EXHIBIT NO. _____ (JMR-4)
DOCKET NO._____
2003 POWER COST ONLY RATE CASE
WITNESS: JULIA M. RYAN

BEFORE THE

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PUGET SOUND ENERGY, INC., Respondent.	Docket No. _____

DIRECT TESTIMONY OF JULIA M. RYAN ON BEHALF OF PUGET SOUND ENERGY, INC.

Chapter 6

MANAGING ENERGY RISK

INTRODUCTION

Following PSE's previous Least Cost Plan, the Washington Utilities and Transportation Commission (WUTC) issued a comment letter dated August 21, 2001, with the following remarks on energy risk management:

Risk Management: *The least-cost planning rule requires utilities to develop integrated resource plans that meet "current and future needs at the lowest cost to the utility and its customers." In fulfilling this rule, PSE must balance price, supply, and weather risks against the directive to minimize costs. The recent energy debacle revealed price and supply risks that few utilities or energy consumers had heretofore recognized. The Commission is keenly interested in the procurement and other strategies utilities use to manage these risks (e.g., acquisition of additional generating capacity, long- and short-term power purchases, fixed and floating price derivatives, and other hedges and risk management instruments.) A detailed description of risk-management strategies and how those strategies advance the twin goals of low and stable rates should be a critical component of PSE's next plan. Moreover, the plan should empirically support the chosen strategies with a short-term evaluation of their economic effects.*

For this Least Cost Plan, PSE is addressing energy risks and their implications for:

- Planning PSE's long-term energy resource portfolio,
- Acquiring new energy resources, and
- Managing PSE's energy resource portfolio

PORTFOLIO PLANNING

Portfolio planning involves developing a long-term resource strategy that identifies the Company's preferred mix, or portfolio, of resources to meet is customers' needs. Setting the preferred portfolio mix includes making choices among resource technologies. It also requires determining what proportion of the portfolio should be composed of long-term resource commitments (e.g., owned generation and long-term contracts), and what remaining proportion (if any) of the portfolio should rely on short-term resources.

As noted in the WUTC comments, the long-term resource strategy and preferred resource portfolio must balance tradeoffs between the objective of minimizing costs and the objective of protecting against undesired variability in costs due to price, supply and weather risks. These issues and activities are the primary focus of the Least Cost Planning process. In particular, Chapters 8 and 9 of this report describe the methods and approach that PSE is using to address energy risks as they relate to development of the long-term resource strategy and the preferred

resource portfolio. Chapter 2 also addresses a number of topics that involve energy-related risks and that bear upon determination of the resource strategy.

RESOURCE ACQUISITION

Resource acquisition involves obtaining specific new energy resources that are consistent with the long-term resource strategy. In essence, acquisition of new resources is an implementation activity that carries out the desired configuration of the energy resource portfolio. However, because new resource opportunities tend to be situation-specific, PSE's resource acquisition activities must be responsive and take into consideration the actual circumstances (including changes in conditions from the previous Least Cost Plan) that exist at the times when resource acquisition decisions are being made. Chapter 2 of this report identifies and discusses various factors that are affecting the risks and opportunities for PSE to acquire new resources.

PORTFOLIO MANAGEMENT

Management of PSE's energy resource portfolio entails managing, at any given point in time, an existing mix and level of long-term and short-term resource commitments – along with the resulting short-term risk exposures. Portfolio management activities include hedging the portfolio against many of the risks that are addressed in long-term resource planning and acquisition. However, portfolio management is a comparatively more dynamic process, involving anticipating and protecting against shorter-term risks and taking actions based on actual circumstances such as observed hydro reservoir levels or shifts in forward market prices for electricity and natural gas.

Resource Planning, Resource Acquisition and Portfolio Management All Involve Risk Management

Determination of PSE's preferred resource strategy, acquisition of new resources and management of the existing portfolio all involve the management of energy-related risks.

For example, development of the long-term resource strategy includes determining how much of the portfolio should be composed of a particular type of resource whose availability may vary with short-term changes in weather conditions or whose cost may vary with fluctuations in market prices. As a result, decisions on the resource strategy typically result in configuring the resource portfolio to accept a certain degree of remaining exposure to such risks. As noted above, decisions like this involve balancing tradeoffs between minimizing costs and minimizing undesired variability in costs. However, these same decisions should also reflect an assessment of how well the resource portfolio can then be managed, including the current – and future – viability and cost-effectiveness of hedging the portfolio's remaining risk exposures using financial derivatives or other short-term instruments.

