COMMODITY UPDATE: NATURAL GAS

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Natural Gas Storage in Canada

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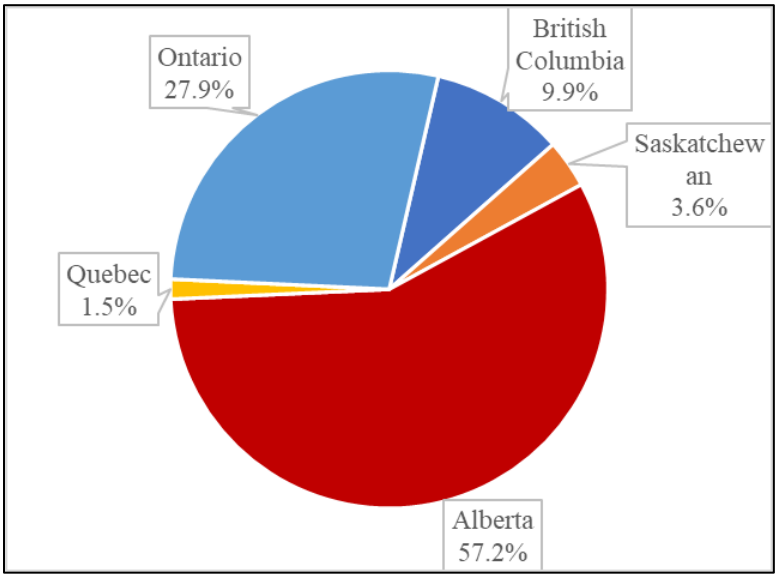
Underground storage popularity grew shortly after World War II, with rising seasonal demands for natural gas and, pipeline deliveries alone being insufficient to meet the need. This article provides an update and an overview of Canadian natural gas storage, inventory levels, and the impact of current market dynamics on gas storage.

Today, natural gas demand in Canada is estimated at 12 billion cubic feet per day (Bcf/d) in the winter and 7 Bcf/d during the summer months. Canada's total natural gas storage capacity is approximately 974 Bcf, 98% (955 Bcf) of which is stored underground. As of June 2020, Canada has 647 Bcf of natural gas stored within its storage facilities. There are 57 underground storage locations in Canada – 50 in depleted reservoirs and seven in salt caverns (mainly in Saskatchewan). The salt caverns make up 2% of the total underground storage capacity. Canada's underground storage facilities are distributed across five provinces: British Columbia, Alberta, Saskatchewan, Ontario, and Québec. There are two LNG storage facilities - one in New Brunswick (Canaport LNG import facility) and the other in Québec (Energir's LNG plant). While Alberta's storage capacity is distributed across the province, Ontario's storage facilities are located near the Dawn hub. The total operating natural gas storage capacity by province is as follows: British Columbia (9.9%), Alberta (57.2%), Saskatchewan (3.6%), Ontario (27.9%), and Québec (1.5%). (CER, NACEI).

