ICF INTERNATIONAL

It's 2020: Are You Capping & Trading Your Carbon Footprint Yet?

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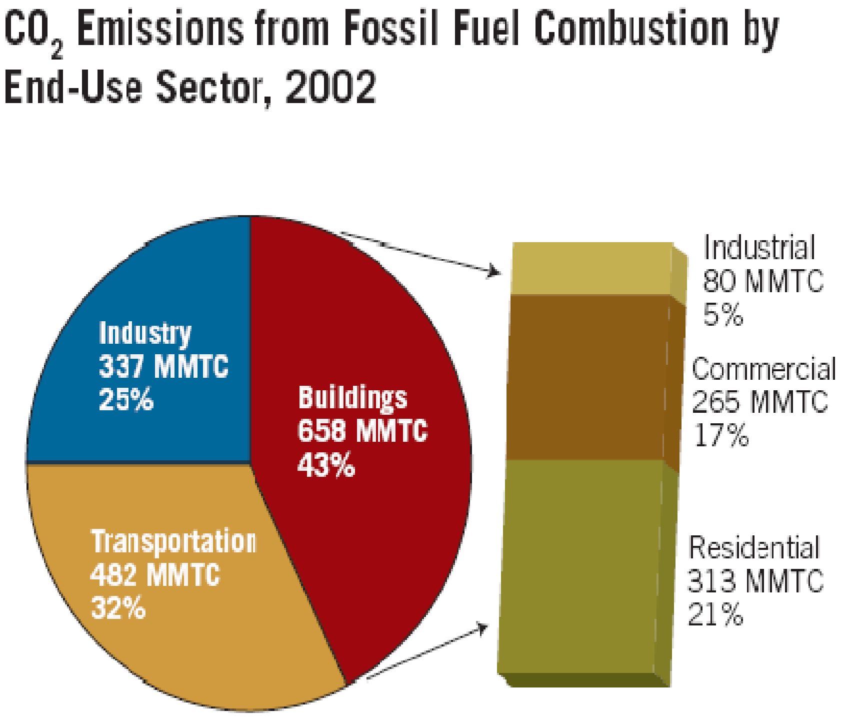
Carbon Footprints in a Nutshell

- Buildings consume energy
- The energy consumed is either generated on-site or off-site
- Most energy produces emissions when it's generated
- The amount of emissions produced depends on where, when, and how the energy is generated
- The quantity of emissions produced defines the building's carbon footprint

Buildings As a Whole Have a Large Carbon Footprint



Source: Pew Center on Global Climate Change, Towards a Climate Friendly Built Environment

Two Key Considerations

- 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:

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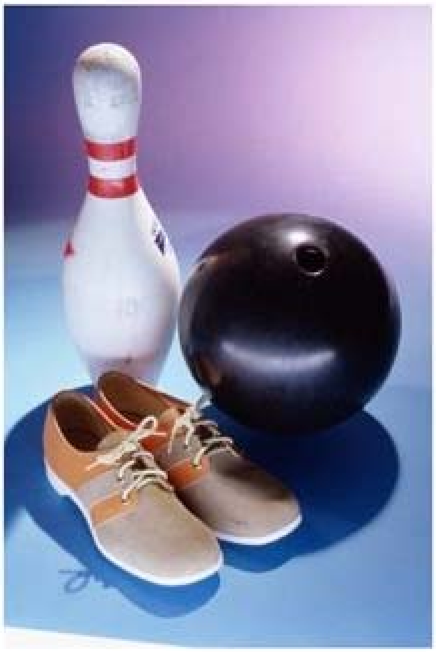


