Science, Society, and Sustainable Economic Growth

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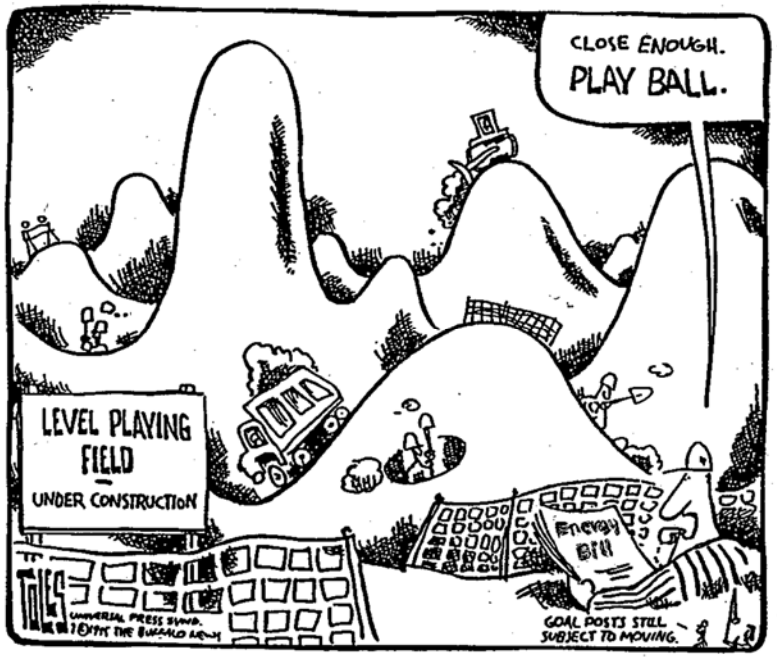
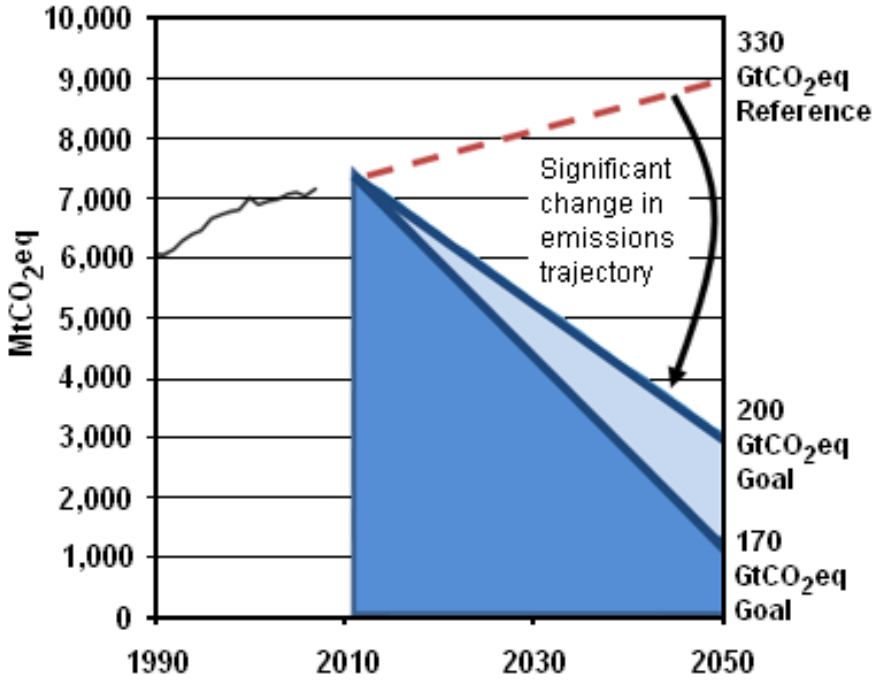


U.S.–European Summit
Washington, DC
September 28, 2010

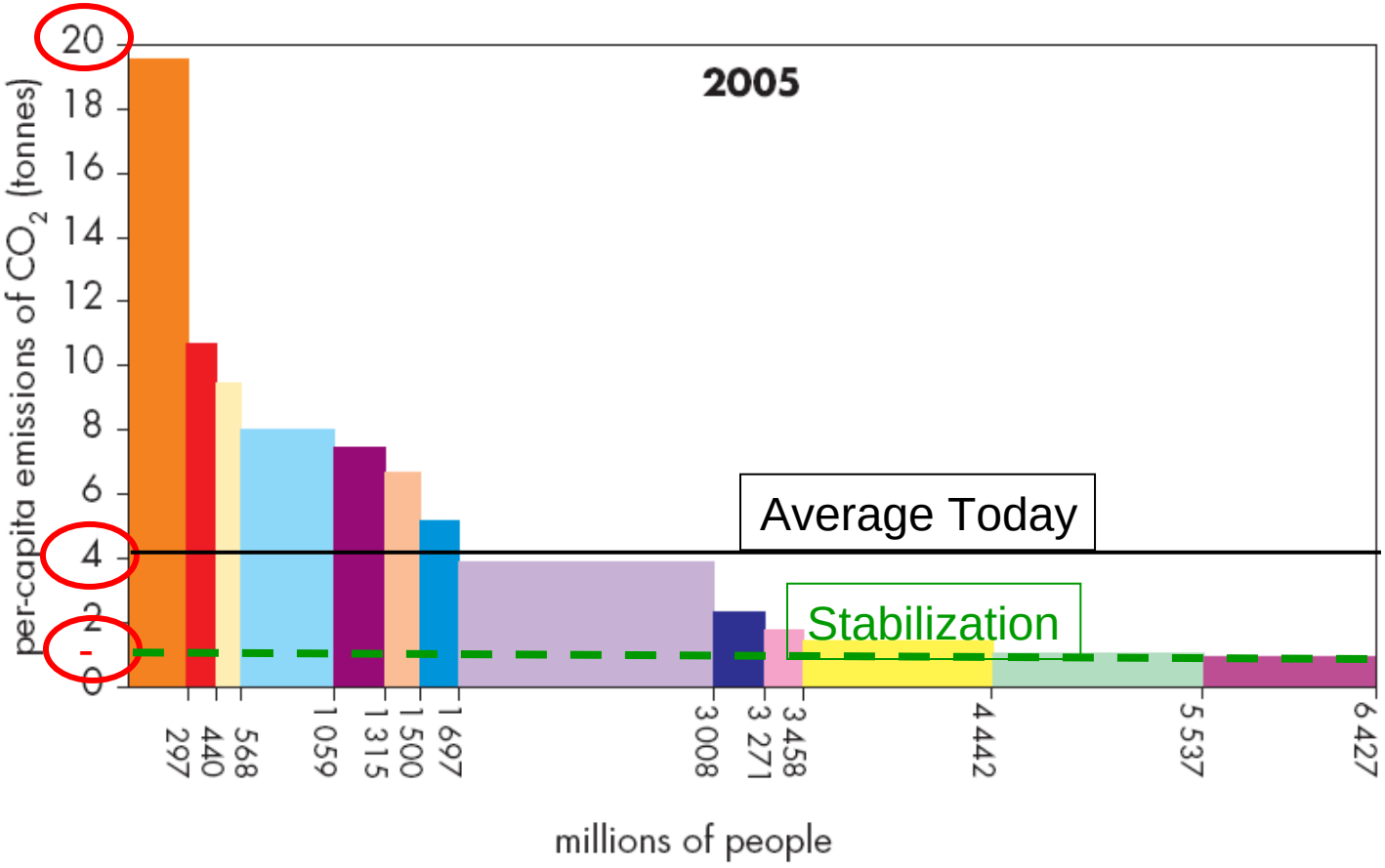
The U.S. Needs to Set a Cumulative GHG Emissions Budget

