

# Room for Improvement:

## Increasing the Value of Economic Modeling for Climate and Energy Policy Analysis\*

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*An Update from the November 2006 ACEEE Workshop*

*“Energy and Economic Policy Models: A Reexamination of Some Fundamental Issues”*

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\*Adapted and expanded from Laitner (2006)

# Acknowledgments

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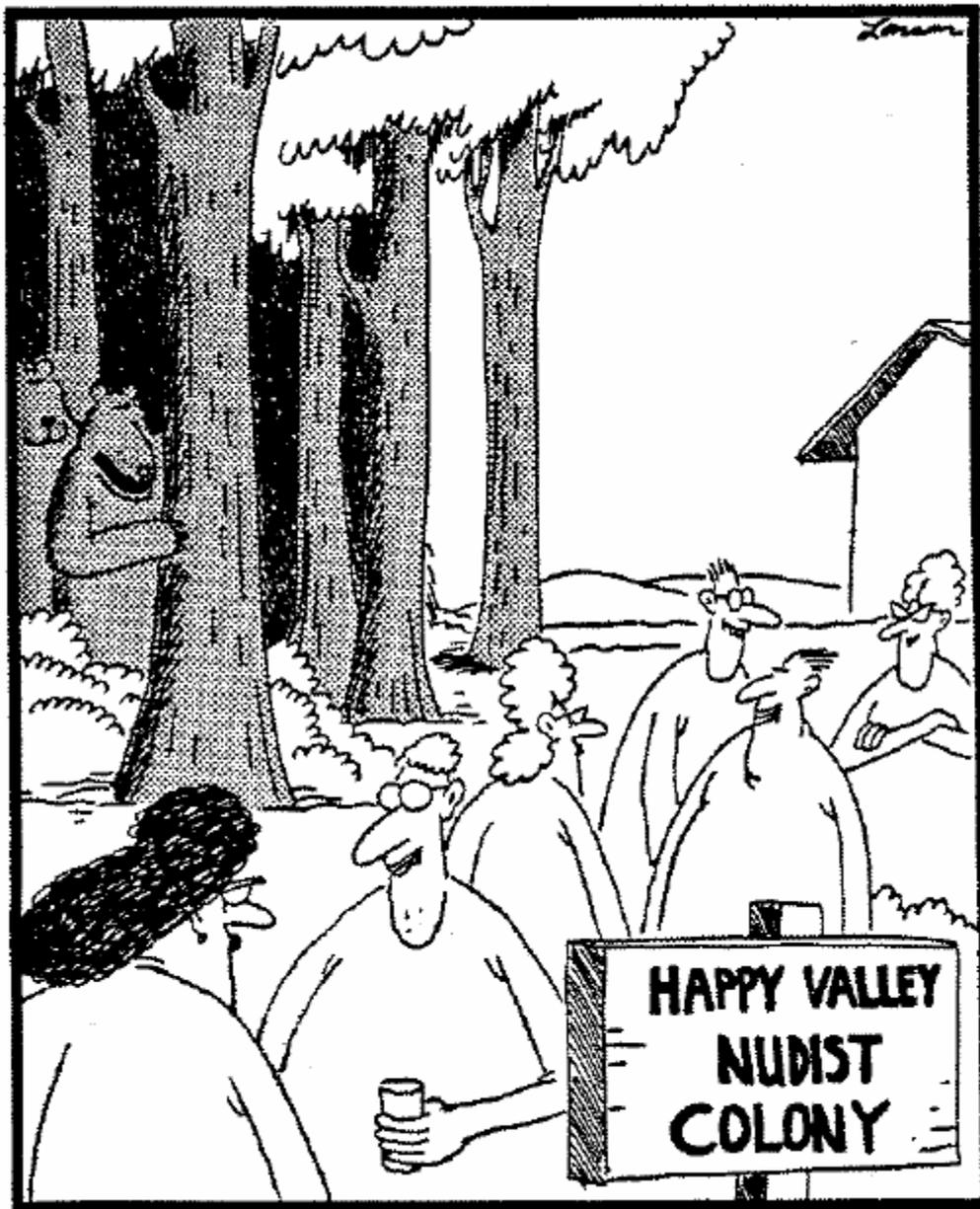
- This presentation draws on the many ideas that emerged and that were discussed at length during, and subsequent to, the ACEEE-University of California November 2006 Workshop:

***“Energy and Economic Policy Models:  
A Reexamination of Some Fundamental Issues”***

<http://www.aceee.org/conf/06modeling/>

- I would also like to recognize the many invaluable insights and thoughts from those speaking at the November 2006 event, including: Frank Ackerman, Inez Azevado, Peter Balash, Jim Barrett, Duncan Callaway, Rachel Cleetus, Stephen DeCanio, Niko Dietsch, Maggie Eldridge, Francisco de la Chesnaye, Neal Elliott, Allen Fawcett, Meredith Fowlie, Christie Galitsky, Donald Hanson, Scott Hassell, John Hoffman, Marvin Horowitz, Michael Leifman, Michelle Manion, Vanessa McKinney, Bill Prindle, Michael Reed, Jason Rudokas, Jayant Sathaye, Kristen Sheeran, Benjamin Sovacool, Samudra Vijay, and Eric Williams.
- And, finally, I would like to acknowledge the many insights of other participants, and the ongoing contributions from ACEEE staff as well as colleagues within the academic, consulting, university, and NGO communities whose earnest questions and sensible insights are helping to shape a positive modeling capacity.

