



## Energy Systems Analysis

Continued domestic and worldwide economic growth depends on reliable sources of power and stable fuel supplies at affordable prices. The professionals at Noblis are seeking solutions to energy-related issues that make the best use of energy resources while minimizing detrimental environmental consequences. To do this, we operate as a center of excellence and technical expertise in energy-related issues. Noblis' technical expertise encompasses many areas of energy technology:

Net energy analysis	Energy demand/supply modeling	Computerized simulation of energy conversion technologies
Energy policy analyses	Energy project evaluation and optimization	Environmental impact assessment
Renewable energy technologies	Coal conversion and utilization	Environmental control technologies
Nuclear systems	Natural gas conversion and utilization	Oil production, refinery, and storage operations

Some examples of our contributions within selected areas are provided below.

### Energy Demand/Supply Modeling

Under an internally-funded research program, Noblis staff developed world and country-by-country energy demand models from the present to the year 2100. These models estimate world and country-by-country demand for total commercial energy and energy demand for sectors based on estimations of annual change in commercial energy use per capita and rates of population increase. These demand estimates are then matched against potential energy supply. Energy policy planners can use these models to make informed energy-related decisions that will maximize the energy security of a country based on available resources and the most appropriate technologies. World oil resource implications derived from our model were independently corroborated by both the World Research Institute and Petro Consultants of Geneva.

Under another internally-funded research program, Noblis developed lifecycle models for three biofuels of current interest: biodiesel, corn-based ethanol, and cellulosic ethanol biofuels. The models include extensive research into biofuel feedstocks, agricultural data, production data, and process by-products. The dynamics between economics, biofuel demand, and available resources are also captured in our biofuels modeling effort. These models have been used to evaluate past and current national goals for U.S. biofuels production.

## **Alternative Fuels**

For many years, Noblis has provided support to national and international organizations in the development of alternative fuels. Noblis has provided considerable technical support to the U.S. Department of Energy (DOE) and its predecessor agencies in programs focused on research, development, demonstration, and commercialization of alternative fuels and power generating technologies. This included programs for oil shale, geothermal energy, coal gasification combined cycles, high-temperature gas turbines, solar energy, and wood combustion. Noblis has also supported DOE programs for fluidized-bed combustion, enhanced oil and gas recovery, and extraction of natural gas from unconventional sources including Devonian shales, western tight sands, coal beds, and geo-pressured aquifers. Our support to these programs included technology assessments, evaluation of pollution control technologies, assessments of plant performance, economic and cost-benefit analyses, assessment of environmental issues and health effects, and determination of research needs. Noblis had conducted major country specific studies and assessments highlighting various renewable energy options suitable for implementation in Egypt, Indonesia, India, Costa Rica, and other developing countries of Central and South America. The renewable energy options included solar, biomass, and solid waste-based energy conversion technologies that could be fully integrated into economic, social and other physical realities present in these countries.

## **Coal, Natural Gas, and Waste Conversion Technologies**

For the U.S. DOE, Noblis developed comprehensive, totally integrated computerized simulation models of coal, waste, and natural-gas-based plants for the production of transportation fuels, chemicals, hydrogen, and electric power. These models simulate the complete performance of the plants from feedstock to refined products and include complete estimates of construction, capital, and operating costs with resulting project viability

assessment. The models are used by DOE and other organizations—such as state governments and regulated utilities—to (1) quantify the benefits of project research and development, (2) assess the economic and technical feasibility of projects based on key parameters such as expected component performance, siting, feedstock costs, etc., and (3) perform cost/benefit analyses and “what if” studies. These models provide DOE and the states with a research guidance tool so that limited research and development funds can be applied to those technical approaches most likely to result in the highest benefits to the country's future energy security.

## **Nuclear Energy**

Noblis has considerable expertise and experience in the multi-disciplinary aspects of nuclear engineering. We have supported international, national, and not-for-profit organizations in the oversight of nuclear systems, facilities, and operations. Our support has included conducting and reviewing risk assessments, examining regulatory issues, developing safety requirements, and ensuring appropriate implementation of requirements. Nationally, Noblis has supported the Nuclear Regulatory Commission (NRC), Defense Nuclear Facilities Safety Board (DNFSB), and Nuclear Energy Institute (NEI), among others.

Internationally, Noblis has assisted both the Swiss Federal Nuclear Safety Inspectorate (HSK) and Paul Scherrer Institute (PSI). For HSK, Noblis supported the development of a methodology and guidance for reviewing the plant-specific data collection aspects of probabilistic safety assessments (PSAs) required to be performed for all Swiss nuclear power plants as part of their relicensing. Noblis assisted the PSI, a nuclear research organization, by developing an approach for the application of expert systems to effectively retrieve and utilize the results of thermal-hydraulic analysis of potential design-basis transients and accidents performed in support of plant licensing.