System for the Analysis of Global Energy Markets (SAGE): Objectives and Status

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Purpose of SAGE

• Produce Integrated International Energy Projections
  – Publish the International Energy Outlook 2003
    • Generate Reference Case Projection
    • Generate Alternative Projections
      – High and Low World Oil Price Scenarios
      – High and Low Economic Growth
  – Archive SAGE results
  – Document SAGE model
Additional Purposes

- Perform Integrated Energy and Environmental Analysis
  - Analyses effecting international energy markets
    - U.S. centric orientation
    - Greenhouse gas analyses
    - Other environmental analyses (mercury?)

Implications of Simulating Energy Projections with LPs

- LPs are good at simulating cost minimizing or profit maximizing behavior (i.e., dispatching electric power plants)
- LP’s do well at indicating how consumers should act to minimize cost
- However, consumers satisfy complex utility functions. The impact of their decisions on energy use are sometimes only incidentally considered (i.e. purchasing a car).
- In making energy projections, we must endogenize mechanisms that represent non-economic aspects of energy markets.
  - Imperfect foresight, hurdle rates, market shares, etc.
Time-Stepped Approach

- One of the benefits of using a time-stepped approach in SAGE is that it allows us to introduce non-optimal or non-linear decision algorithms.
  - Currently: imperfect foresight
  - Potentially:
    - market-sharing algorithm
    - learning by doing
    - cost of service ratemaking

Current Efforts and Status

- Software Development
  - VEDA and GAMS modifications were discussed yesterday
- Model Development
  - Upstream and Conversion templates
- Data Development
  - Often overlooked, but often the most important element of any projection/analysis
Development Efforts: Upstream

- Separated OPEC/non-OPEC supply in each region.
- Added reserves and resources for unconventional oil.
- Added capability to merge IEA and EIA data streams to evaluate and use best available data.
- Added representation for liquefied natural gas.
- Expanded coverage of biomass to include energy crops and biomass ethanol.
- Developed structure for supply curves for oil, gas, coal, and renewable energy. Obtained data.
- Expanded trade capability to include petroleum products.

Development Efforts: Conversion

- Rationalized IEA and UDI data
  - IEA provides fuel consumption and output by plant type.
  - UDI provides data on generation capacity.
  - Used IEA and UDI data to construct data for fuel consumption and output by plant and technology type.
- Estimated retirement profile for existing assets.
- Revised technology assumptions.
- Benchmarked to historical EIA data.
Data

• Probably, the most significant problem SAGE faces is obtaining consistent multiregional data.

• For the most part, we define data in SAGE as historical information about initial capacities, stocks, and resources; and technological/economic assumptions about the future.

• We think we have good data for developed countries and spotty success in developing data for less-developed countries.

• We have sponsored efforts to obtain multiregional information
  – Supply and Conversion sectors.

• Consistency across regions, technologies and time is important.

Regional Data Obtained

• Coal Supply Data: The McCloskey Group
  – Supply curves for hard coal
  – Bilateral coal trade projections
  – Lignite/green coal still a problem

• Renewable Data: Clean Energy Commercialization
  – Biomass (agricultural residues, forestry wastes, and energy crops), Municipal Solid Waste, Solar Photovoltaics, Concentrating Solar, and Geothermal

• Liquefied Natural Gas Tanker Rates: GRI

• Technology Assumptions: SAIC
  – Electric Generating Technologies
  – End-Use Technologies

• Oil and Gas Supply Curves: EIA
Where We Stand

• Reviewing projections generated by SAGE and making modifications as necessary to reflect a realistic projection
• Independent Expert Review
  – ETSAP is coordinating a review of the SAGE model structure and data.
• Documentation
  – A number of individuals are working in this room are working on documentation to be completed March 2003.

Future SAGE efforts

• Perform future environmental analyses as requested by the Administration or Congress
• Enhance the data inputs
• Enhance software system to allow users to effectively model and analyze scenarios.
• Incorporate run control systems to better track model inputs associated with model results.
• Improve model output reports so that even managers can read model results.