

**THE IMPLICATION OF NATURAL GAS SUPPLY,
INFRASTRUCTURE AND SYSTEM OPERATIONS
ON PACIFIC NORTHWEST
POWER GENERATION PROJECTS**

A report prepared for



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THE CHALLENGE AND OPPORTUNITY

The Pacific Northwest has traditionally been one of the most electricity intensive regions of the nation. Growth of electricity demand in the region is expected to continue at a rate of at least one percent annually.¹

More significantly, however, is a major shift that is ongoing in the means of power generation, the types of energy inputs required and the operating characteristics of the electric transmission and distribution systems. The states of Washington, Oregon and Montana have significant renewable portfolio standards, which result in a need for new flexible peaking, regulation, and other ancillary services. The Pacific Northwest hydro system, a reliable supplier of base load and flexible peaking energy, as well as other ancillary services to the region, is no longer able to dependably provide such services.

The *Northwest Conservation and Planning Council* has summarized the reasons for this change in its Sixth Power Plan:

- First, the seasonal patterns of electricity demand in the region are changing as air conditioning use has grown.
- Second, flexibility of the hydroelectric system has been constrained by actions taken to help mitigate for its impacts on fish and wildlife.
- Third, the share of non-hydroelectric generating resources has been growing over the last 40 years and those resources typically do not have the same degree of flexibility as the hydroelectric system.

¹ Sixth Northwest Conservation and Electric Power Plan, Electricity Demand Forecast, February 2010.

- Finally, the region has added significant amounts of wind generation, which is a variable resource and adds to the shaping and flexibility requirements of the power system.²

Against this backdrop, two major coal-fired electric generation facilities in the Pacific Northwest will be closing in the next 8 to 12 years and will be replaced in the region utilizing alternate energy forms, the bulk of which is expected to be natural gas. The states of Oregon and Washington have negotiated the phasing out and closure of the Boardman Plant (2020) and the Centralia Plant (2020 to 2025).

This is where the increased role of natural gas comes into play. Renewables, which in the Northwest principally means wind power,³ require back-up generation to compensate for the intermittent nature of this resource. In addition, aggregate demand growth coupled with coal plant closures will dictate new non-renewal facility additions for both baseload and peaking requirements, along with load shaping. The power sector is increasingly looking to natural gas as the generation fuel of choice to fill the gap where renewables and conservation are inadequate. As a light hydrocarbon, natural gas is attractive due to perceived availability and economic advantages.

In addressing issues concerning the intersection of natural gas and electric generation in the Pacific Northwest, it is advisable to maintain a broad, three-dimensional view. With a clear, unvarnished perspective in the forefront of their thinking, public policymakers, utility planners and others guiding the gas and electric sectors can facilitate sustained development and investment, promote innovation – spurred on by competition – with the result that optimal usage of both energy systems can be achieved.

² Op. Cit., Power Plan, February 2010

³ Approximately 6,000 megawatts of wind power has been installed in Oregon, Washington, Idaho and Montana through 2011.

NATURAL GAS SUPPLY

Less than ten years ago, liquefied natural gas (“LNG”) import facilities were being developed in anticipation of a shortfall in North American supplies to meet growing market demand for natural gas. A stunning and unexpected convergence in seismic, directional drilling and completion technologies has resulted in an unprecedented drilling boom in “non-conventional” shale and tight sand formation. Estimated natural gas recoverable reserves in North America have increased nearly five-fold and the widely respected *Potential Gas Committee* estimates that there are in excess of 100 years of natural gas supplies at current consumption rates.⁴ As a consequence, natural gas commodity prices have collapsed over the past five years to a level where projects are being developed to export LNG. The year 2011 saw the largest single year of growth in U.S. productive capability in history (7%) according to the *Department of Energy’s Energy Information Agency*.⁵

The Pacific Northwest is geographically well situated from a strategic perspective to a number of the most productive and least costly sources of natural gas in North America. Natural gas pipelines that serve the region directly access reserves in such prolific conventional and non-conventional basins as the Rockies, San Juan, Western Sedimentary (Canada), Horn River, Montney, and others. In the longer term, the region will have direct access to the North Slope in Alaska. In any reasonable planning horizon, natural gas supply availability is not an issue in the Pacific Northwest.

⁴ Potential Gas Committee Biennial Report: Estimates of the United States’ Potential Supply of Natural Gas, April 2011.

⁵ U.S. Energy Information Administration: Review of Emerging Resources: U.S. Shale Gas and Shale Oil Play, July 2011.

