

# Double Squeeze

How the Arctic Express and  
natural gas constraints  
are turning the West Coast  
gas and power markets  
upside down



**NW Energy Coalition**  
*for a clean and affordable energy future*

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March 6, 2019  
*Work in progress – updates and  
refinements will be incorporated.*

## Pacific Northwest–Pacific Southwest Intertie



*The Third AC Intertie, which includes components constructed by both Northwest and California utilities, appears in orange. It was energized in 1993, not long after utilities doubled the capacity of the DC line, which extends from The Dalles, Ore., to Los Angeles. Together, these transmission lines make up the largest single electricity link in the United States.*

Bonneville PowerAdministration

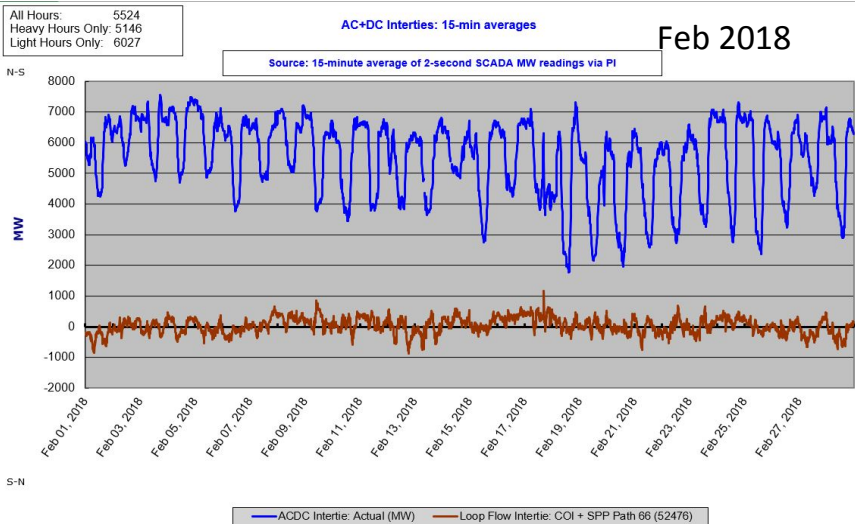
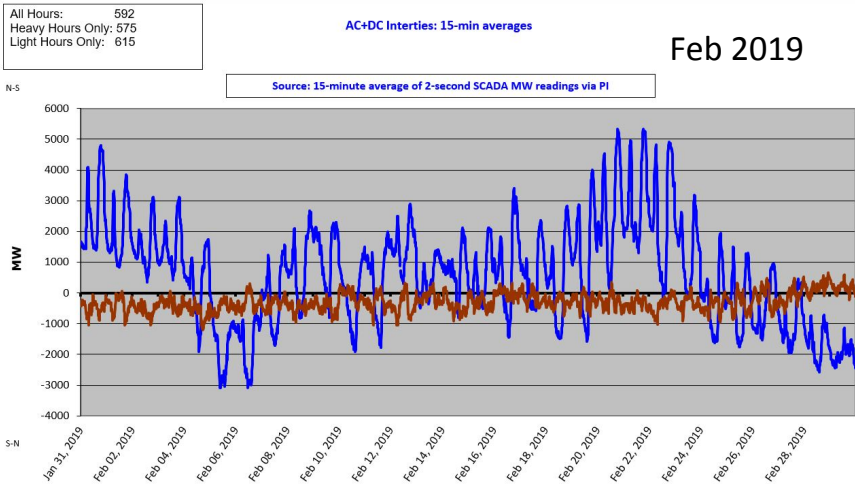
## This story begins with a mystery . . .

- The Pacific Intertie is one of the longest electric power corridors in the world.
- The two AC Interties carry up to 4800 MW of power. The DC Intertie carries up to 3200 MW (north-south) and 1000 MW (south-north).
- Since the 1990s, power has almost always flowed only north-south. That changed on February 4, 2019.



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## February 2019 was unlike February 2018 or any other recent February



- On February 4, 2019, power on the combined Pacific Interties began flowing south-to-north at levels not seen in decades.
- On February 5, S>N flows exceeded 3000 MW and continued high at intervals throughout February and into March.
- In most years, late winter Intertie flows are strongly N>S as Northwest hydro generation ramps up to meet winter demand and to lower reservoir levels ahead of the spring snowpack runoff.
- For example, in February 2018 Intertie flows almost never went below 2000 MW.
- What caused a 5000 MW swing in 2019? BPA told NWECC that it is a matter of power market conditions – that is indeed the case.
- What follows is an exploration of those market forces and what they mean for the Northwest.

