Energy Efficiency in Carbon Markets: Implications for Evaluation and ENERGY STAR® for Homes Sponsors

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ENERGY STAR® for Homes Utility Sponsor Meeting

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Overview

- Will carbon dioxide emissions become an evaluation issue?
- Estimating carbon footprints—evaluation issues
- How Climate Policy Might Engage EE—or not
- How Can ENERGY STAR® Partners Participate in a Climate Policy Future?

Will Carbon Dioxide Become an Evaluation Issue?

Prospects for CO2 Evaluation: A Few Data Points

- Supreme Court ruling places CO2 under Clean Air Act
- EPA finding determines CO2 to be a pollutant requiring action
- Congress considering cap and trade legislation
  - Building codes and building labeling in House draft
  - Building owners unlikely to be directly covered
- RESNET planning a national building registry
- Regional Greenhouse Gas Initiative allows building EE measures (non-electric) to qualify as offsets

Prospects for CO2 Evaluation

- Pressure growing to “know your footprint” from many sides, not just legislation
  - Corporate sustainability programs joining EPA Climate Leaders, Carbon Disclosure Project
  - Online carbon footprint calculators proliferating
  - Voluntary sustainability labeling movements gaining momentum

Estimating Carbon Footprints—Technical Evaluation Issues

Carbon Footprints in a Nutshell

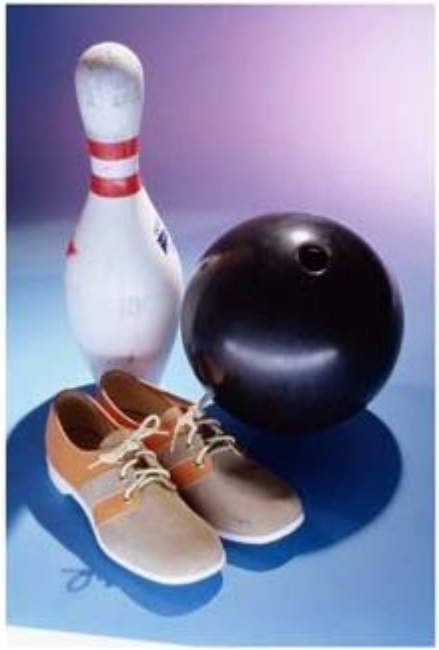
- The energy consumed in a building produces carbon emissions in two ways:
  - Onsite fuel combustion = direct emissions
  - Onsite electricity consumption = indirect emissions
- A building's carbon footprint consists of the combined total of direct and indirect emissions
- Direct emission are simple to calculate
- Indirect emissions can be more complex to calculate
- Direct vs. indirect emissions also factor importantly into how carbon credits are treated in policy frameworks

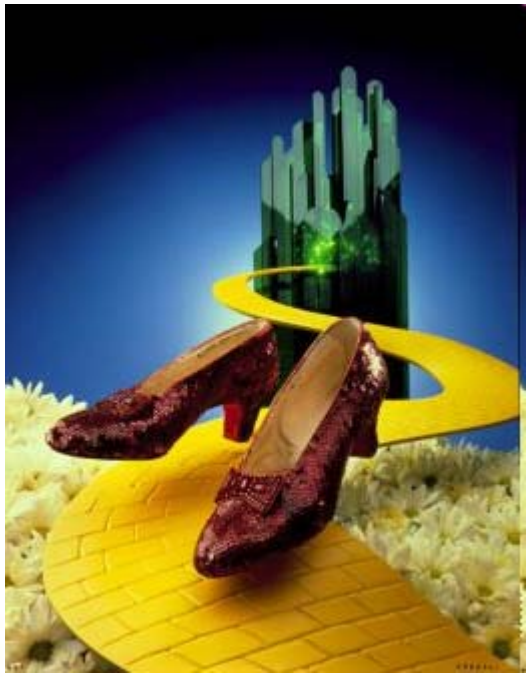
Two Key Questions

- What's the baseline (or initial carbon footprint) from which savings are measured?
- How are emissions reductions quantified?

