Crediting Energy Efficiency Measures Under Air Emissions Programs

Steven Fine, ICF Consulting
Chloe Weil, U.S. Environmental Protection Agency

ABSTRACT

Energy efficiency and renewable actions have not traditionally received credit for the quantifiable emissions reductions from the electric utility grid they produce. Crediting these emission-reducing activities at the point of investment is critical to ensuring that these cost-effective actions are incorporated under air emissions programs – whether under a market based cap and trade programs, or an air inventory system.

In either scenario, determining the energy savings resulting from energy efficiency measures can present a significant challenge. The electricity generated from renewable energy measures can, by and large, be accurately measured through simple metering techniques. Energy efficiency measures however face the same challenge they have traditionally confronted – how to accurately measure energy savings from these actions versus what would have occurred anyway. This paper will focus on measurement and verification challenges that an entity such as a state would face when trying to design a system to credit energy efficiency measures either under a cap and trade or an open inventory system.

The paper also examines several of the tools and protocol that have been developed to support the crediting of energy efficiency and renewable measures, such as EPA's Conservation Verification Protocol, DOE's International Performance Measurement and Verification Protocol, New Jersey's Protocol for Commercial, Industrial and Residential Facilities, to see if these programs could provide valuable "lessons learned" and insight into developing M&V procedures for crediting energy efficiency and renewable measures.

Introduction

Energy efficiency and renewable actions have not often received credit in clean air regulatory programs for the quantifiable air pollution emissions reductions they produce. Crediting these emissions reducing activities at the point of investment may help to unlock the emissions reductions inherent in the implementation of these technologies. This issue is particularly timely given the deregulation and vertical unbundling of the power industry. In a world where generators are no longer charged with the delivery of electricity and delivery of energy efficiency measures, crediting entities that implement the efficiency or renewable measures that lead to quantifiable reductions in emissions levels takes on added significance.

States have used a number of available tools that can help provide incentives to business, industry and consumers to improve energy efficiency. These tools consist primarily of regulatory measures such as building codes and utility regulations in the form of demand side management (DSM) programs. Increasingly, states have been relying on voluntary measures, such as public education campaigns and participation in federal energy efficiency programs, as well as creating financial incentives through standard performance contracts. Crediting energy efficiency measures in cap-and-trade programs is another type of incentive that can provide additional opportunities to encourage energy efficiency.

While programs such as the Conservation Verification Protocol[1] (CVP) under the Acid Rain program allowed for the crediting of energy efficiency measures, it was utilities that received the "bonus allowances." If crediting energy efficiency measures through awarding allowances is meant to provide incentives for greater implementation of energy efficiency measures in a structurally unbundled market, the actions will need to be credited closer to the point of investment.

In order to establish such a system, strategies for insuring that these energy efficiency actions are real, certain and quantifiable need to be addressed. In particular, issues related to measurement and verification uncertainty, as well as accountability that actions are not being taken "anyway", or are additional to those already accounted for in the baseline, create significant hurdles that must be recognized in developing energy efficiency crediting programs in a deregulated environment.

Inventory vs. Cap and Trade Systems

When discussing the crediting of energy efficiency actions by recognizing the emissions that these projects reduce, it is important to distinguish between crediting emissions under an emissions cap vs. crediting emissions under an inventory system. An emissions cap imposed upon system, such as the Title IV SO_2 emissions cap on utility point sources, allocates a specific amount of emissions allowances equal to the annual emissions budget cap. Affected sources must then true-up at the end of the year, surrendering one allowance for each ton of SO_2 emitted. While a cap and trade regime allows individual unit flexibility regarding how it will achieve it's emissions budget (installing post combustion controls, fuel switching, allowance purchases, dispatch changes), the entire system is subject to the emissions cap. When crediting emissions under an emissions cap, such as was done with the CVP under Phase I of the Acid Rain Program, a number of emissions allowances from within the cap are set-aside. In the case of the CVP, a "Bonus Allowance Pool" was created. Since these emissions are taken from the total emissions cap, there is no danger of emitting more than the capped number of emissions – assuming the program is functioning properly. In this case, the award of allowances to energy efficiency projects allows these projects to share in the monetary benefits of reducing the burden imposed upon the system by the emissions cap. By reducing electric demand upon the system, the emissions cap can be attained in a more cost effective manner.