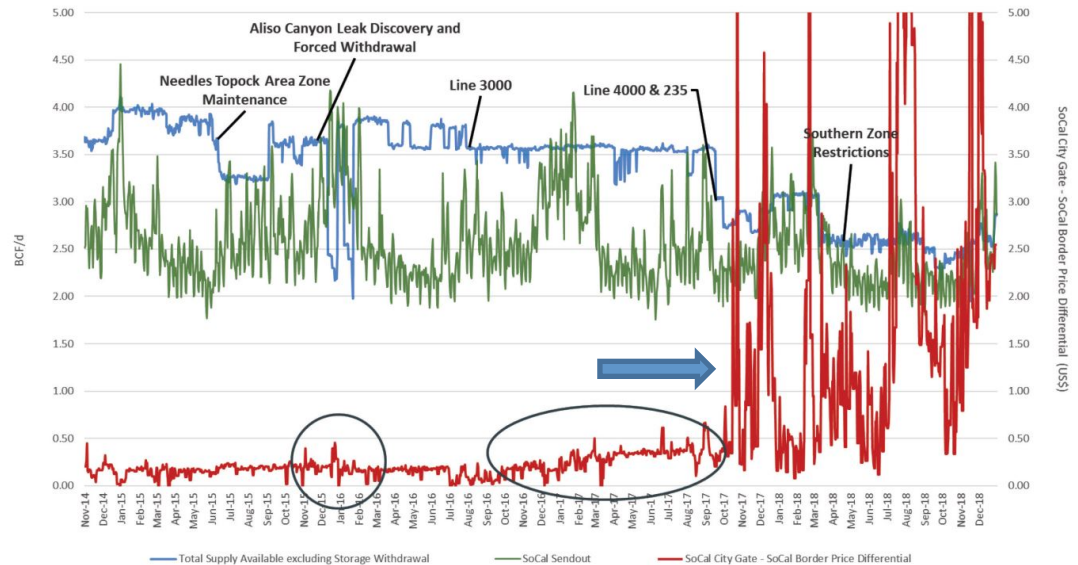
-- Bonneville Power Administration



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# Act 1: Southern California gas and power markets

- In October 2015, the Aliso Canyon gas storage facility in northwest Los Angeles County, the largest on the west coast, had a major well failure and was mostly shut down.
- Subsequently, several desert pipelines supplying gas to southern California had failures and were also restricted.
- When Lines 4000 and 235 were restricted in October 2017, the combined constraint on gas flows into the basin and storage at Aliso caused prices at SoCal CityGate to oscillate when demand rose near total physical supply.



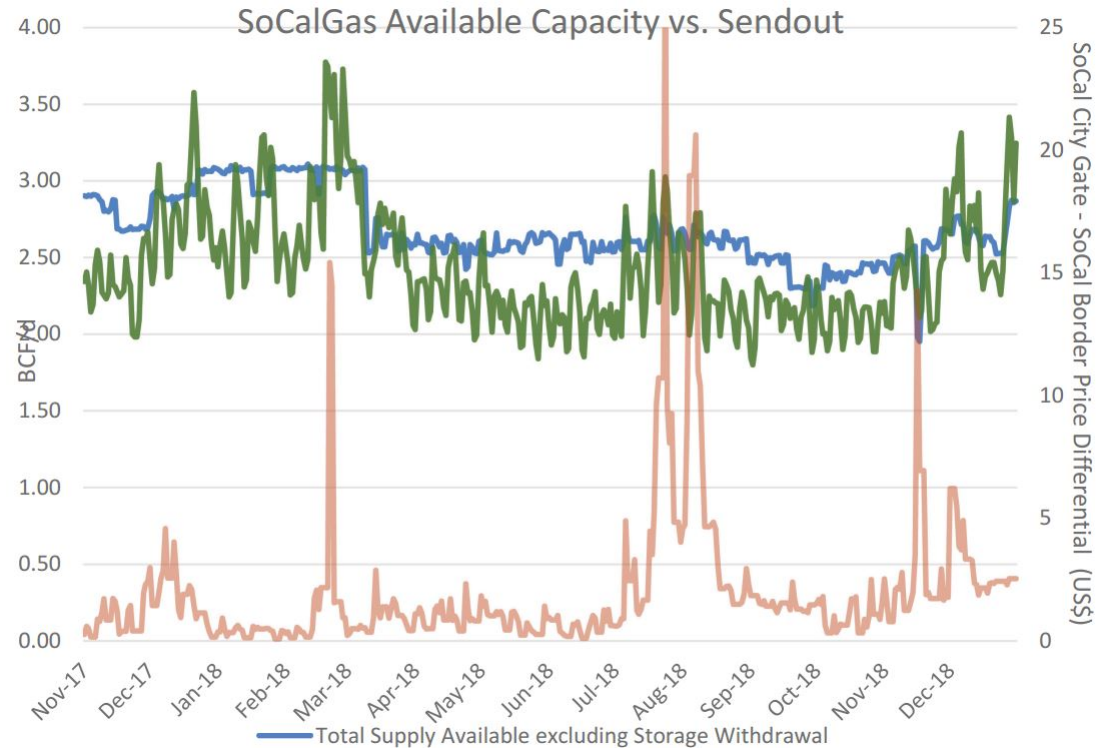
--Indicated Shippers and The Energy Producers and Users Coalition, 1/25/2019, California PUC Docket 18-IEPR-03

