Role of Energy Efficiency in Air Quality Programs

Presentation to EPA Office of Enforcement and Compliance Assurance

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Background

- >10 years of collaboration between NE air regulators, ISO-NE, energy regulators:
  - Agreements to limit use of diesel generators
  - Regulations to promote clean distributed generation
  - Rules in region's Forward Capacity Market to comparably treat all resources
  - Characterization of emissions benefits from energy efficiency
- Focus today on last bullet, but important to note continuum of progress

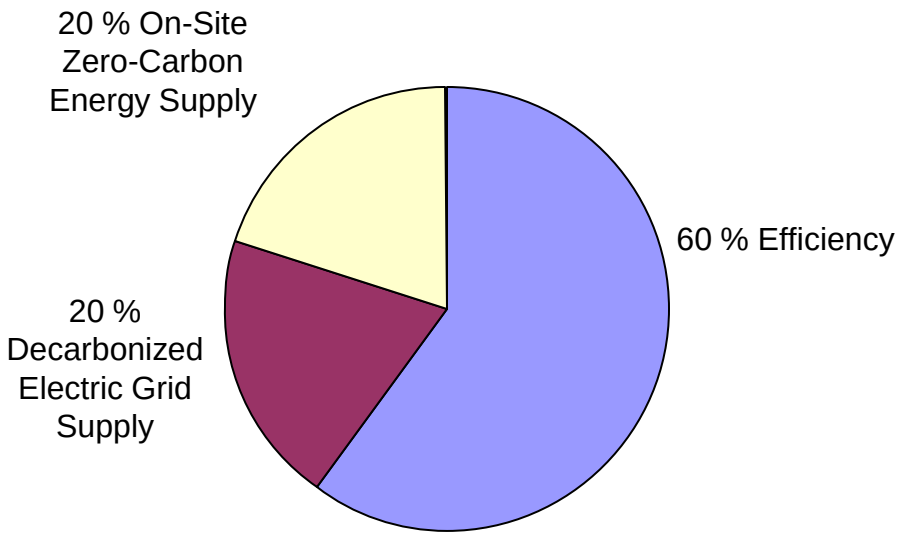
Energy Efficiency Resources

- Energy Efficiency Resources are zero-emission alternatives to electric generation that can be developed, measured, verified and relied upon as an integral component of the electric power system.
- Energy efficiency can be deployed as a least-cost method to meet power supply needs and reduce marginal emissions with the same, or better, reliability and predictability as competing power supply or air quality compliance measures.

Energy Efficiency Resources

- The available efficiency resources are enormous
- Efficiency is a least cost option for both providing energy services and reducing emissions
- Some analysts now project efficiency to provide 60% of a least-cost path to 2050 carbon goals

A 2050 Zero Carbon Scenario for the Building Sector



Typical Efficiency Measures

- Efficient new building design, thermal envelope and mechanical/electrical systems
- Efficient heating and cooling equipment, distribution systems and control systems
- Efficient industrial process equipment
- Efficient motors, compressed air systems
- Efficient lighting: daylighting, lighting design, fixtures, lamps, ballasts, controls, street lighting

