CADMUS

EPA's Clean Power Plan

Implications for State Energy Offices

NASEO Annual Meeting
September 10, 2014

Agenda

- Panelist Introductions . . . . . 2 minutes
- Overviews and Scenario . . . . . 30 minutes
  - EE Program Strategies under the Plan
  - Evaluation, Measurement, & Verification (EM&V)
  - Avoided Emissions
- General Q & A . . . . . 25 minutes

Your Panelists

- Philip Quebe |Cadmus Sr Associate | Arlington
- Pat McGuckin | Cadmus Sr Associate | Denver
- Bryan Ward | Cadmus VP | Madison
- Kim Rankin | Cadmus Associate | Boulder

Overviews and Scenarios

- Introductory Comments
- EE Program Strategies under the Plan
- Evaluation, Measurement, & Verification
- Avoided Emission Accounting

ENERGY EFFICIENCY (EE) PROGRAM STRATEGIES UNDER THE RULE

PAT MCGUCKIN

EE Program Strategies

- Assess market needs and gaps
  - Focus on segments that aren't being served
- Identify funding sources
  - Increased SEO funding?
  - Funding from others: IOUs, coops, munis, IPPs
  - Self-fund (e.g., performance contracting) http://www1.eere.energy.gov/wip/solutioncenter/pdfs/selffundedespcprograms.pdf

More Program Strategies

Collaborate with IOUs

- Help programs meet cost-effectiveness test
  - Factor in non-energy benefits?
  - Provide support services (e.g., marketing, audits)
  - IOUs will want/need to claim emission reduction
- Facilitate statewide programs
  - Share resources, costs, economies of sale

Still More Program Strategies

Develop financing programs

- Facilitate private sector programs
- Who gets credit for emission reductions?
  - Financing or rebates?
  - Don’t try to split the baby

Scenario: Refrigerator Recycling

Rationale

- Significant potential for emission reductions
- Relatively simple to design and implement
- Share statewide/regional recycling center
- Utilities and IPPs might fund program
- Applicable in most states

Scenario: Program Strategy

Already offered by IOUs?

- Yes: expand statewide for coops, IPPs?
- No: facilitate statewide program?

Quick questions?

EVALUATION, MEASUREMENT & VERIFICATION OF ENERGY SAVINGS (EM&V) FROM ENERGY EFFICIENCY PROGRAMS

BRYAN WARD - CADMUS

Objective of EM&V

- Independent, third-party estimate of the *gross* and *net (accounting for free ridership and spillover)* savings resulting from program efforts
- Often required by legislators or regulators as part of state EEPS or RPS rules
- Required for bidding into ISO markets (e.g NE-ISO, PJM, MISO)

EM&V Protocols for 111d

- There are references to the Federal agency protocol efforts – Uniform Methods Project
- Discussion of regional protocols e.g. RGGI, and independent system operator protocols
- Detailed guidance is expected to be included in the final rule

Refrigerator Recycling Program Scenario – EM&V

Program reported activity/savings:

Number of units recycled:	5,694
Average per unit savings:	500 kWh
Reported savings:	2,847,222 kWh
	(5,694 units * 500 per unit)

The first step in EM&V is develop an evaluation plan….

Funding & Prioritization

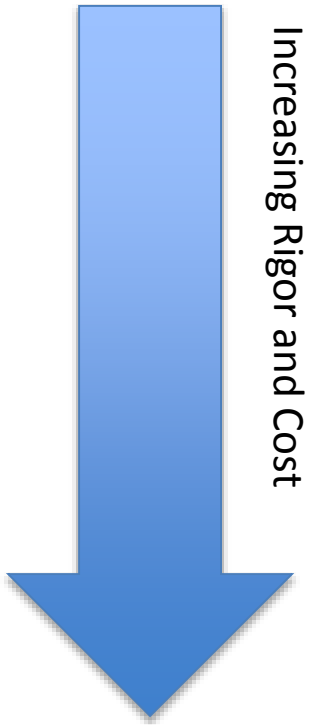
- EM&V plans are limited by available resources
- Decisions of approaches and resource allocation are based on jurisdiction requirements, uncertainty in savings estimates (stability of the program & measures, time lapsed since a “rigorous” evaluation, etc.)