Left axis – gas flows (green), available supply (blue)  
Right axis – SoCal Border and SoCal Citygate price differential (red)



# Reduced supply drove price increases

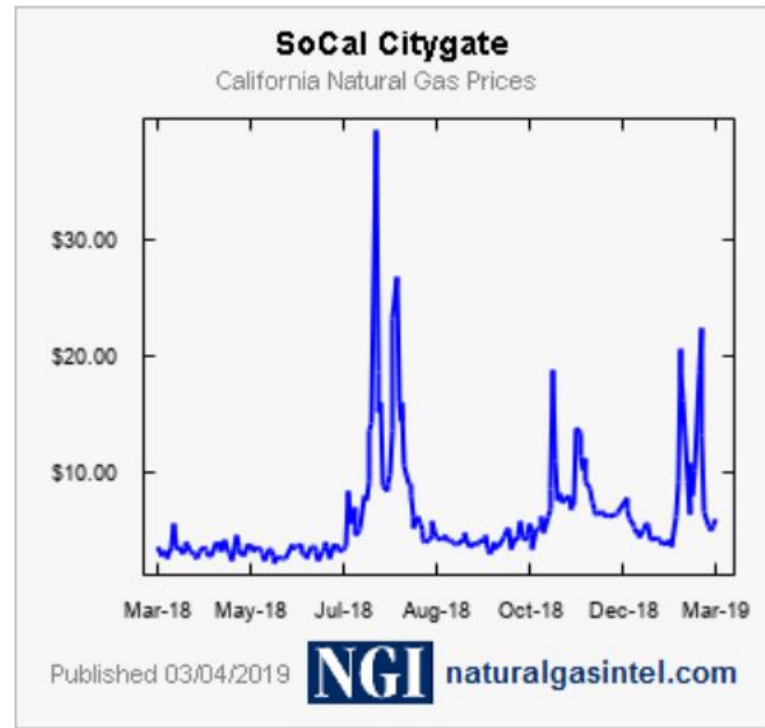
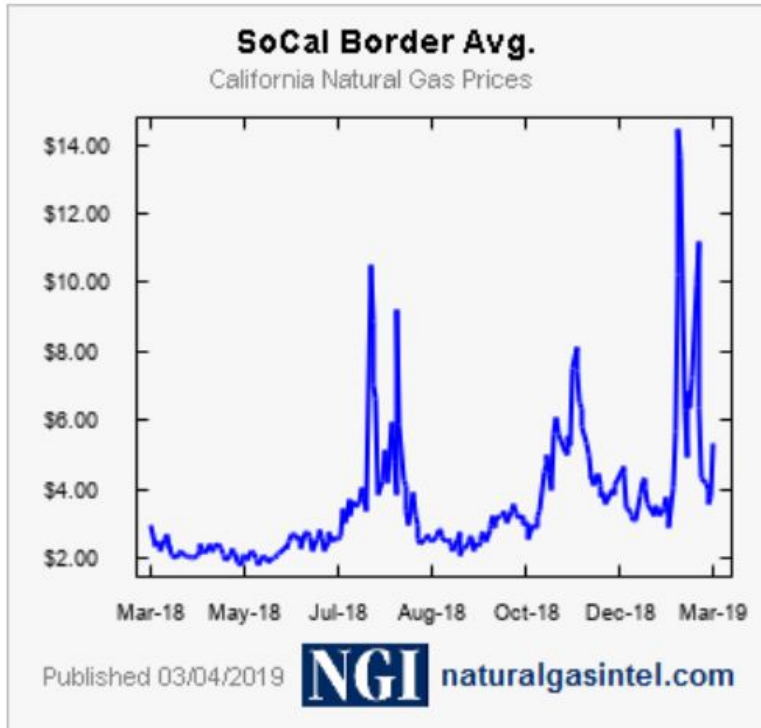
- Since October 2017, during very cold and hot weather conditions, demand (green line) has exceeded supply (blue line) – leaving Southern California dependent on the reduced Aliso storage and other smaller facilities. This spiked SoCal Citygate gas prices (orange line).



--Indicated Shippers and The Energy Producers and Users Coalition, 1/25/2019, California PUC Docket 18-IEPR-03



# But, prices rise at different rates in different places



- Over the last year, while gas prices at SoCal Border rose moderately (left scale = \$15/mmBtu), SoCal Citygate rose much more (left scale = \$40).