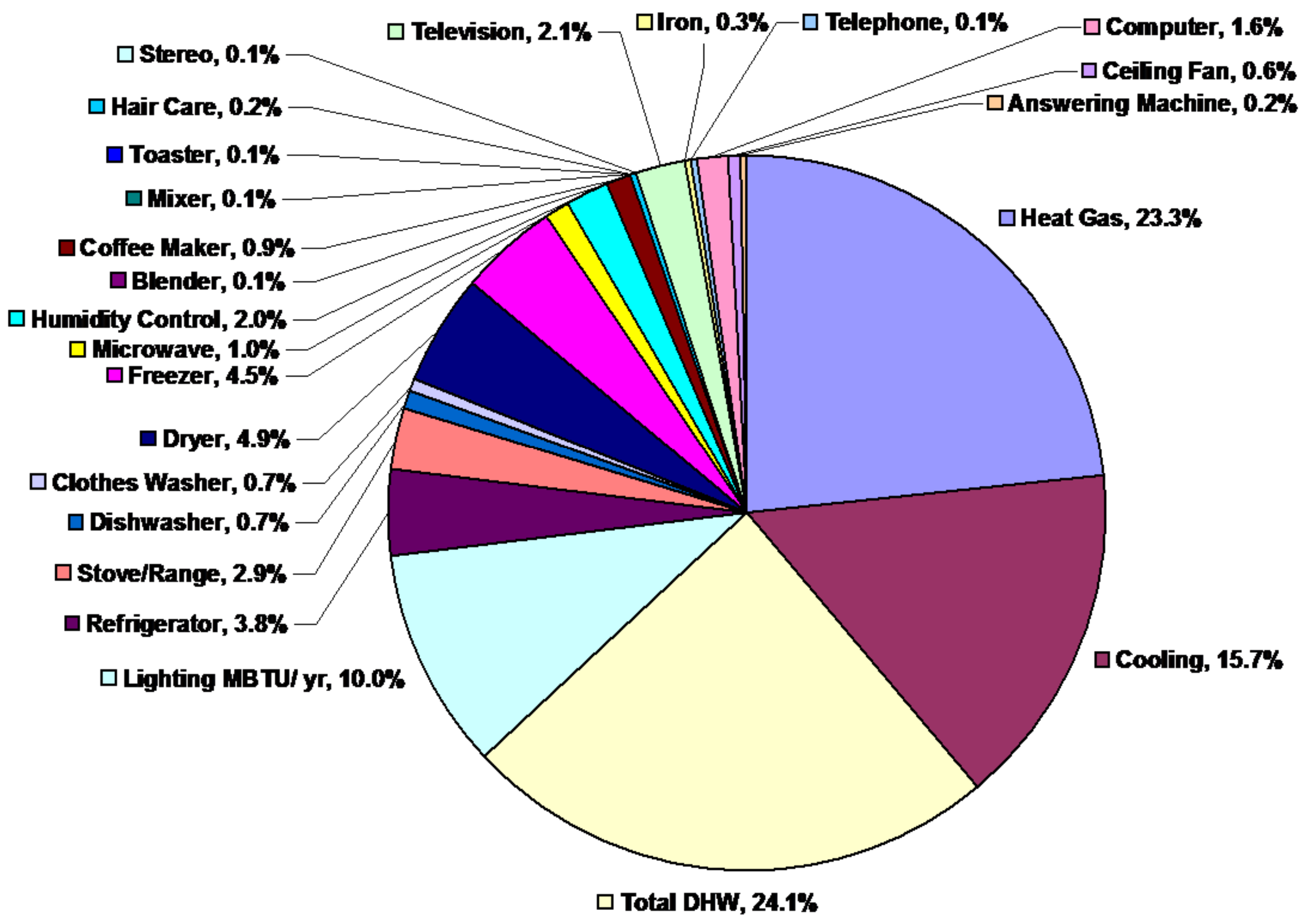
Factors That Impact Footprint

- Some Factors Are Constant for a Given Building
- Architectural Characteristics
  - Building Size
  - Number of Stories
  - Foundation Type
  - Window Area
- Energy Efficiency Features
  - Insulation Levels
  - Equipment Efficiency
  - Infiltration

