Introduction

Q. Please state your name and position.

A. My name is Frank C. Graves. I am a Principal at the economics consulting firm *The Brattle Group*, where I am also co-leader of the utility practice group.

Q. Please summarize your qualifications and experience briefly.

A. I specialize in regulatory and financial economics, especially for electric and gas utilities. I have assisted utilities in forecasting, valuation, and risk analysis of many kinds of long range planning and service design decisions, such as generation and network capacity expansion, supply procurement and cost recovery mechanisms, network flow modeling, renewable asset selection and contracting, and hedging strategies. I have testified before the FERC and many state regulatory commissions, as well as in state and federal courts, on such matters as integrated resource planning ("IRPs"), the prudence of prior investment and contracting decisions, costs and benefits of new services, policy options for industry restructuring, adequacy of market competition, and competitive implications of proposed mergers and acquisitions. I am the author of several publications in risk management. I received an M.S. with a concentration in finance from the M.I.T. Sloan School of Management in 1980, and a B.A. in Mathematics from Indiana University in 1975. A detailed resume is attached.

Q. Have you previously testified for Rocky Mountain Power (the "Company") in regard to risk management and hedging?

A. Yes. I filed testimony on behalf of the Company before the Public Service Commission of Utah in Docket No. 10-035-124. I also filed testimony in the

Company's request for a power cost adjustment mechanism in Utah, Docket No. 09-035-15, some of which addressed risk management and hedging. I participated in the 2011 Utah workshops on risk management goals and approaches between RMP, the Commission Staff, and various customer group representatives. Most recently, I filed rebuttal testimony on behalf of the Company in Wyoming in Docket No. 20000-405-ER-11.

Q. What is the purpose of your testimony?

A. I have been asked to review the pre-filed direct testimony of Dr. J. Robert Malko on behalf of Utah Industrial Energy Consumers ("UIEC") and to comment on his recommendations regarding the disallowance of a portion of the Company's hedging costs.

Q. What specifically do you discuss in your testimony?

A. I will respond to Dr. Malko's views about the prudence of the Company's natural gas hedging practices and his proposed disallowance of a portion of the losses incurred on hedges priced above current forward prices for natural gas. More specifically, I discuss the following three questions:

1. Whether the Company's hedging policies are consistent with good industry practices;
2. Whether cost minimization should be a central part of the Company's hedging goals;
3. Whether various analogies to other hedging and investment situations demonstrate a flaw in the Company's approach.

Each of these is discussed below, after a brief summary of Dr. Malko's position.

Q. Please briefly summarize Dr. Malko's critique.

A. Dr. Malko criticizes the Company for being exposed to, and enduring, roughly 44 months of nearly continuously increasing mark to market losses in the value of its forward gas supply positions. These hedges were entered into and held through a period of time which, in hindsight, has experienced unprecedented reductions in the spot and forward prices of natural gas – largely due to the explosive growth in shale gas. Dr. Malko claims that there were "red flags" that should have warned the Company to get out of some or all of these hedges and (apparently) cause them to cease hedging natural gas needs – although Dr. Malko is not explicit about whether the Company should have later re-hedged any or all of the portions he wishes had been liquidated. (Rather, he simply proposes that 50 percent of losses from mid-2011 to present be disallowed, or about $16.5 million.) He alleges that failure to liquidate out-of-the-money hedges is a sign of casual or perhaps even negligent risk management, perhaps pursued because (he suspects) the Company may have felt indifferent to declining market trends as a regulated entity with fuel cost recovery mechanisms.

Q. What is your response to Dr. Malko's criticisms?

A. I disagree with Dr. Malko's opinions in several respects. First, he is recommending a disallowance without offering a theory of what the costs would have been under alternative risk management practices he believes the Company could and should have used. Such an alternative would have to be demonstrably and repeatedly useful under a variety of market conditions that would not all involve the same pattern of gas price evolution as happened to occur in the last

few years.

Second, he expresses a desire that cost minimization should have been a driving force in the Company's hedging practices, but cost minimization has nothing to do with risk management -- unless he wanted the Company to begin speculating that the market for natural gas was going to continue to go down further than forward prices were showing. (It happened to do so, but that was not the market signal at any point in time).

Third, he also underestimates or does not appreciate the extent of unforeseeability of the amazing recent gas price collapse. Even natural gas exploration and production firms involved in the development of the hydraulic fracturing technology that has caused this price drop appear to have been surprised by the rapid price reductions.

Fourth, he draws several analogies to other trading situations that he believes show the applicability of his approach in other settings, but these are not comparable to managing the Company's fuel risk, and in some cases he is not even correct about what transpired.

1. PacifiCorp's Practices in Relation to Industry Norms

Q. Are you familiar with the Company's hedging policy?

A. Yes. On several occasions over the past few years, I have reviewed the Company's risk policy and various monitoring reports that have been provided to me by PacifiCorp. I have also spoken to employees responsible for managing, measuring and monitoring the Company's risks. I am also familiar with risk management practices commonly used in the utility industry, as well as the

mathematical tools and financial instruments available for energy market hedging.

Q. What are the main components of the Company's hedging program?

A. The main components of the Company's current risk activities that serve to reduce customer exposure to fuel and power price volatility are To-Expiry Value at Risk ("TEVaR") and Value at Risk ("VaR") measurements, TEVaR and VaR limits, and the new hedge percentage guideline ranges that resulted from the collaborative workshop, during which I also participated on behalf of the Company, all of which are outlined in the Company's risk policy and procedures. These limits and targets force the Company to closely monitor the open positions it holds in power and natural gas on behalf of its customers (which it does on a daily basis) and to limit the risk exposure resulting from these open positions for prescribed time frames in order to dampen customer exposure to price volatility. Specifically, the TEVaR metric automatically results in a reduced hedge requirement as commodity price volatility decreases, and it requires an increase in hedged volumes as volatility increases or as correlations among commodities diverge.

Prior to May 2010, the Company had volume-based hedging targets. These can also be effective but are less responsive to shifting market conditions than using TEVaR. The new natural gas hedge percentage guidelines that resulted from the collaborative are also restrictive in this regard, but a reasonable range has been provided that allows some flexibility while TEVaR and VaR take into account combined natural gas and electricity exposures to primarily inform electricity hedging, which is even more dynamic than the Company's natural gas exposure.

Q. What are your opinions about the Company's hedging practices and policies compared to industry norms?

A. The Company's risk policies, analytic methods, and controls are sophisticated, well-developed, and aptly suited to monitoring and managing natural gas and power cost risks over time. The Company has in place an advanced platform for estimating and reporting the mark-to-market value of, and risk metrics pertaining to, its electric and natural gas portfolios. These metrics are reported and reviewed on a routine, timely basis, and the Company is required to resolve movements in its portfolio beyond established risk limits. The hedging policies have been carefully and repeatedly explained to interveners and the Commission Staff, and there are substantial documents reporting on hedging activities and results that are informative and consistent. Dr. Malko himself has commented elsewhere that prudence is defined in large part by comparability to best practices in the industry.[1] In my judgment, the Company's policies stand up well under such comparisons.

Q. Dr. Malko believes that the Company was imprudent for not liquidating out-of-the-money hedges. Do you agree?

A. No. Dr. Malko asserts that "… the Company's failure to be an active manager as it relates to fixed for variable natural gas swaps" (p. 2) and "cut its losses and liquidated at least a portion of its natural gas hedged position" (p. 16) is the reason for his suggestion of imprudence. He alleges that the Company lost hundreds of millions of dollars because the Company allowed "its natural gas fixed for

[1] Pre-filed Direct Testimony of Dr. Malko on Revenue Requirement on behalf of UIEC in Docket No. 10-035-124, p. 9-10.

variable swap hedging program to continue on the pre-set path of destruction with no plan to intercede with intelligent reevaluation." (p. 3-4). This argument implicitly assumes that liquidating hedges would serve some normal goal of risk management, or would reduce expected costs. Neither of these is correct, and I am not aware of any utility that liquidates hedges absent changes in volumes needed.