# System constraints contribute to price differences

Figure 2 Electric Generation Plants Served by Aliso Canyon



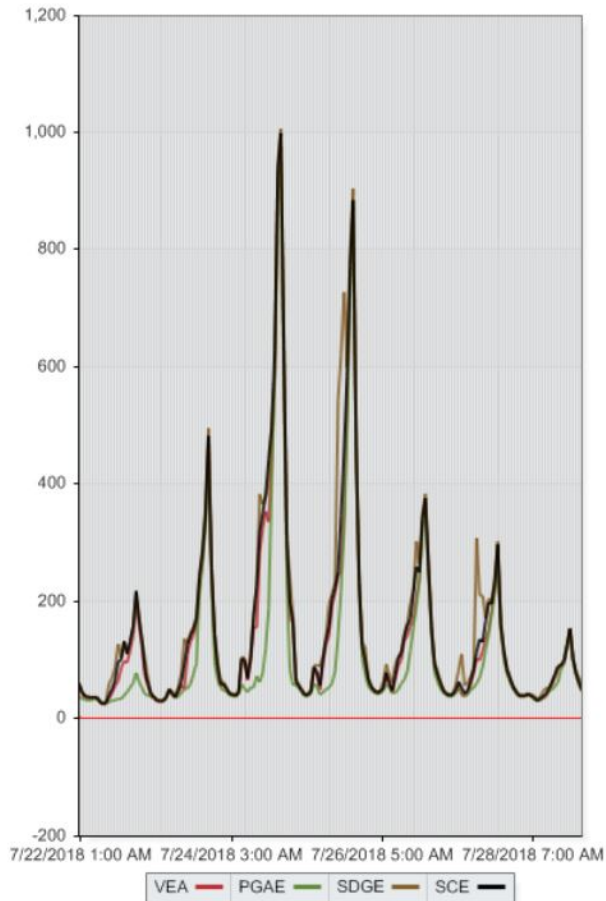
- Aliso Canyon is part of the delivery network for 17 large natural gas power plants with over 9000 MW of capacity in the LA Basin.
- With desert pipeline and Aliso Canyon constraints, gas power plants had little choice during the late July 2018 heat wave and had to pay super-high prices for gas . . . and recover those costs in the power markets.

--Aliso Canyon Risk Assessment  
Technical Report, April 2016



# Natural gas power plants transmit local gas price spikes to the western region at the speed of power markets.

CAISO (California ISO)  
Day-Ahead Price



Source: CAISO

- In the last week of July 2018, a heat wave hit southern California and gas and power prices both spiked.
- There have always been summer heat waves. What happened this time?
- Many gas power plants buy supply at SoCal Citygate and then sell into the California ISO Day Ahead Market (DAM). They have to recover their gas costs, thus the market clearing price is usually set by a less efficient gas plant. The normal price range for the daily peak hour is about \$40 to \$80/MWh, reflecting gas prices in the \$3 to \$4/mmBtu range.
- But with reduced pipeline flows and Aliso Canyon constraints in late July, the gas market hit a critical point and as seen in a previous slide, SoCal Citygate prices went from under \$5 to above \$20/mmBtu.
- With SoCal Citygate above \$20, the CAISO DAM spiked up above \$900, and the impact spread across California and the west.

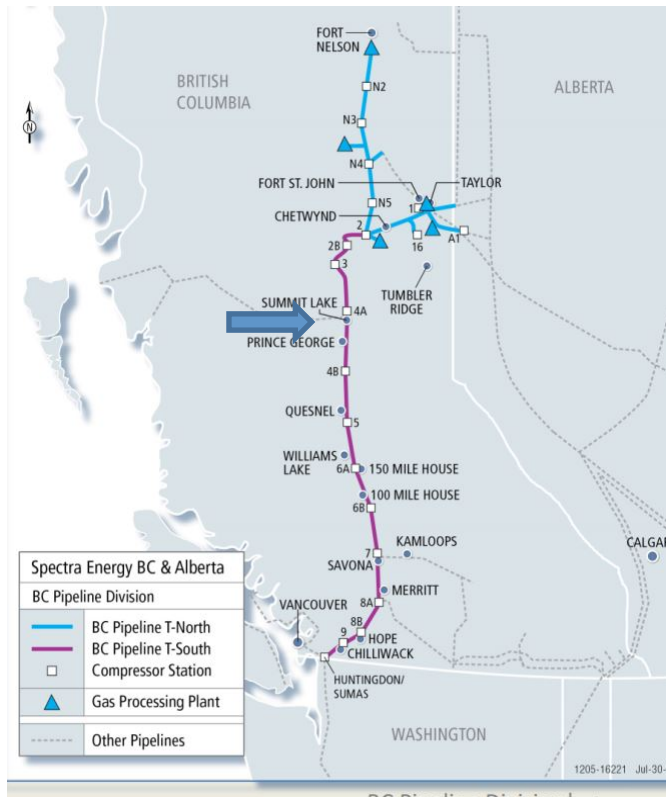
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*EnergyOnline.com*



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# Act 2: British Columbia Pipeline break



- The main BC gas pipeline system is operated by Westcoast Energy Inc. (WEI), a unit of Spectra, in turn owned by Enbridge.
- On October 9, 2018, the 36-inch gas pipeline from northern British Columbia to Huntington, BC and Sumas, WA had an explosion north of Prince George.
- Both parallel lines in that area were taken out of service, creating an immediate gas supply emergency for the BC Lower Mainland, Vancouver Island and western Washington.
- The 30-inch line was returned to service in a few days, and the 36-inch line received temporary repairs and was brought back online with gradually increasing capacity ahead of the winter heating season.
- Prices on both gas and power markets, especially the Mid-Columbia (Mid-C) trading hub, zoomed upward until the interior BC gas flow resumed.