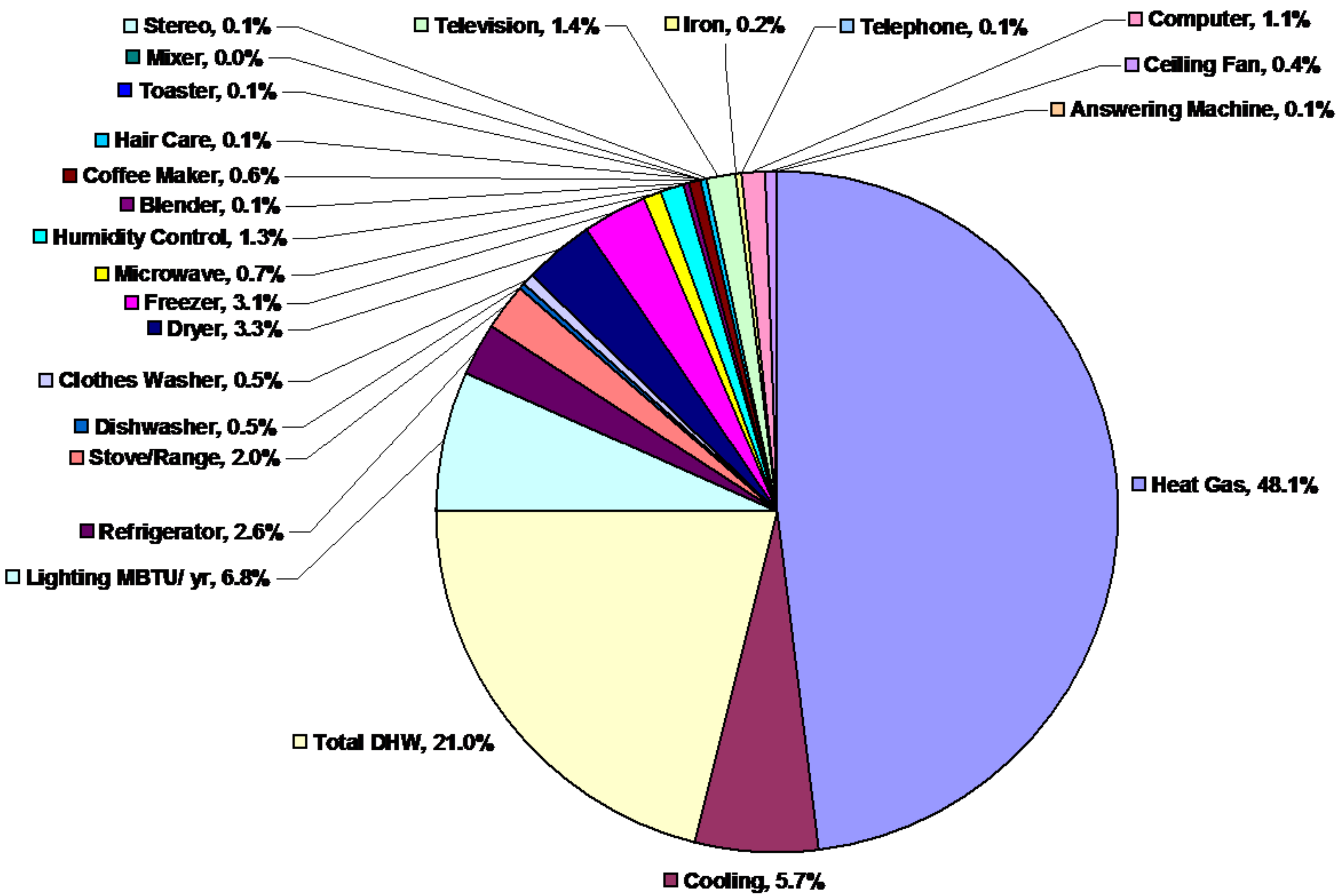
Factors That Impact Footprint

- Some Factors Are Not Constant
- Schedules of Use / Occupant Behavior
  - Hours of Operation
  - Thermostat Setpoints
  - Hot Water Sepoint Temperature
- Geographic Location
  - Weather Conditions