IMPACT OF RECENT DEVELOPMENTS

Over the last several years, PSE has made significant advances in its understanding of various risks associated with its existing energy resource portfolio. The Company has also developed and implemented effective hedging strategies to help mitigate risks. However, ongoing changes and

upheavals in the energy industry, including those discussed in Chapter 2, are making it increasingly difficult to use short-term hedging transactions to manage risk exposures in PSE's existing resource portfolio. Therefore, the remainder of this Chapter addresses management of PSE's existing energy resource portfolio, with particular emphasis on the outlook for the viability and economic effects of hedging the existing portfolio's risk exposures.

PORTFOLIO RISK MANAGEMENT

PSE's near-term portfolio risk management philosophy is to protect its energy portfolios from commodity price risk exposure and counterparty risk exposure. Its risk management practices are based upon the following principles: 1) identify risk exposure in the energy portfolio 2) measure the degree of the risk exposure 3) develop and test risk management strategies designed to reduce risk exposure 4) implement risk management strategies that minimize energy cost volatility and 5) implement the risk management strategies approved by the Risk Management Committee. The energy risk management function is focused on risk mitigation and value protection of the portfolio.

PSE manages its energy supply portfolio to achieve three primary objectives:

- ensure that physical energy supplies are available to serve retail customer requirements;
- manage portfolio risks to serve retail load at overall least cost while limiting undesired volatility on customer bills and PSE financial results; and
- optimize the value of PSE energy supply assets.

PSE manages the physical and financial positions and exposures through real-time trading, daily pre-scheduling, hedging, supply portfolio management, and optimization. Specifically PSE may purchase and sell energy in the spot and forward markets and dispatch or displace generation units and nominate storage injection or withdrawal, both to balance the supply portfolio and to achieve net cost reductions.

PSE manages financial exposures associated with price and volumetric risks consistent with the following:

1. PSE manages the price and volumetric risks associated with its retail and wholesale energy sales with a diverse supply portfolio of resources that includes hydro, coal-based generation, combustion turbines, non-utility generation contracts, long-term purchase and exchange contracts, gas supply contracts, gas transportation and electric transmission, storage and peaking options and physical and financial wholesale energy and options on energy purchases and sales.

2. At times when PSE's energy supply resources may exceed its sales customer obligations, PSE manages the price risk associated with the excess resources by entering into forward energy sales transactions or options on energy sales transactions. For example, PSE may forward sell energy at fixed prices or purchase put options at fixed strike prices.

3. At times when PSE's sales obligations exceed available resources, PSE manages the price risk associated with deficit resources by entering into forward energy purchase

transactions or options on energy purchase transactions. For example, PSE may enter into energy purchases at fixed prices or purchase call options at fixed strike prices.

4. PSE manages the location risk associated with the anticipated energy resource sales by entering into purchase and sales transactions that have the same delivery point, term, and volume as the anticipated transaction. At times PSE may tie purchases and sales together by acquiring firm transmission rights to deliver energy associated with purchase or sale transactions to the point of receipt/delivery for the anticipated transactions.

5. PSE enters into other derivative products such as weather, hydro, and plant outage derivatives for purposes of managing exposure in the energy portfolio. These instruments and their strategic application to the portfolio shall be approved by the Risk Management Committee.

Management of PSE's wholesale energy portfolio is a highly dynamic process driven by a number of factors, including:

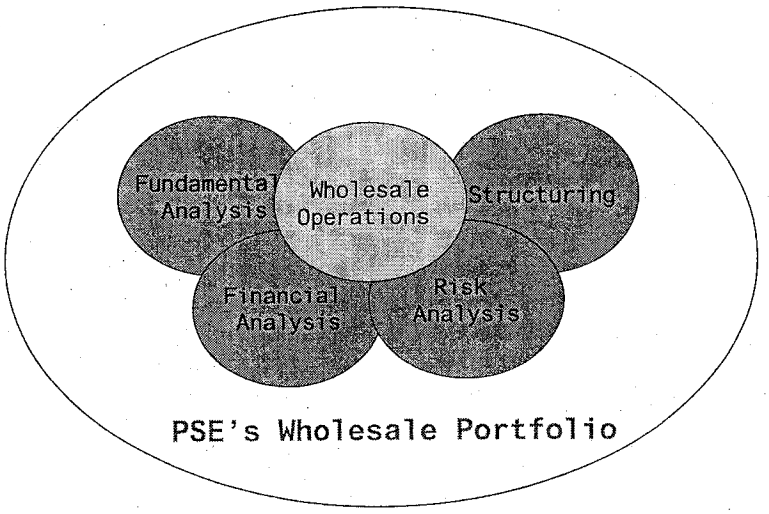
(a) relatively predictable diurnal and seasonal fluctuations in PSE's retail customer requirements;
(b) less predictable fluctuations in PSE's energy supply requirements due to temperature swings, economic conditions, system outages and customer growth;
(c) year-to-year, seasonal, and short-term variability in stream flows and hydroelectric generation and short term supply demand imbalance in gas supply markets;
(d) forced outages of generation;
(e) volatility in market prices for energy; and
(f) constraints in electric transmission, gas transportation capacity and storage injection/withdrawal capability.

