

An Introduction to the EnFore System: A Computerized Decision Support System 3-E Model for Taiwan

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Rapid technological progress has given rise to a new age of advanced efficient computing, with a wide range of decision support systems (DSS) - defined as early as the 1970s - having been developed aimed at improving decision-making effectiveness within various industries. Crude oil, natural gas and coal are severely limited energy resources, which according to many predictions, are set to become exhausted in the foreseeable future. There is therefore an urgent need to minimize the negative impacts from the use of fossil energy, adopting policies based on reliable energy demand forecasting and energy supply planning, with the aid of modern computer technology. The Energy Forecasting (EnFore) System, a computerized decision support system, was therefore developed with the aim of providing fundamental, but extremely valuable, information for the various complex economic, energy, and environmental (3-E) policy problems now existing in Taiwan.

Recent decades of developmental experience in Taiwan have shown energy to be one of the major driving forces behind the island's economic development and social modernization; however, since the island is not endowed with rich natural resources, it has to rely upon imports for around 97 per cent of its energy usage. Taking 2001 as an example, the domestic supply of energy in Taiwan amounted to 3.158 million KLOE (kilo-liter oil equivalent), about 2.9 per cent of the island's gross energy supply, whilst imported energy stood at around 105.363 million KLOE, accounting for the remaining 97.1 per cent. Of all primary energy supplies, crude oils and oil products were the major energy source, accounting for more than half of the island's total energy supply (51.4 per cent).

Despite the island's renowned success in the creation of an economic 'miracle', Taiwan has also seen considerable destruction of the environment upon which people have traditionally relied for their subsistence. The increasing consumption of energy has simultaneously led to steadily worsening environmental quality (air, soil, and water pollution) with the emission of controversial greenhouse gases severely compounding the growing problem of global warming.

Although government officials, as well as academic researchers, are extremely concerned about current 3-E problems and their growing level of complexity, the formation of a solid basis for policy decision making is not an easy task. The huge amounts of 3-E data needed represent an enormous cost burden, in terms of actual data collection costs, whether through field studies or laboratory experiments. Even when such work is completed and a database has been set up, this needs to be continually updated and maintained, whilst the follow-up work of data analysis, is again, no easy task. Building a suitable model can indeed cost a fortune, and this then requires suitable intellectual minds to operate and maintain both the model and the database, representing a further stretching of government resources.

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Energy Modeling Forum (EMF), International Energy Agency (IEA) and IIASA.
24-26 June 2003 at IIASA Conference Center, Laxenburg, Austria

Clearly, however, given the limitations of government budgets, and the many other administrative departments waiting in line for the attention of government officials, there is a need to develop a computerized DSS which can help to find an effective solution to the current fundamental 3-E problems. This has been the major driving force behind the development of the EnFore system in Taiwan since 1995, and indeed, it is very likely that the same needs have been driving the 3-E modeling experiences of many other countries.

The EnFore system is a time-based DSS which effectively integrates economic, energy, and environmental databases, algorithmic models, statistical models and mathematical programming simulation modules, and then presents these through an interface which is extremely user-friendly. The system provides government officials, energy managers, and researchers with a set of analytical forecasts and interactive simulation results on energy supply and demand, which are subjected to economic and technology constraints, for use as a reference in policy decision-making. Users of the EnFore system are able to construct energy policy scenarios by setting appropriate parameters and variable values; the corresponding data reports and figures can then be extracted as required.

The application of the DSS is demonstrated through the operation of policy simulations in the EnFore system, and this paper illustrates, in detail, the design philosophy and implementation of the system, along with a preliminary description of the framework, features and functions. In short, EnFore is a hybrid 3-E system model of economics, statistics, and engineering with a powerful database, simulation tools, and a user-friendly interface, but which is characterized by significantly lower costs.

Keywords: Decision support system, 3-E policy, computer simulation, energy forecasting, systems model, Taiwan

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