



Using NEMS to Estimate the Benefits of DOE's Energy Efficiency Programs

Presentation to EMF

Frances Wood
OnLocation, Inc.

February 5, 2008



DOE Efficiency Programs

- DOE's Office of Energy Efficiency and Renewable Energy (EERE) Efficiency Programs cover a range of sectors and technologies:
 - Building Technologies, FEMP, Vehicle Technologies, Industrial Technologies, and Weatherization and Intergovernmental
- EERE's Portfolio also includes Renewable Energy Programs
 - Biomass, Geothermal, Hydrogen, Solar, and Wind
- The programs encompass R&D, deployment, and regulatory activities



Modeling Program Benefits

- EERE uses NEMS and other tools to measure the benefits of its programs as part of their Government Performance and Results Act (GPRA) reporting
 - Forward looking at impact of future Program budgets
- NEMS provides a consistent economic framework for determining individual program and portfolio benefits
 - Programs may target similar markets and therefore interact
 - Energy efficiency and renewable energy deployment can lead to energy price reductions that in turn dampen the cost-effectiveness of the EERE technologies
- Alternative scenarios used to look at the value of EERE's R&D portfolio under other possible futures, such as carbon mitigation policies or high fuel prices





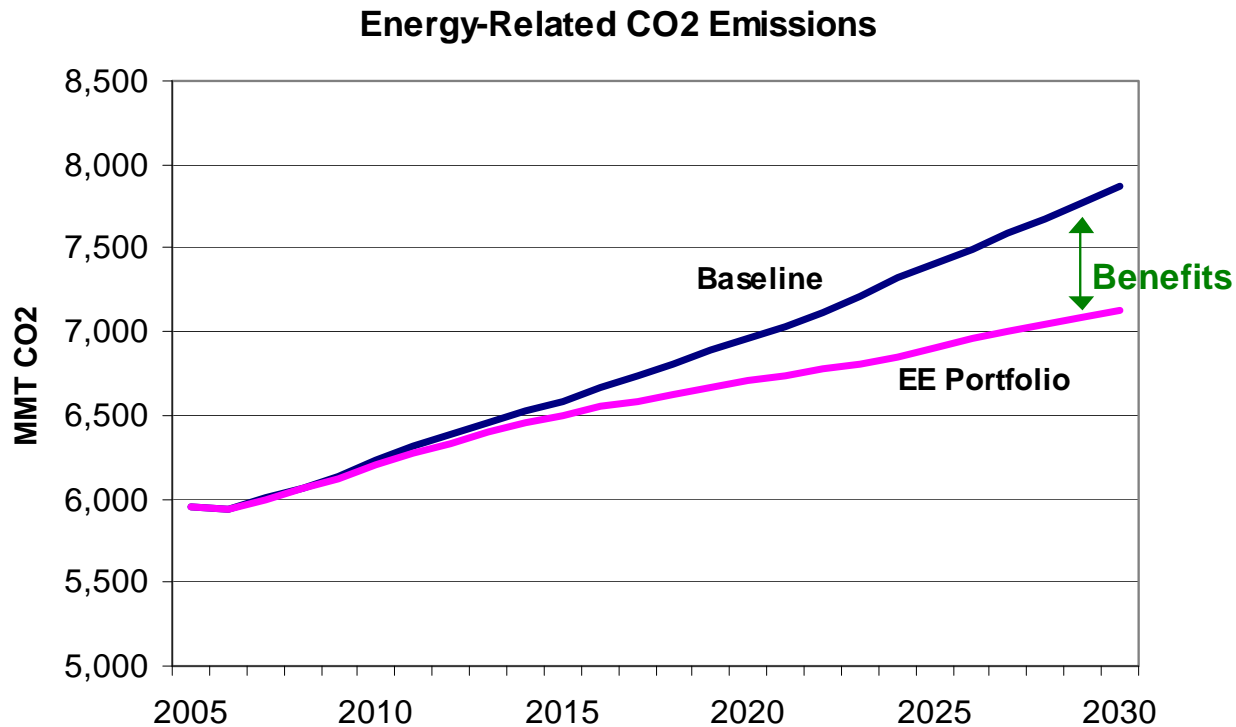
Benefits Modeling Process

- The first step is the development of a common Baseline
 - Modification of the most recent AEO reference case to reflect technologies and markets without DOE Program impacts
 - Assures that underlying improvements in efficiency and renewable energy are not counted as part of the benefits of the EERE programs
 - Provides a basis for assessing how well EERE technologies might compete against future, rather than current, conventional energy technologies
 - Includes selected model enhancements to allow better program representation
- Representation of each of the EERE Programs individually and the Portfolio
 - The activities for each program are represented within NEMS-GPRA assuming success of the program goals



GPRR Benefits Estimation

- Benefits are measured by the difference in projections *with* and *without* the R&D programs.



