Calculating Avoided Emissions Should be a Standard Part of EM&V and Potential Studies

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ABSTRACT

Thanks in large part to guidance documents and proposed federal regulations recently issued by the U.S. Environmental Protection Agency (EPA), state and local air pollution regulators have a growing interest in using energy efficiency (EE) as a strategy to improve air quality. The largest challenge for air pollution regulators is to quantify the impacts of EE in a way that is suitable for regulatory purposes. To measure the air quality impacts of EE, one has to begin with an assessment of energy savings. However, assessing the timing and location of energy savings is also critically important for estimating avoided emissions. EE professionals are better suited to this task of quantifying current or potential future avoided emissions than the air pollution regulators themselves. This paper explains the enormous hurdles that air pollution regulators face in this area, and why the methods are more suitable for use by EE professionals. This paper also suggests how EE professionals might collaborate with air pollution regulators to better understand the data needed for regulatory purposes, and modify their standard practices accordingly. Further, it explains how EE professionals and the other audiences they serve (utilities, public utility commissions, and consumer advocates) will all benefit from a greater emphasis on the air quality benefits of EE. Finally, the paper briefly discusses some encouraging examples where these ideas are already being put into practice.

Introduction

Energy consumption and air quality are closely linked. Data collected by the U.S. Environmental Protection Agency (EPA), shown in Figure 1, indicate that the electric power sector is a major contributor to some of the air pollutant emissions that most concern air quality regulators. Air pollution remains a widespread public health problem, despite decades of improvement in national emissions. The EPA estimates that 150 million Americans live in areas that are currently designated as exceeding health-based National Ambient Air Quality Standards or NAAQS (U.S. EPA 2013). Air pollution regulators in areas so designated are required under the federal Clean Air Act to develop, for the EPA's approval, "State Implementation Plans (SIPs)" for restoring air quality to healthy levels.

Energy efficiency (EE) is an effective means of reducing air pollution, because it directly or indirectly reduces the need to combust fossil fuels. Direct reductions occur when fossil fuels are combusted in the same location where the energy is used; for example, in a residential furnace. A more efficient furnace can heat a home using less fuel and thus avoid emissions at that specific location. Indirect reductions occur when the energy use in one location affects fossil fuel combustion in another location, as is usually the case with grid-supplied electricity. If a small business reduces its electricity consumption, somewhere on the grid a generator will reduce its electric output (all else being equal), and if that generator is fossil-fueled, air emissions in that location are avoided.

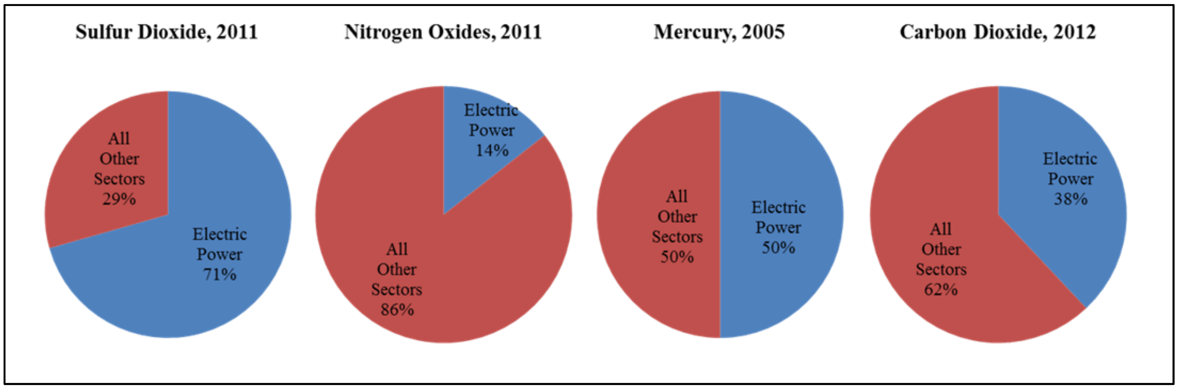

Figure 1. Electric power sector share of national emissions of pollutants of concern in stated year. *Sources*: for Sulfur Dioxide and Nitrogen Oxides, U.S. EPA 2011; for Mercury, U.S. EPA 2012a; for Carbon Dioxide, U.S. EPA 2014a.