# The gas squeeze on Puget Sound

**Figure C1. Northwest Infrastructure and Capacities (MDth)**

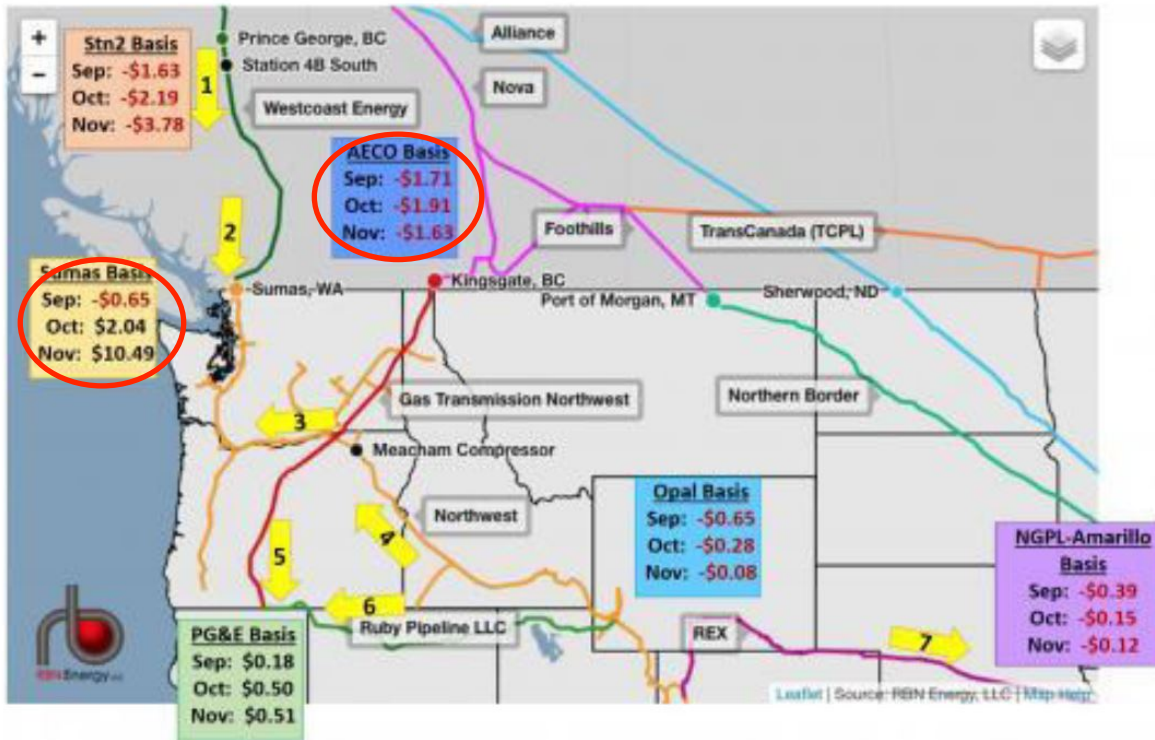


-- Northwest Gas Association

- While British Columbia is heavily dependent on gas for direct use (heating, cooling, water heating, industrial), there are only a handful of gas power plants.
- The Puget Sound region on the US side has several important gas power plants the Northwest depends on through the winter season.
- In October 2018 after the BC pipeline break, gas was rerouted to the Puget Sound area via the Columbia Gorge, Portland and the Jackson Prairie gas storage field.
- In mid-winter, with peak heating demand across the Northwest, backup gas supply from Portland northward is very limited.



## The gas squeeze on Puget Sound - 2



-- RBNEnergy.com

The same kind of gas hub pricing disparity as seen in southern California since 2017 has now emerged in the Northwest. In October and November, following the BC pipeline rupture, AECO (Alberta) gas prices declined because gas fields could move less supply to the Northwest market. On the other side of the constraint, Sumas prices zoomed upward, and Mid-C power market prices followed. Since November, the WEI pipeline returned to less than full capacity service.



