

McCULLOUGH RESEARCH

ROBERT F. MCCULLOUGH, JR.
MANAGING PARTNER

MEMORANDUM

Date: June 21, 2016

To: McCullough Research Clients

From: Robert McCullough
Jacob Gellman
Xian Ng

Subject: Columbia Generating Station (CGS) Market Update

On June 21, news broke that California's 2,200 MW Diablo Canyon nuclear plant will close by 2025. A major factor is economic: the operation and maintenance costs associated with nuclear power are simply too high compared with the low market cost of electricity.

That leaves one nuclear plant on the West Coast. In the Pacific Northwest, approximately 200 miles from Seattle and Portland, the Columbia Generating Station (CGS) nuclear plant provides the Bonneville Power Administration with the most expensive power in its generation portfolio. Since 2008, the plant has had operating and incremental costs far above market alternatives.

Recent management troubles have not indicated a problem in economics per se.¹ Instead, the primary problem is simply the poor location of the plant, its scale of operations, and its age.^{2,3,4} Economic issues have plagued the plant for the last twenty years and do not look likely to abate in the foreseeable future.

¹ A variety of recent press reports indicate that a group of whistleblowers have identified management and safety issues with the plant.

² The Hanford location places the plant at the center of the Mid-Columbia (Mid-C) market. It is also at the center of a vast expansion of renewable resources. The surplus in energy at this location can overwhelm transmission capacity to loads on the I5 corridor and force prices to levels below zero.

³ Most nuclear plants are "twins" which assures economies of scale and operation. The "triplets" of CGS were cancelled thirty years ago.

⁴ CGS was designed in 1970s. It is now in its thirty-third year of its original expected design life of forty years. While there is nothing impossible about operating an aging nuclear power station, ongoing capital costs and required upgrades make these plants uneconomic. The rash of recent nuclear plant closure announcements in New York, Illinois, Massachusetts, and Nebraska reflect the cost of maintaining vintage plant in the face of more cost effective alternatives.

Columbia Generating Station (CGS) Market Update

June 21, 2016

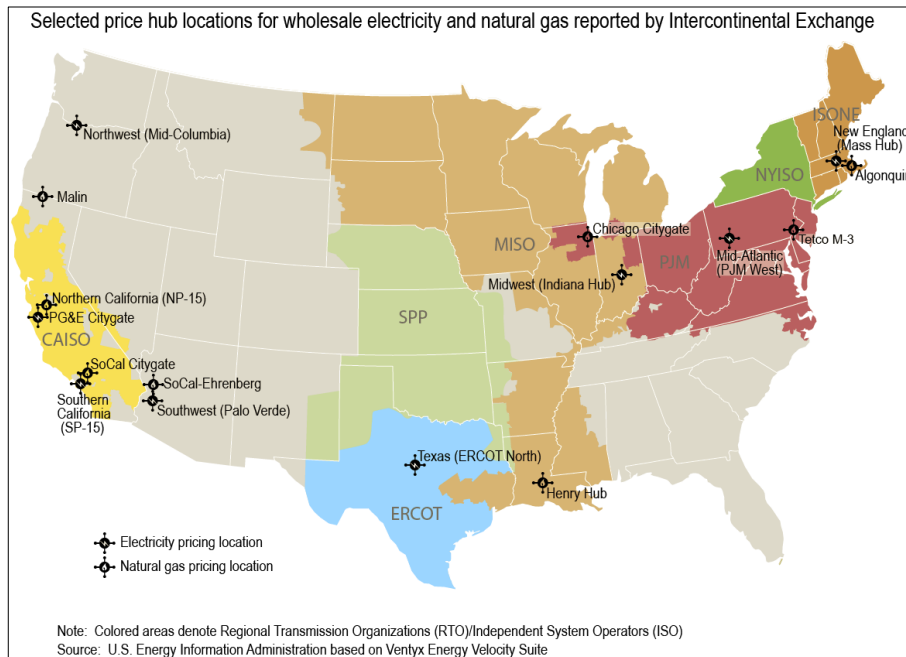
Page 2

In 1999, the Administrator of the Bonneville Power Administration – the federal agency that funds the project and sells its output through a “net billing” contract – and the Chief Executive Officer of Energy Northwest (then named the Washington Public Power Supply System (WPPSS)) agreed that the plant would be closed if it could not meet an annual four year “rate test.”