The air quality benefits of energy efficiency are easy to comprehend and have long been understood by air pollution regulators and energy regulators alike. However, there is evidence in recent years of a growing interest among air pollution regulators in using energy efficiency policies and programs as an explicit and conscious air quality improvement strategy.

In 2004, the EPA offered guidance to states on how to incorporate electric-sector energy efficiency and renewable energy measures in SIPs (U.S. EPA 2004). Based on guidance from this document, energy efficiency measures were included in SIPs prepared by Texas, Louisiana, Connecticut, and the District of Columbia region as a means of reducing ground-level ozone pollution (U.S. EPA 2012b, K8-K10).

In July 2012, the EPA published a new guidance document called the *Roadmap for Incorporating Energy Efficiency/Renewable Energy (EE/RE) Policies and Programs into State and Tribal Implementation Plans (SIPs/TIPs)*. The purpose of this "Roadmap" document, according to the EPA, was "to reduce the barriers for state, tribal and local agencies to incorporate EE/RE policies and programs in SIPs/TIPs by clarifying existing EPA guidance and providing new and detailed information" (U.S. EPA 2012b, 9).

The EPA's publication of the Roadmap sparked renewed interest among state air pollution regulators in using EE to improve air quality. The Roadmap provides states with more options, better explanations, and fewer restrictions than previously existed in guidance documents. As a result, several more states are currently exploring the possibility of including EE measures in SIPs.[1]

While the EPA Roadmap provides guidance to states on including EE in SIPs for criteria air pollutants, there is similar interest in the use of EE as a strategy to reduce greenhouse gas (GHG) emissions.[2] Indeed, EE has for years been a focal point of many states' climate change policies and action plans, and many states and utilities have long attempted to quantify the avoided GHG emissions attributable to EE. Interest in this topic continued to grow in anticipation of GHG regulations for existing power plants that the President directed EPA to propose using its authority under Section 111(d) of the Clean Air Act. EPA eventually released a

[1] For example, between October 2012 and December 2013, Massachusetts, New York, and Maryland participated in an EPA-sponsored pilot project to "field test" the usefulness of the Roadmap.
[2] "Criteria air pollutants" are air pollutants for which a NAAQS has been established by the EPA. They represent a small subset of the list of all regulated pollutants. GHG is not a criteria air pollutant.

proposed rule on June 2, 2014 in which the agency asserts that EE is one of four "building blocks" that collectively comprise the best system for reducing power sector GHG emissions (U.S. EPA 2014b). While there has been and will continue to be a great deal of public debate about the stringency and details of the EPA proposal, one fact that tends to unite environmental and power sector stakeholders is that EE can be used to achieve GHG emissions reductions *more cost-effectively* than most or all other options (McKinsey & Company 2007, 20). The EPA has thus been urged by a broad cross-section of stakeholders to allow EE to "count" toward compliance under any future final GHG regulations for the power sector.

The Challenge

In the Roadmap, the EPA offers several compelling reasons why states might want to include EE or RE policies and programs in their SIPs, but also explicitly acknowledges two associated challenges: 1) establishing partnerships between air and energy regulators; and 2) quantifying the emissions and air quality benefits (U.S. EPA 2012b, 15). In Appendix K of the Roadmap, the EPA further acknowledges that its 2004 guidance had been little used because, "[S]tates found that analyzing the effects of EE/RE policies and programs on air quality was time and resource intensive, and that the potential emissions benefits of EE/RE policies and programs might not have justified the effort necessary to quantify that impact" (U.S. EPA 2012b, K-7). Implicit in this statement is the fact that state air agencies would be more likely to include EE in their SIPs if quantifying the benefits was less "time and resource intensive" for them. The EPA published the Roadmap in part to address this quantification challenge, but it nevertheless remains a difficult one for state and local air regulators.

Why is Quantification Difficult?

With respect to criteria pollutants, air pollution regulators tend to care most about reducing ambient concentrations in a given location (e.g. a "non-attainment area" where air quality exceeds the federal health-based NAAQS). To assess that kind of problem, they need to understand the combined effects over any given time period of all of the emissions from all of the sources that might affect ambient air quality. When and where a pollutant is emitted, and the hourly rate at which it is emitted, are crucially important pieces of this puzzle. With respect to GHG, things are a little different. Regulators are also concerned about ambient concentrations, but less so. That's because every ton of carbon dioxide equivalent emissions has essentially the same impact, regardless of where and when it is emitted.[3] Thus, with respect to GHG, regulators are most interested in knowing the total amount emitted over a time period (e.g., a year) and other details are not as important.

