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October 2, 2018

MEMORANDUM

TO: Council Members

FROM: Steven Simmons

SUBJECT: Gas-Electric Interface Study

BACKGROUND:

Presenter: Steven Simmons

Summary: The power system in the Western Interconnection is undergoing a transformation. Coal and nuclear power plants are set to retire across the West through 2026, while at the same time significant additions of renewable resources such as wind and solar are being added. As a result, in the near term the electricity grid is expected to become more dependent on natural gas to provide both baseload power and quick ramping capability.

As the grid becomes more reliant on natural gas-fired generation, concerns have been raised about the gas-electric interface; especially in light of the impaired operation of the Aliso Canyon gas storage facility. The WECC recently commissioned a study on the Gas-Electric interface to assess the impact of potential disruptions on the gas system. The study found that the Desert Southwest and Southern California regions are extremely sensitive to disruptions to the gas system, while the Northwest is much more resilient because of a robust natural gas system build-out including interconnected pipelines and storage.

This presentation will review recent power related consumption patterns of natural gas in the Northwest, provide a review of the key regional gas infrastructure, and summarize the results of the WECC Gas-Electric Interface study, especially in how it pertains to the Northwest.

Relevance: Gas-fired generation in the Northwest is expected to increase over the next several years and play a more significant role as a source of baseload power and renewable integration. As such, natural gas and the associated infrastructure may play an increasingly key role in future electricity pricing and electric reliability for the region.

Workplan: A.3 Forecasting and Economic Analysis, A.4 Generation Resources, A.5 System Analysis

Background: In 2017, WECC commissioned a study to assess future Gas-Electric Interface. A team from Wood Mackenzie, E3 and Argonne National Lab was selected to perform the study, with the help of a Technical Advisory Committee, which included staff from the Council. The final report was published in June of 2018.

More Info: For a more in-depth read of the WECC study, the final study report and presentation is available at <https://www.wecc.biz/SystemAdequacyPlanning/Pages/Gas-Electric-Interface-Study.aspx>

Gas-Electric Interface Study & Northwest Natural Gas Infrastructure

Steven Simmons
Power Committee Meeting
October 9, 2018

Agenda

- 1. Key Points**
- 2. Natural Gas in the Northwest**
 - a. Consumption**
 - b. Infrastructure**
- 3. WECC Gas-Electric Interface Study**

Key Points

1. The Power System both in the West and the Northwest – is expected to be increasingly dependent on natural gas through 2026
2. The Northwest has a robust and reliable natural gas system
3. The loss of the Aliso Canyon Storage Facility in Southern California has exposed vulnerabilities in the gas-electric interface