On the whole however, in a capped system, the emissions are reduced because of the cap, and not as a direct result of the energy efficiency measures implemented. However, other non-capped emissions are likely to be simultaneously reduced as a result of the lowered electricity demand due to the implementation of energy efficiency and renewable measures (co-benefits). Furthermore, by virtue of the cap, precisely because emissions have been constrained, they become a valuable commodity. Currently for example, SO_2 allowances are worth approximately $150/ton, and NO_X allowances in the Northeast Ozone Transport Region (OTR) are hovering just below $1000/ton.

This is not the case under an emissions inventory system where there is no cap in place. In this case, energy efficiency and renewable measures have a direct impact upon emissions. In this type of "open" system, it is particularly important that the energy savings

[1] U.S. EPA, Conservation Verification Protocol, http://www.epa.gov/acidrain/crer/cvpsumm.htm

resulting from energy efficiency and renewable measures are correctly assessed, as there is a real impact on air quality.

Since, by definition, there is no emissions cap under an open inventory system, there are no emissions allowances and therefore no inherent financial value placed upon emissions. There could be an important public service/green value placed on those programs or organizations that contribute to lower emissions levels. Energy efficiency and renewable energy measures under an open system have also been credited through other methods, such as standard offers and subsidies.[2]

In either scenario, determining the energy savings resulting from energy efficiency measures can present a significant challenge. The electricity generated from renewable energy measures can, by and large, be accurately measured through simple metering techniques. Energy efficiency measures however face the same challenge they have traditionally confronted – how to accurately measure energy savings from these actions versus what would have occurred anyway. This paper will focus on measurement and verification challenges that an entity such as a state would face when trying to design a system to credit energy efficiency measures either under a cap and trade or an open inventory system.

The ability to accurately measure, forecast and verify the energy and emissions savings associated with energy efficiency and renewable energy programs is one of the key elements necessary for crediting these actions. This paper addresses issues central to the measurement and verification (M&V) of electricity demand reducing measures, i.e., measures that reduce the demand for electricity from the centrally dispatched power grid. As such, it concentrates upon the first of two essential aspects to crediting energy efficiency and renewable projects. – determining the energy (kWh) savings. It discusses, but does not attempt to fully address an equally complex issue – translating energy savings into emissions reductions.

The Central Importance of Measurement and Verification

To measure and verify electricity savings for the purpose of crediting energy efficiency and renewable projects as part of an emissions trading program, it is important to follow a consistent set of standards and methods. High quality measurement and verification procedures will help ensure that claimed electricity reductions are real and comprise the first part of the equation in assuring that the currency (i.e., ton of emissions reductions) is real. For that reason, this paper will assess several specific protocols available for varied types of energy efficiency and renewable energy projects, and will briefly discuss how these available methods of measurement and verification could potentially be adapted for designing a measurement and verification system for crediting energy efficiency measures.

Developing Appropriate Measurement and Verification Standards and Mechanisms

In a system designed to credit energy efficiency measures, it is essential that the resultant electricity savings from energy efficiency and renewable projects are real, and

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[2] The one major exception to this is in the case of opt-ins in nonattainment areas, where a local cap or offset market exists for a specific pollutant such as VOCs or NO_X. In these cases, there may be provisions for energy efficiency and renewable projects to generate offsets.

accurately measured. Determining the energy savings resulting from such measures is a two-step process. First, a "but for" – or pre-efficiency measure baseline must be established. It is important to establish the pre-efficiency baseline so that the performance of the post-retrofit energy efficiency measure can be compared against it. In addition to the pre-measure energy use, other criteria need to be considered such as federal minimum efficiency standards. The consideration of minimum efficiency standards are important so that efficiency measures are not overcredited. For example, a building's 20-year-old HVAC system may have been replaced with a newer more efficient unit and as a result, electricity consumption reduced. It is important to consider the baseline changes in HVAC energy efficiency standards that have occurred over the last 20 years. If the new HVAC unit simply saves electricity because it meets current DOE efficiency standards, then no credit is due the project. If the new HVAC unit exceeds current efficiency standards, then the difference between a new standard efficiency unit and the installed higher efficiency unit is the electricity savings that could be credited. By restricting savings to those measures that are in addition to what have would happened anyway, credits are issued only to incremental savings.