To quantify the air quality impacts of an EE program or portfolio, one has to begin with an assessment of energy savings. Countless papers and articles have been written on the difficulty of retrospectively measuring or prospectively estimating energy savings. But as difficult as that task may be, estimating avoided emissions is even harder. The specific *timing* and *locations* of energy savings, which are typically not assessed by standard EE evaluation,

[3] GHG emissions are measured in units called carbon dioxide equivalents (CO_2E), which describes, for any particular GHG or mixture of GHGs, the mass of carbon dioxide (CO_2) emissions that would have the same global warming potential.

measurement, and verification (EM&V) protocols, are also critically important for estimating avoided emissions. This is because there are many different types of electric generating units connected to the electric grid and they vary widely in terms of the emissions produced from the generation of one unit of electricity. In general, when customers reduce electricity use, the grid operator will reduce the output of the most expensive generating unit(s) currently operating – i.e., the "marginal" unit(s) – to match customer load. One caveat is that the grid operator also must consider transmission constraints that affect the deliverability of electric power from generators to customers. So the true reduction in system emissions associated with a given unit of energy savings depends on which of the generators capable of delivering power to that location is operating on the economic margin at the specific time that the customer reduces energy consumption.

In summary, estimates of avoided criteria pollutant and GHG emissions depend on when and where energy is saved because that determines which marginal unit(s) will generate less. The timing and location of avoided criteria pollutant emissions in turn dictates the impact on ambient air quality. Thus, two factors that are frequently overlooked in current EM&V protocols (timing and location of energy savings) are absolutely essential for using EE as an air quality improvement strategy for a SIP, for 111(d) compliance, or for other reasons.

What Must Change to Enable Useful Estimates of Avoided Emissions?

If current EM&V protocols are in most cases not providing the necessary data to use EE as an air quality improvement strategy, what must change?

The basic steps in evaluating EE program impacts are summarized in Figure 2. The entire process has three stages: planning, evaluation, and reporting. We will first look at the question "what must change?" in relation to Figure 2.

Obviously, if estimating avoided emissions is a desired outcome of an evaluation process, it is necessary to consider that question in the planning stage, so evaluators know what data to collect and how to analyze it. This will require some modifications to the evaluation plan. These modifications will feed into the first two of the "core evaluation steps" shown in Figure 2. Specifically, in order for EM&V to be useful for air quality purposes, calculations of gross energy savings and net energy savings will have to consider timing and location of savings. This is not to suggest that complete and perfect information about timing and location are necessary. An incremental level of effort will be required to gather this data, beyond what might otherwise occur. During the planning stage, all of the parties can decide (ideally, in collaboration with air regulators) how much additional effort and cost can be justified based on the expected benefits of having more accurate and complete timing and location data.

At this point in the process, it is necessary to state that even under the best of circumstances where the timing, locations, and amounts of energy savings are known, there are inherent uncertainties and difficulties in estimating avoided emissions because of the dynamic nature of the grid and constantly changing economics that determine which units operate on the margin. This will always be an inexact science, perhaps less so for retrospective impact evaluations but especially so for prospective estimates of future avoided emissions. However, the EPA has developed and made public a number of reasonably simple tools for translating energy savings into avoided emissions, and appears willing to consider the output from these tools in regulatory settings. These tools include the Emissions & Generation Resource Integrated Database (eGRID) and the AVoided Emissions and geneRation Tool (AVERT). Many of the commercially available dispatch models that are commonplace in the electric industry can also