PSE manages a complex energy portfolio that requires careful measurement of volumetric and financial exposures. Specifically, PSE monitors financial positions on a daily basis, analyzes physical and financial variability, conducts portfolio and scenario analysis, develops risk management strategies and executes risk management strategies while giving consideration to financial reporting requirements and accounting treatment under FASB Statement No.133.

RISK MANAGEMENT PERSPECTIVES

Within Energy Risk Management, the company employs several analytical disciplines to cover different facets of portfolio management. It is important that the various functions inter-relate, so that the overall effort is coordinated and models and theories are used consistently for multiple purposes (Figure 1).

Figure 1



Fundamental analysis is the study of supply and demand factors that are influencing the price of energy in a given market for a certain time frame. PSE applies both a top-down and bottoms-up approach to fundamental analysis. The company uses some tools such as stacking models to replicate market behavior. This provides both a base expectation, as well as other scenarios that might result in different market prices. Having a range of possible outcomes enables the risk management group to get a sense for potential risks, and to identify what are the single largest uncertain factors.

COMMODITIZATION OF ENERGY MARKETS

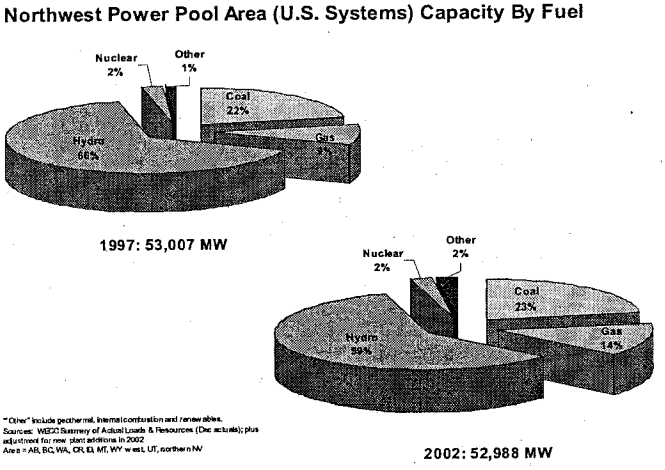
Supply/Demand fundamentals are the primary drivers to commodity prices. Over the last five to ten years, natural gas and electric markets have become 'commoditized' through FERC deregulation of the natural gas pipeline industry and electric power sector. Today, the indicators that power and natural gas are commodity markets are:

- Price discovery through numerous market buyers and sellers electronic exchanges and broker markets.
- Development of liquid pricing locations at central trading hubs such as Mid C for power and Sumas, WA for natural gas.
- Standardization of contractual terms for physical power, natural gas and associated financial derivatives.
- Development of a parallel financial markets and new structured products around physical power and natural gas markets.

POWER MARKET DRIVERS

With respect to understanding the underlying supply/demand factors, the company looks at a number of leading indicators. In power, the key variables in the Pacific Northwest are weather (temperature and precipitation), economic conditions, fuel costs, plant heat rates, plant availability, transmission and intertie capacity, hydro energy and storage, biological opinion

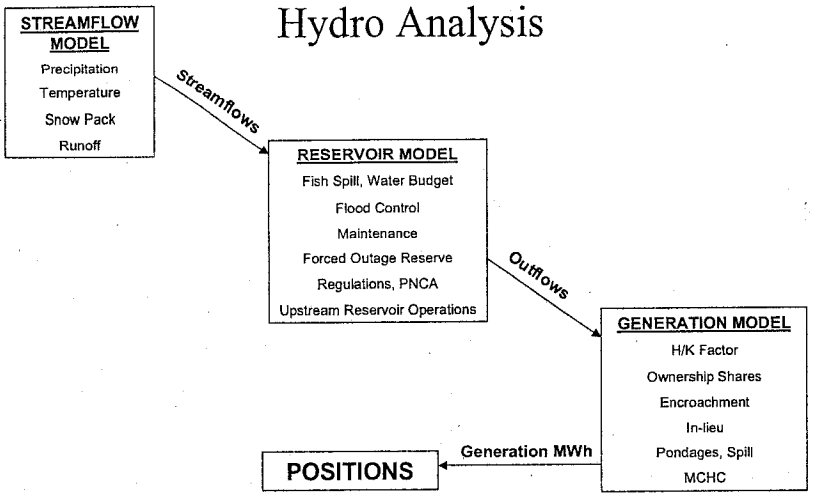
Figure 2



affecting flows on the river system and spill requirements, new generation capacity and other neighboring regional power market dynamics.

