PA Consulting Group

Approaches for Calculating Displaced Emissions for Different EE Programs

What are the Program's Policy Objectives and the Environmental Values Desired?

David Sumi and Bryan Ward, PA Government Services Inc.

Session 10A: Climate Change
January 31, 2008

A·E·S·P
ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

What is the situation?

Markets and regulatory initiatives are emerging that will assign value – *in some form* – to grid-connected displaced emissions where the emission mitigation source is EE programs.

The paper identifies different project and program types based on their objectives, and then suggests approaches for estimating displaced emissions.

This presentation explores the "value in some form" issue – and what methods are suited to the value sought.

Objective of the presentation

- Identify different EE program types based on their objectives
- Assist program sponsors by suggesting approaches for calculating displaced emissions that are appropriate to the program type and objectives – and budgets!

The emission quantification approach taken will depend on the specific value a EE program seeks

What are the program's objectives?

Why is selecting an appropriate approach important?

- Approaches and methods for calculating displaced (and potentially avoided) emissions have proliferated
- Some are more suitable for "conventional" fossil fuel pollutants (SO_x, NO_x mercury), others are specialized for GHG emissions

The approaches vary importantly in rigor and reliability – and costs to implement

What are the relevant program types?

First, this discussion focuses on EE programs as opposed to site-specific EE projects done outside of any program.

And a note: the paper (and this presentation) refers to "displaced emissions" because of the federal cap and trade programs – more on this later

The main program distinctions currently can be seen as:

1. Regulatory mandated programs targeting specific emissions
2. Voluntary programs – where emissions are a secondary benefit
3. Voluntary programs – where emissions are the primary objective

How can emissions calculations vary (e.g., across program types)?

Some of the main differences in methods to calculate displaced (or avoided) emissions involve three (3) considerations:

- Additionality – additional to what would have occurred without the program?
- Boundary issues – for EE programs, defining and encompassing all emissions sources affected by the program's impacts (primary and secondary effects)
- Calculation of emission factors – e.g., lbs/MWh

Additionality has implications for the EE program impact evaluation protocol, as well as the emissions quantification approach.

Boundary and emission factor calculations affect primarily the emissions quantification approach.

A.E.S.P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

Regulatory mandated programs

In the U.S., these programs have tended to use the “cap and trade” mechanism to control specific emissions in the power generation sector.

Examples: Clean Air Act Title IV acid rain SO_2 trading program, and current capping of NO_x emissions during the summer for 21 states.

These programs do not directly impact EE programs (or their evaluations) because considerations like *boundary issues* and *additionality* are pre-determined by the program, and…

EE programs cannot claim actual emission reductions for these capped pollutants – unless allowances are retired

A·E·S·P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

Regulatory mandated programs – Value from EE programs

If EE programs do not reduce total emissions under a cap and trade program – and allowances aren't retired – what is their environmental value?

- The conventional argument is that any emission reduction effects of EE programs help to minimize the cost of compliance in cap and trade programs – a central goal of this mechanism.
- In addition, in EE program net benefit-cost analyses that include economic effects (e.g., REMI modeling of dollar flows attributable to the program), the trading program value of allowances can be included as a monetized benefit accruing to the IOUs in the cap and trade program.

A.E.S.P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

Voluntary programs – emissions mitigation is a secondary goal

This has traditionally included nearly all U.S. EE programs, and the calculation and reporting of emissions impacts – if done at all – helps to substantiate a program co-benefit (e.g., for benefit-cost analysis).

- More rudimentary approaches have typically been used to estimate the emissions impacts, for example:
  - Additionality would usually be assumed, and savings reported as either **gross** or **net** would be used.
  - Calculation of displaced/avoided emissions would likely use a national or regional emission factor.

ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

Voluntary programs, emissions mitigation is a secondary goal – value from EE programs

EE programs can potentially qualify for emission mitigation programs (typically GHG) where a variety of different instruments are offered – registries, credits, offsets, certified reductions, or allowances – depending on the emissions program objectives.

- These instruments vary primarily by the types of projects that are eligible (including M&V requirements).
- For energy efficiency projects (site-specific) and programs (aggregations of projects) to be an eligible source for tradable instruments, *the relevant market must accept grid-connected, purchased electricity reductions*.
- The market will typically provide guidelines for GHG emission rates to be used for electricity production.

Voluntary programs – emissions are primary

Now, the trend could be toward EE programs with **both** energy impacts and avoided GHG emissions as primary goals, where…

- The EE evaluation protocol must rigorously address Additionality (i.e., net savings).
- The Boundary assessment may need to address “leakage” (e.g., reduced emissions in the program area are being displaced to an adjacent territory).
- Emission factor calculation would avoid system average rates in favor of mid-effort analyses – or perhaps even hourly dispatch modeling calculating EGU-specific emissions.

A.E.S.P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

Voluntary programs, emissions are a primary goal – value from EE programs

In the U.S. this is the "leading edge" – and a policy front where the EE program evaluation community must reach out to environmental policy- and rule-making.