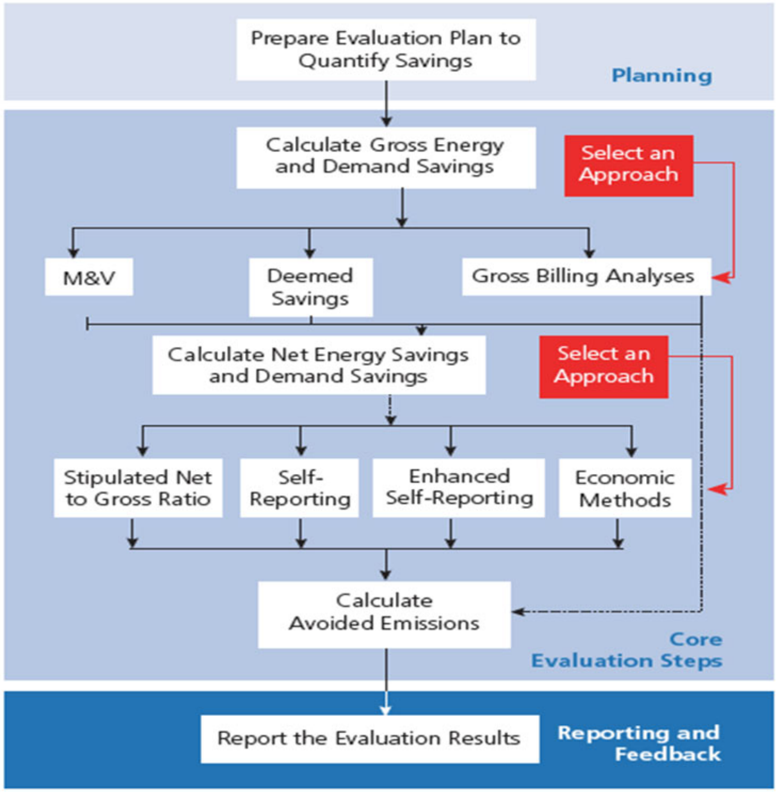

Figure 2. The impact evaluation process. *Source*: National Action Plan for Energy Efficiency 2007, 3-3.

be used in this way to estimate avoided emissions (e.g., the IPM, ERTAC, and MARKAL models). Some other tools and methods have been used in specific states or electricity markets. Although these tools are relatively new and continue to evolve, it may be that nothing in this third "core evaluation step" (i.e., calculating avoided emissions) needs to change at this time. Application of the existing tools and methods may suffice.

Finally, there are significant changes that need to be made to the way EE program impacts are reported. Stated simply, evaluation reports need to include assessments of the timing, locations, and amounts of avoided emissions for multiple pollutants of concern.

Who is Best Suited to Make the Necessary Changes?

For reasons that will be explained below, the author believes that EE professionals are better suited than air pollution regulators to make the EM&V protocol changes that are necessary and, ultimately, to estimate and report avoided emissions.

Why Air Pollution Regulators Can't (or Won't) Do It

EE program evaluations have been conducted for several decades and in nearly every state and municipality that has made a significant public investment in EE. Program evaluation is generally undertaken by one of a relatively small number of companies and experts that specialize in this subject. Many states require that evaluations be done by an EM&V contractor who answers directly to a public utility commission (PUC) or state energy office, not a utility, in order to ensure that the results are viewed as unbiased and legitimate.

The Consortium for Energy Efficiency (CEE) estimates that U.S. electric and gas utilities budgeted over $7 billion for EE programs in 2012 (CEE 2013, 6-7), and Lawrence Berkeley National Laboratory projects that utility spending on EE programs will rise to $9.5 billion in 2025 in a "medium case" scenario (LBNL 2013, 5). In addition, prior research by CEE found that 3.6 percent of total EE program budgets (on average) were allocated to EM&V activities (CEE 2012, 27). This suggests that annual expenditures on EM&V may now exceed $250 million, and could rise to $340 million in 2025. In nearly all cases, these utility ratepayer funds are invested in EE using a delivery structure that has been established by state statute, state regulation, or PUC order. The cost of EM&V, in short, is part of the cost of the EE programs. There are transparent rules in place, governmental oversight, and consequences for deviating from the rules, but the process is normally overseen by a different state agency than the one responsible for air quality.

Given the level of effort and money that is already invested in EE program evaluation, the level of niche expertise involved, and the historical oversight role of agencies that have no air pollution regulatory responsibilities, is it realistic to expect air pollution regulators to make their own assessments of avoided emissions based on energy savings, or even to instigate the changes to EM&V protocols that are necessary to make such assessments? The answer is no.