Second, an effective measurement and verification method must confirm that the energy efficiency measures submitted for allowances were: actually installed in lieu of less efficient equipment; properly installed; and are likely to continue operating and saving energy over time.

Given these considerations, existing energy efficiency crediting programs contain many of the necessary elements needed to develop a sufficiently robust energy efficiency measurement protocol to encompass most of the actions that would be submitted for allowances under an energy efficiency set-aside program. Most notably, the *International Performance Measurement and Verification Protocol*[3] (IPMVP), and various applications of the IPMVP, which are discussed in subsequent sections of this document, establish measurement and verification methodologies that can be readily applied to emissions set-aside programs. (mention here that they vary in scope and cost?)

Measuring Energy Savings

Measurement and verification is the confirmation that energy efficiency and renewable energy actions are producing claimed energy savings. Verified energy savings can then be translated into an associated emissions displacement. However, because efficiency and renewable energy programs and projects are not uniform, differences among them mean that these actions are often measured and verified with varying accuracy and levels of rigor. Likewise, variation among program requirements in the available M/V protocols and how project sponsors elect to use them can lead to uncertainty in the precision with which energy efficiency and renewable energy actions are measured and verified. Furthermore, building and equipment use patterns may not be constant from year to year or season to season, which also introduces variability and some uncertainty.

For example, using metering or sub-metering of equipment to demonstrate pre- and post-retrofit energy use eliminates most or all of the uncertainty about how much that equipment is used during the time period in question. By contrast, using stipulated measurement, where the performance metric of the new equipment is multiplied by the

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[3] U.S. Department of Energy, International Performance Measurement and Verification Protocol, DOE/EE 0157, December 1997.

assumed or historical use of that equipment is inherently less accurate. A hotter summer than usual, higher or lower building occupancy levels, or other variables may have a significant effect on the amount of savings or displacement that is actually realized. There is also an M/V cost vs. performance element that needs to be considered, as the more accurate measurements typically cost more to implement.

Verification procedures should be adequate to ensure that the estimates of savings or generation:

1. Reduce electricity demand from the grid
2. Are reliable/accurate
3. Ongoing/permanent
4. Reduce emissions from within the relevant timeframe[4]
5. Not accounted for in the baseline ("additional")
6. Not accounted for in any other way by another party (eliminate "double counting")
7. Can be aggregated to equal (usually one ton) increments of emissions reductions

Translating Energy Savings into Emissions Reductions

In order for energy efficiency measures to be included in an open inventory or cap and trade program, both the energy savings and the emissions reductions they generate must be quantified. Once energy savings are accurately calculated, they need to be translated into emissions reductions. For measures that result in electricity savings from the grid this can be a challenging process. Ideally, a weighted average marginal emissions rate should be used to determine the real emissions that have been reduced as a result of the energy savings. Calculating such a rate can be a daunting task however as it requires the overlay of the energy efficiency measure's load shape with the utility system's (power pool's) dispatch pattern. By doing so, one could arrive at the marginal unit's generation being displaced by the energy efficiency measure. By knowing the emissions characteristics of those units, an emissions rate for each could be assigned. Furthermore, by knowing which unit was displaced in each hour of the year (or over the summer for NO_x), an annual (or seasonal) weighted marginal emissions rate could be determined. In calculating such a marginal rate, imports of power, for those hours when they are on the margin, would also need to be accounted for.

Overview of Measurement and Verification Protocols

There are multiple past and current efforts to establish uniform measurement and verification standards for energy efficiency and renewable energy actions, as part of either incentive programs or air quality planning strategies. The International Performance Measurement and Verification Protocol (IPMVP) has attempted to codify the framework that stands behind most of these efforts. The IPMVP reflects an international consensus approach to measurement and verification among industry, federal and state agencies, and experts in the energy, water and efficiency industries. The IPMVP details current best practice techniques available for verifying energy efficiency (and water efficiency projects as well), with a particular focus on third-party financed projects.

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[4] Emissions reductions should occur within the same year for which they are credited.

