TACOMA POWER
TACOMA PUBLIC UTILITIES

2004
Integrated Resource Plan

July 2004

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Chapter 1: Introduction and Executive Summary

Tacoma Power's Integrated Resource Plan (IRP) provides the utility with a framework and plan to assure the provision of reliable cost-effective resources that meet customer needs in the future. The IRP process represents a cross-utility, multi-disciplinary planning approach. In practice, it incorporates many planning and analysis components, but in general includes forecasting future customer demand, determining adequacy of existing resource supply, and identifying an optimal resource strategy from a broad range of supply and demand side options.

Section 1.1 Purpose of Integrated Resource Plan

Tacoma Power approaches Integrated Resource Planning with a focus on three general goals:

- Design and maintain a resource strategy that is cost-effective, environmentally responsible, and flexible enough to meet customer demand given a range of plausible futures.
- Maintain high standards for power supply reliability.
- Evaluate products and services that are responsive to the changing needs of our customers.

In practice, these goals emphasize least-cost strategies that underscore reliability, service and environmental standards, and utilize analysis methods that consider future uncertainty.

Section 1.2 Planning Process

Tacoma Power staff perform IRP related analyses on a regular basis and produce formal updates to the IRP periodically. The previous IRP update was completed in May of 2002. Since then, there have been some moderate changes to factors relevant to long-term planning, but overall Tacoma Power's situation has not shifted dramatically. Residential loads appear to be continuing to slowly recover, but industrial loads that were lost in the last few years have not returned. Wholesale power prices have risen moderately and continue to exhibit short-term volatility, albeit not to the extent experienced during 2000 and 2001. In general, the utility's power supply resources have exceeded loads, and are projected to be sufficient several years into the future.

The planning horizon for the IRP is ten-years, thus analyses, plans and recommendations in this update extend out through the year 2013. This update to the IRP includes new forecasts of customer demand, wholesale power price forecasts and updated forecasts of Tacoma Power's load resource balance. It also includes updates on developments with Tacoma Power's energy supply and transmission resources, and other relevant resource issues that have been analyzed as part of the IRP process. Finally, this update contains recommendations for future actions including conservation acquisition plans.

Section 1.3 Executive Summary

This IRP supercedes past IRPs and updates. Staff produces updates to the IRP on a periodic basis. Prior to this document, the IRP was last updated in May of 2002. Since that time, there have been some moderate changes to factors relevant to long-term planning, but overall Tacoma Power's situation has not changed dramatically. The planning horizon of this IRP update is 10-years and extends from 2004 through 2013.

Developments since Last IRP Update During the period since the last update to the IRP (May 2002), Tacoma Power's residential loads have continued to recover somewhat, but significant industrial loads have not returned. As a result, the utility has since experienced power supply-surplus conditions - firm resource capability in excess of retail load. The wholesale power market, in which the utility sells surplus power, has generally exhibited robust prices.

Analyses Performed for this Update As part of this update to the IRP, new forecasts of customer demand and wholesale power prices were produced, and estimates of firm supply resources were modified. Nine combinations of customer demand (load) and hydrological conditions (water) were modeled to determine the utility's load resource balance for the duration of the 10-year IRP-planning horizon. These analyses were used to draw conclusions about future needs for supply resources including energy, capacity and conservation under a range of hydrological, load and market conditions. In addition to summarizing these analyses, this update discusses issues relevant to the utility's generation projects and supply contracts, and other issues relevant to the IRP. It also includes an update to Tacoma Power's conservation strategy.

Conclusions and Recommendations Staff expects customer demand to grow at a slow steady pace during the IRP planning period. Wholesale power prices are expected to remain robust in the long-term and exhibit short-term volatility at times. Analyses of Tacoma Power's load resource balance suggest that under expected load conditions, Tacoma Power will have some surplus energy on an average annual basis under all hydrological conditions, including critical water. In addition, it is expected that the utility has better than adequate capacity to cover its peak loads under normal conditions and adequate capacity to cover most contingencies. As a result, resource acquisition is not required or recommended at this time.

Tacoma Power's current BPA contract ends in 2011, within the IRP planning period of 2004-2013. A new contract will commence after this, but the terms of it are uncertain. This IRP update assumes that the quantity of power available to Tacoma Power through the future contract with BPA will be similar to that under the current contract. This assumption represents the best information currently available. However, it is plausible that the new contract may offer a smaller quantity of power at the lowest preferential rate. This could significantly change the utility's load resource balance after 2011. Staff is actively involved in the dialogue regarding BPA's future role in the region. As part of this process, more will be learned about the terms of Tacoma Power's BPA contract post 2011. This information will be incorporated into future IRP analyses as it becomes available.

Another supply challenge that Tacoma Power will face in the near future is loss of operational flexibility – ancillary services including automatic generation control (AGC), peaking ability, generation shaping, reservoir storage and reserve capabilities. Some operational flexibility will be lost when the existing Priest Rapids contract expires and the new contract begins in November 2005. In addition to this, the utility is at risk of losing some operational flexibility if operations at the Cushman Project are required to be modified. Depending on the timing of such events, this situation could be exacerbated by construction outages at the Mossyrock plant, planned during 2007 and 2008. Staff will continue to evaluate aspects of operational flexibility within Tacoma Power's existing and future supply portfolio to identify strategies to effectively manage this situation.

As a result of Tacoma Power's current and projected supply surplus and projected market conditions, conservation acquisition strategies are generally recommended to remain consistent with those identified in the 2002 IRP Update. In order to avoid upward pressure on revenue requirements, and ultimately rates, only conservation investments that are cost-effective or strategic should be maintained. At this time staff recommends continued focus on programs that concentrate on lost opportunities, investments in market transformation, and public benefit and infrastructure maintenance. As a result of updated analyses and achieved savings since 2002, staff has revised the conservation acquisition targets. The current 10-year total recommended conservation target is 10.8 aMW, up from 8.1 aMW in 2002. In order to more accurately quantify conservation available and cost-effective to acquire in the future, staff recommend that a comprehensive conservation potential assessment (CPA) be conducted. The CPA should quantify cost-benefit ratios and life cycle levelized costs for an assortment of potential energy conservation measures, and be conducted with assistance from an industry-expert consulting firm.

Organization of this Plan

The remainder of this plan is divided into eight chapters.

Chapter 2 – Forecast of Customer Demand describes the results of Tacoma Power's load forecast and the uncertainties associated with estimates of future customer demand.

Chapter 3 – Forecast of Wholesale Market Prices describes price forecasting methods and assumptions used for this Integrated Resource Plan..

Chapter 4 – Energy Supply and Transmission Resources describes the existing portfolio of resources and transmission assets.

Chapter 5 – Analyses of Load Resource Balance examines the adequacy of Tacoma Power's firm power supply to meet forecasted loads over the duration of the IRP study period.

Chapter 6 – Conservation and Load Management Options describes demand side resources available and results of screening and evaluation to determine the best options for Tacoma Power.

Chapter 7 – Planning for Uncertainty describes the scenario planning process and results.

Chapter 8 – Other Resource Issues addresses topics which may become important in the future such as demand response, distributed generation, and wind generation.

Chapter 9 – Conclusions and Recommendations outlines areas for ongoing study and analysis of Tacoma Power's resource strategies.

Chapter 2:
Forecast of Customer Demand

Section 2.1 Profile of Current Customer Base

Service Area

Tacoma Power's service area consists of a 180 square mile area, including the entire 43 square miles comprising the City of Tacoma. Tacoma Power provides electric service within its service territory and indirectly serves other portions of the Tacoma metropolitan area through power sales to McChord Air Force Base, Fort Lewis Military Reservation, the Town of Ruston and several other customers. Several cooperative utility companies, a municipal utility, and the Puget Sound Energy Company serve the area which bounds Tacoma Power's service area.

Tacoma Power Customers

Tacoma Power served approximately 153,955 metered customers in 2002. Tacoma Power serves six classes of electricity customers: Residential; Small General; General, including industrial and large commercial customers; High Voltage General, which includes the two military installations; Contract Industrial, comprised of two large industrial customers; and Other (principally municipal).

Figure 2a

Customer Base – 2002 Statistics

Customer Class	Number of Customers	Annual Retail Sales (MWh)
Residential	137,792	1,785,165
Small General	13,469	321,567
General	2,278	1,521,454
High Voltage General	8	408,812
Contract Industrial	2	468,370
Other	406	35,590
Total	153,955	4,540,958

Residential Customers. In 2002, Tacoma Power supplied electric energy to 137,792 residential customers with a total demand on the resource portfolio of 203.8 aMW (39.3% of total retail sales).

Small General Customers. Small general customers, including retail, restaurants and other small businesses, consumed 36.8 aMW (7.1% of total retail sales) of portfolio resources in 2002. There were 13,469 Small general customers in 2002.

General Service Customers. Tacoma Power had 2,278 general service customers purchasing from its resource portfolio in 2002. Individual loads were as large as 4.0 aMW. These customers include industrial, large commercial, schools, and government facilities, and together consumed 173.7 aMW (33.5% of total retail sales).

High Voltage General Service Customers. Tacoma Power serves two military bases and six industrial companies as the High Voltage General customer class. This class includes the Fort Lewis Army Post and the McChord Air Force Base. All customers in this class are served at transmission level voltage. Together high voltage general customers represented an aggregate load of approximately 46.7 aMW (about 9% of total retail sales).

Contract Industrial. Tacoma Power currently serves two Contract Industrial customers[1] that together represented an aggregate load of about 48 aMW in 2002 (9.3% of total retail sales).

Other Customers. Tacoma Power's other electricity customers primarily consist of street lighting, traffic signals, and private off-street lighting. In 2003, there were 429 customers in this class with consumption of 4.1 aMW (0.8% of total retail sales).

Section 2.2

Forecast of Future Energy Sales

Methodology

As part of this IRP, three distinct load forecasts were developed in late 2003. These include a Low, Base and High Case forecast. The Base Case represents the expected view of future loads in Tacoma Power's service area over the ten-year IRP planning horizon. The Low and High Case forecasts represent potential, but less-likely to occur deviations in either direction.

The Base Case load forecast is the sum of individual rate class retail sales estimates, adjusted for losses and programmatic conservation savings. The individual retail electric sales projections are used for purposes that require kWh sales forecasts by class, such as revenue requirements, budgeting and cost-of-service, where appropriate. These forecasts are updated annually. Specifically, these are Residential, Small General, General, High Voltage General, Contract Industrial and a few other specialized categories of service.

Forecasts for Residential, Small General, General Service and schools were developed using econometric models. These models use statistical techniques which correlate sales to economic, demographic and weather data for some historical period of time. The results of these correlations are reduced to simple algebraic equations and used to forecast sales in the future. Error in the models, after adjusting for weather has average 1.0 to 1.5 percent and has generally stayed below 2.0 percent on an overall basis.

Price elasticity and cross-price elasticity impacts have been incorporated into

[1] Retail sales to Contract Industrial customers shown in Figure 2a on previous page includes retail sales to a third customer that closed its manufacturing operation in Tacoma in early 2002.

several of the statistical models. They provide guidance to the long-run elasticity of electricity consumption when real changes (adjusted for inflation) occur in the price of power. For this forecast the retail price assumptions were assumed to remain at just about the rate of inflation throughout the forecast period. Estimates of inflation are based on national level forecasts.

Classes not estimated by statistical techniques include the High Voltage General Service class and the Contract Industrial customers. Estimates for these customers are based on observation of historical consumption as well as discussions with operating personal at these facilities and Tacoma Power's account executives who work with large customers to understand their present and future electric power requirements.

The Low and High Case forecasts are developed with the use of scenario planning techniques. In general, discrete subtractions and additions that represent low and high load trends are identified and combined with the Base Case forecast to produce the Low and High Case load forecasts.

Section 2.3

Forecast of Future Energy

Results

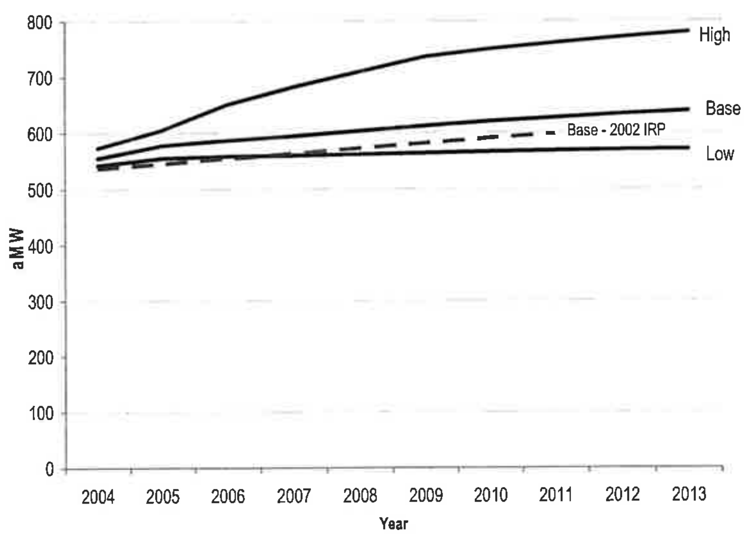
Although all three load forecasts are used in IRP planning analyses, decision making on resource acquisition generally concentrates on analyses that focus on the expected Base Case load forecast. The Base Case forecast assumes annual growth of about 2% in the General Service Class and about 0.9% in the Residential Class, industrial loads remaining at current levels, new loads associated with the University of Washington and Pierce County Port Terminal expansions, and a new casino.

The Low, Base and High Case load forecasts are illustrated in Figure 2b. The expected Base Case load forecast exhibits a somewhat rapid growth rate in the first couple of years – primarily the result of expected new small commercial and industrial loads, before settling into a more moderate growth trend thereafter. On average, over the planning horizon, the overall Base Case forecast grows at a rate of approximately 1.5%.

The Low and High Cases depict significant, yet plausible deviation from the Base Case assumption. In general, the Low Case reflects a scenario of slower growth in residential and commercial loads and various industrial and military loads decreasing over time. The High case assumes faster growth in the same categories plus several new industrial loads. The primary purpose of the Low and High Cases is to provide a basis for sensitivity analyses and to identify the boundaries of plausible load growth and/or decline. Such information is useful for anticipating planning and acquisition schedules. Because these cases include some relatively extreme events, and because they depend on the occurrence of a number of load impacting events to all happen, the probability that they will occur as depicted should be considered low. As a result, the Low and High forecasts should not be used as the basis for resource acquisition decisions.

Finally, for purposes of comparison, the Base Case load forecast used in the last IRP update (May 2002) is also included in Figure 2b. As illustrated, the current Base Case load forecast is higher than the Base Case forecast used in the last IRP update (on average over the 10-year planning horizon). This trend is explained as a partial return and further expected return of loads that had declined significantly during the 2000 to 2001 period. During the 2000 to 2001 period, Tacoma Power area loads had declined significantly as a result industrial load loss, Tacoma Power's conservation appeals and price induced conservation. At this time, a return of primarily residential load and some small commercial and industrial is expected.

Figure 2b
Load Forecasts



Section 2.4

Forecast of Peak Demand

Customer demand for energy must be examined not only from the perspective of average annual and monthly projections but also on an hourly basis, because this is how the system is managed in real time. The peak load forecast increases gradually from 898 MW in 2004 to 1011 MW in 2013. In Tacoma Power's climate zone the highest customer demand coincides with the coldest temperatures. While we assume average weather for our long-range base load forecasts, we must be prepared to meet customer demand if we have extended cold weather during the winter. Chapter 5, "Analysis of Load Resource Balance" treats this topic in more detail.

Chapter 3: Forecast of Wholesale Market Prices

The forecast of long-term wholesale electricity prices (price forecast) discussed in this section supercedes the price forecast used in the 2002 IRP Update and was used for analyses in this 2004 IRP. The price forecast presents a Base Case (expected scenario) along with High and Low price cases. The High and Low Cases represent possible outcomes driven by certain plausible shifts in key variables for the region, such as fuel prices and electricity demand. All three price forecast cases, along with the price forecast used in the 2002 IRP Update, are illustrated in Figure 3b.

Section 3.1 Forecast Methodology

The price forecast used for this update to the IRP was generated using the Aurora model, created and maintained by EPIS, Inc. Aurora is a price forecasting model used widely in the Pacific Northwest and nationally. The Aurora model uses a database of input variables that represent resource and market fundamentals to simulate the regional power market, and in particular, the development of future power generation resources. Output of the Aurora model includes a series of power price forecasts that are a function of the generation resources built by the model during model simulations. Specifically, the market clearing price (the price forecast) is related to the dispatch cost of the generation unit used at the margin in each time period (during each hour). In other words, the marginal unit (the last generation unit turned on) sets the marginal price – the market clearing price for electricity in the wholesale market during each time period.

The Aurora model functions as a platform for modeling power prices allowing the user to maintain and utilize their own database of input assumptions in combination with the model's default assumptions. As a result, the nature of the price forecast is a direct result of Tacoma Power's outlook on key market drivers such as fuel prices, regional supply (existing resources) and demand, and other inputs.