Determining Carbon Footprints

- Not as simple as it looks:





Factors That Impact Footprint

Factors That Are Constant for a Given Building (absent retrofits):

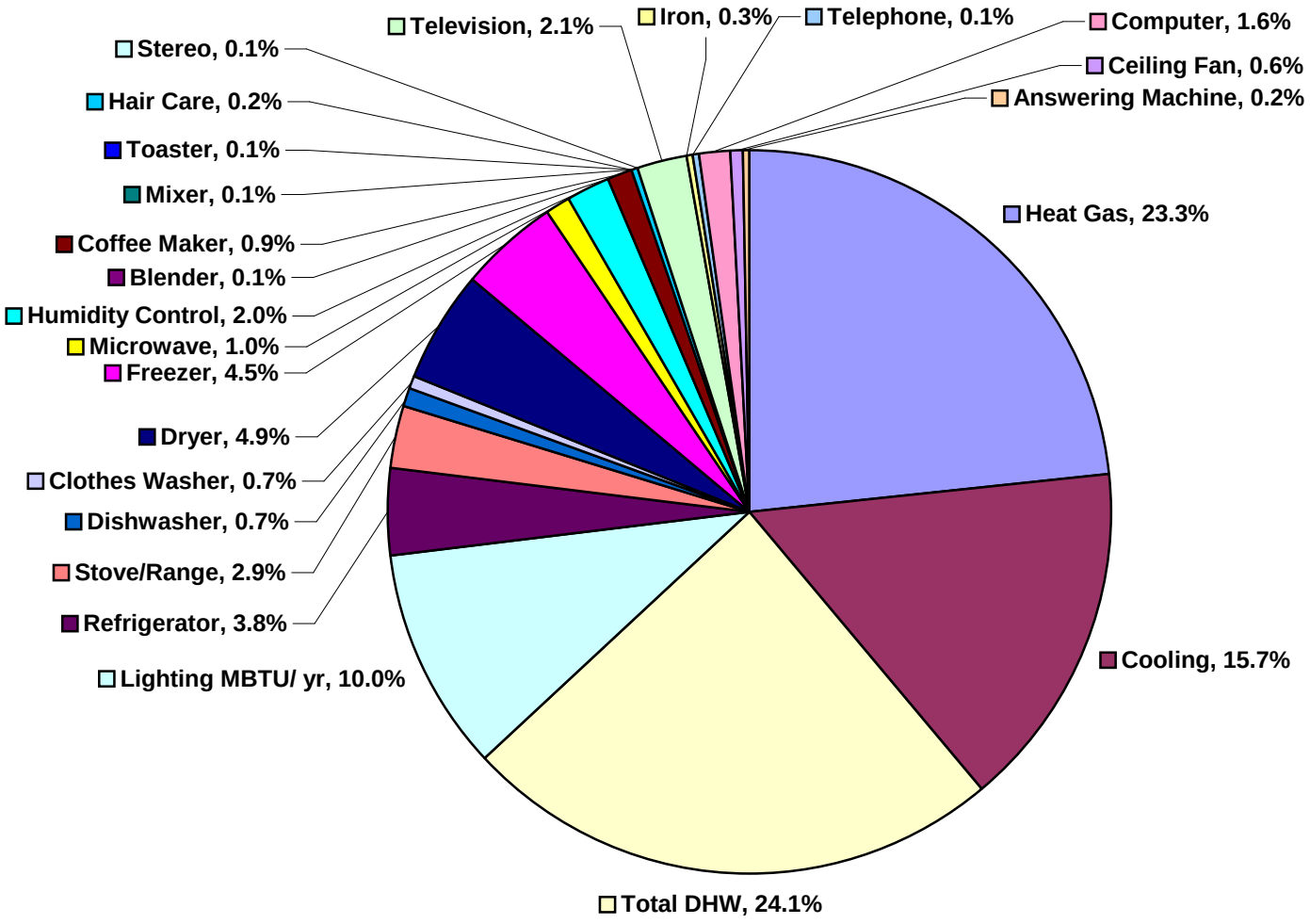
- Architectural Characteristics
  - Building Size
  - Number of Stories
  - Foundation Type
  - Window Area
- Energy Efficiency Features
  - Insulation Levels
  - Equipment Efficiency
  - Infiltration