Values to be Considered for EM&V

- Gross
  - Verification
  - Annual Energy Consumption
  - Part-Use Factor
- Net
  - Free Ridership
  - Secondary Market
  - Induced Replacement
  - Spillover

EM&V Options

- Data review
- Verification - Phone
- Engineering analysis/modeling
- Verification - Site
- Metering (IPMVP Option A – Isolation Metering)



EM&V Research Objectives & Activities

	Evaluation Activities	
Research Objective	**Modeling**	**Participant Survey**
Gross – Verification		☀
Gross – Annual Energy Consumption	☀	
Gross - “partial-use”		☀
Net – Free Ridership		☀
Net – Induced Replacement		☀
Net - Spillover		☀

Reporting EM&V Impact Results

Verification:	1.0	
Annual Energy Consumption:	1.25	625 kWh/500 kWh
Partial-Use Factor:	0.8	
Free Ridership:	0.8	
Induced Replacement:	0.0	
Spillover:	0.0	

Reported Savings	Evaluated Gross Savings	Gross Realization Rate	Evaluated Net Savings	Net-to-Gross Ratio
2,847	2,563	0.9	2,050	0.8

Questions?

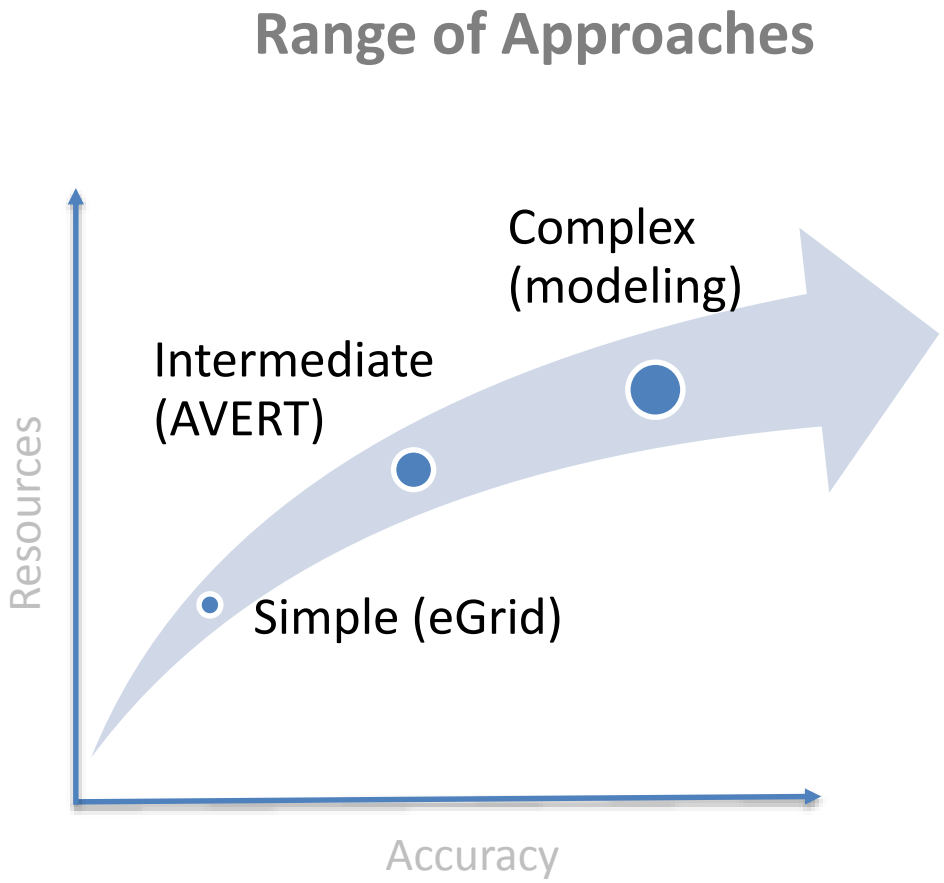
QUANTIFYING EMISSIONS FROM ENERGY EFFICIENCY PROGRAMS

KIM RANKIN - CADMUS

Emissions Quantification

- To use Block 4 as a 111(d) compliance option, EE must have a measurable impact on carbon emissions
- Converting energy savings (EM&V findings) into avoided carbon (CO_2) emissions
- Range of approaches available