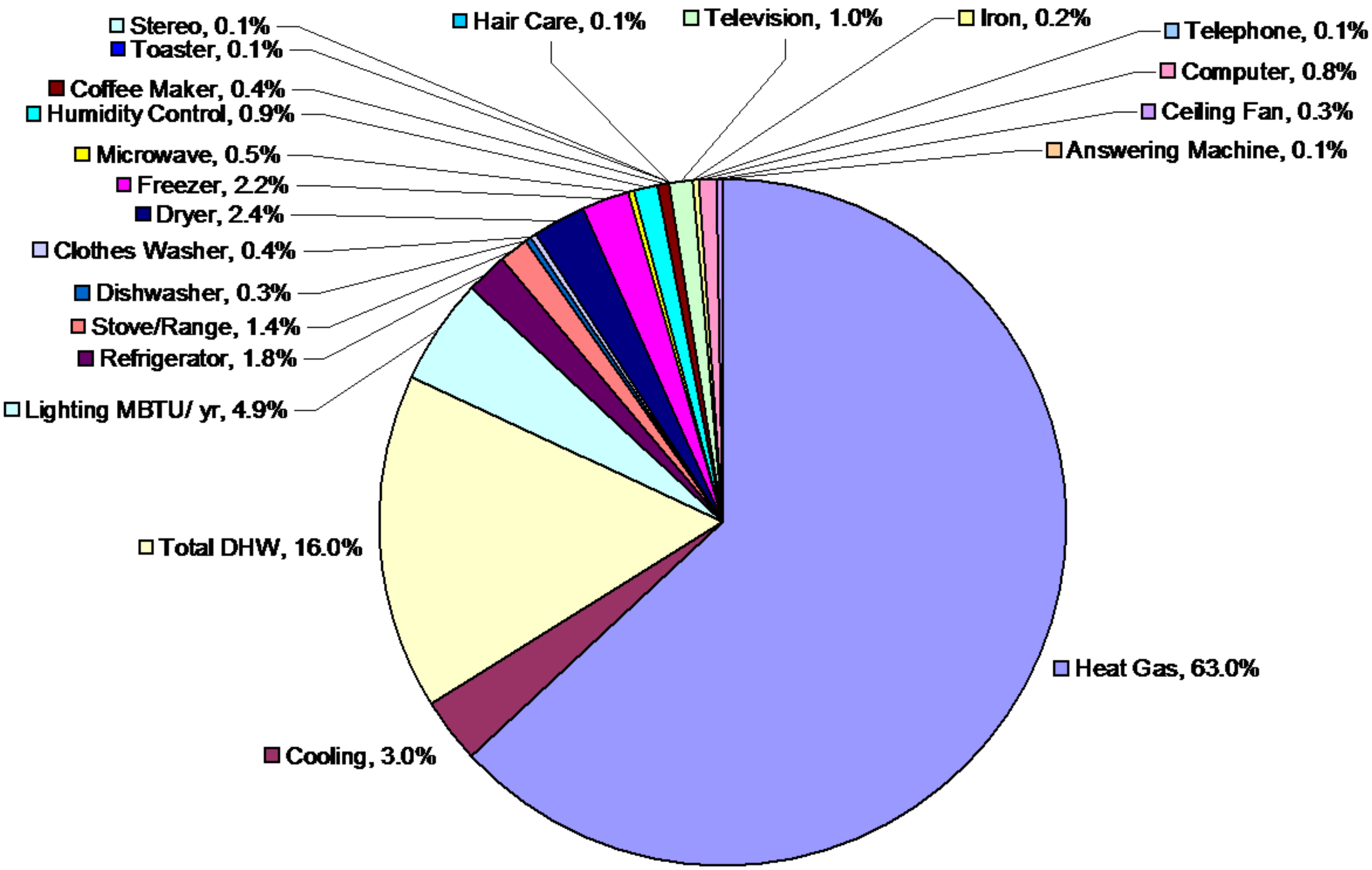
Sample Consumption - Houston



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 Questions on Baseline

- To what extent do you account for varying behavior, including the influence of occupants on plug loads?
- To what extent do you account for variations in weather conditions?