Representation of R&D Programs

- R&D programs generally are represented by changing technology cost and performance characteristics to reflect program goals.
 - Examples include: solid state lighting, high efficiency air conditioning, hybrid vehicles
- In some cases analysis must be done off-line either due to insufficient technology information or lack of NEMS-GPRA detail
 - Savings are then input into the model
 - Examples include: Industrial technology R&D, building technologies with zero incremental costs



Representation of Deployment Activities

- Deployment programs have adoption rate goals
- The Energy Star program is represented by lowering consumer hurdle rates for end uses targeted by the program to achieve the program adoption goals
 - Examples include residential lighting, refrigerators and water heaters.
- Weatherization savings estimated offline based on expected budget levels and past performance are implemented by reducing heating and cooling demands in residential buildings
- Industrial Best Practices savings are estimated offline and are subtracted from industrial energy demands



Representation of Regulatory Activities

- Appliance standards and building codes also impact market adoption of energy efficiency, but through a regulatory mechanism
- In theory, these would be represented in NEMS-GPRA by eliminating low efficiency options over time
- In practice, appliance standards are set in a collaborative process with industry so cannot be determined in advance
 - Approximations of expected energy savings are used instead
- Building codes and standards are highly local and are difficult to model at the regional level



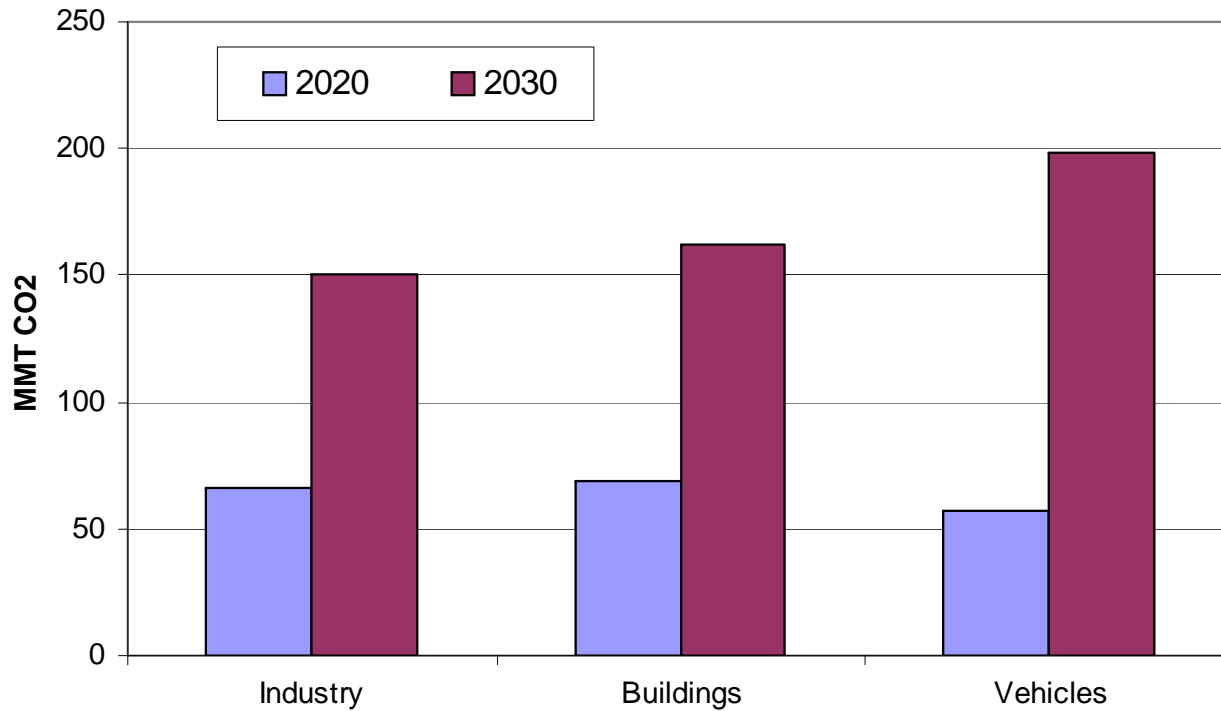
Metrics for Program Benefits

- Benefits metrics include
 - Consumer energy expenditures
 - Power industry costs
 - Energy intensity of the economy
 - Carbon dioxide emissions
 - Oil imports
 - Vehicle miles traveled per gallon of oil
- Benefits are reported at the program level and for the Portfolio as a whole.



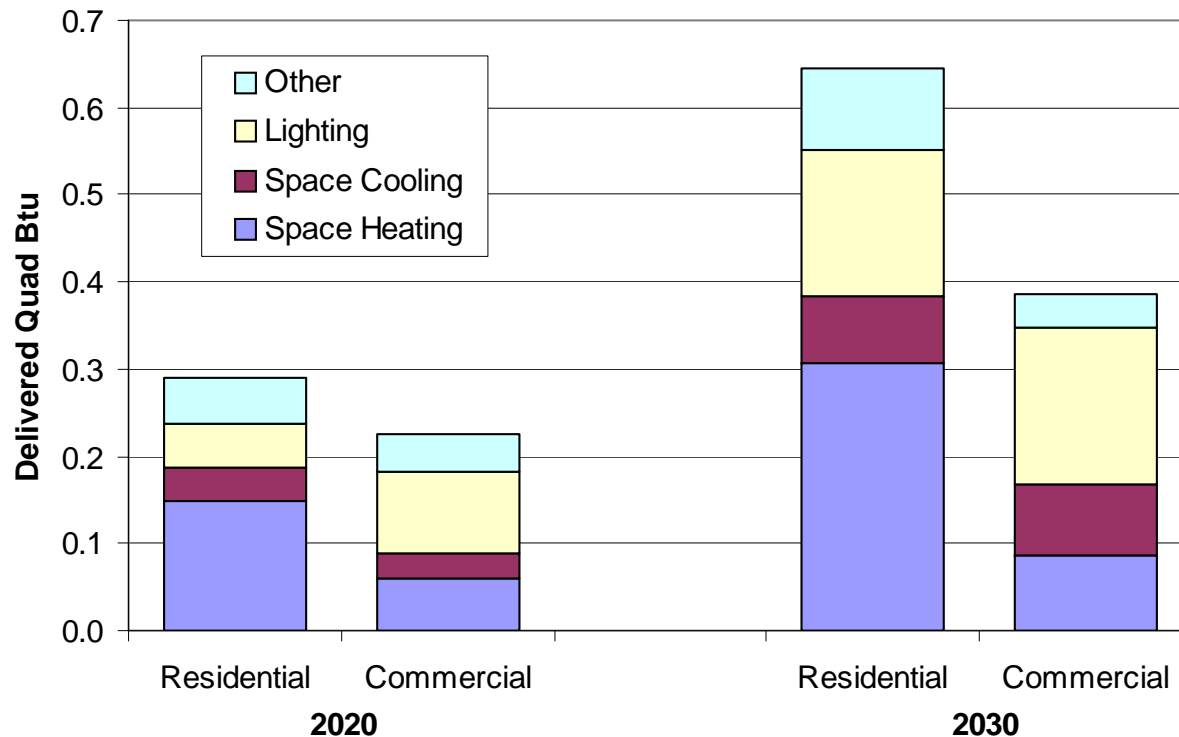
CO2 Emission Reductions

- The efficiency programs are projected to reduce annual CO2 emissions by roughly 500 MMT by 2030.



