Planning Environment

Contents

Here we present the factors and conditions that defined the planning context for the 2011 IRP. We also describe briefly how the related risks and challenges were treated in the analysis.

New considerations for this IRP include:

- Slow economic growth and even slower job growth
- A regional energy surplus that is expected to last for years
- Significantly increased estimates for North American natural gas supplies and production
- Over-generation and the attendant transmission and market challenges.

Other planning considerations include:

- Uncertainty about CO_2 costs and regulation
- The influence of RPS requirements on portfolio builds
- Limited resource alternatives
- The effects of increasing reliance on natural gas for power generation
- The limitations and modeling challenges of ”real world” demand-side resources (DSR)

1. Economic Environment

Economic activity, demand, and resource timing. The quantity and shape of the energy our customers will demand in the future depends a great deal on economic activity and technological advancement. Factors such as employment and population growth are key determinants of our resource need.

The energy marketplace outlook has changed considerably over the past three years. Following a sharp economic contraction, growth is slow and job growth is even slower. Job growth is the arguably the single most important variable in predicting future loads. A strong labor market is indicative of strong residential and commercial demand. As discussed in Chapter 4, Key Assumptions, and Appendix H, Demand Forecasts, job growth in the Pacific Northwest is forecast to be weak.

But today's weak economic outlook can change, and this creates uncertainty around long-range planning:

- How long will demand remain subdued?
- How might more robust growth impact the company?

The estimated timing and size of resource needs vary greatly depending on these and many other variables. New supply and transmission resources take time to develop, so portfolios must be both flexible and robust to meet changing conditions

Accordingly, the IRP modeled a range of demand forecasts based on different economic outlooks to incorporate this uncertainty.

Regional energy surplus. Today, the Pacific Northwest finds itself highly interconnected by transmission to Canada in the north and California in the south. Our regions are interdependent both physically and in market terms. Accordingly, our planning, our markets, and our system operations must be carefully coordinated. The Pacific Northwest is "long" on generation resources for both energy and capacity – provided sufficient transmission exists to deliver that electricity into and out of the region and to the ultimate load. Constraints to PSE's ability to access this regional surplus is an important aspect of PSE's capacity resource need reflected in resource planning analysis.

The conclusion that the region is long on resources is based on analytical findings of the Pacific Northwest Regional Resource Adequacy Forum (Resource Adequacy Forum). Created in 2005 by the Northwest Power and Conservation Council (NPCC) and BPA, the Resource Adequacy Forum's express purpose is "developing a framework to provide a. . . means of assessing whether the region has sufficient deliverable resources to meet its electricity demands reliably." Their assessment is based on forecasts of loads, existing (not planned) generation, and conservation consistent with the NPCC's 6th Power Plan; it looks five years into the future. Their analysis concludes that the region has sufficient energy and capacity to meet adequacy metrics, provided such resources can be delivered to loads.[1] PSE is an active participant in the Forum's work, and we find their detailed examination of the sufficiency of market resources extremely useful to the resource planning process.

2. *Policy Requirements and Influences*

Renewable portfolio standards (RPS). The state of Washington's RPS continues to require renewable resource additions to PSE's planning portfolios. The RPS requires that PSE meet 3% of load with renewable resources by 2012, 9% by 2016, and 15% by 2020. The company, the region, and the I-5 corridor markets are in the early days of estimating the direct costs and indirect benefits of the addition of large-scale, zero-variable-cost renewables to a slow-growing energy market. Great caution must be exercised when discussing the long-term costs and benefits of renewable energy; RPS standards have the potential to create economic winners and losers in the marketplace and pronouncements about renewable costs and operational impacts must be carefully considered.

The company's RPS need is expressed in units called renewable energy credits (RECs). To model RPS need for the IRP analysis, PSE tested how different load levels affected our need for RECs.