Changes since Last Forecast

The price forecast used in the 2002 IRP Update was developed in December of 2001. The forecast used for the 2004 IRP was developed in October of 2003. Staff continually updates Tacoma Power's Aurora database of input variables to reflect current conditions. In addition, EPIS continuously improves and adjusts the Aurora forecasting model including changes to model operation and logic and updates in the default database assumptions. As a result, it is expected that forecasts produced at different intervals will be different to the extent that key input variables have changed.

Several updates were made to the Aurora input database between December 2001 and October 2003. Of these updates, changes in fuel price assumptions, especially natural gas, have been the key drivers for change to Tacoma Power's power price forecasts over time. Natural gas prices and forecasts of future prices have risen sharply since the December 2001 price forecast was completed. As a result, significantly higher natural gas price forecasts were used for model assumptions in the current (October 2003) price forecast, resulting in higher forecasted power prices.

Another change reflected in the current price forecast is the input assumption used for regional demand. Significantly lower regional demand inputs were used for the current (October 2003) price forecast. This is because the December 2001 price forecast did not compensate for the significant load decline experienced by the region due to the energy crisis and economic recession. These data were not available at the time of the 2001 forecast. The demand forecast used to generate the current price forecast appropriately includes these effects. The impact of using lower regional demand inputs alone, all other inputs remaining unchanged, would result in a lower power price forecast. However, the impact of using higher fuel price inputs is more significant than the demand impact, and results in a marginally higher power price forecast.

Section 3.2 Modeling Assumptions

Fuel Price Assumptions

The key fuel input is the forecast of natural gas prices. The model requires the input of forecasted natural gas at Henry Hub and hub basis differentials for all major hubs within the WECC.[1] The model calculates hub specific prices by applying the input basis differentials to the Henry Hub forecast. Staff carefully reviewed natural gas price forecasts from multiple sources and determined that, at the time, NYMEX futures represented the best indicator of natural gas prices through 2009. Staff estimated basis differentials for natural gas trading hubs throughout the western region based on examination of historical patterns and through review of other forecasts.

Because gas-fired resources are often on the margin in the Aurora modeled resource stack (that set the market clearing price), the gas price forecast model input is extremely important. This modeled outcome reconciles well with the fact that observed Mid-Columbia electricity prices are heavily influenced by natural gas prices. As would be expected, Aurora results are quite sensitive to natural gas price input variations.

Figure 3a lists the Base, High and Low natural gas price forecast assumptions used for the power price forecast. High prices are 30% greater than base prices, while low prices are 25% less than base prices.

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[1] Henry Hub refers to a location is Louisiana that acts as the official delivery point for natural gas futures contracts traded on the New York Mercantile Exchange (NYMEX). Hub basis differentials represent the difference in cost of gas delivered at different hub locations relative to Henry Hub.

The high and low natural gas price assumptions are based on statistical analysis of historical volatility and fundamental analyses provided by an economic data consulting firm.

Figure 3a

Natural Gas Price Forecast (Nominal$)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
High	6.62	6.26	6.17	6.24	6.30	6.45	6.62	6.78	6.95	7.12
Base	5.09	4.81	4.75	4.80	4.84	4.96	5.09	5.22	5.35	5.48
Low	3.82	3.61	3.56	3.60	3.63	3.72	3.82	3.91	4.01	4.11

Inflation = 2.5% Real Escalation = 0.25%

Although to a much lesser extent than natural gas, the Aurora model is somewhat sensitive to coal prices – at least during certain periods (hours of the day). Because of this, a significant amount of attention was given to review of forecasted prices for coal throughout the WECC. The result of this review was a general acceptance of the Aurora default coal price assumptions. The only change made to these default assumptions was a change in real price escalation from the default forecast of -0.5% to 0%.

The Aurora model default fuel price inputs for diesel and uranium were reviewed and validated by staff. These fuel inputs are less important as determinants of the final price forecast because, in most cases, the modeled marginal resources are gas-fired, and to a lesser extent coal, rather than uranium, diesel or some other resource type.

Demand Assumptions

Electricity demand is another key model input. The Aurora default database uses demand values based on regional planning forecasts. Staff reviewed the Aurora database demand assumptions against NWPPC and WECC load observations and forecasts. As a result of this review, staff adjusted the demand escalation rate for use in the Low and High power price forecasts and kept the Aurora default escalation rate for the Base Case price forecast. The annual demand escalation rates used in the price forecast are 1.8% for the Base Case, 1% for the Low Case, and 3.6% for the High Case.

Supply Resource Assumptions

The resource database used in the Aurora default database includes existing and planned generation resources as well as generic resource types that are added to the modeled resource stack over the forecast period during price forecast simulations. The database of resources was reviewed by staff for accuracy and some of the resources were removed or updated based on current information. The modeled resource stack (model output) was also reviewed for plausibility and represents a reasonable simulation of expected generation additions for the region.

The Northwest region is unique in that a large percentage of the resources in the region are hydroelectric dams. This means that the overall supply capability of the region is highly dependant on how much precipitation and runoff is realized. While hydro rarely sets the marginal price, the availability of this inexpensive resource shifts the supply curve up or down, significantly impacting what resource is on the margin and therefore shifting the market clearing price.

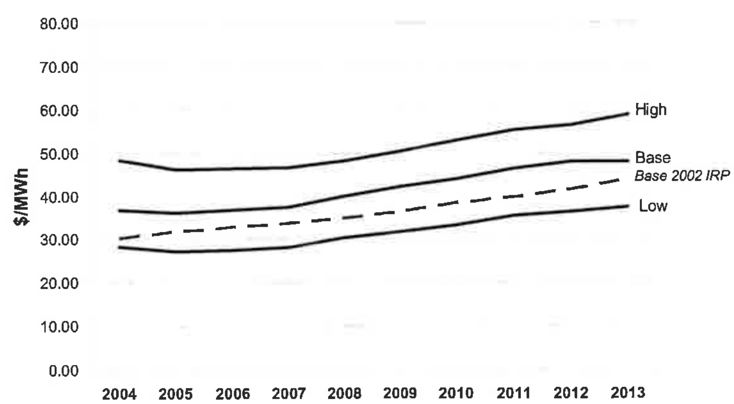
For purposes of power price forecasting over a 10-year forecast horizon (a long-term horizon), average water conditions must be assumed because it is not possible to know what precipitation will be in years to come. Therefore, hydrological inputs that reflect average water conditions were utilized for all three price forecast scenarios - Base, High and Low. All simulations were made using the Aurora default inflow database, which is comprised of calculated average inflows of a 50-year record. Actual hydro conditions will vary significantly over time on a short-term basis. As a result, considerable short-term price variation (that is not modeled in the price forecast) driven by changing water conditions will occur throughout the forecast horizon.[2]

Section 3.3 Price Forecast Results

The Base, High and Low Case price forecast scenarios are illustrated in Figure 3b on an annual basis in nominal $/MWh. After an initial decline in prices during the near-term horizon, the forecast predicts prices to generally rise with inflation throughout the forecast horizon. The figure also illustrates a comparison of the current Base Case forecast with the Base Case forecast used in the 2002 IRP Update. As depicted in the figure, the current forecast is, on average, about 15 % higher than the December 2001 forecasts over the IRP planning horizon.

Figure 3b

Price Forecast Comparisons



[2] In addition to changing water conditions, other factors such as fuel price volatility may impact prices in the short-term.

Chapter 4:
Energy Supply and Transmission Resources

Tacoma Power's present power requirements are supplied from generating facilities owned by Tacoma Power, by purchases from hydroelectric resources owned by others, by purchases from the Bonneville Power Administration (BPA) and through contractual arrangements with the Grand Coulee Project Hydroelectric Authority and with Grant County Public Utility District.

Section 4.1 Water Conditions and Project Output

Tacoma Power's Owned Resources

Tacoma Power owns four hydroelectric generation projects – Nisqually, Cowlitz, Cushman, and Wynoochee. Table 4a shows a summary of the expected output of these resources under median and critical water conditions. These projections are based on 72 years of recorded data. Extreme low water conditions are represented by 'critical water'. Critical water conditions are defined as the lowest annual inflows during a twelve-month period. Operating year 1941 (August 1940 to July 1941) represents the critical water period for Tacoma Power's system.

Figure 4a
Tacoma Power Resource Capability

Project	Nameplate Capacity (MW)	72-year Median Annual Energy Production (aMW)	Critical Period Average Annual Energy Capability (aMW)
Nisqually	114.0	68.1	40.5
Cushman	124.2	37.5	32.7
Cowlitz	462.0	206.3	103.7
Wynoochee	12.8	3.8	3.6
Total	713.0	315.7	180.5

Due to the range in available energy supply depending on the water conditions, analyses done for this IRP have included a range of assumptions to encompass the risk of lower than expected precipitation.

Cowlitz Project

The largest of Tacoma Power's hydroelectric projects, the Cowlitz River Project, consists of two coordinated hydroelectric plants, Mossyrock and Mayfield. Both are located on the Cowlitz River in Lewis County. The Mossyrock powerhouse contains two generating units, each rated at 150 MW, resulting in a total nameplate capacity of 300MW. The Mayfield powerhouse contains four generating units, each rated at 40.5 MW, resulting in a total nameplate rating of 162 MW. Both plants are operated by Tacoma Power under the terms of a single FERC license.

The original FERC license for the Cowlitz project expired on December 31, 2001. On July 18, 2003, a new 35-year license for the Cowlitz Project was issued from the FERC. Tacoma Power submitted an application for a new license in December 1999 and filed a comprehensive agreement between Tacoma Power, federal and state agencies, tribes and conservation groups in September 2000. The new license is based on that agreement. The license is the result of more than five years of study and negotiation, and describes fisheries, recreation, cultural resources, wildlife and water quality programs that Tacoma Power will provide.

Both of the generating units at the Mossyrock plant (Units 51 and 52) are beyond their design life and require refurbishment. Comprehensive analyses have been conducted to identify the optimal timing and nature of plant refurbishment. These analyses included several refurbishment scenarios incorporating various options of rebuilding existing units and building an additional third unit. Both analyses conducted in-house by Tacoma Power staff and externally by an independent consulting engineering firm suggest immediate rebuild of the existing units as the optimal refurbishment option. Tacoma Power staff is currently receiving proposals for design and rebuild services of the units. At this time, it is expected that construction will require the units to be out of service for approximately six months each. Construction on the first unit is expected to commence in the spring of 2007 and conclude in the fall of that year. Construction on the second unit is expected to take place during the same period in 2008.

Staff is evaluating strategies to manage planned outages of the Mossyrock units associated with the construction periods discussed above. Strategies will likely focus on reservoir management options, but may also include financial management options.

Because the Mossyrock units are beyond the end of their design life, a greater risk of an unplanned outage at the plant exists. Because of this risk, and because of Mossyrock's significance as part of Tacoma Power's supply portfolio, staff has analyzed the impacts associated with an unplanned outage of one or more of the units. The results of this analysis are presented and discussed in Chapter 5 – Analyses of Load Resource Balance. In order to mitigate the risk of an unplanned outage (prior to refurbishment), staff will continue to closely monitor plant equipment, continue to operate under reduced maximum capacities, and remain prepared to quickly repair the units (if possible) when and if unplanned outages occur.

Cushman Project

The Cushman Hydroelectric Project consists of two hydroelectric plants, Cushman No. 1 and Cushman No. 2, located on the North Fork of the Skokomish River in Mason County, on the Olympic Peninsula. Cushman No. 1 has two generating units, each rated at 21.6 MW, resulting in a total nameplate capacity of 43.2 MW. Cushman No. 2 has three generating units, each rated at 27 MW, resulting in a total nameplate rating of 81 MW.

The Cushman Project was issued a new 40-year license in July of 1998. As the terms of this license are prohibitively costly, they were appealed by Tacoma Power. At this time, this appeal is still pending. If the appeal is not successful and an unreasonable license is ultimately issued by FERC, Tacoma Power will not accept it and will terminate generation. Under such circumstances, Tacoma Power will be required to make up for the power and other ancillary benefits[1] that the Project provides with other owned generation resources and market purchases. The Cushman Project provided approximately 6.3% of Tacoma Power's total resources in 2003.

Nisqually Project

The Nisqually River Project consists of two separate hydroelectric plants, Alder and LaGrande, located on the Nisqually River in Lewis County. The Alder plant has two generating units, each rated at 25 MW, resulting in a total nameplate capacity of 50 MW. The LaGrande plant has five generating units, one rated at 40 MW and four at 6 MW, resulting in a total nameplate capacity of 64 MW. The original license for the Nisqually River Project was issued by the FERC on November 27, 1944. On March 7, 1997, Tacoma Power received a new 40-year license from FERC. Tacoma Power is in the process of implementing the new license requirements which include numerous fish and wildlife enhancements and recreation improvements. All the compliance plans required by the license have been reviewed by state and federal agencies and filed with FERC; over 90% have been approved to date.

In the fall of 2003, the Nisqually River Project received certification as a low-impact hydroelectric project by the Low Impact Hydropower Institute. The Project is currently one of only eight facilities in the nation to earn this certification. The certification confirms that Tacoma Power operates the plant in an environmentally responsible manner and considers its output as "green" or "low impact". The certification process entailed an independent scientific review which determined that the manner in which the plant operates protects or mitigates impacts on river flows, water quality, fish passage, watersheds, threatened and endangered species and cultural resources.

Wynoochee Project

The Wynoochee Project is located on the Wynoochee River in Grays Harbor County, on the Olympic Peninsula. The Wynoochee Project has one generating unit with a nameplate capacity of 12.8 MW. The project's generation is transmitted to BPA's transmission grid over Grays Harbor County Public Utility District No.1's transmission system under a contractual arrangement. Currently, the Wynoochee Project is owned and operated by the cities of Tacoma and Aberdeen as co-licensees. In 1995, the cities entered into an agreement to transfer Aberdeen's rights, title and interest in the Wynoochee Project to Tacoma in consideration of Tacoma relieving Aberdeen of its ongoing operations and maintenance responsibility. The

[1] Including AGC (a real-time signal used for load following), reserve capacity, and load shaping (ability to shape load from light load hours to heavy load hours).

agreement is contingent upon obtaining the approval of the Army's Corps of Engineers (Corps). Congress passed legislation in 2000 permitting the transfer of title from Aberdeen to Tacoma with similar conditions to 1990 legislation that allowed transfer of title from the Corps to Aberdeen. Currently, the Corp is reviewing Tacoma's request for its approval of a transfer agreement.

Section 4.2 Bonneville Power Administration (BPA)

Power Supply Contracts and Exchanges

Tacoma Power supplies more than half of its retail load through its Priority Firm Power Block Sales Agreement with BPA. The current BPA contract began on October 1, 2001 and concludes on September 30, 2011. This 10-year contract supplies Tacoma Power with firm power to serve its retail load. The quantity supplied is termed Tacoma's "net requirement" and was determined by subtracting Tacoma's monthly forecasted demand under heavy load hours (HLH) and light load hours (LLH) from its resource capabilities under critical water conditions. The quantity of power to be purchased over the contract term began at 385 aMW in the first year, and increases over the first five years to 429 aMW. Each year of the contract, BPA and Tacoma Power review Tacoma's net power requirement to determine if an adjustment is necessary. The quantities of power to be supplied during the second half of the contract will be subject to future negotiations.[2]

The contract provides some flexibility. Key elements of the contract include:

- Monthly HLH/LLH shapes for 10 years based on net power requirement.
- Ability to shape the energy other than flat over the HLH periods.
- Load growth for the first five years; load growth to be negotiated in 2006 for the remaining 5 contract years.
- Lower rates in the first 3 years, higher in the next 2 years.
- Rates for the last 5 years will be determined in the 2006 rate case.

Some components of the contract, such as rates, have changed since its inception, and several BPA related developments have taken place since the 2001 IRP was published. These developments are important to Tacoma Power, as they often have a direct impact on the cost and amount of power purchased from BPA. In addition, a new BPA contract (to begin in 2011) will need to be negotiated within the IRP planning horizon.

BPA rates have increased since the 2001 IRP. While Tacoma Power's BPA contract provides supply certainty, the rate Tacoma Power pays for its BPA purchase changes according to various adjustments built into the rate structure. The contracts contain Cost Recovery Adjustment Clauses

[2] For modeling purposes, we assumed that the quantity of BPA remains at 429 aMW for the remaining five years of the contract.

("CRACs") that permit rates to be adjusted if BPA's net reserves fall below a threshold amount, if BPA purchased power supply costs are greater than expected, or if BPA is projected to miss a Treasury payment. There are three CRACs: a Load-Based (LB) CRAC, a Financial-Based (FB) CRAC and a Safety Net (SN) CRAC. The Cost Recovery Adjustments are not additive, but are indexed off the base rates effective at the beginning of the contract - October 1, 2001. To date, all three CRACs have been invoked. The CRAC adjustments have caused Block power costs to increase approximately 45% from October 1, 2001 to October 1, 2003 – from approximately $20 to $29 per MWh on an annual basis. Some of BPA's customers have petitioned the Federal Ninth Circuit Court of Appeals to review the manner in which BPA has determined its rate structure. A recent attempt to settle the pending litigation and to cancel the SN CRAC failed. The outcome of this case may have an impact on the cost of power purchased from BPA.