How Are Emissions Reductions Quantified?

- No “carbon meter” used in buildings yet
- Energy savings must be determined first
- Then energy can be converted into carbon using an intensity factor
- However, intensity factors vary:
  - By fuel location (direct vs indirect)
  - For indirect, by generation method
  - For indirect, by generation period

Intensity Varies by Fuel Location

- Fuel Combustion On-site Produces Emissions
- Electricity Consumption On-Site Results in Offsite Emissions Production

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 Many 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 Can Impact 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

Intensity Varies by Generation Period

- Energy Systems Laboratory has used hourly output from DOE-2, combined with EPA's eGRID emissions database to estimate time-dependent emissions impacts
- E3 has developed a methodology in CA that similarly ties in with eGRID to produce time-dependent emissions impacts

Some Key Questions on Savings

- How do you quantify consumption for fuels that are not metered?
- To what extent do you tie buildings to specific generation sources? Over what time period?

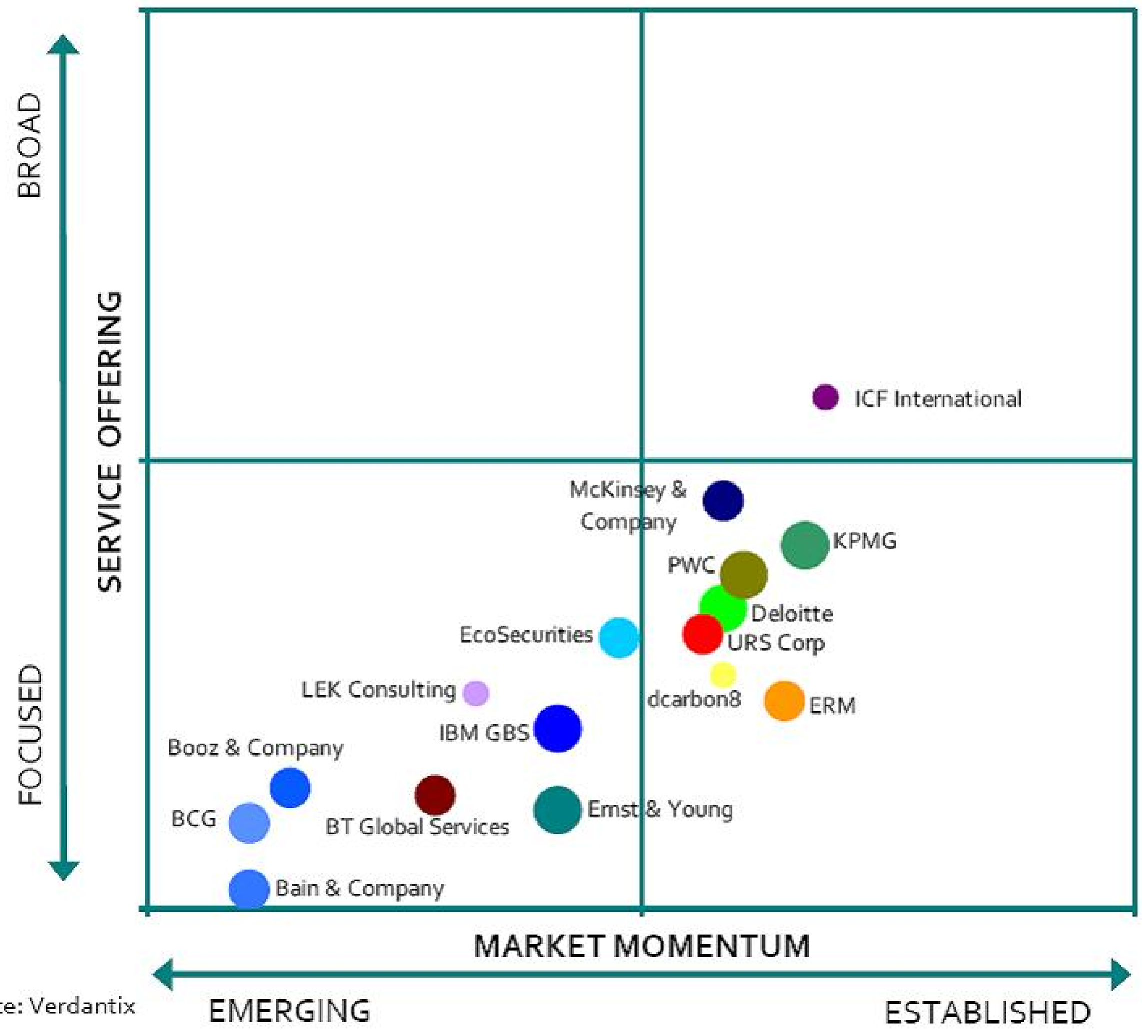
Climate Policy and EE Overview

- About ICF and our climate/energy practice
- How efficiency reduces CO2 emissions—or not
- How climate policy might engage EE—or not
- Hybrid policy solutions that can engage EE effectively
- How RESNET members and others in the building performance business can position themselves to profit in a climate policy future

