Northwest **Power** and **Conservation** Council

April 29, 2014

MEMORANDUM

TO: Council Members

FROM: Charlie Black, Power Planning Division Director

SUBJECT: IHS Report on Columbia Generating Station

In 2013, Energy Northwest retained IHS CERA to perform an economic assessment of the Columbia Generating Station. The lead author of the assessment is Lawrence J. Makovich, IHS Chief Power Strategist, IHS Energy Insight.

IHS CERA's report on its economic assessment of the Columbia Generating Station was published in December 2013. The report concludes that continuing to operate and maintain CGS on an ongoing basis is cost-effective.

At the Council meeting in Boise on May 6, 2014, Mr. Makovich will provide a summary of his report, including the approach, assumptions and conclusions used in the economic assessment of CGS. He will also be available to respond to questions from the Council.

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NWPCC Presentation

6th May, 2014

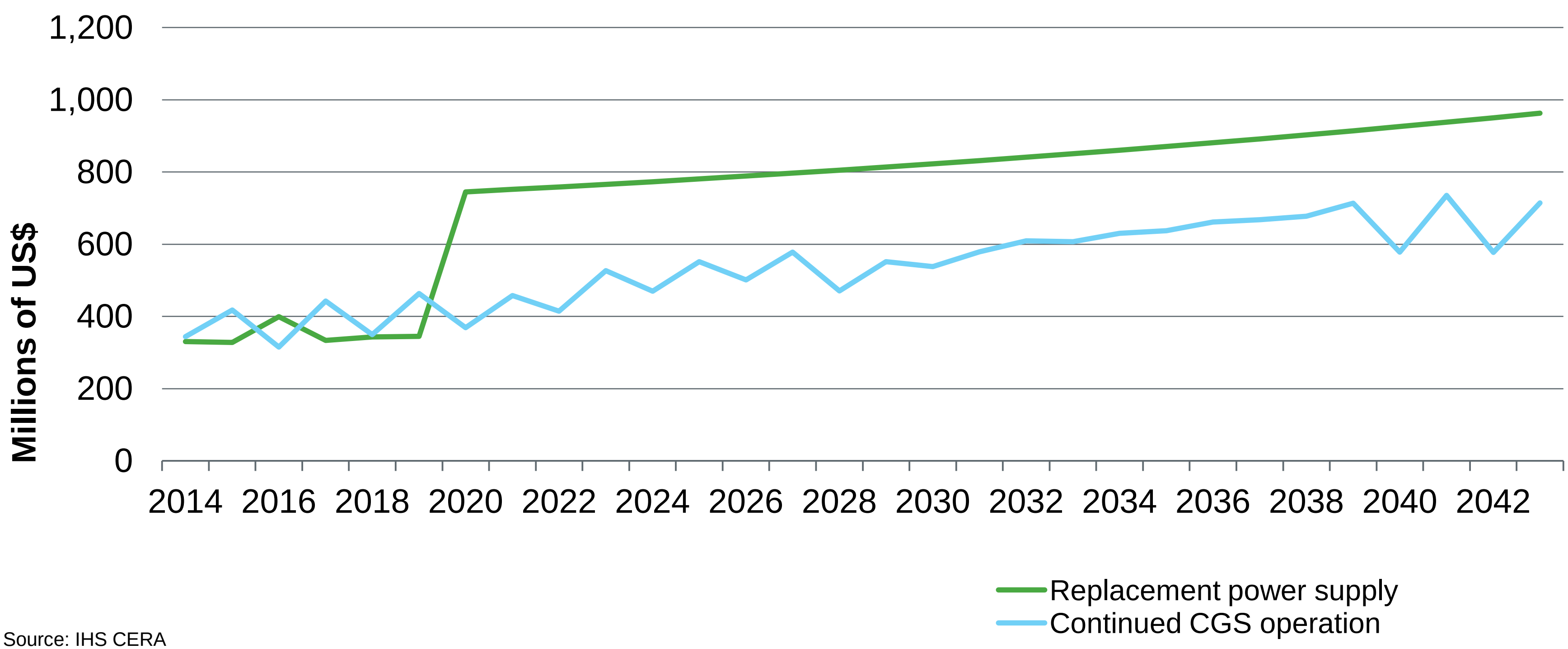
Columbia Generating Station economic assessment: Key points