The “rate test” is quite simple: check whether the plant’s output was worth more than its operations over the next four years. This has not been true for CGS since 2008. Based on forward market bids and offers at the Chicago Mercantile Exchange, this situation is likely to still be true in 2020.⁵

One of the largest electric markets in the world is named “Mid-Columbia” since the pricing point is the series of dams at the bend of the Columbia River in eastern Washington State. Mid-Columbia is often abbreviated to Mid-C. Mid-C prices can be found on the Internet, in many periodicals, and major commodity exchanges such as the Chicago Mercantile Exchange and the International Commodity Exchange.

The graphic below, taken from the U.S. Energy Information Administration’s market price website, shows the nation’s electricity and natural gas trading hubs:



⁵ The prices from the Chicago Mercantile Exchange are not forecasts. A forward market allows any market participant to place orders for future supplies at the posted prices. Colloquially, it is the equivalent of an energy “CostCo,” where you can fix prices of future supplies by buying ahead of requirements.

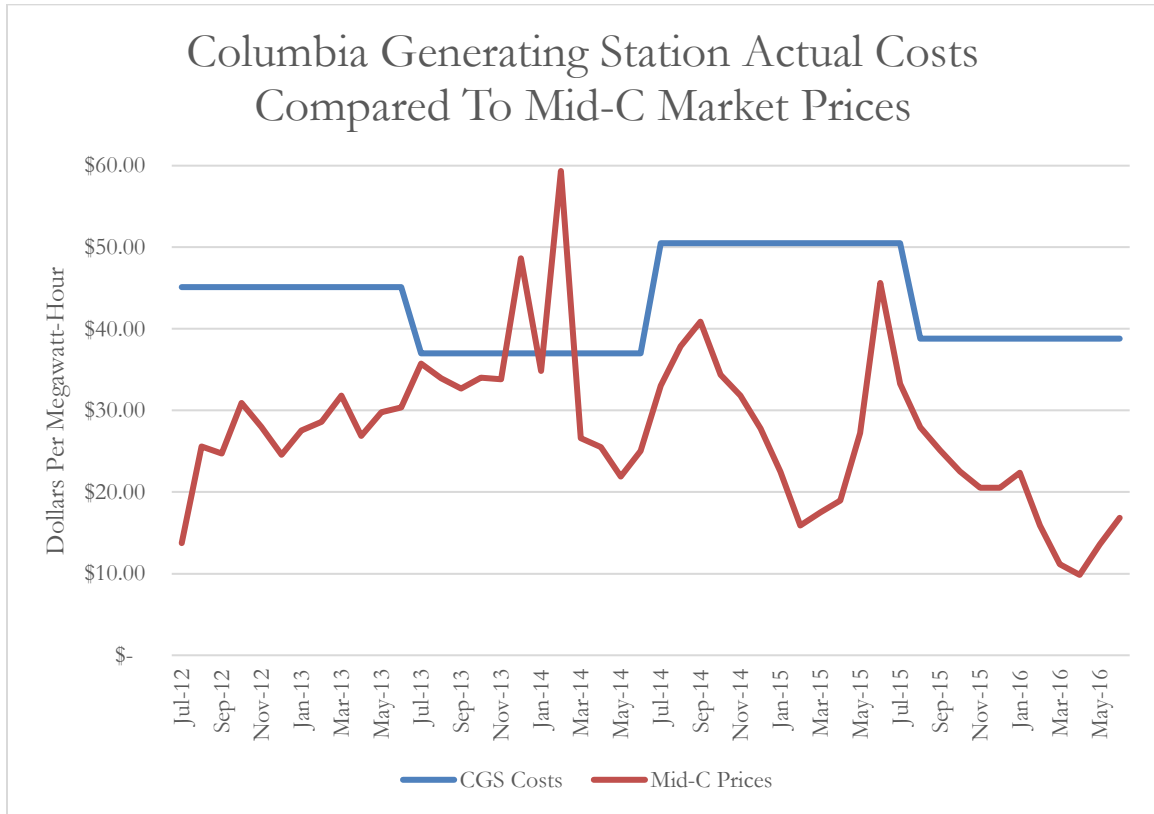
⁶ <http://www.eia.gov/electricity/wholesale/>

Columbia Generating Station (CGS) Market Update

June 21, 2016

Page 3

In December of 2013, we published a monograph on the plant that predicted that the plant would not be able to meet the rate test. This has turned out to be the case.