The goal of the IPMVP is to reduce major barriers to the expansion of the energy and water efficiency industries by helping increase reliability and level of energy efficiency savings, reduce transaction costs by providing an international consensus, and reduce financing costs. The IPMVP does not prescribe contractual terms or specific program requirements, and is intended to help project developers select a measurement and verification plan that best matches project cost and savings magnitude, and the particular energy efficiency measure or technology. As such, reflecting the different types of potential energy efficiency actions, the IPMVP includes four different measurement and verification approaches that project developers can then choose from.

The four IPMVP options are based upon the complexity of the energy efficiency measure or technology, such as the number of exterior factors affecting its performance, similarity between individual components of the measure at a single project site, and interaction between these components. For that reason, the IPMVP M&V options have different precision and accuracy characteristics, vary in cost of implementation, and have distinct strengths and limitations. The options have some similarities, but serve distinct purposes:

- Option A is a deemed-savings approach, limited to a select group of well documented, non-weather sensitive measures. Option A utilizes pre-determined performance factors (e.g. lighting wattage). Energy savings are determined by simply multiplying the agreed upon performance factors by a stipulated estimate of operational hours. This option has the advantage of simplicity, though accuracy can be sacrificed if the estimate of operation hours is incorrect. In addition, Option A is only available for independent actions and equipment upgrades and not for full building retrofits.
- Option B builds upon Option A, by more correctly estimating operating hours and other operational factors. It involves end-use data analyses and engineering calculations, based upon sub-metering of the individual energy efficiency measures taken on a continuous basis over the term of the project. As such, Option B can be more expensive than the other approaches, but tends to be more precise.
- Option C also involves long-term metering data, but focuses on whole-building data analyses rather than on sub-metering. Option C energy savings are usually based upon a statistical analysis of utility billing data. Option C techniques range from simple comparison to multivariate regression analysis. However, once an Option C crediting mechanism has been designed, it can prove to be one of the simplest and easiest methods of crediting, while providing a high degree of accuracy.
- Option D is based upon a calibrated simulation of facility components or the whole building, and can involve a combination of Option A stipulations and Options B or C, end-use or whole-building data analyses. Option D is most often employed for verification of savings in new construction, in which both performance and operation factors are modeled. Option D provides a high degree of accuracy, but the costs associated with developing a simulation model for purposes of a cap and trade program could be high.

Each of these options is intended as general guidelines to help involved parties understand how savings could be calculated, given the variety of information that may be known or unknown about a project's load profile, as well as other performance and operational factors. As such, the IPMVP does not include fixed or prescriptive requirements, and in and of itself, cannot be used as a "protocol" for establishing the energy savings resulting from the implementation of energy efficiency measures. For example, it is up to the entity designing the crediting program to determine the amount of sub-metering that would be required for an individual retrofit with a variable load profile, or the types of assumptions that would go into determining performance factors for a deemed value approach.

For that reason, the remainder of this paper assesses a range of energy efficiency crediting programs to illustrate the variation among M&V methodologies to calculate energy savings even from similar projects. In particular, the overall scope, type of incentive, and mechanism associated with existing energy efficiency crediting programs has influenced the appropriate level of stringency chosen by program administrators. If not carefully designed, the cost involved to achieve the highest levels of stringency and precision may outweigh the financial incentives provided by the crediting programs.

The crediting programs detailed in this paper include cap and trade programs and pay-by-performance (standard offer) crediting programs. It is important to note that the focus of the pay-by-performance crediting programs discussed is to provide incentives for new energy efficiency actions by providing potential project sponsors with a financial incentive funded through a system benefits charge, rather than, ultimately, air quality compliance. The following programs each address measurement and verification issues through a variety of methods, each balancing the required level of accuracy in measuring energy savings with the programmatic costs and burdens.

The following energy efficiency crediting programs are discussed in this paper:

- The Conservation and Renewable Energy Reserve, administered under the US EPA's Acid Rain Program,
- The New Jersey Incentive Reserve,
- The New York Emissions Budget and Allowance Program,
- The New York State Energy Research and Development Authority's (NYSERDA) *Energy $mart* Non-Residential Performance Contracting Program,
- The California Large Non-Residential Standard Performance Contracting Program,
- The California Residential Standard Performance Contracting Program,
- The Green-e "Negawatt" component of their Certification Program (specific to Pennsylvania), and
- The South Coast Air Quality Management District's Regional Trading Program (RECLAIM).