Q. Why don't utilities liquidate out of the money hedges?

A. Once a utility has set its hedging goals based on risk metrics and begins covering those needs, it rarely if ever reverses prior positions. This is not a matter of neglect or disinterest, but an appropriate policy because there is no expected economic benefit from liquidating. The only way to get out of a contract is to sell it at market forward prices -- which is the same set of prices the utility then faces for replacing that supply of fuel or power going forward. Assuming there is still a future need for just as much fuel or power, there is no expected savings from marking to market and then buying at market thereafter. For PacifiCorp, as forward gas prices fall, its future demand for gas supply actually increases, because its gas-fired generation becomes more likely to be in the money. Thus there is no reason to unwind hedges. Replacing them would simply involve incurring the bid-ask spread needlessly.

As explained below, there can only be a savings from unwinding and not replacing hedges if the market falls in the future to an extent not already anticipated at the time the liquidation occurs. Sometimes this may happen (as here), but it cannot happen on average, or else the forward prices are inefficient. It would be speculative to assume it would occur. This would also require a finding

that either the Company's risk goals should change (to tolerate more risk) or that market risk had fallen so much that replacement hedges were not needed in order to keep the Company's expected costs within target bounds. Importantly, Dr. Malko offers neither such an assessment nor a recommendation.

Even if risk metrics are falling (such as forward volatility, VaR or TEVaR) there is still no expected economic advantage to unwinding positions already under contract. At most, this change in future risk will allow a deceleration of incremental (remaining) hedging prior to delivery dates. (Interestingly, the recently held workshops in Utah on RMP hedging practices explored a possible practice that is diametrically opposed to Dr. Malko's suggestion – namely, there was great interest in whether the Company should increase its extent of hedging as prices fall, so that more forward supply is locked in at a low price.) (He cites a few analogies to other investment situations to support his belief that liquidating hedges is normal, good business practice, but as discussed later in this testimony, these analogies are not apt or informative here.)

Q. How does the EBA affect the Company's incentives to control cost?

A. Dr. Malko alleges that the Company may have been indifferent to liquidating its hedges because of a lack of exposure to out-of-the-money positions. He is simply incorrect, in two respects. First, the Company has strong incentives to control costs regardless of the EBA, because like nearly all utilities, it recovers a significant portion of fixed costs through variable charges. Accordingly, volume of sales matter to its financial health. Second, the 30 percent disallowance in the EBA of the difference between actual net power costs and base net power costs in

rates was insisted upon by UIEC and adopted by the Commission (over the Company's strenuous objections) under the theory that the provision was essential to provide the Company with an incentive to control costs.

2. Cost Minimization Is Not a Proper Goal of Risk Management

Q. Please explain what risk management is expected and is not expected to control.

A. Dr. Malko repeatedly criticizes the Company for failing to formalize criteria for cost minimization in its risk policies, and for failing to adopt what he regards as cost minimizing practices (here, unwinding hedges that move out of the money). For example, on p. 12, Dr. Malko states:

> "The concept of balancing price stability with cost minimization continues to fall on deaf ears."

Properly understood and practiced, risk management is about controlling the potential width (and shape) but NOT the mean of the distribution of future costs (or revenues). Fairly and competitively priced hedges will only trade if both sides regard the amount paid for the risk transfer to be worth the value gained (or cost incurred). This means there can be no improvement in the expected cost for one side of the deal, or else the other side is facing an expected degradation. If so, they would be better off not trading. For the same reason, you cannot expect to reduce your future costs by NOT hedging. The hedges you forego have a fair price that reflects what you would likely pay on an unhedged basis as well (albeit with a different, more certain pattern over time).

Q. Does hedging change expected costs?

A. No, hedging does not change the expected costs of the commodity being hedged. The only costs that are eligible for minimization under hedging are transaction costs and potential costs of non-performance of the other side. Both of these are generally small in relation to the traded price at delivery. Ironically, these are the very costs that Dr. Malko's approach would increase, because he would have had the Company move out of hedges (at a small bid-ask placement loss), thereby incurring unnecessary transactions costs for no expected benefit.

If Dr. Malko is suggesting that the Company should have liquidated and never re-hedged (as appears to be the case – certainly this is the basis for his disallowance calculations), then he is effectively saying either that:

1. the Company should have set new goals for its risk management by mid-2011, or
2. the Company should have speculated that prices were going to continue to fall.

The "red flags" he describes as signals of this need are the continuing monthly losses in mark to market value of the Company's prior positions, and the falling prices of natural gas. Of course, the expectations for price reductions were fully reflected in the forward price of gas at any time, to the extent this possibility was understood by the market. In fact, the market proved wrong, month after month, but it would have been speculative to bet against it by going "naked". This likely would have violated the Company's strict and appropriate risk policies in two ways which would have been genuinely imprudent: First, it would have

involved decisions against its own risk metrics. Second, it would have been speculation, which is disallowed in every utility hedging policy in the country.

Note that neither of Dr. Malko's flags is a measure of risk, hence they are not informative as to how to proceed. They simply are measures of ex post luck in whether the hedges proved in or out of the money.

3. Misguided Analogies

Q. Do the analogies that Dr. Malko relies upon as contrasting practices demonstrate a flaw in Pacificorp's hedging policy?

A. No. Dr. Malko cites three situations he believes show the correctness of his view:

(i) Berkshire Hathaway's $1Billion write-down for its holding of certain bonds (with the aside that he believes gas and electric performance can and should be evaluated independently)

(ii) the punitive actions of JP Morgan for the rogue trading operations of their London office in regard to certain credit derivatives that incurred roughly $2Billion in losses, and

(iii) the Company's decision to repower a coal plant with natural gas (rather than retrofit it with environmental controls for cleaner coal burning).

However, none of these situations is meaningfully comparable to fuel hedging for power plants, and in some cases, Dr. Malko seems to be misinterpreting what transpired in his analogies.

Q. Please explain why the actions of Berkshire Hathaway are not applicable.

A. Dr. Malko cites the actions of PacifiCorp's parent company, Berkshire Hathaway,

in taking an accounting loss for a division which had impaired assets (related to credit insurance) and was not performing up to expectations held when it was acquired: "Berkshire was willing to take some action and write-down $1 billion." (p. 18).

He is correct that Berkshire Hathaway acknowledged its losses, but other than that the citation from Berkshire Hathaway's 10-K is taken out of context to such an extent that it overlooks a completely opposite motivation and effect to Dr. Malko's claim. The annual report cited by Dr. Malko (Berkshire Hathaway 2010 10-K) was accompanied by a letter from Mr. Warren Buffet to shareholders, which actually refutes Dr. Malko's perception of Berkshire Hathaway's practices. On page 12 of that letter, Mr. Buffet stated that it was *not* his practice to liquidate investments simply because they initially appear unprofitable.[2]

> *Any management consultant or Wall Street advisor would look at our laggards and say "dump them." That won't happen*. For 29 years, we have regularly laid out Berkshire's economic principles in these reports (pages 93-98) and Number 11 describes our general reluctance to sell poor performers (which, in most cases, lag because of industry factors rather than managerial shortcomings).

In essence, Mr. Buffett's explanation shows that Berkshire Hathaway has done exactly what PacifiCorp has done. It has recognized a loss in value, but it has not liquidated the underlying assets. No value is being created, restored, or protected by this accounting recognition, nor are future additional losses prevented for

[2] Mr. Buffett, Chairman of the Board, Letter to the Shareholders of Berkshire Hathaway Inc., February 25, 2012.

Berkshire by reflecting the currently impaired value of its assets on its books.

Q. Dr. Malko also asserts, that the performance of the Company's natural gas hedges can and should be evaluated on their own, without regard to how electric sales might partially offset them. He claims this is much like focusing on poorly performing stocks (or lines of business) in a portfolio, without regard to whether some other investments might be doing well. Do you agree that this separation is appropriate?