BPA and its customers are currently in discussions regarding both the short (FY 2007-2011) and long-term (beyond 2011) role that BPA will play in the region. Key elements of the discussion include methods to control BPA's costs and alternative approaches to ratemaking. For the 2006 rate case, which will determine the initial rates (for a 2- or 3-year period) for the second half of Tacoma Power's BPA contract (FY 2007-2011), BPA believes rates will be set at their lowest embedded cost. In July 2004 BPA issued a "Policy Proposal for Power Supply Role for Fiscal Years 2007 – 2011" on its future role and plans to issue a final Record of Decision (ROD) in fall of 2004 prior to commencing the 2006 rate case.

Although staff cannot predict with certainty the outcome of these discussions, Tacoma Power expects the quantity of BPA contract purchase power for FY 2007-2011 to remain at 429 aMW annually and anticipates that the cost of priority firm power will be lower than compared to the FY 2002-2006 period.[3] After 2011, BPA has suggested that a long-term (20-year) power contract will be offered, but it is uncertain as to the quantity of power that will be available for Tacoma Power to purchase. In addition, the issue and application of a tiered rate methodology is being evaluated. The concept would allocate the existing Federal System costs to a rate (tier 1) and those loads served above the capability of the existing Federal System would be served under a higher rate (tier 2) based on the cost of incremental resources used to serve that incremental load.

Staff will continue to closely monitor BPA related developments and will adjust these estimates accordingly.

Priest Rapids Contract

Tacoma Power's current agreement with Grant County PUD for 8% of the production of the Priest Rapids development will end on October 31, 2005, the same year the project's current FERC operating license expires. Since the 2001 IRP, significant developments in the negotiation

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[3] Costs are expected to be lower (in real terms) as the result of the new BPA cost savings initiative and lower cost augmentation of the Federal Base System.

of a new contract have taken place. In December 2001, Grant PUD reached agreement with purchasers throughout the Northwest, ensuring that they will continue to share the power generated by the Priest Rapids Project (the Priest Rapids Development and eventually the Wanapum Developments) throughout the next license period. Three post-2005 power sales contracts for four Priest Rapids Project generation products were signed by the purchasers and Grant PUD. The new contracts, starting on November 1, 2005 and lasting through the new license period, provide that each power purchaser has the right of first refusal to purchase its proportionate share of Priest Rapids Project generation in excess of the actual and prospective needs of Grant PUD. As a result, after October 31, 2005, Tacoma Power's share of Priest Rapids Project generation will be affected by Grant PUD loads, water conditions, and future FERC License operating requirements.

Forecasted average generation available annually to Tacoma Power during the first couple of years of the contract is estimated to be approximately 38 aMW - a quantity similar to the current contract. However, over time this quantity is expected to decrease as Grant PUD loads increase. In addition, flexibility under the new contact will be significantly decreased. Specifically, the new contract offers less reservoir storage capability (for shaping energy deliveries to periods when Tacoma Power needs it most) and less Automatic Generation Control (AGC), a real-time signal used for load following. This loss of flexibility will need to be made up for by other resources. For example, Tacoma Power may have to operate its owned resources in a different, potentially less efficient manner in order to compensate for lost flexibility. Finally, estimated power costs under the new contract will be significantly higher than costs under the current contract.

On October 29, 2003 Grant PUD submitted a new license application to FERC for the Priest Rapids Project. The new license should be issued in late 2005 and is proposed to last for 50 years. Significant risks to Tacoma Power's expected generation and costs exist if FERC rules against relicensing, the new FERC license changes dam operations considerably or FERC changes the power sales contracts between the purchasers and Grant PUD.

Grand Coulee Project Hydroelectric Authority

The cities of Tacoma and Seattle have entered into power purchase agreements with three Columbia Basin Irrigation Districts (South, East and Quincy) for the acquisition of the output of five low-head hydroelectric projects which were constructed along irrigation canals in eastern Washington. The California Energy Commission has certified four of the five projects as renewable small hydro resources for the purposes of marketing green power. Tacoma Power has five separate power purchase agreements for the output of these projects, each one lasting 40 years. Power deliveries under the contracts began between 1982 and 1986 and will end on corresponding dates for each project between 2022 and 2026. These projects are operated by the Grand Coulee Project Hydroelectric Authority (GCPHA) and utilize water released during the irrigation season, which usually flows from the end of March through mid-October. The total nameplate capacity of all five projects is approximately 130 MW, with a total average annual energy production of approximately 450,000 MWh. Tacoma Power receives 50% of the actual project output, or approximately 225,000 MWh.

Other Contracts and Exchanges

Since the 2001 IRP, Tacoma Power's exchange arrangements including the Columbia Storage Power Exchange and the Seattle City Light exchange have expired. In addition, Tacoma Power's contract with Minnesota Methane LLC for power purchased from their landfill gas development hosted at the Tacoma landfill has expired. Extension of this contract was at one time considered, but was ultimately deemed infeasible because of lower than expected methane gas production at the plant. The project has since been decommissioned.

Green Power Program

Tacoma Power continues to provide its customers with a green power choice by way of its Evergreen Options program. The power supply for the program (currently 0.5 megawatt) is purchased from BPA under its Environmentally Preferred Power Program (EPP). Power is supplied from a host of environmentally preferred resources, including wind, geothermal, and hydroelectric.

Section 4.3 Operating Reserves

Tacoma Power is a control area and subject to the policies of the North American Electric Reliability Council (NERC), the Western Systems Coordinating Council, and the Northwest Power Pool. The policies require all control areas to maintain operating reserves. Operating reserves require the system to operate its control area resources such that the most severe single contingency will not cause the interconnection to collapse. Each control area, or reserve sharing group, must provide for contingency reserve equal to a minimum of either its most severe single contingency or 5% of its on-line hydro generation plus 7% of its on-line thermal generation. A regulating margin for load following and any interruptible imports are added to the contingency reserves for the total operating reserve requirement. Half of the contingency reserve and all of the regulating reserve must be spinning reserve. The remainder may be non-spinning reserve, which must be capable of being brought on-line in 10 minutes. Interruptible load or interruptible exports can meet the non-spinning requirement. The result is that generation levels must account for the meeting of the operating reserve requirement at all times.

Section 4.4 Short-Term Purchases and Sales

Under most water conditions Tacoma Power expects to be a net seller into the wholesale electricity market throughout the 10-year IRP planning horizon. In 2003, a near normal year in terms of both precipitation and stream flows, Tacoma Power sold over 1.6 million MWh of surplus power generated by its hydro-electric facilities. This compares to wholesale purchases in that same year of less than 15,000 MWh. Tacoma Power will continue to use the wholesale power market to optimize the value of the power supply portfolio, sell energy during times of surplus, and if necessary, help meet native loads. With the changing industry structure, the number of entities participating in the wholesale marketplace has increased significantly. This is a positive development. In order to manage risk, Tacoma Power has responded by instituting a set of trading guidelines and has established procedures for monitoring the continued creditworthiness of approved trading partners.

Section 4.5 Transmission Resources and Issues

The mission of Tacoma Power's Transmission and Distribution department is to ensure a high performing transmission and distribution system with low and stable rates. T&D plans, designs, constructs, operates and maintains the transmission and distribution system including substations, the underground network system, the system control and data acquisition system ("SCADA"), revenue metering facilities and all overhead and underground lines and associated equipment.

Tacoma Power owns, operates, and maintains 44 circuit miles of high voltage (230 kV) facilities and 314 circuit miles of sub-transmission (110 kV) facilities which are used to integrate generation, serve retail loads, and provide wholesale transfer service.

Facilities

Tacoma Power owns and maintains 160 circuit miles of transmission facilities used to integrate power from Tacoma Power's generating projects:

- 18 miles of 230 kV transmission integrate Tacoma Power's Mayfield and Mossyrock hydroelectric generation on the Cowlitz River Project into BPA's transmission grid. Tacoma Power takes delivery of this power at its Cowlitz and Northeast Substations.
- 43 miles of double circuit (86 circuit miles) 110 kV sub-transmission facilities, known as the Potlatch lines, integrate Tacoma Power's hydroelectric generation at the Cushman Project into Tacoma Power's 110 kV sub-transmission system. The Potlatch lines cross Tacoma Narrows via a 6,200-foot transmission span which, when installed in 1926, was the longest electrical crossing in the world.
- 28 miles of double circuit (56 circuit miles) 110 kV sub-transmission facilities, known as the LaGrande lines, integrate Tacoma Power's Alder and LaGrande hydroelectric generation at the Nisqually River Project into Tacoma Power's 110 kV sub-transmission system

Tacoma Power owns and maintains 181 circuit miles of transmission facilities including 13 miles of double circuit (26 circuit miles) 230 kV transmission and 172 miles of single circuit 110 kV sub-transmission, which are primarily used to serve Tacoma Power retail loads.

Tacoma Power is a member of the Western Electricity Coordination Council (WECC), one of the ten reliability organizations that compose

NERC. Tacoma Power is a WECC Control Area. None of Tacoma Power's transmission facilities are WECC "rated" paths or considered significant to the operation of the regional interconnection transmission system.

Interchange Points

Tacoma Power has four points where it connects to the regional interconnected transmission network:

- Northeast - 230 kV interconnection with BPA
- Cowlitz – 230 kV interconnection with BPA
- Starwood – 115 kV interconnection with Puget Sound Energy
- Cowlitz Hydroelectric Project – 230 kV with BPA

Wholesale Use

Tacoma Power uses portions of its 110 kV and 230 kV electrical system to provide wholesale transfer service to 10 publicly owned Pierce County utilities and also to the Lewis County Public Utility District. Tacoma Power has provided some of this service for over thirty years.

Transfer service began in 1974 when Tacoma Power provided access to BPA for the benefit of its Pierce County customers. In 1993, Tacoma Power and Lewis County Public Utility District executed an agreement to transfer power generated by the PUD's Cowlitz Falls Hydroelectric Project across our system. Finally, in 1996 Tacoma Power provided access to the Peninsula Power and Light Company (PenLight) for its non-BPA power purchases.

In 2000, Tacoma Power reaffirmed its policy to provide non-discriminatory open access to its high-voltage system through adoption by the Tacoma Public Utility Board of a new master Interconnection Agreement and open access Transfer Tariff. These agreements are progressive and they are aligned with industry and FERC pro-forma standards.

Tacoma Power's agreement with Penlight expired in 2001, and the parties did not renew. In March 2003, BPA signed Tacoma Power's new open access Transfer Tariff, marking the end of the old transfer agreements established nearly 30-years earlier. BPA opted to purchase transfer service for a period of ten years.

Capacity

Currently, Tacoma Power has sufficient transmission capacity (lines, point of interconnection with neighboring systems) to serve both its retail and wholesale customers in a reliable manner. However, based on Tacoma Power's February 2000 Transmission & Distribution Six-Year Plan (T&D Plan) and two system impact studies that analyzed the effect of BPA's transfer request on Tacoma Power's system, Tacoma Power anticipates that insufficient capacity will exist in the near future. South and west Pierce County have experienced significant development and growth, driving the need for electrical infrastructure additions and/or improvements. As a result, Tacoma Power initiated, in partnership with

BPA, capacity and reliability improvements for both the LaGrande and Potlatch lines.

LaGrande Lines The LaGrande lines were originally constructed to transmit power from the Nisqually Project to Tacoma. In addition to their original function, these lines now also support wholesale power transfers, enabling BPA to serve five of its customers: Parkland Light and Water, Elmhurst Mutual Power and Light, Ohop Mutual Light Company, Alder Mutual Light Company and the Town of Eatonville. The existing LaGrande lines are over 60 years old; they were rebuilt in 1943 to replace wood pole lines.

Over the last ten years, rapid growth has occurred in south Pierce County affecting primarily Tacoma Power, Parkland Light and Water, and Elmhurst Mutual Power and Light. New substations were constructed and connected to the LaGrande lines to serve this load. The LaGrande lines are currently near their capacity limit, in fact it would be difficult for Tacoma Power to serve significant new industrial load in the Frederickson area of its service area. Further, under certain planning scenarios, loss of one line could over-load the other.

To remedy the capacity constraints and improve system reliability, Tacoma Power and BPA plan to construct a new switching station (Canyon Substation) and increase the 110 kV transmission line capacity between the Cowlitz and Canyon Substations. Future considerations for Canyon Substation include interconnection with BPA. The pre-construction phase began in 2002, including conceptual planning and land acquisition. Detailed engineering design and the construction phase will begin in 2004 and continue to 2010.

Potlatch Lines The Potlatch Lines were originally built over 75 years ago to transmit power from the Cushman Project to Tacoma. As with the LaGrande lines, the Potlatch lines not only transmit Cushman generation, but also support wholesale power transfers, enabling BPA to serve its customer, PenLight.

While the Potlatch lines have been significantly rebuilt over the last ten years, the Narrows Crossing towers and the conductors are original equipment. The conductors were analyzed in 1999 and determined adequate for existing transmission requirements. However, by 2002, a system impact study determined that PenLight's growth was such that its load would exceed line capacity by 2006 for an average winter. In response, Tacoma Power and BPA will rebuild the Tacoma Narrows Crossing and adjacent transmission. The pre-construction phase commenced in 2003, with detailed engineering design to occur through 2004. Construction is scheduled for 2005-2006.

National and Regional Issues

Over the last nine years the Pacific Northwest experienced a number of significant national and regional initiatives intended to restructure the regional transmission system and its operation. These initiatives impact Tacoma Power twofold: First, Tacoma Power uses the regional transmission network to deliver and receive the majority of its power. Second, Tacoma Power is a system operator and it owns assets over which wholesale transfer transactions occur. As such, Tacoma Power has tracked and/or participated in these initiatives.

Over the last twelve years, Congress and FERC took four major actions they believed would establish competitive bulk power markets and bring more efficient, lower cost power to the Nation's electricity consumers. The Energy Policy Act of 1992, FERC Orders 888 and 889, FERC Order 2000, and Standard Market Design (SMD) have focused primarily on promoting open, non-discriminatory transmission access. The industry has incorporated and responded to the first three of the legislative/regulatory actions. The fourth, SMD, is still an unknown and, as such, will be discussed herein. Please refer to Appendix A for a more thorough description of the four legislative and regulatory actions.

Standard Market Design (SMD)

SMD was a FERC initiative to promote, refocus and accelerate wholesale market restructuring beyond that accomplished by utilities in response to Order 2000. FERC intended to cure continued biases it believed persisted in the power industry.

In August 2002, FERC issued the SMD Notice of Proposed Rulemaking, known simply as the NOPR. In the NOPR, FERC proposed a wide-ranging list of changes to the wholesale electric power market, which would be standard for every utility across the country.

After FERC received over 1,000 sets of formal comments and considerable negative feedback from Congress, FERC issued a White Paper outlining a scaled-back SMD option.

In the White Paper FERC outlined plans to force all jurisdictional utilities to turn over operational control of transmission facilities to a regional transmission organization (RTO). FERC stated their desire for RTOs to develop real-time and day-ahead markets for power supply and transmission services. FERC proposed a number of other market changes:

- Bidding for available transmission capacity
- Establishment of resource adequacy requirements
- Elimination of multiple charges for power crossing control area boundaries
- Managing transmission congestion through fixed transmission rights and locational pricing

RTOs would also be granted more authority over market power abuses and mitigation of such abuses for a limited list of known schemes.

Faced with considerable opposition, FERC decided to not issue a final order on SMD, instead working to implement SMD through their RTO orders. Standard market design has not gone away as a potential issue facing the industry.

Since 1992 Northwest utilities have made six significant efforts to coordinate and/or unify regional transmission entities, much of which is in response to national initiatives. These efforts are discussed in Appendix A.

Tacoma Power actively participated in these efforts and continues to track all developments related to grid operation and market design.

Chapter 5:
Analyses of Load Resource Balance

Tacoma Power's load resource balance refers to a comparison between its firm supply of power and forecasted loads over the duration of the IRP study period. Analyses of the balance between loads and resources are primarily used to draw conclusions about future energy and capacity needs, and form the basis for planning resource acquisition, including conservation.

There is significant financial risk associated with being overly long, or short on supply resources. If Tacoma Power over acquires supply-resources – including generation resources, contract resources or conservation - that are high cost (relative to wholesale market prices), customers will pay higher rates. On the other hand, if Tacoma is caught short – a supply-deficit, reliance on a potentially volatile spot market could have a similar effect. Because of these risks, comprehensive analysis of load resource balance is an integral part of IRP planning.