Over the last four years the Columbia Generating Station cost \$541,604,328.83 more than its output could be sold at market prices. This figure was calculated by taking daily production from CGS and multiplying against corresponding peak and off-peak market prices sourced from Platts Megawatt Daily⁷. CGS costs were taken from the 2013, 2014, and 2015 Energy Northwest annual reports. For Fiscal Year 2016, we used the forecast contained in the FY 2016 Long Range Strategic Plan – though the annual output of CGS is likely to be less than projected due to shutdowns and extended periods of partial power, which were not predicted in the Long Range Strategic Plan.

It is worth noting the marked change of prices over the past year, with a fall of over 40% compared to June 2015. This is not unexpected. Recent technological changes in oil and

⁷ See, for example, Platts Megawatt Daily for June 18, 2016, page 11.

Columbia Generating Station (CGS) Market Update

June 21, 2016

Page 4

natural gas exploration have created a glut in both markets. Since the cost of the most expensive resources operating on the West Coast use natural gas, the falling natural gas prices have forced current and forward prices to very low levels.

WEST POWER MARKETS														
WESTERN DAY-AHEAD POWER PRICES (\$/MWh)														
Hub/Index	Symbol	18-Jun	Marginal heat rate	Spark spread @7K	@12K	Price change Chg	% Chg	Prior 7-day Average	Month Min	Month Max	Yearly change Jun-16	Jun-15	Chg	% Chg
On-Peak														
NP15	ICNGM00	25.88	9276	6.35	-7.60	-1.05	-3.9	26.01	24.36	34.46	28.02	37.75	-9.73	-25.8
SP15	ICSGM00	26.09	9253	6.35	-7.75	-1.09	-4.0	25.87	23.88	33.74	27.79	36.49	-8.70	-23.8
ZP26	ICZGM00	25.79	9147	6.05	-8.04	-0.95	-3.6	25.84	23.82	32.76	27.31	35.46	-8.15	-23.0
COB	WEABE20	22.50	9514	5.95	-5.88	0.00	0.0	19.54	17.25	33.71	23.33	39.99	-16.66	-41.7
MEAD	AAMBW20	24.00	9979	7.16	-4.86	0.00	0.0	23.36	21.50	33.00	25.19	33.88	-8.69	-25.7
MID-C	WEABF20	19.47	9663	5.37	-4.71	0.00	0.0	16.98	14.83	32.78	20.07	37.22	-17.15	-46.1
Palo Verde	WEACC20	21.76	9133	5.08	-6.83	0.00	0.0	22.20	21.50	31.61	24.02	31.76	-7.74	-24.4
Off-Peak														
NP15	ICNGP00	24.44	9352	6.15	-6.92	0.57	2.4	21.27	16.37	24.44	20.43	28.41	-7.98	-28.1
SP15	ICSGP00	25.07	9993	7.51	-5.04	1.05	4.4	22.18	17.82	25.07	21.60	28.84	-7.24	-25.1
ZP26	ICZGP00	24.69	9840	7.13	-5.42	0.69	2.9	22.16	17.90	24.69	21.63	28.58	-6.95	-24.3
COB	WEACJ20	19.25	8140	2.70	-9.13	0.00	0.0	15.11	13.25	24.00	16.68	25.66	-8.98	-35.0
MEAD	AAMBQ20	17.50	7277	0.67	-11.36	0.00	0.0	16.07	14.00	20.00	16.96	23.64	-6.68	-28.3
MID-C	WEACL20	16.66	8268	2.56	-7.52	0.00	0.0	12.89	10.53	23.20	14.50	24.54	-10.04	-40.9
Palo Verde	WEACT20	15.91	6678	-0.77	-12.68	0.00	0.0	15.53	12.50	18.91	15.79	21.85	-6.06	-27.7

It should be noted that in 2013, Energy Northwest released a short but very expensively produced study that purported to show natural gas prices doubling in the near future.⁸ As we noted at the time, this assumption was contradicted by the IHS Cambridge Energy Research Associates' (CERA) own natural gas price forecasts. In reality, gas prices have declined since 2013.

As noted above, it is not necessary to spend hundreds of thousands of dollars to make a doubtful forecast. The prices on the Chicago Mercantile Exchange are public record.⁹

Energy Northwest provides its own forecast of its power costs for future periods in their Fiscal Year 2016 Columbia Generating Station Long Range Plan.¹⁰ This makes an easy calculation of the rate test for the next four years. We can simply compare the costs set out in the CGS Long Range Plan with actual market prices. In fact, if the Bonneville Administrator were so motivated, he could trigger the contract provision and terminate the plant at any time. Doing so would save at least \$703,852,170.52.