A revenue requirement cost cap is also included in the statute that governs RPS requirements. According to RCW 19.285 all electric utilities in Washington must meet 15% of their electric load with eligible renewable resources by 2020. However, if the incremental cost of those renewable resources compared to an equivalent non-

[1] *See* http://www.nwcouncil.org/energy/resource/Default.asp

renewable is greater than 4% of its revenue requirement, then a utility shall be considered in compliance with the annual target. PSE will examine if incremental renewable resource additions place the company at or above the cost cap. Unfortunately, the statute does not contemplate that market-wide level must run/must take renewable resources lower market heat rates and market prices thus lowering portfolio costs to companies like PSE that are short energy. The actual all-in portfolio cost to customers of renewables is likely overstated. The state will have to find means and methods to estimate such effects and reflect them in the statutory framework in the future

The last section of Appendix I, Electric Analysis, fully discusses how close PSE comes to reaching the incremental cost cap.

Surplus energy events. So-called "surplus energy events" occur when the supply of electricity exceeds demand. Such events have been common to the region for many years and are not new. The rapid growth of wind in the region will make periodic surpluses even more common. Surplus energy events tend to lower market prices, and in some instances they result negative market power prices. BPA, the region's largest transmission operator and the operator of the federal hydroelectric system, published the Columbia River high-water operations study in September 2010. In it, BPA describes how it managed surplus energy events in June 2010 by taking a combination of measures. These included providing zero-cost energy to generators in hopes of displacing higher-cost generation, thereby bringing the supply – demand balance into equilibrium. While helpful, it is likely that market mechanisms that occasionally provide for negative-cost energy will be needed in the future. Such mechanisms are proving very effective in other regions where regional transmission providers rely on market signals to manage generator activity to balance the system.

It is unclear how the region's transmission provider will evolve its practices to reflect the realities of federal and state policies toward renewable energy and the inexorable march toward larger regional transmission systems that rely on market mechanisms to balance and operate the system.

No Northwest Coal? The state of Washington has bound itself by law to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020.[2] Currently, the state is discussing the future of the Centralia coal-fired generation plant. The Boardman plant (located in Oregon) faces significant retrofit investments in order to comply with emission regulations, particularly with regard to mercury. Portland General Electric has agreed to shut down Boardman in 2020, though the regulatory process has not been completed. Though neither plant currently supplies power directly to PSE on a long-term contractual basis, if their operations were significantly curtailed or shut down, PSE and its customers would be affected by the resulting impacts on market prices and regional transmission reliability.

To model the possibility that future regulatory policies could force the closure of the region's coal plants, PSE's analysis in this IRP includes a "No Northwest Coal" sensitivity in which the company also loses access to the Colstrip generating plant in Montana. The absence of regional coal-fired generation plants may cause a scenario where the region becomes "short" energy and capacity. How markets and laws and regulations respond to such events will impact PSE's judgments about whether participating in replacement baseload gas CCCT generation would be least cost for our customers.

CO_2 emissions costs. The consequences of potential CO_2 emissions costs and regulations can have significant impacts on PSE's cost structures, but only a small impact on resource decisions. Emissions charges will increase the cost of fossil fuel-burning power plants and change market power prices, but analysis in this IRP demonstrates that politically sustainable carbon cost policies would probably have little impact on the least-cost mix of resources ultimately selected to meet need. While it no longer seems likely that the federal government will take immediate action to limit greenhouse gas emissions through taxation or a cap-and-trade system, state governments remain active in the arena. It is entirely possible that future policy decisions could increase emissions costs within the 20-year planning horizon.

To capture this uncertainty, the IRP analysis models a range of CO_2 costs that vary from $0.32 to $150 per ton. Increasing the use of renewable resources is only part of the solution. Resources like wind and solar must be backed up with other power supplies

[2] *RCW 70.235.020*

because they generate intermittently, and the back-up generation will most often use fossil fuels.

Fueling electric cars. Seattle is a test market for Nissan's new all-electric vehicle, the Leaf; Chevy introduced the Volt, a plug-in hybrid in 2010; and President Obama has said he wants to pursue policies that will place one million electric cars on the road by 2015. How will electric vehicles affect PSE's resource portfolio? PSE has been working with local governments, companies, and other stakeholders to plan for the infrastructure needs of these vehicles. Meanwhile, this IRP tests how the adoption of these vehicles will affect the company's resource needs, and future IRPs will make adjustments to the vehicle forecast to account for marketplace developments.

