

67 Understanding Power and Fuel Markets and Generation Response

Program Overview

Program Description

This program assesses energy market developments to provide in-depth understanding of the changing generation infrastructure and related markets in coal, natural gas (NG), and emission allowances. It offers objective and authoritative data, analysis, and tools that give insight into wholesale electricity markets, generation development, and the changing structure and impacts of natural gas trading. With a focus on the near- to intermediate-term, the program provides strategic insight into business risks, technology needs, and energy and asset management strategies for power plant owners and operators, the fuel industry, and the financial industry.

Industry Needs and Issues Addressed

- Cancellations/withdrawals of planned coal plants alter the mix of new plants and disrupt expectations for natural gas. This is the tip of the iceberg of industry and market changes that can be expected to result from climate change.
- Record international markets have driven up U.S. coal exports and domestic prices.
- The U.S. gas infrastructure is changing rapidly, led by development of liquefied natural gas (LNG) terminals and major pipelines.
- Coal supplies and use are changing rapidly, with widespread FGDs and new life for the Illinois Basin.
- Speculative cash flow in commodities is adding dimensions to NG pricing and risk.
- Surging wind capacity is changing operations and profit for existing generation portfolios, increasing spinning reserves and fast response generation, and altering new asset choice and NG procurement.
- The large amount of available information, opinion and uncertainty demands flexible analysis and foresight.

Impact

- Improved fuel management. Stakes are high; the value of a five-year coal supply for one 500-MW plant is \$400–\$500 million or more. These costs affect an entire company -- through rates, possible non-recovery, and budgets for non-fuel investment – and tie profitability to a volatile commodity.
- Greater confidence in views of markets and uncertainties, improved basis for technology evaluations and capacity expansions, well-documented third-party information, credibility with regulators, better fuel supply chain management, and improved basis for plant budgeting.

Key Accomplishments

- Helped planners become informed consumers of forecasts and opinions
- Improved understanding of NG market changes and price risks, such as the impacts of coal plant cancellations
- Provided insight on SO₂ emission allowance outlook (price trajectories), causes and uncertainties
- Investigated the outlook for new power plants: likelihood, retirements, reserve margins, and uncertainties
- Provided comprehensive perspective on international developments in power generation, NG/LNG, and coal
- Applied top software for fuel inventory evaluations

- Demonstrated of state-of-the-art market simulations applied to FGD additions and plant budgeting.
- Provided authoritative documentation of fossil plant investment and performance trends

Current Year Objectives

- Identify power industry development paths: the extent and impacts of coal plant cancellations and power industry development, tightening reserves margins, the likelihood of non-coal alternatives, and requirements for natural gas (case studies initiated in 2008).
- Identify gas market risk: Major changes in NG gas supply infrastructure, leading to temporary improvement of supply-demand balance (regional assessments initiated in 2008). Also assess longer-term (im)balance.
- Identify gas market risk: LNG pricing, and the strength of oil linkage versus NG (HH) linkage. Impacts of capital inflows into natural gas trading.
- Identify coal market risk: the value of fuel source flexibility (initiated in 2008) with monitoring of U.S. and international expansions and market adjustments from 2008 peaks.
- Identify fuel delivery disruption risk and the implications for inventory planning and software tools
- Report on commodity and trade factors: update on steel (initiated in 2008), guidance on exchange rate impacts across the fuel spectrum
- Report on impacts of wind capacity growth on existing portfolios such as markets, operations, asset value, and triggering thresholds (case studies initiated in 2008)

Industry Involvement

- Estimated 2009 funding: \$0.5M

Program Technical Lead

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Summary of Projects

Project Number	Project Title	Value
P67.001	Future Power and Fuel Directions	Examines greatest risks in volatile fuel markets, with emphasis on natural gas, coal, and the power sector's role in these markets. Studies assess impacts of coal cancellations, widespread FGD, and surging wind capacity. Studies build on base of U.S. and global research, and include new topics such as LNG price formation and capital inflows into NG trading.
P67.002	Generation Portfolio Optimization	Assesses generation investment performance and profitability for critical issues using state-of-art, market-based power industry simulations. Current focus is impacts of wind generation. Case studies demonstrate actual impacts as well as methods of analysis. Recent examples include impacts of FGDs and of changes in duty cycle and EFORs.

