Electric System Dispatch Modeling

In separate projects for four different electric utilities (Northern Indiana Public Service, Southern Company Services, Minnesota Power, Louisville Gas & Electric), ECO staff installed an advanced model for optimizing the dispatch of electric generation plants and conducted client training on the model. As part of installation, ECO staff developed and entered utility-specific system data and tailored the model's performance to the characteristics of each utility system. The training process facilitated full transfer of model operation and analysis of results to utility operating staff.

Assessment of Utility Asset Management Strategies

For the Los Angeles Department of Water and Power, ECO staff evaluated the potential opportunity to sell or lease the Department's excess fuel oil storage capacity to a commercial provider. By assessing the commercial market for storage of hydrocarbon products in the Los Angeles basin, an initial economic analysis was performed to investigate and prioritize several alternative strategies for selling or leasing these surplus assets. The analysis examined the key market, environmental, regulatory and power adequacy risks associated with re-deployment of these storage facilities and supported initial contract negotiations between the Department and potential buyers.

Assessment of Power Adequacy Risks

For a major association of Ontario Hydro customers, ECO staff analyzed the power adequacy risks associated with the utility's long range generation supply plan. Using the utility's assumptions about demand growth and uncertainty, as well as the cost and performance assumptions for major new supply options, the analysis assessed the "option value" of maintaining the ability to install major new supply options. The study's recommendations challenged the utility's plan to defer development of major new supply options and served as supporting documentation in a regulatory proceeding on the utility's power adequacy.

Financial Analysis of a High-Voltage Transmission Research Facility

For the Electric Power Research Institute (EPRI), ECO staff conducted a financial analysis of a research facility used to test high-voltage transmission equipment for electric utility applications. The analysis reviewed available financial documents to identify major sources of funding as well as key components of facility operating costs. By understanding important trends in the financial performance of the facility, the study highlighted potential areas for EPRI management concern and provided recommendations for specific management action to improve the cost-effectiveness of the research program.

Development of a Financial Evaluation Model for a Utility

For the Electric Power Research Institute (EPRI), ECO staff developed a model to evaluate the full capital and operating costs of installing an advanced coal-fired generation technology in a utility generating system. Using estimates of cost and performance for the new technology, the model applied utility financial and regulatory principles to quantify plant revenue requirements. The modeling framework facilitated extensive sensitivity analysis to understand how alternative utility-system and demand-growth assumptions impact the plant's total power costs.

Development of a Project Evaluation Model for a Municipal Utility

For the Los Angeles Department of Water and Power, ECO staff developed a model to evaluate the costs and benefits of the Department's participation in projects developed by independent power producers. The model used a "total project" perspective that incorporated estimates of all required capital and operating expenditures over the lifetime of the project. In addition, the model used a multiple party perspective to consider the financial impacts of a project to a private developer or co-generator, as well as to the Department. The model was successfully transferred to the Department staff and used extensively in evaluations of potential contracts for co-generation and geothermal power.

Evaluation of Power Plant Investment Alternatives

For Portland General Electric (PGE), ECO staff analyzed the financial and operational impacts of re-powering an existing gas combined cycle generating plant. The approach used a simplified representation of the PGE electric system to quantify net cash flows under several alternative re-powering options. Extensive sensitivity analysis was used to test the importance of key assumptions about PGE's future power needs and the potential cost and performance improvements resulting from re-powering. The study recommended early re-powering of the plant as a low-cost hedge against the risks in PGE power availability.

Development of Electric Production Costing Methodology

In an independent research paper, ECO staff developed an electric utility production costing algorithm that evaluated the benefits of load-shifting resources, such as pumped hydro storage, with much greater accuracy than previously available methods. The approach used discrete approximations to efficiently simulate the large number of permutations of plant outage conditions and, consequently, marginal production costs, in a large utility system. Since the economics of load-shifting technologies require displacing expensive on-peak power with less expensive off-peak power, an improved understanding of the variability in the relationship between on-peak and off-peak marginal costs is critical to accurate benefits assessment. Using illustrative examples for a typical electric system, the paper quantified the algorithm's improved accuracy in measuring the savings in production costs due to load-shifting resources.

Integrated Resource Planning Model Enhancements

For the Electric Power Research Institute (EPRI), ECO staff implemented key regulatory and financial enhancements to the Load Management Strategy Testing Model that supports integrated supply-side/demand-side resource planning for electric utilities. The enhancements focused on providing greater flexibility to represent state by state variations in regulatory policies, as well as capturing the impact of changes in Federal tax laws.