Figure 1: Average Inventory of Gas Capacity



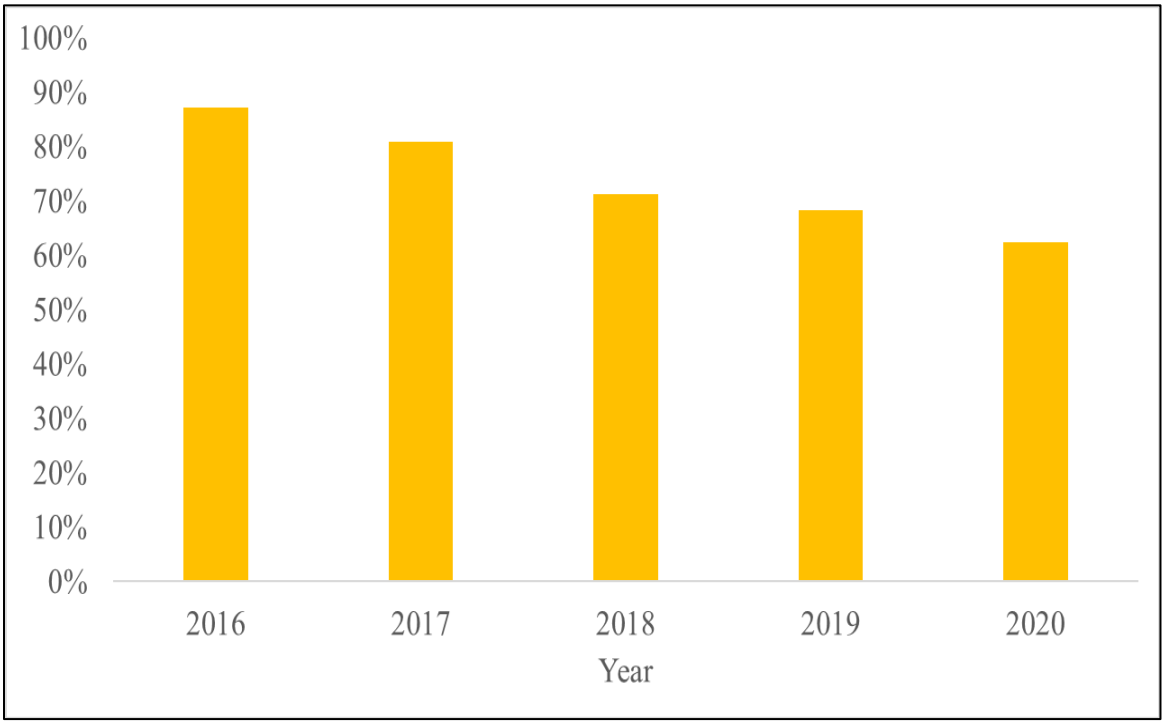
Source: CER, NACEI

Eighteen LNG export facilities have been proposed in Canada with a combined potential export capacity of 29 Bcf/d (NRCAN). The proposed LNG export facilities are located in British Columbia (13); Nova Scotia (3) and Québec (2). New pipelines and expansions to existing lines will be required for the proposed LNG facilities. The proposed LNG facilities would have an approximate storage capacity of 240 Bcf, adding to the total operating natural gas storage capacity in Canada.

The bulk of Canadian storage is in Alberta, with a capacity of 548 Bcf. Alberta has the second largest storage capacity in North America, the first being in Michigan, U.S. In 2016 and 2017, Canadian natural gas storage inventory levels peaked at an average storage capacity of approximately 780 Bcf, representing more than 80% of capacity. Given typical demand, this inventory could serve approximately 65 days of Canadian natural gas demand during winter. The inventory levels have been dropping steadily, with a decline rate of nearly 7%, currently holding at 62% of total storage – or 51 days of winter demand.

Figure 2 illustrates the average inventory levels of natural gas in storage facilities from 2016-2020 as a percentage of total operating capacity.