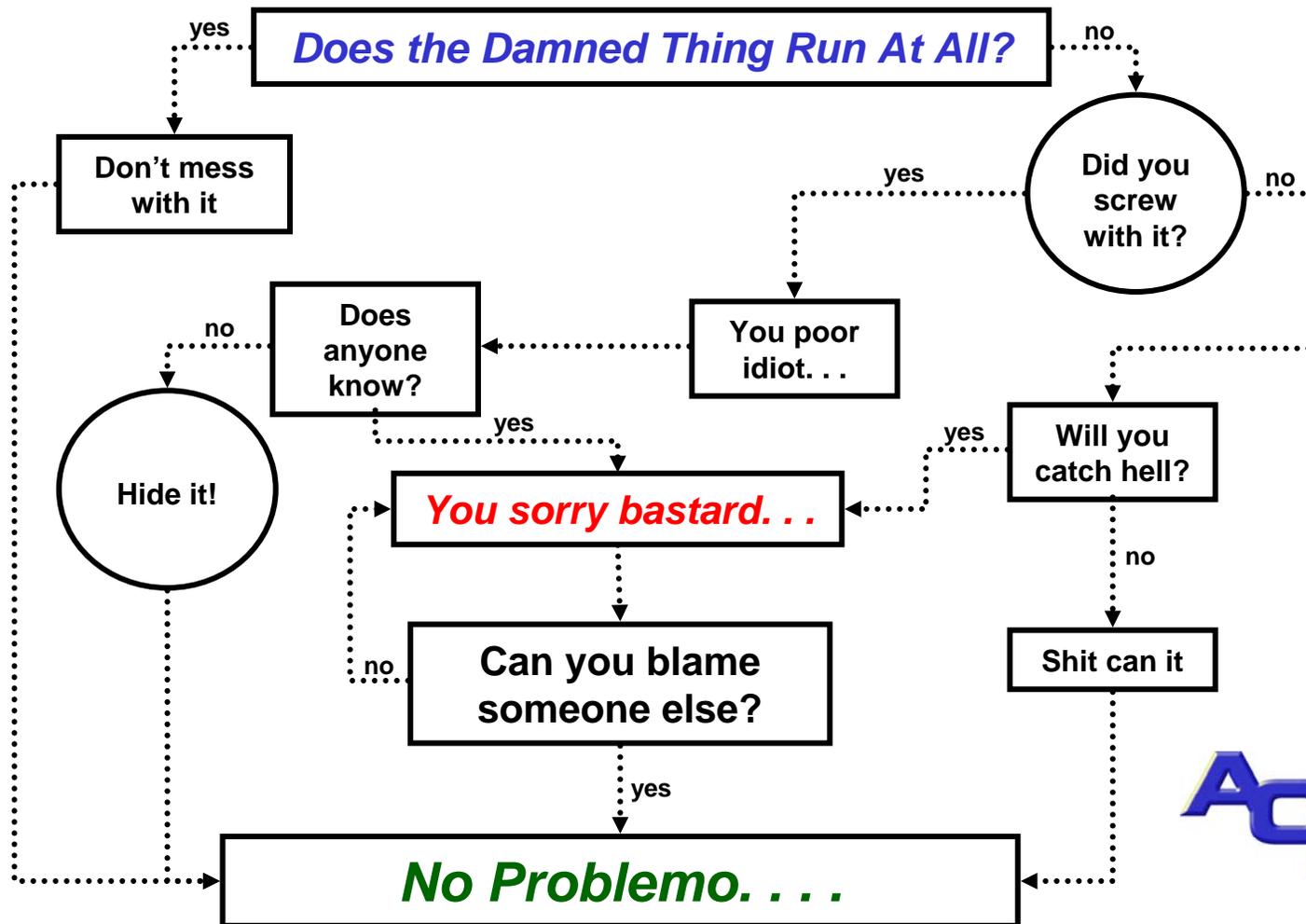




*Uhhmm. . . And in the interest of full disclosure, the gentlemen in the foreground – yes, the one with a glass of beer – is me. . . .*

“Well, there goes my appetite.”

# Evaluating Sensible Modeling Results



***Some preliminary (and perhaps a bit more sophisticated) observations***

# The Energy and Climate Policy Community Requires Both. . . .

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*Different horses for different courses;*

*and*

*Analytical efforts that also build from*

*First Principles of Good  
Energy Policy Modeling*



# An Egregious Example in which (at least) Five Models Have Used Some Form of the Following Characterization of Potential GDP Impacts

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$$GDP_t = GDP_0 * GrowthRate * \left( \frac{P_{new}}{P_{old}} \right)^{-Elasticity}$$

So that no matter how cost-effective the policies or the technologies, if there is any kind of net price increase from a given policy initiative, the macroeconomic impacts (by definition) must be negative.

