by the cost savings at the company's manufacturing plant resulting from participation in a lighting efficiency program decides to install energy efficient lighting in a branch sales office without assistance from the program.

Non-participant spillover is associated with actions influenced by an energy program, but not linked with direct program participation. This type of spillover can occur in a number of ways including through a conscious awareness of the program (e.g., advertising) or because the program induces

* Any opinion expressed explicitly or implicitly are those of the author and do not necessarily represent those of the New York State Department of Public Service or the members of the Public Service Commission.

changes in the marketplace (e.g., stocking practices). For example, a homebuilder decides not to participate in a program designed to encourage sales of high-energy efficient homes, but increases the energy efficiency of their product offerings to remain competitive with builders participating in the program.

Despite the challenges associated with accurately measuring free riders and spillover, also sometimes called attribution analysis, they are essential components in calculating a program's net-to-gross (NTG) ratio. This ratio is used to summarize the degree of program-induced actions. Specifically, the gross energy savings of a program are adjusted to reflect the negative impacts of free ridership and the positive impacts of spillover. Mathematically the ratio is typically expressed as:

NTG ratio = (1-Free ridership) + spillover

Regulators Need Reliable Free Rider/Spillover Estimates: Three Critical Reasons

There are a number of reasons why regulators should strive for, and will benefit from quality evaluation data, especially as it relates to free ridership and spillover measurement. Below are three critical reasons based on the New York experience, but consistent with universal goals of a reasonably priced, secure and environmentally friendly electricity supply:

1. Protect Ratepayers'/Taxpayers' Economic Interests -- Regardless if the energy efficiency investment comes from utilities or public benefits funds, the ratepayer ultimately pays the bill. In the last 10 years, billions of dollars of public funds have been invested in energy efficiency programs. Regulators have a responsibility to monitor the programs to protect the ratepayers' interests by examining the programs for cost effectiveness and responsiveness to program goals and state energy policy. Moreover, having a properly targeted and cost effective energy efficiency portfolio is crucial to making electricity bills more affordable, especially for low-income residents and encouraging economic development.

2. **A Secure Supply of Electricity --** Peak electric demand has been rising significantly in recent years resulting in New York's Independent System Operator (NYISO) to periodically activate emergency demand response programs to avert possible power reserve shortages. In August 2006, New York experienced an hourly average peak load of nearly 34,000 MW. To place this number in context, the peak demand ten years earlier in 1996 was 25,587 MW. The March 2007 NYISO's Reliability Needs Assessment predicts that power deficiencies, primarily in the New York City region, could occur by 2011 and become acute by 2016 if additional energy resources are not acquired. (NYISO, 2007)

As electricity supply becomes tighter, energy efficiency is being increasingly viewed as a resource on par with electric generation, and being able to quantify the impacts of energy efficiency programs is becoming a critical component for both short and long term planning. The bottom line is can regulators and planners trust the energy savings estimates?

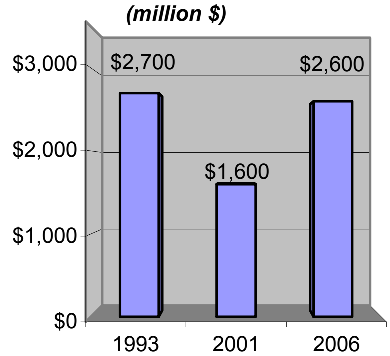
3. Environmental -- Effectively quantifying the benefits of energy efficiency programs is also crucial in understanding the reduction of greenhouse gas emissions resulting from electric generation. The power generation sector contributes an estimated 25 percent of New York's total greenhouse emissions. Regulation currently under consideration for implementing the Regional Greenhouse Gas Initiative (RGGI) requires New York to cap or limit the total $C0_2$ emissions to approximately current levels beginning in 2009 through 2015; and then begin to reduce CO_2 emissions incrementally over a four –year period to achieve a 10 percent reduction by 2019.

Free Rider/Spillover Measurement: A Brief History

In recent years, there has been a renewed interest in free ridership and spillover. The interest level, not surprisingly, correlates with the fluctuating investment levels in energy efficiency programs over the past approximately twenty years.