Section 5.1 Methodology

Much like its loads, Tacoma Power's firm supply resource capability can vary significantly on a short-term basis. The quantity of firm generation that Tacoma Power can produce in a given year depends largely upon short-term water conditions – including precipitation and snow pack. In order to adequately consider this uncertainty, staff assesses Tacoma Power's supply capability under three distinct hydrological scenarios. These include Critical, Adverse and Average hydrological conditions.[1] In combination with each distinct supply scenario, each of the three load scenarios described in Chapter 2 – Low, Base and High, are considered. In total, nine combinations of supply and load scenarios are assessed. Table 5a lists the nine load resource balance scenarios staff considered as part of this IRP.

In practice, staff quantifies Tacoma Power's load resource balance - assesses resource adequacy, by simulating dispatch of Tacoma Power's resources against forecasted loads with the use of an hourly optimization model[2]. Results of these analyses forecast the ability of Tacoma Power's firm resources to cover load on an average energy and peaking basis[3]. As part of this IRP, staff modeled Tacoma Power's load resource

[1] Critical represents Tacoma Power's worst system year on record. Adverse represents system inflows that have been exceeded 75% of the time, and Average represents average system inflow over all years on record.
[2] Staff uses Tacoma Power's Hourly Analysis Model (HAM) for estimation of the load resource balance.
[3] Peaking basis refers to the ability to cover winter peaking loads.

balance for each load / water scenario describe in Figure 5a for the duration of the 10-year IRP study horizon. In addition, staff conducted analyses to assess Tacoma Power's ability to cover loads under on a peaking basis, and under cold snap and unit outage scenarios.

Figure 5a
Load Resource Balance Scenarios

Scenario	Description
1	Low Load / Critical Water
2	Low Load / Adverse Water
3	Low Load / Average Water
4	Base Load / Critical Water
5	Base Load / Adverse Water
6	Base Load / Average Water
7	High Load / Critical Water
8	High Load / Adverse Water
9	High Load / Average Water

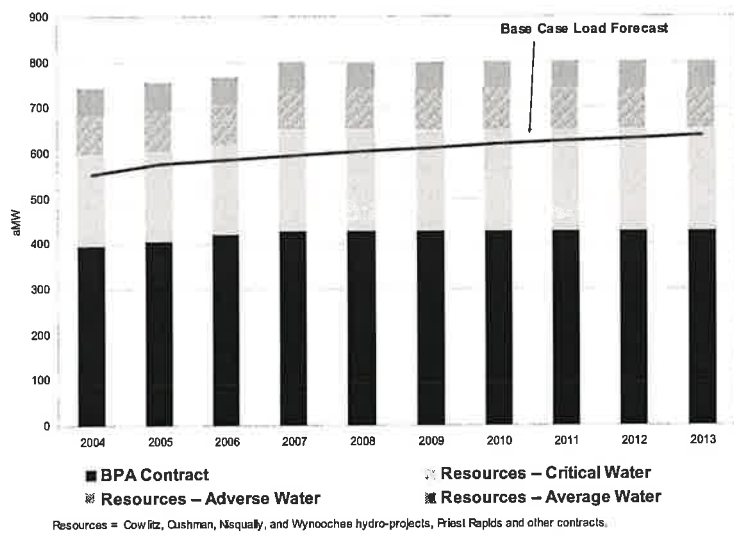
Section 5.2 Results

The results of all of the load resource balance scenarios modeled provide useful information for planning. However, primary focus is placed on the scenarios that assume Base Case load assumptions. Figure 5b compares Tacoma Power's Base Case load forecast with the utility's power supply capability modeled under critical, adverse and average water, on an average annual basis. As the figure depicts, forecasted output from Tacoma Power's firm resources exceeds forecasted Base Case loads. This implies that, on an average annual basis, surplus conditions are expected to exist under all hydrological scenarios under Base Case loads for the duration of the IRP planning horizon. Figure 5c identifies the magnitude of the expected surplus on an average annual basis for the duration of the IRP planning horizon. As an example, the figure depicts the expectation that Tacoma Power will be approximately 25 aMW surplus on an average annual basis in calendar year 2005, under Base Case loads and critical water conditions.

In addition to the assumption of Base Case load, Tacoma Power considers resource adequacy to require neutral or surplus resource capability under critical water conditions. Although results suggest that surplus conditions prevail on an average annual basis under critical water (as illustrated in Figures 5b and 5c.), surpluses do not necessarily prevail during all months of the year – some periods are in fact significantly surplus and some show minor deficits. Figure 5d shows an example of this. It depicts Tacoma Power's expected surplus / deficit position under critical water conditions and Base Case loads for calendar year 2005 on a monthly basis. As can be seen in the figure, the magnitude of the surplus (deficit) changes throughout the year, and small deficits do occur at times (in October in 2005 for example).

Analyses of the utility's ability to cover winter peak loads produce similar results. In general, under critical water conditions, Tacoma Power has adequate peaking capability to cover peak Base Case loads, which generally occur during the winter months. However, this capability may become constrained in the event of a prolonged cold snap.[4] Although such short-term capacity or energy deficits are possible, they would be minimal and would primarily occur in the later years of the IRP planning horizon. In the event that short-term deficits do occur, they can be effectively managed with wholesale market transactions.

Figure 5b
Resource Capability and Base Case Load Forecast



[4] Cold snap refers to a prolonged period of colder than expected temperatures during a winter period. For modeling purposes staff forecasted a load profile that would result from a cold snap consisting of temperatures approximately 20 degrees below normal for a one week duration.

Figure 5c
Average Annual Surplus / Deficit Position

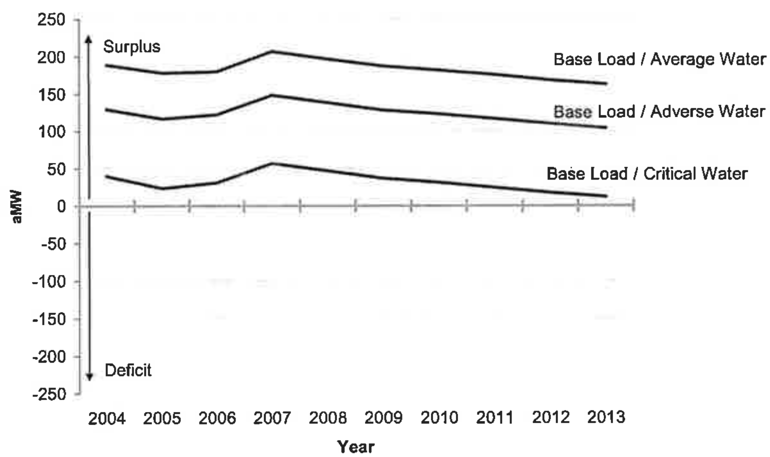
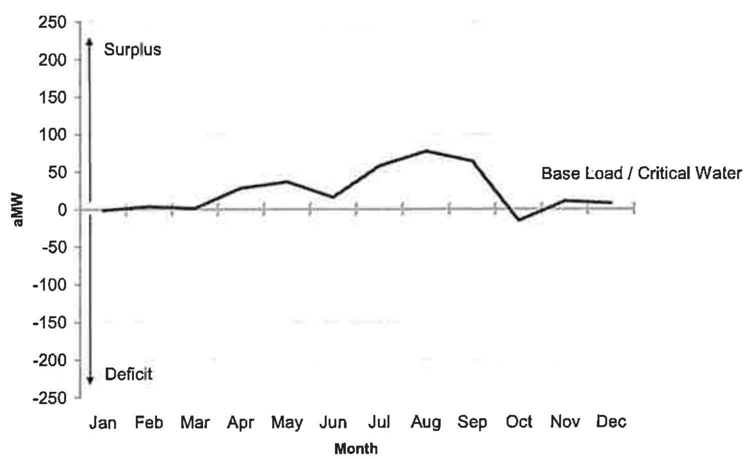


Figure 5d
Average Monthly Surplus / Deficit Position - 2005

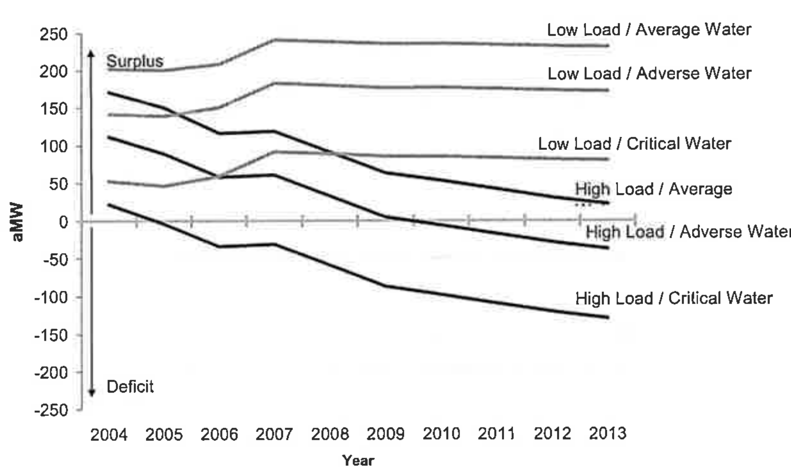


Regardless of short-term water conditions (i.e. critical water), under Base Case load assumptions, Tacoma Power is forecast to have adequate energy supply resources, indeed a small surplus, throughout the 10-year IRP planning horizon. However, it is possible that this small surplus could be eroded over time by load growth, or on the other hand, that additional load loss will cause the surplus to increase. Either scenario could be undesirable from a financial perspective. Figure 5e depicts Tacoma Power's surplus deficit position under the Low and High load scenarios, for critical, adverse and average water conditions. As the graph illustrates, significant supply deficits are only prevalent under the high load critical water scenario. Low load scenarios would result in significant surpluses in most years, and would cause considerable sales into the wholesale energy market. To mitigate the impact of such scenarios, staff will continue to closely monitor load trends and modify planning strategies accordingly.

In addition to demand-side trends (load growth or decline), Tacoma Power's load resource balance can also be impacted by short-term supply-side events, such as a unit outage. In order to assess the impacts of potential supply-side events, staff has done extensive modeling of unit outage scenarios. As an example, under critical water, loss of one of the two Mossyrock units on a planned or unplanned basis could be managed without significantly impairing Tacoma Power's ability to cover Base Case loads. However, such an event would be undesirable from a financial perspective, due to a diminished ability to cover peaks (loss of capacity)[5].

Figure 5e

Average Annual Surplus / Deficit Position



[5] Financial consequences get worse (opportunity costs increase) under adverse or better water conditions, as the likelihood of the need to spill water increases.

In general, Tacoma Power's current portfolio of firm resources is adequate to meet forecasted Base Case loads. During most years in the IRP planning horizon Tacoma Power will likely be resource surplus. Tacoma Power will continue to use the wholesale energy market to sell surplus energy and optimize the value of Tacoma Power's power supply portfolio. Resource acquisition is not required or recommended at this time.

Chapter 6: Conservation

Section 6.1 Background

Since the enactment of the Pacific Northwest Electric Power Planning and Conservation Act (Power Act) in 1980, conservation has been an integral part of the resource strategy for Tacoma Power. The Power Act resulted in the creation of the Northwest Power Planning and Conservation Council (NWPCC), a planning agency charged with developing a coordinated conservation and generating resource development plan to guide BPA and the region in decisions about how to meet future electricity loads. The original Northwest Conservation and Electric Power Plan, adopted by the NWPCC in 1983, identified about 1,500 average megawatts of achievable conservation potential available in the Pacific Northwest by the year 2002. Subsequent revisions of that plan continued to identify large amounts of conservation potential for the region. In response to the 1983 Power Plan, BPA proposed to acquire 660 aMW from its own system and in the service area of its public utility customers. In the years that followed, BPA continued to support conservation acquisition through a variety of funding agreements with its utility and Direct Service Industrial customers.

Tacoma Power began its first conservation program in 1980 and signed its first major energy conservation contract with BPA in 1982. Since that time, Tacoma Power has actively and continuously pursued energy conservation in the homes and businesses of its customers, becoming a regional leader in the development of conservation as an efficient, cost-effective and environmentally sound resource. Life-to-date conservation savings achieved between 1980 and 2003 is approximately 54 aMW, with just under 35 aMW achieved between 1993 and 2003 as reflected in Figure 6a below.

Figure 6a

10-Year Conservation Savings Accomplishments by Sector (aMW)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
Residential	2.33	0.66	0.84	0.67	0.29	0.17	0.13	0.10	0.56	0.36	0.23	6.11
Commercial	1.80	2.47	1.38	1.50	0.93	0.08	0.00	0.01	0.92	0.92	0.02	10.02
Industrial	1.75	3.09	0.87	8.16	1.74	0.01	0.12	0.00	0.13	0.13	0.00	15.99
Military	0.06	0.11	0.41	0.39	1.33	0.35	0.00	0.00	0.00	0.00	0.00	2.65
Totals	5.94	6.33	3.50	10.72	4.29	0.61	0.25	0.11	1.61	1.41	0.25	34.77

Note: Totals may not sum due to rounding. Totals are correct.

In the early 1990's, BPA was spending about $150 million per year to acquire conservation savings, mostly through the programs run by its utility customers, including Tacoma Power. However, by 1996, significant changes were occurring in the utility industry. Retail competition was on the horizon and there was a glut of inexpensive energy on the wholesale market. As a result, a number of BPA's customers reduced the amount of their firm power contracts. In response, BPA slashed funding for its conservation programs, fearing that its investment would be "stranded." In response to this, Tacoma Power also ramped down its conservation programs - although continued to provide weatherization assistance and zero-interest loans to residential customers and to businesses for conservation investments. Since that time conservation related activities have continued, although at a reduced pace as compared to the early 1990's

The energy crisis in 2000 and 2001 spurred renewed interest in conservation, both as a short-term and as a long-term strategy. [1] This was reflected in the 2001 IRP with an aggressive plan for conservation acquisition. However, between the time the 2001 IRP and 2002 IRP Update was completed, wholesale market prices had dropped dramatically, loads had fallen off, and supply-surpluses materialized. The conservation analysis at the time of the 2002 IRP Update sought to analyze conservation investments in this new environment. The 2002 IRP Update recognized that the aggressive ramp-up of conservation in response to the energy crisis of 2000 - 2001 was no longer appropriate, and that some of the current and proposed projects at the time were no longer cost-effective. As part of the 2002 IRP Update, a new 10-year conservation acquisition goal of 8.1 aMW was targeted. This updated goal acknowledged that some conservation acquisition was still justified. Three sound reasons for continuing implementation of conservation programs in the then current environment were cited. These continue to be relevant given Tacoma Power's load resource balance and current market conditions. They include:

- capturing energy saving "lost opportunities" that are cost-effective at the opportune time;
- supporting "market transformation" programs that provide future conservation at a reduced cost; and
- providing "public benefits" and infrastructure maintenance, such as the low income weatherization programs that assist customers in managing home energy consumption.

These are further described in detail below.

Lost Opportunities Some conservation investments that have the potential to produce long-term benefits are only available at a particular time. Typical examples of these lost opportunities include installation of efficiency measures, above and beyond those required by the energy code during new construction, major building retrofits

[1] During the energy crisis, Tacoma Power distributed additional emergency conservation measures identified as cost-effective including compact fluorescent lamps, vending misers, clock thermostats and conservation kits. These measures resulted in savings of just under one aMW.

during industrial process design, or when appliances and major equipment are purchased in both the residential and commercial sectors.

Market Transformation Market transformation investments are intended to cause significant, permanent changes in the products and services that are available in the marketplace. Examples of market transformation efforts include adoption of codes and standards that establish new minimum efficiency levels and financial incentives to promote purchase of efficient appliances, equipment and services. When these short term programs create a more developed market for high efficiency products, the investment pays dividends into the future at no additional cost.

Public Benefits and Infrastructure Maintenance As a municipally owned utility, Tacoma Power sets aside some of its revenue for investment in the community and for assistance to disadvantaged citizens. The low-income weatherization program is an example of this kind of program.

In addition, some continued level of investment is necessary to preserve the delivery infrastructure needed for conservation programs. For example, if residential weatherization efforts declined below a threshold, it is likely that some or all of the remaining contractors providing this service would find work elsewhere, rendering a future weatherization ramp-up far more expensive and administratively challenging.

Section 6.2

Current Status

Over the past two years since the 2002 IRP Update, 0.6 aMW of conservation has been achieved of the estimated 8.1 aMW of market transformation, lost opportunities, and public benefits and infrastructure maintenance categories. The majority of energy savings achieved are from residential weatherization projects. During 2002 and 2003 1,029 homes were upgraded. Seven Super Good Cents Manufactured homes were sited in 2003 to account for lost opportunity savings of 0.002 aMW. Market transformation programs assisted in the purchase of 975 energy efficient clothes washing machines and 13,126 compact fluorescent lights. Figure 6b shows recent conservation accomplishments and the balance remaining of the 2002 IRP Update 10-year target.