Factors That Impact Footprint

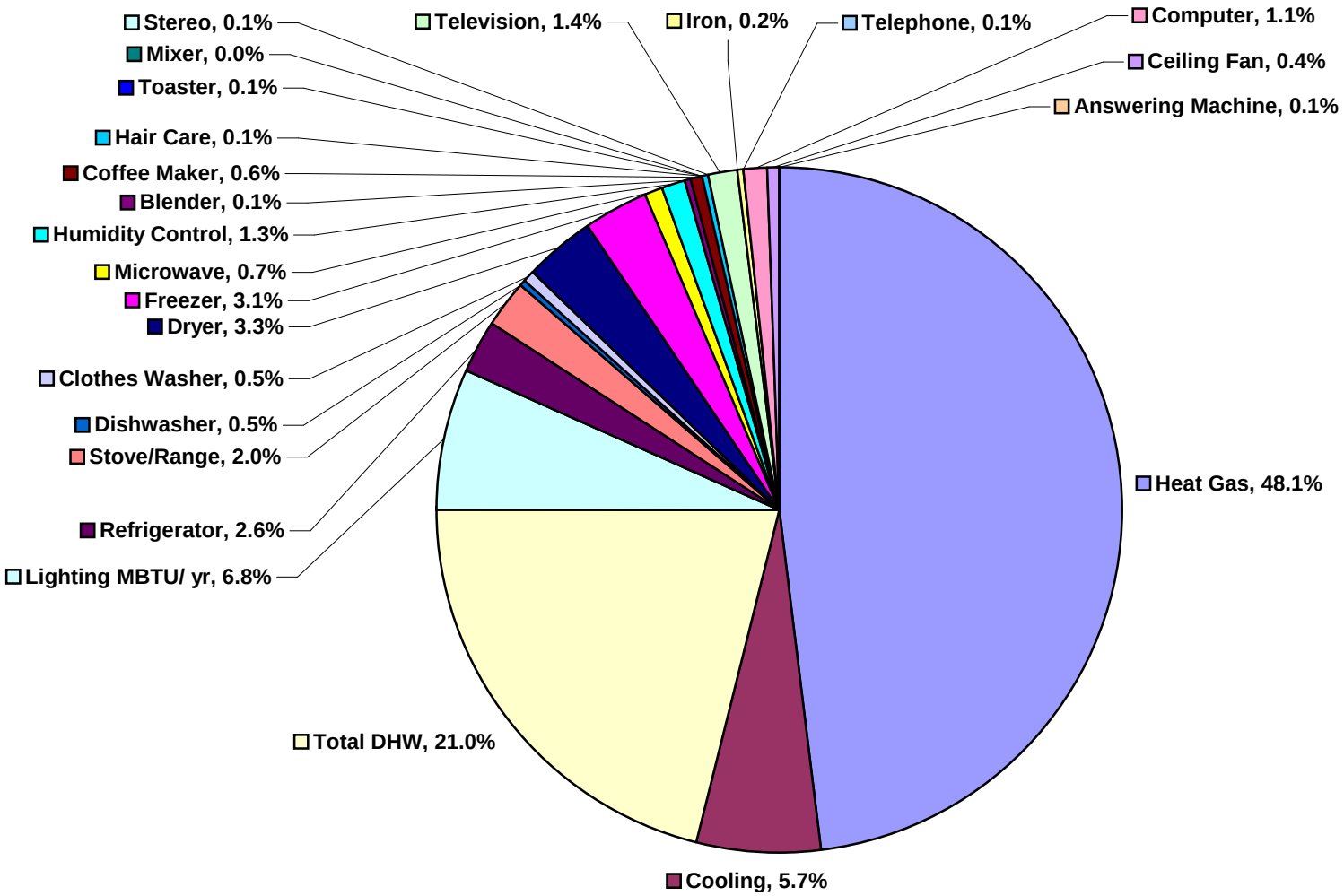
Factors That May Not Remain Constant:

- Schedules of Use / Occupant Behavior
  - Hours of Operation
  - Thermostat Setpoints
  - Hot Water Setpoints
  - Additional end uses
- Geographic factors
  - Weather Conditions