In the late 1980s, utility industry investment in energy efficiency programs began to rise dramatically. Nationally, spending rose from about $873 million in 1989 to about $2.7 billion by 1993 (Battles 2005, 9). As the size of the investment rose, the need for accurately documenting net program impacts became increasingly critical, and interest in free ridership and, to a lesser extent, spillover grew.

Figure I -- U.S. Spending on Energy Efficiency - Selected Years *(million $)*



For a variety of reasons -- most notably the deregulation of the electricity industry, increased availability of energy efficient products and generally ample electricity reserves -- investment in energy efficiency programs began to decline in the late 1990s. By 2001, spending on energy efficiency programs fell by nearly 50 percent from the 1993 level, to about $1.6 billion (Battles 2005, 9).

More recently, energy efficiency program budgets have been rising sharply. This renewed interest in energy efficiency is attributable to a number of factors including increased concern over global warming; accelerating energy prices; and strains on the electricity infrastructure in keeping pace with increasing demand. In 2006, expenditures for energy efficiency programs were conservatively estimated at about $2.6 billion (Consortium for Energy Efficiency, 2007, 4). Adjusted for inflation however, spending is still below the 1993 levels. Using the Consumer Price Index, the 1993 spending level would be the equivalent of about $3.8 billion in 2007 dollars, but indications are that the spending will continue to rise over the foreseeable future. In September 2005, for example, the California Public Utilities Commission created "the most ambitious energy efficiency and conservation campaign in the history of the United States, approving $2 billion in energy efficiency funding for the state's utilities for 2006-2008." Energy efficiency is described as "California's highest priority resource for meeting its energy needs in a clean, reliable and low-cost manner." (California Public Utilities Commission, 2007)

Energy Program Spending in New York State

In New York State, utility spending peaked in 1993 at nearly $300 million, and declined to well under $100 million in the mid nineties. In 1996, the New York State Public Service Commission (PSC) called for the establishment of a System Benefits Charge (SBC) to fund public policy initiatives, such as energy programs, not expected to be adequately addressed by New York's competitive electricity markets. In 1998, the PSC specified a three-year SBC budget of $234 million and the framework for energy programs targeting efficiency measures, research and development and the low-income sector. The SBC programs are designed to serve the diverse needs of New York energy consumers from upstate dairy farmers to office towers in New York City. The SBC program portfolio is primarily administered by a statewide administrator, NYSERDA.

The SBC was renewed for a five-year period in 2001 with increased funding ($150 million per year) and additional focus on programs designed to achieve peak load reductions. In December 2005, the PSC extended the SBC program for an additional five-year period (7/1/2006-6/30/2011) with an annual funding level of $175 million.[1] Currently, the role of the utilities in energy efficiency programs in New York is limited, but annual spending on energy efficiency programs is roughly $300 million including the budgets of NYSERDA, the Long Island Power Authority and the New York Power Authority.

Expectations are that investment in energy efficiency will continue to rise. New York's Governor Spitzer proclaimed in his January 2007 State of the State Address that "[I] n order to lower the second highest energy costs in America, we must implement an aggressive conservation strategy led first and foremost by an effort to reduce the state's own energy consumption." In May 2007, the PSC initiated a proceeding to design an electric and natural gas Energy Efficiency Portfolio Standard. The key goal of this ambitious undertaking is to reduce New York's electricity usage 15% from expected levels by 2015 (New York State PSC, Case 07-M-0548).

Reliability of Free Ridership and Spillover Measurement: A Work in Progress

Free Ridership

Over the past three decades, free rider measurement techniques have steadily improved, but there remains a notable variation in the approaches and methodologies used to identify and report free ridership in addition to legitimate questions about the reliability of the data and the role of the results. Documenting what would have happened, absent a program, remains one of the biggest challenges in energy program evaluation.