NATURAL GAS INFRASTRUCTURE

The Pacific Northwest's natural gas infrastructure is currently capable of delivering over 6.5 million Dth/day of gas.⁶ The 48,000 miles of transmission and distribution pipeline serves more than 3.2 million natural gas customers. Many projects have been proposed to further increase delivery capacity. The Ruby Pipeline built by El Paso Natural Gas began operations in July of 2011. The new pipeline stretches from the Wyoming trading hub Opal to the Oregon trading hub Malin and has increased supplies to Northern California, Oregon and Washington by 1.5 Bcf/day.⁷

Although the sluggish economy has reduced the number of proposals, substantial projects all continue to move ahead. According to the *Northwest Gas Association*⁸ active proposals include:

Washington Expansion – Williams' Northwest Pipeline continues to pursue expanded transportation service from Sumas, WA to markets along the I-5 Corridor. The expansion would involve looping sections of 36-inch diameter pipeline with the existing pipeline, plus additional compression at existing compressor stations. Actual miles of pipe and incremental compression added will depend on incremental volume and delivery pattern, but can be readily scaled to meet market demand.

Blue Bridge/Palomar Expansion – Williams' Northwest Pipeline is also working with the current Palomar pipeline project sponsors – Northwest Natural Gas and TransCanada GTN – to develop the Cascade (eastern) section of Palomar in conjunction with an expansion of its existing system. The Cascade section of Palomar would consist of a 106-mile, 30 inch diameter pipeline that would run from TransCanada GTN's mainline in

⁶ A Dth represents a decatherm of natural gas equivalent to one million BTUs.

⁷ A Bcf/day is equivalent to a billion cubic feet a day.

⁸ Northwest Natural Gas Association: 2012 Gas Outlook, May 2012.

central Oregon to a Northwest Natural Gas/Williams' Northwest Pipeline hub near Molalla, Oregon – enhancing delivery capacity to the I-5 Corridor. Palomar would be a bi-directional pipeline with an initial capacity of approximately 300 million cubic feet per day (MMcf/d), expandable up to 750 MMcf/d.⁹ It would be linked to an expansion on the existing Northwest Pipeline system to deliver gas to other markets along the I-5 corridor.

FortisBC Kingsvale-Oliver Reinforcement Expansion – FortisBC and Spectra Energy are considering a 100-mile, 24-inch expansion project from Kingsvale to Oliver, BC to expand service to Pacific Northwest and California markets. Removing constraints will allow expansion of Spectra's T-South Enhanced Service offering, which provides shippers with the options of delivering to Sumas or the Kingsgate markets. Expansion of the bi-directional Southern Crossing system would increase capacity at Sumas during peak demand periods. Initial capacity from the Spectra system to Kingsgate would be 300 MMcf/d, expandable to 450 MMcf/d. Expanded east-to-west flow capability will increase delivery of supply into Sumas to serve the I-5 Corridor by an additional 150 MMcf/d.

In addition to high-pressure natural gas pipeline systems, the Pacific Northwest has substantial in-ground natural gas storage facilities along with LNG manufacturing/storage facilities. Jackson Prairie in Washington and Mist in Oregon are the region's two principal in-ground storage facilities that currently can deliver in excess of 1.7 BCFD¹⁰ on peak on a combined basis and both have expansion potential. There are LNG facilities at Plymouth, Gig Harbor and Swarr Station, Washington; at Newport and Portland, Oregon; at Namps, Idaho and at Mt. Hayes, British Columbia, which have a combined delivery capacity of nearly 1 BCFD on peak.

⁹ MMcf/d represents a million cubic feet/day.

¹⁰ BCFD represents a billion cubic feet a day.

Enhancements in pipeline and storage capabilities are inevitable and will occur regardless of where market demand and competition determines that individual power generation facilities are – or are not – constructed.

NATURAL GAS AND ELECTRIC INTEGRATION

Utilization of natural gas for electric power generation is not a new application, but is growing rapidly across North America due to the increased desirability of natural gas as a fuel on a relative basis. In 2010, 27 percent of natural gas in the region was for electric generation, up from less than five percent 15 years earlier.¹¹ Still, the majority of natural gas consumed in the U.S. is used in direct applications and therein lays the challenge.

Electric generators typically meet peak demands through redundancy of facilities. After all, electricity is essentially delivered instantaneously. In contrast, natural gas providers rely upon interruptibility, storage and pressure fluctuations to manage load variability. It is occasionally suggested that natural gas is a slow traveling commodity; however, this is misleading and can lead to erroneous conclusions regarding integration.

Instantaneous increases in natural gas demand and general daily load variability are managed utilizing pipeline pressure. Pressure is managed through the utilization of “line pack” and altering input sources from production areas, market area storage, LNG, etc. In general, the natural gas pipeline and distribution system is quite elastic and flexible within certain overall capacity parameters.

¹¹ U.S. Energy Information Administration: Natural Gas Year-in-Review, July 2012.

There are principally two issues to be addressed when considering the overall integration of natural gas and increasing demands for gas-fired generation.