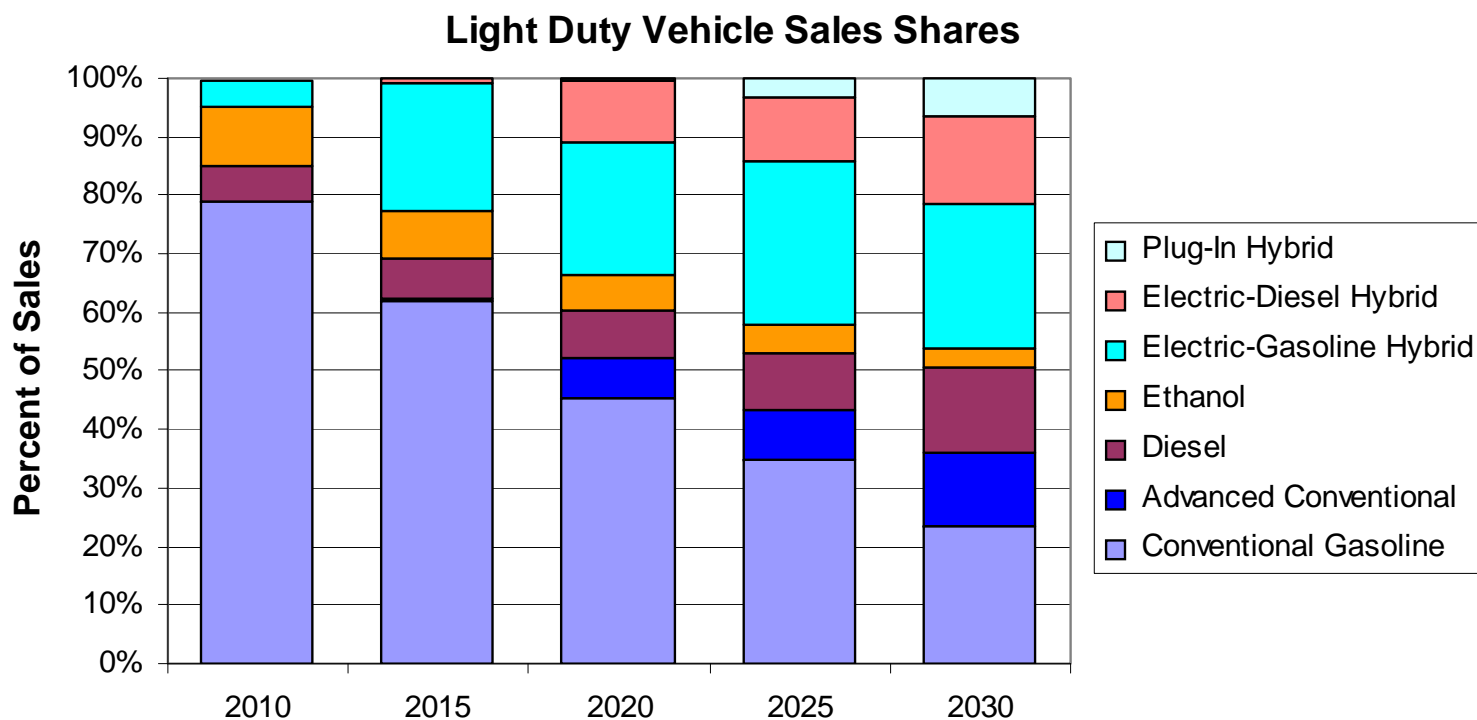
Energy Savings in Buildings

- Significant efficiency improvements are projected in most end-uses with the greatest percentage improvements in lighting and air conditioning



Vehicle Markets

- Energy savings in the vehicles market results from a shift to advanced vehicles