Quantification Approaches



- 111(d) TSD: State Plan Considerations
  - Different approaches described
  - No guidance on which will be approved
- All approaches require energy savings and an emissions rate
  - Emission rate translates energy to carbon (fuel-specific)

Simple Approach

- EPA's Emissions & Generation Resource Integrated Database (eGRID)
- Uses an annual regional average of all generator emissions rates
- Scale
  - Temporal: Annual
  - Geographic: Regional
- Easiest to use, but may over/under estimate program's impacts

$$\text{Energy Savings (MWh)} * \text{Emissions Factor } \left(\frac{\text{tons}}{\text{MWh}}\right) = \text{Avoided CO2 (tons)}$$

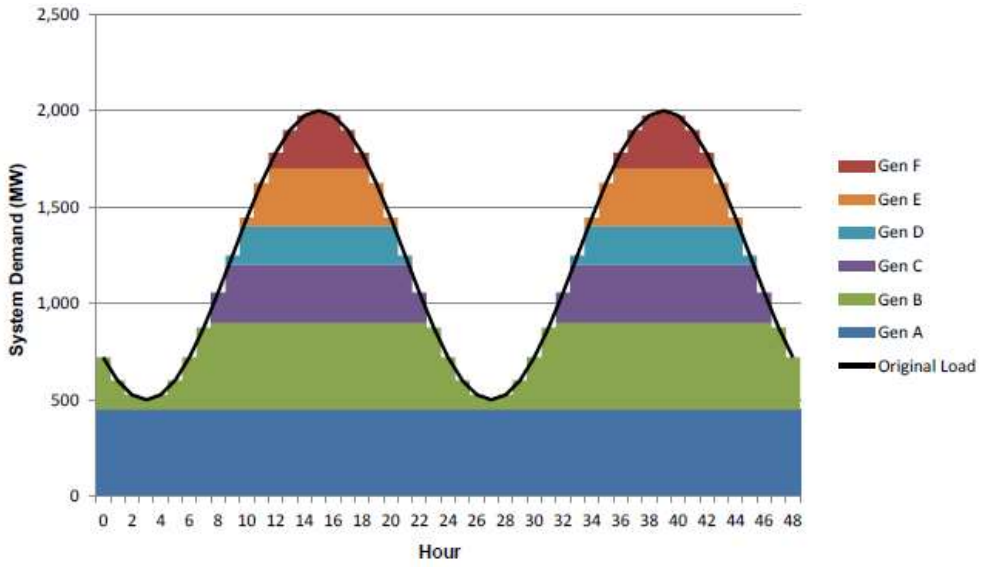
Intermediate Approach

- EPA's AVoided Emissions and geneRation Tool (AVERT)
- Use historical hourly EGU data to simulate avoided emissions resulting from EE programs
- Scale
  - Temporal: Hourly (historical)
  - Geographic: County, state, region
- Easy to use tool, but not for projections

AVERT
AVoided Emissions and geneRation Tool
www.epa.gov/avert

Complex Approach

- Energy modeling
  - The most accurate but the most resource intensive
  - Requires more data
- Compare baseline generation to hourly program impacts
  - What fuel is on the margin when EE savings occur
- Scale
  - Temporal: Annual, seasonal, hourly
  - Geographic: Modeled region



Refrigerator Recycling Program

- 2 approaches for quantifying avoided CO2
  - The emissions avoided by pulling the inefficient refrigerators off the grid
- Assumptions
  - Region (for selecting an EF)
    - This program is run in the state of Ohio
  - Energy savings
    - EM&V found the energy savings from this program are 2,050 MWh (annual)

