**Next Steps and Conference Summary**
EMF 25 Initial Working Group Meeting
*Energy Demand and Efficiency*

Westin Washington DC City Center
November 6-7, 2008

## Next Steps

The next meeting of EMF 25 will probably be held in mid to late April at Stanford University, Stanford, California, subject to final confirmation. The EMF staff will prepare a first-round study design based upon this first meeting's discussion and circulate it to the working group. There will be a conference call for the modeling teams to resolve any remaining issues related to the scenario design, input assumptions and output variables.

Other action items from the kickoff meeting include:

- The group will continue to identify and investigate sectoral models and sectoral experts that may complement the larger economy-wide models. Particular emphasis will be placed upon the transportation and building sectors.
- Amol Phadke, Jayant Sathaye, and Skip Laitner will lead an effort to collect detailed information on policies and technologies that may be relevant for the study. Where possible, they will try to coordinate with the upcoming McKinsey study on energy efficiency cost curves. They will produce and distribute a questionnaire in order to determine what information is already available, and will then proceed to gather production costs, operating costs, availability information, and other variables for a few representative technologies before checking back with the group and embarking on a larger data organization/collection effort.
- David Montgomery, Eric Smith, and John Conti will design a specific proposal for both a carbon and BTU tax to use in the price scenarios (see below). The two taxes will be similar in terms of their first-round impacts on energy expenditures.
- Gale Boyd from Duke University has offered to lead a proposal to Census for using the micro data to study U.S. energy demand. Obviously of interest to industrial modelers, this data also includes the housing survey (and possibly other data) that may shed light on demand in other sectors. Participants need not be direct co-authors or collaborators, but having a common research theme will be needed to obtain Census approvals. Please contact Hill Huntington if you are interested and EMF will send the information directly to Gale.

## Meeting Purpose and Key Decisions

The primary purpose of the meeting was to bring together policy modelers and policymakers to lay the groundwork for EMF 25, a policy relevant modeling exercise in energy demand

and efficiency.  Decisions were reached on a number of key issues pertinent to the study design, summarized below:

- **Standardization.** As always, this exercise must walk a line between the need to ensure comparability by standardizing inputs and the danger of decreasing output quality by overstandardization. Models should be calibrated to the upcoming AEO 2009 reference case for exogenous drivers of energy consumption (i.e., population, GDP, etc). Modeling teams should use these inputs for any variables that they consider as exogenous, but should not override endogenous output variables in their systems.  Technology assumptions, discount rates, and other behavioral parameters should not be standardized. Modelers should report all inputs in an assumptions document associated with output, and output should be standardized to the greatest level of disaggregation appropriate for the model.

- **Time Horizon.** Model scenarios should be reported through 2050 or the last reported year in models that do not extend out that far.

- **Geographical Scope.** The study will have a "US bias" in that it will be primarily focused on the United States, but other countries such as Canada, Russia, Japan, and China will be brought in for comparison where possible. It was determined that technological data may be lacking for a world study.

- **Data Collection and Exchange.** As described above, Jayant, Amol, and Skip will conduct an initial data survey and collection effort in order to ensure that relevant technological and policy data will be available. McKinsey & Co. is currently undertaking an efficiency study as well, and barring confidentiality issues it may be possible to exchange and incorporate the data gathered in their effort.

- **More is More.** Each modeling team should provide data output disaggregated to the level appropriate for their model, with a bias to reporting more. As long as adequate definitions for the resulting data are provided, the group will be able to do whatever translation is necessary for comparison.  If possible, teams should report back services (vehicle miles traveled, commercial floor space, etc) as well as other common demand drivers (GDP, labor productivity, population, etc).