The National Academies report – "Limiting the Magnitude of Climate Change" – offers a representative range of: 170–200 gigatons (Gt) of CO_2-eq for 2012–2050.

Business-as-usual emissions would consume these budgets well before 2050; thus, the case for URGENCY.



The emissions of the rich eventually must equal the emissions of today's poor



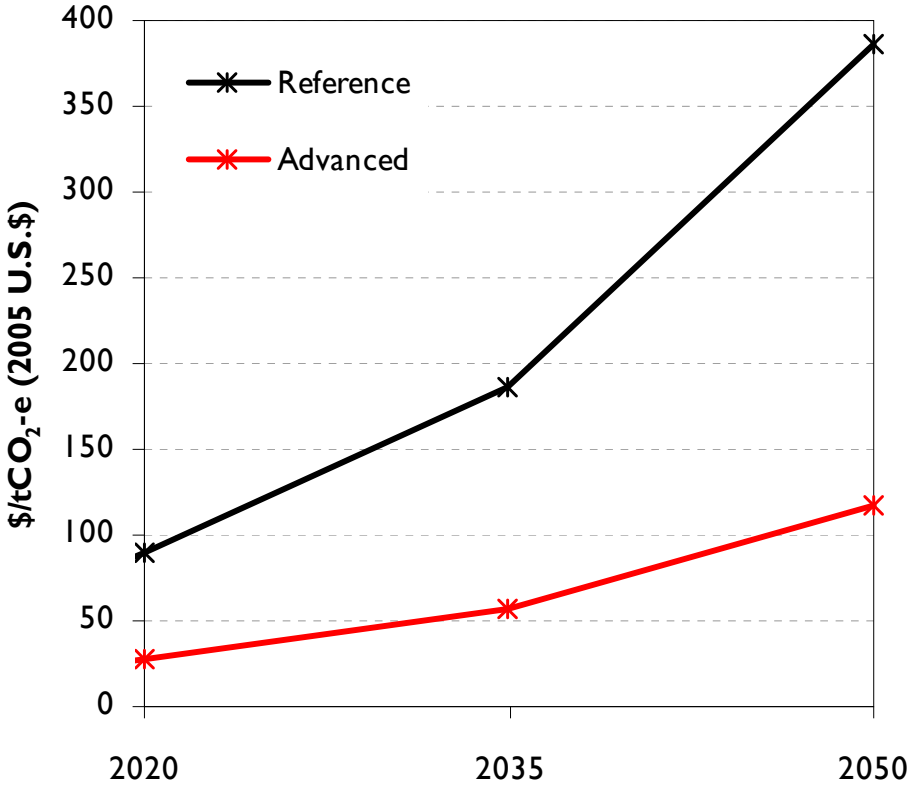
Source: IEA WEO 2007 and Socolow (2009)

Value of Sustained R&D

Projected price of CO_2 emissions under two technology scenarios:

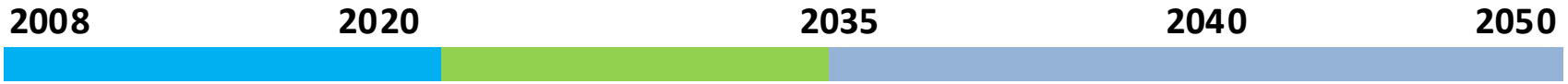
<u>REFERENCE CASE</u>: continue historical rates of technology improvement

<u>ADVANCED TECH</u>: more rapid technological change



The availability of advanced technologies can greatly reduce the cost of emission reductions

*"The deployment of existing energy-efficiency technologies is the nearest-term and lowest-cost option for moderating our nation's demand for energy, especially over the next decade."**