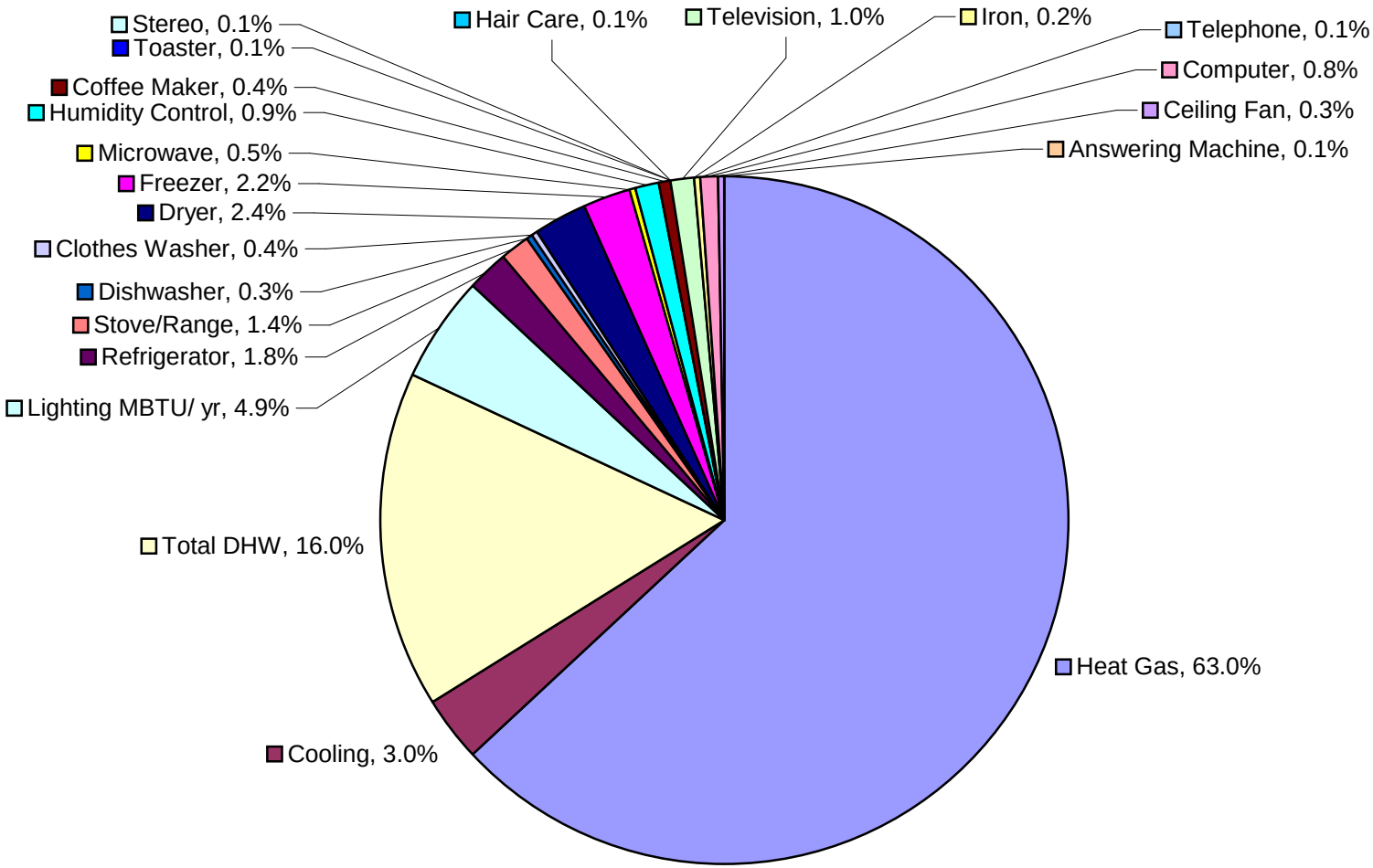
Sample Consumption - Houston



Sample Consumption - Baltimore



Sample Consumption - Minneapolis



Potential Impact of Behavior

Category	Variations Considered	Absolute Impact		
		Houston	Balt.	Minn.
Thermostats	Setpoints	46%	41%	39%
Lighting	Fixture quantity and % fluorescent lighting	26%	16%	10%
Freezers	Equipment efficiency and quantity	12%	7%	4%
Refrigerators	Equipment efficiency and quantity	10%	6%	3%
Cooking Range	Burner efficiency and hours of use	8%	5%	3%
Dishwashers	Equipment efficiency and annual wash cycles	7%	7%	6%
TV/DVD	Equipment efficiency and annual hours of use	6%	3%	2%
Clothes Washer	Equipment efficiency and annual wash cycles	5%	4%	3%
Computers	Equipment efficiency and annual hours of use	4%	3%	1%
Microwaves	Equipment capacity and quantity	3%	2%	1%
Telehphones	Equipment efficiency and annual hours of use	3%	2%	1%
Ceiling Fans	Equipment efficiency and quantity	2%	1%	1%

Some Key Evaluation Questions

- To what extent do you account for varying behavior, including the influence of occupants on comfort settings, and use of plug loads?
- To what extent do you account for variations in weather conditions?
- Treating these issues on a portfolio basis can help overcome variability issues…but some policies want building-level data reporting

How Are Emissions Reductions Quantified?

- No standard “carbon meter” defined for buildings
- Energy savings must be determined first
- Then energy can be converted into carbon using an intensity factor
- However, intensity factors vary:
  - By emissions type (direct vs. indirect)
  - For indirect, by
    - generation method
    - generation period

Intensity Varies by Emissions Type

- Site Fuel Combustion Produces Direct Emissions
- Site Electricity Use Causes Indirect Emissions

Residential Emissions Intensity by Fuel Type

(Gg CO_2-eq. / PJ)

Fuel Type	Emissions Source	Intensity
Natural gas	Direct	51
LPG	Direct	60
Lighting kerosene	Direct	69
Heating oil	Direct	70
Black coal	Direct	90
Electricity	Indirect	234