Reliability and Persistence

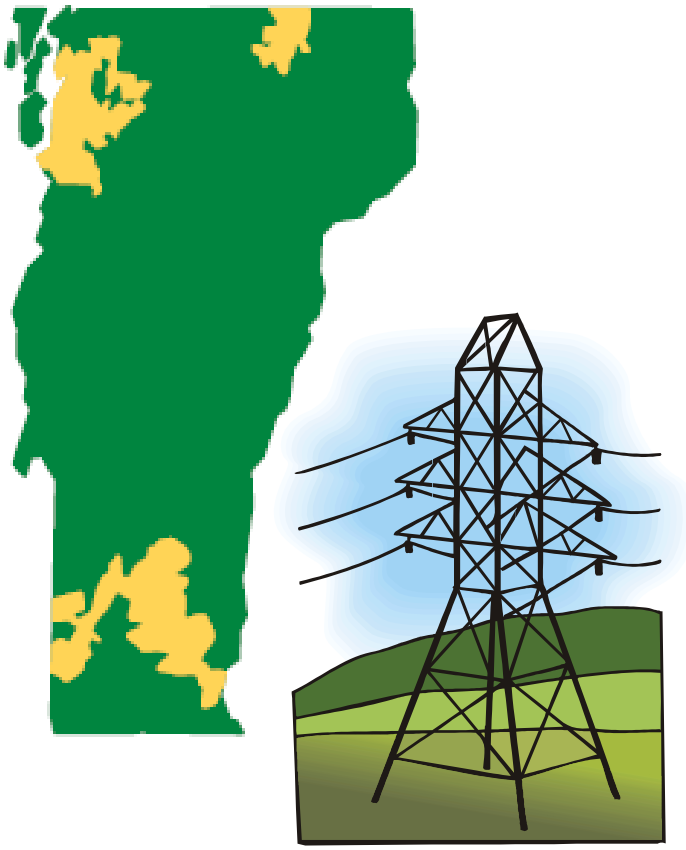
Savings estimates account for:

- Measure lifetimes (3 to 50 yrs – typical average: 12 yrs)
- Installation rates (for products)
- Commissioning impacts
- Renovation cycles, changes in use, removal rates
- Degradation of performance over time
- Free rider rate (would have done it anyway)
- Spillover rate

Efficiency Can Be Targeted

- A least-cost alternative designed to get deep, fast savings in targeted areas
- Avoid or defer major capital investments in transmission and distribution system that would otherwise be required to address system reliability
- Load reduction goals of 2% to 5% annually

Vermont Targeting for Past 4 Yrs



Measurement and Verification:

A well-developed framework of widely-accepted, technically rigorous, methods and standards

- International Performance Measurement and Verification Protocol (IPMVP) (www.evo-world.org)
- 2007 NAPEE Model Energy Efficiency Program Impact Evaluation Guide. www.epa.gov/cleanrgy/documents/evaluation_guide.pdf
- 2006 California Energy Efficiency Evaluation Protocols: http://www.calmac.org/publications/EvaluatorsProtocols_Final_AdoptedviaRuling_06-19-2006.pdf
- 2000 Federal Energy Management Program M&V Guidelines. (http://ateam.lbl.gov/mv/docs/26265.pdf)
- 2002 ASHRAE Guideline 14 Measurement of Energy and Demand Savings. (www.ashrae.org)

Measurement and Verification: Supervision and Oversight

- State Regulatory Commissions
  - Approve of M&V Plans
  - Requirements for Annual M&V of Savings from Utility Efficiency Resource Portfolios (typically costing 4% of program budgets – about $140M nationwide last year)
- Regional Transmission Organizations
  - ISO New England establishes rules and must approve (in advance) M&V plans of market participants bidding efficiency resources in the Forward Capacity Market.

Evaluation Science

- Methods include direct metering, statistical methods applied to billing data, engineering modeling, surveys, and a range of established social science program evaluation methods
- An established profession with specialized training
- Extensive academic literature and several evaluation result clearinghouses
- High-level conferences dedicated to sharing latest methods and results

Technical Reference Manual

An established system for documenting all assumptions for determination of energy savings for efficiency measures in a designated jurisdiction, including, for each measure and application:

- Measure characterization
- ID of variables that affect savings and savings algorithms
- Baseline efficiency and market information
- Load shape of savings (hourly, monthly, annual)
- Install rate, free ridership and spillover assumptions
- Measure lifetime and savings degradation
- Initial and ongoing (O&M) costs for the measure
- Variability for different building types and applications

Data on Efficiency Resources

In Vermont, for example, every measure (over 100,000/yr) is in a data base with information including:

- Description of measure, location, usage, lifetime
- Measure kWh, kW and Btu savings; load shape of savings; baseline
- Savings adjustments (install rate, free ridership, spillover)
- Customer name and contact information; premise location
- Utility account number
- Identification of all measures that are part of a single project
- Links to all prior projects and measures at the same premise
- Identification of all “players” (e.g. engineer, builder, contractor, retailer, supplier, architect, sales representative)
- Initial cost and ongoing O&M costs; amount of incentive
- Link to data base of customer electrical use for the past 15+ years

Forward Capacity Market (FCM)

- "Forward Capacity Market" (FCM) – an approach for addressing power sector resource adequacy
  - auction-based markets for capacity held several years ahead of need.