Air pollution regulators typically have no history of working with EM&V professionals, no say in or formal oversight of EM&V protocols, and little experience with or understanding of how the work is actually done. Few air regulators could pick up a typical EE evaluation report and understand on a first reading how to properly interpret the reported results. Should they look at gross energy savings or net energy savings? First-year savings or lifetime savings? The truth is, most air regulators are completely unfamiliar with these terms. In fact, it is not an exaggeration to say that many air regulators are completely unaware that this $250 million industry exists and produces data reports that often assess air pollution impacts. They can hardly be expected to reform or expand upon an industry that they barely know exists.

Putting aside these barriers, there is also the simple fact that many of the methodological changes to EM&V protocols that are necessary for assessing avoided emissions essentially have nothing directly to do with air pollution. The data that are lacking have to do with timing and location of energy savings. Air pollution regulators cannot tell the EM&V professionals how to properly assess the timing and location of energy savings. They need the results, but the means of getting those results is beyond their professional expertise.

Finally, air pollution regulators across the country are faced with rather limited resources and a large burden of mandatory regulatory activities. This severely constrains their ability to undertake new data analysis activities, learn about energy efficiency program implementation details, or experiment with new quantification tools – especially where such activities are not mandatory or separately funded. Unlike EE program evaluators, they do not have a reliable funding source for assessing EE program impacts. These points are underscored by testimony provided by the National Association of Clean Air Agencies to the United States Senate on April 29, 2013 (NACAA 2013, 1-2):

"State and local air pollution control agencies have been facing significant funding deficits for many years, with adverse impacts on their ability to implement the federally mandated core elements of the clean air program. A study NACAA conducted several years ago showed that there is an annual shortfall of $550 million in federal grants for state and local air programs... Many agencies have reported reductions in and/or elimination of programs, as well as diminishing staff levels... State and local agencies find it difficult to operate in the midst of these types of staffing woes, as it is hard to recover from the loss of trained and valuable staff. Many NACAA agencies report worrisome program contractions, including reductions and/or elimination of [a wide variety of core Clean Air Act implementation activities]."

Why EE Professionals are Better Positioned to Estimate Avoided Emissions

In contrast to air regulators, EM&V professionals are already familiar with the methods and terminology for estimating energy savings. In some cases, they are already assessing the timing or location of energy savings (retrospectively or prospectively). There are also numerous examples of EE program evaluations that assess avoided GHG emissions, and a smaller number of examples that assess avoided criteria pollutant emissions. A few such examples are provided later in this paper.

EM&V professionals also have better prospects for funding any additional work necessary to estimate avoided emissions. As noted previously, the costs of EM&V are generally included in the overall EE program budgets.

A review by the author of several avoided emissions quantification tools offered by the EPA found that virtually all of the data inputs needed to use the tools focus on energy savings data, meaning the tools themselves can be used by EM&V professionals just as easily as by air pollution regulators, if not more easily. For example, to estimate emissions impacts using the AVERT tool, one simply chooses an electricity market region and then enters the hourly or annual impacts of EE programs in that region. AVERT then estimates the emissions reductions at each power plant in the region. No understanding of air pollution issues, regulations, models, or terminology is necessary, but an understanding of energy savings data is required.

Another argument for why EE professionals should be the ones to tackle this challenge is based not on their advantages in terms of expertise or resources, but rather on the fact that they have other reasons intrinsic to their industry for considering the timing and location of energy savings. To accurately assess avoided energy costs, avoided capacity costs, and some of the other components of standard EE cost-effectiveness tests, it is useful – if not essential – to know when and where energy is saved. Measures that save energy in off-peak hours will generally have much less of a capacity benefit than measures that save energy on peak. On the other hand, measures that save energy in a transmission-constrained location may have a disproportionately high impact on avoided energy, transmission, and distribution costs. EE program planners and utility regulators need timing and location information to maximize the benefits of EE programs for ratepayers.