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## Reduced BC gas supply and high demand squeezes Northwest power markets

HISTORIC PRICES (ICE HLH month average)	Nov	Dec	Jan	Feb
2018/19 Mid-C Prices in \$/megawatt-hour	53.82	51.28	32.14	91.85
2017/18 Mid-C Prices in \$/megawatt-hour	26.06	27.44	22.51	21.42

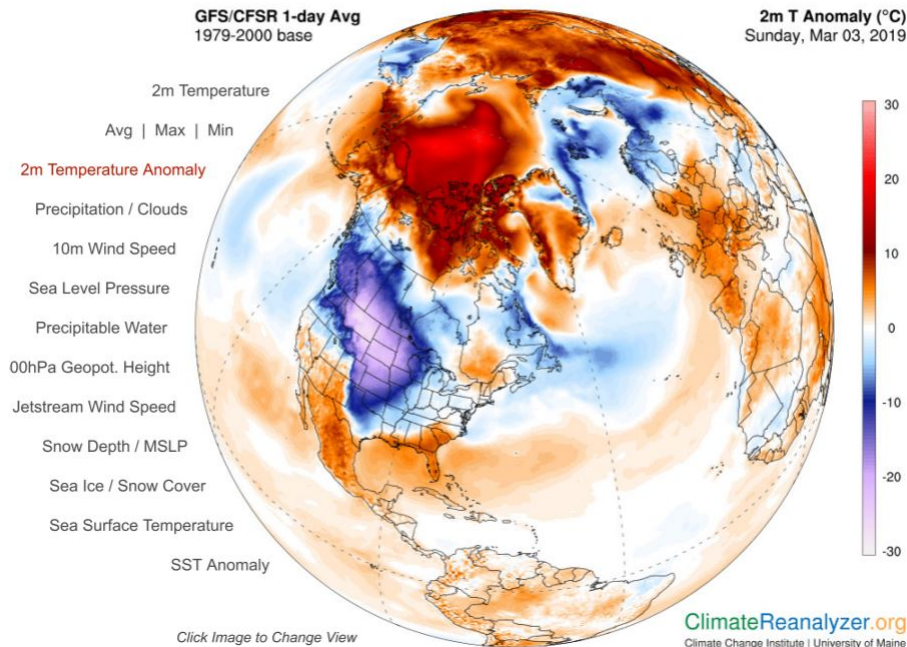
--BPA Power Operations Report, March 2019

- In October and November, with diminished BC gas supply, the power markets in the Northwest, especially the Mid-Columbia (Mid-C) trading hub, trended substantially higher.
- With mild temperatures in January, prices came down closer to normal levels, while reflecting lower than normal snowpack and hydro generation.
- Prices were sharply upward through February with the onset of the Arctic Express.
- Once again local gas prices are being transferred to regional electric prices “at the speed of power markets.”



# Act 3: Arctic Express

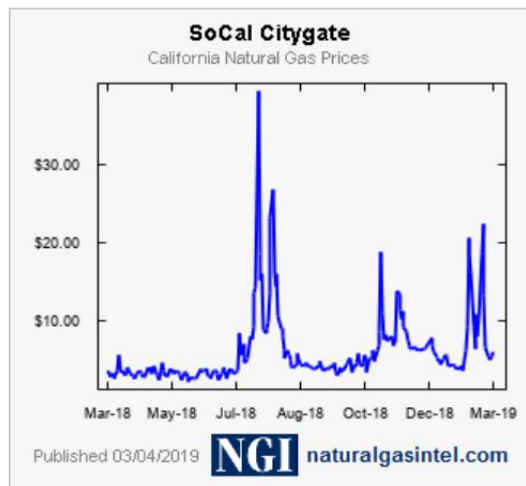
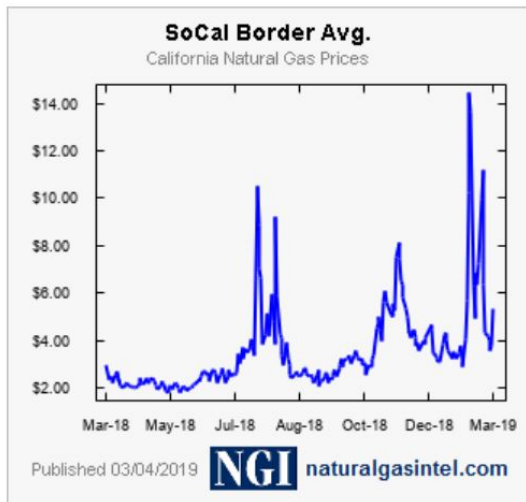
## Today's Weather Maps