Gas Transmission System Planning

For San Diego Gas & Electric, ECO staff evaluated the costs and benefits of alternative capacity-planning strategies for their gas transmission system. The existing system planning at the utility was based on a "design winter," with more severe winters requiring more transmission capacity to meet demand. Using a probabilistic demand forecast, the modeling approach balanced the excess capital costs due to over-capacity system with the outage costs due to under-capacity in developing a least-cost strategy. The evaluation used sensitivity analysis to understand the importance of key uncertainties in the timing and cost of system expansion, the reliability of critical equipment, and the costs associated with customer outages. The study recommended adopting a less severe "design winter" for system planning, with anticipated savings in customer gas bills of nearly one percent.

Generation System Planning Model Enhancements

For the Electric Power Research Institute (EPRI), ECO staff developed enhancements to the Over/Under Capacity Planning Model to better quantify the costs and benefits of alternative capacity expansion strategies. The specific enhancements included improved representation of advanced storage technologies and improved quantification of the value of reliable capacity. The enhancements were implemented in a new release of the model that was distributed to EPRI member utilities and applied extensively in utility planning applications.

Electric Generation System Planning

In separate projects for five different electric utilities (Kansas City Power & Light, Kansas Gas & Electric, Iowa Power & Light, San Diego Gas & Electric, and Iowa-Illinois Gas & Electric), ECO staff analyzed the costs and benefits of alternative capacity-expansion plans in support of regulatory proceedings. The analyses used the Electric Power Research Institute's Over/Under Capacity Planning Model, which made explicit tradeoffs between the costs of over-capacity (primarily excess capital costs) and the costs of under-capacity (including the costs of power outages, excess generation costs, and the environmental impact of excess plant emissions). The planning model explicitly quantified uncertainty in future electric demand growth, and used this probabilistic forecast to develop a capacity expansion plan with the lowest expected total cost to consumers.

Benefits of Modular Power System Expansion

For the Electric Power Research Institute (EPRI), ECO staff analyzed the benefits of modular generation technologies in electric generation system planning. Modular technologies represent an alternative to large-scale generation units, which utilities had traditionally installed on the basis of superior scale economies. Modular generating units, however, enable the utility to add capacity more quickly in response to fluctuations in system demand, and can help avoid the significant regulatory and financial risks associated with delays in construction of large-scale generation. An illustrative analysis was used to quantify the benefits of modularity to utility ratepayers and shareholders under alternative assumptions about demand growth, utility system characteristics, and the cost and performance of modular generating technologies.

Evaluation of Demand-Side Planning Options

In separate projects for three different electric utilities (Sierra Pacific Power, Public Service of Indiana, and Pacific Gas & Electric), ECO staff performed an economic analysis of alternative demand-side planning options, such as energy conservation programs. The analyses characterized electricity use profiles for major customer segments, estimated the potential impact of a demand-side program on electric demand in each segment, and used a production costing model quantify the potential generation savings from each program. The importance of key uncertainties in electric demand growth, cost and availability of generation capacity, and the cost and performance of each demand-side option was assessed in developing program recommendations.

Market Assessment of Energy Storage Options

For the Electric Power Research Institute (EPRI), ECO staff analyzed the potential market for both utility-owned and customer-owned storage technologies to meet future growth in energy demand. The analysis employed a linear programming model to simultaneously determine the optimal mix of electric generation and supply-side (utility-owned) as well as end-use (customer-owned) storage technologies. The results were used to communicate key regional trends in the market potential of each technology, to better understand the interactions between supply-side and end-use storage technologies, and to guide EPRI R&D investment decisions.

Economic Evaluation of End-use Energy Technologies

For the Electric Power Research Institute (EPRI), ECO staff performed an economic evaluation of the market potential for a broad range of advanced end-use energy technologies. The analysis combined economic screening with a more detailed linear programming model to determine the optimal mix of each technology under different regional market growth scenarios. The analyses illustrated how variations in regional heating and cooling demand, as well as the price of electricity, are the principal drivers of the market for new end-use technologies. The results guided EPRI R&D funding allocation decisions.

Commercialization Strategies for Battery Energy Storage Systems

For the Electric Power Research Institute (EPRI), ECO staff developed a model of the potential market for advanced battery energy storage systems for electric utility applications. Based on estimates of anticipated battery cost and performance, the utility system characteristics for major U.S. market regions, and the availability of alternative technologies, ECO staff forecasted the dynamics of battery market growth under various planning scenarios. The model was applied in case studies for two major U.S. utilities and used to develop recommendations for potential EPRI actions to facilitate commercial introduction of batteries.

Evaluation of Utility Power Exchange Opportunities

For the Los Angeles Department of Water and Power (LADWP), ECO staff performed economic analysis of alternative power exchange agreements with the Bonneville Power Administration (BPA). The analysis focused on expanding the scope of an existing "environmental exchange" agreement, in which LADWP received power from BPA during summer months, when NOX emission standards limited gas-fueled generation in the Los Angeles basin, and returned the power at negotiated exchange rate during the winter. Using a model of the LADWP electric system, the analysis measured the economic and environmental impacts of expanding the exchange agreement under a wide range of alternative scenarios for the future demand growth, gas prices, and resource supply scenarios.

