

**A SELECTION OF POSSIBLE STUDIES
FOR THE ENERGY MODELING FORUM**

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INTRODUCTION

The Energy Modeling Forum seeks to improve the use of energy models in the decision and policymaking process. EMF studies, each organized around a key energy issue, provide an opportunity for participating model builders and users of model results to join in examining model strengths and weaknesses. It is the EMF's goal that this cooperative effort will improve communication and understanding among model builders and users.

Since selection of a study topic is important to maintaining the relevance of EMF investigations, a broad range of people working and interested in the energy field is polled for possible study suggestions. Typically, a study topic is of broad concern, timely, and the focus of several modeling efforts. EMF has conducted 14 studies on a variety of important energy issues: "Energy and Economy," "Coal in Transition: 1980-2000," "Electric Load Forecasting: Probing the Issues with Models," "Aggregate Elasticity of Energy Demand," "U.S. Oil and Gas Supply," "World Oil," "Macroeconomic Impacts of Energy Shocks," "Industrial Energy Demand, Conservation, and Interfuel Substitution Under Alternative Energy Futures," "North American Natural Gas Markets," "Electricity Markets and Planning," "International Oil Supplies and Demands," "Global Climate Change: Energy Sector Impacts of Greenhouse Gas Control Strategies," "Markets for Energy Efficiency" and "Integrated Assessment of Climate Change" (in progress).

This year a wide variety of suggestions for future study topics has been received. Ideas from many of the suggestions have been consolidated into ten topics covering a spectrum of energy issues. These topics are described in this paper by individual outlines. The issues, topics, and models included are by no means exhaustive, but rather are intended to serve as the basis from which new ideas can evolve.

Following these individual topic descriptions, we list suggested topics that were interesting but for which we do not have a description at this time. Descriptions for these topics will be developed, depending upon the interest in these topics.

The Energy Modeling Forum would like to thank the following people for providing useful suggestions for potential study topics. The topics presented here incorporate many elements of those recommended. All suggestions are very much appreciated.

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A COMPETITIVE ELECTRICITY INDUSTRY

QUESTIONS

- What will be the future institutional organization of the electricity industry?
- What will the spot price of electricity be at different points in the network?
- How will transmission capacity be allocated?
- What will be the security available for making capital intensive generation investments?
- What will be the incentives for transmission investments?

MOTIVATION

Electricity remains one of the large network industries yet to be deregulated. There is extensive discussion of the appropriate industry structure both in the US and abroad. Foreign developments have in some cases preceded those in the US.

ANALYSIS (focus on one of the options below):

Compare results from network pricing models for different assumptions about industry structure.

Compare the effects of open transmission and spot market pricing on generation decisions, based upon restructured electric generation models.

POTENTIAL MODELERS

William Hogan, Harvard
George Dantzig and collaborators, Stanford
Martin Baughman, U of Texas
Fred Schweppe and collaborators, MIT
Hung-Po Chao and Stephen Peck, EPRI
EPRI Power Delivery Group
Shmuel Oren, UC Berkeley
Energy Information Administration
World Bank (Dennis Anderson, Bernie Tenenbaum)
National Grid Co, UK
Mario Perreira, Brazil
Grant Read, New Zealand

THE IMPACT OF WORLDWIDE ELECTRICITY DEREGULATION ON ENERGY USE

QUESTIONS

- How will electric restructuring affect overall fuel balances and energy prices?
- Will changes in energy use be limited to price effects only?
- What types of conservation programs will survive?
- What can be learned from abstract economic models which deal with the existence of a stable core? Are models of contestable markets relevant here?

MOTIVATION

Many countries are implementing policies that will fundamentally change the electricity industry and the way that power is priced. This massive restructuring, probably the most important remaining regulatory issue of our time, will fundamentally alter not only the power industry but also the markets for fossil fuels as well. Restructuring will change the electric generation mix as well as the competition between electricity and fossil fuels in end-use applications.

ANALYSIS

Determine the future institutional organization of the electric utility industry that will result from this deregulation trend.

Project electricity prices, demand, and generation mix consistent with this deregulation scenario.

Project demands for and prices of all energy types consistent with this deregulation scenario.

POTENTIAL MODELERS

Argonne National Laboratory
Energy Information Administration
Electric Power Research Institute end use models
Gas Research Institute (including ISTUM II, etc.)
International Energy Agency

CONSTRAINED ENERGY DEMAND FUTURES

QUESTIONS

- How would energy use constraints affect fuel prices?
- How would certain end-use constraints such as efficiency standards affect the demand for energy-using services?