- Where national or regional cap and trade programs are the primary emissions control mechanism there is still the option of allowance retirement, e.g., set-aside allocations of allowances, for achieving actual emission reductions (see EPA guidelines).
- In Europe (and globally) different types of GHG programs are developing rules for rights of ownership to credits, fungibility of credits, liability, persistence and "delivery risk" for credited displaced emissions, double counting across programs, and other coordination issues potentially involving different trading philosophies in the U.S., Europe, and globally.

A.E.S.P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

Establishing credibility for EE-attributable emission effects

For EE program energy impacts to translate into emissions impacts that are viewed as credible requires:

1. Verifiable energy impacts, and

2. Acceptable estimation of the emissions effects associated with those energy impacts

Various protocols are available to guide efforts on both of these quantification tasks:

- An example of the protocols for verification of energy impacts is the California CPUC/CEC EE Protocols for Impacts and M&V.
- For estimation of emissions effects the GHG Protocol for Project Accounting (World Resources Institute and the World Business Council for Sustainable Development) is a standard, widely accepted protocol (also see companion *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*).

Calculating displaced emissions

When suitable EE evaluation and air emissions protocols have credibly established net program impacts, there is a continuum of analytic rigor for the next step – *calculating emission factors* (EFs)

- A simple approach – a "*system average*" obtained from a database (e.g., EPA has emission factors for each state).
- So called "middle ground" calculation methods, including methods for estimating *marginal hourly emission rates* (modeling plants that were actually marginal producers).
- The strongest case for maximizing the value of emissions credits from EE programs may depend in some circumstances on calculating displaced emissions based on electricity *hourly dispatch modeling*.

A.E.S.P ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

A "system average" approach – *when* to use

For most EE programs the primary goal (perhaps sole goal) is saving energy (and/or demand).

- In these cases, where emissions benefits are at most a secondary goal, a simple approach is estimating emissions effects is usually most appropriate.

And, as noted above, it may not be appropriate to report <u>avoided</u> emissions if the EE activities are associated with emissions from capped sources regulated within a cap and trade program.

A·E·S·P
ASSOCIATION OF ENERGY SERVICES PROFESSIONALS

PA

A "system average" approach – *how* to use

The "system average" approach for calculating emissions effects from EE programs uses regional or system average emission factors.

- This would involve dividing total annual emissions from all electric generating units (EGUs) in a geographically specified region (or power system grid) by the total energy output of those units.

Sources for these system average emission factors include EPA's eGRID database (U.S. EPA, 2007), and the Clean Air-Climate Protection Software (CACPS, ICLEI, 2003).

A key uncertainty with a “system average” approach

While this emissions factor approach is easy and very low-cost to apply, there is greater uncertainty associated with the resulting estimated emissions impacts.

The uncertainty tends to be attributable to one key factor:

> Where marginal (load-following) generating units displaced by EE programs have quite different emissions characteristics from the non-marginal (i.e., base load) generating units, the system average emissions factors will be biased toward reflecting the base load units.

An alternative – the "middle-ground" approach

The key deficiency of the system average approach to emission factor estimation is a central objective for the middle-ground approach:

The calculations assume that the energy savings results in reduced or displaced generation at the power plant *for those power plants operating at the margin during a particular time of day or season.*

"Middle-ground" approaches typically rely on data for:

- Total generation from each EGU on the relevant grid
- Emissions (and/or fuel consumption) for each EGU
- System dispatch order of operation for each EGU, or an algorithm estimating this order

Wisconsin's Focus on Energy EF calculations

To estimate emission factors for Focus on Energy, we created a model that incorporates hourly monitored emissions and power generation data (from EPA data).

The model:

- Identifies plants that were actually operating in the specified seasons and times
- Predicts which were the marginal producers, and
- Calculates emission factors from all producers operating on the margin during the specific times and seasons
  - Using a generation-weighted mean approach

Hourly dispatch modeling

In some circumstances, the strongest case for maximizing the value of emissions impacts from EE programs depends on the ability to demonstrate via detailed analysis of electricity dispatch the specific impact of the EE programs on the grid system.

This option could be important for satisfying requirements for cap and trade programs. How to use this approach?

- The initial task is to convert the program impacts (from evaluation) to 8,760 hour load impact shapes
- Combine this with the marginal hourly emission factors

Though involving more work (e.g., by evaluators), the tools for using the dispatch modeling approach are available.

The methods should suit the EE program "value" sought for emissions benefits

As is usually the case in evaluation, more reliable approaches and methods cost more.

Based on review of the GHG Protocol, the additional costs for obtaining larger emissions value from EE programs are likely to come from rigorous boundary and additionality assessments, as well as more complex calculation of emission factors.

EE program sponsors, together with evaluators, will need to assess program objectives and the environmental value sought to determine approaches that are appropriate.