- Reliably and efficiently supplying consumers with the amounts of electricity they want, when they want it, requires producing electric energy and capacity from a diverse generation mix that augments power supply from natural endowments—such as hydro-electric resources—with base load, cycling and peaking power supply technologies. (Appendix A of the IHS CERA Study)
- CGS is part of cost effective base load generation in the Northwest regional power system. Under expected conditions, continued operation of CGS provides $1.6 billion dollars of benefits to power consumers. (Costs of continued operation of CGS versus replacement power supply, 2014-43)
- An economic retirement and replacement of any type of power plant (baseload, cycling or peaking) occurs when the cost of replacing the energy and capacity outputs of the power plant is less than the avoidable costs of continued operation. (Energy Northwest nominal costs to produce 1,150 MW and 9,000 GWH, 2014-43)

Columbia Generating Station economic assessment: Key points

- The delivered price of natural gas to the Pacific Northwest exhibits multi-year cycles, strong seasonality and periodic price spikes. The future delivered price of natural gas to the Pacific Northwest is hard to predict with a high degree of accuracy and this uncertainty creates a wide range of plausible future price levels. (Historical and projected gas prices for Pacific Northwest, 2000-43)
- The long run marginal cost of power supply in the Pacific Northwest is greater than $60 per MWh. (levelized cost comparisons of baseload generating alternatives)
- Mid-Columbia wholesale power prices reflect the short run marginal costs of power supply that typically average around half of the level of the long run marginal cost. (Mid-Columbia wholesale power prices, 2002-14 YTD)
- Direct CO2 emissions from currently available power generation technologies reflect the inherent carbon content of the fuels required for power production. (Tons of direct CO2 emissions to produce 1,000 average MW)

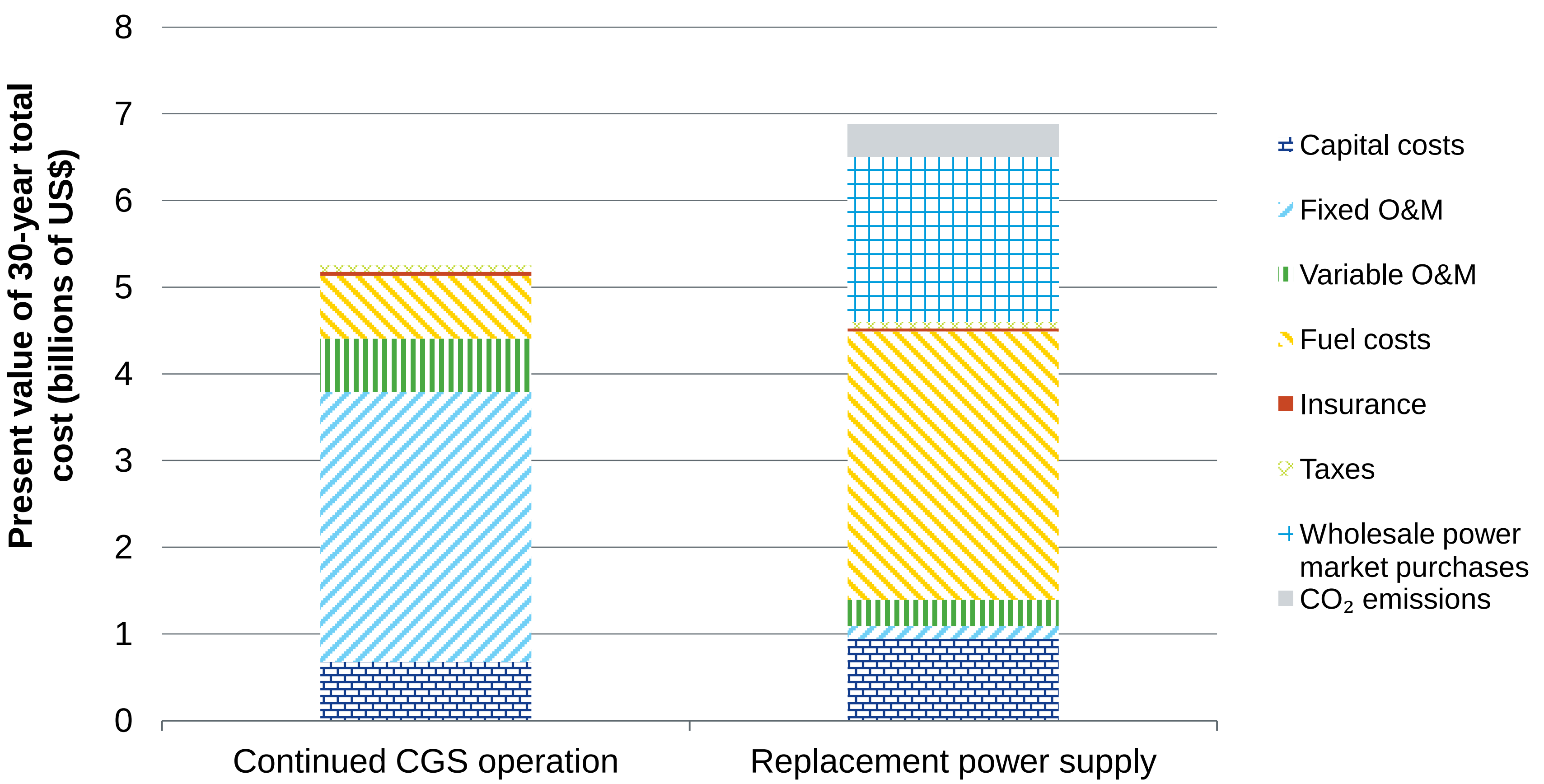
Energy Northwest nominal costs to produce 1,150 MW and 9,000 GWh, 2014-43