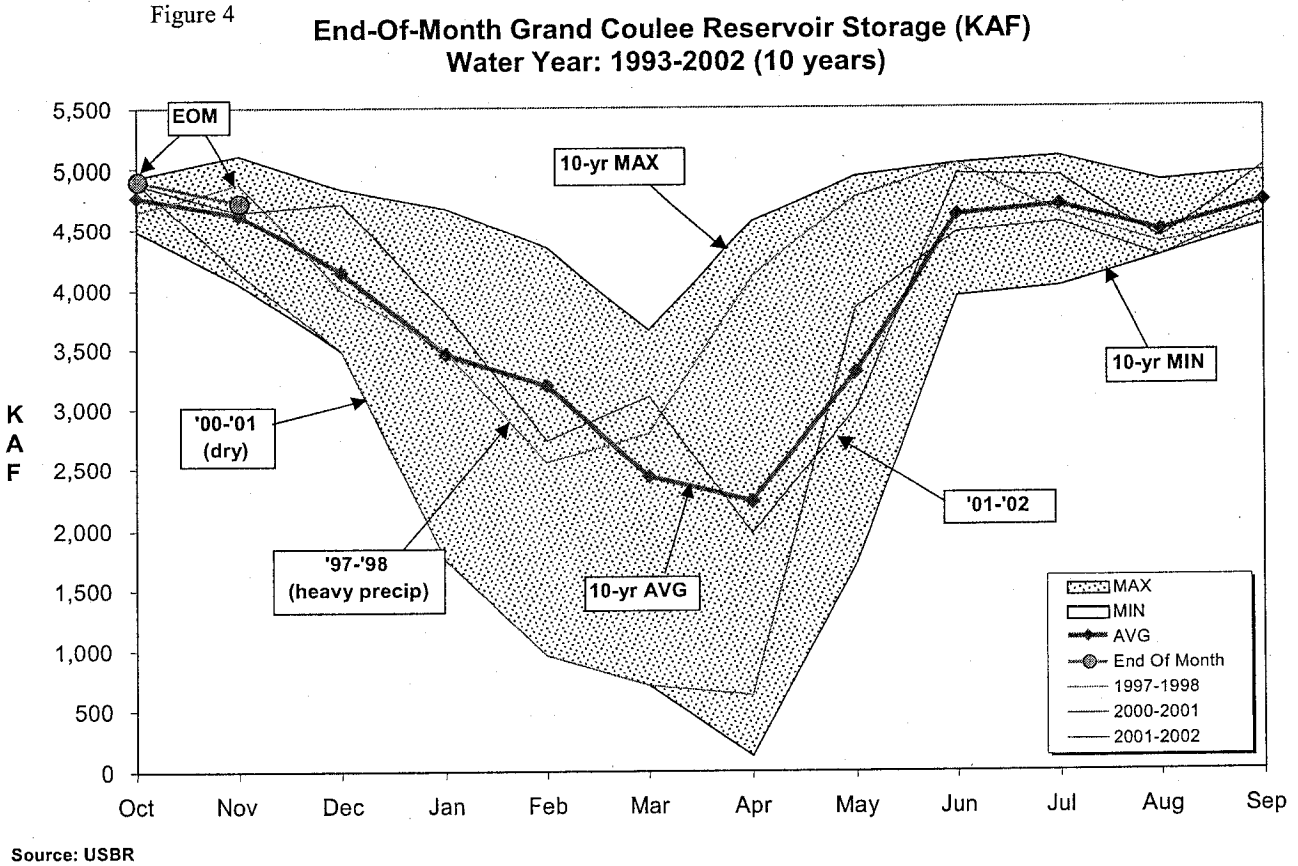
Hydro energy is the largest share of power generation in the Pacific Northwest (Figure 2). Hence, hydro energy availability is the single largest source of variability in PSE's energy portfolio. This is because the cost of the energy is extremely low, relative to market-based replacement power. Additionally, the percentage change in any given year from normal hydro output is a meaningful number in PSE's portfolio (between 5,600,000 and 9,800,000 MWh). As a result, hydro analysis is very important. Forecasting energy out of the hydro system is highly complex. As a result, PSE conducts analysis internally, and supplements the analysis with two outside consultants. Information is gathered on precipitation at critical locations that mimic the Company's West Side hydro facilities and which correspond to the rainfall into the federal river system. See Figure 3. shows a schemata of PSE's hydro modeling. The precipitation information feeds a "Streamflow Model" which feeds a "Reservoir Model" that subsequently models fish spill, flood control, forced outages, regulation and other factors affecting outflows of water. The last piece of the modeling effort is the Generation Model, from which PSE forecasts available energy for the base case position. The final stage, which the company is just now completing, it to take the base case forecast and run scenario tests based upon historical years. This allows the Energy Risk Management group to project a range of possible energy outcomes as a result of the scenario testing.