Evaluation of Wind Energy Reliability

For U.S. Windpower, ECO staff estimated the potential value of wind energy resources in meeting firm energy requirements for electric utilities in the Pacific Northwest. ECO staff developed a methodology to quantify the reliability of wind energy based on historical wind data that is consistent with other metrics commonly used in reliability planning by hydro-based utilities. The approach helped to understand the potential interactions between wind and hydroelectric energy in ensuring system reliability. U.S. Windpower incorporated the analysis in the development proposals submitted to several Northwest utilities.

Financial Evaluation of Geothermal Energy Projects

For the Los Angeles Department of Water and Power, ECO staff evaluated potential investments in two separate geothermal energy projects. The evaluation estimated the project cash flows from the perspective of the Department, as well as the independent power producers who developed the projects. A key result of the analysis was to quantify the risks and returns to both parties, given uncertainty in project cost, performance, and economic lifetime. The analysis facilitated timely evaluation of alternative contract structures that the Department used to support negotiations with the project's developers.

Implementation of Demand-Side Planning Model

For Niagara-Mohawk Power Corporation, ECO staff developed a model to evaluate alternative demand-side management and conservation options for power system planning. The model combined information about the cost and performance of each demand-side option with Niagara-Mohawk system marginal cost information, obtained from a separate, more detailed production costing model. System marginal costs provide a reasonable estimate of the cost savings obtained when electric demand is reduced or shifted due to demand-side management programs. The model was used by the utility for extensive cost-benefit screening analysis of a wide range of options that the utility was considering in its integrated resource planning process.

Market Evaluation for Fuel

For a utility, ECO characterized the local market for fuel, described and forecasted economic variables that influence the market, and developed a model for predicting the availability of fuel at various prices over a five-year period.

Demand-Side Management Conservation Program

For the California Public Utilities Commission, ECO assisted with efforts to monitor and evaluate the multi-year, demand-side-management conservation program. This included sample process and program evaluation design, database integrity checking, and review and replication of statistical analyses.

Interim Review of City Water Rates

For Seattle Public Utilities, ECO reviewed the cost allocations between wholesale and retail customers for an interim rate increase associated with salmon recovery efforts and the impacts of Washington State Initiative 695. This work included a review of current rate calculations and agreements, and a memorandum report.

Privatization of a Utility

For PAC/WEST Communications, ECO evaluated a plan to have six counties purchase Portland General Electric. This analysis included an assessment of the likelihood of reduced electricity rates that were promised by the plan's proponents.

Profitability and Risk of New Electricity Generating Capacity

For Electric Power Research Institute, ECO developed a financial model to study the profitability and risk of an investment in new generating capacity for electric utilities. The model also projected the CO_2 emissions reductions as a function of CO_2 value, natural gas price, and demand.

Financial Evaluation of Risk Associated with CO2 Regulation

For a private client, ECO expanded a financial model to estimate electricity demand, profitability, CO_2 emissions and other factors under different probabilities for fuel and emissions prices. ECO compared potential demand under many different price scenarios, allowing the client to estimate the financial risk associated with building new generating capacity.

Option Value of Carbon Capture and Storage

For the Electric Power Research Institute, ECO developed a model to estimate the value of capturing and storing carbon emitted by coal-fueled electricity plants. The model explicitly incorporated uncertainty in future CO_2 prices. The results yielded information to inform electricity plant owners about the value of retro-fitting plants to capture and store carbon.

Evaluation of Conservation Financing Techniques

For the City of Eugene and the Bonneville Power Administration, ECO evaluated a range of financing techniques to increase the conservation of energy among commercial users.

Environmental Analysis for Utility

For a large public utility, ECO analyzed all public documents relating to environmental issues for a potential acquisition, including 10-K and annual reports on two companies spanning an eleven-year period, as well as all published newspaper, magazine, trade journal, and news wire accounts from 1979 through 1997. ECO compared each company's spending on environmental matters to that of a selected peer group.

Utility System Planning

Economic and Financial Analysis of Energy Markets

For Kinergy, LLC, ECO provided ongoing economic and financial analysis associated with electricity power markets, hydro and other electricity generating facilities analysis, and other support. Work included analysis of Bonneville Power Administration's demand charge rate structure and 30 year forecasting of electricity power rates.

Environmental Accounting in Least-Cost Planning

For Portland General Electric (PGE), ECO evaluated the adjustments applied to the economic costs of alternative energy resources to account for environmental externalities in PGE's least-cost planning effort.

Natural-Gas-Distribution Reconnaissance Study

For the Springfield Utility Board, ECO performed a natural-gas-distribution reconnaissance study. ECO analyzed the costs of procuring and distributing retail natural gas, performed an analysis of market demand, and a feasibility analysis of the utility's entry into the market.