A. No. Again, his analogy is not apt, and is not even entirely correct. In an investment portfolio, it is often (but not always) true that individual stocks will perform independently, so some being up while others are down is not a cause for accepting the losers (though it may be temporarily comforting). However, this is very different from the fact that the Company typically experiences an offsetting benefit to its gas purchase losses from gains in its electric sales' position. This is not a coincidental result. Rather, it intrinsically occurs in power markets for companies with a mix of generation assets like PacifiCorp's. The Company tends to be "long" on energy and "short" on capacity. That is, it has low cost, baseload capacity that is more than it needs in off-peak periods, so it can sell some slack output profitably into the wholesale market. If gas prices fall after it has already sold electricity forward and covered the needed supply with forward gas, it tends to lose money on the gas supply but make money on the power sale.

The potential gains vs. losses are not one for one, because they depend on whether forward prices for power fall more or less than the corresponding gas prices (as well as on how similarly the positions were hedged in timing and

duration, what other types of power plants are supporting the off-system sales, and other factors). On balance for the Company, the electric gains have usually more than offset the gas cost losses in the past. Moreover, this effect is predictable, so it can be (and is) incorporated explicitly into the risk management practices of the Company. If market conditions change (e.g., the net long electric vs. net short gas needs, or the correlations or volatilities of the two commodities), the Company changes its incremental hedging practices. Thus, these are more like two sides of the same coin for utility operations, while having one bad stock and one unrelated good stock whose performances are independent is more like two separate coins. It is not meaningful to criticize gas performance by itself, as the electric performance would not be feasible (or the same) without the gas situation, and vice versa.

Q. How did Dr. Malko compare the recent JP Morgan "London Whale" problem to the Company?

A. He cites the punitive actions of JP Morgan's management against its traders and risk officers (for rogue or uncontrolled trades now suspected of involving as much as $9 billion of losses) as an example of taking managerial responsibility for bad outcomes and bad practices. On p. 14-15 of his testimony, Dr. Malko stated:

> ... in the case of JP Morgan Chase, that when a company without the luxury of having ratepayers to pay its losses does experience such losses, that company's management acts, it acts decisively, and it acts quickly.

Q. What is your view on the comparison?

A. I agree that JP Morgan has acted fairly decisively in revealing and responding to its uncontrolled losses. However, the comparison appears to be misguided, as the nature of the errors and lack of controls in the JP Morgan situation are wholly different than situation underlying PacifiCorp's natural gas losses. While the public record on what transpired for "the London Whale" is not yet complete, it appears that JP Morgan's CIO division engaged in highly speculative activities and was betting on mispricing and future corrective market movements in the price of very complex credit derivatives. It appears that this strategy relied on dynamic hedging and that it became infeasible when very large collateral calls and increased hedging were required to maintain the original value. There may have even been attempts at market manipulation via gigantic trades. Finally, this set of trades apparently violated JP Morgan's own risk controls.

In contrast, the PacifiCorp gas positions were all static hedges tied directly to internally forecasted needs for gas, consistent with reviewed risk management goals and practices. The market simply moved against those hedges. There was no speculation nor any liquidity problem nor any worsening of losses through "doubling down" attempts to capture or induce a favorable turn in the market. The two situations are entirely different in causes, scope, methods, and intent, such that the way JP Morgan is handling its embarrassments has no relevance to evaluating PacifiCorp's hedging program.

Q. Is Dr. Malko's comparison to the retrofit of the Naughton 3 coal plant relevant?

A. No. Dr. Malko believes that "… [the Company's] decision not to retrofit the environmental controls on Naughton 3 but to instead convert the facility to natural gas" shows that it was anticipating lower gas costs but that it ignored its own expectations in hedging.

This criticism confuses two very different kinds of decisions that have different purposes, different time frames, and different analytic methods to guide them. The decision to retrofit or convert a power generating facility is based on the long term outlook (15-20 years out) for cost differences between coal and natural gas, as well as the capital costs of complying with environmental legislation. This is a horizon far beyond the visibility or availability of traded hedges in either coal or gas, and it is intended to minimize costs via a prudent choice of the capital expenditures the Company can make to reduce its fixed costs relative to its variable costs. Many, if not the majority, of the costs at issue do not involve traded assets, commodities or securities with revealed fair market values or liquidity. Hedging, by contrast, is about a one to four year horizon of controlling uncertainty in energy costs only (from existing or committed assets), using market instruments with visible, traded prices. As explained above, it is not a cost minimization decision at all. Therefore, the comparison is misguided and fails to recognize the long term nature of a power plant decision.

Q. Based upon your review of the matter, including the data points brought forward by the UIEC intervention group, do you find the Company's actions with respect to its hedges and subsequent decisions to not liquidate current out-of-money positions to be prudent and consistent with good utility practice?

A. Yes.

Q. Does this conclude your rebuttal testimony?

A. Yes.

RESUME OF MR. FRANK C. GRAVES

Mr. Frank Graves is a Principal of *The Brattle Group* who specializes in regulatory and financial economics, especially for electric and gas utilities. He has assisted utilities in forecasting, valuation, and risk analysis of many kinds of long range planning and service design decisions, such as generation and network capacity expansion, supply procurement and cost recovery mechanisms, network flow modeling, renewable asset selection and contracting, and hedging strategies. He also provides consulting and expert witness support for commercial litigation matters, such as contract disputes and securities fraud proceedings. He has testified before the FERC and many state regulatory commissions, as well as in state and federal courts, on such matters as integrated resource planning (IRPs), the prudence of prior investment and contracting decisions, costs and benefits of new services, policy options for industry restructuring, adequacy of market competition, and competitive implications of proposed mergers and acquisitions.

In the area of financial economics, he has assisted and testified for companies in regard to contract damages estimation, securities litigation suits, special purpose audits, tax disputes, risk management, and cost of capital estimation.

He received an M.S. with a concentration in finance from the M.I.T. Sloan School of Management in 1980, and a B.A. in Mathematics from Indiana University in 1975.

AREAS OF EXPERTISE

- *Utility Planning and Operations*
- *Regulated Industry Restructuring*
- *Market Competition*
- *Electric and Gas Transmission*
- *Financial Analysis*

EXPERIENCE

Utility Planning and Operations

- Air quality and other power plant environmental regulations are being tightened considerably in the period from about 2014-2018. Mr. Graves has co-developed a market and financial model for determining what power plants are most likely to retire vs. retrofit with new environmental controls, and how much this may alter their profitability. This has been used to help several power market participants assess future capacity needs, as well as to adjust their price forecasts for the coming decade.

- Merchant power plant development and financing depends in part on obtaining a long term power purchase agreement. Mr. Graves directed a study of what pricing points and risk-sharing terms should be attractive to potential buyers of long-term power supply contracts from a large baseload facility.

- Many utilities are pursuing smart meters and time-of-use pricing to increase customer ability to consume electricity economically. Mr. Graves has led a study of the costs and benefits of different scales and timing of installation of such meters, to determine the appropriate pace. He has also evaluated how various customer incentives to increase conservation and demand response might be provided over the internet, and how much they might increase the participation rates in smart meter programs.

- Wind resources are becoming a critical part of the generation expansion plans and contracting interests of many utilities, in order to satisfy renewable portfolio standards and to reduce long run exposure to carbon prices and fuel cost uncertainty. Mr. Graves has applied *Brattle*'s risk modeling capabilities to simulate the impacts of wind resources on the potential range of costs for portfolios of wholesale power contracts designed to serve retail electricity loads. He has also assessed the amount and costs of additional ancillary services that may be required to successfully integrate large quantities of wind generation on the transmission grid.

- The potential introduction of environmental restrictions or fees for CO_2 emissions has made generation expansion decisions much more complex and risky. He helped one utility assess these risks in regard to a planned baseload coal plant, finding that the value of flexibility in other technologies was high enough to prefer not building a conventional coal plant.