Figure 3



Hydro reservoir storage is a short-term market indicator, in addition to elevation levels on the federal system above Grand Coulee dam, and MAF (million acre-feet) streamflow levels. These, in addition to plant outages, weather reports, and spot fuel prices help PSE understand what energy is coming into the market, and understand the relative changes by day and through the current month of energy costs. Figure 4 illustrates graphical representation of historical reservoir levels.

Figure 4

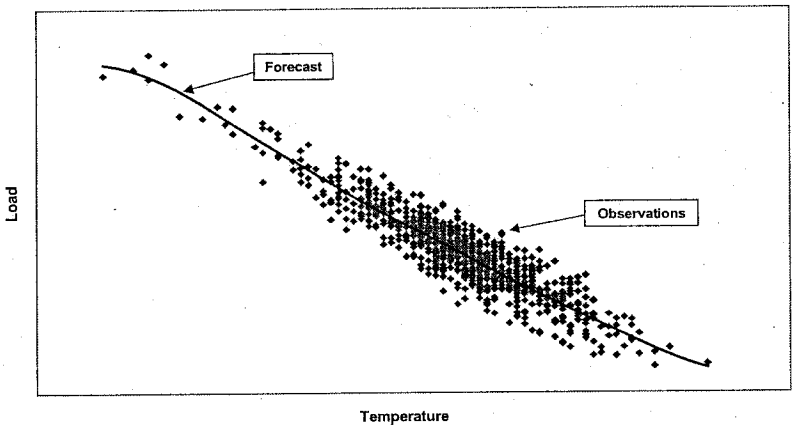


Source: USBR

The next largest source of variability in PSE's Power portfolio is load, which is driven by customer count, temperature and economic conditions. The Energy Risk Management group models expected average load, and then develops a forecast range for minimum and maximum loads that is needed to model variability for exposure testing. The challenge is to have enough energy to serve the peak loads, but to have some flexibility to back down supplies in off-peak periods in order to mitigate costs.

Figure 5

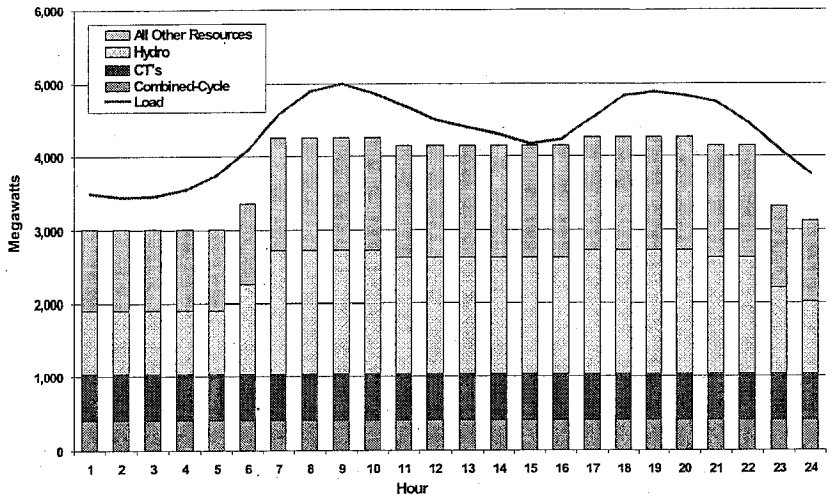
Load versus temperature relationship



The nature of PSE's load is that it has hourly variability, as well as diurnal and seasonal variability. At any given time, the company must plan to meet that load, especially in an extreme winter peak condition. The hourly management is further complicated because the load profile has a double peak. Figure 6 shows a typical load picture over a twenty four-hour period. PSE's hydro storage is a very important resource for balancing the resource and loads on a short-term basis. The company has storage both at its Baker facilities and through its Mid C contracts.