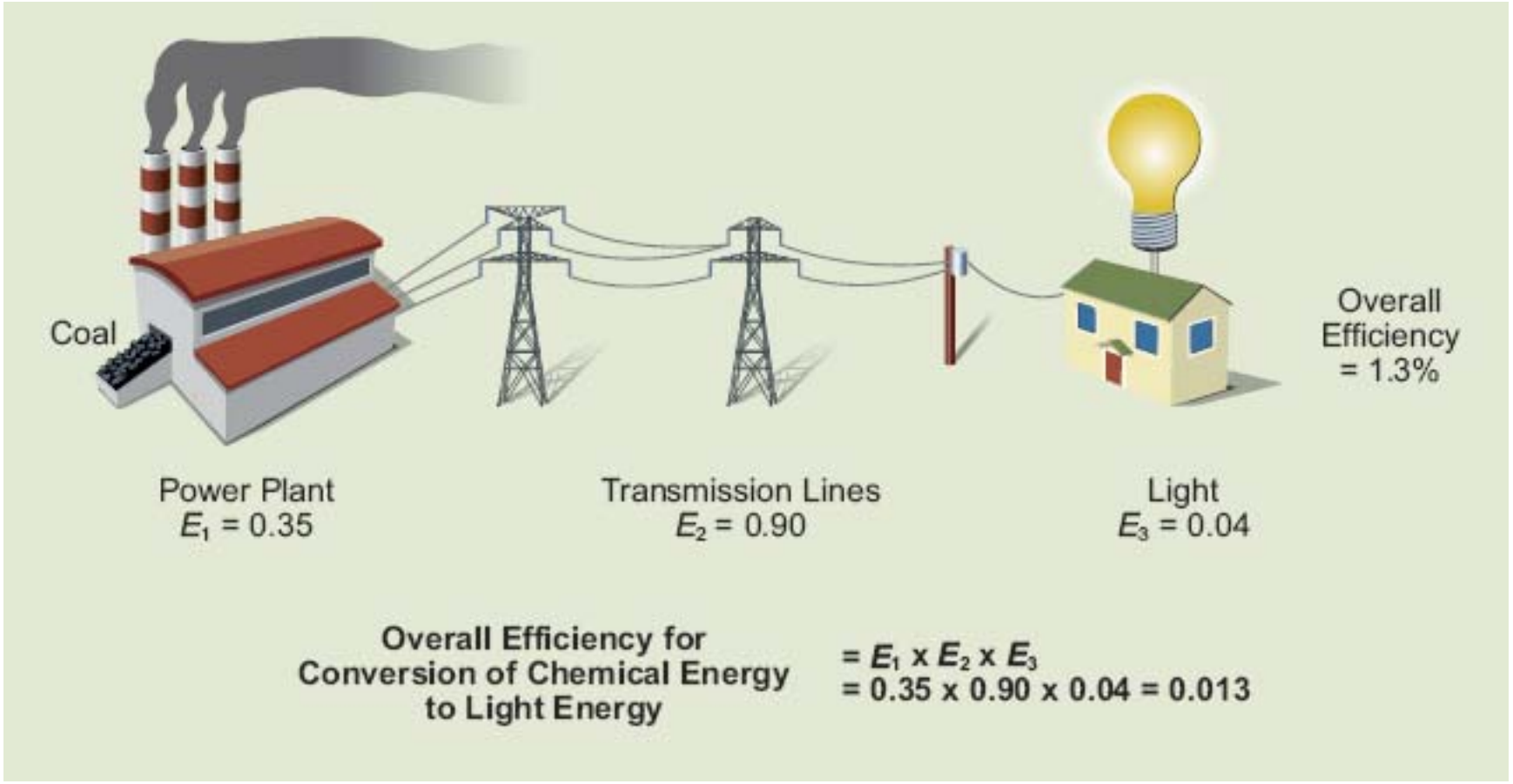
15 Percent (15-17 Quads) by 2020

30 Percent (32-35 Quads) by 2030

NOTE: Even greater savings would be possible with more aggressive policies and incentives.

**Finding of the National Academies of Science's America's Energy Future: Energy Efficiency Potential*

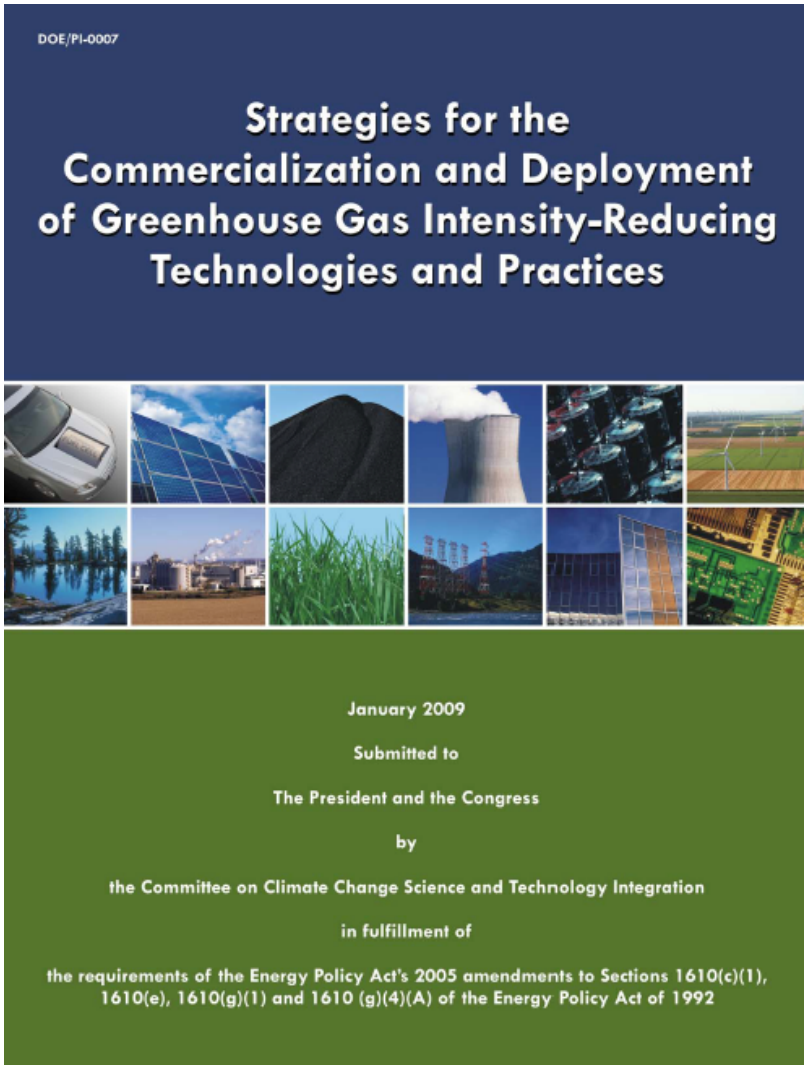
The U.S. Energy System is Highly Inefficient



Source of calculations: Suplee, Curt, Allen Bard, Marilyn Brown, Mike Corradini, and Jeremy Mark. 2008. "What you Need to Know About Energy," National Academy of Sciences, http://sites.nationalacademies.org/energy/Energy_043338

NPV-positive investments in energy efficiency face numerous barriers.