***Given today's understanding of returns on technology and market dynamics, this is not an acceptable characterization.***



# And Recall this Accounting Identity

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$$\text{GDP} = \text{Investment} + \text{PCE} + \text{Gvt} + \text{NetExports}$$

Hence, if we can envision a policy that:

- (1) Increases overall productive investment;
- (2) Generates a net savings for consumers and businesses;
- (3) Benefits from smart government spending patterns; and
- (4) Contributes to a net positive export balance. . . .

Then we should expect economic policy models to reflect this set of impacts. If not, then those models may not properly map the correct set of economic assumptions.



# The Good News About Energy Efficiency Investments and Climate Change Policies

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- It does not have to be about ratcheting down our economy (Laitner et al. 2005);
- Rather, it can be all about:
  - using innovation and our technological leadership;
  - investing in more productive technologies (including both existing and new technologies); and
  - developing new ways to make things, and new ways to get where we want to go, where we want to work, and where we want to play.
- ***But again, most economic models appear to assume the former.***



# An On-Going Review Suggests (at least) Four Areas of Needed Modeling Improvements

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- As a direct outcome from our successful economic modeling workshop, I suggest four critical areas of needed improvement in our modeling practices so that modeling results can be properly evaluated and understood:
- **(1) Implementing a more dynamic technology characterization** based on the emerging technologies of the 21st century rather than the more limited and stylized technologies of the 1970s, 1980s, and 1990s that are now typically mapped into most existing policy models. Even these late 20th century technology characterizations are often limited and even inappropriate – for both the demand and the supply-side of the equation. Hence, these limited technology mappings, almost by definition, lead to hugely biased results for policy makers.
- **(2) An improved mapping of investment flows** to meaningfully disaggregate production capital and consumer purchases. For example, most models assume that the Internet economy has the same capital and information flow as an iron and steel mill or a pulp and paper plant. In other words, there is no distinction between equipment that carries information compared to foundries that smelt, shape, and form aluminum and steel. Hence, the models need to reflect and characterize different technologies and processes as well as different sectors of the economy.



# An On-Going Review Suggests (at least) Four Areas of Needed Modeling Improvements (cont'd)

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- **(3) Strengthening model assumptions that now limit otherwise real-world choices** and responses by consumers and firms. Evidence from disciplines ranging from sociology and psychology to behavioral finance, and experimental and institutional economics suggest models may reflect unrealistic behaviors and also give misleading insights about innovative policy options.
- **(4) Finally, providing an appropriate accounting of technology investments, costs, and benefits** to give models a more accurate pattern of returns that might flow from policies which support those more productive technologies. For example, most models now assume that anything done to decrease petroleum imports or reduce greenhouse gas emissions will likely “cost the economy” compared to a business-as-usual reference case. But if such models “knew” that some technologies can actually deliver productivity improvements or increase information flows in ways that cost-effectively save energy, the modeling results might show realistic returns on those investments that benefit both the economy and the environment.
- In the limited time here today, I will focus on items three and four in a bit more detail.