ICF does climate as well as EE

July 2008 survey of corporate carbon consultancies

VERDANTIX



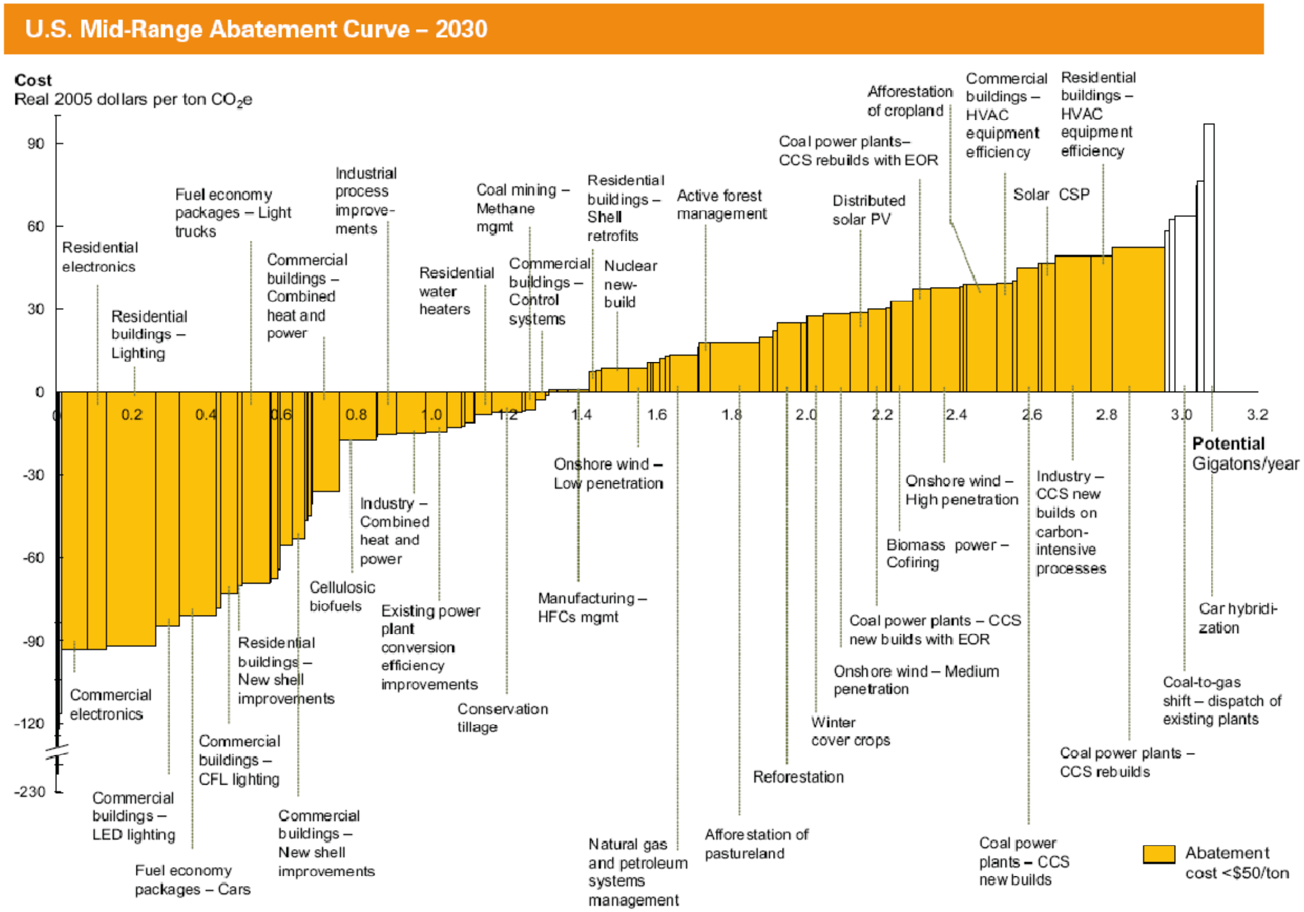
Source: Verdantix

ICF EE and Climate Clients:

- Federal agencies like EPA on energy efficiency (ENERGY STAR), and air quality and climate policy
- Electric and gas utilities and other energy industry companies, implementing efficiency programs
- State and local governments on energy seeking to meet environmental challenges
- State initiatives like the Regional Greenhouse Gas Initiative and the Western Climate Initiative
- Corporate clients looking to develop business-friendly sustainability strategies, from Yahoo and Ebay to BP and Rolls-Royce

How Efficiency Reduces CO2 Emissions….or not

Potential Studies Show Large CO2 Impacts of EE Technologies



Source: McKinsey analysis

Note: The McKinsey report only examines a scenario through 2030. NRDC recommends a goal of 80 percent emissions reductions by 2050.

Potential Studies Limitations

- Studies look only at technology and cost, not market structure or policy design
- In electricity markets, EE technologies provide indirect reductions
- CO2 impacts of electric EE depend on marginal generation emission factors
- Timing matters—saving energy in a given hour may not reduce emissions over an annual compliance period

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

Fortunately, there are Policy Solutions

- Within climate policy design:
  - Allocate allowances to parties that will use them for EE purposes
  - Auction allowances and use the proceeds for EE investment
  - Create set-asides for EE
  - Allow use of EE for offsets

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 CO_2 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 RESNET Members Profit in a Climate Policy Future?

Catch the Climate Dollars

- Allocation and auction funds, flowing from:
  - State and regional programs
  - Federal legislated program
- Learn the key state entities that will be programming climate dollars
- Propose and support programs that use building performance rating methods

Energy Efficiency Resource Standards

- EERS in place or emerging in ~20 states
- Markey 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, though more bilateral tradable commodity

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 workable EEM programs

Building Codes

- IECC becoming more performance-oriented
  - Duct sealing, air sealing in 2009 version
- Code officials and builders may turn to RESNET 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

Rating Methods

- Can/should RESNET integrate carbon calculations into rating standards or allied methods?
  - Complexity—average vs. marginal
  - Relative vs. absolute
  - Additionality

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