Figure 6

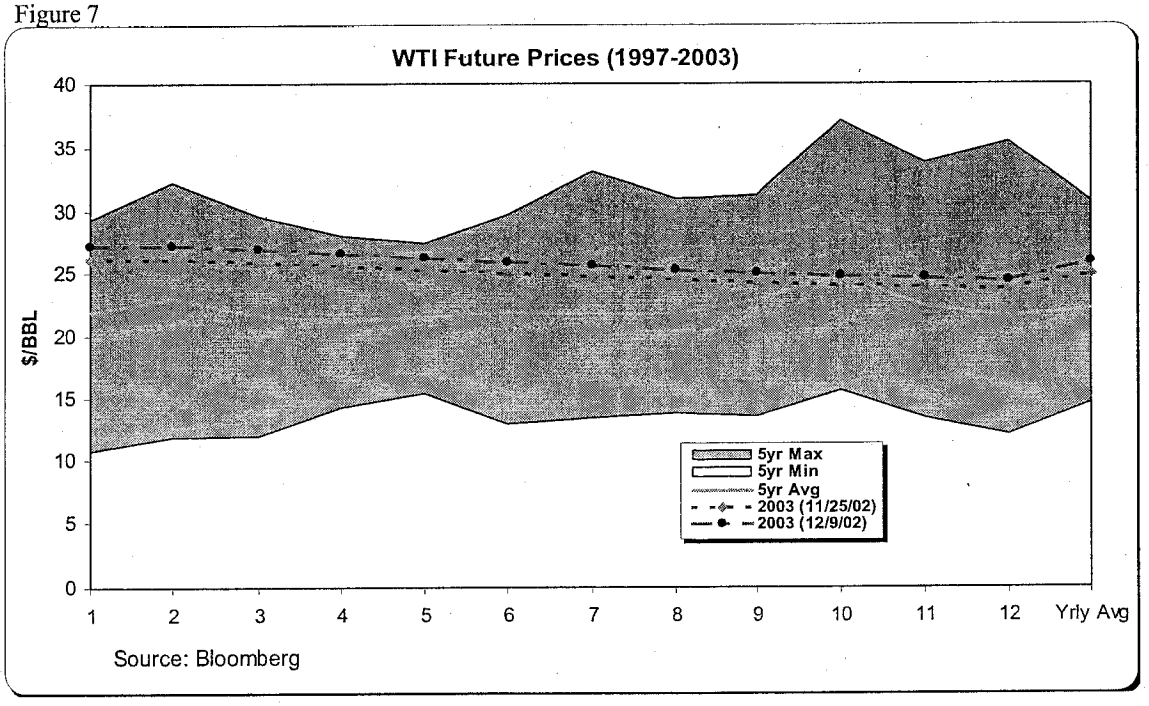
Peak Load Analysis and Planning



NATURAL GAS MARKET DRIVERS

Natural gas market drivers are similar, for natural gas is a growing part of the generation mix in the Pacific Northwest (Figure 2). Therefore power market factors, particularly the relative surplus or deficit of hydro energy, can have a large impact on regional natural gas demand. Significant movements in natural gas market prices will also affect power prices.

Figure 7



Oil prices are strongly linked to natural gas prices for a couple of reasons (Figure 6). In the fuel consumption area, natural gas competes with two refined products, residual fuel and distillate fuel which are burned in older fossil fuel plants as an alternate fuel to natural gas. In the exploration

& production sector, natural gas and crude oil are sometimes found together ("associated oil"), or at times have to compete for exploration budgets. An indicator of natural gas drilling activity is 'rig counts', and there can be an eight to eighteen month lag time between drilling and gas coming to market. PSE tracks rig counts to monitor the longer term increasing or decreasing supply trends.

An important gauge to natural gas supply/demand imbalances is the storage inventories. The natural gas industry uses salt caverns and depleted oil wells as underground storage facilities. The relative level of inventory is an important determinant of relative surplus or deficit in the short-term markets. PSE tracks the weekly and monthly storage inventory levels nationally, as well as in the western US and Canada.

As with power markets, weather and economic factors are important determinants in price volatility. PSE's gas load is predominantly heating load-based, and is extremely sensitive to variations in load on account of changing weather patterns. PSE monitors weather patterns from several sources including local weather stations, national weather service and through a weather subscription with Weatherbank.

CREDIT RISK MANAGEMENT

The company faces significant constraints executing wholesale transactions in short-term and medium-term power and gas markets. There are several factors at work. One, the markets are much less liquid with fewer parties transacting, and the forward time frame is shrinking to shorter-term delivery periods. Two, the industry is extremely concerned about default risk, given the recent bankruptcy filing of Enron, NRG, and TXU Europe. Therefore credit requirements have risen dramatically. Three, the higher rated companies command a 'premium' in their power and natural gas prices to transact with them. That increases operating costs significantly for PSE since its credit rating is only just above investment grade.