Early energy program evaluations (pre-1985) primarily focused on government funded energy conservation programs. These pioneering evaluations had many positive qualities, but were often deficient in quantifying program attribution. An Oak Ridge National Laboratory study of those early evaluations found that most (89 percent) failed to adequately address attribution issues. According to the study, "information is collected only on what clients liked, disliked or say they did. These approaches inspire no confidence that any observed savings were indeed caused by the program." (Berry 1985,154-55)

An analysis of free ridership measurement during the period from 1985-1995, reflecting an analysis of about 100 program evaluations from several states, concluded "elaborate and costly energy consumption analysis is frequently compromised by questionable estimates of free ridership…." evaluators have "often failed to fully exploit the value of free rider data to better understand customers and maximize program efficiency." (Saxonis 1995, 847)

Caveats usually surround free rider estimates, even in the most recent and rigorous program evaluations. In a 2006 study reviewing energy program evaluations in California (the 2002-2003 program portfolio), the authors concluded that, in general, evaluation results suffered from three key problems: incompatibility, incompleteness and a lack of rigor. The study also went on to highlight that less than half of the evaluations took free ridership into consideration when reporting energy savings, covering only 29 percent of the reported kWh savings. The study also noted that "the issues of identifying free riders are complicated and estimating highly reliable program-specific free ridership is problematic at best." (TecMarket Works 2006, p. 41, 68-69)

Spillover

Like free ridership, spillover measurement has improved, but it is still evolving. Spillover analysis trails free ridership measurement in the level of research attention and the level of confidence in

[1] Details about the history of the New York's SBC program, including evaluation data, can be found at the PSC's web page (http://www.dps.state.ny.us/sbc.htm).

the reliability of the results. Many regulators and evaluators recognize that energy programs are likely to have a spillover effect, but they often consider it too difficult and too uncertain to measure. In New York, during the peak period of utility energy programs, spillover measurement was virtually ignored. This phenomenon was also true in other regions of the country. A national review of spillover measurement conducted in 1994 found "very few studies have actually applied any method to capture spillover. Of the 38 studies cited…only 11 actually estimated spillover or overall net savings with spillover…the authors concluded that the "need for more applications is evident." (Cambridge Systematics Inc 1994, 3-16). A review of the California program portfolio (2002-2003), about ten years later, found that only a few of the evaluations contained spillover estimates (TecMarket Works 2006, 42).

Overall, the policy for treatment of spillover and free riders can vary significantly from state to state. For example, in 2006, Northeast Energy Efficiency Partnership (NEEP) examined how spillover and free ridership are used in eight northeastern states to adjust energy savings estimates. NEEP found that three states used both free ridership and spillover (Connecticut, Massachusetts, New York); two states required neither (New Jersey and Maine); and two states used spillover data, but not free rider data (New Hampshire and Rhode Island). Vermont used free rider and spillover results, but limited spillover to the non-participant variety (NEEP 2006, 20).

In New York, spillover is an important monitoring tool, especially for NYSERDA programs with a strong market transformation focus. In developing the SBC program, New York's PSC recommended that emphasis be placed on energy efficiency programs capable of "permanently transforming" markets rather than "achieving immediate or customer-specific savings." (New York State PSC 1998, Case 94-E-0952) While spillover is only one tool used by NYSERDA to monitor market trends and transformation, from a regulatory standpoint, it would be inconsistent to require market transformation initiatives, but not allow NYSERDA the opportunity to use spillover measurement to help capture the results.

An Overview of the NYSERDA Free Rider/Spillover Methodology

In New York, free ridership and spillover are both important factors in assessing the effectiveness of NYSERDA's SBC funded portfolio of energy efficiency programs. In the early years of the SBC programs, limitations on evaluation spending restrained NYSERDA's ability to conduct rigorous evaluation, including free ridership and spillover measurement. When the PSC increased the SBC evaluation budget from less than 1 percent to 2 percent, free ridership and spillover measurement became a priority in the enhanced NYSERDA evaluation metrics introduced in 2003. NYSERDA's evaluation program is implemented using a team approach consisting of an experienced internal staff and respected contractors from around the country.