Figure 6b

2002 IRP Update Conservation Targets, Achieved Savings and Balance

Conservation Project	Conservation Target Estimated from 2002 IRP Update	2002 Savings	2003 Savings	Ten Year Conservation Target Balance
Total Weatherization*	4.10	0.25	0.19	3.67
Lost Opportunity	3.02	0.00	0.00	3.02
Market Transformation	1.00	0.11	0.04	0.85
Total aMW	8.12	0.36	0.23	7.53

*Weatherization includes common area lighting in multi-family complexes

Staff reviewed Tacoma Power's existing conservation approach in light of Tacoma Power's most current load, wholesale power price, and load resource balance forecasts. The results of this review and a plan for going forward are discussed below. In general, Tacoma Power continues to have a surplus of power, primarily due to a reduction in customer loads. This surplus, in combination with projected market conditions, continues to moderate the need for acquisition of new resources, including conservation.

Section 6.3 Analysis Methodology

For planning purposes, Tacoma Power's expected load resource balance is estimated using Base Case load assumptions. Under Base Case load assumptions and critical water conditions, Tacoma Power remains surplus in all but a few months over the 10-year IRP planning horizon. Despite the projected surplus, staff recommends continued focus on programs that emphasize lost opportunities, market transformation and public benefits and infrastructure maintenance. In the event that Tacoma Power experiences significant load growth or if future market conditions justify it, staff recommends consideration of increasing Tacoma Power's current conservation targets.

In order to avoid upward pressure on revenue requirements, and ultimately rates, only conservation investments that are both cost-effective and strategic should be maintained. This implies that each conservation program selected for participation must be cost effective on a regional basis, which means that the expected benefits accruing to the region from these programs must exceed their total cost. Each program is individually evaluated in a cost-benefit analysis, and those programs that do not pass this cost-effective criterion are not pursued. Regional cost-effectiveness and other perspectives are explained more fully later in this section.

The identification and selection of energy efficiency technologies targeted for conservation programs is an iterative process. There are various criteria by which technologies are evaluated. First, data and analysis provided by various national organizations that are actively researching new energy efficient technologies is reviewed. These include the Consortium for Energy Efficiency, the American Council for an Energy Efficient Economy, and the Department of Energy (DOE) in partnership with the Environmental Protection Agency (EPA). DOE and EPA jointly fund a national effort to promote products proven to be the top tier of efficiency - the Energy Star program. Tacoma Power has used the Energy Star standard as a basis for promoting specific technologies such as compact fluorescent lamps and front loading washing machines.

Before launching a program, manufacturers must have products available for purchase. Typically there must be a minimum of two to three manufacturers with viable products in order to provide customer choice and competitive pricing. Early experimental technologies without a proven track record are not included in programs. Manufacturers of efficiency products must be able to produce studies performed and validated by accredited independent testing laboratories prior to any consideration. Each product must also meet all pertinent health and safety requirements and be listed by Underwriters Laboratory.

Another important consideration used during the vetting process of potential market transformation technologies is the review of program offerings by other electric utilities. Consultation with program staff regarding equipment reliability, economics and energy savings are generally reviewed. Other organizations such as the Northwest Energy Efficiency Alliance (NEEA), the Lighting Design Lab, E-Source and the Regional Technical Forum (RTF) are also consulted. A product technology review service is utilized through the Electric Ideas Clearinghouse for screening electrical saving devices and literature and internet research is also conducted.

After a product has met the initial screening criteria it is referenced for possible consideration by Tacoma Power. In certain cases, independent verification of energy savings is conducted by Tacoma Power staff with appropriate testing equipment.

The final steps involve a cost effectiveness analysis of the technologies. Costs and benefits are analyzed from a "regional perspective" over the lifetime of energy savings when considering new energy efficiency programs. The costs include the utility program costs of administration, incentives (if applicable), and the net owner costs to purchase and install all necessary equipment. The benefits are calculated by converting the annual energy savings into dollars by multiplying the annual savings each year by the projected wholesale power rate. These costs and benefits are compared in current dollars. The program is deemed cost effective from the regional perspective if the net present value is positive.

While the regional perspective is generally used to determine cost effectiveness, energy efficiency programs are also analyzed from the perspective of the customer and Tacoma Power. The customer perspective compares the net costs to the customer to the energy savings that the customer will realize over the life of the efficiency measure(s). Tacoma Power's perspective is similar to the regional perspective, but it also considers the lost revenue from not selling the conserved power as an additional cost.

Finally, merchants and customers are contacted to assess the viability and desirability of the concepts. Once these numerous considerations have been met, the technology or program concept is submitted for consideration by management and the Public Utility Board.

Section 6.4 Conservation Strategy

As noted in section 6.3, as a result of a projected supply surplus and expected future market conditions, staff recommend conservation strategies consistent with those identified in the 2002 IRP Update. At this time, staff recommend continued focus on programs that concentrate on lost opportunities, investments in market transformation, and public benefit and infrastructure maintenance. This approach, including updated conservation acquisition targets for each program type, is described in detail below.

Lost Opportunities As the result of updated analysis, staff recommends maintaining the scope of conservation acquisition related to lost opportunity as initially laid out in the 2002 IRP Update, but increasing efforts to better assure targets will be realized. While Tacoma Power currently offers limited lost opportunity related programs, there is ample room to expand services in this area to meet projected targets.

Tacoma Power's commercial lost opportunities programs will acquire savings in new construction, primarily by providing design assistance and energy analysis services at little or no cost to building designers during the earliest stages of the design process. Specific services include computer energy modeling, day-lighting and lighting analysis, economic life-cycle analysis, design review, and energy code review. Potential new construction projects will be screened to evaluate the cost-effectiveness of services. In addition to acquiring energy savings, the lost opportunities programs will provide supplementary benefits such as improving efficient design practices and customer retention.

The new lost opportunity target is dependant upon a revised forecast of new construction in future years. Since the 2002 IRP Update, staff has performed a more in-depth analysis of new construction for both residential and the commercial sectors. The new ten-year target for the commercial sector is determined by first estimating the average annual square footage of new commercial/industrial building space. Data comes from the Tacoma Economic Development Division and the City of Tacoma building permit data. The square footages were then applied to various building types based upon the distribution of the current building stocks in the service area. An annual kWh consumption was calculated for each building type based upon data obtained from NEEA. The achievable target is estimated to be a reduction of the annual kWh consumption by 10%. This percentage was obtained from the Northwest Public Power Planning Council's estimates of energy savings potential beyond current state energy codes.

The new ten-year target for the residential sector consists of manufactured housing, traditional wood-framed homes with resistance heat and traditional wood-framed homes with heat pumps. The target for manufactured homes was calculated assuming the annual number of manufactured homes installed within the service area will grow at a constant rate and the savings per manufactured home is from an average savings estimate calculated by the RTF. The estimate for traditional wood framed homes is based upon estimated savings from a study performed by the Washington State University Extension Energy Program and building permit data.

Although direct incentives to owners for efficient equipment will not generally be offered, there may be some incentives provided for certain innovative efficiency strategies. Also, direct incentives or payments to design teams for specific efficiency services may be considered, and will depend on the project and design team capabilities.

Tacoma Power will target larger commercial construction projects (25,000 square feet or more) and non-profit projects as prime candidates. Typically, efficiency enhancements for these types of projects include under floor air handling systems, high efficiency lighting systems and optimized day lighting and glazing. Based on city permit data and identification of individual project characteristics, total savings associated with commercial lost opportunities are estimated at approximately 0.18 aMW per year.

In addition to commercial programs, Tacoma Power will acquire savings in residential construction. Tacoma Power currently offers rebates to customers who purchase Super Good Cents Manufactured Homes. Tacoma Power is also working with Washington State University to investigate the cost-effectiveness of Energy Star measures that go beyond building codes. Current residential conservation targets associated with lost opportunities are estimated at approximately 0.06 aMW per year.

Depending on cost-effectiveness, staff recommends up to a total of 0.24 aMW per year of lost opportunity related conservation acquisition. As a result of changes to the energy code and improved estimation methodology, this represents a slight downward revision of the lost opportunity target associated with the 2002 IRP Update of 0.3 aMW per year (3.0 aMW over ten years).

Market Transformation There are a number of energy efficiency products that have the potential to produce long-term benefits without continuous reliance on utility incentives. Unfortunately, due to their present cost to implement, their unfamiliarity or their complexity, many of these opportunities are not currently accepted by the market place. Tacoma Power's goal is to make market transformation investments to help the market overcome these barriers - to promote the creation of sustainable market oriented programs that provide long-lasting benefits that perpetuate themselves without continual utility investment.

The ten-year market transformation target of 1.0 aMW associated with the 2002 IRP Update (see Figure 6b) consisted of compact fluorescent lighting, clothes washers, dishwashers and residential refrigerators. Over the last two years, 0.2 aMW of this target has been achieved, resulting in a balance of 0.8 aMW remaining. As the result of updated analysis, staff recommends increasing the scope of market transformation conservation acquisition above 2002 planned levels.

Over the past year, Tacoma Power staff has researched several market transformation program options involving technologies that were not included in the market transformation potential of the original 2001 IRP or subsequent 2002 IRP Update. These include high intensity fluorescent lighting in industrial and commercial high-bay applications, Energy Star transformers, Energy Star residential heat pumps, efficient commercial refrigeration, high efficiency commercial rooftop heat pumps and air conditioners, residential compact fluorescent light fixtures, light emitting diodes in traffic signals and commercial signage, and commercial solid refrigerator and freezer doors. Additional analysis is still needed to further refine some of these projections and confirm their cost-effectiveness.[2] However, preliminary estimates of the achievable potential of these new market transformation technologies is estimated to equal an additional 6 aMW over a ten-year period, in addition to the 0.8 aMW remaining from the target associated with the 2002 IRP Update. Itemization of the additional 6.0 aMW is listed in Figure 6c. In the event that all of the additional 6 aMW of market transformation conservation are ultimately confirmed to be cost effective – the revised total 10-year market transformation target will be equal to approximately 6.8 aMW. These targets will be refined as additional analyses are completed. Figure 6d reports estimates as to the cost-effectiveness of the proposed new programs.

[2] Additional refinement or analysis of cost-effectiveness is still required for high efficiency commercial rooftop heat pumps and air conditioners, residential compact fluorescent light fixtures, light emitting diodes in traffic signals and commercial signage.

Figure 6c

Additional Market Transformation Program Achievable Potential (aMW)

Technology / Program	Achievable Potential
High Intensity Fluorescent Lighting (high bay)	2.98
High Efficiency Commercial Roof Top Heat Pumps and AC	1.17
Energy Star Transformers	0.43
Energy Star Residential Heat Pumps	0.25
Residential Compact Fluorescent Light Fixtures*	0.32
Comercial Solid Door Refrigerators and Freezers	0.17
Light Emitting Diodes (LED) Traffic Signals	0.66
Total	5.98

*Residential compact fluorescent light fixtures were only estimated at .13 aMW during earlier assessments. The new achievable potential of .321 is the increase over the original .13 estimate.

Figure 6d

Lifecycle Analysis of Additional Market Transformation Measures

Measure	Lifecycle (Years)	PV Benefits	PV Costs	NPV	Levelized NPV ($/aMW)
High Intensity Fluorescent Lighting (high bay)	12	$ 8,921,417	$ 1,437,699	$ 7,483,717	$ 32.65
High Efficiency Commercial Roof Top Heat Pumps and AC	15	$ 4,410,357	$ 3,166,847	$ 1,243,510	$ 11.29
Energy Star Transformers	30	$ 2,319,670	$ 1,041,615	$ 1,278,055	$ 20.05
Comercial Solid Door Refrigerators and Freezers	19	$ 736,984	$ 293,248	$ 443,735	$ 23.51
Light Emitting Diodes (LED) Traffic Signals	8.5	$ 1,529,564	$ 505,372	$ 1,024,192	$ 25.65
Energy Star Residential Heat Pumps	18	$ 999,402	$ 669,930	$ 329,472	$ 12.38
Residential Compact Fluorescent Light Fixtures	15	$ 1,153,301	$ 1,148,016	$ 5,285	$ 0.17

Public Benefits and Infrastructure Maintenance As an investment in the community, staff recommends continuation of conservation acquisition for public benefits. To preserve future options for conservation, staff recommends maintaining program delivery infrastructure. The Residential Weatherization program serves both of these purposes.

The ten-year weatherization target associated with the 2002 IRP Update was 4.1 aMW. Weatherization savings of 0.245 aMW and 0.187 aMW were achieved in 2002 and 2003, respectively. Staff estimate that approximately 0.17 aMW per year will be achieved in the future. The weatherization target is being reduced from 2002 IRP Update because the earlier target was overly optimistic. The new ten-year target is estimated to be 1.7 aMW after evaluating how much weatherization could be reasonably completed during a ten year period. This new target is considered to be a more reasonable estimate based upon our current rate of weatherization projects.

Staff is currently conducting a preliminary assessment to identify available data to more precisely determine the size of the remaining weatherization market. As detailed in the following section, Tacoma Power is planning a comprehensive conservation potential assessment (CPA) that will combine and analyze the preliminary data to establish definitively the size of the remaining weatherization market. Once the CPA is completed, a more refined ten year conservation target will be available.

Figure 6e outlines current recommended conservation acquisition targets including lost opportunity, market transformation, and public benefit related investments.

Figure 6e

Current Conservation Targets, Achieved Savings and Balance (all data in aMW)

Conservation Project	Conservation Target Estimated from 2002 IRP Update	2002 Savings	2003 Savings	Adjustments	Ten Year Conservation Target
Total Weatherization*	4.10	0.25	0.19	-1.97	1.70
Lost Opportunity	3.02	0.00	0.00	-0.65	2.37
Market Transformation	1.00	0.11	0.04	5.98	6.82
Total aMW	8.12	0.36	0.23	3.36	10.89

*Weatherization includes common area lighting in multi-family complexes

The achievable potential for weatherization was reduced from 3.66 aMW to 1.70 aMW because of staff limitations. The potential is still there, but, it is not realistic to assume that we will operate at that level. We believe that we will operate a little less than 2003.

High Load Scenario In the event Tacoma Power experiences significant load growth that erodes the current supply-surplus, or if future market conditions justify, Energy Services staff recommends an increase of additional conservation acquisition above and beyond that recommended under Base Case (current) conditions. For example, if loads trend upward similar to Tacoma Power's High load case, staff estimate that additional acquisition programs of up to 17.6 aMW over a period of 8 years may be achievable. Additional commercial conservation acquisition programs such as lighting rebate programs and site-based commercial programs could be brought on-line. In addition, residential conservation programs such as decommissioning of non-primary refrigerators, expansion of grant programs for weatherization, multi-family rehabilitation projects and exterior lighting programs could be launched.

Higher sustained energy prices are also a plausible scenario in the future. For example, if both Tacoma Power and the region experience significant load growth, upward pressure on power prices could result. If such market conditions were expected to persist for more than a short period, additional conservation acquisition may become cost-effective. It is important to note that sufficient lead time, trade allies and associated infrastructure will be needed in order to preserve an ability to ramp-up conservation activities when conditions dictate. The actual scope and magnitude of additional conservation acquisition associated with high load and/or price scenarios will be calculated accordingly when and if load and market conditions change.

Section 6.5 Conservation Potential Assessment

Much of the underlying conservation related analysis and assumptions associated with both the 2002 IRP Update and this IRP have used data from the original 2001 IRP. In the years since 2001, there have been significant changes in the economic, technical and programmatic assumptions used to calculate achievable conservation potential. As an example, much of the savings potential identified in new construction is based on building data compiled under an old energy code that has since been changed. These changes could have significant impacts on energy saving potential estimates currently being used. In addition, the cost of energy-saving equipment has fallen in many cases, making the actual cost of conservation lower than assumed in current analyses. As a result of the changes that have taken place in the last few years, many of the current conservation potential calculations are inaccurate. Staff recommends that a new CPA be conducted to correct for these deficiencies. This analysis should be performed by a consulting firm with significant industry expertise. Additional details in regard to this recommendation are discussed below and in Chapter 9 of this document.

Other technological advances and data sources that have become available since the 2001 IRP include:

New Viable Technologies Over the past few years, there have been efficiency advances in a variety of end-use equipment. These changes in technologies are not reflected in the current conservation potential. Equipment such as high performance fluorescent T8 lamps (often referred to as "super T8s") in conjunction with low ballast factor electronic ballasts were not considered in the 2001 analysis because they were not available in the market place. These, along with a variety of other energy efficient equipment, could be analyzed in the proposed CPA.

Potential Data Sources A major analysis of non-residential buildings located in the Pacific Northwest, "Assessment of the Commercial Building Stock in the Pacific Northwest" was completed in March 2004. This study was co-funded by several organizations including the Northwest Energy Efficiency Alliance, BPA, and the Northwest Power and Conservation Council. The researchers conducted site visits at over 800 facilities and surveyed energy consuming equipment. Data regarding energy utilization indexes, lighting types, HVAC equipment, plug loads and operating hours by building type were collected. The data gathered will be invaluable for Tacoma Power as we proceed to quantify the conservation potential within the commercial sector as the 2001 IRP used data collected in the 1990s.