In both power and gas markets, there has been a huge decline in forward market activity by traditional investor owned utilities and municipal load serving entities. Moreover, the large energy marketing companies have either exited the Pacific

Northwest markets have scaled back for strategic purposes, have stopped trading altogether in North America (Aquila, Dynegy), or simply cannot transact because of their weak credit rating There are several implications to the liquidity concerns. Forward hedging is much more difficult, and the company is in an uncomfortable position of having to ration credit across multiple needs and activities (power, gas, weather derivatives, peaking capacity, regional exchanges to improve reliability). In Core Gas, PSE has ample storage and pipeline capacity, but because of market illiquidity, the company cannot optimize its assets fully, but must hold open capacity or inventory for significant changes in load. Another implication to the market liquidity problem is that the Company is challenged in displacing and dispatching its generation units to respond to all price opportunities.

In addition to liquidity concerns that hamper hedging, short-term balancing and asset optimization, PSE faces serious credit concerns from counterparties. Entities who would have transacted with PSE a year ago, are now concerned about our credit rating. By example, a surprising number of natural gas producers are reluctant to sell fixed price to us because they are concerned about PSE's credit rating.

TOOLS AND METHODS

Portfolio Management

PSE utilizes an energy transaction capture and risk management system ("system") to capture, monitor, manage, and control physical positions, exposures, and variances. The system monitors volumetric positions and financial exposures and variability. Additionally, PSE uses proprietary models to conduct portfolio and scenario financial analysis of the energy supply portfolio. These models are analytical applications incorporating industry- models and third party software. The Energy Risk Management and Risk Control groups perform specific analyses to quantify volumetric and financial exposures with internal written procedures. Risk Control is responsible for deal capture, data integrity, and reporting from the system. Figure 8 gives the KWI explanation for the Risk Analysis module.

Figure 8.

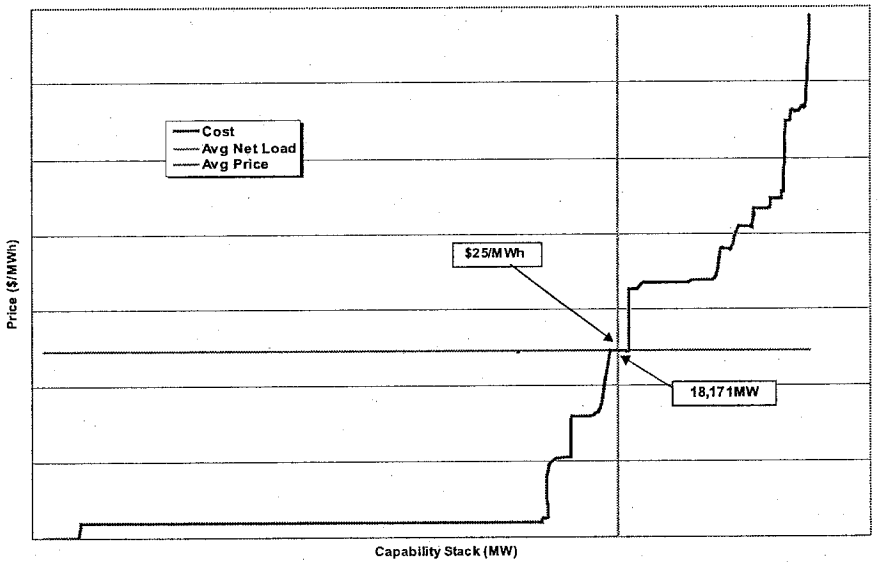
Module Name
Risk Analysis
kWRiskAnalysis.exe
The objective in using this module is to find a strategy that best improves the profit/risk trade-off in a portfolio or sub-portfolio of the company. In this module the Risk Manager (or similar person) can carry out detailed risk analysis to ascertain the expected profitability of the total portfolio or any part of the portfolio in the potential profit at risk. Risk managers can see the effect of adding a new trade or trades and then can assess how their position relates to a variety of categories such as Production, Bilateral purchases, Futures (or Standard Product) purchase, Spot purchases, End user sales, etc. This data can also be viewed in a graphical manner. Risk managers are then able to perform sensitivity analysis in order to evaluate the impact on ratio between profit and risk of any trading, production or sales strategies. This is used to develop hedging strategies that create a portfolio including physical assets (such as generation plant and retail customers) that is robust to changes in the market.

Fundamental Analysis Tools

To model the Pacific Northwest region's power supply/demand dynamics, the company utilizes the Aurora model. Energy Risk Management staff have adapted the long-term forecasting tool to simulate economic dispatch throughout the region in short-term market scenarios.

Figure 9

Fundamental Analysis Example:
Forecasting Regional Supply and Demand



The intersection of projected load and the resource stack gives the theoretical market-clearing price. PSE does not use the model so much for a point estimate for price, but more as a tool to give an indication of market price direction, and the scale of that potential market price move, given changes to inputs in the model. This tool is used to give a sense of relative change in market prices given different assumptions for regional load and estimated generation availability.