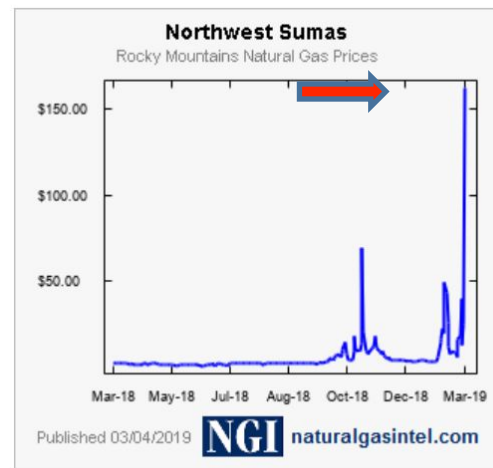
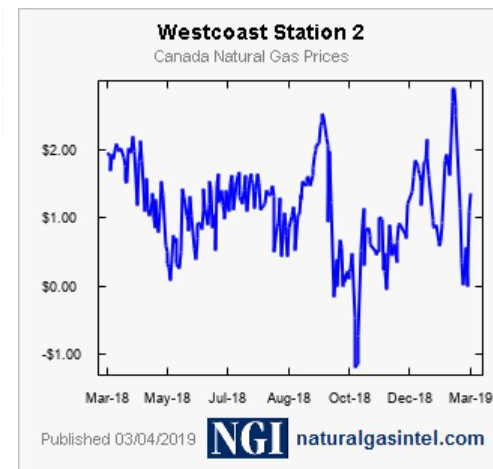
- A major heat dome over Alaska and the western Arctic is causing weather disruptions around the world.
- The headlines call this the “polar vortex,” but the polar vortex always exists. Normally it contains very cold air within the Arctic region, but new and persistent blocking patterns associated with extended very warm periods in the Arctic are displacing cold air southward.
- The current Arctic Express began in late January with an enormous wave of cold air hitting the midwest and east.
- The cold air then moved westward and has been centered over Alberta and Montana for the last month.
- Temperatures have also periodically been very cold in southern California.
- This has resulted in gas and power market disruptions even larger than July 2018.



## Gas Market Hub Prices during the 2019 Arctic Express



- In February, gas prices in southern California and the Northwest reflected the local weather from day to day. When it was very cold in either region, prices spiked upwards -- over \$20/mmBtu at SoCal Citygate in mid-February, and to \$30 at Sumas.
- On March 1, with cold to super-cold weather across the Northwest, Sumas prices for gas delivery on Saturday, Sunday and Monday reached extraordinary levels over \$150/mmBtu, while Westcoast Station 2 in northeast BC, with no ability to send additional gas south, traded around \$1.
- The Mid-C power market exploded to nearly \$900/MWh.





ELECTRIC POWER — 01 Mar 2019 | 20:29 UTC — Houston

# Mid-Columbia spot on-peak power price reaches nearly \$900/MWh, hits over 18-year high

*The Platts story notes:*

- Mid-C peak (high load hour) prices for Monday, March 4 traded at \$890/MWh (normal this time of year is around \$30).
- Sumas gas prices traded at \$152/mmBtu for Saturday-Monday; the previous record of \$66 was set during cold weather in November when the WEI pipeline was still coming back to full capacity.
- WEI capacity at Sumas is set to drop for maintenance from March 4-6.
- *Other press reports indicate a reduction in output at the Jackson Prairie underground gas storage facility near Chehalis, WA.*
- *Because gas power plants won't operate with super-high gas prices when they can't cover those costs in the power markets, power supply in the Northwest becomes constrained and Mid-C prices have gotten double squeezed.*



# BPA NEWS

PR 04-19

BONNEVILLE POWER ADMINISTRATION  
FOR IMMEDIATE RELEASE: Friday, March 1, 2019  
CONTACT: Mike Hansen, 503-230-4328  
or 503-230-5131

## **Northwest energy supplies tight, consumers asked to conserve electricity**

**Portland, Ore.** – Unseasonably cold temperatures, low stream flows for hydropower production, transmission import constraints and high natural gas constraints are putting pressure on the regional electricity system. BPA is taking steps to increase power supplies and reduce consumer demand to keep the federal power system operating smoothly and support regional reliability.

“It’s always a good idea to use electricity wisely, and it’s even more important when supplies are tight,” says Elliot Mainzer, BPA administrator.

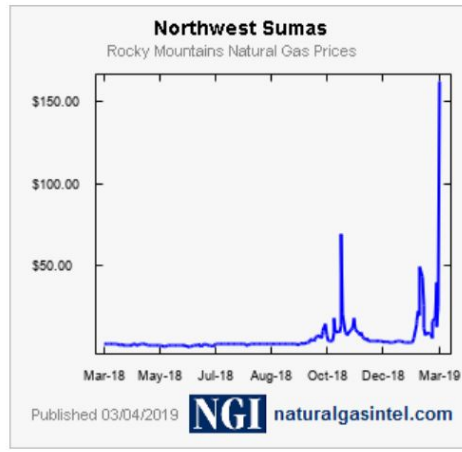
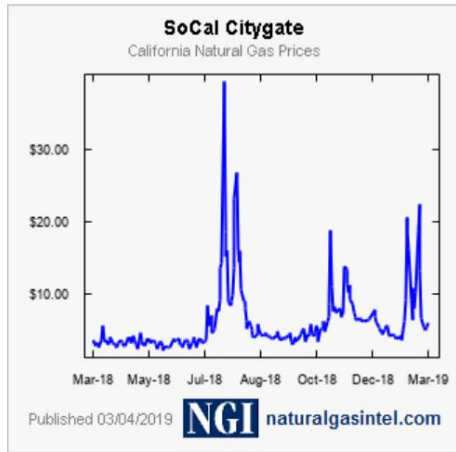
As temperatures are forecast to remain unseasonably cool across much of the region through the first week of March, BPA is asking customers to reduce energy use when possible to relieve stress on the power system.