Finally, EE professionals have one more reason for taking that last core evaluation step and estimating avoided emissions. Avoided emissions may translate into avoided environmental compliance costs for utilities and lead to lower bills for ratepayers. In addition, avoided emissions virtually always translate into public health benefits that are paid for outside the utility system but nevertheless benefit ratepayers. These avoided costs are (or should be) a component of the standard cost-effectiveness tests that are used to determine whether EE measures, programs, and portfolios have been (or will be) cost-effective (RAP 2013). This in turn affects estimates of achievable potential for energy savings and influences EE program planning decisions. In particular, estimates of the societal benefits of avoided GHG emissions can have a huge impact on cost-effectiveness tests. For example, a recent evaluation report for Wisconsin's

Focus on Energy program found that over 20 percent of the total economic benefits of this statewide energy efficiency program were attributable to avoided emissions when a value of $30 per ton of GHG was assumed (The Cadmus Group 2013, 49-52). Even if a lower value had been assumed, the impact of avoided emissions on cost-effectiveness tests would be substantial – and there is no reason to think this example from Wisconsin is unique. In short, EM&V professionals, EE program planners, utilities, and energy regulators need estimates of avoided emissions to fulfill their own responsibilities, regardless of whether the results are needed or wanted by air pollution regulators.

Collaboration is Part of the Solution

Open communication and collaboration between EE professionals, air pollution regulators, and energy regulators that oversee program evaluations are critically important if program evaluations are to produce the data needed by air regulators in an efficient fashion. Even though EE professionals are better suited to develop estimates of avoided emissions, they cannot be expected to know and generally will not know the specific data needs of air regulators. Those needs have to be clearly communicated by air regulators, and some back and forth between air and energy regulators and EE program evaluators may be necessary to match what is ideally desired with what is practically achievable.

For example, with respect to criteria pollutants and SIP development, air regulators will often be most concerned with gathering data on EE program impacts for a specific pollutant, in a specific location (e.g., within a designated non-attainment area or "upwind" of the area), in some cases during a particular time of year, and in a specific future year (e.g., the year in which the state is required to demonstrate that ambient air quality will meet national standards).[4] These specific needs might have a substantial impact on how retrospective EM&V results or prospective program impacts are assessed and reported. For example, if air regulators are working on a SIP and need an estimate of avoided nitrogen oxide (NO_x) emissions on hot summer days in a particular county in the year 2018, EE program evaluators can probably develop such estimates. But if they are unaware of that data need, they are more likely to produce an estimate of annual avoided emissions across a utility's entire service territory. With additional work after the fact, it might be possible to develop time-specific and location-specific avoided emissions estimates based on annual totals across a broader geographic area, but those estimates will be less accurate and thus less useful than would be the case if evaluators knew which details were important at the beginning of the evaluation planning process.[5]

With time and experience, it may be that EE professionals and the energy regulators that oversee them will learn to modify standard practices to routinely produce information on avoided emissions that meets the needs of air pollution regulators. Such is not the case today. One way to get to that outcome is to open the channels of communication and involve air pollution regulators up front in the evaluation planning process.

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[4] For GHG emissions impacts, air regulators will generally care less about the timing of avoided emissions within any calendar year, but might remain interested in the location of emissions reductions if, for example, EE is part of the state's strategy for meeting 111(d) compliance requirements.

[5] The author is not suggesting that annual estimates have no value, only that they may not be sufficient to answer the most pressing needs of air pollution regulators. Annual, utility-wide estimates of avoided emissions do have value for EE program planning and cost-effectiveness purposes and for other public policy purposes, and in some cases will even be sufficient for air pollution regulatory purposes.

EE professionals and energy regulators may initially be reluctant to involve a new party in the evaluation planning process, especially if they see that party solely as a benefactor of any process revisions. In reality, EE professionals, energy regulators, and the other audiences they serve (utilities, ratepayers, and the broader public) will all benefit from a greater emphasis on the air quality benefits of EE. This is because, as previously noted, accurate assessments of avoided emissions can substantially affect benefit-cost analyses and those in turn can affect program planning decisions. In other words, involving air regulators in EE program planning is not an act of charity; all parties will benefit.

Examples of Good Practices

The practice of including estimates of avoided emissions in EE program evaluations, market potential studies, or special studies has become increasingly commonplace in recent years. In addition, attempts to standardize and improve assessment practices have arisen in several jurisdictions. The author believes that the recommendations of this paper have not been fully adopted in any jurisdiction, and there is room for improvement everywhere. However, a few examples of good practices are offered below that demonstrate implementation of some of the recommendations herein. This is by no means an exhaustive list.

