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ASSOCIATION CANADIENNE DU GAZ

CGA By the Numbers:
The natural gas storage advantage

In this issue of By the Numbers, we look at the important role storage plays in today's energy systems, specifically the natural gas storage capacity in Canada and how it is critical to deliver reliable and stable energy supply. We will also look at the significant role that natural gas played during the cold weather event in Western Canada in early 2024. We finish by examining the current state of electric battery storage and provide a comparison of the storage capacities between the gas energy and electric systems.

The key points are as follows:

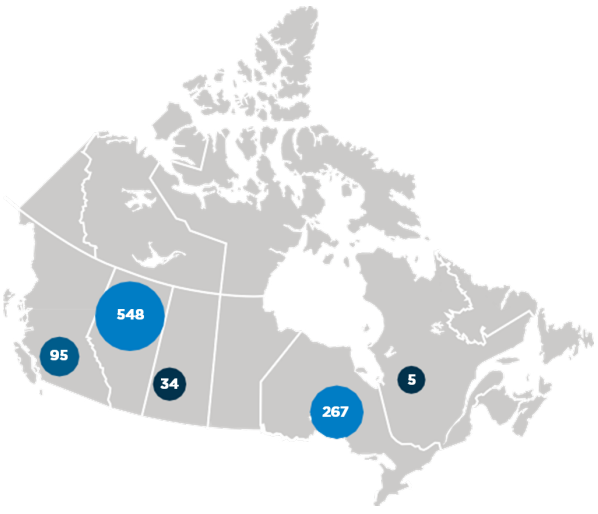
1. Canada's gas storage system is indispensable due to its vast capacity and length of supply. In total, the country has 948 billion cubic feet of storage capacity. This is equivalent to 286 million MWh of energy storage and more than 50 days of supply for a typical winter's day.

2. Gas storage played an outsized role during the polar vortex in January 2024, proving it to be an invaluable asset in responding to emergencies. In Alberta, the gas system delivered nearly 10 times more peak energy than the electric system, with about 50% of the gas supply being directly provided by withdrawals from storage.

3. With only 539 MWh of capacity and about 1.5 hours of average run-length, Canada's electric battery storage lags significantly behind that of its natural gas assets. This emphasizes the value of the natural gas system and raises questions about just how ready or capable such an all-electric system would be in meeting our peak energy needs.

Energy storage is an essential tool that allows energy system operators to capture energy at one point in time and use it at a later date. Energy storage comes in many forms: batteries, pumped hydro, hydrogen, RNG, etc. By far the largest form of energy storage in Canada is operated by the natural gas industry. In this issue of By the Numbers, we will discuss the role of Canada's natural gas storage both as a tool to meet fluctuating energy needs but also how it compares to other forms of energy storage options.

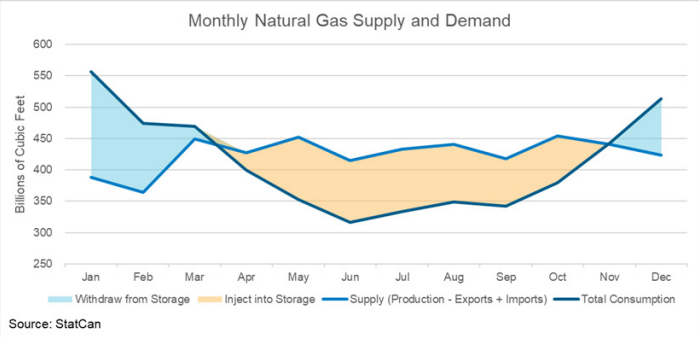
Most of Canada's natural gas storage capacity is found underground in depleted oil and gas reservoirs or in salt caverns. As such, most of the storage exists in Western Canada where much of the production comes from. Altogether, British Columbia, Alberta, and Saskatchewan have more than 70% of the total storage capacity. The rest of the capacity is concentrated near Dawn, Ontario. Altogether, Canada has 948 billion cubic feet of underground natural gas storage capacity. This is enough to heat 11.5 million residential customers or equal to our average gas use over 50 winter days.