Figure 2: Average Inventory of Gas Capacity



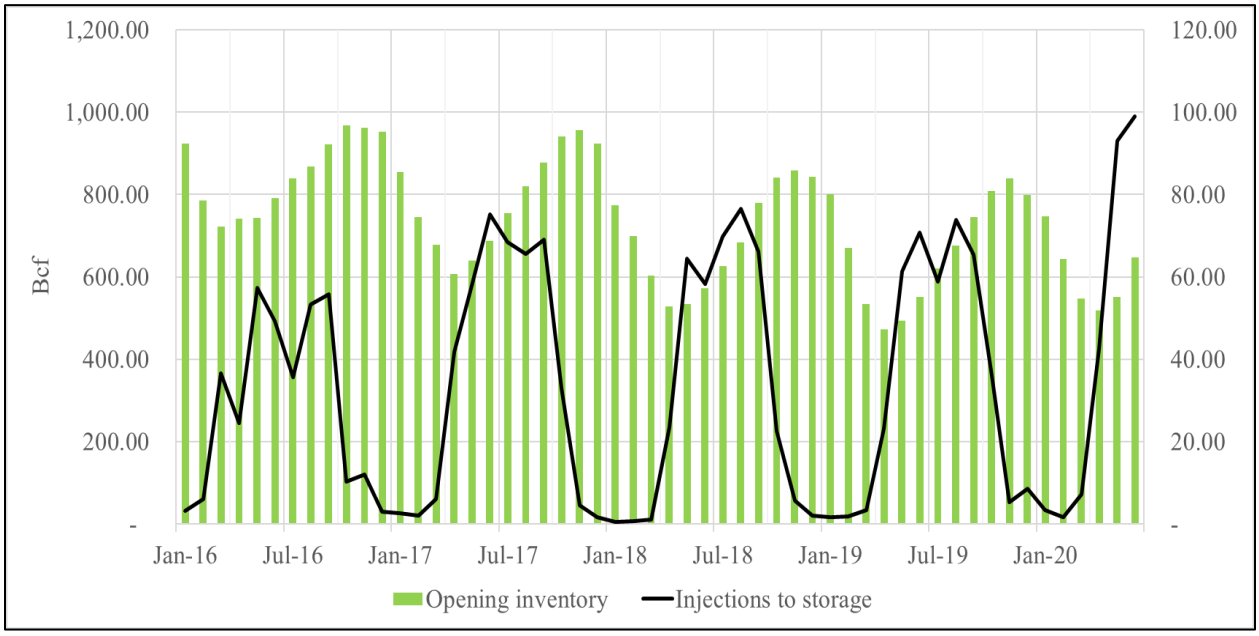
Source: Statistics Canada

Underground natural gas storage is primarily utilized to fulfill the load variation with injections into storage during low demand and withdrawals during peak demand periods. Underground storage ensures producers can maintain reliability of gas supply to consumers at minimum cost, (as required by regulatory bodies) when unforeseen circumstances arise, interrupting production or distribution systems.

Producers utilize storage units to store gas that is not immediately marketable or when producers expect prices to increase in the future. The cost associated with new pipeline construction and maintenance to reach daily demands is higher than maintaining underground storage units.

Figure 3 illustrates the cyclical nature of Canada's natural gas storage inventory and gas injection volumes (increased injection during summer months and increased withdrawal during the winter season).

Figure 3: Natural Gas Inventory Change (2016-2020)

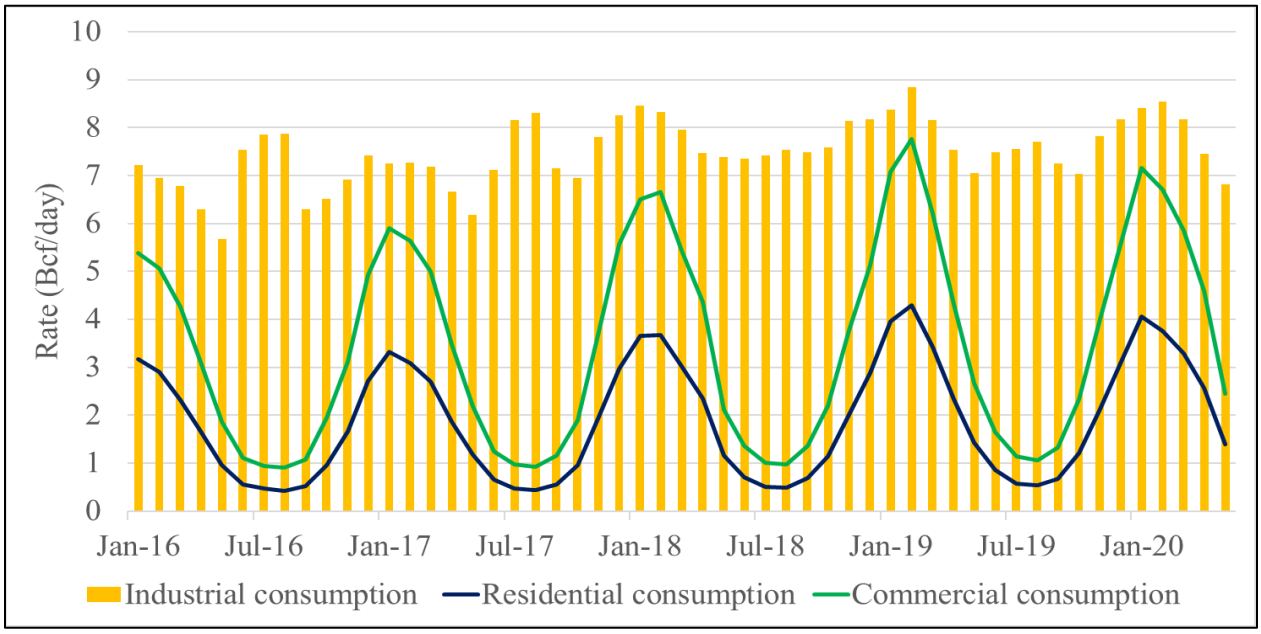


Source: Statistics Canada

Injection into storage facilities rose by 25% in 2017 and stayed high until 2019. The high volume of injection in 2020 is an outlier in the data set and directly related to the COVID-19 pandemic which forced industry and business to slow production and consumption of gas. As mentioned previously, the inventory levels had been declining over the last few years. The depleting volume of inventory in gas storage is a mix of several parameters: 1) changes in the demand of end-use consumers; 2) the volume of U.S. gas being consumed in Canada; 3) incremental growth in U.S. shale gas production and 4) weather predictions for the upcoming winter.