Section 6.6 Methodological Improvements

In addition to assessing the current conservation potential in Tacoma Power's service territory (the CPA outlined above), a more detailed understanding of various customer end-uses is desired. Specifically, more current and detailed information about the load shapes associated with end-uses such as space-conditioning, lighting, etc., and their impacts on winter-time peak-loads would improve our ability to develop demand-side measures and programs to meet such loads. High-quality end-use data – hourly level data derived from a large enough number of customers to validate a peak-focused demand-side program, is ordinarily difficult and expensive to collect. It is conceivable; however, that such enhanced end-use data could be accessed economically through Tacoma Power's Gateway project. Tacoma Power will benefit greatly as these technological advances allow improvements in the analytical methods used for developing new conservation programs.

Section 6.7 Recommendations

In summary, although Tacoma Power is not in need of additional supply resources at this time, staff recommends continued focus on conservation program efforts on market transformation, lost opportunities, and public benefit and infrastructure maintenance programs. Specifically, staff recommends the following:

- Work cooperatively with regional utilities to offer the Cool Rebates program for commercial solid door refrigerators and freezers and expand the program to include additional refrigeration equipment where feasible. Staff are currently in discussions with Seattle City Light, Puget Sound Energy and Snohomish PUD to offer a consistent program modeled after the Tacoma Power initiative.

- Work cooperatively with regional utilities to offer a residential new construction program. This program will focus on efficiency strategies which exceed the current energy code requirements. Trade allies such as the building and design community will be key market players.

- Develop and launch a commercial new construction program. The major emphasis of the program will be design assistance and energy analysis services. Limited direct incentives will be available for innovative efficiency strategies. The program will focus on energy efficiency improvements within the context of the US Green Building Council's Leadership in Energy and Environmental Design.

- Launch new market transformation programs in the commercial and industrial sectors such as *Bright Rebates* - the High Intensity Fluorescent Lighting program. This new application enables electricity reductions of 30 – 40% while maintaining current light levels. The other proposed market transformation programs are Energy Star Transformers, LED traffic signals & signs, and high efficiency commercial rooftop packaged equipment.

- Explore the feasibility of launching a compressed air market transformation program targeted primarily at industrial customers.

- Initiate a comprehensive CPA which will be regularly updated.

- Continue to examine load shape characteristics of various energy consumption end uses and develop conservation programs that reduce winter peak loads. As the Gateway project progresses, additional data becomes available which may enable refined targeting of peak load reductions that potentially can minimize peaking costs to Tacoma Power.

- Continue to work closely with the Northwest Energy Efficiency Alliance to offer services to customers and trade allies that are relevant to the Tacoma Power marketplace. For example the Lighting Design Lab and the Daylighting Lab are resources used extensively by the design community for Tacoma area projects.

- Withhold initiating any additional conservation acquisition programs above and beyond those identified in this IRP until such time that the load resource balance shifts sufficiently to warrant it.

- Maintain conservation infrastructure and capability by continuing to offer programs such as residential weatherization.

Chapter 7:
Planning for Uncertainty

As part of the IRP, Tacoma Power staff prepare regular scenario analysis updates. A scenario analysis team including members from Power Management, Energy Services, Generation, Transmission & Distribution and the Gateway Project developed four varied scenarios of possible futures for the utility and meet twice a year to evaluate sign posts that might indicate a tilt toward realization of one or more of the scenarios. The most recent Scenario Analysis Update was completed in March 2004.

Section 7.1 Scenario Planning Process

The scenario analysis team began with a consideration of driving forces that shape the operating environment for Tacoma Power. Team members determined key variables that impact the future of the utility and constructed four different story lines about possible future events that could occur. The stories are updated and altered as necessary to keep them relevant for planning purposes.

The four scenarios continue to be useful for capturing a range of possible load, price and resource impacts relevant to Tacoma Power.

- **"Global Conflict"** focuses on the possibility and consequences of terrorism and international strife;
- **"Joy in Competition"** imagines a future where regulatory structures change substantially and competitive markets for energy develop and thrive;
- **"Double Dip"** envisions the return of recession and contemplates the effects of a nasty economic downturn;
- **"Living in the Greenhouse"** supposes significant environmental degradation and the possible responses to these conditions.

The scenario analysis team agreed that the "Global Conflict" scenario could materialize at any time. Because of the fundamental unpredictability of terrorist acts and other destabilizing geopolitical events it is impossible to say when or if this scenario might come to pass. The return of an economic recession as portrayed in "Double Dip" also seemed plausible. There are mixed economic indicators – some pointing to continued recovery and others suggesting on-going weakness and uncertainty. "Living in the Greenhouse" could be developing now but slowly. It may be years before we see enough evidence and impact of climate change that society takes the problem seriously enough to take steps to change policies and behaviors. As the team discussed "Joy in Competition" it became apparent that we could actually be in the early stages of this story. Rather than the robust and intentional market competition envisioned in this scenario we may be in the midst of a gradual and slow move toward less regulated energy markets.

The most recent Scenario Analysis Update included demographic analysis as a sign-post monitoring tool. This work culminated in a package of detailed graphs on basic demographics that offer some insights into Tacoma Power's customer base. The analysis also makes some comparisons between Tacoma and Pierce County and the state and nation. Among other things, the data show clearly the impact of the recent economic downturn.

For the fall 2004 scenario planning effort the team plans a re-examination of the driving forces and themes for our stories. This may result in totally new scenarios for further consideration. The team will also undertake scenario based load and price forecasts to complement the forecasts used for load resource balance modeling in the IRP.

The scenario analysis team continues to believe that the process serves Tacoma Power well and that the scenario stories help staff know what sign posts to watch for. The qualitative observations continue to support and inform the quantitative load resource modeling performed as part of the IRP process.

Section 7.2 Evaluating Existing Resource Portfolio

The potential impacts of each of the four scenarios are summarized below:

Global Conflict *(flat loads and high prices)*

Our current resource portfolio should perform well. Tacoma Power is likely to make profitable surplus sales. BPA should also benefit from high market prices. The economy may suffer and trigger some moderate decline in loads.

Double Dip *(low loads and low prices)*

This is not the best circumstance for Tacoma Power's current resource portfolio – market prices could fall lowering surplus sales revenues. Declines in retail sales would further decrease utility revenue. These factors would likely impact BPA as well and could make it a comparatively expensive resource – at least for a little while – as BPA's rates would likely rise to cover their revenue shortfalls. Plan for this scenario using a low price forecast.

Joy in Competition *(higher loads and volatile prices)*

Resource flexibility would become more important under this scenario. Managing market ups and downs would likely become a significant issue for the utility. Tacoma Power might need to acquire additional resources under this scenario – fuel price volatility and market price volatility will make this challenging. Good internal systems and controls will make it easier to manage changing market conditions.

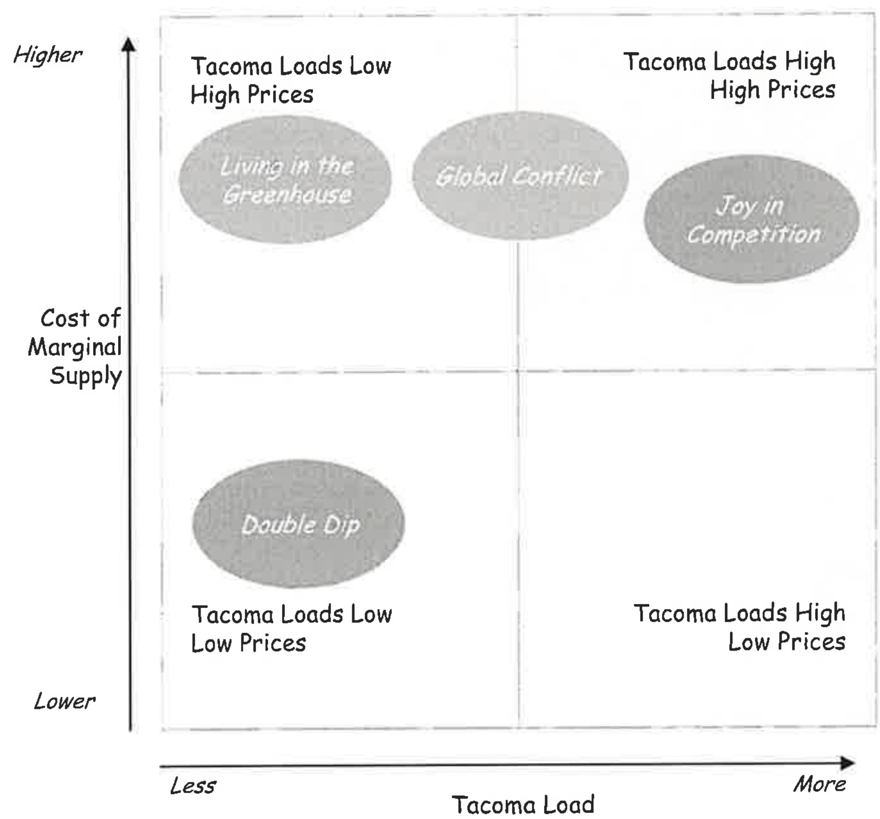
Living in the Greenhouse *(low loads and high prices)*

Tacoma Power is likely to need different resources. A renewables portfolio standard is likely. Hydroelectric power doesn't cause greenhouse gases and it could become very desirable. Nuclear power plants might be developed somewhere in the region – again, because they don't emit greenhouse gases. This scenario, if it unfolds is likely to develop slowly at first.

The matrix used for developing these four scenarios allowed for different outcomes along two axes, cost of marginal supply ranging from low to high and Tacoma Power loads ranging from less to more. Figure 7a shows the four scenarios plotted conceptually on this matrix.

Figure 7a

Scenario Planning Matrix



Chapter 8:
Other Resource Issues

Section 8.1
Demand Response

Tacoma Power, along with other Northwest utilities, remains vulnerable to resource shortages triggered by dry conditions. Drought could be exacerbated by unusually cold weather. It is also possible that energy prices could surge due to some other unforeseen market dynamic. Although our load resource modeling shows that the utility has adequate resources under nearly all scenarios, there is a possibility that we might need to make market purchases to serve our load under extreme conditions.

Shortages are likely to drive up prices. The current $250/MWh price cap in the Western region helps significantly to reduce risks posed by short-term price spikes. Under critical water conditions and high market prices some form of demand response program such as a Voluntary Load Reduction (VLR) program may provide short-term benefit to the utility. Reducing peak loads during these critical and unusual periods could be very beneficial in a number of ways - to avoid some expensive market purchases, to take economic advantage of high market prices, and to ease a shortage if power is hard to acquire. If FERC decides to lift the cap to $1000/MWh or remove it entirely then VLR could become significantly more valuable.

After study and evaluation of numerous Demand Response (DR) program alternatives in use or proposed around the nation, staff has concluded that Tacoma Power should develop a draft VLR Program for CP and HVG customers; continue to study and evaluate rate structures that offer incentives for customers to change electric power consumption patterns; and continue to study and evaluate commercial and residential DR program options that take advantage of opportunities provided by the Gateway Project.

A framework for a VLR Program was detailed in the Demand Response Investigation conducted during 2003 and staff has developed a draft VLR agreement that can be refined in the event that Tacoma Power needs to deploy this option.

The Gateway Project offers tremendous potential for developing diverse and flexible demand response programs when market and resource conditions make them desirable. Developing and testing Gateway interfaces is a necessary precursor to implementing many demand response programs for Tacoma Power's commercial customers. These DR options can be developed based on the information and experience acquired as the Gateway Project progresses.

Some of the options that may be possible with the full deployment of the Gateway Project are:

- information displays that help commercial customers control their own electricity usage;
- direct load control using advanced interfaces that adjust building temperature and/or lighting;
- voluntary load control programs;
- rate structures that encourage shifts in electricity usage patterns – Real-Time Pricing or Coincident Peak Pricing for example;
- ability to broadcast messages to customers regarding their electricity use.

Section 8.2

Distributed Generation

Distributed generation continues to be studied and tested by the utility industry but has not yet become a widely used resource. Distributed generation resources have the potential to be useful for alleviating transmission constraints and for providing end-users with new opportunities to generate all or part of the electricity that they consume. This type of resource can range in size from very small units that could be used by individual residential customers to units as large as 10 MW that could support an industrial load. These units could, in some circumstances, operate in isolation from transmission and distribution systems but more commonly are being evaluated and tested in connection with utility systems. Although distributed generation technologies are evolving, none are cost competitive for urban utilities in the Northwest at this time.

Significant barriers exist for expanded use of distributed generation resources. For technologies that rely on natural gas or diesel fuel currently high commodity prices cause a commensurate increase in operating cost and make them less competitive with conventional electric power generation resources. Interconnection rules for distributed resources are not standardized across the nation and each utility may impose unique requirements that may increase cost or complicate installation. While some states (such as Washington) require utilities to allow net-metering of small customer-owned and operated renewable resources, larger installations connected to utility grids will generally require extensive interconnection and standby service agreements. Overall it is easier to make an economic case for distributed generation in electric power markets with energy or capacity constraints where market prices for electricity are typically higher than those observed in the Northwest.

Any reduction in the cost to install or operate a distributed generation resource will make it a more attractive option for utilities and their customers. Tacoma Power will continue to monitor these trends. The experience gathered by other utilities located where power costs are higher, and resources constrained, will help frame future decisions about when or if distributed generation should be tested and deployed by Tacoma Power.

Section 8.3 Wind Generation

Power Management staff regularly tracks industry developments in power generation. In the last few years a lot of interest has been demonstrated regionally on the subject of wind power. Although Tacoma Power does not need to acquire new supply-resources at this time, staff felt it was appropriate to include a brief summary on wind generation and its potential relevance to Tacoma Power in this IRP.

Wind energy is a "green" resource as it is renewable, clean and non-polluting. Wind farms, which are modular and can be easily expanded, are usually comprised of several turbines ranging from 250 kW to 1.5 MW. The greatest benefit of wind power as a resource is that fuel is inexhaustible and free. By the end of 2003, total US wind capacity increased to just less than 6,400 MW after almost 1,700 MW were added in 2003. The average US growth rate over the past five years is 24% including a 2003 growth of 36%.[1] The Northwest has seen a large portion of the growth in wind resources. As of January 2004 there were almost 640 MW of operating wind capacity and 3,000 MW of planned wind projects in the Northwest. Significant growth in wind capacity is predicted to continue.

Wind resources in the Northwest can produce electricity for approximately $35-$45/MWh[2], making wind one of the least expensive renewable resources. Wind can be competitive with combined cycle gas turbines strictly on an energy cost basis. However, wind resources generally have very low capacity factors, typically around 30%, due to the wind speed variability. This means that a one MW wind turbine generates about 0.3 aMW annually, compared to 0.75-0.85 aMW for one MW fossil fuel resources. Since wind energy can't be called up on demand it has no capacity value, unlike fossil fuel resources. Also, wind energy can't be used for load following and can itself act as a load because of its inherent minute-by-minute output variability. Integrating a volatile wind resource into Tacoma Power's system could significantly reduce Tacoma Power's operating flexibility. To offset this problem, wind resources are often firmed up with more shapeable and reliable energy sources.

BPA recently began offering a service to shape wind energy for public utilities. Under this service, BPA would receive wind power from the generator and deliver it to the receiving party a week later in a steady, predictable supply. Cost for this service to Tacoma Power would be about $16.5/MWh - in addition to the cost for the associated energy. This includes two transmission wheels that are required to complete the transaction. On a MWh basis, transmission costs for wind resources are

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[1] American Wind Energy Association, "Global Wind Power Growth Continues To Strengthen." March 2004.

[2] In order to make wind projects economically competitive they require significant federal incentives approved by Congress.

approximately three times higher than those that run in a consistent baseload condition because transmission must be purchased for the maximum capacity, as opposed to the average energy output of the resource. Overall, Tacoma Power recognizes wind energy as a clean and renewable resource, but understands that currently there are a number of significant hidden costs that set the actual costs of wind ownership well above our current energy portfolio costs.

In evaluating potential load increases, market change and energy requirements, Tacoma Power monitors wind and other renewable resources to stay abreast of the technology and the feasibility of incorporating more of these types of resources into our power portfolio.

Section 8.4 Renewable Portfolio Standards

The 2003 and 2004 sessions of the Washington State Legislature have considered bills that would impose a requirement for utilities to expand the amount of renewable resources included in power supply portfolios. None of the bills introduced in our state have passed, however renewable portfolio requirements are becoming increasingly common around the nation. According to the Center for Renewable Energy and Sustainable Technology, 12 states have mandatory renewable portfolio standards and 3 more have voluntary standards. The requirements vary widely. Some include very modest increases over a period of years and a few mandate substantial – 10% to 20% – proportions of renewable resources used to serve load. The definition of what counts as a renewable resource also varies widely. Some include energy conservation as a renewable resource and some allow purchase of "green tags" to meet the requirement. Many states have determined that refuse burning resources and large hydropower resources cannot be considered renewable resources. It isn't clear how widely Low Impact Hydro Resource certification will be accepted to define renewable resources for purposes of complying with these requirements.