The following is an overview of the approach used by NYSERDA in capturing free ridership and spillover. It is important to note that due to the size and scope of the NYSERDA program portfolio there may be some variations in the evaluation process from program to program, and the methodology has been subject to continual refinements.

For free ridership measurement, NYSERDA employs a multi-question survey approach that has evolved from their own experience and insights from similar research in other states. Importantly, NYSERDA relies on experienced interviewers who are knowledgeable enough to probe respondents for details of program influences and who can characterize the responses in quantitative terms. The core of the approach includes the following steps:

- Directly asking program participants if they would have implemented the same energy efficiency measures without the assistance of the program;

- Asking quantitative and open-ended questions regarding the influence of the program on specific energy related actions;
- Scoring of open-ended responses by experienced interviewers using an established formula to capture the degree of free ridership based on factors such as the timing of measure installation and the energy efficiency and quantity of the measures installed.

The approach to quantifying spillover depends on a multi question survey approach similar to the free rider measurement methodology. For program participants, the core of the research strategy is to determine if participants believe the program experience had any influence on projects not associated with the program and, if an effect exists, quantify the extent of the effect. For example, NYSERDA's residential audit program (Home Performance with ENERGY STAR) evaluation found that contractors associated with the program were transferring many of the program-influenced practices (e.g., high efficiency insulation, ENERGY STAR furnace/boilers) to non-program homes.

For some programs, non-participants were surveyed to determine if they were aware of the NYSERDA program and the extent, if any, the program had any influence on their energy efficiency related behavior. For example, surveys of building owners and architectural/engineering (A&E) firms not participating in NYSERDA's High Performance New Buildings program discovered that 18 percent of these building owners and 13 percent of the A&E firms increased their knowledge of the benefits of energy efficiency improvements either "somewhat" or "a great deal" because of their awareness of the program. Approximately two in five non-participating firms believe the program influenced building/design practices at their firms.

For some evaluations, NYSERDA uses an "Integrated Data Collection Process" to gain participant feedback, in "near real time," to supplement the more traditional retrospective survey efforts. Simply stated, participants are asked to complete an abbreviated survey containing questions related to program attribution soon after their participation in the program. The theory behind this approach is that survey respondents will have a better sense of the factors influencing their decisions the closer the survey is in time to the decision itself. While the approach is not as rigorous as the retrospective approach, it has proved effective in identifying trends and confirming free rider and spillover values in between major evaluation cycles.

The NYSERDA Free Rider/Spillover Results

A review of four years of free rider and spillover data from NYSERDA's SBC funded Energy $mart portfolio found high free rider rates, and even higher spillover rates, in many key programs. The NYSERDA free rider and spillover data are of interest because together they reflect a large percentage of the energy impacts, especially for the C&I portfolio. For example, NYSERDA's high efficiency motors program had a 67 percent free rider rate and a spillover rate of 168 percent; with a positive NTG ratio the program continues to be offered, but with changes in the program design. Using 2006 data, other key findings related to 10 C&I programs (8 expressing MWh saving and two demand response programs with savings expressed as MW) include:

- Six of the ten programs have spillover rates roughly double the free rider rates.
- Nine of the ten programs have free rider rates 24 percent or higher, including 4 with free rider rates of 39 percent or higher.
- About thirty percent or 576,663 MWh, of the reported savings attributable to eight C&I energy efficiency portfolio programs (1,974,174 MWh) are from spillover.
- Eight of the ten programs have spillover rates higher than the free rider rate.
- The unweighted <u>average</u> free rider rate for the eight programs targeting energy efficiency is 38 percent and the unweighted spillover rate is 66 percent. The program weighted average

free rider and spillover rates are 31% and 51%, respectively. The NTG ratio is only slightly above one (1.07)

- The <u>average</u> spillover percentage drops significantly to 17 percent, or about 81 MW, for the two programs associated directly with demand response. The NTG ratio equals one.