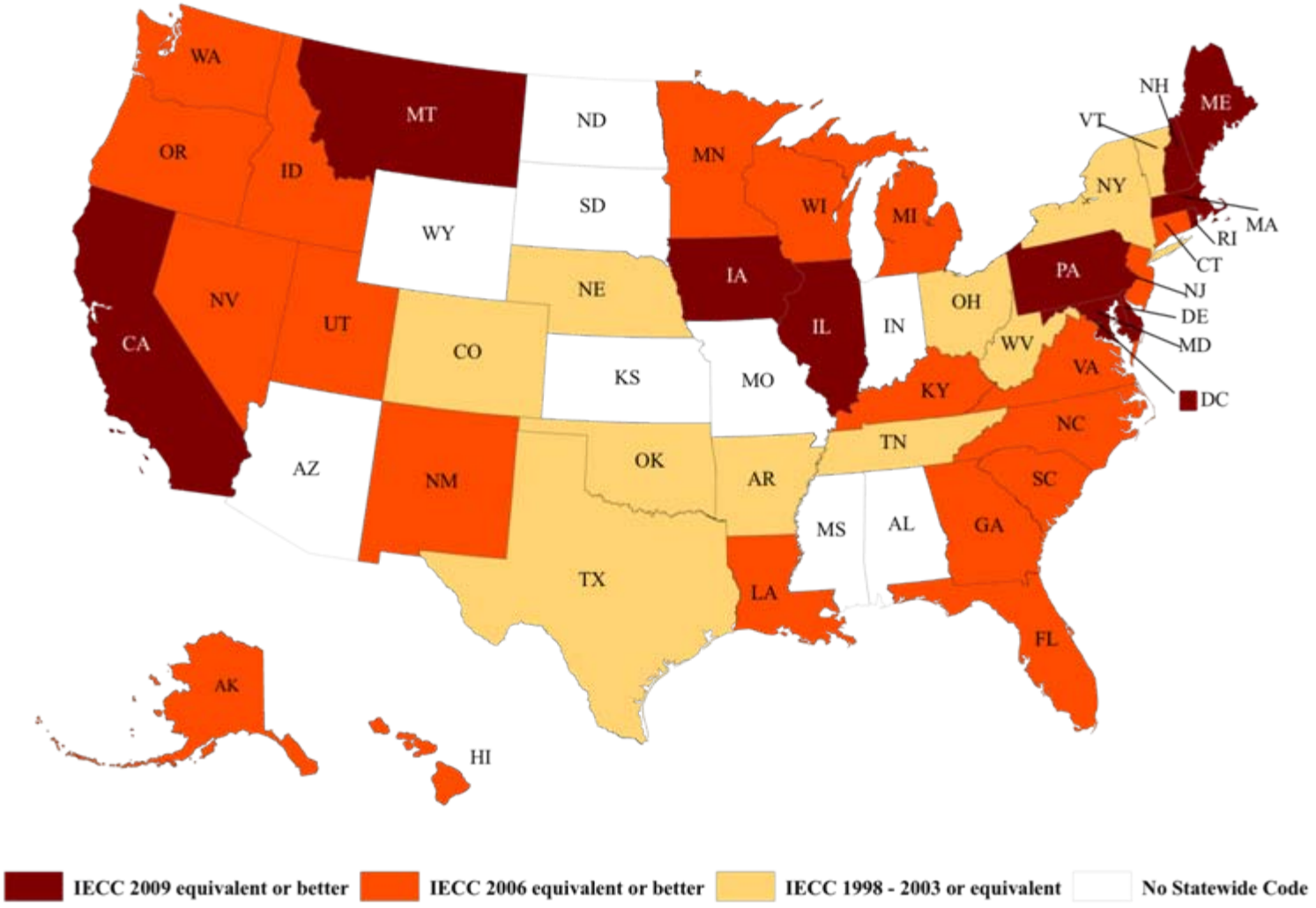
This report has an excellent description of these (www.cliimatetechnology.gov)