To model its natural gas portfolio, PSE utilizes a model called "U Plan G". This model enables the energy risk management staff to simulate the gas portfolio using estimated loads and capacity utilization. The model is loaded with assumptions about estimated load, transportation requirements, storage requirements, and an estimated market value for unused capacity.

APPROACH TO MANAGING PRICE RISK

PSE's goals in hedging and managing price risks in the power and gas portfolios are to:

- Provide price certainty and to lock down risks (Gas and Power)
- Keep prices stable and minimize costs (Gas and Power)

PSE has internal risk management processes to help bring focus and order to the energy risk management function. For power, Energy Risk Management staff develops position reports based upon probabilities load, generation output, and unit availability. The probabilities position is driven by several important inputs. First, the analysis centers on current market prices for fuel and power, and price dispersion around those base prices. Next, each plant's operating characteristics are modeled, and a resulting fuel need and estimated power output results. Plants with lower heat rates (better conversion costs of fuel to power) will typically be economically dispatched more often in the models feeding the position, whereas, peaking units have less impact and contribution to position. Lastly, dispatchable contracts are modeled to be fully optimized for a given set of price assumptions and load/resource balances.

The resulting information is a position report that illustrates the net open position for every month for power and natural gas. The positions are generated for 12-24 months out in time. Next, the energy risk management staff evaluate the forward positions, and explore which of them have significant forward risks associated with them. There is a prioritization process of focusing on these items that can be hedged, and which have the greatest risk associated with them.

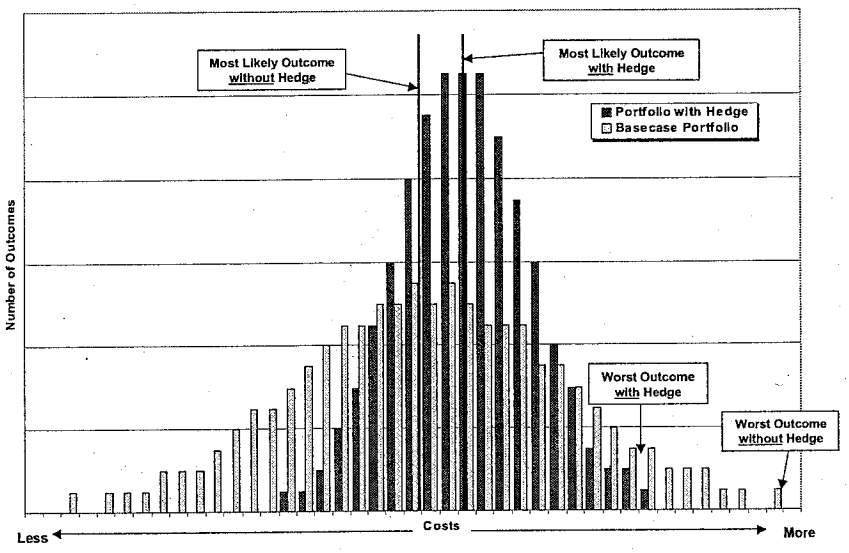
Hedge strategies are developed. A wide range of deal structures is evaluated. The hedge might be a straightforward fixed price purchase or sale of fuel or power. It might be a seasonal exchange, or a buy/sell at different locations. Still other common instruments are options, such as a call (option to purchase) or a put (option to sell). Calls and puts can be valuable instruments, *depending upon their cost,* to offset the risks PSE has in a load that is highly weather-related.

Strategies are tested, not only against the current probalistic position, but also for the portfolio in numerous other market scenarios (different hydro, load, energy prices, etc.). The goal is to identify a strategy not only the base case, but also for other scenarios. Sometimes the 'winning' strategy is not the immediately obvious strategy, but one that takes significant risks out of the portfolio under a range of conditions.

PSE has just begun to utilize the new KW 3000 tool to measure how hedging strategies take out risks in different scenarios. Figure 10 shows a histogram of what a hedge strategy ideally does in terms of reducing outlyer risks and not moving expected outcome (the mean) too much as a result of the hedged cost.

Portfolio Risk Analysis

Measuring cost of Hedging versus Risk Reduction



PSE monitors how the hedge cost affects the bottom line costs. PSE sets a budget for power costs at the beginning of the year. This includes hedging costs, as well as operating costs. Hedge costs need to be taken into consideration so the hedge costs don't move the expected value or outcome too much in a negative fashion.

Integration of Optimization with Hedging and Risk Management

PSE strives to find a healthy tension between removing price exposure, but doing it so as to not assume large hedging costs. In addition, in both the power and gas portfolios, the company seeks to optimize idle capacity and maximize the operational flexibility of its assets and contracts. The optimization is a cost mitigation function, as it helps defray some of the fixed costs associated with transmission, transportation, storage and inventory costs.