Simple Approach – Regional Average Emissions Rate

EPA's Emissions & Generation Resource Integrated Database (eGRID)

eGRID subregion acronym	eGRID subregion name	Annual non-baseload output emission rates		
		Carbon dioxide (CO_2) (lb/MWh)	Methane (CH_4) (lb/GWh)	Nitrous oxide (N_2O) (lb/GWh)
AKGD	ASCC Alaska Grid	1,387.37	34.05	6.93
AKMS	ASCC Miscellaneous	1,427.76	59.97	11.80
AZNM	WECC Southwest	1,210.44	21.88	9.86
CAMX	WECC California	932.82	35.91	4.55
ERCT	ERCOT All	1,181.70	20.12	7.63
FRCC	FRCC All	1,277.42	38.73	10.83
HIMS	HICC Miscellaneous	1,690.72	104.05	19.12
HIOA	HICC Oahu	1,588.23	119.48	20.10
MROE	MRO East	1,755.66	31.53	27.99
MROW	MRO West	2,054.55	59.86	35.53
NEWE	NPCC New England	1,106.82	61.55	12.07
NWPP	WECC Northwest	1,340.34	41.38	17.84
NYCW	NPCC NYC/Westchester	1,131.63	23.58	2.44
NYLI	NPCC Long Island	1,445.94	34.03	3.91
NYUP	NPCC Upstate NY	1,253.77	36.83	13.67
RFCE	RFC East	1,562.72	35.93	20.02
RFCM	RFC Michigan	1,744.52	32.31	26.00
RFCW	RFC West	1,982.87	24.50	31.07
RMPA	WECC Rockies	1,808.03	24.56	22.89
SPNO	SPP North	1,951.83	25.15	26.90
SPSO	SPP South	1,436.29	27.94	12.10
SRMV	SERC Mississippi Valley	1,222.40	27.71	6.63
SRMW	SERC Midwest	1,964.98	23.93	29.65
SRSO	SERC South	1,574.37	26.52	21.49
SRTV	SERC Tennessee Valley	1,873.83	24.99	28.88
SRVC	SERC Virginia/Carolina	1,624.71	36.42	23.06

$$2{,}050\ \text{MWh} * 1{,}982.87\ \frac{\text{lbs}}{\text{MWh}} =$$

4,064,884 lbs CO2

(2,032 tons)

Intermediate Approach – Hourly Approach

EPA's AVoided Emissions and geneRation Tool (AVERT)

Enter EE impacts based on the % reduction of regional fossil load

Reduce generation by a percent in some or all hours		
Apply reduction to top X% hours:	0%	% of top hours
Reduction % in top X% of hours:	0.0%	% reduction

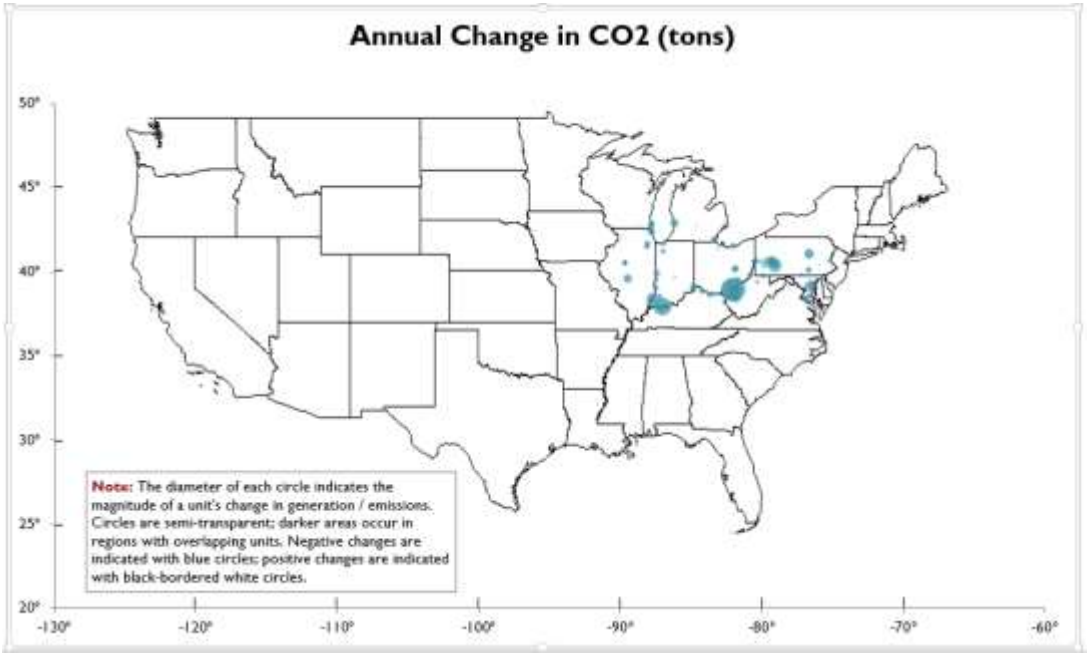
And/or enter EE impacts distributed evenly throughout the year