***Strengthening model assumptions that  
now limit real-world choices***

# ***Economics Science Has Not Solved. . . .***

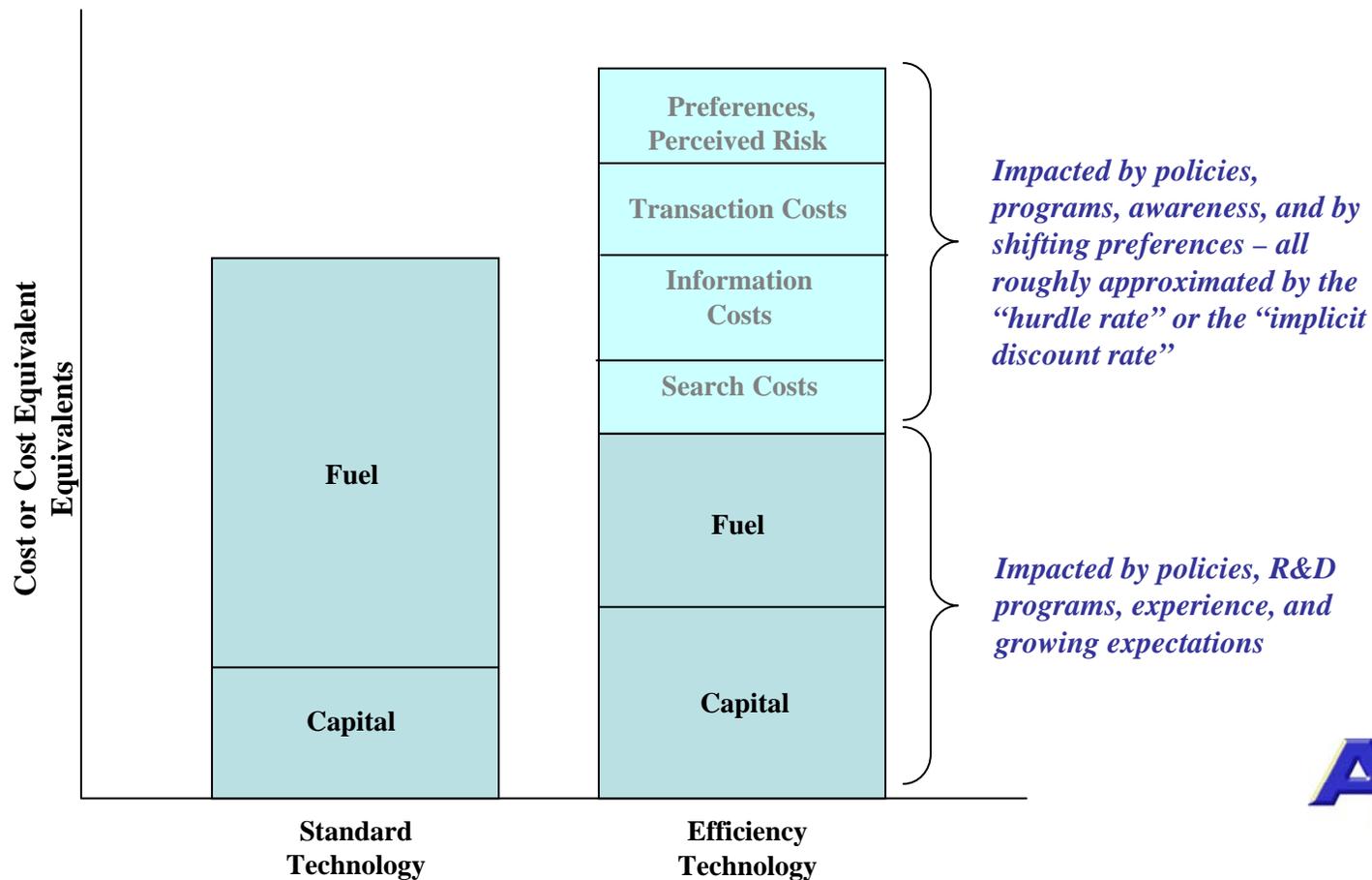
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- Its first problem – namely, what determines the price of a commodity? (Robinson 1947)
- Among things that can influence commodity prices:
  - Belief
  - Value
  - Habit
  - Alternatives
  - Necessity
  - Income
- All of which can be shaped by changed perceptions, clear and persistent policy signals, as well as new or expanding programs (Brown 2001).