Source: IHS CERA

Notes: Replacement power supply = spot wholesale power market purchases from 2014-2019, and the all-in costs of a new natural gas fired combined cycle gas turbine (CCGT) from 2020-2043. GWh = Gigawatt-hours. The variation in costs for CGS reflect a combination of changes in O&M every other year for refueling outages and timing of payments that were established in the nuclear fuel purchase contract signed in May 2012 between EN, Tennessee Valley Authority (TVA), the U.S. Enrichment Corporation (USEC), and the Department of Energy (DOE).

Costs of continued operation of CGS versus replacement power supply, 2014-43



Source: IHS CERA. Note: O&M = operation and & maintenance

Historical and projected gas prices for Pacific Northwest, 2000-43

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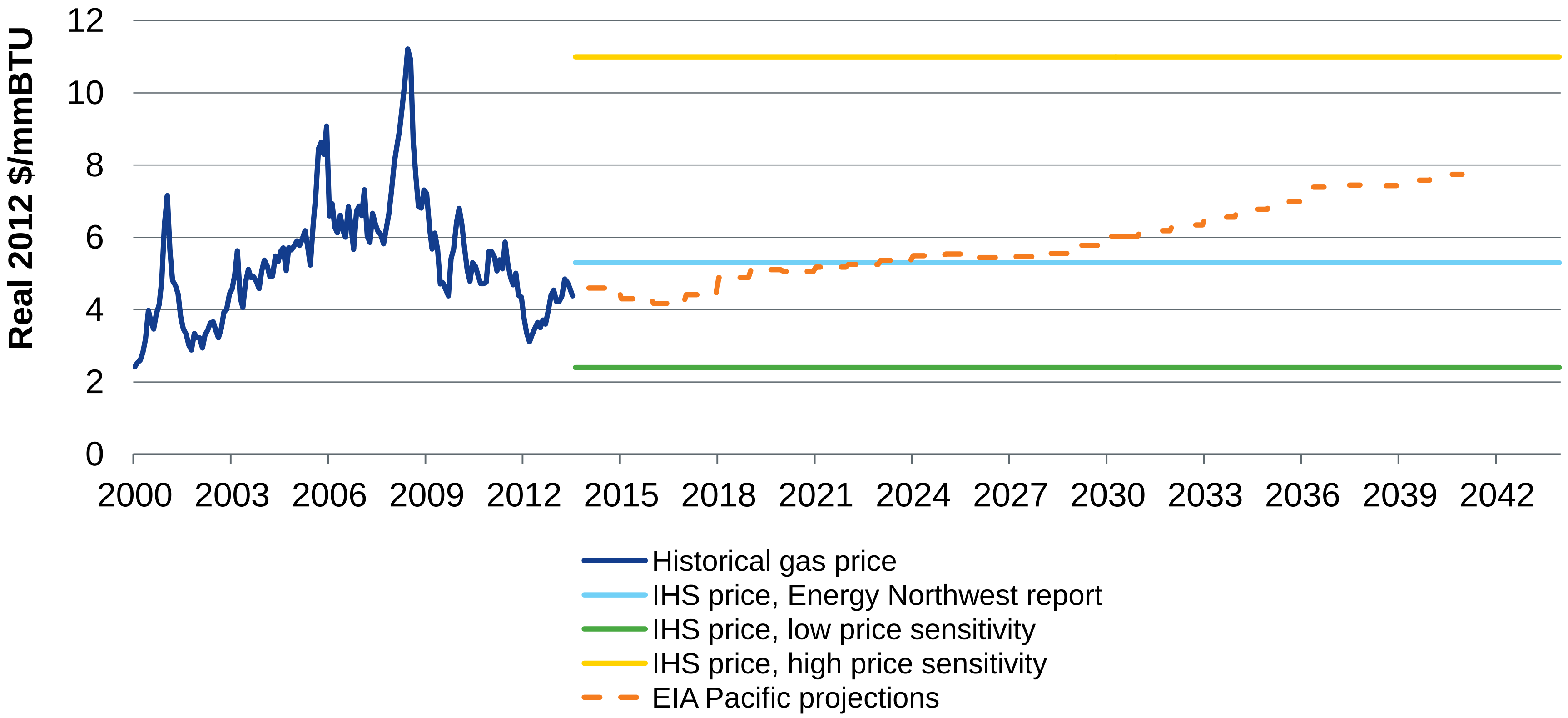