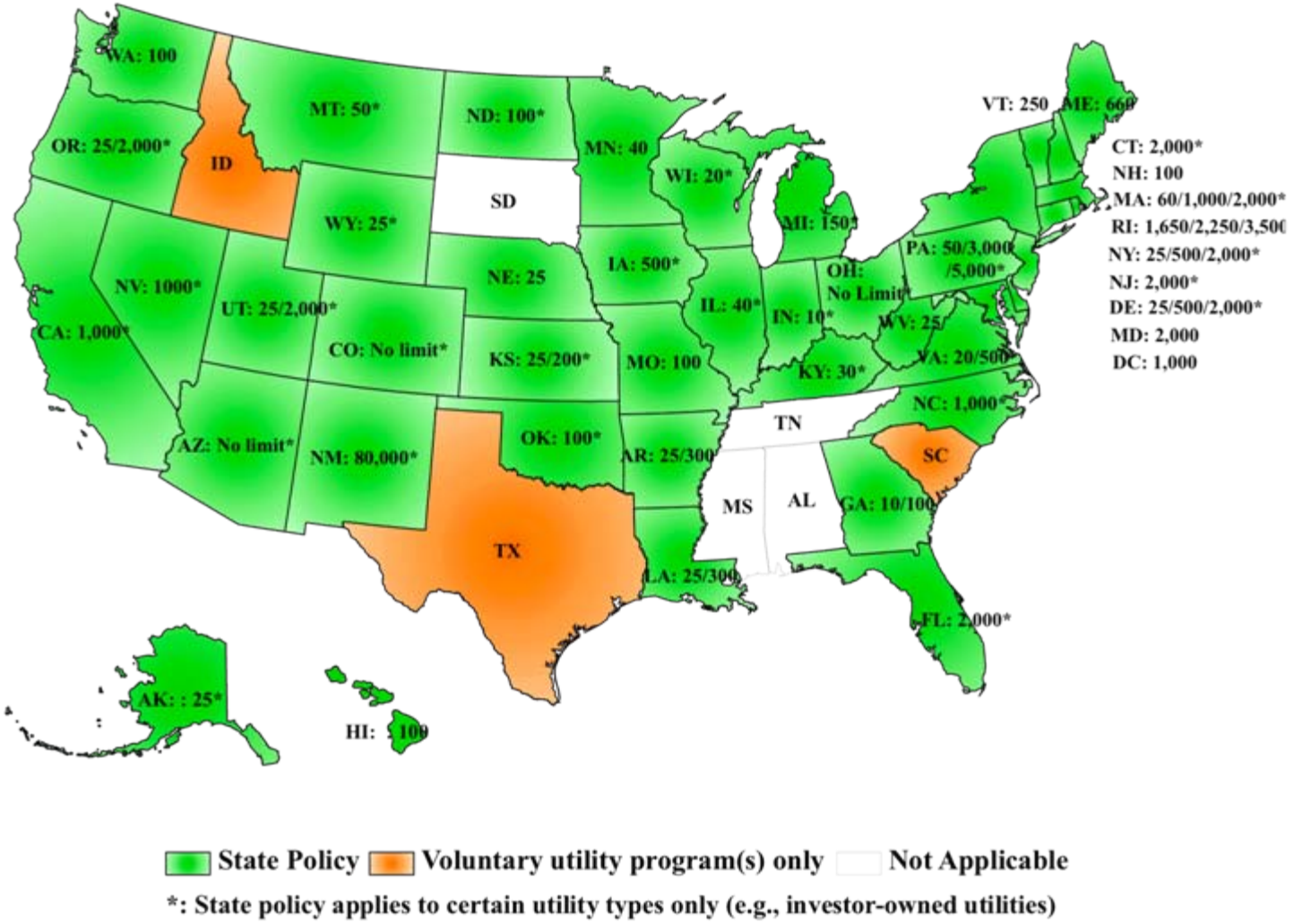
For further details, see:

Brown, Marilyn A. and Sharon (Jess) Chandler, 2008. "**Governing Confusion**: How Statutes, Fiscal Policy, and Regulations Impede Clean Energy Technologies," *Stanford Law and Policy Review, (19) 3: 472-509.*

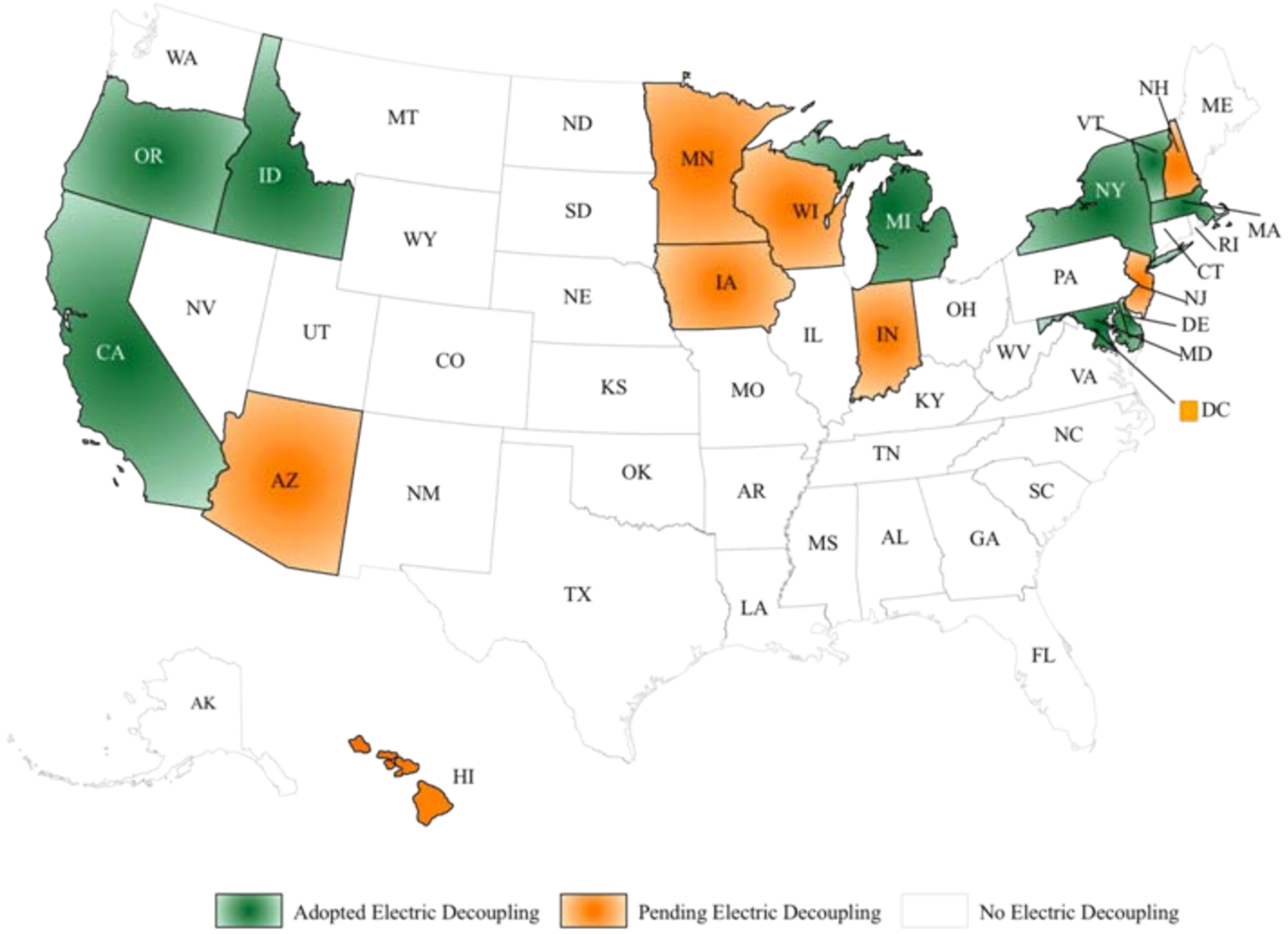
State Building Codes: A Chaotic Policy Landscape