The first is communications. Due to the differences in how protocols are designed in their respective industries, essential communications to address varying cycles, fluctuations, and balancing periods between the gas and electric sectors can occasionally be problematic. The issue is now front and center at both the national and regional levels.

In the Pacific Northwest, the Northwest Gas Association and the Northwest Mutual Assistance Group (“NMAG”) are pursuing initiatives to define and enhance industry communication procedures and systems, particularly in regards to wind power integration, reliability and gas supply. NMAG is leading an effort to create “Mutual Aid” coordination between natural gas distribution companies, pipelines and investor owned electric utilities to respond to extreme reliability events that may force outages on either or both energy networks.

The second issue now under the spotlight is the ability to provide natural gas on a near instantaneous basis to electric generation facilities that assist with load following and shaping, especially when demand appears on an “intra-day” basis, out of cycle with little notice.

The issue recently surfaced in connection with the Request For Proposals (“RFP”) released by Portland General Electric (“PGE”).¹² Portland General Electric is seeking to secure via contract, acquire or self-build, additional baseload and peaking generation to meet load growth, assure sufficient capacity, and integrate wind power. Implicit in the RFP are PGE’s assumptions that the natural gas system lacks intra-day scheduling and operating flexibility; that incumbent gas pipeline assets and contractual arrangements are unlikely to be of

¹² Portland General Electric Company: Power Supply Resources, June 8, 2012.

substantial benefit and that pipeline expansion is required to support new “firm” electric generation requirements when they are most needed.

With regard to natural gas system flexibility, there are several observations worth highlighting. The Pacific Northwest has access to multiple producing basins in the U.S. and Canada as discussed herein. There are multiple pipelines that access these resources that ultimately connect to a single pipeline system that serves Western Washington and Western Oregon (among other areas). That pipeline is Williams’ Northwest Pipeline GP (“Northwest”). Local distribution companies (“LDCs”), such as Northwest Natural Gas Company and Puget Sound Energy are sanctioned monopolies regulated by state utility commissions. Both LDCs are connected to the Northwest Pipeline GP while maintaining their own discreet pipeline and storage resources/assets dedicated to serving their customer base. The principal difference is that, as a “Contract Carrier” regulated under federal law, Williams, like TransCanada GTN, offers service on all wholesale basis without regard to end use.

In a letter sent to Accion Group, the Independent Evaluator overseeing Portland General Electric’s RFP process, Williams’ Northwest Pipeline described its system operations and capabilities as follows:

“As you may be aware, Northwest has served the major market areas in the Pacific Northwest reliably for over 55 years. Our system has over 3,900 miles of bi-directional pipe with a peak design capacity of 3.7 Bcf/d and is directly connected to four gas storage facilities with a total storage capacity of over 90 Bcf (approximately 2 Bcf/d of deliverability). We are conveniently situated in the Pacific Northwest with access to supply in British Columbia, Alberta, and several supply basins in the Rocky Mountain area. The bi-directional nature of our pipeline provides the Portland area with two supply path options: 1) from the northern section of our pipeline originating at the Washington/Canadian border and 2) from

the southern section of our pipeline originating in the Rockies/San Juan area. This system design, along with our postage stamp rate structure and flexible business practices, allows our customers the opportunity to ‘shop’ for gas supply from the numerous receipt points on our system based on price.”¹³

While it is an LDC, Northwest Natural’s own system of pipelines and storage facilities, to a great extent, competes with Williams’ Northwest Pipeline to provide firm and interruptible services to electric generation facilities. Northwest Natural’s potential expansion of its Mist Storage Field offers a very attractive opportunity for “sister” regulated utilities such as PGE to add storage capacity to support its fleet of operating – and proposed – gas-fired generators. In negotiating a significant storage position with PGE for its overall generation fleet, Northwest Natural has been able to offer PGE attractive storage terms; terms not available to those requiring a much less substantial storage position. The Federal Energy Regulatory Commission’s Part 284 contract that is the likely basis for an agreement between the PGE and Northwest Natural provides considerable balancing flexibility without day-ahead scheduling. Notably, the same operational flexibility – in functional terms – is also imbedded in the region’s NAESB¹⁴ day-ahead gas procurement schedule protocols. As a consequence, Portland General’s requirement of intra-day storage capability as required in its RFP is not, in operational terms, decisive. In short, the requirement will not affect the ability of a gas-fired generator to reliably dispatch electricity on demand.