If Washington State passes a legislated renewable portfolio requirement it will likely impact Tacoma Power's resource acquisition decisions. The details of any proposed legislation will determine the impact that it might have on resource costs and characteristics. Tacoma Power staff will continue to monitor this trend closely.

Chapter 9: Conclusions and Recommendations

In relation to analyses and discussions that were part of this IRP, the following four general actions items are planned:

- Continue active involvement in the forums related to the future role of BPA in the region.
- Conduct further evaluation of aspects of operational flexibility in Tacoma Power's current power supply portfolio and how it will change in the future.
- Continue to enhance analytical and decision support system tools for optimization of the power supply portfolio, and
- Initiate a comprehensive conservation potential assessment (CPA).

Each of these items is discussed in more detail below.

Section 9.1 Resource Supply BPA, Flexibility and Analytical Tools

Tacoma Power is forecast to be supply surplus on an average annual basis for the duration of the ten-year IRP planning horizon. In addition, it is expected that the utility has better than adequate capacity to cover its peak loads under normal conditions, and adequate capacity to cover most contingencies. As a result, need for new supply resources are not anticipated at this time. This average surplus condition, however, is not to say that Tacoma Power is without supply risk. Several of the utility's supply resources, including the BPA and Priest Rapids contracts and the Mossyrock and Cushman projects are subject to some level of supply uncertainty within the 10-year IRP planning horizon.

As discussed in Chapter 4, there is uncertainty in regard to the future terms of Tacoma Power's power purchase contract with BPA, particularly the quantity of power that will be available to Tacoma Power post 2011. For purposes of analysis in this IRP update, staff assumed that the quantity of power available for Tacoma Power to purchase from BPA post 2011 would approximate that available during the 2006-2011 contract period (approximately 428 aMW on an annual basis). This represents the best information available at this time. As the regional dialogue concerning BPA's future role continues, and additional information becomes available, uncertainty regarding Tacoma Power's post 2011 contract should diminish. Staff will continue to participate in the process and will negotiate the most beneficial outcome possible for Tacoma Power's ratepayers. New assumptions about the BPA contract will be incorporated into future IRP analyses as they become available.

As discussed in detail in Chapter 4 of this document, Tacoma Power will be losing some operational flexibility when the existing Priest Rapids Contract expires in November of 2005 and the new contract begins. This includes a loss of AGC, peaking ability, generation shaping, reservoir storage and reserves capabilities. In addition to these, the utility is potentially at risk of losing some of the operational flexibility currently afforded by the Cushman Project. In the event that operations at this project are required to be modified, additional loss of ancillary services including AGC, generation shaping, reservoir storage and reserves capabilities may be encountered. Depending on the timing of such events, a concurrent Mossyrock unit outage, construction related or associated with a failure, may exacerbate this situation. In general, loss of such ancillary services erodes Tacoma Power's operational flexibility and hinders the utility's ability to operate its other resources in an optimal manner. Some or all of these services may be replaced by purchasing them elsewhere and/or compensated for by modifying operations. Both of these approaches will entail economic costs. Staff will continue to evaluate aspects of operational flexibility within Tacoma Power's existing and future supply portfolio to identify strategies to effectively manage this situation.

In order to effectively meet increasingly challenging operational issues such as diminishing operational flexibility in our supply portfolio, enhancement of analytical and decision support tools and methods is essential. Power Management is currently conducting a pilot study to evaluate an operation and planning decision support system (DSS). A DSS is a computer-based tool designed to assist in making operational and planning decisions that pursue optimization of Tacoma Power's power supply portfolio. A DSS uses mathematical optimization and modeling techniques to formulate optimal decisions to operational and planning related questions. For example, a DSS may be used to help maximize the value of seasonal reservoir storage, to recommend optimal dispatch of generating units and contract energy, or to help plan efficient acquisition of new resources. The DSS pilot study has entailed the creation of a detailed computer model simulation of Tacoma Power's entire supply portfolio, native loads and wholesale market opportunities. Staff are currently demonstrating the DSS in-house. As part of this demonstration, staff are conducting analyses to identify the potential benefits of a DSS for Tacoma Power. Staff will make a recommendation regarding acquisition of a DSS upon completion of the pilot study – likely in the Fall of 2004.

Section 9.2 Conservation

As a result of Tacoma Power's current and projected supply surplus and projected market conditions, conservation acquisition strategies are generally recommended to remain consistent with those identified in the 2002 IRP Update. In order to limit upward pressure on revenue requirements, and near-term rates, only conservation investments that are cost-effective and strategic should be maintained. At this time staff recommends continued focus on programs that concentrate on lost opportunities, investments in market transformation, and public benefit and infrastructure maintenance.

Staff recommends that a rigorous and in-depth conservation potential assessment (CPA) be conducted. The purpose of the new CPA will be to quantify the level and timing of conservation available and cost-effective to acquire. Both the technical and achievable CPA will be analyzed for the three primary sectors: residential, commercial and industrial. The analysis will entail an examination of both the existing building stock and the potential future building stock. Energy conservation measures which improve building energy efficiency beyond the energy code will also be researched. The proposed CPA will quantify the cost-benefit ratios and life cycle levelized costs for an assortment of energy conservation measures. Staff recommends that an industry expert consulting firm be retained to conduct the analysis in conjunction with Tacoma Power staff.

It is anticipated that it will take between six and eight months to complete the CPA. The results will be incorporated into future iterations of the IRP and will form the basis for targeting efficiency programs. The CPA will be updated periodically to reflect programmatically achieved conservation and changes in technologies and economics. The new CPA will enable higher confidence in the results and thus become a better planning tool for resource acquisition decisions.

Integrated resource planning is continuous effort. Staff will continue to conduct analyses relevant to the IRP on an ongoing basis. As we learn more about what our BPA contract will entail post 2011 we will once again re-assess the future and formally update the IRP.

Appendix A: Transmission Resources and Issues

Transmission and Distribution Section (T&D) Mission
The mission of T&D is to ensure a high performing transmission and distribution system with low and stable rates. T&D plans, designs, constructs, operates and maintains the transmission and distribution system including substations, the underground network system, the system control and data acquisition system ("SCADA"), revenue metering facilities and all overhead and underground lines and associated equipment.

Transmission
Tacoma Power owns, operates, and maintains 44 circuit miles of high voltage (230 kV) facilities and 314 circuit miles of sub-transmission (110 kV) facilities which are used to integrate generation, serve retail loads, and provide wholesale transfer service.

Facilities
Tacoma power owns and maintains 160 circuit miles of transmission facilities used to integrate power from Tacoma Power generating projects:

- 18 miles of 230 kV transmission integrate Tacoma Power's Mayfield and Mossyrock hydroelectric generation on the Cowlitz River Project into the Bonneville Power Administration's transmission grid. Tacoma Power takes delivery of this power at its Cowlitz and Northeast Substations.

- 43 Miles of double circuit (86 circuit miles) 110 kV sub-transmission facilities, known as the Potlatch lines, integrate Tacoma Power's hydroelectric generation at the Cushman Project into Tacoma Power's 110 kV sub-transmission system. The Potlatch lines cross Tacoma Narrows via a 6,200-foot transmission span which, when installed in 1926, was the longest electrical crossing in the world.

- 28 miles of double circuit (56 circuit miles) 110 kV sub-transmission facilities, known as the LaGrande lines, integrate Tacoma Power's Alder and LaGrande hydroelectric generation at the Nisqually River Project into Tacoma Power's 110 kV sub-transmission system

Tacoma Power owns and maintains 181 circuit miles of transmission facilities including 13 miles of double circuit (26 circuit miles) 230 kV transmission and 172 miles of single circuit 110 kV sub-transmission, which are primarily used to serve Tacoma Power retail loads.

Tacoma Power is a member of the Western Electricity Coordination Council (WECC), one of the ten reliability organizations that compose North American Electric Reliability Council (NERC). Tacoma Power is a WECC Control Area. None of Tacoma Power's transmission facilities are WECC "rated" paths or considered significant to the operation of the regional interconnection transmission system.

Interchange Points
Tacoma Power has four points where it connects to the regional interconnected transmission network:

- Northeast - 230 kV interconnection with BPA
- Cowlitz – 230 kV interconnection with BPA
- Starwood – 115 kV interconnection with Puget Sound Energy
- Cowlitz Hydroelectric Project – 230 kV with BPA

Wholesale Use
Tacoma Power uses portions of its 110 kV and 230 kV electrical system to provide wholesale transfer service to 10 publicly owned Pierce County utilities and also to the Lewis County Public Utility District. Tacoma Power has provided some of this service for over thirty years.

Transfer service began in 1974 when Tacoma Power provided access to the Bonneville Power Administration (BPA) for the benefit of its Pierce County customers. In 1993, Tacoma Power and Lewis County Public Utility District executed an agreement to transfer power generated by the Cowlitz Falls Hydroelectric Project across our system. Finally, in 1996 Tacoma Power provided access to the Peninsula Power and Light Company (PenLight) for its non-BPA power purchases.

In 2000, Tacoma Power reaffirmed its policy to provide non-discriminatory open access to its high-voltage system through adoption by the Tacoma Public Utility Board of a new master Interconnection Agreement and open access Transfer Tariff. These agreements are progressive and they are aligned with industry and FERC pro forma standards.

Tacoma Power's agreement with Penlight expired in 2001, and the parties did not renew. In March 2003 BPA signed Tacoma Power's new open access Transfer Tariff, marking the end of the old transfer agreements established nearly 30-years earlier! BPA opted to purchase transfer service for a period of ten years.

Capacity
Currently, Tacoma Power has sufficient transmission capacity (lines, point of interconnection with neighboring systems) to serve both its retail and wholesale customers in a reliable manner. However, based on Tacoma Power's February 2000 Transmission & Distribution Six-Year Plan (T&D Plan) and two system impact studies that analyzed the effect of BPA's transfer request on Tacoma's system, Tacoma Power anticipates that insufficient capacity will exist in the near future. South and West Pierce County have experienced significant development and growth, driving the need for electrical infrastructure additions and/or improvements. As such, Tacoma Power initiated, in partnership with BPA, capacity and reliability improvements for both the LaGrande and Potlatch lines.

LaGrande Lines

The LaGrande lines were originally constructed to transmit power from the Nisqually Project to Tacoma. In addition to their original function, these lines now also support wholesale power transfers, enabling BPA to serve five of its customers: Parkland Light and Water, Elmhurst Mutual Power and Light, Ohop Mutual Light Company, Alder Mutual Light Company and the Town of Eatonville. The existing LaGrande lines are over 60 years old; they were rebuilt in 1943 to replace wood pole lines.

Over the last ten years, rapid growth has occurred in south Pierce County affecting primarily Tacoma Power, Parkland Light and Water, and Elmhurst Mutual Power and Light. New substations were constructed and connected to the LaGrande lines to serve this load. The LaGrande lines are currently near their capacity limit, in fact it would be difficult for Tacoma Power to serve significant new industrial load in the Frederickson area of its service territory. Further, under certain planning scenarios, loss of one line could over-load the other.

To remedy the capacity constraints and improve system reliability, Tacoma Power and BPA plan to construct a new switching station (Canyon Substation) and increase the 110 kV transmission line capacity between the Cowlitz and Canyon Substations. Future considerations for Canyon Substation include interconnection with BPA. The pre-construction phase began in 2002, including conceptual planning and land acquisition. Detailed engineering design and the construction phase will begin in 2004 and continue to 2010.

Potlatch Lines

The Potlatch Lines were originally built over 75 years ago to transmit power from the Cushman Project (Cushman #1 and #2 hydroelectric generating projects) to Tacoma. As with the LaGrande lines, the Potlatch lines not only transmit Cushman generation, but also support wholesale power transfers, enabling BPA to serve its customer, PenLight.

While the Potlatch lines have been significantly rebuilt over the last ten years, the Narrows Crossing towers and the conductors are original. The conductors were analyzed in 1999 and determined adequate for existing transmission requirements. However, by 2002, a system impact study determined that PenLight's growth was such that its load would exceed line capacity by 2006 for an average winter. In response, Tacoma Power and BPA will rebuild the Tacoma Narrows Crossing and adjacent transmission. The pre-construction phase commenced in 2003, with detailed engineering design to occur in 2004. Construction is scheduled for 2005-2006.

National and Regional Issues

Over the last nine years the Pacific Northwest experienced a number of significant national and regional initiatives intended to restructure the regional transmission system and its operation. These initiatives impact Tacoma Power twofold: First, Tacoma Power uses the regional transmission network to deliver and receive the majority of its power. Second, Tacoma Power is a system operator and it owns assets over which wholesale transfer transactions occur. As such, Tacoma Power has tracked and/or participated in these initiatives.

National Issues

Over the last nine years, Congress and FERC took four major steps they believed would establish competitive bulk power markets and bring more efficient, lower cost power to the Nation's electricity consumers. The Energy Policy Act of 1992, FERC Orders 888 and 889, FERC Order 2000, and Standard Market Design (SMD) have focused primarily on promoting open, non-discriminatory transmission access. The four major steps are described below.

Energy Policy Act of 1992

The U.S. Congress passed the Energy Policy Act of 1992 (the Energy Policy Act) to encourage new generation entrants, known as exempt wholesale generators (EWGs), and to expand FERC's authority under sections 211 and 212 of the Federal Power Act (FPA) to approve applications for transmission services.

FERC aggressively implemented the revised sections of the FPA leading to a number of industry changes. One such change was FERC began ordering utilities to provide "network" transmission service – a service similar to the service transmission-owners provide to their own retail electric customers. Previously, most utilities had offered point-to-point service and refused to offer network service.

Another change was the articulation of a "comparability standard." FERC and others noted that transmission owners provide themselves and their affiliates with several services and levels of quality of service, but really only offered one or two types and levels of service to other parties. FERC articulated a comparability standard, and began ordering utilities to offer comparable levels of service to third parities.

Transmission access changes occurred case-by-case, and generally when FERC was deciding another question – such as how to mitigate market power in a merger proceeding. FERC recognized the need for generic findings, and undertook a process that resulted in Orders Numbers 888 and 889.

FERC Order Numbers 888 and 889

April 1996 FERC issued Order Numbers 888 and 889. Order 888 established procedures for offering transmission services in a non-discriminatory manner and established rules for the recovery of stranded costs. Order 889 set guidelines for standards of conduct and for the provision of equal access to data for all parties.

The main thrust of Order 888 was to order FERC jurisdictional utilities to develop and file an Open Access Transmission Tariff (OATT.) Order 888's central theme was "comparability." FERC ordered utilities to post an OATT that offered transmission service and the terms and conditions under which it was available. FERC ordered utilities to provide transmission access to all parties under the same terms and conditions offered to their own affiliated companies. FERC provided a pro forma OATT, which became the template used by most utilities in the development of their own OATT.

Order 888 also required utilities to unbundled services – power supply, transmission, distribution, and ancillary services. With limited exceptions, FERC required utilities to offer to provide ancillary services under terms and conditions specified in their OATT.

Order 889 set guidelines for standard of conduct, called for the establishment of Open Access Same-Time Information Systems (OASIS), and listed contents of the OASIS. The purpose of an OASIS is to ensure equal, non-discriminatory access to real-time information about transmission capacity availability, service prices, and pricing discounts offered to customers. Real-time access to information helps ensure that utilities do not use their ownership, operation, or control of transmission to unfairly deny access or provide competitive advantages to selected parties.

Order Numbers 888 and 889 stopped short of ordering the development of regional transmission organizations although FERC clearly favored the formation of regional organizations. Orders 888 and 889 spurred attempts – successful and unsuccessful – to form such organizations and led to FERC's next major order, Number 2000.

FERC Order Number 2000

In December 1999, FERC approved Order No. 2000, which governs the development and implementation of regional transmission organizations (RTO.) An RTO is an umbrella organization that will put under common control all public utility transmission facilities in a region.

While RTO formation is voluntary under Order 2000, FERC asserted authority to mandate RTO participation to remedy undue discrimination, to address market power, or as a condition of merger approval. FERC also set a clear direction for the industry, outlining guidelines for what RTOs must do, effective pricing mechanisms, a timetable for action, a collaborative process, and a persuasive case for the need for RTOs.

Order 2000 required all FERC-jurisdictional public utilities that own, operate, or control interstate transmission to file by October 15, 2000, either a proposal for an RTO or explain why it opted not to participate in an RTO. Order 2000 required RTOs to be operational by December 15, 2001 while existing, FERC-approved, regional entities were to make compliance filings by January 15, 2001.

Order 2000 permitted several different types of RTO, including non-profit independent system operators and for-profit transmission companies. The Order also provided flexibility in ratemaking options and enables RTO participants to design an organization, which meets their regional needs. However, all RTOs must embrace four core characteristics (independence, scope and regional configuration, operational authority, and short-term reliability) and eight key functions (tariff administration and design, congestion management, parallel path flows, ancillary services, OASIS, market monitoring, planning and expansion, and interregional coordination.)

Standard Market Design (SMD)
SMD was a FERC initiative to promote, refocus and accelerate wholesale market restructuring beyond that accomplished by utilities' in response to Order 2000; FERC intended to cure continued biases it believed persisted in the power industry.