Intensity Varies by Generation Source

- Electricity Can Be Generated by Different Fuels

Emissions Intensity for Electricity Produced by Various Fuel Types

(Gg CO_2-eq. / PJ)

Brown coal	345
Black coal	255
Gas	157
Biomass	0
Other renewable/ hydro	0

Intensity Varies by Generation Period

- Time of Generation Impacts Emissions Intensity

Emissions Intensity for Electricity Produced At Varying Times

(Lbs CO_2 / MW)

Broad Peak	Winter Peak	2,027
	Winter Off-Peak	2,287
	Summer Peak	1,788
	Summer Off-Peak	2,233
Narrow Peak	Winter Peak	n/a
	Winter Off-Peak	2,076
	Summer Peak	1,476
	Summer Off-Peak	2,073
Shoulder Scenario	Shoulder Peak	2,186
	Shoulder Off-Peak	2,269
	Non-Shoulder Peak	1,945
	Non-Shoulder Off-Peak	2,260

Modeling Hourly CO2 Emissions

- Emissions can be modeled for specific efficiency measures and programs:
  - TX--TAMU Energy Systems Laboratory combined hourly DOE-2 building simulations with EPA's eGRID emissions data, to estimate hourly emissions impacts
  - CA--E3 has developed a methodology that similarly ties in with eGRID to produce time-dependent emissions impacts
  - WI--Similar work conducted in Wisconsin for Focus on Energy program

Other Questions on Savings

- How do you quantify consumption for fuels that are not metered? Eg. biomass—how “green”?
- To what extent do you tie buildings to specific generation sources? Over what time period?
  - Today’s generation mix/dispatch sequence may not be the same in 2, 5, 10, 20 years or more
  - Yet we want to project energy savings and carbon reductions over the life of efficiency measures

Other Key Evaluation Issues

Measurement and verification rules can vary widely in stringency and cost

- For homes, key issues include:
  - Portfolio vs. building level approach
  - Deemed savings vs. measured savings
- Additionality rules matter:
  - Financial—
  - Regulatory—code/standards baselines
  - Market—eg. eligible measures < X% market share
- Challenge is to balance accuracy and cost

The Bottom Line: "What's it Worth to you?"