The role of gas storage

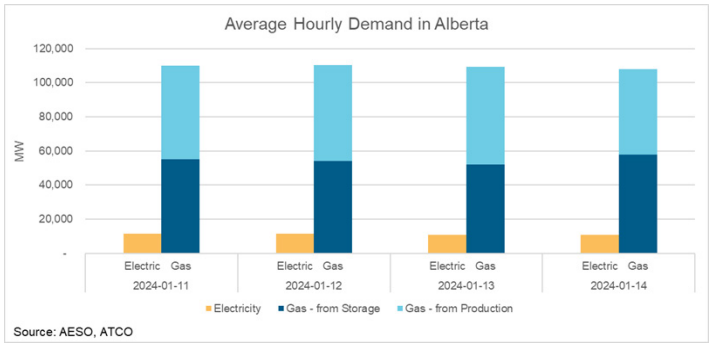
While much of the attention today seems to be focused on storage solutions for the future, it should be noted that storage is already an integral aspect of today's natural gas system and has been for several decades. Natural gas storage plays a vital role in the natural gas sector by providing reliable supply, buffering against seasonal variations, providing market stability and flexibility, and responding to emergencies.

Natural gas inventories rise and fall every year according to a seasonal cycle. The graph below shows how this natural gas supply and demand cycle typically works. During the spring and summer months, when natural gas demand is low, storage operators fill their caverns, and inventories continue to increase until late fall.



By late fall, natural gas consumption starts to increase as the demand for space heating increases. However, as the graph shows, production volumes alone are typically not enough to cover demand in the winter months, creating a supply deficit that is met by gas withdrawn from storage. Storage draws continue until temperatures start to warm again, and by the beginning of spring, natural gas inventories are at their lowest and the supply and demand cycle starts all over again.

However, the value of storage goes beyond just seasonal variations. Gas storage is tremendously important to meet extreme weather situations. This is best illustrated by the polar vortex event in Western Canada from earlier this year. As temperatures dropped below -46°C, energy demand in Alberta spiked between January 11th to January 14th. The electricity demand in the province had hit an all-time peak record of 12,384 MW while also putting tremendous stress on that system. In comparison, natural gas delivered up to a peak of 110,340 MW, nearly 10 times more than that of the



electric demand. What's more, about 50% of the natural gas that was delivered over that period was withdrawn directly from natural gas storage, as shown in the chart below.

Finally, it should be noted that aside from ensuring adequate supply, storage also plays an important role in keeping gas prices affordable. In the event of a price spike or an emergency event, gas does not necessarily need to be purchased from external supply sources. Rather, the gas can simply be withdrawn from storage to meet the needed demand in response. Since the gas that was withdrawn was often purchased and stored when prices were low, this is ultimately reflected in the prices that customers pay.

Background on battery storage

Battery storage has a bright future, and understandably, much of the public discussion around 'energy' storage refers to electric batteries, both in the form of utility-scale batteries and EV cars. Let's take some time to understand the current state of electric battery storage.

Battery capacity is usually described in two ways: the power capacity and the energy capacity. Power capacity refers to the maximum instantaneous power that can be delivered at a given point in time, usually measured in kW or MW. The energy capacity refers to the total amount of energy that the battery can store, usually measured in kWh or MWh. For reference, one of the largest utility-scale battery units that is currently available on the market has a power capacity of about 100 MW and an energy capacity of 400 MWh[1]. This means that these

[1] https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/aes-starts-building-largest-battery-peaker-highlighting-technology-s-potential-52610550