Traditional – Regulated Utility Programs

Acid Rain Program: Conservation and Renewable Energy Reserve. In 1990, as part of Title IV of the Clean Air Act Amendments (CAAA), Congress set a national emissions cap on SO_2, to be maintained through the issuance of emission allowances under EPA's Acid Rain Program. As part of the cap-and-trade program, Congress created the Conservation and Renewable Energy Reserve (CRER) to award SO_2 allowances as incentives for energy efficiency and renewable energy measures. For every 500 MWh of energy saved through demand-side efficiency or generated through renewable energy, a utility earns one allowance from the Reserve. About 3% of the entire pool were set-aside to be allocated to utilities that initiate energy conservation or renewable energy measures.

The verification process was left up to the states, but EPA developed a voluntary guidance, the "Conservation and Verification Protocols" (CVP) as an alternative or default option to help states ensure that reported electricity reductions have taken place, and to help determine when reductions have occurred. The CVP, which was developed before the IPMVP, generally falls into IPMVP Option B. Utilities could choose measurement methods from the CVP to determine baselines and post-retrofit savings, or use state-mandated requirements, most likely determined by the state PUC. There are two general savings verification paths detailed in the CVP, one for monitored energy use, and one for estimating stipulated energy savings from a limited number of conservation measures for which expected energy savings are well understood.

To qualify for the program, investor-owned utility applicants were required to follow a "net income neutrality" rate-making process, such that potential DSM energy efficiency measures could not affect sales or utility profits. Because the program focuses solely on utilities and utility sponsored DSM programs, the CVP provides no mechanism for counting or crediting efficiency measures by non-utility project developers brought about without utility sponsorship.

In addition, the M&V requirements in the CVP sets the bar so high (especially with regard to subsequent year allowances) that utilities either preferred to use their states' less rigorous quantification methodologies or opted not to participate in the process at all. The program's rigor and its lack of flexibility restricted the program's potential success.

New Jersey Incentive Reserve

New Jersey's Department of Environmental Protection, in coordination with the Ozone Transport Commission, set a cap on NO_x emissions from large stationary sources and implemented this cap through tradable emissions credits. As part of the emissions cap, the Department of Environmental Protection set aside incentive allowances for projects with demonstrated ozone season electricity from either energy efficiency or renewable energy. Utilities that developed demand side management (DSM) programs were eligible for allowances. Owners and operators of sources that generate electricity from renewable generation including landfill and digester gas, fuel cells, and solar and wind energy, are also among those technologies approved by the department.

Energy savings in this program are calculated following the New Jersey Measurement Protocol for Commercial, Industrial and Residential Facilities[5] (MPCIRF). The MPCIRF was specifically prepared for use in conjunction with utility DSM programs, and prescribes explicit formulas for calculating the energy savings associated with discrete, and common, energy efficiency measures, including lighting, motor controls and HVAC retrofits. The MPCIRF is only applicable to the project types where formulas have been developed.

The protocol was developed in 1993, when the effects of utility restructuring were not clear. Based on the assumption that franchise monopolies and cost-based regulation would continue, the MPCIRF is utility specific with regard to sampling procedures and is heavily reliant on a complex regulatory structure. As such, the protocol may be more measurement

5 Measurement Protocol for Commercial, Industrial, and Residential Facilities, State of New Jersey, March 11, 1996.

cost-intensive than is suited for market-based efficiency crediting programs since it was designed for a period when utility rates of return were adjusted upward based on DSM conservation achieved, and ESCO services were subsidized.

Ultimately, in order for the MPCIRF to be applied outside the utility context, standardized sampling procedures, metering standards and time-periods would have to be specified on a statewide basis. These standards have been approved individually by the New Jersey Bureau of Regulatory Commissioners Staff and Rate Council for the New Jersey Incentive Reserve. Historical load data, one of the main measurement tools, would also have to be made available to ESCOs or relevant parties.