NEEP EM&V Forum

Northeast Energy Efficiency Partnerships (NEEP) fosters regional partnerships that leverage expertise and funding to increase the impacts of individual state efforts in 11 Northeast and Mid-Atlantic States plus the District of Columbia. In 2008 NEEP initiated an EM&V Forum to provide a regional resource for developing and supporting implementation of consistent protocols for EM&V and reporting of energy and capacity savings. NEEP's new Regional Energy Efficiency Database (REED) serves as a warehouse for standardized and transparent reporting of program impacts from participating jurisdictions. The first REED Annual Report includes estimates of avoided carbon dioxide (CO_2), nitrogen oxide (NO_x), and sulfur dioxide (SO_2) emissions for eight states, developed using locally-specific emissions factors provided by regional transmission organization experts (NEEP 2013, 57-58).[6]

Texas

In 2001, the State of Texas enacted legislation mandating the kind of collaboration recommended in this paper: "In cooperation with [the Energy Systems Laboratory at Texas A&M University], the utility commission shall provide an annual report to [the Texas Commission on Environmental Quality (TCEQ)] that, by county, quantifies the reductions of energy demand, peak loads, and associated emissions of air contaminants achieved from [mandated energy efficiency] programs..." (An Act Relating to the Texas Emissions Reduction Plan 2001). In the ensuing years, the Energy Systems Laboratory has published numerous papers on avoided emissions quantification topics and produced annual summary reports on avoided emissions for TCEQ (Energy Systems Laboratory 2013). The Laboratory has also hosted an

[6] The emissions factors provided by the ISO-New England regional transmission organization are especially noteworthy. ISO-New England has established a standing Environmental Advisory Group that collaborates with air regulators on an ongoing basis to develop appropriate emissions factors and assess other air pollution issues.

annual Clean Air Through Energy Efficiency conference. The TCEQ benefits from having an outside evaluator deliver detailed information about air quality impacts of the state's EE policies and programs. It is thus not surprising that TCEQ is one of the only air regulatory agencies in the U.S. to include EE measures in an approved SIP (U.S. EPA 2012b, K8-9).

Wisconsin

In Wisconsin, energy efficiency programs are offered on behalf of most utilities by a single, statewide, third-party program administrator, branded as *Focus on Energy* and overseen by the Public Service Commission (PSC). In each of the two most recent *Focus on Energy* annual program evaluations, an evaluation contractor has developed estimates of avoided emissions for CO_2, NO_x, and SO_2, using locally-specific emissions factors (The Cadmus Group 2013, 49-52). An economic value is then attributed to avoided NO_x and SO_2 emissions based on actual market prices for emission allowances under the federal Acid Rain program. The economic value of avoided CO_2 emissions is also determined, based on an assumed $30 per ton value established by the PSC. Thus, in a manner consistent with the recommendations of the author, the program evaluator produces annual estimates of avoided emissions and the economic value of avoided emissions is included in the evaluation of EE program cost-effectiveness. Air pollution regulators in Wisconsin now have useful data at their disposal, but they did not have to do the work themselves or fund it.

Conclusions

Calculating the air pollutant emissions avoided due to EE programs will probably never be an exact science, but it is increasingly a part of EE program evaluations and potential studies, and such calculations should, with time, become a standard practice. Although estimating the avoided emissions attributable to EE is by no means a simple endeavor, it is not a task that requires special expertise in air pollution science or regulation. Rather, the expertise most in need is that of the EE professional. It is impossible to derive estimates of avoided emissions without developing sound estimates of energy savings, and ideally energy savings that are detailed in terms of when and where energy is saved. With good energy savings data in hand, EE professionals can use standardized tools published by the EPA or others to estimate avoided emissions. Furthermore, EE professionals can use those tools just as easily as air quality professionals; the crucial data *inputs* all have to do with energy savings rather than air pollution data. The states participating in the NEEP EM&V Forum have demonstrated that EE professionals are up to this challenge and are well on their way toward standardizing avoided emissions calculations.