- Mr. Graves helped design, implement, and gain regulatory approvals for a natural gas procurement hedging program for a western U.S. gas and electric utility. A model of how gas forward prices evolve over time was estimated and combined with a statistical model of the term structure of gas volatility to simulate the uncertainty in the annual cost of gas at various times during its procurement, and the resulting impact on the range of potential customer costs.

- Generation planning for utilities has become very complex and risky due to high natural gas prices and potential CO2 restrictions of emission allowances. Some of the scenarios that must be considered would radically alter system operations relative to current patterns of use. Mr. Graves has assisted utilities with long range planning for how to measure and cope with these risks, including how to build and value contingency plans in their resource selection criteria, and what kinds of regulatory communications to pursue to manage expectations in this difficult environment.

- Several utilities with coal-fired power plants have faced allegations from the U.S. EPA that they have conducted past maintenance on these plants which should be deemed "major modifications", thereby triggering New Source Review standards for air quality controls. Mr. Graves has helped one such utility assess limitations on the way in which GADS data can be used retrospectively to quantify comparisons between past actual and projected future emissions. For another utility, Mr. Graves developed retrospective estimates of changes in emissions before and after repairs using production costing simulations. In a third, he reviewed contemporaneous corporate planning documents to show that no increase in emissions would have been expected from the repairs, due to projected reductions in future use of the plant as well as higher efficiency. In all three cases, testimony was presented.

- The U.S. Government is contractually obligated to dispose of spent nuclear fuel at commercial reactors after January 1998, but it has not fulfilled this duty. As a result, nuclear facilities that are shutdown or facing full spent fuel pools are facing burdensome costs and risks. Mr. Graves prepared developed an economic model of the performance that could have reasonably been expected of the government, had it not breached its contract to remove the spent fuel.

- Capturing the full value of hydroelectric generation assets in a competitive power market is heavily dependent on operating practices that astutely shift between real power and ancillary services markets, while still observing a host of non-electric hydrological constraints. Mr. Graves led studies for several major hydro generation owners in regard to forecasting of market conditions and corresponding hydro schedule optimization. He has also designed transfer pricing procedures that create an internal market for diverting hydro assets from real power to system support services firms that do not yet have explicit, observable market prices.

- Mr. Graves led a gas distribution company in the development of an incentive ratemaking system to replace all aspects of its traditional cost of service regulation. The base rates (for non-fuel operating and capital costs) were indexed on a price-cap basis (RPI-X), while the gas and upstream transportation costs allowances were tied to optimal average annual usage of a reference portfolio of supply and transportation contracts. The gas program also included numerous adjustments to the gas company's rate design, such as designing new standby rates so that customer choice will not be distorted by pricing inefficiencies.

- An electric utility with several out-of-market independent power contracts wanted to determine the value of making those plants dispatchable and to devise a negotiating strategy for restructuring the IPP agreements. Mr. Graves developed a range of forecasts for the delivered price of natural gas to this area of the country. Alternative ways of sharing the potential dispatch savings were proposed as incentives for the IPPs to renegotiate their utility contracts.

- For an electric utility considering the conversion of some large oil-fired units to natural gas, Mr. Graves conducted a study of the advantages of alternative means of obtaining gas supplies and gas transportation services. A combination of monthly and daily spot gas supplies, interruptible pipeline transportation over several routes, gas storage services, and "swing" (contingent) supply contracts with gas marketers was shown to be attractive. Testimony was presented on why the additional services of a local distribution company would be unneeded and uneconomic.

- A power engineering firm entered into a contract to provide operations and maintenance services for a cogenerator, with incentives fees tied to the unit's availability and operating cost. When the fees increased due to changes in the electric utility tariff to which they were tied, a dispute arose. Mr. Graves provided analysis and testimony on the avoided costs associated with improved cogeneration performance under a variety of economic scenarios and under several alternative utility tariffs.

- Mr. Graves has helped several pipelines design incentive pricing mechanisms for recovering their expected costs and reducing their regulatory burdens. Among these have been Automatic Rate Adjustment Mechanisms (ARAMs) for indexation of operations and maintenance expenses, construction-cost variance-sharing for routine capital expenditures that included a procedure for eliciting unbiased estimates of future costs, and market-based prices capped at replacement costs when near-term future expansion was an uncertain but probable need.

- For a major industrial gas user, he prepared a critique of the transportation balancing charges proposed by the local gas distribution company. Those charges were shown to be arbitrarily sensitive to the measurement period as well as to inconsistent attribution of storage versus replacement supply costs to imbalance volumes. Alternative balancing valuation and accounting methods were shown to be cheaper, more efficient, and simpler to administer. This analysis helped the parties reach a settlement based on a cash-in/cash-out design.

- The Clean Air Act Amendments authorized electric utilities to trade emission allowances (EAs) as part of their approach to complying with SO_2 emissions reductions targets. For the Electric Power Research Institute (EPRI), Mr. Graves developed multi-stage planning models to illustrate how the considerable uncertainty surrounding future EA prices justifies waiting to invest in irreversible control technologies, such as scrubbers or SCRs, until the present value cost of such investments is significantly below that projected from relying on EAs.

- For an electric utility with a troubled nuclear plant, Mr. Graves presented testimony on the economic benefits likely to ensue from a major reorganization. The plant was to be spun off to a jointly-owned subsidiary that would sell available energy back to the original owner under a contract indexed to industry unit cost experience. This proposal afforded a considerable reduction of risk to ratepayers in exchange for a reasonable, but highly uncertain prospect of profits for new investors. Testimony compared the incentive benefits and potential conflicts under this arrangement to the outcomes foreseeable from more conventional incentive ratemaking arrangements.

- Mr. Graves helped design Gas Inventory Charge (GIC) tariffs for interstate pipelines seeking to reduce their risks of not recovering the full costs of multi-year gas supply contracts. The costs of holding supplies in anticipation of future, uncertain demand were evaluated with models of the pipeline's supply portfolio that reveal how many non-production costs (demand charges, take-or-pay penalties, reservation fees, or remarketing costs for released gas) would accrue under a range of demand scenarios. The expected present value of these costs provided a basis for the GIC tariff.

- Mr. Graves performed a review and critique of a state energy commission's assessment of regional natural gas and electric power markets in order to determine what kinds of pipeline expansion into the area was economic. A proposed facility under review for regulatory approval was found to depend strongly on uneconomic bypass of existing pipelines and LDCs. In testimony, modular expansion of existing pipelines was shown to have significantly lower costs and risks.

- For several electric utilities with generation capacity in excess of target reserve margins, Mr. Graves designed and supervised market analyses to identify resale opportunities by comparing the marginal operating costs of all this company's power plants not needed to meet target reserves to the marginal costs for almost 100 neighboring utilities. These cost curves were then overlaid on the corresponding curve for the client utility to identify which neighbors were competitors and which were potential customers. The strength of their relative threat or attractiveness could be quantified by the present value of the product of the amount, duration, and differential cost of capacity that was displaceable by the client utility.

- Mr. Graves specified algorithms for the enhancement of the EPRI EGEAS generation expansion optimization model, to capture the first-order effects of financial and regulatory constraints on the preferred generation mix.

- For a major electric power wholesaler, Mr. Graves developed a framework for estimating how pricing policies affect the relative attractiveness of capacity expansion alternatives. Traditional cost-recovery pricing rules can significantly distort the choice between two otherwise equivalent capacity plans, if one includes a severe "front end load" while the other does not. Price-demand feedback loops in simulation models and quantification of consumer satisfaction measures were used to appraise the problem. This "value of service" framework was generalized for the Electric Power Research Institute.

- For a large gas and electric utility, Mr. Graves participated in coordinating and evaluating the design of a strategic and operational planning system. This included computer models of all aspects of utility operations, from demand forecasting through generation planning to financing and rate design. Efforts were split between technical contributions to model design and attention to organizational priorities and behavioral norms with which the system had to be compatible.