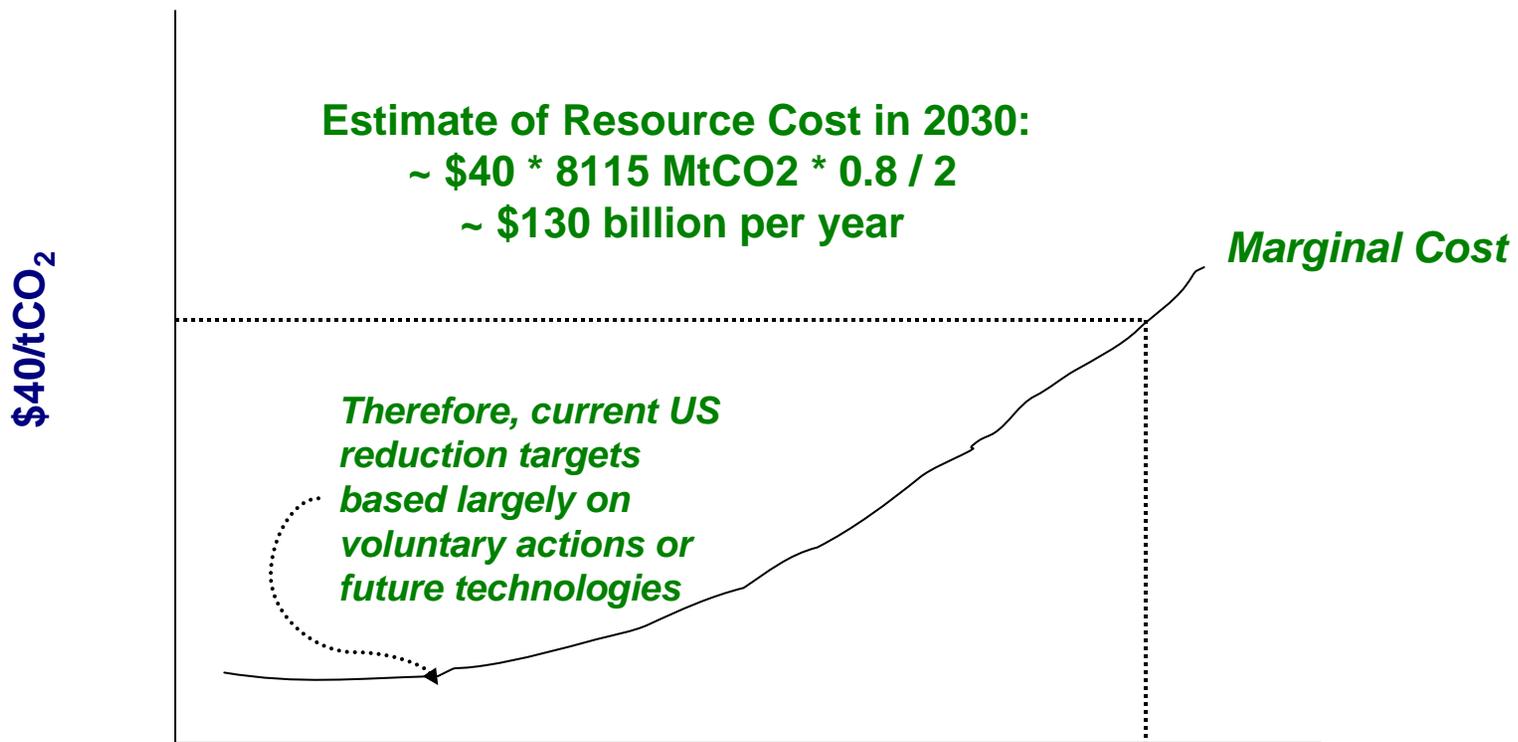


# Comparing Hardware and Energy Costs with “Soft” Search and Transaction Costs



***Providing an appropriate accounting of  
technology investments, costs, and  
benefits***

# Re-examining the Conventional Marginal Abatement Cost Curve



Domestic CO<sub>2</sub> Emissions to 80%  
of Reference Case Values



## But What If. . . .

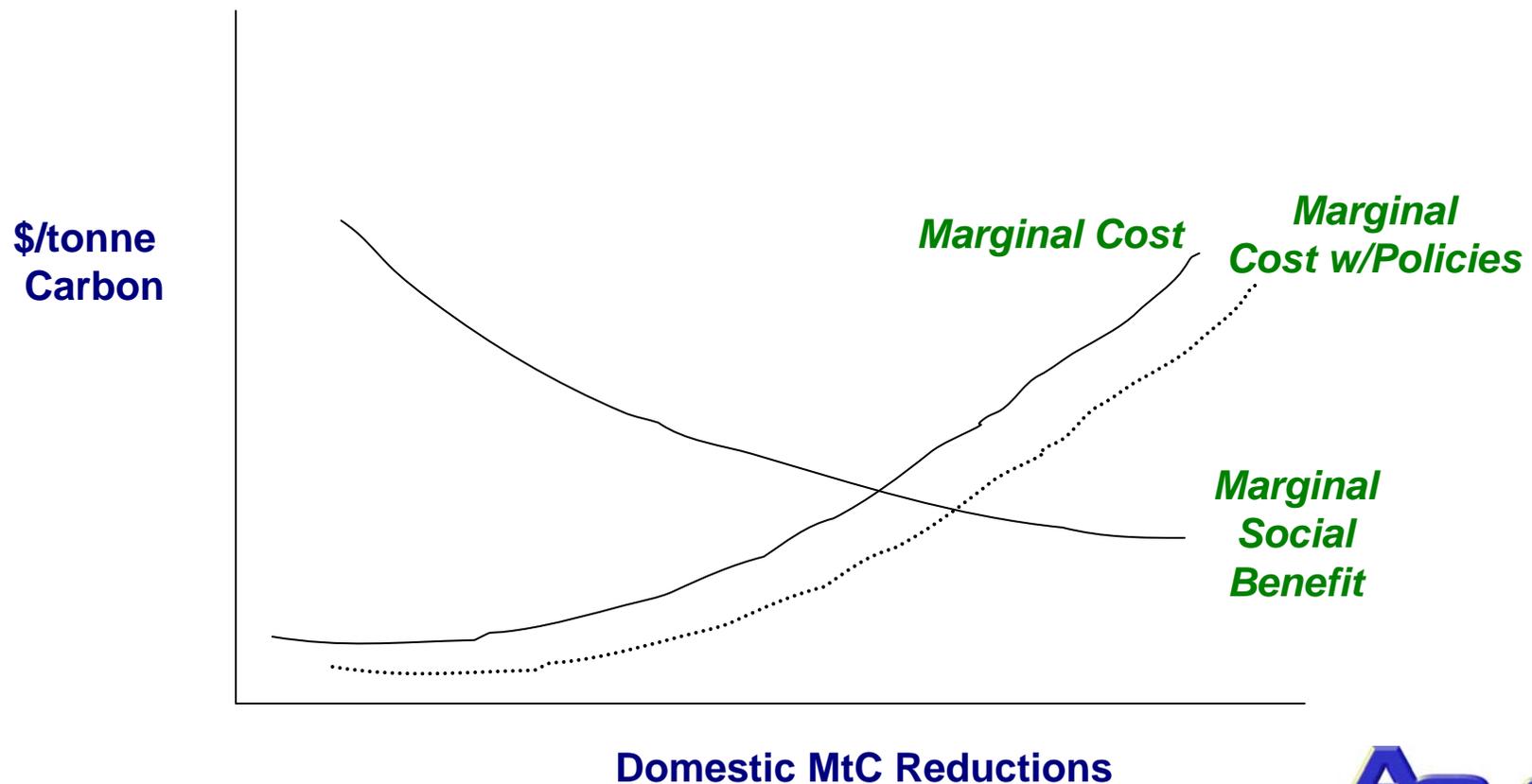
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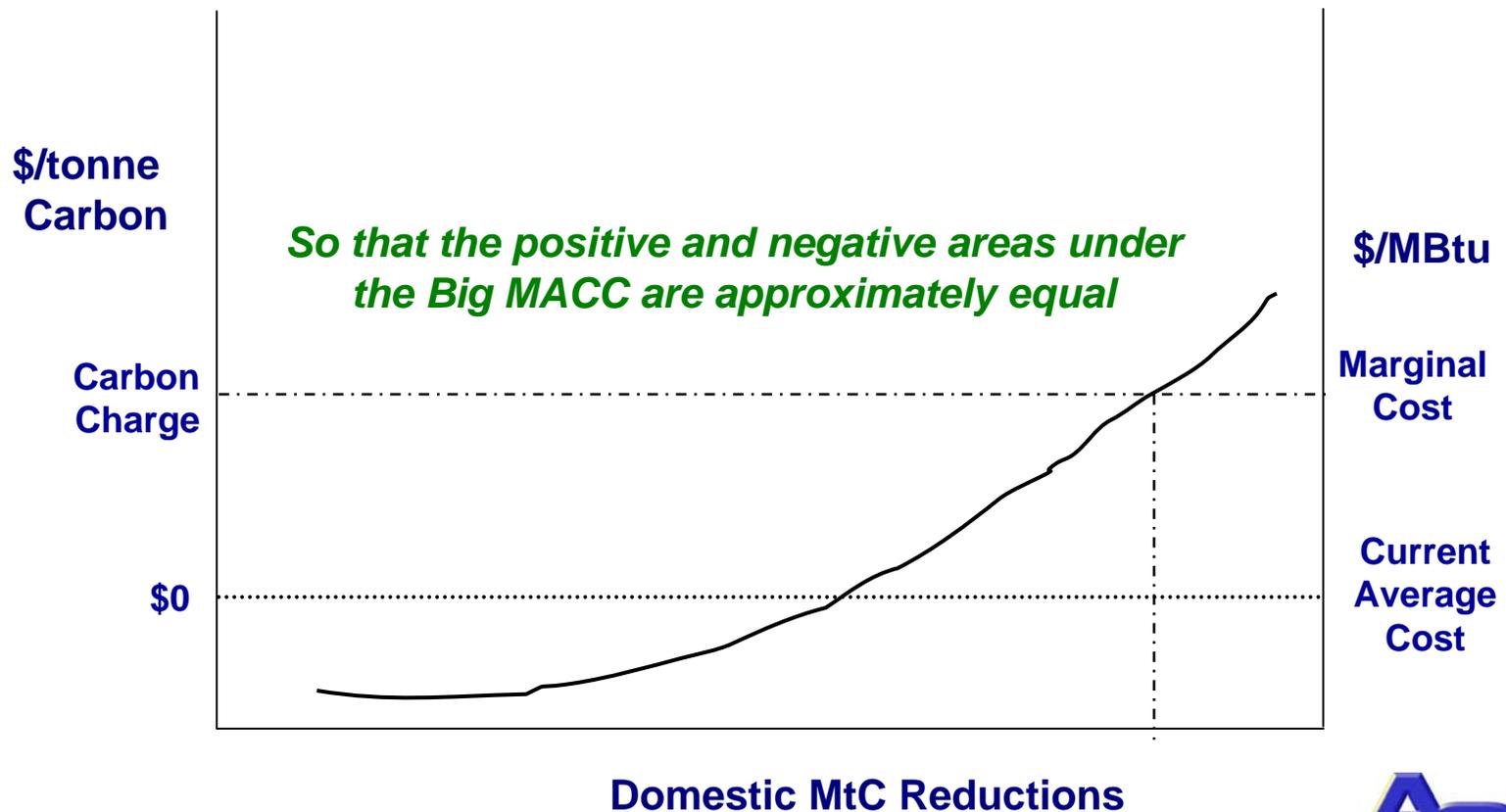
- The price signal, in this case, \$40/tCO<sub>2</sub> is not a highly accurate estimate of resource costs, but only a signal that changes behavior and patterns and investments?
- What if the 20% reductions were energy bill savings:
  - generated through productive efficiency investments that had (on-average) a 5-year energy payback
  - Lowered the non-carbon portion of energy prices by 10%, and
  - Stimulated other productivity innovations?
- Then a negative \$130 billion resource cost might become a \$227 billion net savings – not at all a free lunch, but a significant return on more productive pattern of investments.