Source: IHS CERA, EIA
EIA Data from the 2014 Annual Energy Outlook

Levelized cost comparisons of baseload generating alternatives

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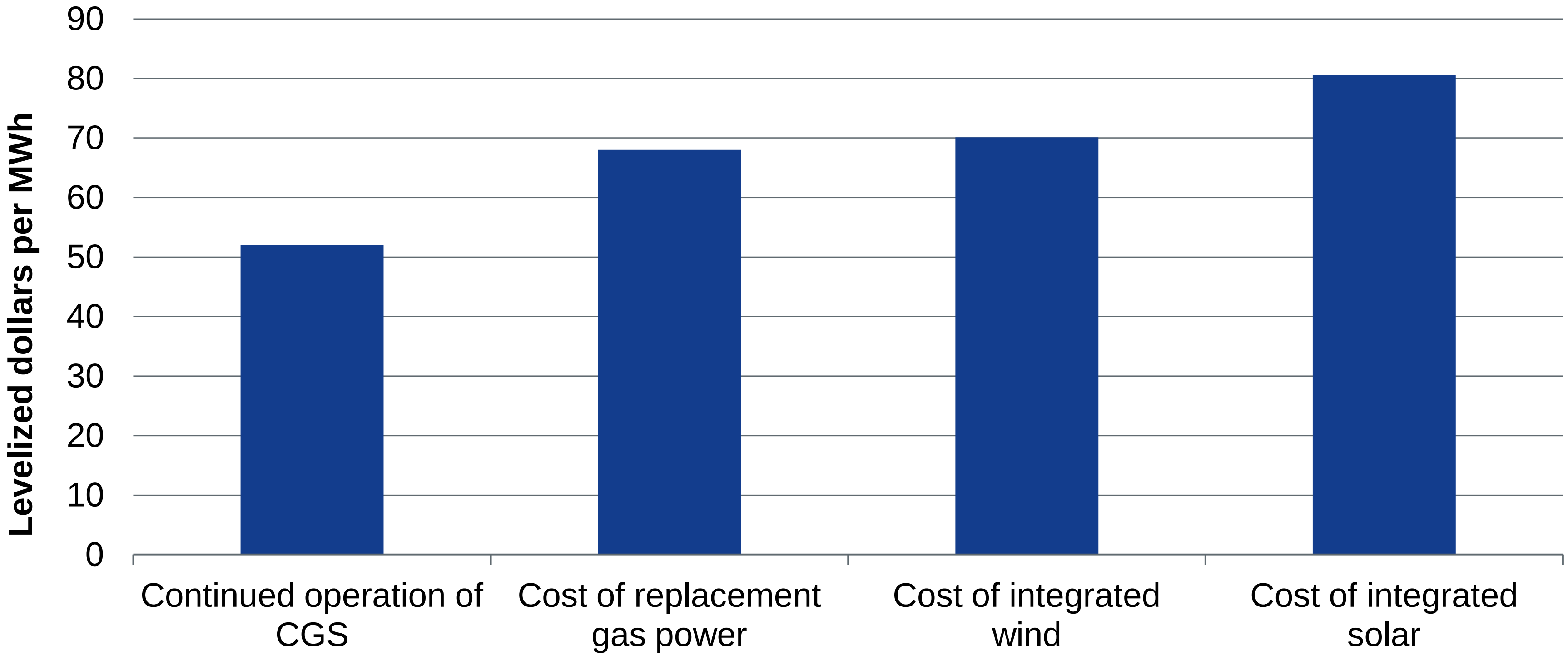
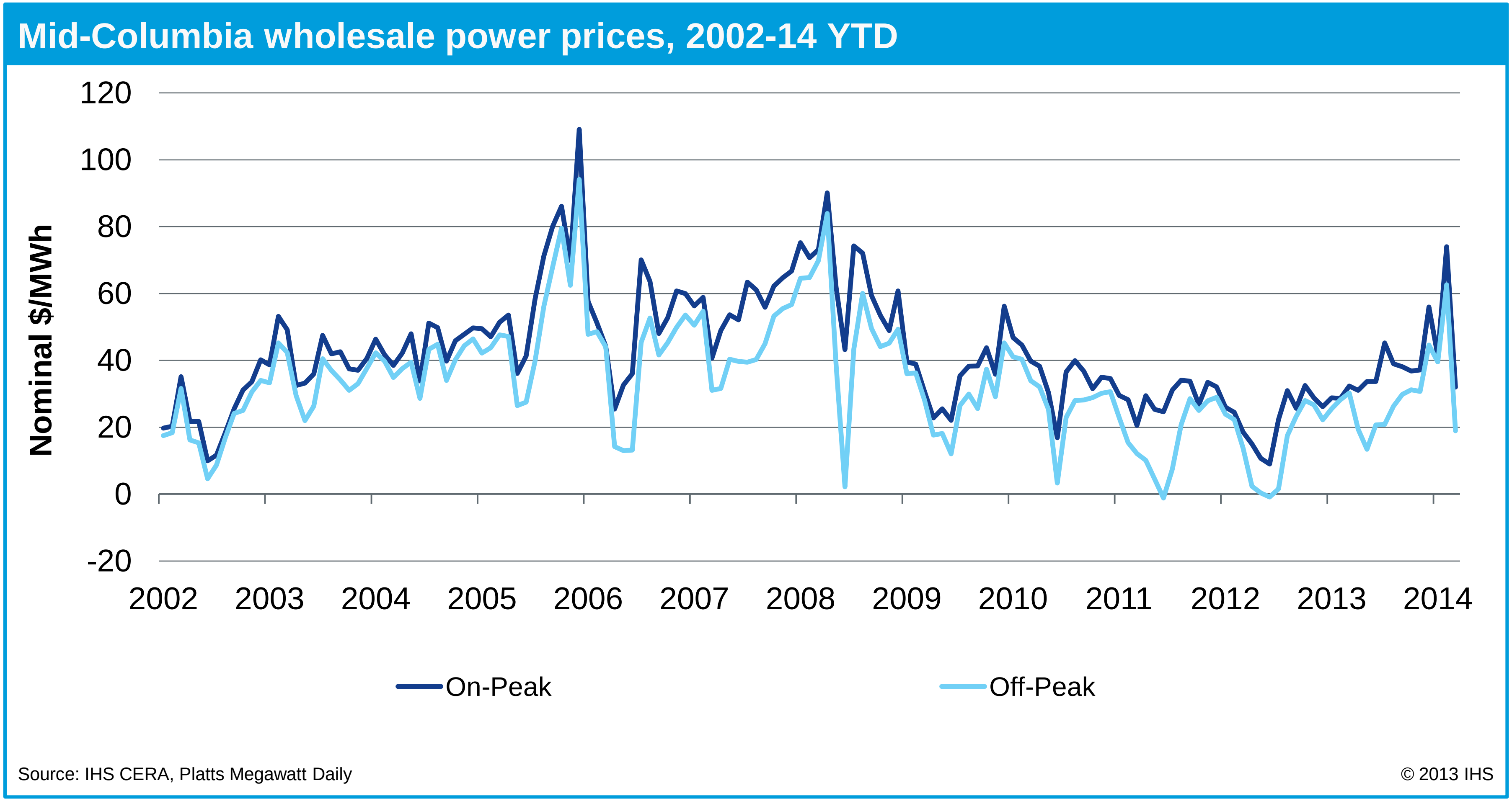


Source: IHS CERA
Note: Integrated wind and solar represent wind and solar backed up by gas to ensure 90% availability, assuming a 33% capacity factor for wind and 25% capacity factor for solar. Wind requires 1MW of gas for every 0.6 MW of wind, solar requires 0.7 MW of gas for each 0.8 MW of wind; these combinations each produce 1 effective MW of capacity and energy.
Replacement gas power, integrated wind and integrated solar all assume spot wholesale power market purchases from 2014-2019 before generation comes online in 2020.