For the seven residential programs in our study the NTG ratio equals about one. Approximately 18 percent of the reported 127,060 MWh savings is attributable to spillover or 22,336 MWh. The unweighted <u>average</u> free rider rate is 16 percent (17% program weighted) and the unweighted <u>average</u> spillover rate is about 20 percent (16% program weighted). Table 1 lists the names and types of programs examined in our study and highlights key results.[2] Figures two-four highlight the impact free ridership and spillover have on the NYSERDA program portfolio.

When we examined the free rider and spillover data for both free ridership and spillover over the four-year period (2003-2006), we found relatively little change in the results. In some cases new research was not conducted, but in other cases the results simply didn't change significantly.

Table 1- Program Type and Key Results

	FR (%)	Spillover (%)	NTG (ratio)	Gross Savings	Net Savings
C&I					
Demand Response	24	25	0.95	247	235
Interval Meters	10	22	1.09	216	236
Total (MW)				463	471
Demand Response (permanent)	25	37	1.03	90,560	93,276
C&I Performance	31	44	1.04	731,900	757,427
Smart Equipment	51	45	0.7	112,640	78,848
Lighting	39	79	1.09	33,541	36,559
Motors	67	168	0.88	9,689	8,822
Loan Fund	27	19	0.92	55,717	51,260
New Building	40	85	1.22	205,201	250,345
Flex tech Audit	25	48	1.14	611,962	697,637
Total (MWH)				1,851,210	1,974,174
RESIDENTIAL					
Energy Star	28	48	1.17	7,914	9,259
Home Performance	26	41	1.12	13,031	14,595
Comprehensive Energy	2	18	1.16	3,096	3,592
Multifamily	27	15	0.84	27,511	23,109
Direct Install	N/A	N/A	1	11,494	11,494
Keep Cool (AC)	18	15	0.94	29,460	27,781
Bulk Purchase	10	5	0.95	39,397	37,230
Total (MWH)				131,903	127,060

Figure 2
Net Savings w/Free Rider & Spillover Components
C/I Demand Response Programs
(MW)

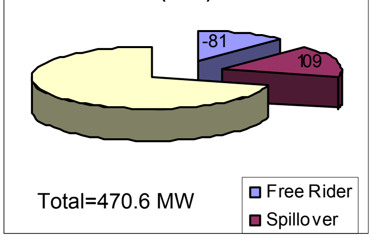


Figure 3
Net Savings w/Free Rider & Spillover Components
C/I Programs
(MWH)

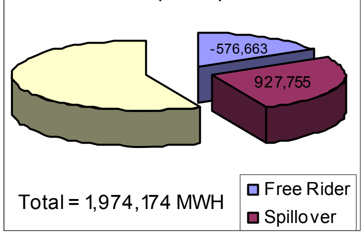
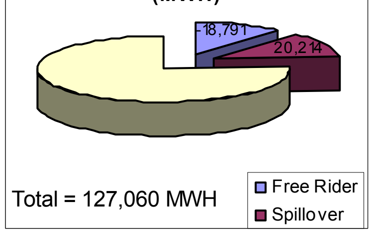


Figure 4
Net Savings w/Free Rider & Spillover Components
Residential Programs
(MWH)



[2] Details about the NYSERDA program portfolio can be found at the NYSERDA web page at http://www.nyserda.org/Energy_Information/evaluation.asp.

Comparing New York's Results to Other States

In the early days of New York utility programs, an acceptable free rider rate was never formally established, but generally a rate of about 20 percent or higher would attract regulatory attention. Spillover data was too limited to develop a benchmark, but by historical standards, rates over 20 percent were unusual. Are these benchmarks still reasonable? One way to better understand the NYSERDA data is to examine similar data from similar programs in other states.