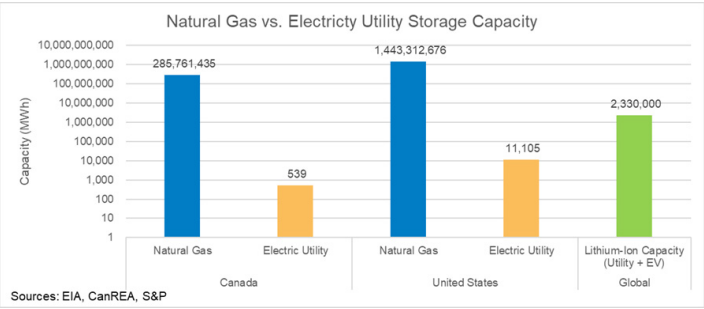
batteries would have an average run length of 4 hours before they need to be recharged.

Gas storage vs. electric storage:

With that background, just how much battery storage currently exists in Canada? And in other parts of the world? And how does natural gas storage stack up? By the end of 2023, the total electric battery storage installed in Canada has a power capacity of 356 MW and an energy storage capacity of 539 MWh . By comparison, the United States has 11,105 MWh of installed battery capacity, the highest amount in the world.

The difference between the gas and battery storage systems is astronomical. The chart below compares storage capacities of both the natural gas and electric battery systems in Canada, the US, and the rest of the world (note the logarithmic scale). As previously stated, Canada has 948 billion cubic feet of natural gas storage capacity – this is equivalent to 285,750,000 MWh of energy; compared to Canada's 539 MWh[2] of battery storage. In sum, the gas storage system currently has 530,000 times more capacity. That's like comparing the volume of a one-gallon container to the volume of an Olympic-sized swimming pool.

The sheer magnitude of Canada's natural gas storage is further solidified when comparing it to the battery capacity in other parts of the world. Despite being the global leader, the battery storage capacity in the US is more than 130,000 times lower than its own domestic gas storage and still 25,000 times lower the Canada's gas storage capacity. Furthermore, even if we consider the global capacity of lithium-ion batteries, we can see that Canada's gas storage alone is still more than 100 times greater.



Beyond the capacity numbers, the other factor that needs to be considered between the two options is run length. As previously stated, Canada's natural gas capacity allows for approximately 50 days of reserve supply during a typical winter, when demand is at its highest. Meanwhile, with 356 MW of power and 539 MWh of storage, it means that Canada's current energy storage can only provide 1.5 hours of energy supply before needing to be recharged. Though 50 days is likely not necessary for a battery system, a more realistic question is to ask how such a system would meet our peak energy needs?

Conclusion

As the comparison above shows, Canada's natural gas storage is an critical asset in Canada's energy security. The tremendous amount of capacity and supply in reserve is simply unmatched by battery storage solutions. Gas storage continues to expand in Canada and the US though the market is generally finding existing storage caverns are sufficient to meet fluctuating natural gas demand. However, as more gas fired power generation and LNG exports come online some new storage caverns are being developed such as the Trinity Gas Project, which will add 24 billion cubic feet of storage capacity[3]: equivalent to more than 18,000 large scale utility batteries.

As we've seen in this issue of By the Numbers, gas storage is and will continue to be an integral part of our energy infrastructure. As we look to the future and ponder on how our energy systems need to evolve, it is critical that we look at a diverse set of solutions and technologies. We need to look beyond wired solutions like batteries if we want to build out a reliable and resilient system to meet the needs of all Canadians. The solution is quite literally under our feet.

[2] https://renewablesassociation.ca/news-release-new-2023-data-shows-11-2-growth-for-wind-solar-energy-storage/#:~:text=In%20Saskatchewan%2C%20CanREA%20is%20currently,projects%20in%20the%20proposal%20stage.

[3] https://www.prnewswire.com/news-releases/trinity-gas-storage-llc-trinity-secured-189-million-in-funding-for-the-groundbreaking-of-its-natural-gas-storage-facility-in-east-texas-a-milestone-for-energy-security-and-electrical-reliability-for-texas-301921525.html