- System operators (e.g., PJM, ISO New England)
  - solicit bids to meet estimated levels of resource commitment to meet future system peak demand and
  - provide market-based revenues to resources that can fulfill that commitment.

- PJM and ISO New England FCM include not only "supply-side" resources, but also those (EE, DR, and DG) on "demand-side"
  - Demonstrates that reducing consumer demand for electricity is functionally equivalent to — and cleaner — producing power from generating resources for keeping supply and demand in balance.

Forward Capacity Market cont.

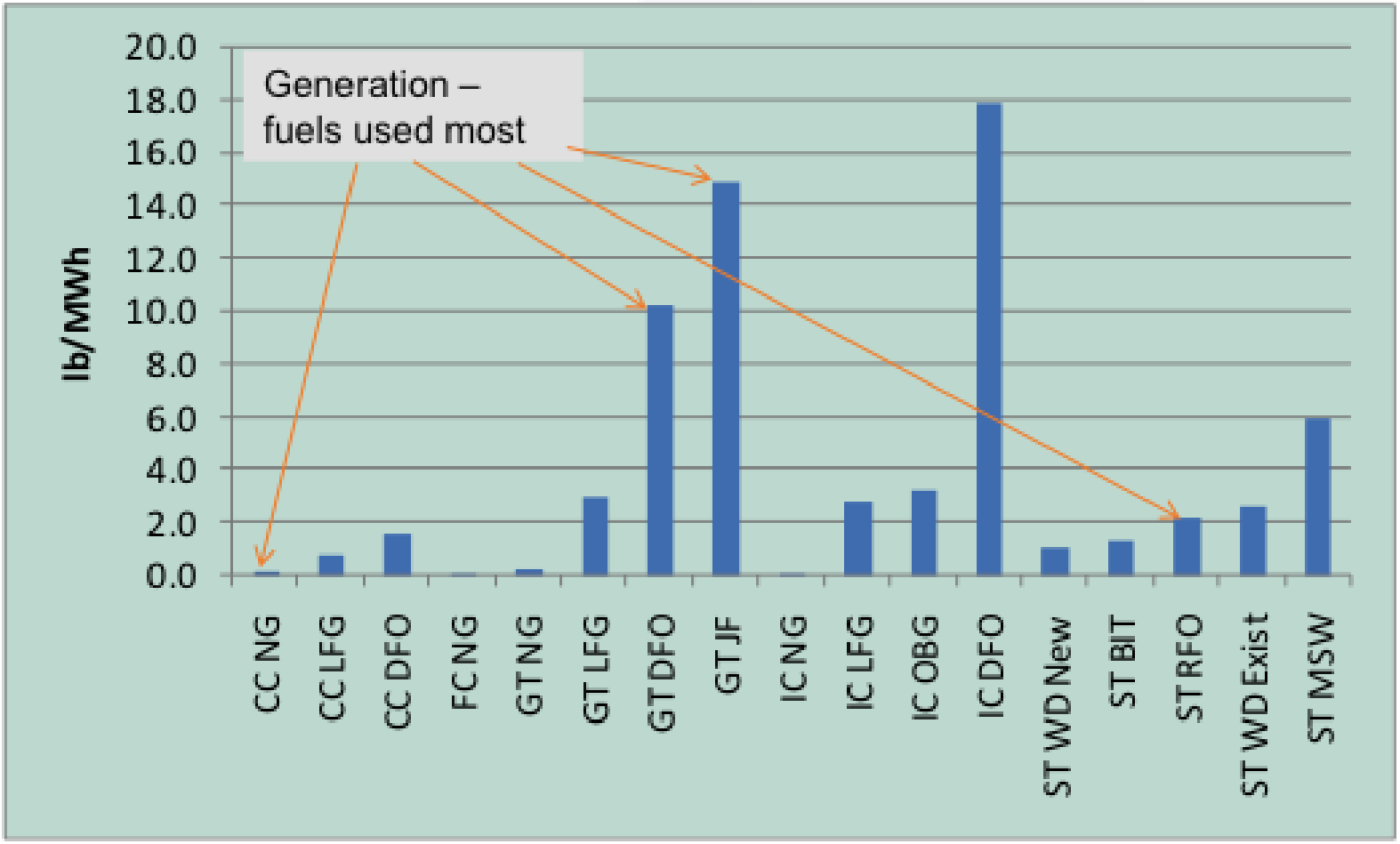
- Demand-side resources subject to comprehensive standards for measurement and verification (M&V).
  - failure to comply with M&V protocols makes the resource ineligible for the auction;
  - failure to submit post-installation M&V reports results in a final capacity offering of zero for the delivery year, plus penalties; and
  - energy efficiency resources also are audited for compliance.