Net Metering: Variable and Limiting

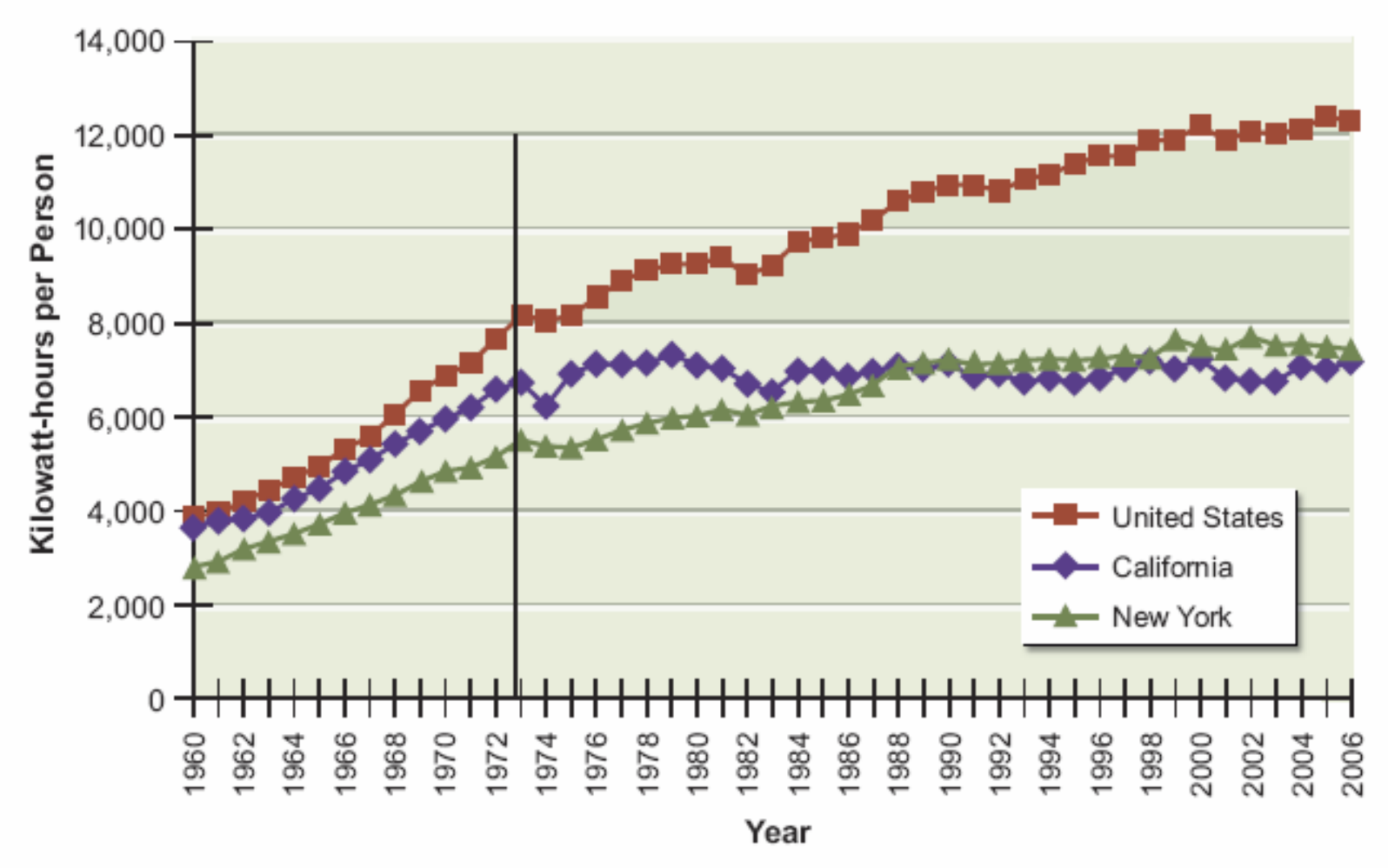


Electricity Decoupling: Utility Profits Remain Tied to Electricity Sales

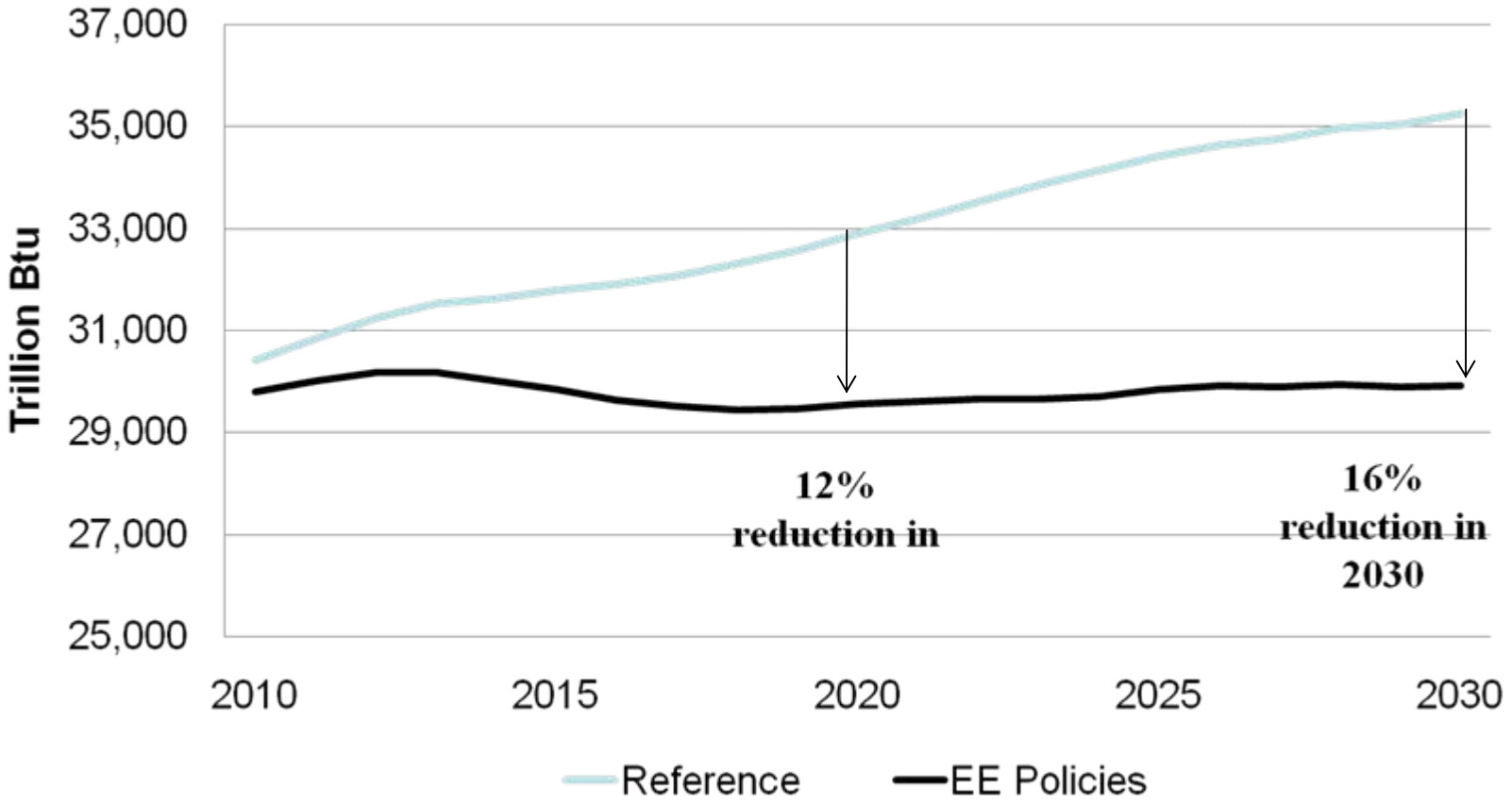


State Policies Can Make a Difference

Per capita electricity consumption in California, New York, and the United States, 1960–2006 – But what about the rest of the country?



Primary Energy Consumption Projections (RCI Sectors) in the South



Source: Brown et al 2009, “Energy Efficiency in the South”, www.SEEAlliance

Energy Efficiency Metrics are Favorable

Economic and Employment Impacts of Energy-Efficiency Policies in the South

	2020	2030
Annual Energy Savings (billion $2007)	$40.9	$71.0
Annual Public and Private Investment (billion $2007)	$15.8	$22.4
Annual Increased Employment (in FTEs)	380,000	520,000
Additional Gross Regional Product (billion $2007)	$1.23	$2.12

Historic Energy/Environment Regulatory Focus on Industry