- **Scenario Design.** It was determined that modelers will run four scenarios prior to the April meeting.  The first is a reference case, with clearly reported baseline assumptions, including provisions from the Energy Independence and Security Act (EISA) of 2007. The second is a standard carbon tax scenario with tax revenue recycled back as a lump sum to households in a way that avoids any additional incentives for behavior change. The third is a BTU tax on final/delivered energy, calibrated to have a similar first-round revenue impact as the carbon tax. The fourth scenario will consider a set of non-price policy instruments (either standardized codes or subsidies) in several key building and transportation applications.  In future rounds, the group intends to explore the impact of complimentary efficiency policies and technology introduction when carbon price policies are also introduced.

## Meeting Summary

The meeting was organized into four panel presentations with questions following each, as well as several hours of discussion. This document provides a brief, integrated summary of each of the first three panels and associated discussion, as well as a summary of the "scenario design" discussions that took place during and following the fourth panel.

### Panel 1: What do Decisionmakers Want?
*Robert Fri (moderator), David McIntosh, Sam Baldwin, James Lockhart*

The current political landscape is one in which climate change remains a top energy priority, but where the state of the economy makes it somewhat unlikely that comprehensive cap and trade legislation will be passed in the near term. Given this, policymakers are increasingly interested in "complementary policies" such as efficiency standards, renewable energy and efficiency resource standards, tax incentives, and research support. Ideally, the analysis would be structured in such a way as to show the cost and impact of each individual policy, as well as how that policy interacts (and potentially lowers total costs for) a federal carbon cap and trade program. Federal energy research programs will have a keen interest in understanding how research funding influences energy conservation and energy demand and how such impacts can be quantified. Private companies providing energy supply will be interested in the range of energy demand under alternative fuel price and economic conditions. Additionally, those companies investing in power generation and infrastructure emphasize that hourly load profiles and other demand structure details are just as important as overall trends.

### Panel 2: What Might Modelers Provide?
*John Weyant (moderator), Henry Jacoby, Leon Clarke, Mark Jaccard, John Conti*

Modeling teams discussed the structure of their models (EPPA, MiniCAM, CIMS, NEMS) and the variables that drive demand in their models, such as GDP, AEEI, sector shifts, and relative prices. It was noted that it may not be possible to produce many of the scenarios discussed in the previous panel due to the architecture of the models and the availability of explicit data.

Consensus was reached that a climate study, by itself, will not provide additional valuable modeling insights, but the simulation of a carbon price may be an interesting way to approximate other demand side efficiency and aggregate demand effects. In general, modelers were excited about conducting an exercise that would increase their ability to model the complexities of the end use sector. To that effect, analysis of McKinsey-type costs curves might be useful for AEEI calibration, but would need to be aggregated to the sectoral level for use in the CGE models.

Much of the discussion focused on the need to have access to comprehensive technological data at a relatively granular level, including costs, availability, and operating characteristics over time and by region. This is especially important given that many technologies that are considered to be substitutes for one another in fact provide different qualities of service at different costs. Collection of explicit detail is necessary to allow models such as NEMS and

CIMS to use the data thus collected, and data can be aggregated or synthesized for application in less technologically explicit models. Jayant Sathaye, Amol Phadke, and Skip Laitner will lead a data collection effort that will involve organizing existing data and surveying modeling teams to determine what data is already available. It may also be possible to interface with McKinsey on their ongoing energy efficiency study.

Lastly, it is vital that the group employ a consistent and defensible definition of "efficiency." There are numerous ways in which this concept could be defined: in the end, however, the most important variable is final energy consumption.

### Panel 3: Extending Models with Policy and Micro-Level Analysis
*Jim Sweeney (moderator), Jayant Sathaye, Peter Mulder, Karen Palmer, Robert Earle*

In this panel, modelers discussed their research and possible avenues for extending models using more explicit micro-level data. Discussion focused on two primary threads; the application of explicit technological engineering data for more accurate representation of end use technologies, and strategies for including behavioral and policy parameters in the forecasts. It is vital, the group agreed, to understand that energy efficiency and changes in energy use over time are complex processes. Programs, standards, and technological availability play central roles, but can be very difficult to model given the associated data requirements. It is also important to try to quantify market failures and their impact on consumer responses to price changes. Models with less aggregated detail can produce more valuable results, but greater disaggregation is also associated with greater uncertainty.