In August 2006, National Grid released a free ridership and spillover study of its 2005 C&I programs offered in New England. The study focused on two programs: Energy Initiative and Design 2000*plus*. The Energy Initiative Program encourages C&I and governmental customers to upgrade to more energy efficient equipment (e.g., lighting, HVAC controls, motors) by covering 50 percent of the total installation costs. Based on 2005 data, the Energy Initiative Program has a free rider rate of 9 percent and a spillover rate of about 4 percent. By contrast, a package of 4 roughly similar NYSERDA programs has, on average, a free rider rate of 47 percent and a spillover rate of 84 percent. The Design 2000*plus* Program targets new construction and major renovation of existing buildings by offering architects, engineers and builders technical and financial assistance to incorporate energy efficient options. The Design 2000*plus* has a free rider rate of approximately 22 percent and a spillover rate of 12 percent (National Grid 2006, 1-12). The roughly equivalent NYSERDA program, High Performance in New Buildings, exhibits a free rider rate of 40 percent and a spillover rate of 85 percent.

Relatively new programs, designed to serve the business sectors in Maine and Oregon, experienced free rider rates of 27 and 17 percent respectively, but spillover of 2 percent or less. In both cases, however, evaluation of non-participant spillover was not included (Maine 2005 4-14, Research into Action, 2005 135). Roughly similar results were experienced in Wisconsin for energy programs targeting the C&I sector (Wisconsin 2007). Examining several utility operated C&I program evaluations in California found spillover rates ranging from 5-21 percent and free rider rates ranging from 30-46 percent. These evaluations were conducted using a variety of methodologies and over a fairly wide time frame, 1999-2006 (Hummer, 2006).

The Regulatory Dilemma: Dealing with Free rider and Spillover Results

While the number of comparable studies is limited, it appears that spillover, and to a lesser extent free ridership, represents a bigger impact in New York compared to other states. Does New York overestimate spillover and free ridership? Are programs in other states underestimating these effects? Is a high free rider rate a cost for having high spillover? Are the estimates generally accurate, but the differences are a result of the program designs? These are all critical questions to understanding spillover and free rider results.

Unfortunately, there are no clearly defined answers to these questions. While this comparative analysis is insightful, interpreting the results needs to be tempered with caution. A variety of factors can influence the results including differences in program design, customer base, age of the program, evaluation period, evaluation methodologies and reporting protocols. It is instructive to note that several of the studies in our comparison, specifically the National Grid, Maine and several of the Wisconsin studies were conducted by the same evaluation firm using a similar survey based approach. This approach is also similar to NYSERDA's methodology as discussed in detail earlier in this paper.

While the evaluations highlighted in our review appear generally sound, we know that measurement of free ridership, and especially spillover, is uncertain even when employing the best techniques and highly skilled evaluators. Even within the studies themselves there is sometimes puzzling results. For example, in the National Grid Design 2000*plus* Program, participant spillover in 2005 in New Hampshire was 28 percent, but less than five percent in Rhode Island, a state less than 100 miles away. In many studies we have seen large differences in spillover and free rider rates from measure to measure. At a micro level, it may be possible to discover possible explanations for the variations, but it would be speculative. Assuming the research doesn't suffer from gross infirmities, it is difficult, perhaps impossible, to conclusively determine if an "unusual" result is a reflection of reality or a flaw in the methods or research implementation. For example, two NYSERDA programs with both high spillover and free rider rates, the High Performance Buildings Program and the Motors program, place a priority on market transformation. This is a plausible explanation for a high spillover rate, and possibly high free ridership, but how do we test the validity of the theory? The California Evaluation Framework concluded, "We can never know the 'true' free rider rate." (TecMarket Works 2004, 140). Spillover is even a greater challenge.

An added dilemma is the impact of free ridership and spillover on NTG ratios. Interestingly, despite the magnitude of the NYSERDA free rider and spillover results, the impact on the NTG ratios of their two major program categories, C&I and residential, is virtually non-existent with NTG ratios of almost exactly one. In states with overall lower free rider and spillover rates, however, the impact on the NTG ratio is sometimes more significant because free ridership tends to be higher than spillover, the opposite of the New York results.

To maximize the value and have a high level of confidence in free rider and spillover data, it is obvious that data quality needs to be improved. This is not a simple or inexpensive task and one that has challenged evaluators for decades.