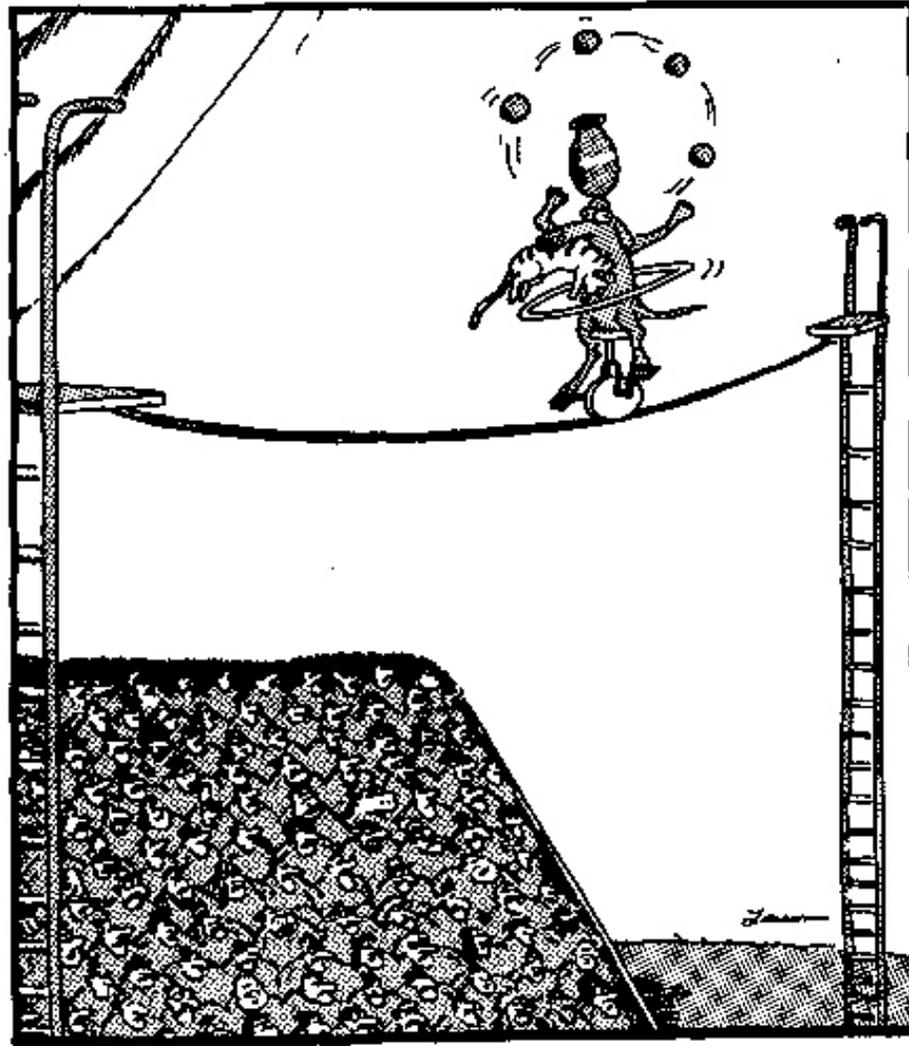


# So, a Different Result Emerges Using Both Costs and Benefits in the Analysis



# Or More Conventionally, a Different Result Emerges with Better Metrics





High above the hushed crowd, Rex tried to remain focused. Still, he couldn't shake one nagging thought: He was an old dog and this was a new trick.