Figure 4 represents the daily consumption rates of natural gas across Canada in the industrial, commercial, and residential sectors.

Figure 4: Natural Gas Consumption Rates



Source: Statistics Canada

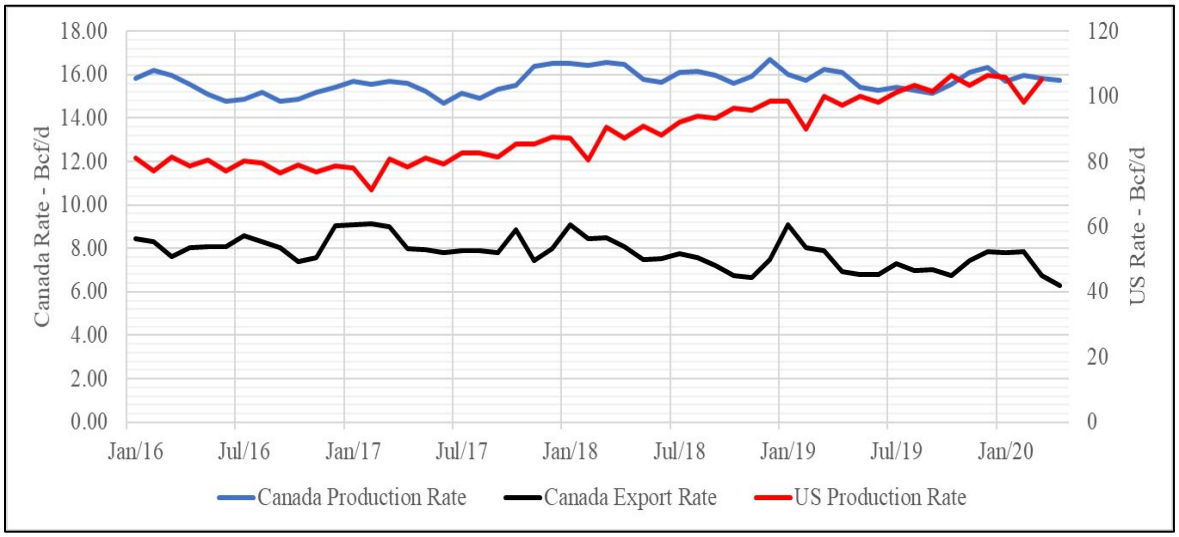
Consumption in commercial and residential sectors also exhibits a cyclic trend, with higher consumption during the winter period to maintain space heating. Upon closer inspection, residential consumption was higher in 2020 than in previous years, with the majority of the population following stay at home orders due to the pandemic.

Canadian natural gas markets are split into a western Canadian market and an eastern Canadian market. Western Canada accounts for 71% of gas storage capacity and 99% of total Canadian natural gas production. Eastern Canadian markets, while historically reliant on storage, can now access gas produced from the U.S. Marcellus formation. The highest withdrawal volumes in Canada (67%) occur in eastern Canada, given the consumption by the most populous provinces of Ontario and Quebec located in this region.

Canadian and U.S. natural gas markets are highly integrated. Canada has an average total production rate of approximately 16 Bcf/day and an export rate of approximately 8 Bcf/d. Canada's natural gas exports are linked solely to U.S. markets, but Canadian natural gas producers are losing that market share as export rates decline due to an increase in U.S. shale gas production.

Figure 5 illustrates the marketable production rates of natural gas in the U.S. and Canada against export rates of Canadian natural gas.