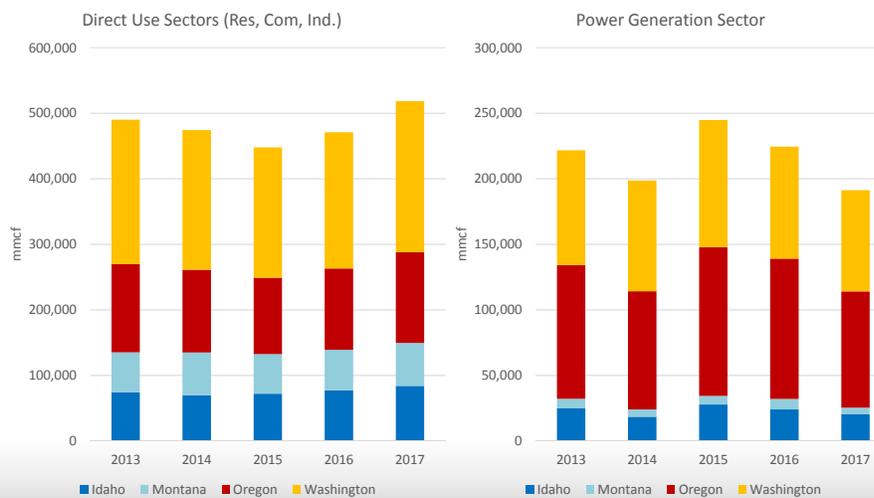
Gas-Electric Interface Study

NATURAL GAS IN THE NORTHWEST

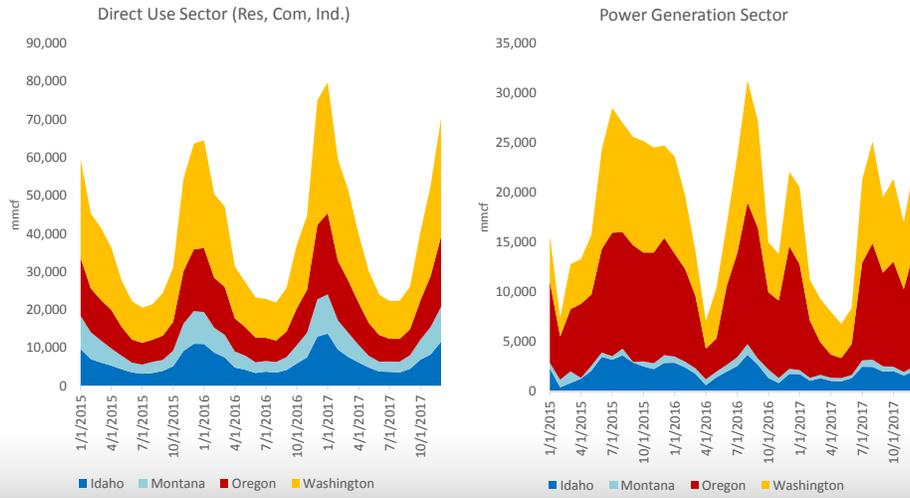
Gas Consumption

1. Annual gas consumption over the last 5 years in the Northwest has averaged 696, 329 mmcf
 Power Gen Sector accounts for 31 % – 216,155 mmcf
2. Power Gen gas consumption varies based on electricity demand, and hydro and renewable generation conditions
3. Overall gas consumption in California is over 3.1 times that of the entire Northwest and Power Gen gas consumption is 3.5 times

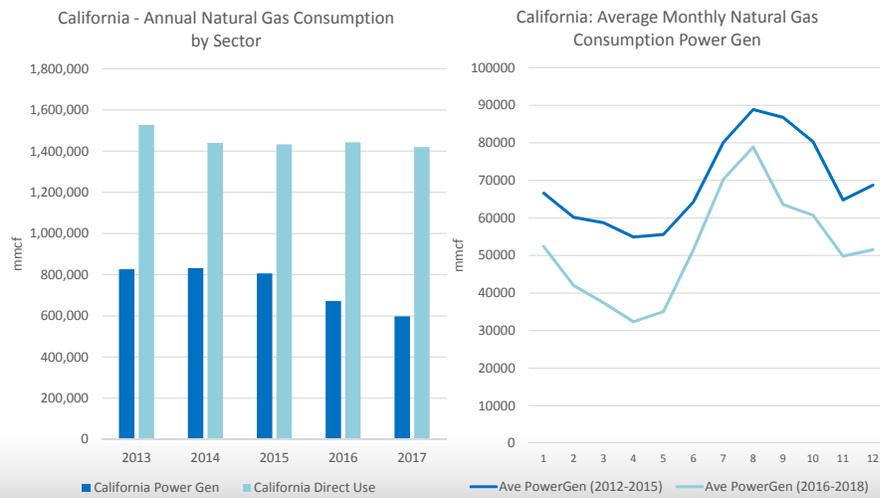
Annual Natural Gas Consumption in the Northwest



Monthly Natural Gas Consumption in the Northwest



Gas Consumption in California





Pipelines & Storage

Gas Transmission Northwest Pipeline (GTN)	Williams Northwest Pipeline (NWP)	Northwest Storage Facilities - bcf	
TransCanada	Williams	Jackson Prairie	25
612 mile long pipeline	3,900 mile long pipeline system	Mist	16
Primary path for WCSB* gas to reach the Northwest markets and beyond	Connects to three basins – WCSB*, US Rockies, and the San Juan basin	Plymouth (LNG)	2
Kingsgate BC/ID border to Malin OR/CA border	Sumas BC/WA border to CO/NM border	Southern California Storage Facilities – bcf	
		Aliso Canyon	86 (currently at 24)
		Honor Rancho	27
		La Goleta	20