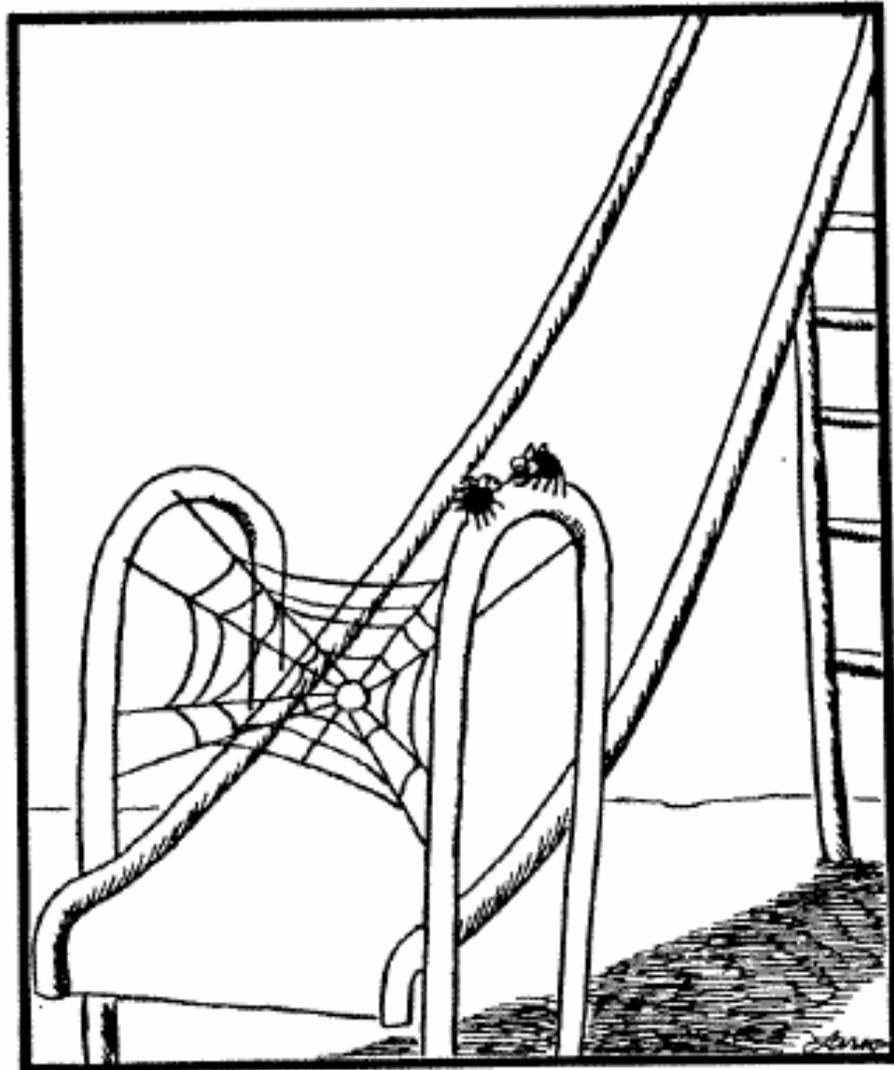
# Concluding Thoughts and Next Steps

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- Unlike the conclusions drawn from a number of previous modeling exercises, there are many cost-effective technologies (and technology policies) that can strengthen economic activity as well as improve environmental quality. This idea is supported both by the new E3 Network (see accompanying handout) and other mainstream economists.
- More work is needed – in effect, a return to the economic fundamentals and best modeling practices – to ensure economic modeling assessments that are appropriate to real world policy concerns (see the second accompanying handout).
- Toward that end there is also a critical need for greater data and systematic information as well as a collaborative approach in these and other critical modeling issues – with an eye toward a major national policy modeling conference in 2008.
- One important barrier in all this is the lack of funds to support appropriate review and capacity building, as well as the development of diagnostic tools and exercises.





**"If we pull this off, we'll eat like kings."**

# A Selected Modeling and Technology Characterization Bibliography

- **Elliott, R. Neal, Therese Langer, and Steven Nadel.** 2006. "Reducing Oil Use through Energy Efficiency: Opportunities Beyond Cars and Light Trucks," Washington, DC: American Council for an Energy Efficient Economy, January.
- **Elliott, R. Neal and Shipley, Anna Monis.** "Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets: Updated and Expanded Analysis," Washington, DC: American Council for an Energy Efficient Economy, 2005.
- **Geller, Howard, Philip Harrington, Arthur H. Rosenfeld, Satoshi Tanishima, and Fridtjof Unander.** "Policies for increasing energy efficiency: Thirty years of experience in OECD countries," *Energy Policy*, 34 (2006) 556–573.
- **Koomey, Jonathan G., Paul Craig, Ashok Gadgil, and David Lorenzetti.** 2003. "Improving long-range energy modeling: A plea for historical retrospectives." *The Energy Journal*, vol. 24, no. 4. October. pp. 75-92.
- **Laitner, John A. "Skip" and Alan H. Sanstad.** 2004. "Learning by Doing on Both the Demand and the Supply Sides: Implications for Electric Utility Investments in a Heuristic Model." *International Journal of Energy Technology and Policy*, 2004, 2(1/2), pp. 142-152.
- **Laitner, John A. "Skip."** 2004. "How Far Energy Efficiency?" *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, DC: American Council for an Energy Efficient Economy.
- **Laitner, John A. "Skip", Donald A. Hanson, Irving Mintzer, and Amber J. Leonard.** 2005. "Adapting in Uncertain Times: A Scenario Analysis of U.S. Energy and Technology Futures." *Energy Studies Review*, Vol. 14, No.1, 2005 pp120-135.
- **Laitner, John A. "Skip" and Donald A. Hanson.** 2006. "Modeling Detailed Energy-Efficiency Technologies and Technology Policies within a Cge Framework." *Energy Journal*, 2006, Special Edition, Hybrid Modeling of Energy-Environment Policies: Reconciling Bottom-Up and Top-Down, pp. 151-69.
- **Laitner, John A., Stephen J. DeCanio, Jonathan G. Koomey, and Alan H. Sanstad.** 2003. "Room for Improvement: Increasing the Value of Energy Modeling for Policy Analysis." *Utilities Policy*, 11, pp. 87-94.
- **Martin, Nathan, et al.** 2000. "Emerging Energy-Efficient Industrial Technologies," Washington, DC: American Council for an Energy Efficient Economy, 2000.
- **Sachs, Harvey et al.** 2004. "Emerging Energy-Saving Technologies and Practices for the Buildings Sector," Washington, DC: American Council for an Energy Efficient Economy, 2004.
- **Shipley, Anna Monis and R. Neal Elliott.** 2006. "Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?" Washington, DC: American Council for an Energy-Efficient Economy, April.



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