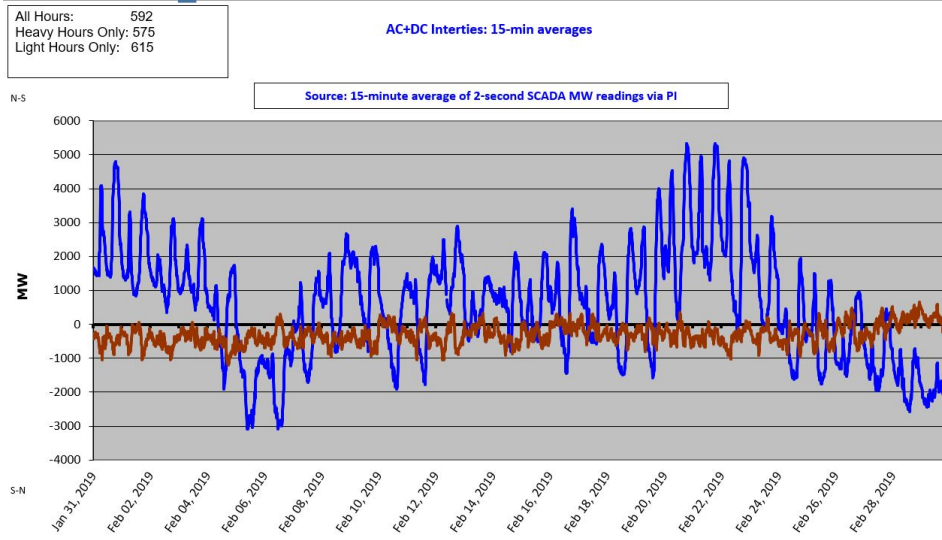
NW Energy Coalition



# Mystery solved



- Starting in early February, gas hub prices have been high periodically in both southern California and the Northwest.
- When prices are high at SoCal Citygate, the CAISO Day Ahead Market goes up dramatically and other western power markets including Mid-C follow at a lower level.
- When prices are high at Sumas, Mid-C prices go up dramatically.
- When Sumas is well above SoCal Citygate, gas generators in the Puget Sound region are constrained, Mid-C trades at a big premium to CAISO Day-Ahead – and power flows northward from California at historically high levels.



# The Double Squeeze

- Gas and electric supplies are always tight in the winter.
- In most years gas pipelines and storage can support direct use and power plants even in very cold weather.
- ***The Double Squeeze is the extended cold weather from the Arctic Express plus restrictions on regional gas pipeline flows and storage.***
- When the weather is very cold and gas demand reaches a critical level, natural gas wholesale prices will rapidly zoom upward until the weather warms up.
- Furthermore, gas price breakouts in southern California or the Northwest – or both – will have an immediate effect on power markets across the region.
- Because gas pipeline and storage constraints will continue for many months in both regions, the risk of similar price run-ups is very real through the rest of 2019 whenever weather is very hot or cold and energy demand is high.
- The Double Squeeze highlights two new risks – over-dependence on gas when flows and storage are reduced, and the impact of climate change on energy markets. The combined effect creates major system reliability and price risk.
- In the end, gas and electric customers will pay the Double Squeeze premium.



# Going forward . . .

## 1. Assessment

- The current Double Squeeze is still underway, and further assessment will be needed on the causes and consequences.
- The effect of market price surges on gas and electric customers must be a high priority for utilities and regulators.
- Rapid changes in generation and transmission patterns during high stress periods requires further system reliability studies.

## 2. Reduce peak demand

- Local gas price spikes that push up the regional power markets can be diminished by strong demand reduction programs on both the gas and electric side.

## 3. Diversify supply

- Development of resources such as Montana wind that provide high capacity value during peak demand periods must be accelerated.

## 4. System coordination

- System operations must be better coordinated, including better alignment of gas nomination and electric scheduling, pipeline/storage maintenance, and cross-area work among California, the Northwest and other regions in the west.

## 5. Market Reform and Expansion

- Stronger oversight is needed to reduce market power and gaming risk. The proposed Energy Imbalance Market (EIM) enhanced day ahead market could help all regions in the west manage unexpected supply crunches and price spikes

## 6. Joint planning and action agendas

- The gas-electric interface studies by WIEB (Western Interstate Energy Board) and WECC (Western Electricity Coordinating Council) provide a starting point for detailed work.