3. Resource Considerations

Transmission to market to capture the benefit of regional energy surplus. At this time, the company relies on resources that lie on both the east and west sides of the Cascade Range. Should we become unable to continue to rely on economic supplies from west-based resources, we may have to consider ways to augment transmission access other geographical areas. Such resources could be made available by the regional transmission provider and/or by investment in new transmission lines.

While the company has developed preliminary conceptual estimates of costs to develop or acquire transmission, this is not intended to reflect a specific transmission project. Rather, theoretical incremental transmission is postulated as a means of testing a solution that would make it possible for PSE to access additional market energy on a firm basis. This resource alternative was examined to determine if it should be investigated in more detail during the company's resource acquisition process.

PSE currently uses 1,200 MW of transmission capacity to meet its needs. The company's experience in the market will allow it to assess the potential benefits of access to additional market supplies. These additions could consist of energy purchases from the Mid-C trading hub, purchased power agreements (PPA) secured from an existing resource, acquisition of an existing resource outside of our service territory, or some combination of the above.

Air quality issues on the west side of the Cascades pose significant challenges to the siting of new thermal generation projects, and opportunities are limited and shrinking over time. While the IRP does not explicitly model where a new resource will be developed, it does assume that any new generation can be delivered to its service territory using firm transmission service. If future power plants cannot be built on the west side due to air quality limitations, the incremental transmission hypothesis may become part of the solution for delivering power to PSE's service territory from other parts of the region.

Limited alternatives. Consistent with the 2009 IRP, resource alternatives remain limited. For PSE, market purchases, possibly firmed up for delivery by gas-fired peakers with oil back-up if firm transmission is not available, will be likely to increase. Gas-fired CCCT plants are also potential viable resources, though constructing a new CCCT plant under expected market conditions would be challenging. With respect to renewable resources, PSE has found that wind and biomass are the only practical alternatives for PSE's portfolio at this time. Solar and geothermal resources remain theoretically and morally attractive options, but are not yet cost competitive or capable of attaining utility scale. However, rapid reductions in the cost of solar could alter that assessment in the next decade if they continue. Large-scale expansion of the region's hydroelectric generation portfolio is not likely due to licensing challenges and fish constraints; nuclear generation is not financially feasible and remains vexed by fuel cycle and safety concerns; and coal generation is constrained due to legislative policy and environmental enforcement issues. Limited development of biomass has occurred (and is included in this IRP), but utility-scale renewable options have not yet expanded much beyond wind and solar.

Natural gas. Reliance on natural gas for electric generation will continue to increase for the foreseeable future. Aside from market power plus transmission capacity – and after adding demand-side and wind resources – natural gas-fueled generation (in the form of peaking plants that furnish back-up reliability or CCCT plants that run for energy purposes) appears to be the only viable option for filling resource need.

Gas supplies and pricing. Earlier concerns about supply diversity have been allayed by a dramatic increase in production that has taken place over the past two to three years. The application of horizontal drilling and rock fracturing technologies has made it feasible to recover gas from shale-gas deposits that are widely dispersed across North America. The Marcellus shale in Appalachia, the Fayetteville and Haynesville shale in the Southeast, the Barnett shale in Texas, and shale reserves in the Rockies area all

have significant reserves. Canadian supplies have increased due to production from the Montney and Horn River shales in northern B.C. These supplies are being developed at relatively low costs (less than $5 to $6 per MMBtu).

Gas prices have declined significantly as supplies have increased. For example, the forward market prices for calendar year 2012 declined from about $7.10/MMBtu in March 2009 to about $4.75/MMBtu in January 2011. Over the next several years however, prices are expected to increase due to a number of possible developments. Among them:

- possible carbon legislation,
- coal plant retirements caused by more stringent regulation of SO_2 and mercury emissions,
- the switch from oil to gas by energy-intensive industries if gas prices remain lower than crude oil on a heat-content basis, and
- possible LNG exports.