The overall operating flexibility of the natural gas pipeline and distribution system in the Northwest is robust and exceeds what is made apparent through rate and tariffs. Adjustment in rates, tariffs and protocols going forward are likely to be made to support new electric generation baseload and peaking projects. In

¹³ Letter to Accion Group, Independent Evaluator, Lynn Dahlberg, Director Marketing Services, Northwest Pipeline GP, February 22, 2012

¹⁴ National Energy Standard Board

addressing this specifically, Williams' Northwest Pipeline stated in its letter to the Independent Evaluator:

“Northwest currently serves directly or indirectly over 25 gas-fired power plants with a total potential capacity of nearly 6,000 MW (which represents a potential gas load of approximately 1 Bcf per day). Power plants that are directly connected to us hold approximately 400 MDth/d of firm capacity (some power plants are served by third parties that hold the pipeline capacity). We have served these power plants reliably for many years. We understand that power plants can be unpredictable as to their gas needs throughout each day. Our gas control department (which handles the physical dispatch of gas) works closely with power plants, under the communication protocols of FERC Order 698 to manage gas needs that fall outside of the typical NAESB gas day cycles. When a plant needs to ramp up unexpectedly, our customers have been able to burn what they need and arrange to pay us back after the end of the gas day by utilizing either storage on our system, our Park and Loan services, or arranging a payback/makeup schedule with our schedulers. Our current communication protocols and operating procedure should allow for the intra-day gas scheduling flexibility required by Portland General Electric in the Capacity RFP.”¹⁵

In developing this report, the authors specifically asked Northwest Pipeline to what extent its tariffs and operating parameters can accommodate electric power generation requirements. Northwest Pipeline responded that it has services and system operating characteristics that are designed to address the load variability characteristics and reliability requirements of high-volume end users such as electric generators and industrial end-users. For instance, no uniform hourly flow rates under normal operating conditions have been enforced and shippers are allowed 45 days to correct an imbalance. Additional flexibility is

¹⁵ Op. Cit., Dahlberg letter.

granted to transporters who also have access to storage, such as at Jackson Prairie, by allowing more frequent adjustments on an intraday basis. End-user friendly product offerings include a "Park and Loan" option coupled with "Banking and Drafting" services which essentially allow a shipper to manage its variable flows with a significant of flexibility. These types of offerings are not widely understood. One example is Portland General Electric's current RFP, where the utility asserts the natural gas system lacks intra-day scheduling and operating flexibility.¹⁶

Expansion of pipelines in the region whether developed by LDCs or common carriers is inevitable to serve growing natural gas demand overall including the addition of new electric generation. Whether new electric generation is owned by Investor Owned Utilities ("IOUs") or Independent Power Producers ("IPPs") is irrelevant to how the natural gas system expands and evolves. On this matter, Northwest has clearly explained that:

"Northwest stands ready to accommodate any requests for new transportation through a combination of available capacity and/or new expansion capacity. We have reviewed our major customers' integrated resource plans, modeled the potential gas load of the Portland General RFP, and run a series of high level studies. Based on reasonable design assumptions, we have the potential to utilize a combination of new and existing firm capacity to serve both the capacity and energy resources contemplated in this RFP process, with rates as low as our maximum tariff rate for firm transportation. The exact rate will depend on the supply source chosen by the customer (generator) and the size and location of the potential power plant(s)."¹⁷

¹⁶ Op. Cit., Portland General Electric.

¹⁷ Op. Cit., Dahlberg letter.

CONCLUSION

As the region's natural gas and electric power sectors move forward, we offer the following conclusions by way of guidance.

- Natural gas availability and affordability in any reasonable planning horizon is not an issue.
- The natural gas delivery system is far more flexible and adaptable than is commonly understood.
- Expansion of pipeline, distribution and storage resources is inevitable and not dependent upon how ownership of any specific power generation project is structured.
- Optimization of the design and integration of new electric generation projects will require the utilization of existing physical and contractual natural gas assets in combination with new facilities.
- Increased competition in both the natural gas and electric generation segments will drive costs lower and reliability higher. Diversity of asset ownership can only be accomplished if access to incumbent pipeline, storage, transmission and distribution resources are encouraged and facilitated.
- Cost to consumers will be lowered and the operational efficacy of new gas-fired electric generation will be enhanced when incumbent utilities allow for cost sharing, asset sharing and sourcing such as "tolling."

Coupled with its low-cost, vintage hydroelectric capacity, the Pacific Northwest also enjoys secure access to diverse, abundant and now inexpensive natural gas resources. This enviable infrastructure is unique in North America and provides a foundation for sustained growth while meeting new challenges such as wind power integration.

ABOUT THE AUTHOR

Rick Harper has been in the energy business for over 40 years. Among other things, he has served as President, ARCO Gas; Senior Vice President of Northwest Natural Gas Company; Assistant to the President of United Gas Pipeline Company; and CEO of CANOR Energy Ltd (a fully integrated Canadian oil and gas exploration and production company).

He is presently Principal and Managing Director of Energy of Business Consulting Associates with offices in Houston, Texas and Portland, Oregon. The firm provides services to clients domestically and internationally, which include various industrial, utility, legal, and government entities along with private individuals. In the region, he has served in an advisory capacity to the Northwest Industrial Gas Users Association and the Northwest Conservation and Planning Council, among others.