Scenarios

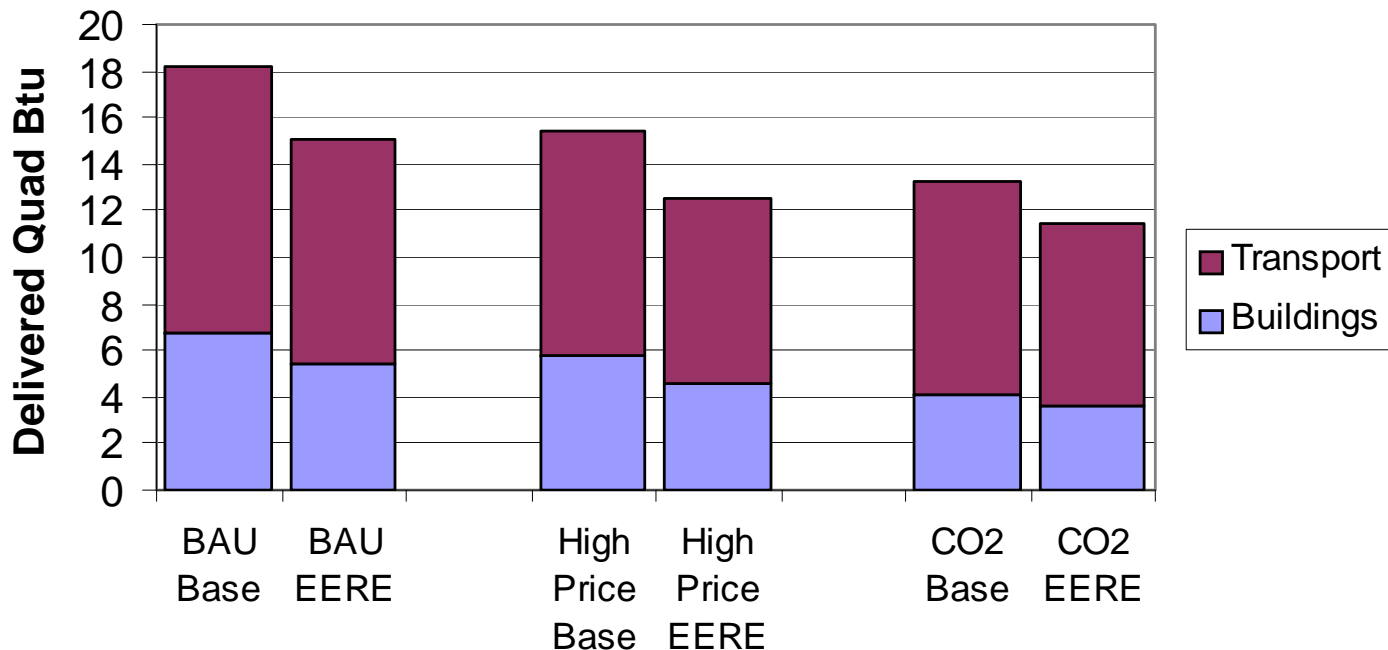
- Scenarios are used to explore the role of R&D under other possible market conditions
 - Business as Usual (BAU) Scenario
 - High Fuel Price Scenario
 - Carbon Cap and Trade Scenario
- Economic benefits are likely to be higher in these other scenarios where renewable sources and energy efficiency improvements are more valuable.



End-Use Consumption

- The reduction in energy consumption due to EERE R&D may decrease in the alternative scenarios due to
 - greater efficiency and
 - lower service demands in the Base (No R&D) cases

Growth in Energy Use 2005 to 2025



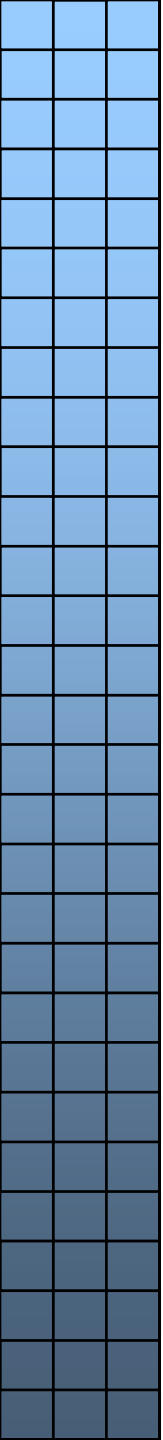
Note – example from earlier analysis



Challenges

- R&D programs are the most straightforward to model in a technology based economic model such as NEMS-GPRA
 - However, full program success is uncertain, and EERE is beginning to assess probabilities of technological success
 - Market adoption uncertainty remains due to potentially additional attributes that might make new technologies *more or less* attractive to consumers
- Deployment programs are more difficult to represent
 - Either one accepts program goals for adoption rates and modifies model parameters to achieve them, *or*
 - One has to understand the underlying mechanism of each program for how the greater adoption will be achieved (and the current barrier to adoption)
 - Lack of data on consumer adoption rates is a key issue





Thank You