Although EE professionals are best suited to produce estimates of avoided emissions through enhancements to routine practices, they will need to communicate and collaborate with air quality regulators in order to understand how to develop estimates that are most useful for air pollution regulatory purposes. This is best done at the program evaluation planning (or potential study scoping) stage, with oversight and support from energy regulators, and before EM&V data are collected. In time, as understanding grows, these modified EM&V practices may become standardized to the point where air regulators become data "customers" and there is no longer a need to involve them in EE program evaluation planning. The State of Texas offers a well-established and successful example of collaboration between EE program evaluators, energy regulators, and air pollution regulators.

Avoided emissions can form a significant component of the economic benefits of EE programs, as demonstrated in recent program evaluations from Wisconsin. EE professionals and energy regulators need good estimates of avoided emissions not just to support air pollution regulators, but also to fulfill their own responsibilities with respect to designing and implementing cost-effective EE programs and measuring the results of implemented programs.

References

An Act Relating to the Texas Emissions Reduction Plan. 2001. Texas Health and Safety Code, Subtitle C, Title 5, Chapters 386, 387, 388, and 389.

The Cadmus Group. 2013. *Focus on Energy Calendar Year 2012 Evaluation Report: Volume I.* Madison, WI: Public Service Commission of Wisconsin.

CEE (Consortium for Energy Efficiency). 2012. *State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts 2011*. Boston, MA: Consortium for Energy Efficiency.

——— . 2013. "Purpose of the Efficiency Program Industry by State and Region Appendices and Limitations of Data." Boston, MA: Consortium for Energy Efficiency.

Energy Systems Laboratory. 2013. "Calculation of Integrated NO_x Emissions Reductions from Energy Efficiency and Renewable Energy (EE/RE) Programs across State Agencies in Texas." ESL-IC-13-10-01. College Station, TX: Energy Systems Laboratory.

LBNL (Lawrence Berkeley National Laboratory). 2013. *The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025*. Berkeley, CA: Lawrence Berkeley National Laboratory.

McKinsey & Company. 2007. *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* U.S. Greenhouse Gas Abatement Mapping Initiative: Executive Report.

NACAA (National Association of Clean Air Agencies). 2013. "Testimony of the National Association of Clean Air Agencies Provided to the Senate Appropriations Committee Subcommittee on Interior, Environment, and Related Agencies Regarding the FY 2014 Budget for the U.S. Environmental Protection Agency." April 29. Washington, D.C.: National Association of Clean Air Agencies.

National Action Plan for Energy Efficiency. 2007. *Model Energy Efficiency Program Impact Evaluation Guide*. Prepared by Steven R. Schiller, Schiller Consulting, Inc. Washington, D.C.: U.S. Environmental Protection Agency.

NEEP (Northeast Energy Efficiency Partnerships). 2013. *Regional Energy Efficiency Database: Program Year 2011 Annual Report*. Lexington, MA: Northeast Energy Efficiency Partnerships.

RAP (Regulatory Assistance Project). 2013. *A Layer Cake of Benefits: Recognizing the Full Value of Energy Efficiency*. Montpelier, VT: Regulatory Assistance Project.

U.S. EPA (Environmental Protection Agency). 2004. *Guidance on SIP Credits for Emission Reductions from Electric-Sector Energy Efficiency and Renewable Energy Measures*. Washington, D.C.: U.S. Environmental Protection Agency.

———. 2011. *2011 National Emissions Inventory.* Washington, D.C.: U.S. Environmental Protection Agency. Accessed May 13, 2014. http://www.epa.gov/ttn/chief/net/2011inventory.html

———. 2012a. *40 CFR Parts 60 and 63 National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units; Final Rule.* Federal Register 77, no. 32 (February 16, 2012): 9310.

———. 2012b. *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans.* EPA-456/D-12-001a. Washington, D.C.: U.S. Environmental Protection Agency.

———. 2013. *The Green Book Nonattainment Areas for Criteria Pollutants: Summary Nonattainment Area Population Exposure Report*. Washington, D.C.: U.S. Environmental Protection Agency. Accessed May 13, 2014. http://www.epa.gov/airquality/greenbook/popexp.html

———. 2014a. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012*. EPA 430-R-14-003. Washington, D.C.: U.S. Environmental Protection Agency.

———. 2014b. *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule*. Accessed June 12, 2014. http://www2.epa.gov/sites/production/files/2014-05/documents/20140602proposal-cleanpowerplan.pdf