MOTIVATION

Policies are constraining energy use in an era of low energy prices. Energy-producing industries face the prospect of both lower-than-otherwise energy consumption and price. However, lower energy prices and higher economic growth resulting from such policies could partially offset the initial reduction in energy consumption.

ANALYSIS

Apply constraints on energy use in the models through surrogate variables, e.g., higher shadow prices for end users.

Compare resulting energy balances and prices and economic activity.

POTENTIAL MODELERS

Energy Information Administration
International Energy Agency
Data Resources
Gas Research Institute
Applied Energy Services (IDEAS)
ICF (DEGREES)
Decision Focus (GEMINI)

DEMOGRAPHICS, TRAVEL, AND TRANSPORTATION FUEL DEMAND

QUESTIONS

- What are the separate effects of income and demographic factors on transportation fuel demand?
- What factors contribute to the choice of transportation mode, e.g., the shift from private automobiles to airline jets.

MOTIVATION

The demand for transportation fuels continues to grow more rapidly than what many analysts project, creating concerns about oil security and such environmental pollutants as NO_x and VOCs. Changing demographic characteristics of the population exert an important and separate effect on transportation fuel demand, independent of the growth in disposable income and the economy. Congestion in key urban areas may constrain fuel demand in the future.

ANALYSIS

Use standardized scenarios to separate the effect of demographics from income on the demand for vehicles and travel.

Simulate scenarios of low fuel demand growth in order to generate discussion about the likely conditions that would slow down demand growth in this sector.

Perhaps broaden the analysis to nonpassenger demands for transportation fuel, e.g., freight transport.

POTENTIAL MODELERS

Applied Energy Services
Argonne National Laboratory
Joyce Dargay, Oxford and Dermot Gately, NYU
Decision Focus (GEMINI)
Energy and Environmental Analysis
Energy Information Administration
David Greene, Oak Ridge
Stephen Peake, OECD
Kenneth Train, UC Berkeley (CARS)

ALTERNATIVE FUELED VEHICLES

QUESTIONS

- What is the impact of government programs and manufacturer incentives to promote the sale of alternative fueled vehicles?
- Which alternative fuels are most cost effective with higher future oil prices?
- How important is fuel price in the choice of transportation mode and fuel?

MOTIVATION

Despite low oil prices, interest in alternative-fuel vehicles (AFVs) is increasing. Advances in technology have reduced the projected vehicle costs, and environmental concerns about NO_x and VOC emissions in urban areas have spawned policies and regulations promoting alternatives to gasoline-powered engines. The choice of vehicles depends not only on fuel price but also on a set of amenities or vehicle characteristics.

ANALYSIS

Test sensitivity of future use of (AFVs) to different crude oil price paths.

Project impact of clean-air and other proposed policies on the use of AFVs.

Evaluate the importance of non-price amenities (horsepower, range, interior space) on vehicle consumer choices.

POTENTIAL MODELERS

Applied Energy Services

Argonne National Laboratory

Decision Focus (GEMINI)

Energy and Environmental Analysis

Energy Information Administration

Dan Sperling, UC Davis

Andy Ford, Washington State University

Kenneth Train, UC Berkeley (CARS)

WORLD OIL MARKET TRENDS

QUESTIONS

- How robust are projections of rapid oil demand growth, particularly among the developing countries?
- Can oil supplies outside OPEC and the former Soviet Union keep pace with this demand growth without higher real oil prices?
- How are prices formed in the oil market and what influence do OPEC members have in this process?

MOTIVATION

Despite its importance to all energy markets and policy, the world oil price path is extremely difficult to project. Not only is the behavior of OPEC members not well understood, but analysts are changing their perception of price and income elasticities of demand and of the cost factors influencing production.

ANALYSIS (focus on one of the options below):

Identify appropriate price and income elasticities in developing countries and whether they are likely to shift over time.

Evaluate the underlying costs of potential oil supply outside of OPEC and the former Soviet Union.

Compare alternative explanations for OPEC behavior and how it influences international oil prices.

Evaluate how well models have performed in projecting past trends.

POTENTIAL MODELERS

Stephen P.A. Brown, Federal Reserve Bank of Dallas

Canadian Energy Research Institute

Nazli Choucri, MIT

Decision Focus Inc.

Energy Information Administration

Dermot Gately, New York University

William Hogan, Harvard

International Energy Agency

Robert Kaufmann, Boston University

PETROLEUM SUPPLY DISRUPTIONS

QUESTIONS

- What is the most likely type of petroleum supply disruption over the next 20 years?
- How much oil would be removed and how much would be offset by available excess capacity outside the affected region?
- What are the impacts on petroleum prices and on the economy?