The panel also discussed international trends in energy productivity, or the inverse of energy intensity. It is critical to evaluate these trends at the sectoral rather than the economywide level and to understand the reasons for industries performing at or below their potential production frontier, essentially disaggregating inefficiency into technical and allocative components.

The group also spent a fair amount of time discussing discount rates, and their application in the context of energy efficiency modeling. It is generally understood that discount rates, as commonly reported, reflect a variety of bundled costs in addition to pure time preference. While this remains a "pet peeve" of some forum participants, it is probably beyond the scope of this study to address. In reporting final study output, modelers should not standardize discount rates, but should clearly document the discount rates employed.

### Panel 4: Possible Model Scenarios and Discussion
*Hill Huntington (moderator), Alan Sanstad, Michael Leifman, Charles Rossman, Eric Smith*

This discussion began with panel members reviewing relevant energy literature and past studies before moving to the implications that this work has for current EMF 25 scenario design. Pioneering work in the 1970s and 1980s on energy efficiency barriers and the behavioral components of energy use found great heterogeneity in the rate and structure of energy efficiency. Numerous models partially explain these trends, including loss aversion, income-based discount rates, hyperbolic discounting, contagion, social learning, and diffusion of technologies; a fundamental challenge in this study is to understand how this heterogeneity can be modeled. In order to achieve this goal, it may be appropriate to gather

and incorporate improved end-use technological data as discussed earlier, as well as to interface with appropriate sectoral models.

Climate change is still a primary energy priority for policymakers, and implementation of a carbon price can be a methodologically simple way of simulating other demand side effects. In particular, legislators are increasingly interested in how supplementary efficiency incentives and standards may interact with, and potentially lower costs of, comprehensive climate legislation. This suggests two scenario pairs: 1) demand and efficiency growth with and without a carbon price, and 2) growth with and without a suite of efficiency initiatives modeled after the policies and technologies included in the upcoming McKinsey study on energy efficiency. This would not only provide validation and greater understanding of McKinsey's cost curves, but would also provide an AEEI calibration tool for use in other models.

In undertaking a study of such a fundamental topic, the group runs the risk of trying to undertake a "study of everything." To avoid this risk, emphasis should be placed on consumption of final energy, taking into account policies, costs, and efficiency. Implementation of a "Btu tax" scenario may be valuable because it isolates the end-use sector and avoids complexities introduced by supply side variations. This would be calibrated to have approximately the same initial revenue impact as a carbon tax, and would enable every model to employ the same end-use tax on energy (in contrast to a carbon tax, with which supply side efficiency differences would result in variations in the equivalent energy tax).

As discussed previously, defining the output metric and establishing a consistent definition for energy efficiency is vital. The group agreed that the primary metric of concern is energy demand, and if all modelers report this it should be possible to drill down and separate out energy intensity, energy efficiency, and service changes.

### *Meeting Adjournment and Next Steps*

At the end of the meeting, the EMF working group made several recommendations for the next steps. Initial scenarios will consist of 1) a reference case, standardized to AEO 2008 and with additional assumptions clearly documented, 2) a carbon tax scenario implementing a carbon tax of a to-be-determined level, 3) a Btu tax on final or delivered energy, calibrated to have approximately the same initial revenue impact as the carbon tax, and 4) a "non-price" scenario which layers additional policies and technologies on to a carbon scenario. Although a thorough non-price scenario will require additional data collection and other refinements, there will be efforts in this first round of modeling to represent several such policies that are both important and likely to be implemented. These policies might be represented in a number of different ways (decreased discount rates to mimic informational programs, intangible fixed factors to allow for imperfect substitutes, and technology phase-outs to represent regulation). Experience with implementing these assumptions in the first round will help the working group understand how the full, non-price scenario might be implemented in later rounds.

*Notes Prepared by Douglas Hannah, November 21, 2008.*