Standard Performance Contracts

NY Energy $mart Standard Performance Contract Program. The New York Public Service Commission was concerned about the continuation of public benefit programs in a competitive energy marketplace. To address this problem, the Commission named the New York State Energy Research and Development Authority (NYSERDA) administrator of the New York Energy $mart[6] program. Energy $mart is funded by a system benefits charge on users of the electric transmission and distribution systems in New York State. Energy $mart includes energy efficiency, research and development, low-income services, and environmental protection programs. The Energy $mart standard performance contracting (SPC) program offers fixed-price incentives to energy service companies (ESCOs). A total of $45 million is available in three funding cycles, for specific pre-approved measures including lighting, motors, and cooling upgrades, as well as certain custom measures.

The Energy $mart measurement and verification guidelines are adapted from those defined in the IPMVP with the exception of Option A. The choice of M&V option depends on the specific equipment being installed and the complexity and interaction of the energy efficiency measures. All projects with 70% or more of direct energy savings from lighting are required to utilize a M&V based upon IPMVP Option B. NYSERDA provides applicants with instructions on how to complete a lighting M&V plan that is statistically valid, documents all assumptions that affect the determination of lighting usage and energy savings, meets metering requirements, and uses a specific energy savings calculation formula.

For non-lighting retrofit and control measures, Option B end use metering methods are preferred for projects that include measures that are not strongly interrelated. Option D, calibrated computer simulation, is preferred for projects with multiple interrelated measures. Option C is not recommended, but can be utilized if Options B and D are not cost-effective. Option B M&V methods and requirements are included for motors, variable speed drives, chillers, and variable load profile projects. In addition, M&V procedures are included for an Option D-based billing analysis calculation formula, using DOE-2.1 or DOE-2 computer simulation software. A regression model methodology, based upon Option C, is also included, as is a discussion of the general approach that would be required for renewable energy projects.

These comprehensive guidelines could be fairly easily adopted as part of a prescriptive approach for measuring energy savings under an emissions crediting program.

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6 *New York Energy $mart Standard Performance Contract Program*, Procedures Manual, The New York State Energy Research and Development Authority, January 1999.

California Large Non-Residential Standard Performance Contract Program. Beginning in 1998, as part of restructuring in the California electric utility industry, a public goods charge was established to fund energy efficiency programs. The California Large Non-Residential Standard Performance Contract Program[7] (LNSPC) program was developed to promote energy efficiency and market transformation by offering incentive payments to energy efficiency service providers who develop energy efficiency projects. Similar to the NYSERDA Energy $mart program, LNSPC is a performance-based program that offers financial incentives based on documented energy savings. To participate in the program, projects must save at least 200,000 kWh annually. Energy savings are measured and verified annually by the applicant over a two-year period following the installation of the energy-efficient equipment.

Measurement and verification guidelines, and M&V reporting forms and materials are virtually identical to those developed for Energy $mart for non-lighting efficiency projects. However, LNSPC includes an IPMVP Option A approach for measuring direct energy savings resulting from lighting retrofits.

California Residential Standard Performance Contracting Program. In the face of utility restructuring, to broaden the market for energy efficiency projects, several utilities and the California Board for Energy Efficiency (CBEE) designed the California Residential Standard Performance Contract Program (ReSPC) program to encourage entrance of new participants in the energy efficiency marketplace. As an alternative to providing rebates for equipment installations, the ReSPC Program pays energy efficiency service providers, customers, manufacturers and retailers financial incentives based on measured energy savings. The program was funded under a public goods charge and was established in 1998, and is now closed to new applicants.

In the ReSPC program, manufacturers, distributors, sellers and installers of residential energy efficiency products and services were paid incentives according to how much energy they save customers in a particular utility's service area. HVAC installers, window contractors, insulation companies, lighting designers, and other providers of energy-efficient products and services could apply to the program. Property management companies, homeowners associations, and other residential customers who could meet the minimum project size requirements were also eligible.