- For an oil and gas exploration and production firm, Mr. Graves developed a framework for identifying what industry groups were most likely to be interested in natural gas supply contracts featuring atypical risk-sharing provisions. These provisions, such as price indexing or performance requirements contingent on market conditions, are a form of product differentiation for the producer, allowing it to obtain a price premium for the insurance-like services.

- For a natural gas distribution company, Mr. Graves established procedures for redefining customer classes and for repricing gas services according to customers' similarities in load shape, access to alternative gas supplies, expected growth, and need for reliability. In this manner, natural gas service was effectively differentiated into several products, each with price and risk appropriate to a specific market. Planning tools were developed for balancing gas portfolios to customer group demands.

- For a Midwestern electric utility, Mr. Graves extended a regulatory *pro forma* financial model to capture the contractual and tax implications of canceling and writing off a nuclear power plant in mid-construction. This possibility was then appraised relative to completion or substitution alternatives from the viewpoints of shareholders (market value of common equity) and ratepayers (present value of revenue requirements).

- For a corporate venture capital group, Mr. Graves conducted a market-risk assessment of investing in a gas exploration and production company with contracts to an interstate pipeline. The pipeline's market growth, competitive strength, alternative suppliers, and regulatory exposure were appraised to determine whether its future would support the purchase volumes needed to make the venture attractive.

- For a natural gas production and distribution company, he developed a strategic plan to integrate the company's functional policies and to reposition its operations for the next five years. Decision analysis concepts were combined with marginal cost estimation and financial *pro forma* simulation to identify attractive and resilient alternatives. Recommendations included target markets, supply sources, capital budget constraints, rate design, and a planning system. A two-day planning conference was conducted with the client's executives to refine and internalize the strategy.

- For the New Mexico Public Service Commission, he analyzed the merits of a corporate reorganization of the major New Mexico gas production and distribution company. State ownership of the company as a large public utility was considered but rejected on concerns over efficiency and the burdening of performance risks onto state and local taxpayers.

Regulated Industry Restructuring

- For several utilities facing the end of transitional "provider of last resort" (or POLR) prices, Mr. Graves developed forecasts and risk analyses of alternative procurement mechanisms for follow-on POLR contracts. He compared portfolio risk management approaches to full requirements outsourcing under various terms and conditions.

- For a large municipal electric and gas company considering whether to opt-in to state retail access programs, Mr. Graves lead an analysis of what changes in the level and volatility of customer rates would likely occur, what transition mechanisms would be required, and what impacts this would have on city revenues earned as a portion of local electric and gas service charges.

- Many utilities experienced significant "rate shock" when they ended "rate freeze" transition periods that had been implemented with earlier retail restructuring. The adverse customer and political reactions have lead to proposals to annual procurement auctions and to return to utility-owned or managed supply portfolios. Mr. Graves has assisted utilities and wholesale gencos with analyses of whether alternative supply procurement arrangements could be beneficial.

- The impacts of transmission open access and wholesale competition on electric generators risks and financial health are well documented. In addition, there are substantial impacts on fuel suppliers, due to revised dispatch, repowerings and retirements, changes in expansion mix, altered load shapes and load growth under more competitive pricing. For EPRI, Mr. Graves co-authored a study that projected changes in fuel use within and between ten large power market regions spanning the country under different scenarios for the pace and success of restructuring.

- As a result of vertical unbundling, many utilities must procure a substantial portion of their power from resources they do not own or operate. Market prices for such supplies are quite volatile. In addition, utilities may face future customer switching to or from their supply service, especially if they are acting as provider of last resort (POLR). This problem is a blending of risk management with the traditional least-cost Integrated Resource Planning (IRP). Regulatory standards for findings of prudence in such a hybrid environment are often not well understood or articulated, leaving utilities at risk for cost disallowances that can jeopardize their credit-worthiness. Mr. Graves has assisted several utilities in devising updated procurement mechanisms, hedging strategies, and associated regulatory guidelines that clarify the conditions for approval and cost recovery of resource plans, in order to make possible the expedited procurement of power from wholesale market suppliers.

- Public power authorities and cooperatives face risks from wholesale restructuring if their sales-for-resale customers are free to switch to or from supply contracting with other wholesale suppliers. Such switching can create difficulties in servicing the significant debt capitalization of these public power entities, as well as equitable problems with respect to non-switching customers. Mr. Graves has lead analyses of this problem, and has designed alternative product pricing, switching terms and conditions, and debt capitalization policies to cope with the risks.

- As a means of unbundling to retain ownership but not control of generation, some utilities turned to divesting output contracts. Mr. Graves was involved in the design and approval of such agreements for a utility's fleet of generation. The work entailed estimating and projecting cost functions that were likely to track the future marginal and total costs of the units and analysis of the financial risks the plant operator would bear from the output pricing formula. Testimony on risks under this form of restructuring was presented.

- Mr. Graves contributed to the design and pricing of unbundled services on several natural gas pipelines. To identify attractive alternatives, the marginal costs of possible changes in a pipeline's service mix were quantified by simulating the least-cost operating practices subject to the network's physical and contractual constraints. Such analysis helped one pipeline to justify a zone-based rate design for its firm transportation service. Another pipeline used this technique to demonstrate that unintended degradations of system performance and increased costs could ensue from certain proposed unbundlings that were insensitive to system operations.

- For several natural gas pipeline companies, Mr. Graves evaluated the cost of equity capital in light of the requirements of FERC Order 636 to unbundle and reprice pipeline services. In addition to traditional DCF and risk positioning studies, the risk implications of different degrees of financial leverage (debt capitalization) were modeled and quantified. Aspects of rate design and cost allocation between services that also affect pipeline risk were considered.

- Mr. Graves assisted several utilities in forecasting market prices, revenues, and risks for generation assets being shifted from regulated cost recovery to competitive, deregulated wholesale power markets. Such studies have facilitated planning decisions, such as whether to divest generation or retain it, and they have been used as the basis for quantifying stranded costs associated with restructuring in regulatory hearings. Mr. Graves has assisted a leasing company with analyses of the tax-legitimacy of complex leasing transactions by reviewing the extent and quality of due diligence pursued by the lessor, the adequacy of pre-tax returns, the character, time pattern, and degree of risk borne by the buyer (lessor), the extent of defeasance, and compliance with prevailing guidelines for true-lease status.

Market Competition

- Mr. Graves has testified on the quality of retail competition in Pennsylvania and on whether various proposals for altering Default Service might create more robust competition.

- Regulatory and legal approvals of utility mergers require evidence that the combined entity will not have undue market power. Mr. Graves assisted several utilities in evaluating the competitive impacts of potential mergers and acquisitions. He has identified ways in which transmission constraints reduce the number and type of suppliers, along with mechanisms for incorporating physical flow limits in FERC's Delivered Price Test (DPT) for mergers. He has also assessed the adequacy of mitigation measures (divestitures and conduct restrictions) under the DPT, Market-Based Rates, and other tests of potential market power arising from proposed mergers.

- A major concern associated with electric utility industry restructuring is whether or not generation markets are adequately competitive. Because of the state-dependent nature of transmission transfer capability between regions, itself a function of generation use, the quality of competition in the wholesale generation markets can vary significantly and may be susceptible to market power abuse by dominant suppliers. Mr. Graves helped one of the largest ISOs in the U.S. develop market monitoring procedures to detect and discourage market manipulations that would impair competition.

- Vertical market power arises when sufficient control of an upstream market creates a competitive advantage in a downstream market. It is possible for this problem to arise in power supply, in settings where the likely marginal generation is dependent on very few fuel suppliers who also have economic interests in the local generation market. Mr. Graves analyzed this problem in the context of the California gas and electric markets and filed testimony to explain the magnitude and manifestations of the problem.

- The increased use of transmission congestion pricing has created interest in merchant transmission facilities. Mr. Graves assisted a developer with testimony on the potential impacts of a proposed line on market competition for transmission services and adjacent generation markets. He also assisted in the design of the process for soliciting and ranking bids to buy tranches of capacity over the line.