Project Descriptions

P67.001 Future Power and Fuel Directions (062018)

Issue

Fossil fuel costs in the U.S. power sector have reached \$91 billion/yr (through 2007) and still are rising. The costs of individual fuel transactions are enormous: \$500 million for coal supply for a 500-MW plant is not unusual. Natural gas, representing only 21.5% of generation, accounts for 54% of the cost and places even greater pressure on peak power prices. And there is great uncertainty about the duration of high prices, with a variety of view and opinions. The goal of this program is to understand the circumstances in depth and with transparency, interpreting the flow of information and opinions from the perspective of those who must make sense of this information to use it in their decisions and plans.

Description

This project provides information about the principal drivers of fuel markets and how they affect uncertainty. The project also examines the power sector's use of fuel and tracks new power plants and the special challenges created by the cancellations, withdrawals and deferrals of proposed coal plants. The research priorities are adjusted each year. Natural gas is a perennial priority, focusing on forces causing lessening and tightening of the markets over the intermediate term, and addressing the vital but little-understood questions of how, and how much, international oil prices could influence U.S. gas and power prices through LNG price formation. The popularity of commodities is intensifying speculative capital inflows into NG trading. Coal markets are in great turmoil, with prices reaching record levels pushed by surging international markets, which raises questions about market correction and future benchmarks. In the meantime, flexibility to use non-traditional coals can bring enormous savings. The weak U.S. dollar is a poorly quantified planning factor, and this project will examine this and other important and related non-fuel issues, such as steel's indirect reach into fuel costs.

Value

- Information about the extent and sources of risk in fuel markets.
- Indications of market turnarounds, and the divergence between fundamentals and the activities of traders.
- Information about boundaries on likely price movements (ceilings and floors).
- Guidance on longer-term planning and assumptions used in technology evaluations.
- Quantification of changes in revenues and net income due to investments at individual plants and changes in the generation mix.

How to Apply Results

Fuel costs are the greatest portion of daily operating costs and, if not recovered, have the potential to put great strain on net revenues, customers, and regulators. Because of their magnitude, they also can greatly limit companies' financial flexibility, while at the same time—as high natural gas prices raise power prices—they also can add to the revenues of solid-fuel plants. These considerations mean many stakeholders use fuel information. EPRI studies, newsletters, workshops and seminars supplement the many sources of public and private information, bringing depth of analysis, disclosure of uncertainties, and early awareness of emerging factors and changes in risk. Planners can use this information in forming assumptions used in fuel and technology planning.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Energy Markets and Generation Response Article Series: This newsletter provides about six articles per year. One series of articles is "Update on New Power Plants," which evaluates the status of announced plants more critically than other sources, and incorporates information on retirements, capacity utilization of new combined-cycle units, and related assessments. Other articles address a wide range of fuel and power topics, emerging issues, and international developments. Examples of article topics include the impacts of coal plant cancellations on natural gas use for power generation and possible gas market price impacts; an explanation of global steel market volatility and its outlook; and coal contract negotiations and coal transportation cost escalation. In some cases, topics introduced as article are taken up in subsequent major studies. Examples include SO₂ price volatility, capacity reserve margins, China coal, and European and Asian natural gas markets.</p>	12/31/2009	Technical Resource
<p>EPRI-EEI Annual Power & Fuel Supply Seminar: This annual event, co-hosted with EEI as the EPRI-EEI Annual Power & Fuel Supply Seminar, is one of the program's flagship activities. Investigators bring insights based on original research for the program. Additional speakers and topics widen the coverage. By convening key personnel from across the industry to evaluate top issues in fuel and asset planning and management, the seminar helps attendees gauge risks and identify new priorities for the program. Where possible, close coordination with a host utility and its executives brings a strong client perspective to the design and discussions.</p>	12/31/2009	Workshop, Training, or Conference
<p>Power Industry Development Paths and Natural Gas Market Risks: Power industry development is becoming tightly intertwined with the outlook for natural gas through coal plant cancellations, falling reserve margins, inevitable increases in gas-fired capacity and generation, and tighter gas markets. This study assesses and integrates the chief elements shaping gas market risk over the intermediate to long term. Specific research priorities include:</p> <ul style="list-style-type: none"> • Tightening reserve margins (for example, in response to coal plant cancellations) and default choices of natural gas generation through case study scenarios taking into account coal, gas, nuclear and renewables • Relief from an expanding natural gas infrastructure as evidenced by numerous pipeline projects and record additions of LNG regasification capacity • Countering forces affecting the longer-term outlook such as power sector demand increases and questions about Arctic gas and Canadian supplies • The vital question of LNG pricing, weighing logic and views on the linkage to oil • Changes in natural gas trading and their impacts on price risks and hedging, including perspectives on capital inflows first seen in large volumes during the first quarter of 2008. 	12/31/2009	Technical Report