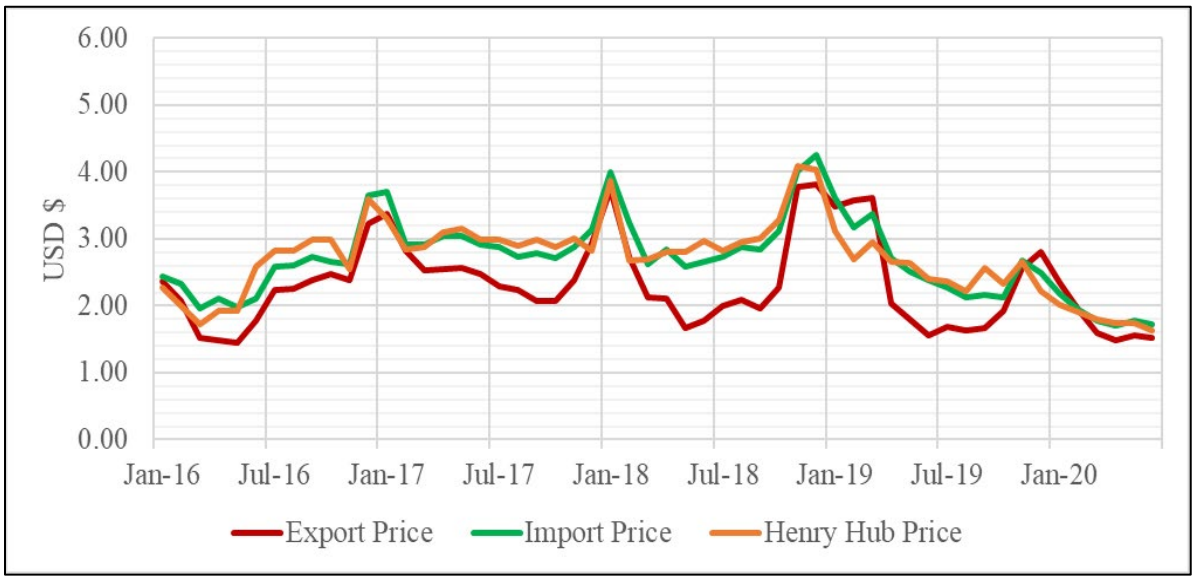
Figure 5: Natural Gas Rates across North America (2016-2020)



Source: CER, EIA

Canada imports approximately 2 Bcf/d of natural gas from the U.S., mainly into eastern Canada. The import rates are on the rise with higher production in the northeast of the U.S. and shorter transportation distances (lower tolling charges) into the Dawn hub (CER, EIA). Figure 6 illustrates the natural gas price for gas imports and exports expressed in U.S. dollars along with U.S. Henry Hub gas prices.

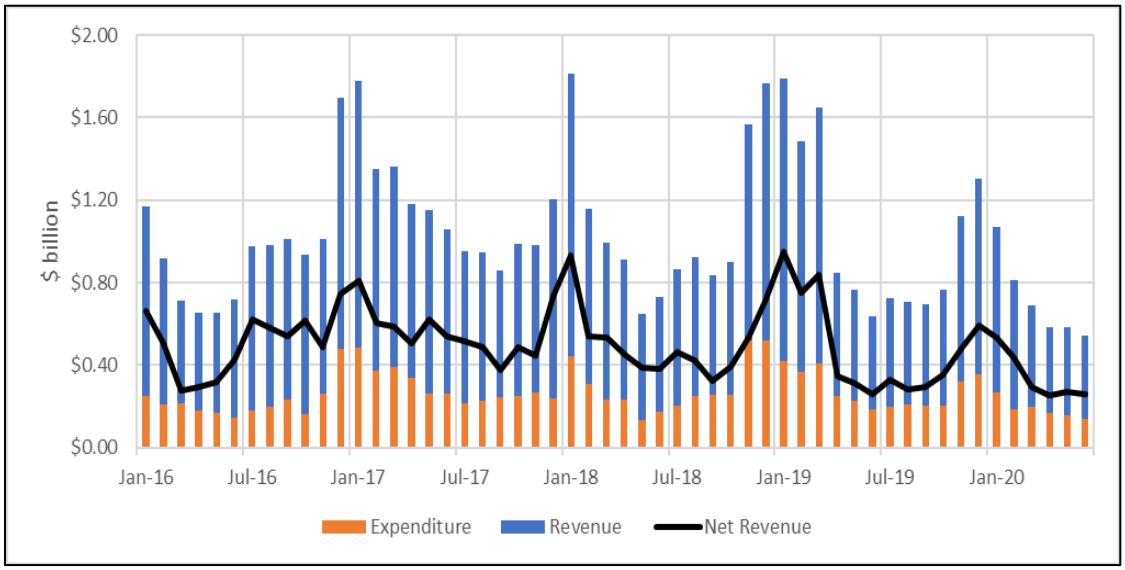
Figure 6: Gas Prices for Exports and Imports in Canada