MOTIVATION

World petroleum production is being increasingly concentrated in the Persian Gulf, a politically volatile region. Religious, political, and financial pressures are operating on the governments in these countries. At the same, oil markets appear to be more adaptive to sudden disruptions, and the importance of energy prices to macroeconomic performance is being reevaluated.

ANALYSIS

Simulate the effect of a most-likely disruption event (including offsets) on world petroleum prices.

Analyze the impact of such a disruption on the economy, based upon recent statistical analyses of the relationship between energy prices and the economy.

POTENTIAL MODELERS

Disruption Impact Simulator Model (EIA)

Teisberg Model (DOE)

Gately Model (Dermot Gately, NYU)

HOMS (Bill Hogan, Harvard)

researchers conducting statistical macroeconomic studies (Knut Mork, Steve Brown, Prakash Loungani, Fred Joutz, Doug Bohi)

LONG-TERM WORLD ECONOMIC GROWTH

QUESTIONS

- What are reasonable bounds for projections of future economic growth by country or major groups of countries?
- Which factors contribute most to these projected economic growth rates or to the variation in growth rates across models?

MOTIVATION

Studies of climate change policy are critically dependent upon projections of future economic growth by country. Rapid growth in certain developing countries and the potential recovery in the transitional economies of Eurasia are two important developments that can have enormous impact on the type of fuels demanded and hence on the outlook for the future quality of the world's environment. Despite their critical significance, long-term economic projections are seldom scrutinized carefully.

ANALYSIS

Compare available projections for economic growth and identify the important factors for their differences.

Simulate standardized scenarios that attempt to control for differences in these key factors, e.g., labor productivity gains, country savings rates, etc.

Evaluate these projections within the context of recent conceptual explanations for economic growth, e.g., endogenous technological progress.

POTENTIAL MODELERS

Data Resources

World Bank

Organization for Economic Cooperation and Development

Proprietors of country-specific models and country experts

WORLD ECONOMIC GROWTH: IMPLICATIONS FOR ENERGY DEMAND

QUESTIONS

- By how much will future international energy demand growth lag economic growth?
- Which factors contribute most to the decoupling of energy demand and economic growth in various regions?

MOTIVATION

Studies of climate change policy are critically dependent upon projections of future economic growth by country and how these trends affect the world energy outlook and environmental quality. The relationship between economic growth and energy use depends upon the evolving structure of the economy, lifestyles, and the nature of technological progress.

ANALYSIS

Compare world energy demand projections that have been standardized on several assumed world economic growth paths.

Identify key factors, e.g., economic structure, that shape the extent of decoupling between energy use and economic growth.

Compare world energy demand projections that have been standardized on several assumed energy price/economic growth paths in order to evaluate several "what-if" scenarios in which economic growth affects energy prices.

POTENTIAL MODELERS

Energy Information Administration
International Energy Agency
World Bank
Lawrence Berkeley Laboratory

ENERGY MODELING IN LATE RESPONSE GLOBAL WARMING SCENARIOS

QUESTIONS

- What can currently available energy models tell us about minimizing remediation and adaption costs when decisions are made far into the future (ie, late response strategies)?
- In what ways are models inadequate for such purposes, due either to data deficiencies or to structural limitations?

MOTIVATION

Large scientific uncertainties and geopolitical realities reduce the incentives for effective, collective action today. Global agreement is likely to be attained only when the threat of climate change damages is perceived as proximate and large. If and when such a time materializes, response strategies may be extremely costly unless preparatory steps are taken. The study of "late response strategies" may entail major shifts in research priorities.

ANALYSIS

Evaluate the greenhouse gas emission reduction and climate change adaption costs associated with a scenario of no action for a number of decades, followed by strong action in later decades to meet various emissions targets, global temperatures, etc.

Consider the implications for delayed action of using alternative climate damage functions of differing levels of severity.

POTENTIAL MODELERS

Participants in current study on climate change (EMF 14).

OTHER SUGGESTED TOPICS

Certain topics are interesting areas of inquiry but do not lend themselves easily to an EMF study, which requires a number of existing models focused on a similar set of issues. We list below several topic recommendations that would be valuable to study using a different process than an EMF working group or that may become candidate topics with further development of existing models:

1. Innovation in energy technologies.
2. Managing risks in energy projects.
3. An appropriate welfare measure for CO2 analyses.
4. Implications of a source of power that is nonpolluting, low-cost, and abundant.