Product Title & Description	Planned Completion Date	Product Type
<p>Coal Market Risk and Response: Forecasting national and international coal prices no longer is an easy task. When this research portfolio was prepared, coal markets were in the midst of a spike on top of a plateau—the third major market event since 2000. Building on EPRI’s 2008 report (1014147) and initial research into radical changes in the economic balance of coals from different regions, research priorities include evaluating the value of fuel flexibility at coal-fired generating plants and monitoring U.S./international expansions and market adjustments set in motion by several years of escalating prices. Assessments combine analysis of commodity price and transportation rate levels and feedbacks, providing insight into price extremes, expected market corrections, price floors, and benefits of measures to enhance fuel flexibility. An additional priority is to evaluate fuel delivery disruption risk, which will provide information about the EPRI Utility Fuel Inventory Planning Model as well as those employing other techniques to evaluate inventory levels. The research will remain flexible, considering transportation corridor analysis or emerging priorities related to CO₂ reduction targets as they are identified.</p>	12/31/2009	Technical Update
<p>Commodity and Trade Factors: Commodity prices and the weak U.S. dollar are key factors in increasingly important energy and financial forecasting. This study will detail these forces and their volatility and interrelationships over the intermediate term. Changes in the value of the U.S. dollar may have their greatest and most direct impacts on international coal prices, but their impacts on oil and natural gas pricing are far more controversial. Among commodities, the enormous global steel market affects the power industry in many ways: directly, in the costs of capital equipment (examined elsewhere by EPRI under Program 9); and indirectly, in the costs of mining equipment, rail cars, barges, petroleum industry tubulars, pipelines, oceangoing vessels (coal, LNG), and more.. This analysis will build on the currency analysis in EPRI’s recent international coal report (1014922) and on the Program’s 2008 steel review.</p>	12/31/2009	Technical Update
Future Year Products		
Product Title & Description	Planned Completion Date	Product Type
<p>Power Industry Assessment: Reserve Margins, Retirements and Capacity Utilization—Update: The outlook for new power plants is growing more uncertain. This study offers a systematic assessment of new plants and their likelihood, announced and projected retirements, load growth, the role and efficacy of different regional market structures and incentives for new capacity, implications of skyrocketing capital and construction costs, and other factors. The study will examine ongoing regional studies of resource adequacy and pending problems, evaluate the range of views, provide a framework for evaluating these factors, and build on knowledge gained in the program’s 2008 research.</p>	2009	Technical Update

Product Title & Description	Planned Completion Date	Product Type
<p>Future Power and Fuel Directions – Continuing Assessments, New Topics, International Dimensions: Domestic and international fuel markets are intertwined, as most recently demonstrated in coal pricing. Coal plant cancellations and development difficulties are changing technology choices and fuel dependence. LNG is experiencing record buildup both in supplies (liquefaction capacity) and terminal development. The role of the Henry Hub in Atlantic Basis LNG pricing is growing in importance. Dramatic downward swings in fuel markets are widely expected, yet any relaxation in the gas markets is expected to be followed soon by difficult-to-contemplate tightening. Research priorities will anticipate, monitor and adapt to these global dynamics and others associated with clarifying CO₂ policies.</p>	2009	Technical Update

P67.002 Generation Portfolio Optimization (062019)

Issue

The power industry faces many factors that are rapidly changing the generation mix, including particularly rapid buildups in FGD installations and, in some regions, wind capacity. The pace of change will accelerate with enactment of requirements to reduce CO₂ emissions. Authoritative assessments using case study techniques give insights into factors that will change operations/dispatch and revenues, and which might revise asset valuations for both regulated and non-regulated companies.