A Pathway to Better Results

Simply stating a problem is only part of the equation. We know that based on clear evidence:

- For a variety of reasons, including regulatory accountability, it is important to collect free rider and spillover data.
- Free ridership and spillover are major factors in New York energy programs.
- Free ridership and spillover are difficult to measure.
- There is a high level of uncertainty in free ridership and spillover measurement.

Where do we go from here? This paper offers specific recommendations to help improve the research and make the resulting data more useful to regulators and other policy makers. Specific suggestions focus on improving data reliability, leveraging knowledge and using the collaborative process to reduce evaluation costs.

Improve Data Reliability

There are several research challenges. First, it is difficult to determine the research approaches that provide the most reliable results. A lesson learned from our analysis is that it is difficult to conclusively determine why results from similar programs can vary dramatically from study to study, measures to measure and program to program. Are the differences "the truth" or the result of flawed evaluation? There are numerous free rider and spillover studies, but little research has been conducted to quantify free rider and spillover results using multiple approaches in the same study. While we may never have complete confidence in the results, this type of research would help increase confidence in the data especially if multiple approaches produced similar results.

In addition to simply dealing with the fundamental question of data reliability, there are also broader methodical issues that deserve additional attention. For example, a case can be made that spillover research, especially using the survey approach, tends to underestimate spillover simply because it is constrained to a specific period of time and to the knowledge and recollection of the respondent. If a program participant decided to install additional energy efficiency measures, above and beyond the program offerings, two months after the spillover survey, it would not be included in the spillover results. A case can also be made that free ridership is overestimated because of the cumulative influence of energy programs over many years. Even with a well-designed survey, it is unclear how to adjust the data for these factors. Recommendations include:

- Increase emphasis on using additional methods to quantify free rider ship and spillover to "triangulate" the data. This could involve techniques such as comparison groups, statistical models and different survey strategies.
- Increase the precision and confidence levels of survey related work to determine if changes in free rider and spillover rates, especially among specific measures, reflect changes in reaction to the program or statistical noise.
- Employ more long term and comparative analysis.
- Conduct studies that compare adoption of energy efficient products in regions with and without intervention programs to assess the magnitude of the impacts.
- Develop more probing questions that go beyond questions related to specific energy actions.

Leverage Free rider/spillover Data to Maximize Value

Ultimately, measurement of spillover and free ridership attempts to quantify a cause and effect relationship given a constantly changing market environment. A challenge often ignored by evaluators and regulators is understanding the change in free rider and spillover levels as economic conditions and markets evolve. This is especially important as markets evolve at a rate that just a few decades ago would have been considered unimaginable. It is remarkable to reflect upon some of the market changes that likely impacted NYSERDA's programs during our analysis period, 2003-early 2007. For example:

- Residential natural gas prices in New York State rose from about $11.00 (MCF) in December 2003 to over $15.50 in December 2006.
- The price of a barrel of oil more than doubled from about $30 per barrel in 2003 to over $65 per barrel in May 2007.
- A boom in one of the most critical elements of the U.S. economy, housing. For example, home prices in the New York City metro region rose 46 percent between 2003 and the first quarter of 2006 compared to a national increase of 31 percent (National Association of Realtors, 2006).
- Increased interest in environmental issues. A February 2007 survey, conducted for Yale University, found a significant shift in public attitudes toward the environment and global warming. Fully 83 percent of Americans say that global warming is a "serious" problem up from 70 percent in 2004. (Yale Center for Environmental Law and Policy, 2007) The results also suggest that many Americans want "greener" products and are ready to invest in new technologies that will help reduce greenhouse gas emissions.
- Increased sensitivity to environmental concerns from the business community. General Electric made environmental products a key element of its growth strategy, and Wal-Mart established aggressive environmental goals including, "to be supplied 100 percent by renewable energy; to create zero waste; and to sell products that sustain our resources and our environment."(Wal-Mart, 2007)

While spillover and free rider measurement can serve as an indicator of market effects, it is underutilized in this regard. A key concern of New York regulators has focused on determining whether or not SBC funded programs are continuing to be responsive to consumers, the changing marketplace and the State's energy policy objectives. We do not want to continually approve programs simply because they have been offered in the past, but rather because they are meeting today's, not yesterday's needs. There are several ways of gaining insights into these concerns, such as monitoring program application rates, process evaluations, product baselines and customer feedback, but there is no established protocols for using free rider and spillover results to refine or update program designs.