- Many regions have misgivings about whether the preconditions for retail electric access are truly in place. In one such region, Mr. Graves assisted a group of industrial customers with a critique of retail restructuring proposals to demonstrate that the locally weak transmission grid made adequate competition among numerous generation suppliers very implausible.

- Mr. Graves assisted one of the early ISOs with its initial market performance assessment and its design of market monitoring tests for diagnosing the quality of prevailing competition.

Electric and Gas Transmission

- Substantial fleets of wind-based generation can impose significant integration costs on power systems. Mr. Graves assisted in assessing what additional amounts and costs for ancillary services would be needed for a large Western utility.

- For a utility seeking FERC approval for the purchase of an affiliate's generating facility, Mr. Graves analyzed how transmission constraints affecting alternative supply resources altered their usefulness to the buyer.

- As part of a generation capacity planning study, he lead an analysis of how congestion premiums and discounts relative to locational marginal prices (LMPs) at load centers affected the attractiveness of different potential locations for new generation. At issue was whether the prevailing LMP differences would be stable over time, as new transmission facilities were completed, and whether new plants could exacerbate existing differentials and lead to degraded market value at other plants.

- Mr. Graves assisted a genco with its involvement in the negotiation and settlement of "regional through and out rates" (RTOR) that were to be abolished when MISO joined PJM. His team analyzed the distribution of cost impacts from several competing proposals, and they commented on administrative difficulties or advantages associated with each.

- For the electric utility regulatory commission of Colombia, S.A., Mr. Graves led a study to assess the inadequacies in the physical capabilities and economic incentives to manage voltages at adequate levels. The *Brattle* team developed minimum reactive power support obligations and supplement reactive power acquisition mechanisms for generators, transmission companies, and distribution companies.

- Mr. Graves conducted a cost-of-service analysis for the pricing of ancillary services provided by the New York Power Authority.

- On behalf of the Electric Power Research Institute (EPRI), Mr. Graves wrote a primer on how to define and measure the cost of electric utility transmission services for better planning, pricing, and regulatory policies. The text covers the basic electrical engineering of power circuits, utility practices to exploit transmission economies of scale, means of assuring system stability, economic dispatch subject to transmission constraints,

and the estimation of marginal costs of transmission. The implications for a variety of policy issues are also discussed.

- The natural gas pipeline industry is wedged between competitive gas production and competitive resale of gas delivered to end users. In principle, the resulting basis differentials between locations around the pipeline ought to provide efficient usage and expansion signals, but traditional pricing rules prevent the pipeline companies from participating in the marginal value of their own services. Mr. Graves worked to develop alternative pricing mechanisms and service mixes for pipelines that would provide more dynamically efficient signals and incentives.

- Mr. Graves analyzed the spatial and temporal patterns of marginal costs on gas and electric utility transmission networks using optimization models of production costs and network flows. These results were used by one natural gas transmission company to design receipt-point-based transmission service tariffs, and by another to demonstrate the incremental costs and uneven distribution of impacts on customers that would result from a proposed unbundling of services.

Financial Analysis

- Holding company utilities with many subsidiaries in different states face differing kinds of regulatory allowances, balancing accounts with differing lags and allowed returns for cost recovery, possibly different capital structures, as well as different (and varying) operating conditions. Given such heterogeneity, it can be difficult to determine which subsidiaries are performing well vs. poorly relative to their regulatory and operational challenges. Mr. Graves developed a set of financial reporting normalization adjustments to isolate how much of each subsidiary's profitability was due to financial, vs. managerial, vs. non-recurring operational conditions, so that meaningful performance appraisal was possible.

- Many banks, insurance firms and capital management subsidiaries of large multinational corporations have entered into long term, cross border leases of properties under sale and leaseback or lease in, lease out terms. These have been deemed to be unacceptable tax shelters by the IRS, but that is an appealable claim. Mr. Graves has assisted several companies in evaluating whether their cross border leases had legitimate business purpose and economic substance, above and beyond their tax benefits, due to likelihood of potentially facing a role as equityholder with ownership risks and rewards. He has shown that this is a case-specific matter, not per se determined by the general character of these transactions.

- Many utilities have regulated and unregulated subsidiaries, which face different types and degrees of risk. Mr. Graves lead a study of the appropriate adjustments to corporate hurdle rates for the various lines of business of a utility with many types of operations.

- A company that incurred Windfall Tax liabilities in the U.K. regarded those taxes as creditable against U.S. income taxes, but this was disputed by the IRS. Mr. Graves lead a team that prepared reports and testimony on why the Windfall Tax had the character of a

typical excess profits tax, and so should be deemed creditable in the U.S. The tax courts concurred with this opinion and allowed the claimed tax deductions in full.

- For a defendant in a sentencing hearing for securities' fraud, Mr. Graves prepared an analysis of how the defendant's role in the corporate crisis was confounded by other concurrent events and disclosures that made loss calculations unreliable. At trial, the Government stipulated that it agreed with Mr. Graves' analysis.

- For the U.S. Department of Justice, Mr. Graves prepared an event study quantifying bounds on the economic harm to shareholders that had likely ensued from revelations that Dynegy Corporation's "Project Alpha" had been improperly represented as a source of operating income rather than as a financing. The event study was presented in the re-sentencing hearing of Mr. Jamie Olis, the primary architect of Project Alpha.

- Mr. Graves has assisted leasing companies with analyses of the tax-legitimacy of complex leasing transactions. These analyses involved reviewing the extent and quality of due diligence pursued by the lessor, the adequacy of pre-tax returns, the character, time pattern, and degree of risk borne by the buyer (lessor), the extent, purpose and cost of defeasance, and compliance with prevailing guidelines for true-lease status.

- For a utility facing significant financial losses from likely future costs of its Provider of Last Resort (POLR) obligations, Mr. Graves prepared an analysis of how optimal hindsight coverage would have compared in costs to a proposed restructuring of the obligation. He also reviewed the prudence of prior, actual coverage of the obligation in light of conventional risk management practices and prevailing market conditions of credit constraints and low long-term liquidity.

- Several banks were accused of aiding and abetting Enron's fraudulent schemes and were sued for damages. Mr. Graves analyzed how the stock market had reacted to one bank's equity analyst's reports endorsing Enron as a "buy," to determine if those reports induced statistically significant positive abnormal returns. He showed that individually and collectively they did not have such an effect.

- Mr. Graves lead an analysis of whether a corporate subsidiary had been effectively under the strategic and operational control of its parent, to such an extent that it was appropriate to "pierce the corporate veil" of limited liability. The analysis investigated the presence of untenable debt capitalization in the subsidiary, overlapping management staff, the adherence to normal corporate governance protocols, and other kinds of evidence of excessive parental control.

- As a tax-revenue enhancement measure, the IRS was considering a plan to recapture deferred taxes associated with generation assets that were divested or reorganized during state restructurings for retail access. Mr. Graves prepared a white paper demonstrating the unfairness and adverse consequences of such a plan, which was instrumental in eliminating the proposal.

- For a major electronic and semiconductor firm, Mr. Graves critiqued and refined a proposed procedure for ranking the attractiveness of research and development projects. Aspects of risk peculiar to research projects were emphasized over the standards used for budgeting an already proven commercial venture.

- In a dispute over damages from a prematurely terminated long-term power tolling contract, Mr. Graves presented evidence on why calculating the present value of those damages required the use of two distinct discount rates: one (a low rate) for the revenues lost under the low-risk terminated contract and another, much higher rate, for the valuation of the replacement revenues in the risky, short-term wholesale power markets. The amount of damages was dramatically larger under a two-discount rate calculation, which was the position adopted by the court.