The rules, incentive payments, procedures, and agreements were standardized for all participants. As part of the program, applicants were required to aggregate 200,000 kWh or 20,000 therms annually (this is roughly equivalent to retrofitting 400 homes or apartments). Energy savings were determined based upon if the program participant was the seller or the installer of the retrofitted equipment. For retail projects, program participants were required to use pre-approved "deemed savings" performance values for approved measures to estimate project energy savings, compatible with IPMVP Option A. For direct install projects, program participants could utilize the deemed savings option, or a "measured savings" option for measures that do not appear on the pre-approved list. The measured savings option energy savings are measured using prescribed billing analysis in a calibrated simulation of equipment/building performance. This program is of particular interest since it

[7] California's 2000 Large Non-Residential Standard Performance Contract Program: Procedures Manual, Version 1.0, May 1, 2000.

includes measurement techniques for residential energy efficiency measures for which it may not be possible to develop deemed values.

Other Energy Efficiency Quantification Programs

Pennsylvania Green-e Deemed Savings for Residential Energy Efficiency The Green-e brand is a mark of certification available to electricity providers who deliver cleaner power in competitive electric service markets, and is administered by the California-based Center for Resource Solutions. The brand is operational today in California, and a stakeholder advisory committee is developing standards for implementing a similar certification process in Pennsylvania. In Pennsylvania, the green-e certification program will be exclusively available to electricity providers who initiate energy efficiency programs for residential customers. Deemed savings values and verification methods for eligible energy efficiency measures are currently available, as part of a report prepared for the Center of Resource Solutions by Schiller Associates.

Within the report, 20 residential electrical energy-savings measures and an associated "deemed" electrical energy-savings value are presented. Included are lighting, water heating, space conditioning, energy supply and building shell upgrades, as well as home appliances like high-efficiency refrigerators and dishwashers. A simple verification process that relies on participant certification submittal of receipts, and customer certification is also outlined in the report. The deemed value approach defined in this report can provide a simple, and useful, starting point for crediting residential energy efficiency measures.

South Coast Air Quality Management District's Regional Trading Program. The South Coast Air Quality Management District (California) manages a regional trading program called the Regional Clean Air Incentives Market (RECLAIM) in which energy efficiency measures can be credited. Similar to the Acid Rain emissions trading market, RECLAIM was designed to maximize compliance flexibility, minimize compliance costs and spur innovations in emissions controls. RECLAIM requires facilities that emit four or more tons per year of either NOx or SOx to cut their emissions, such that in total, NOx and SOx emissions will be reduced by 80% by 2003. Facilities in the RECLAIM program can implement energy efficiency measures as part of their compliance options to meet their annual emissions cap.

As part of their 1997 Air Quality Management Plan, SCAQMD adopted provisions that provide several opportunities for crediting energy efficiency as part of the RECLAIM program. In particular, Rule 2506, "Area Source Credits for NOx and SOx" allows small, non-regulated area sources to receive credit for energy efficiency actions involving on-site fuel consumption. SCAQMD's method for calculating emissions reductions as part of this program may be of particular value to states considering giving credit to CHP and certain industrial processes, because these measures often involve changes to on-site fuel consumption as well as electricity consumption.

In addition to Rule 2506, two additional provisions, although still in draft form, were developed to encourage additional energy efficiency actions to receive credit as part of RECLAIM. CMB-04, "Area Source Credits for Energy Conservation/Efficiency" is aimed at small sources that implement natural gas conservation measures including efficiency of combustion equipment, reducing thermal loads, re-use of waste heat, and improved cooking equipment. CMB-04 is noteworthy because it contains parameters for developing a public awareness and education component in the program. MSC-01 may also be of assistance to states in developing a M&V strategy, because it presents a framework for including innovative types of energy efficiency measures in a crediting program.

It is important to note, that emission reductions in Rule 2506 are calculated based on changes in on-site fuel use, rather than by measurement of kWhs saved or displaced. Likewise, because CMB-04 and MSC-01 are still in draft form, measurement techniques for both programs are not finalized.

Conclusion

A deregulated marketplace in which integrated utilities no longer provide energy efficiency services requires policymakers to design energy efficiency crediting programs that do not follow the same rules as traditional demand-side management programs. Programs designed to provide incentives for energy efficiency at the point of investment, and which can lead to real benefits in air emissions reductions, will require both an understanding of the known characteristics of energy consumption as well as an anticipation of the potential sources of variation and uncertainty associated with measurement and verification. The various programs discussed in this paper provide a strong starting point for designing such programs. At the very least, these programs could provide invaluable "lessons learned" and insight into developing M&V procedures for crediting energy efficiency and renewable measures.