Description

This project uses state-of-the-art market simulation methods to reveal impacts of major factors affecting generation and generation planning. Proposed and recent studies span wind capacity impacts (a continuing priority), changes in unit operations and performance such as the value of cycling and of reducing EFOR risks, revenue and operational impacts associated with widespread FGD retrofits, and increasing generating unit flexibility (for example, achieving lower turndown levels). Case study or scenario results include generation levels and changes in capacity utilization for individual units and portfolios, markets (peak and off-peak prices) over different periods of time, net income, and components of revenues including energy, ancillary services, and capacity.

First assessed in this program's simulations in 2004, the recent emphasis on wind capacity is part of a multi-year analysis conducted during 2008-2009.

Value

- Anticipate market and operational changes associated with the expansion of renewables across existing generation portfolios.
- Identify revenue-enhancing and revenue-reducing impacts across a fleet.
- Assess changes in asset valuation -- for example, appreciate how and when a greater premium for highly flexible generation would reconfigure the value of NGCCs versus NGCTs.
- Tap into industry experience on meeting the need for greater flexibility in generation and fuel storage and delivery.

How to Apply Results

Tasks modified when wind generation levels increase or new market structures are introduced can include

- Plant operation, through additional shifts, more startups, and providing ancillary services such as spinning
- Budgeting
- Fuel procurement procedures, particularly the daily challenge of acquiring natural gas for fast-response generation on short notice
- Possible revisions in asset valuation of new capacity.

EPRI’s studies provide a “heads-up” on the nature and scale of these effects. Companies can use the results both for comparison and to refine their own analyses.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Generator Operations, Investment and Revenue Analysis: Case Studies: Dominant changes in the power generation infrastructure over the intermediate term include the expansion of renewables, particularly wind, and widespread proliferation of FGD retrofits that will affect more than 70% of all coal generation by 2016 (per EPRI report 1014147). This study will examine the numerous impacts and threshold points of wind capacity additions. Developments in Texas are illustrating a wide range of impacts, including severely depressed zonal prices in the most-affected areas; the need for greater spinning reserves and fast-response generation; shifts in the balance of energy versus ancillary services revenues (a key finding from the 2004 report); and changes in the relative economics of CT versus CC capacity additions. The scale and triggering points of these effects will be investigated, offering guidance on the phenomena, methods of analysis, and the applicability of findings to other geographic areas.</p>	12/31/2009	Technical Update
<p>How New Market Structures Change Plant Dispatch and Revenues: New market structures such as the start-up of MISO and SPP have altered traditional patterns of dispatch and operations. In some cases, CTs and CCs have dispatched in opposite fashion from expectations and tradition. Information about this phenomenon and its implications will be developed through webcast-facilitated discussions and targeted market simulations. Implications extend to changes in fuel use, improved coordination with fuel suppliers, the need for natural gas storage, changed reserve requirements, increased gas-fired generation, and shifts among sources of revenues. This study is an opportunity to gain insights both from industry colleagues and EPRI analysis.</p>	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<p>Generator Operations, Investment and Revenue Analysis: Case Studies: Unprecedented financial hurdles and environmental obstacles to solid-fuel plants, regardless of how advanced, place an enormous premium on the value of existing assets. This project features a series of market-based financial and operational simulations that provide insights on plant investment risks and methods of analyzing them. By 2010, research priorities are expected to shift from the recent emphasis on wind impacts to assessing turnover in the fossil fleet, as reflected in coal plant retirements and natural gas or other capacity additions. Responses to CO₂ reduction measures likely will dominate longer-term planning, even though the industry will have just completed a massive expansion of FGD units and begun to learn their impacts on fuel choice, operating flexibility, and competitive positioning. Case studies will take these issues into account in evaluating portfolio changes in regional dispatch and portfolio performance.</p>	2010	Technical Update