- The energy and telecom industries have been plagued by allegations regarding trading and accounting misrepresentations, such as wash trades, manipulations of mark-to-market valuations, premature recognition of revenues, and improper use of off-balance sheet entities. In many cases, this conduct has preceded financial collapse and subsequent shareholder suits. Mr. Graves lead research on accounting and financial evidence, including event studies of the stock price movements around the time of the contested practices, and reconstruction of accounting and economic justifications for the way asset values and revenues were recorded.

- Dramatic natural gas price increases in the U.S. have put several natural gas and electric utilities in the position of having to counter claims that they should have hedged more of their fuel supplies at times in the past. Mr. Graves developed testimony to rebut this hindsight criticism and risk management techniques for fuel (and power) procurement for utilities to apply in the future to avoid prudence challenges.

- As a means of calculating its stranded costs, a utility used a partial spin-off of its generation assets to a company that had a minority ownership from public shareholders. A dispute arose as to whether this minority ownership might be depressing the stock price, if a "control premium" was being implicitly deducted from its value. Using event studies and structural analyses, Mr. Graves identified the key drivers of value for this partially spun-off subsidiary, and he showed that value was not being impaired by the operating, financial and strategic restrictions on the company. He also reviewed the financial economics literature on empirical evidence for control premiums, which he showed reinforced the view that no control premium de-valuation was likely to be affecting the stock.

- A large public power agency was concerned about its debt capacity in light of increasing competitive pressures to allow its resale customers to use alternative suppliers. Mr. Graves lead a team that developed an Economic Balance Sheet representation of the agency's electric assets and liabilities in market value terms, which was analyzed across several scenarios to determine safe levels of debt financing. In addition, new service pricing and upstream supply contracting arrangements were identified to help reduce risks.

- Wholesale generating companies intuitively realize that there are considerable differences in the financial risk of different kinds of power plant projects, depending on fuel type, length and duration of power purchase agreements, and tightness of local markets. However, they often are unaware of how if at all to adjust the hurdle rates applied to valuation and development decisions. Mr. Graves lead a Brattle analysis of risk-adjusted discount rates for generation; very substantial adjustments were found to be necessary.

- A major telecommunications firm was concerned about when and how to reenter the Pacific Rim for wireless ventures following the economic collapse of that region in 1997-99. Mr. Graves lead an engagement to identify prospective local partners with a governance structure that made it unlikely for them to divert capital from the venture if markets went soft. He also helped specify contracting and financing structures that create incentives for the venture to remain together should it face financial distress, while offering strong returns under good performance.

- There are many risks associated with operations in a foreign country, related to the stability of its currency, its macro economy, its foreign investment policies, and even its political system. Mr. Graves has assisted firms facing these new dimensions to assess the risks, identify strategic advantages, and choose an appropriate, risk-adjusted hurdle rate for the market conditions and contracting terms they will face.

- The glut of generation capacity that helped usher in electric industry restructuring in the US led to asset devaluations in many places, even where no retail access was allowed. In some cases, this has led to bankruptcy, especially of a few large rural electric cooperatives. Mr. Graves assisted one such coop with its long term financial modeling and rate design under its plan of reorganization, which was approved. Testimony was provided on cost-of-service justifications for the new generation and transmission prices, as well as on risks to the plan from potential environmental liabilities.

- Power plants often provide a significant contribution to the property tax revenues of the townships where they are located. A common valuation policy for such assets has been that they are worth at least their book value, because that is the foundation for their cost recovery under cost-of-service utility ratemaking. However, restructuring throws away that guarantee, requiring reappraisal of these assets. Traditional valuation methods, *e.g.*, based on the replacement costs of comparable assets, can be misleading because they do not consider market conditions. Mr. Graves testified on such matters on behalf of the owners of a small, out-of-market coal unit in Massachusetts.

- Stranded costs and out-of-market contracts from restructuring can affect municipalities and cooperatives as well as investor-owned utilities. Mr. Graves assisted one debt-financed utility in an evaluation of its possibilities for reorganization, refinancing, and re-engineering to improve financial health and to lower rates. Sale and leaseback of generation, fuel contract renegotiation, targeted downsizing, spin-off of transmission, and new marketing programs were among the many components of the proposed new business plan.

- As a means of reducing supply commitment risk, some utilities have solicited offers for power contracts that grant the right but not the obligation to take power at some future date at a predetermined price, in exchange for an initial option premium payment. Mr. Graves assisted several of these utilities in the development of valuation models for comparing the asking prices to fair market values for option contracts. In addition, he has helped these clients develop estimates of the critical option valuation parameters, such as trend, volatility, and correlations of the future prices of electric power and the various fuel indexes proposed for pricing the optional power.

- For the World Bank and several investor-owned electric utilities, Mr. Graves presented tutorial seminars on applying methods of financial economics to the evaluation of power production investments. Techniques for using option pricing to appraise the value of flexibility (such as arises from fuel switching capability or small plant size) were emphasized. He has applied these methods in estimating the value of contingent contract terms in fuel contracts (such as price caps and floors) for natural gas pipelines.

- Mr. Graves prepared a review of empirical evidence regarding the stock market's reaction to alternative dividend, stock repurchase, and stock dividend policies for a major electric utility. Tax effects, clientele shifting, signaling, and ability to sustain any new policies into the future were evaluated. A one-time stock repurchase, with careful announcement wording, was recommended.

- For a division of a large telecommunications firm, Mr. Graves assisted in a cost benchmarking study, in which the costs and management processes for billing, service order and inventory, and software development were compared to the practices of other affiliates and competitors. Unit costs were developed at a level far more detailed than the company normally tracked, and numerical measures of drivers that explained the structural and efficiency causes of variation in cost performance were identified. Potential costs savings of 10-50 percent were estimated, and procedures for better identification of inefficiencies were suggested.

- For an electric utility seeking to improve its plant maintenance program, Mr. Graves directed a study on the incremental value of a percentage point decrease in the expected forced outage rate at each plant owned and operated by the company. This defined an economic priority ladder for efforts to reduce outage that could be used in lieu of engineering standards for each plant's availability. The potential savings were compared to the costs of alternative schedules and contracting policies for preventive and reactive maintenance, in order to specify a cost reduction program.

- Mr. Graves conducted a study on the risk-adjusted discount rate appropriate to a publicly-owned electric utility's capacity planning. Since revenue requirements (the amounts being discounted) include operating costs in addition to capital recovery costs, the weighted average cost of capital for a comparable utility with traded securities may not be the correct rate for every alternative or scenario. The risks implicit in the utility's expansion alternatives were broken into component sources and phases, weighted, and compared to the risks of bonds and stocks to estimate project-specific discount rates and their probable bounds.

PROFESSIONAL AFFILIATIONS

- IEEE Power Engineering Society
- Mathematical Association of America
- American Finance Association
- International Association for Energy Economics

TESTIMONY

Direct testimony on behalf of Ohio Power Co. before the PUC of Ohio in regard to performance of PJM Capacity Markets, in Ohio Power's application for its ESP service charges, Case No. 10-2929-EL-UNC, March 30, 2012.

Expert report and oral testimony on behalf of Pepco Holdings, Inc. before the Maryland Public Service Commission in regard to inadequacies in the MD PSC's RFP for new combined cycle generation development in SWMAAC, Case No. 9214, January 31, 2012.

Direct testimony on behalf of Columbus Southern Power Company and Ohio Power Company before the Public Utilities Commission of Ohio in the Matter of the Commission Review of
the Capacity Charges of Ohio Power Company and Columbus Southern Power Company, Case No. 10-2929 -EL-UNC, August 31, 2011.

Rebuttal report on spent nuclear fuel removal on behalf of Yankee Atomic Electric Company, Connecticut Yankee Atomic Power Company, Maine Yankee Atomic Power Company before the United States Court of Federal Claims, Nos. 07-876C, No. 07-875C, No. 07-877C, August 5, 2011.

Direct Testimony on rehearing regarding the allowance of swaps in Rocky Mountain Power's fuel adjustment cost recovery mechanism, on behalf of Rocky Mountain Power before the Public Service Commission of the State of Utah, July 2011.