The value of carbon credits ultimately determine markets' willingness to pursue EE-based credits

For example: If we value of savings at:

- $3.51/ton (current RGGI price) = .27 cents/kWh
  - = $2.70 per 1000 kWh
- $17/ton (current EU price) = 1.3 cents/kWh
  - = $13.00 per 1000 kWh
- $50/ton (robust price) = 3.85 cents/kWh
  - = $38.50 per 1000 kWh

How Climate Policy Might Engage EE—or not

Policy Design Can Limit EE's Ability to Play in Carbon Markets

- Cap and trade the most likely policy paradigm
- Setting caps "upstream" means indirect reductions (like EE) won't be directly marketable
- Allowance holders will be "upstream" in energy markets, and traders won't buy indirect reductions without a dedicated mechanism

Policy Design Can Get Around the Indirect-Reductions Problem

- Within climate policy design:
  - Allocate allowances to parties that will use them for EE purposes (eg. Lieberman/Warner bill)
  - Auction allowances and use the proceeds for EE investment (eg. RGGI states)
  - Create set-asides for EE (eg. SO2, NOx programs)
  - Allow use of EE for offsets (eg. RGGI)

Policy Options Pros and Cons

- Allocations—simple to administer, hard to control
- Auctions—not simple to administer, but easier to control
- Set-asides—history shows them to be weak
- Offsets—depends on the geographic and technical scope of the cap and trade system, and can be complex to administer

Hybrids to the Rescue: Climate and Energy Policies

- Complementary energy policies work outside the cap and trade system, but advance its goals and reduce its costs
- Examples include:
  - Building codes
  - Appliance standards
  - Utility EE resource standards
  - Utility public benefits funds
  - Rating/labeling/benchmarking

It's Already a Hybrid World

- RGGI
  - States auctioning 100% of allowances, using much of proceeds for EE
  - Most RGGI states have complementary policies
- CA AB 32
  - Scoping plan shows ~80% of CO2 reductions from complementary policies
- Congress
  - Recent bills auction % of allowances, allocate allowances to states and utilities for EE, and include building codes provisions

How Can ENERGY STAR® Partners Participate in a Climate Policy Future?

Catch the Climate Dollars

- Allocation and auction funds, flowing from:
  - State and regional programs
  - Federal legislated program
- Participate in offset markets where they exist—e.g. RGGI non-electric building EE
- Learn (or become!) the key entities that will be programming climate dollars
- Propose and support programs that use building performance rating methods, and that calculate carbon emissions

Energy Efficiency Resource Standards

- EERS in place or emerging in ~20 states
- Waxman bill introduced this year would set national EERS of 15% by 2020
- RPS bill could also incorporate EE as a defined resource, as in NV or CT
- Pressure to enable third-party credit systems is growing
- Building efficiency measures could be aggregated into marketable “white tags”
- Limited white tag transactions in CT, NV
- More action in Europe—possible future link with EU building labeling program

Rating/Labeling/Benchmarking

- States and localities beginning to mandate rating/benchmarking, at time of sale or otherwise
  - CA, NV, Austin, DC
- Fannie Mae and Freddie Mac, under federal control again, may emerge with newer and better EEM programs
  - Fannie developed a carbon emissions calculation tool
- Carbon disclosure for new and/or existing buildings could become a requirement—fed/state/local?

Building Codes: Today

- IECC becoming more performance-oriented
  - Duct sealing, air sealing in 2009 version
- States, code officials, builders may turn to utilities and others to provide technical services for compliance
- Beyond-code programs booming, and most require ratings of one kind or another
- Stimulus grants to states contingent on adoption of latest codes, PLUS plan for 90% compliance within eight years

Building Codes: Tomorrow

- Longer term question: what is the role of utilities in reducing new building connections' energy and carbon footprints?
  - Builders historically bore costs of code compliance
  - Utilities ran voluntary, beyond-code programs
  - Some states are pushing code performance levels towards zero-energy-performance
  - Congress debating 50% increase in code stringency
  - Who administers/who pays in a ZEB future?
  - Measuring the carbon footprint of new buildings could become a code requirement

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