- Since the explosion of environmental regulation in the early 1970s, policymakers have focused most regulatory prescriptions on large industrial sources.
- Thus, controlling emissions from cars = adoption of fuel economy standards for manufacturers.
- Controlling emissions from residential electricity use = regulating the building industry + rate reform for utilities.

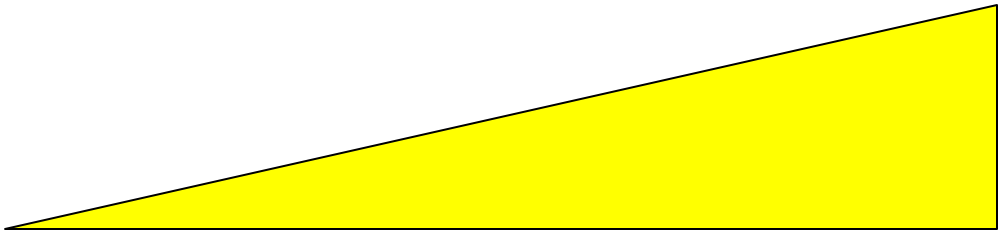
Yet Consumers are Increasingly the Driving Force of Domestic Energy/Carbon

- Schipper, et al. (1989) = 45-55% of energy use
- Vandenergh and Steinemann (2007) = 32% of carbon emissions
- Bin and Bin, S. and H. Dowlatabadi (2005) = More than 80% of the energy used and the CO2 emitted in the U.S. are a consequence of consumer demands and the economic activities to support these demands.

The Behavioral Wedge

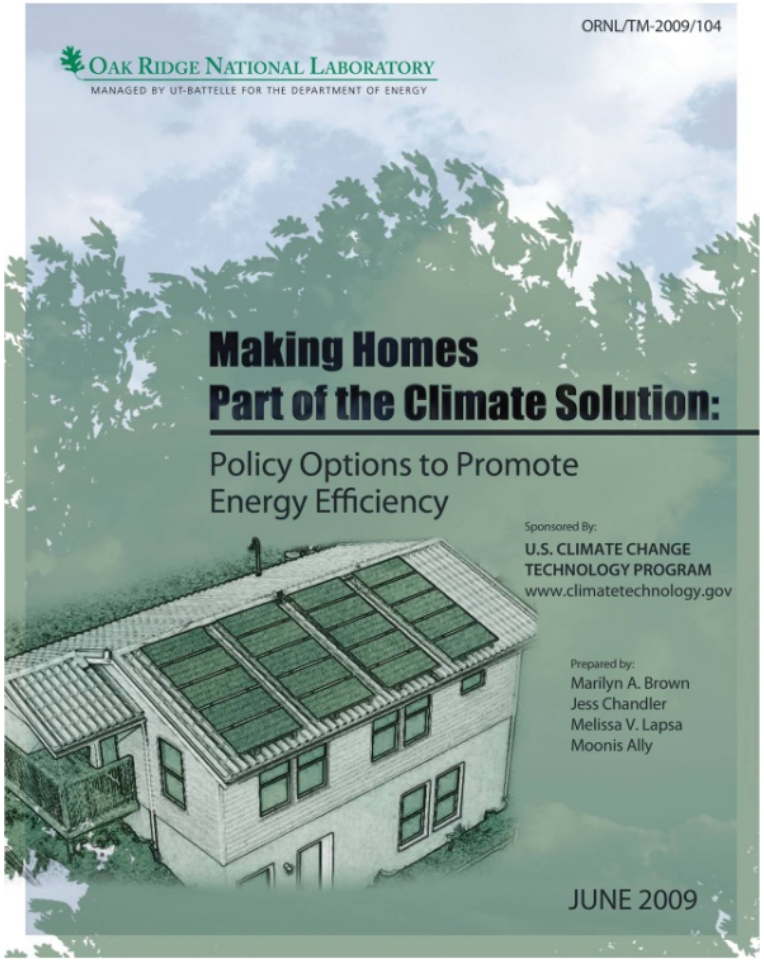
"Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions"