A study suggested that the deteriorating economic climate in New York State during the early 1990s had a direct influence on declining free rider rates in an appliance rebate program as consumers became more intent on finding value in their purchases. During roughly the same period, the utility serving the New York City area, Consolidated Edison, found that electric contractors eager for business aggressively recruited customers to participate in the utility's energy efficient lighting program as a way of replacing lost business. The result was an unexpectedly low free rider rate. (Saxonis 1995, 847-52) Unfortunately, little of this type of innovative research has been conducted.

It is difficult to understand and accurately interpret free rider and spillover data as market indicators based on current measurement techniques. Is a housing boom distorting results from the ENERGY STAR home program? Will the results change as the housing prices decline? If so, how? Is a high free rider rate resulting from the influence of an energy price spike occurring just as consumers are being surveyed or a signal that a program needs to be redesigned? What are the characteristics of free riders and what are the drivers of spillover? We have some ideas, but, at best, our knowledge is sketchy and uncertain.

One way to answer these questions is through more imaginative use of free rider and spillover databases, especially using the data, not simply for calculating cost effectiveness, but also for better understanding program designs, impacts and relevancy, and the marketplace in general. An added bonus is that the value of free rider and spillover data would be significantly enhanced and more justifiable from a cost standpoint if it offered clear benefits as a market indicator and as a tool for program enhancement. Specific recommendations include:

- Link free rider/spillover data with results from questions related to areas such as demographics, attitudes toward the environment and energy efficiency, reasons for program participation, shopping preferences and the status of the economy.
- Conduct longitudinal studies to see how free rider and spillover rates change over time and under what conditions.

Increase Collaboration

NYSERDA has made important strides in the challenging task of quantifying free ridership and spillover. Compounding the challenge is the need to perform many types of evaluations (e.g., measurement and verification, process) within limits of resources and time constraints. Other states are in a similar position. Financial limitations make it difficult to conduct the types of ambitious research advocated in this paper. A possible solution is increased collaboration.

The issue of attribution needs to be discussed in both regional and national forums. Some efforts are already underway. In the New England states, for example, a State Program Working Group is in the process of exploring ways to standardize measurement and verification methods and considering approaches to dealing with energy program attribution issues. Regulators, government leaders, utility managers, evaluators and other interested parties should be encouraged to examine innovative methods to enhance the quality of free rider/spillover measurement and to begin to view the data as a tool for seeing beyond simply calculating B/C ratios. A clear advantage of a collaborative is that methodologically related research studies could be conducted on a group basis, defraying the costs, which has proven to be a major barrier to this type of research. In addition, a collaborative could also serve as a forum for innovative ideas and to consider standardization of definitions and research approaches.

Conclusion

The popular book on management techniques, “First Break all the Rules,” begins chapter one with a provocative question: “What do we know to be important but are unable to measure?” The authors then tell the story of how in 1707, Great Britain lost nearly an entire fleet of ships as ships one after another crashed into the rocks of the Scilly Isles. Two thousand sailors died as result of this tragic miscalculation of position. Sailors had understood the concept of longitude and latitude for years, but crude measurement was the problem. A common navigational technique of the era was to drop a log over the side of the boat and time how long it took to float from bow to stern. (Buckingham, 1999, 21)

The concept of free ridership and spillover have been know for years and most agree that properly used and properly understood this data can be an important tool for regulators and others involved in energy efficiency programs. The most important lesson learned is that we need to focus more on improving measurement techniques, not just for computing B/C ratios, but for better understanding energy efficiency programs and markets. While we can’t compare the importance of free riders and spillover measurement to the tragedy experienced by Britain’s navy, the story does vividly illustrate that it is not sufficient to simply understand a concept, but to have the tools and skill to maximize and apply the concept under real world conditions.

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