* Western Canadian Sedimentary Basin

Gas-Electric Interface Study

WESTERN INTERCONNECTION GAS-ELECTRIC INTERFACE STUDY

Study Background

How vulnerable is power system reliability in the WECC to natural gas supply disruptions?

To find out, WECC commissioned a study beginning in September of 2017.

- A team of **Wood Mackenzie, E3, and Argonne National Lab** was selected to lead the study, along with various Gas and Electric stakeholders
- Final report issued in June 2018

Study Background

The base forecast used in the study is the 2026 WECC Common Case. Between 2017 and 2026:

1. Full decommission of Aliso Canyon
2. Steady retirement of coal & nuclear
3. Significant additions of wind and solar
4. 7% increase in load
5. 30% increase in gas burn for power gen

Modeling Work

- Simulate disruptions to gas flow – via pipeline ruptures or supply restrictions from winter “freeze-offs” and earthquakes
- Allow the gas and electric systems to attempt to compensate in order to meet load and reserve requirements
 - Gas Storage & linepack
 - Gas Pipeline interconnects and firm contracting, LDCs
 - Alternative sources of electricity generation
 - Power imports from other regions via transmission
- Measure any unserved energy demand and unmet spinning reserves

Modeling Work

Required coordination of multiple models

- Aurora – EPIS, electricity forecasting and analysis tool
- NGFast – Argonne National Lab, simulation tool for assessing the impact of pipeline disruptions
- GPCM – Wood Mac, Gas Pipeline Competition Model, gas flows and prices

Disruption Scenarios & Results for the Northwest

Scenario	Details	Time of Year	Sensitivity	Results
Disruption on a PNW Pipeline	Rupture on GTN at or around Kingsgate (BC/ID border)	December	Average Hydro	0 unserved energy & spinning reserves
			Low Hydro	0 unserved energy & spinning reserves
Seismic event disrupting Alberta gas supply	M6 plus earthquake in the Rocky Mountain House area restricts supply	December	Average Hydro	0 unserved energy, 59 GWh unmet spinning reserves
			Low Hydro * Lowest event probability in the study	1 GWh unserved energy, 70 GWh unmet spinning reserves

The Northwest is more resilient to natural gas disruptions than other regions

1. Gas system compensation

- a) Multiple pipelines with interconnections and multiple supply basins**
- b) Market area gas storage available**
- c) Lean on Utility and LDC firm contracts**

2. Electric system compensation

- a) Other generation sources in the region – such as hydro**
- b) Imports available from western grid**

Issues in Southern Cal & Desert Southwest (DSW)

- **The SoCal & DSW regions are highly susceptible to pipeline disruptions in the DSW – due to reliance on a few long-haul pipelines and limited storage – scenario results in 438 GWh of unserved energy**
- **More likely events such as winter “Freeze-Offs” in the Permian and San Juan supply basins result in unmet spinning reserves – the system is right on the edge**

Themes

- Value of gas storage and pipeline interconnections
- Firm pipeline contracting
 - Some utilities in the NW and Rockies have firm contracting for full coverage
 - CA does not – due to state gas protocol that curtails power generation from gas first – causes a lack of incentives for upstream firm contracting & expansion
- Electricity generation from a variety of sources, and available transmission
- Loss of flexibility (Aliso Canyon) at the same time that Southern Cal needs more flexible ramping due to the Duck Curve

Further Information

WECC Study

<https://www.wecc.biz/SystemAdequacyPlanning/Pages/Gas-Electric-Interface-Study.aspx>

NWGA Outlook

<https://www.nwga.org/gas-outlook/>

EIA – Natural Gas

<https://www.eia.gov/naturalgas/>