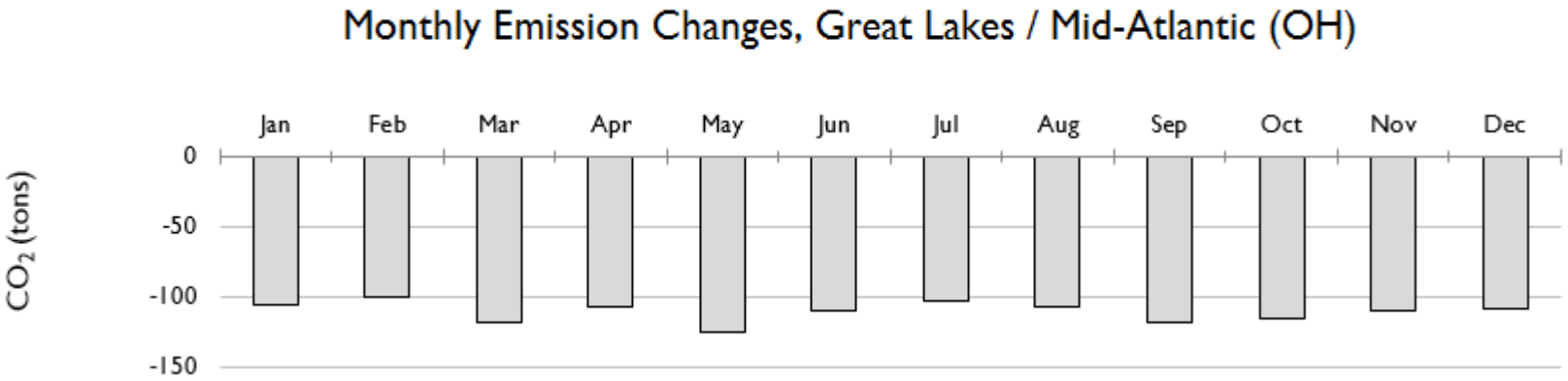
Reduce generation by annual GWh:	2.05	GWh
OR		
Reduce each hour by constant MW:	0.0	MW

	Original	Post-EERE	Impacts
Generation (MWh)	613,319,900	613,317,800	2,000
Total Emissions			
SO_2 (lbs)	2,500,851,500	2,500,844,000	7,500
NO_x (lbs)	958,897,600	958,894,800	2,700
CO_2 (tons)	539,148,800	539,147,200	1,500

Remember the simple method calculated 2,032 tons CO2

AVERT can create many output tables and graphics





Takeaway

- There are many approaches to quantify emissions from energy-efficiency programs
  - Many considerations in choosing an approach, like interstate impacts, costs, and scale. Also, what will 111(d) require?
- It can be complex, but there is expertise available
  - This is not new to EE programs
- EE should not be avoided because of the EM&V and quantification requirements; its still the most cost effective option
- The rule is not yet final –additional guidance from EPA is expected
  - Stay tuned!

QUESTIONS?

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