- Assurances Required
  - Prequalification of all resource bidders by system operator ensures high likelihood of performance.
  - Qualification deposit, and provision of other financial assurances.
  - Penalties for non-performing bidders.

Approaches for Determining Avoided Emissions

- Applying **emission factors** (e.g., pounds of CO2 per MWh) to net energy savings
- Using **emissions scenario analyses**, e.g., using computer models to estimate the difference in emissions from power plants with and without the reduced electricity consumption associated with an efficiency program.

Emissions Benefits from EE Depend Upon What is Being Displaced



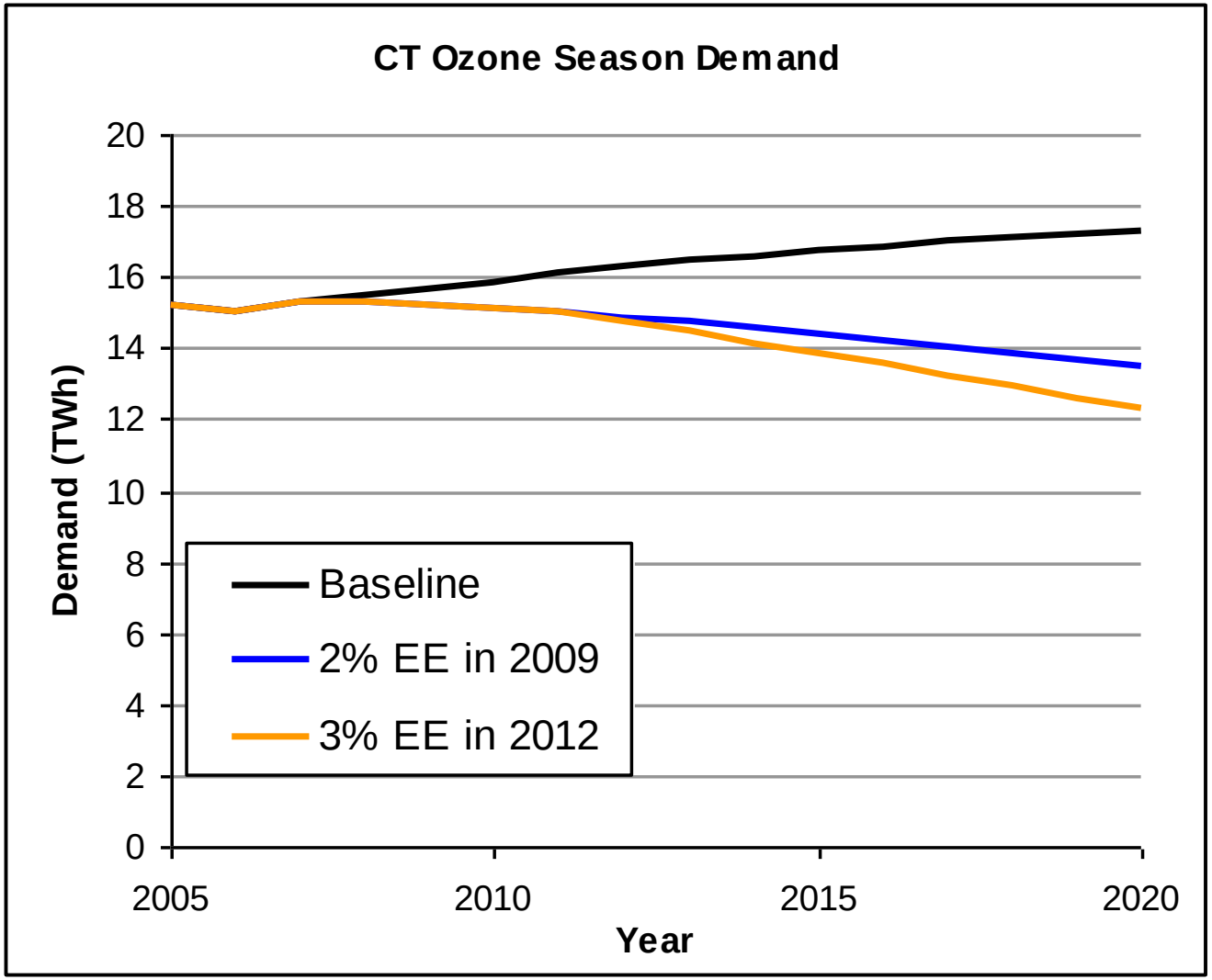
Marginal Emissions

- Efficiency resources reduce system supply requirements at the margin
- For example, efficiency implementation in Vermont typically displaces a marginal combined cycle gas plant in southern New England.
- Even though Vermont's nominal supply mix is almost completely nuclear and hydro, in 2008, Efficiency Vermont saved 880,000 tons CO2, with an associated ratepayer investment of $31.4M