⁸ Columbia Generating Station: Economic assessment Prepared for Energy Northwest by IHS CERA, November 2013, page 12.

⁹ <http://www.cmegroup.com/trading/energy/electricity/mid-columbia-day-ahead-peak-calendar-month-5-mw-futures.html>

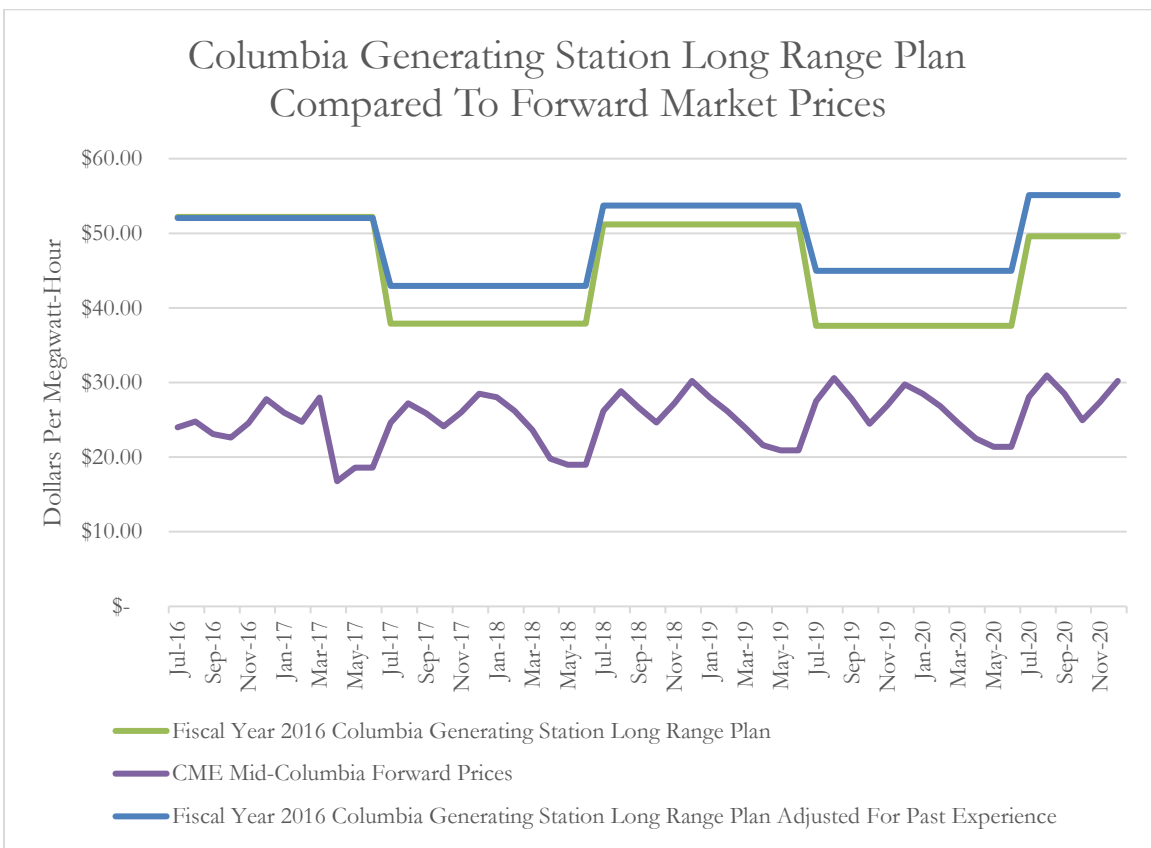
¹⁰ <https://www.energy-northwest.com/whoweare/finance/Documents/2016%20Budget%20Documents/Final%202016%20CGS%20Long%20Range%20Plan.pdf>

Columbia Generating Station (CGS) Market Update

June 21, 2016

Page 5

The actual savings would be greater than the simple values in the FY 2016 Long Range Plan in a number of ways. First, he would avoid four more years of used nuclear fuel to store until a long term storage facility is found. Second, he would avoid the rapidly escalating nuclear decommissioning costs by addressing them today. Most importantly, the forecasts in the previous Long Range Plans have tended to be adjusted downward by a combination of political pressures and unforeseen events. Since 2007 the forecasts have tended to underestimate actual expenses by 19.5%. If the current forecast reflects the tendency shown since 2007, the actual savings would be \$833,855,012.75.



In conclusion, the Columbia Generating Station has failed the established rate test for the past four years – as predicted in 2013 – and will fail the market test for the next four years.