In August 2002, FERC issued the SMD Notice of Proposed Rulemaking, known simply as the NOPR. In the NOPR, FERC proposed a wide-ranging list of changes to the wholesale electric power market, which would be standard for every utility across the country.

After FERC received over 1,000 sets of formal comments and considerable negative feedback from Congress, FERC issued a White Paper outlining a scaled-back SMD option.

In the White Paper FERC outlined plans to force all jurisdictional utilities to turn over operational control of transmission facilities to an RTO. FERC stated their desire for RTOs to develop real-time and day-ahead markets for power supply and transmission services, including:

- Regulation
- Balancing energy
- Losses
- Reserves

FERC proposed a number of other market changes:

- Bidding for available transmission capacity
- Establishment of resource adequacy requirements
- Elimination of multiple charges for power crossing control area boundaries
- Managing transmission congestion through fixed transmission rights and locational pricing

RTOs would also be granted more authority over market power abuses and mitigation of such abuses for a limited list of known schemes.

Faced with considerable opposition, FERC decided to not issue a final order on SMD, instead working to implement SMD through their RTO orders. Standard market design has not gone away as a potential issue facing the industry. FERC merely placed it on-hold pending the 2004 election cycle.

<u>Regional Response</u>
Since 1992 Northwest utilities have made six significant efforts to coordinate and/or unify regional transmission entities, much of which is in response to national initiatives. These efforts are discussed below.

Northwest Regional Transmission Association

The Northwest's first effort to coordinate regional transmission was the formation of the Northwest Regional Transmission Association (NRTA.) The NRTA was one of three Regional Transmission Associations (RTA) formed in the early 1990s in the western interconnected region (the others being the Southwest Regional Transmission Association [SWRTA] and the Western Regional Transmission Association [WRTA]). NRTA formed to serve the specific interests of transmission owners and consumers located in the Pacific Northwest. NRTA originally had three main objectives:

- Promote open access;
- Facilitate coordination of regional transmission planning; and,
- Facilitate development of a regional transmission tariff.

NRTA added a fourth objective after a year of operation – promotion of a set of neutral commercial practices for the transmission system, independent of the other functions of the utilities owning the system.

NRTA is composed of transmitting utilities in the U.S. and Canada, transmission users in the U.S. and Canada, and Northwest regulatory commissions. Tacoma Power was a founding member of NRTA, and continues to be a member to this date.

The NRTA concept pre-dated the Energy Policy Act, and centered on a perceived need for open transmission access for non-transmission owners. Formation of NRTA was further spurred by pro-regional transmission organization sentiments in Congress at the time of the Energy Policy Act, and similar sentiments at the FERC prior to Order 888.

The three RTA's provided valuable regional forums in the early to mid-1990s. However by the late 1990s, the proliferation of regional initiatives and forums together with FERC's focus on development of RTOs placed the RTAs at a crossroads. By 2001, SWRTA and WRTA chose to merge with the Western Systems Coordinating Council (WSCC) and form one organization called the Western Electric Coordinating Council (WECC). The parties merged to gain efficiencies and compliment the expected emergence of RTOs.

NRTA opted to remain an independent organization. However by 2003, the NRTA Board decided to dissolve NRTA by March 2005 as others now performed most of NRTA's core functions. NRTA's original tariff related goal was subsumed in 1996, by the IndeGO effort, and later by RTO West. In 2003 Northwest Transmission Assessment Committee (NTAC) assumed NRTA's planning function; NTAC is a regional transmission planning effort coordinated by the Northwest Power Pool. NRTA will perform dispute resolution until 2005, and then transfer that function to either an RTO or another existing organization.

Northwest Transmission Assessment Committee

Regional utility and energy market participants established the NTAC effort to address forward-looking planning and development for a robust and cost effective transmission system for the Pacific Northwest. The participants expect NTAC will develop solutions to enable an efficient, lower cost, and reliable regional transmission system that meets end-use customer needs.

The effort intends to implement a truly integrated planning effort for the Pacific Northwest transmission system, wherein the system is reviewed holistically, rather than system-by-system as is current practice. As such this planning and development would identify future transmission needs by performing studies to identify solutions. The forum will consider transmission and non-transmission alternatives. This effort would go beyond reliability planning and maintaining current capability, to include economic efficiency and market power mitigation. Tacoma Power staff actively participates in this forum.

North American Electric Reliability Council and Western Electric Coordinating Council
NERC is a not-for-profit corporation whose members are ten reliability councils. WECC is the largest and most diverse of the ten regional councils. Since formation in 1968, the mission of the regional councils is to ensure that the bulk electric system in North America is reliable, adequate and secure. WECC and NERC represent all segments of the electric industry, including private utilities, municipalities, rural electric cooperatives, federal power marketing agencies, and power marketers. WECC and NERC have historically operated successfully as voluntary organizations, relying on reciprocity, peer pressure and the mutual self-interest of all those involved. However, the growth of competition and the structural changes that have occurred in the industry have significantly altered the incentives and responsibility of major participants. In response to the electrical industry's restructuring, WECC and NERC have also begun to adjust. As examples, WECC implemented a program to enforce compliance with reliability standards and consolidated with two west coast RTAs. NERC focused on independence through seating of an independent board in 2001, sponsored reliability legislation over the last few years, and disaggregated its reliability standards to accommodate a restructured industry.

The formation of WECC in 2002 was a culmination of a four-year cooperative effort through WSCC, SWRTA, WRTA and other regional organizations in the West.

WECC both retained and assumed additional responsibilities after its merger with WRTA and SWRTA. As the WSCC's successor, WECC continues to promote a reliable electric power system in the Western Interconnection. WECC will also support efficient competitive power markets, assure open and non-discriminatory transmission access among members, provide a forum for resolving transmission access disputes, and provide an environment for coordinating the operating and planning activities of its members. Tacoma Power is a member of WECC and actively participates in its Planning and Operating Committees, along with a number of subcommittees.

WECC's emphasis not only to develop and promote but to also enforce standards for a reliable North American bulk electric system is founded on erosion, through the introduction of competition, of the electric industries' historically voluntary system of maintaining reliability. Under the existing system, compliance is expected, but not enforceable. In 1999 WECC established enforcement though a contractual arrangement with many of its members, which NERC ultimately adopted as a model. Tacoma Power has not executed an enforcement agreement, however, Tacoma Power voluntarily reports reliability statistics to WECC.

In 1999 NERC also began work to disaggregate Control Area reliability functions through development of its Functional Model. Historically, vertically integrated utilities established a Control Area to operate its individual power system in a secure and reliable manner and to provide for its customers' electricity needs. A traditional Control Area operator will balance its load with its generation, implement interchange schedules with other control areas, and ensure transmission reliability. NERC's Operating Policies ascribed nearly every reliability function to a Control Area operator. However, with vertically integrated utilities disaggregating plus new entrants in the advent of electric industry restructure – the Control Area no longer had sole control or responsibility to implement NERC's Operating Policies. As a result, NERC's Operating Policies lost relevance and enforceability.

In a multi-year process, NERC developed its Functional Model. The Functional Model defines the set of functions that must be performed to ensure the reliability of the bulk electric system. The Functional Model also linked "utility" functions (e.g. Generator Owners, Generator Operators, Transmission Service Providers, Transmission Owners, Transmission Operators, Distribution Providers, etc.) with the reliability requirements. The Functional Model provides the foundation and framework upon which NERC develops and maintains its Reliability Standards. NERC is revising its planning and operating requirements in alignment with the Functional Model.

NERC has also sponsored national reliability legislation. Such legislation makes compliance with regulatory standards mandatory, with penalties for non-compliance. What is of import is the move from an industry where reliability was established through voluntary organizations whose members were electric utilities to a mandatory system with a much broader membership. Legislation has yet to pass, a victim of the nation's failure to come to a broader consensus on energy policy.

Independent Grid Operator

Between 1996 and 1998 twenty-one utilities undertook an extensive effort to develop an Independent Grid Operator (IGO) called IndeGO. IndeGO was to be a nonprofit, independent operator of the aggregated transmission systems of the 21 participants, including Tacoma Power. IndeGO's region included Washington, Oregon, Idaho, and parts of Montana, Wyoming, Utah, Colorado, Nevada and Nebraska.

Under the proposal, IndeGO would not have owned any facilities. Rather, IndeGO would have controlled each participating owner's transmission facilities in exchange for an annual payment that would cover the owner's capital, operation, and maintenance costs. IndeGO's main objective was to be a common carrier electric transmission system operator, independent of the energy sales and power production aspects of the participating owners. IndeGO's goals were to ensure comparable transmission access to all grid customers, promote economically efficient use and expansion of the IGO grid, and avoid "pancaked transmission charges" wherein a transmission customer must pay charges to several utilities as it wheels power from source to sink.

While the IndeGO proposal was never submitted to the FERC for approval, FERC was supportive of the effort to form an IGO. The IndeGO effort ultimately ended when it became apparent that the pricing proposals would result in cost shifting between utilities.

Tacoma Power and the other participants invested significant amounts of staff time and resources, the results of which were large numbers of contracts, organizational documents, white papers, and other documentation. The resulting documents have formed the basis for much of the RTO West effort that followed.

Formation of the Regional Transmission Organization
In March 2000, in response to FERC Order 2000, nine utilities initiated RTO West, a Regional Transmission Organization ("RTO") that would span eight Western states. The original "Filing Utilities" were Avista Corporation, Bonneville, Idaho Power Company, Montana Power Company, Nevada Power Company, PacifiCorp, Portland General Electric, Puget Sound Energy, Inc., and Sierra Pacific Power Company.

In fourth quarter 2000, the Filing Utilities submitted the RTO West Stage 1 filing to FERC, wherein the Filing Utilities asked for a declaratory order on the governance, scope and configuration, and an agreement limiting liability. On April 25, 2001, FERC predominately approved Stage 1, although rejected the proposal to incorporate a limited liability agreement into the RTO West operating agreement.

In March 2002, the Filing Utilities filed a Stage 2 filing with the FERC. The British Columbia Hydro and Power Authority (B.C. Hydro), a non-FERC jurisdictional Canadian utility, became a Filing Utility with this filing. The Stage 2 filing contained amended governance and operating proposals, and proposed congestion management, pricing, ancillary services, market monitoring, and planning/expansion approaches. In September 2002, FERC approved the Stage 2 filing and ordered RTO West to file a tariff with FERC, and to make other clarifications to the Stage 2 filing.

Northwest Power Works and RTO West
By mid-2002 the numerous entities in the Pacific Northwest, including Tacoma Power, determined that RTO West and FERC's SMD would confer few benefits to consumers. Tacoma Power worked to actively oppose SMD and influence RTO West through formation of Northwest Power Works (NWPW.) NWPW is a consortium of over 140 organizations in Washington, Oregon and Idaho and includes utilities, businesses, labor unions, cities, community organizations and others. NWPW includes all Washington State's Public Utility Districts, Seattle City Light and numerous smaller public utility customers of BPA. NWPW promoted its purpose by informing and influencing political leaders, the community, and the media.

By mid-2003, the efforts to oppose RTO West together with significant divisions within the Filing Utility group made it improbable that RTO West could become operational as proposed in the Stage 2 filings. This forced RTO proponents into a more collaborative mode. Tacoma Power hoped the parties would produce a process that afforded incremental improvements to the regional transmission system rather than a completely restructured market as envisioned by the Stage 2 filings.

RTO West initiated a process to seek broader regional consensus on the formation of an RTO. RTO West expended considerable time and energy soliciting input from non-FERC jurisdictional utilities and state regulators. By the end of 2003, RTO West adopted the "Platform" a new strategy to implement improvements to the regional transmission system. The Platform provides a guide for incremental RTO development, with greater regional stakeholder involvement. The Platform envisions a Beginning Stage where the RTO assumes very basic and fundamental responsibilities. Over time the RTO, after some regional acceptance, may proceed to greater market restructuring.

Notwithstanding, many fear that RTO West proponents will use the Platform as a forced march to implement the Stage 2 filings! As such, Tacoma Power anticipates 2004 will revert to the confrontational situation existing previously.

Current efforts on the Beginning State include development of governance and technical proposals. Governance proposals will address draft articles and bylaws. Technical proposals will address treatment of existing contracts, control area consolidation, facilities, pricing, the transmission operating agreement, and BPA issues.

Tacoma Power actively participated in the last collaborative effort, and continues to track development of the Beginning State.

Appendix B: Glossary of Terms

adverse water conditions: Adverse water conditions are defined as the annual inflows that are exceeded 75% of the time.

aMW or average annual megawatt or average megawatt (aMW): A unit of energy output over a year that is equal to the energy produced by the continuous operation of one megawatt of capacity over a period of time. (Equal to 8,760 megawatt-hours).

average water conditions: Average water conditions represent the historic mean monthly inflows.

base load: A power plant that is planned to run continually except for maintenance and scheduled or unscheduled outages. Base load also refers to the minimum load in a power system over a given period of time.

Btu or British thermal unit: The amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit (3,412 BTUs are equal to one kilowatt-hour).

capability: The maximum generation that a machine, station or system can generate under specified conditions for a given interval without exceeding approved limits.

capacity: The maximum power that can be produced by a generating resource at specified times under specified conditions.

critical water: The extreme low water conditions are represented by 'critical water'. Critical water conditions are defined as the lowest annual inflows during a twelve-month period. Operating year 1941 (August 1940 to July 1941) represents the critical water period for Tacoma Power's system.

demand: The rate at which electric energy is delivered to or by a system at a given instant or averaged over a designated period, usually expressed in kilowatts or megawatts.

DSM or demand-side management: Strategies for reducing consumption by influencing when and how customers use electricity. Demand-side management includes such things as conservation programs and incentives for switching electricity use from peak usage periods to off-peak hours.

distribution: The transport of electricity to ultimate use points such as homes and businesses.

FERC or Federal Energy Regulatory Commission: A federal agency responsible for regulating key activities of the nation's natural gas utilities, electric utilities, natural gas pipeline transportation utilities and hydroelectric power producers.

good water conditions: Good water conditions represent the annual inflows that are exceeded 25% of the time.

grid: The linking system of transmission lines, regionally and locally.

heat rate: a measure of generating station thermal efficiency--generally expressed in Btu per net kilowatthour. It is computed by dividing the total Btu content of fuel burned for electricity generation by the resulting net kilowatthour generation.

historical streamflow record: The unregulated streamflow data base of the 50 years from July 1928 to June 1978. The data are modified to take into account adjustments due to irrigation depletions and evaporations for the particular operating year being studied.

IPP or independent power producer: A non-utility power generating entity, defined by the 1978 Public Utility Regulatory Policies Act, that typically sells the power it generates to electric utilities at wholesale prices.

independent system operator (ISO) or independent grid operator (IGO): Independent manager of transmission lines to assure safe and fair transfer of electricity from generators to distribution companies.

kW or kilowatt: A unit of electrical power equal to one thousand watts.

kWh or kilowatt-hour : A basic unit of electrical energy which equals one kilowatt of power used for one hour.

load: The amount of electric power delivered or required at a given point on a system. (Amount of electric power consumed at a location).

marginal cost: The cost of the next generator needed to serve additional electricity demand.

MW or megawatt: A unit of electrical power equal to one million watts or one thousand kilowatts.

MWh or megawatt-hour: A unit of electrical energy which equals one megawatt of power used for one hour.

mill: One-tenth of one cent. The common unit for pricing electricity.

nameplate rating or nameplate capacity: A measurement indicating the approximate generating capability of a project or unit, as designated by the manufacturer. In many cases, the unit is capable of generating substantially more than the nameplate capacity since most generators installed in newer hydroelectric plants have a continuous overload capacity of 115 percent of the nameplate capacity.

peak demand: The maximum electrical load demand in a stated period of time. On a daily basis, peak loads occur at midmorning and in the early evening.

peaking capability: The maximum peak load that can be supplied by a generating unit, station or system in a stated time period.

power: A term usually meant to imply both capacity and energy.

RTO or regional transmission organization: A group of utilities, independent power producers and state agencies that join to provide more equitable and easier access to power lines in an area covering many states.

restructuring: Reconfiguring the market structure by eliminating the monopoly on the essential functions of an electric company.

shaping: The scheduling and operation of generating resources to meet changing load levels. Load shaping on a hydro system usually involves the adjustment of water releases from reservoirs so that generation and load are continuously in balance.

transmission: The act or process of transporting electric energy in bulk from one point to another in the power system, rather than to individual customers.

transmission grid: An interconnected system of electric transmission lines and associated equipment for the transfer of electric energy in bulk between points of supply and points of demand.

variable cost: The total costs incurred to produce energy, excluding fixed costs which are incurred regardless of whether the resource is operating. Variable costs usually include fuel, maintenance and labor.

wet water conditions: Wet water conditions represent the highest annual inflows

wholesale power market: The purchase and sale of electricity from generators to resellers (who sell to retail customers) along with the ancillary services needed to maintain reliability and power quality at the transmission level.