Mid-Columbia wholesale power prices, 2002-14 YTD



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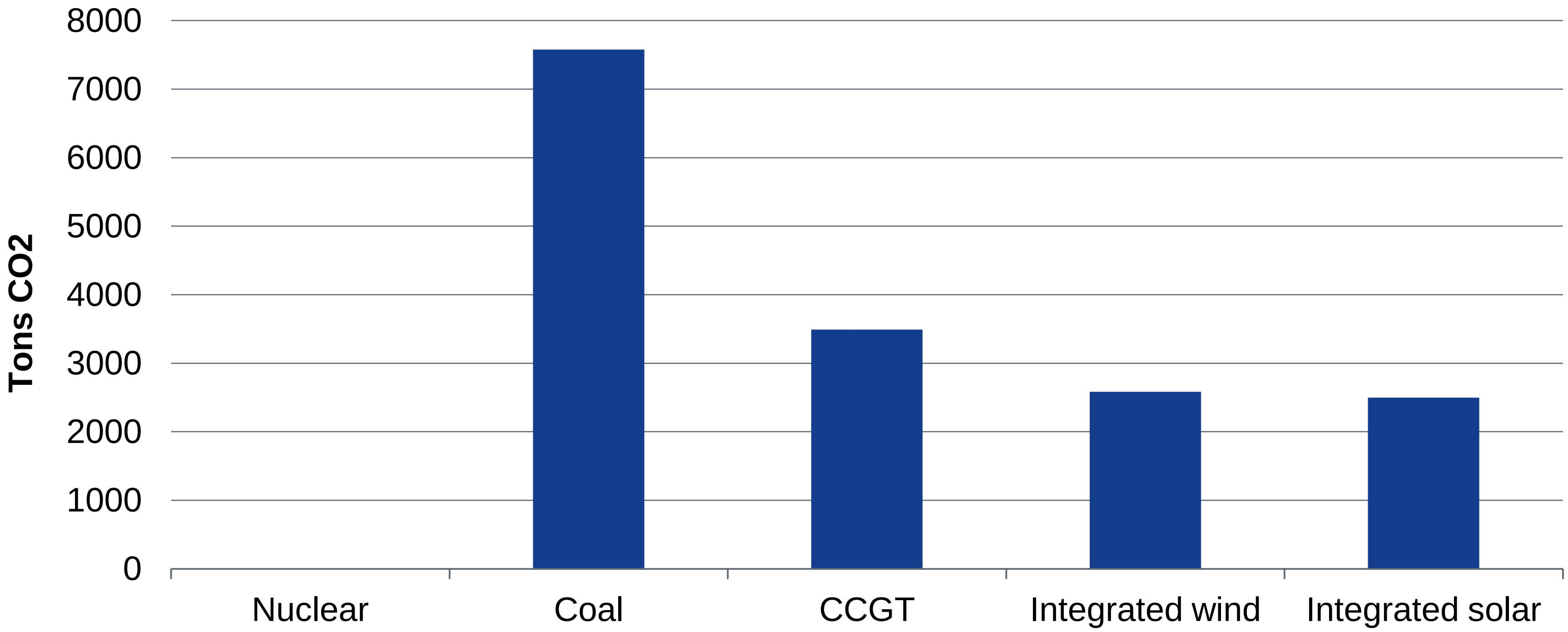

Source: IHS CERA
Notes: 1000 average MW is equivalent to 8760 GWh, and approximately the annual output of CGS
Integrated wind and solar represent wind and solar backed up by gas to ensure 90% availability, assuming a 33% capacity factor for wind and 25% capacity factor for solar. Wind requires 1MW of gas for every 0.6 MW of wind, solar requires 0.7 MW of gas for each 0.8 MW of wind; these combinations each produce 1 effective MW of capacity and energy. Nuclear is assumed to be incumbent, and not require further integration.