

Appendix I

System for the Analysis of Global Energy Markets (SAGE)

The projections of world energy consumption appearing in *IEO2006* are based on EIA's international energy modeling tool, SAGE. SAGE is an integrated set of regional models that provide a technology-rich basis for estimating regional energy consumption. For each region, reference case estimates of 42 end-use energy service demands (e.g., car, commercial truck, and heavy truck road travel; residential lighting; steam heat requirements in the paper industry) are developed on the basis of economic and demographic projections. Projections of energy consumption to meet the energy demands are estimated on the basis of each region's existing energy use patterns, the existing stock of energy-using equipment, and the characteristics of available new technologies, as well as new sources of primary energy supply.

Period-by-period market simulations aim to provide each region's energy services at minimum cost by simultaneously making end-use equipment and primary energy supply decisions. For example, in SAGE, if there is an increase in residential lighting energy service, either existing generation equipment must be used more intensively or new equipment must be installed. The choice of generation equipment (type and fuel) incorporates analysis of both the characteristics of alternative generation technologies and the economics of primary energy supply.

The *IEO* provides projections of total world primary energy consumption, as well as projections of energy consumption by primary energy type (oil, natural gas, coal, nuclear, and hydroelectric and other renewable resources) and projections of net electricity consumption. Projections of carbon dioxide emissions resulting from fossil fuel use are also provided. All projections are computed in 5-year intervals through the year 2030.

More detailed tables emphasize the end-use demand-driven nature of SAGE.

SAGE provides projections for 16 regions or countries, including the North American countries of the United States, Canada, and Mexico; OECD Europe; the OECD Asian countries of Japan, South Korea, and Australia/New Zealand; Russia; other non-OECD Europe and Eurasia; China; India; other non-OECD Asia; the Middle East; Africa; Brazil; and other Central and South America.

Projections of world oil prices over the projection horizon are provided to SAGE from EIA's International Energy Module, which is a submodule of the National Energy Modeling System (NEMS). Projections of world nuclear energy consumption are derived from installed nuclear power capacity projections developed by nuclear power experts within EIA. All U.S. projections are taken from EIA's *Annual Energy Outlook (AEO)*.

A full description of the SAGE model is available in a two-volume set. The first volume provides a general understanding of the model's design, theoretical basis, necessary user-defined assumptions, and output. It also lists the software necessary to develop and analyze the results of SAGE-based policy and energy market scenarios. In addition, Volume I includes a Reference Guide, which explains each equation in detail. The second volume serves as a User's Guide for those actively developing SAGE-based scenario analyses. The documentation is available on EIA's web site in the model documentation section of "Current Publications" (<http://www.eia.doe.gov/bookshelf/docs.html>). SAGE documentation is also available as part of the documentation for the MARKAL family of models (http://www.etsap.org/MRKLDOC-III_SAGE.pdf).