Dietz, T., G. T. Gardner, J. Gilligan, P. C. Stern, and M. P. Vandenbergh. 2009. *Proceedings of the National Academy of Sciences.* http://www.pnas.org/content/106/44/18452.



17 types of household actions can reduce energy consumption with available technology, low cost, and without appreciable lifestyle changes.

Hypothesis: By understanding consumers, we can design better public policies



- Revisit evidence of an “energy efficiency gap” in light of a growing body of recent social and behavioral research.
- Identify promising federal policy options and provide supporting analysis.

www.ornl.gov/btric/pdfs/cctp_rpt_making%20homes_6-09.pdf

The Rational Actor vs Bounded Rationality

If consumers were rational:

- Adoption of energy-efficient technologies and practices would be commonplace because energy costs money, preventing the consumption of other goods.
- Consumers would always choose the more efficient product, all other characteristics being equal.
- Responding to consumer choices, suppliers would improve the efficiency of their products – with demand pulling supply.

Three Key Decision Levers Challenge the Rational Actor

- **Deliberation costs:** consumers reduce the cost of evaluating alternatives by relying on heuristics, copying others, and defaulting to the status quo
- **An aversion to losses:** people strongly prefer avoiding losses to acquiring gains; the "sunk cost" fallacy results in high discount rates and inertia
- **Past experience:** People put greater weight on options grounded in recent experience…personalized information is most important.

Policies to improve residential energy decision-making by decision lever

Decision Lever / Policy Option	Reducing Deliberation Costs	Minimizing the Likelihood of Losses	Linking Actions More Strongly to Outcomes
Mandatory disclosure of home energy performance	**Allows energy information to be included in purchase decision with less cognitive demand than a list of home features**	More efficient homes will save money	Over time, consistent performance information might make its way into the vernacular.
On-bill financing		More efficient homes will save money **Reduced upfront costs allows consideration of full implications of material or equipment selection**	
Smart meters with dynamic pricing	Provides near immediate feedback	Avoiding wasted energy use saves money	**Provides conditioning information to relate decision actions to money or energy**

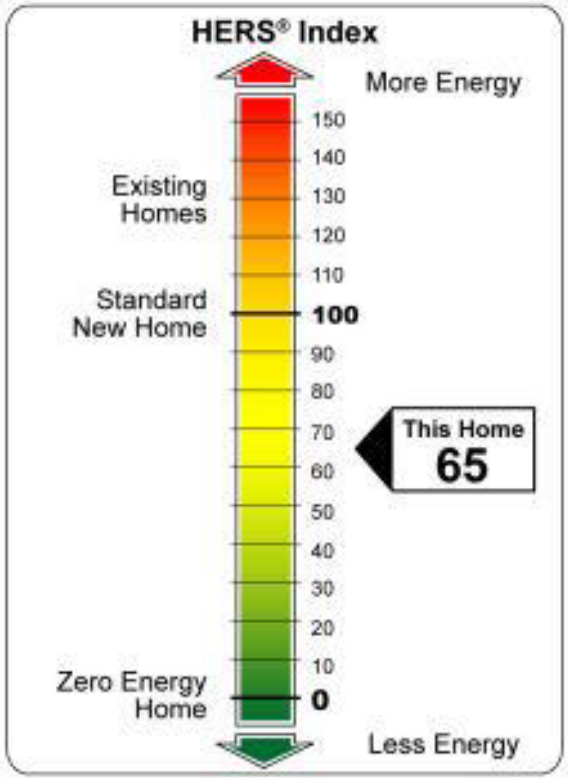
*The bold cells are the principal decision lever targeted by a policy option.

Smart Meters and Dynamic Pricing

- Relates actions to energy use and cost by providing real-time feedback to consumers.
- Ensures that meters using the label “smart meter” have the capability to both “listen” and “talk” preventing market confusion.
- Creates savings immediately following implementation.
- Reduces peak load – avoiding the construction of new plants.

Mandated Disclosure of Energy Performance Information

- Mandated disclosure of energy usage or performance for housing units advertised for resale or rent
- Reduces deliberation costs and addresses *asymmetric information, information gaps,* and *misplaced incentives*
- Encourages demand for more energy efficient homes – leading to improvements in existing building stock



On-Bill Financing

- Addresses risk aversion by “mainstreaming” retrofit financing
- Overcomes the cash-flow barrier confronted by many homeowners and small businesses
- Loans are made by the utility company and are repaid by adding a charge to the utility bill
- A revolving loan fund could extend the positive impact of the Stimulus Bill by many years

Grounds for Optimism

- Carbon emissions have just begun to be priced – “market signals” will spur innovation.

- Most of the 2050 physical plant is not yet built – with growth comes opportunity.

- Our current energy system could be made much more efficient – creating jobs and reducing imports.

✓ Can behavior be changed at acceptable levels of economic and political cost?
✓ Information programs appear to hold promise, but broader social marketing is viewed by many with skepticism.