Source: CER, EIA

The import price and Henry hub price are closely correlated, while the export price exhibits a price discount to the other two prices, except for peak periods. All three prices reach similar levels during winter months and diverge during non-heating periods. Figure 7 illustrates the total revenues and expenditures for exports and imports of natural gas out of and into Canada.

Figure 7: Economics of Canadian Natural Gas Market

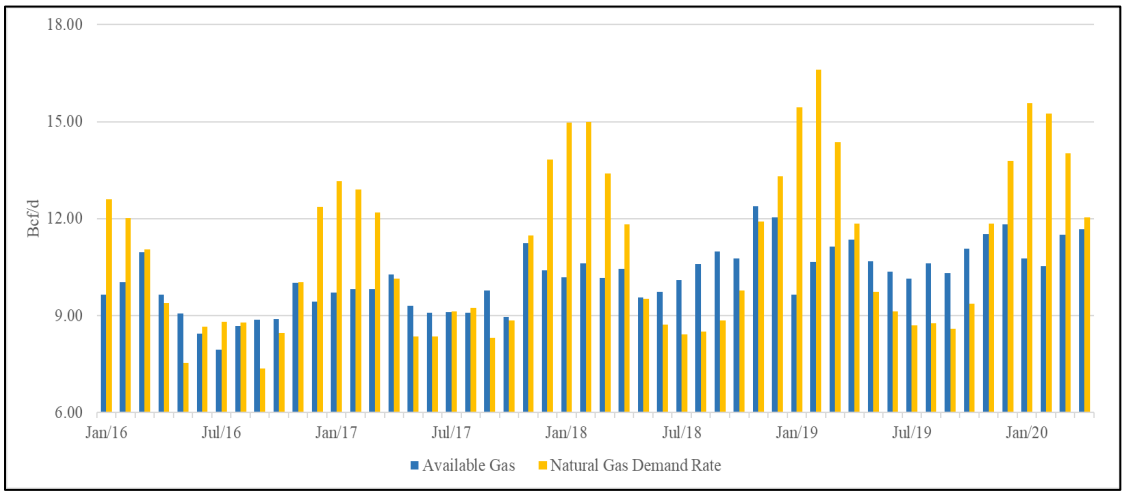


Source: CER

The net revenue generated from natural gas sales in Canada is decreasing. With the rapid rise of natural gas production in the U.S., the U.S. exported a record high 12.8 Bcf/d to 38 different countries and lowered their import volumes to 7.5 Bcf/d as of 2019 (EIA, 2020). Increasing production in the U.S. could further reduce Canadian natural gas exports to the U.S. and revenues in the long-term due to the reduced export volumes.

Figure 8 illustrates the net available gas and natural gas demand rate in Canada, with high demands during heating periods.

Figure 8: Natural Gas Supply and Demand in Canada



Source: CER, EIA, CEIC, Statistics Canada

Demand has been increasing rapidly with population growth, extended heating periods, and upward summer peaks, due to natural gas slowly displacing coal-fired power plants across the

country for electricity generation. The demand for natural gas during heating periods is higher than the supply of natural gas; thus, the shortage is used to balance supply and demand during peak periods.

Internationally, the demand for natural gas has been rising to replace coal-generated electricity, capturing new markets, and serving increased industrial demand. However, with reduced exports of Canadian natural gas to the U.S. and other Canadian markets, Canada's biggest gas market has become Canada's major supply competitor. This creates a changing market dynamic for storage. What is the future value and use of storage? Given the potential increase in LNG activities, it will depend on how the operations of those facilities intersects with the continental demand we have experienced for the last several decades. If LNG becomes a baseload demand on the system, that might suggest storage will be less valuable.

It is too soon to suggest how LNG and lower exports will affect storage? What is the future of natural gas storage?

Endnotes

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