Comments and Reply Comments on capacity procurement and transmission planning on behalf of New Jersey Electric Distribution Companies before the State of New Jersey Board of Public Utilities in the Matter of the Board's Investigation of Capacity Procurement and Transmission Planning, NJ BPU Docket No. EO11050309, June 17, 2011; July 12, 2011.

Rebuttal testimony regarding Rocky Mountain Power's hedging practices on behalf of Rocky Mountain Power before the Public Service Commission of the State of Utah, Docket No. 10-035-124, June 2011.

Expert and Rebuttal reports regarding contract termination damages, on behalf of Hess Corporation before the United States District Court for the Northern District of New York, Case No. 5:10-cv-587 (NPM/GHL), April 29, 2011, May 13, 2011.

Expert and Rebuttal reports on spent fuel removal at Rancho Seco nuclear power plant, on behalf of Sacramento Municipal Utility District before the U.S. Court of Federal Claims, No. 09-587C, October 2010, July 1, 2011.

Rebuttal testimony on the Impacts of the Merger with First Energy on retail electric competition in Pennsylvania, on behalf of Allegheny Power before the Pennsylvania Public Utility Commission, Docket Numbers A-2010-2176520 and A-2010-2176732, September 13, 2010.

Expert and Rebuttal reports on the interpretation of pricing terms in a long term power purchase agreement, on behalf of Chambers Cogeneration Limited Partnership before the Superior Court of New Jersey, Docket No. L-329-08, August 23, 2010, September 21, 2010.

Expert and Rebuttal reports on spent fuel removal at Trojan nuclear facility, on behalf of Portland General Electric Company, The City of Eugene, Oregon, and PacifiCorp before the United States Court of Federal Claims No. 04-0009C, August 2010, June 29, 2011.

Rebuttal and Rejoinder testimonies on the approval of its Smart Meter Technology Procurement and Installation Plan before the Pennsylvania Public Utility Commission on behalf of West Penn Power Company d/b/a Allegheny Power, Docket Number M-2009-2123951, October 27, 2009, November 6, 2009.

Supplemental Direct testimony on the need for an energy cost adjustment mechanism in Utah to recover the costs of fuel and purchased power, on behalf of Rocky Mountain Power before the Public Service Commission of Utah, Docket No. 09-035-15, August 2009.

Expert and Rebuttal reports on spent nuclear fuel removal on behalf of Yankee Atomic Electric Company, Connecticut Yankee Atomic Power Company, Maine Yankee Atomic Power Company before the United States Court of Federal Claims, Nos. 98-126C, No. 98-154C, No. 98-474C, April 24, 2009, July 20, 2009.

Expert report in regard to opportunistic under-collateralization of affiliated trading companies, on behalf of BJ Energy, LLC, Franklin Power LLC, GLE Trading LLC, Ocean Power LLC, Pillar Fund LLC and Accord Energy, LLC before the United States District Court for the Eastern District of Pennsylvania, No. 09-CV-3649-NS, March 2009.

Rebuttal report in regard to appropriate discount rates for different phases of long-term leveraged leases, on behalf of Wells Fargo & Co. and subsidiaries, Docket No. 06-628T, January 15, 2009.

Oral and written direct testimony regarding resource procurement and portfolio design for Standard Offer Service, on behalf of PEPCo Holdings Inc. in its Response to Maryland Public Service Commission, Case No. 9117, October 1, 2008 and December 15, 2008.

Direct testimony regarding considerations affecting the market price of generation service for Standard Service Offer (SSO) customers, on behalf of Ohio Edison Company, *et al*., Docket 08-125, July 24, 2008.

Direct testimony in support of Delmarva's "Application for the Approval of Land-Based Wind Contracts as a Supply Source for Standard Offer Service Customers," on behalf of Delmarva Power & Light Company before the Public Service Commission of Delaware, July 24, 2008.

Oral direct testimony in regard to the Government's performance in accepting spent nuclear fuel under contractual obligations established in 1983, on behalf of plaintiff Dairyland Power Cooperative before the United States Court of Federal Claims (No. 04-106C), July 17, 2008.

Direct testimony for Delmarva Power & Light on risk characteristics of a possible managed portfolio for Standard Offer Service, as part of Delmarva's IRP filings (PSC Docket No. 07-20), March 20, 2008 and May 15, 2008.

Oral direct testimony regarding the economic substance of a cross-border lease-to-service contract for a German waste-to-energy plant on behalf of AWG Leasing Trust and KSP Investments, Inc before U. S. District Court, Northern District of Ohio, Eastern Division, Case No. 1:07CV0857, January 2008.

Direct testimony regarding portfolio management alternatives for supplying Standard Offer Service, on behalf of Potomac Electric Power Company and Delmarva Power & Light Company before the Public Service Commission of Maryland, Case No. 9117, September 14, 2007.

Direct testimony in regard to preconditions for effective retail electric competition, on behalf of New West Energy Corporation before the Arizona Commerce Commission, Docket No. E-03964A-06-0168, August 31, 2007.

Direct and rebuttal testimonies regarding the application of OG&E for an order of commission granting preapproval to construct Red Rock Generating Facility and authorizing a recovery rider, on behalf of Oklahoma Gas & Electric Company (OG&E) before the Corporation Commission of the State of Oklahoma, Case No. PUD 200700012, January 17, 2007 and June 18, 2007.

Testimony in regard to whether defendant's role in accounting misrepresentations could be reliably associated with losses to shareholders, on behalf of defendant Mark Kaiser before U.S. District Court of New York SI:04Cr733 (TPG).

Rebuttal testimony on proposed benchmarks for evaluating the Illinois retail supply auctions, on behalf of Midwest Generation EME L.L.C. and Edison Mission Marketing and Trading before the Illinois Commerce Commission Docket Number 06-0800, April 6, 2007.

Direct and rebuttal testimonies on the shareholder impacts of Dynegy's Project Alpha for the sentencing of Jamie Olis, on behalf of the U.S. Department of Justice before the United States District Court, Southern District of Texas, Houston Division, Criminal Number H-03-217, September 12, 2006.

Direct and rebuttal testimony on the need for POLR rate cap relief for Metropolitan Edison and Pennsylvania Electric and the prudence of their past supply procurement for those obligations, on behalf of FirstEnergy Corp before the Pennsylvania Public Utility Commission, Docket Nos. R-00061366 and R-00061367, August 24, 2006.

Direct testimony regarding Deutsche Bank Entities' opposition to Enron Corp's amended motion for class certification, on behalf of the Deutsche Bank Entities before the United States District Court, Southern District of Texas, Houston Division, Docket No. H-01-3624, February 2006.

Expert and Rebuttal reports regarding the non-performance of the U.S. Department of Energy in accepting spent nuclear fuel under the terms of its contract, on behalf of Pacific Gas and Electric Company before the United States Court of Federal Claims, Docket No. 04-0074C, into which has been consolidated No. 04-0075C, November 2005.

Direct testimony regarding the appropriate load caps for a POLR auction, on behalf of Midwest Generation EME, LLC before the Illinois Commerce Commission, Docket No. 05-0159, June 8, 2005.

Affidavit regarding unmitigated market power arising from the proposed Exelon – PSEG Merger, on behalf of Dominion Energy, Inc. before the Federal Energy Regulatory Commission, Docket No. EC05-43-000, April 11, 2005.

Expert and rebuttal reports and oral testimonies before the American Arbitration Association on behalf of Liberty Electric Power, LLC, Case No. 70 198 4 00228 04, December 2004, regarding damages under termination of a long-term tolling contract.

Oral direct and rebuttal testimony before the United States Court of Federal Claims on behalf of Connecticut Yankee Atomic Power Company, Docket No. 98-154 C, July 2004 (direct) and August 2004 (rebuttal), regarding non-performance of the U.S. Department of Energy in accepting spent nuclear fuel under the terms of its contract.

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