TFIAM/EC4MACS

WORKSHOP ON UNCERTAINTY TREATMENT

PRIMES ENERGY SYSTEM MODEL: UNCERTAINTIES AND THEIR TREATMENT

Dr. Leonidas MANTZOS

E3MLab of National Technical University of Athens

IIASA, Laxenburg, November 2010

E3M - Lab

Main Features of PRIMES

- Full coverage of the energy system, both in demand and supply
- Mixed representations:
  - Bottom-up (engineering, explicit technology choices) and
  - Top-down (microeconomic behaviors, consistent economic decisions by agent)
- Modular, with separate modules for each demand and supply sector and separate decision making
- Decentralized decisions form demand and supply of each energy commodity
- Market-oriented: market equilibrium prices drive energy balancing of demand and supply per energy commodity
- Electricity and/or Gas trade within the EU Internal Market and beyond is simulated
- Extensive set of policies represented
  - Taxes, subsidies, tradable permits or certificates
  - Technology supporting policies
  - Environmental policy instruments
  - Market interventions and regulations
- Policies and measures, the world energy markets, technology and the economy are exogenous and drive behavior and market equilibrium
- The assessment of alternative policy options is performed through the appropriate quantification of scenarios

System Coverage

- Geographical coverage
  - Each EU-27 member-state taken individually
  - Also, candidate MS and neighbors, such as Norway, Switzerland, Turkey, South East Europe
- Network coverage
  - Electricity and gas interconnections over Eurasian area
  - For electricity and gas markets, the European countries can be simulated as an interlinked system
- Core of the model: market linked sub-models for demand sectors, power/steam generation, fuel supply
- Satellite models: Biomass supply, refineries, detailed transport sector model, gas supply (Eurasian), H2 supply
- Time frame : 2000 to 2050 (2030) by five-years periods
- Model results fully calibrated to EUROSTAT data for the period 1990 to 2005 (simulated). Projections start from 2010

Data Input Sources

NEW CRONOS - EUROSTAT

- Energy Balance sheets (as available in April 2009)
- Energy prices (complemented by other sources)
- Macroeconomic and sectoral activity data
- Population data and projection

Technology databases developed under EC programs

- MURE, ICARUS, ODYSEE – demand sectors
- VGB, SAPIENTIA, TECHPOL – supply sector technologies
- NEMS model database, US DOE

Activity data from Industry associations

Various surveys (e.g. CHP)

Specifically commissioned studies

- ECN's and Observer's databases on RES potential
- TNO study on CO2 storage potential
- Specific database on biomass resources and possibilities

PLATTS and ESAP databases used for power generation capacities

Member States specific data and policy measures

INPUTS FOR A SCENARIO

- GDP and economic growth per sector (many sectors)
- World energy supply outlook – world prices of fossil fuels
- Tax and subsidy policies
- Interest rates, risk premiums, etc.
- Environmental policies and constraints
- Technical and economic characteristics of future energy technologies
- Energy consumption habits, energy efficiency options, parameters of supply curves for primary energy, potential of sites for new plants, …

QUANTITATIVE ANALYSIS APPROACH

- Definition of a Reference case (the "Baseline" scenario) which reflects the effects of current trends and policies
    - Baseline is not a forecast, nor the most likely future
    - Baseline should not overestimate nor underestimate effect of current trends and policies
    - It's quantification involves extensive consultation and exchange of ideas with Commission officials, industry stakeholders and Member States experts
- The "Baseline" provides the reference needed for the assessment alternative scenarios which reflect new policies and contrasted evolutions.

Types of uncertainties for PRIMES projections

- Historical data

  Arising usually due to historical data revision from Member States

  As the model is calibrated for the past such changes have an impact on future projections

  Such uncertainties cannot be handled except after the revision of the model database

- Baseline scenario assumptions

  Related to macro assumptions (macro-economic, demographic, international fuel prices)

  Related to policy assumptions (possible policy failures, underestimation or overestimation of the effectiveness of policies in place, introduction of new policies incentives etc.)

  Related to technological assumptions (possible technology failures, faster penetration, new technological options etc.)

  The impact on the model outcome depends on the degree of deviation from reality

  Handling this type of uncertainties involves the definition of alternative scenarios reflecting contrasted evolution for macro assumptions and the introduction of alternative policy sets

  - The alternative scenarios may exploit the effects of individual or combined changes of model assumptions
  - This is the usual approach retained in context of the analysis performed for various DGs

- Finally, no systematic biases have been identified in projections performed with the use of the PRIMES model

Thank you for your attention