Transportation and storage. While supplies are abundant now, the natural gas transportation system is likely to come under increasing stress as more and more of the region's electric generation requires natural gas for fuel. Significant additions of gas-fired resources – as with the 2,400 MW of peaking plants added over the 20-year planning period in this IRP – could create unprecedented swings in gas loads on the interstate pipeline system and strain the entire supply chain. Increasing reliance on natural gas is likely to increase the need for gas storage in the future.

Wind. Renewable energy tax and grant incentives may affect the timing and cost of adding wind resources to the portfolio. Generally, the lowest cost strategy to meet the RPS requirements is to acquire RECs as they are needed; however, the presence of expiring tax incentives can make it less expensive to develop new wind resources before the tax incentives expire than it will be to do so after they expire. To incorporate this variable in the analysis – and to examine how to best meet RPS targets while minimizing cost to customers – this IRP tested how different policies regarding the extension of tax incentives affect the cost and timing of additional renewable resources.

Wind Integration. As of December 2010, there is over 4,700 MW of installed wind capacity in the Pacific Northwest including Washington, Oregon, Montana, and

Idaho. Another 11,000 MW of wind is under construction or in various stages of the permitting process.[3] Over 3,000 MW of installed wind capacity is interconnected to BPA's balancing authority. The region trails other parts of the country in implementing market mechanisms to assure efficient and reliable system operations. PSE is actively engaged in the regional dialogue to help advance the adoption of flexible, market-based mechanisms to help assure a flexible, fair and reliable regional transmission grid. PSE is also closely examining its own portfolio to optimize the management of its wind on its own system.

Wind is an intermittent and non-dispatchable generation resource with two primary generating characteristics that present integration challenges: first, the variability in output that results from the natural, minute-to-minute volatility of wind and second, the uncertainty associated with accurately forecasting wind output. While the variability can be managed similarly to managing PSE's load, the unpredictable nature of wind creates additional system uncertainty. The combined uncertainties around wind and load are drivers of the company's need to carry balancing reserves.

Currently, balancing reserves are provided primarily by the company's mid-Columbia hydroelectric assets. As these contracts expire, however, the company anticipates using natural gas turbines more frequently to provide reliable reserves that were formerly supplied by mid-Columbia hydropower. We anticipate more gas turbine starts, more off-peak operation, and potential changes to maintenance schedules. Wind integration is further discussed in Appendix G.

Demand-side resources. The acquisition of demand-side resources is dependent on the decisions of many individual customers to undertake a wide array of actions. These actions can range from installing a compact fluorescent light (CFL) bulb to overhauling a large industrial facility. For example, in 2010 PSE achieved 56,690 MWh of savings from the purchase of 2.3 million CFL bulbs and fixtures by residential customers. In that same time frame, PSE also achieved 76,003 MWh of savings from 872 custom commercial/industrial customer efficiency projects.

Customers may be driven by a variety of motivations: cost savings, comfort, productivity, environmental responsibility, or legal compliance. Barriers to widespread customer adoption of demand-side measures include high first costs, access to information about

[3] *Renewable Northwest Project,* http://mp.org/node/New-Renewables

benefits and costs, convenience, decision timing, unfamiliar technologies, and capacity of the supply-chain infrastructure. Customer decisions are further affected by more "global" factors, such as employment, income, or general industry conditions.

Projecting energy savings available from a specific market or measure in a particular time period is a less than perfect science due to this complexity. Assumptions are made that are simplifications of the real world, particularly around the level and timing of customer adoption of demand-side measures. Actual customer behavior will likely follow a different path than predicted by a planning model.

In addition to general market complexity, PSE, like any utility, must determine how much of the total available demand-side resource potential is within its control to achieve. Generally speaking, demand-side resource potential may be achieved through utility-funded programs, tax incentives, mandated codes and standards, or independently by customers with no utility or government encouragement. The total "achievable" potential may therefore require further screening to determine what can realistically be acquired by utility programs.

Finally, PSE must balance positive and negative customer impacts, regulatory requirements, and financial performance, including lost revenues from reduced sales, in setting its program mix and targets.