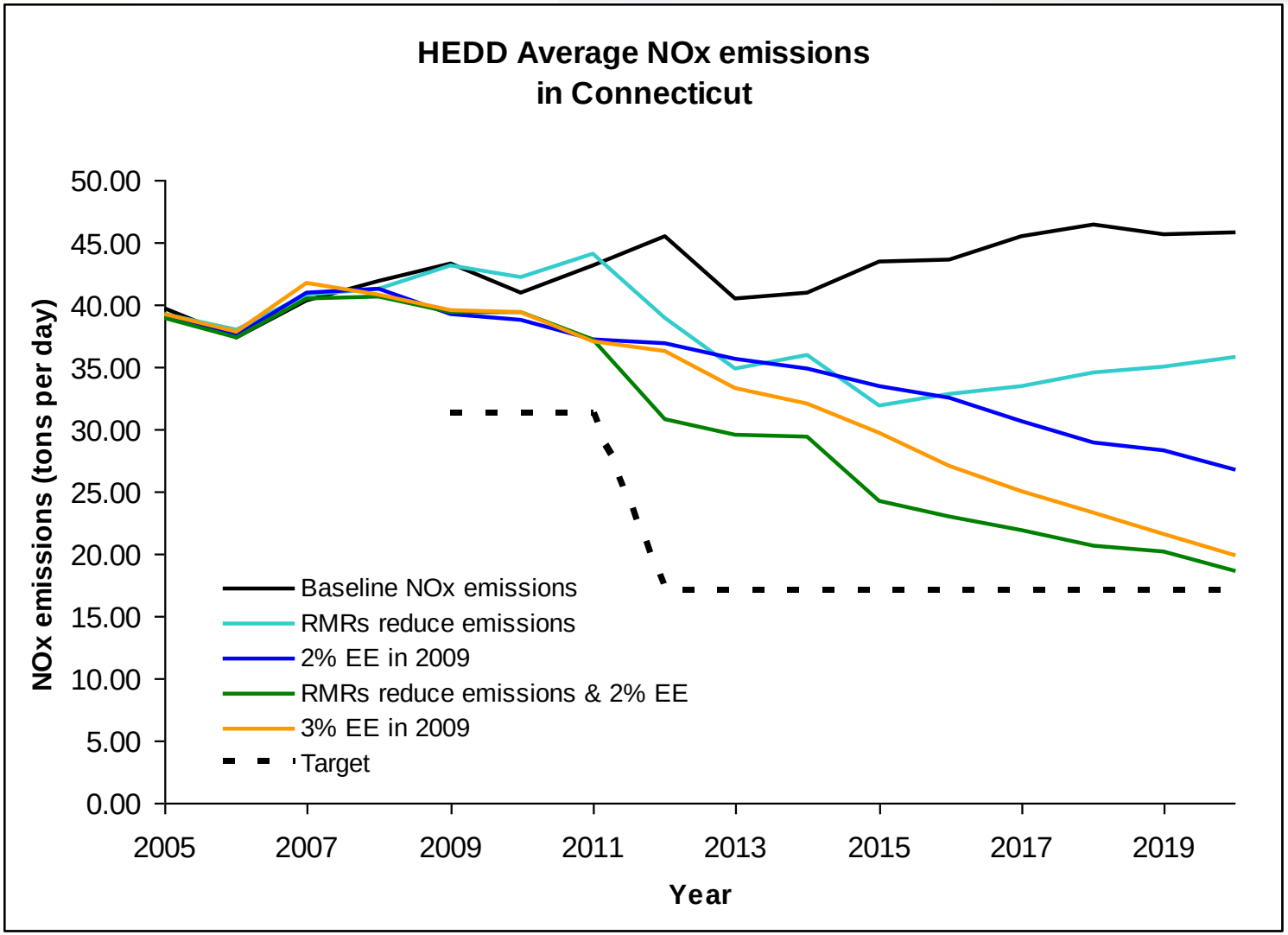
ISO-NE Marginal Emissions Analysis

Ozone / Non-Ozone Season Emissions (NOx)					
Air Emission	Ozone Season		Non-Ozone Season		Annual Average (All Hours)
	On-Peak	Off-Peak	On-Peak	Off-Peak	
NO_X	0.23	0.20	0.21	0.22	0.21
Annual Emissions (SO_2 and CO_2)					
Air Emission		Annual			Annual Average (All Hours)
		On-Peak	Off-Peak		
SO_2		0.33	0.33		0.33
CO_2		952	976		964

2008 Report for EPA and CT Evaluated EE Influence on Demand



EE Influence on NO_X Emissions in CT During the Ozone Season



Past Evaluation of EE and Emissions Benefits

- Texas A&M tool evaluates emissions displaced by county
- New Jersey, Maryland, Connecticut: EE and RE measures in SIP
- Many utility efficiency portfolio evaluations and annual reports are required to include emission impacts

Related Current Work

- Northeast Energy Efficiency Partnerships (NEEP) EM&V Forum work on Standard Reporting Formats
- ISO-NE refinement of marginal emissions analysis
- PJM nascent forward capacity market
- California avoided emissions analysis and modeling

Reporting Template – DRAFT

Table 3. Emissions Reporting Template

Jurisdiction/State:

Pollutant	Emissions Calculation Method Used	Emissions Factor Used	Annual Emissions Reduction (metric tons)		Annual Peak Emissions Reduction (metric tons)*	
			From Electric Savings	From Nat. Gas Savings	From Electric Savings	From Nat. Gas Savings
eCO_2		☐ Marginal ☐ Average ☐ Other Source: _____				
NO_x		☐ Marginal ☐ Average ☐ Other Source: _____				
SO_2		☐ Marginal ☐ Average ☐ Other Source: _____				
Other						

Based on Annual Demand Savings coincident with:

☐ High Electricity Demand Days ☐ Utility Peak Demand ☐ ISO/RTO System Peak ☐ Other

Provide description of peak coincidence hours:

_____

_____

Discussion Questions

- How to consider affects of where emissions are displaced v. where the EE investments occur?
- Does the agency responsible for enforcing the EE matter? i.e. must it be a DEP or could a PSC be responsible
- What is the potential role of transmission as an air quality control measure?

Thank You!

Factors That Influence Quantity of Emissions Displaced by Efficiency

- The quantity of emissions displaced relates to:
- Location of load as compared to locations of generation
  - Load pockets may have transmission constraints, which require local generators to serve local load
  - In regional markets, generation may be in other states
- Time of day and season
  - Peak summer hours may require simple cycle gas turbines and diesel generators to run