CANADIAN GAS ASSOCIATION
ASSOCIATION CANADIENNE DU GAZ

NATURAL GAS STORAGE

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OVERVIEW

Natural gas has a central place in Canada's energy mix meeting over 30 per cent of the country's energy needs. Today over 6.7 million customers representing well over 20 million Canadians rely on affordable, clean, safe and reliable natural gas for heat and power in homes, apartments, buildings, businesses, hospitals and schools.

That reliability is assured because of the extensive distribution and storage infrastructure. This is especially important when temperatures fall and/or stay low for extended periods. Utilities can rely on stored natural gas to meet the demand and deliver the energy needed to heat homes, businesses and institutions during those cold winter days.

The following report focuses on natural gas storage and the role it plays in the delivery of energy solutions for Canadians. It summarizes:

- the different types of storage facilities;
- storage locations and volume capacity;
- the role that storage plays in ensuring a reliable supply of natural gas; and
- an outlook of storage levels ahead of this heating season.

NATURAL GAS STORAGE AND AFFORDABLE AND RELIABLE ENERGY SERVICES

The storage of natural gas in North America plays a critical role in balancing supply and demand. Natural gas demand fluctuates significantly between winter and summer. In fact, peak winter demand in Canada's residential and commercial sectors can surpass summer demand by up to six times. Natural gas storage has a role in ensuring smooth supply levels and an ability to respond to demand peaks year round. This helps secure affordable and reliable energy services for Canadians as natural gas stored in the warmer summer months is withdrawn for use in the cooler winter months.

NATURAL GAS STORAGE AND AFFORDABLE AND RELIABLE ENERGY SERVICES

Combined, the United States and Canada have approximately 4.72 trillion cubic feet (Tcf) of working natural gas storage capacity (3.9 Tcf in the U.S. and 0.80 Tcf in Canada). This volume is equal to approximately 60 days of average daily North American consumption. In Canada storage capacity is equivalent to approximately 30 per cent of domestic annual natural gas demand.

Types of Storage Facilities

There are four common types of storage facilities used in North America: depleted oil or gas reservoirs, aquifers, salt caverns, and liquefied natural gas (LNG) or compressed natural gas (CNG) units[1]. In the case of geological storage, the more porous and permeable the storage medium, the quicker the stored gas can be recovered.

Depleted natural gas or oil reservoirs:

This is the most common type of storage. It consists of an underground rock formation that has already been tapped of its recoverable oil or natural gas. Natural gas can be pumped back into the formation using large compressors and held there until it is required. Porosity and permeability of these facilities are low, meaning injection and recovery occur at a slower rate than salt caverns or LNG storage.

Aquifers:

The geology of an underground aquifer is similar to a depleted field or reservoir, but aquifers usually require more gas and greater monitoring of withdrawal and injection performance since deliverability rates are affected by the pressure from any residual water in the aquifer. In order to use an aquifer for storage, operators inject gas into the formation displacing the water. Similar to depleted natural gas or oil reservoir base storage, the porosity and permeability from aquifer storage is low.

Salt caverns:

This type of storage is built in underground caverns created by mining or dissolving the salt and creating a space that can then be used to store natural gas. The porosity and permeability of salt caverns is very high. This makes salt caverns ideal for managing large, quick swings in natural gas demand or supply such as those seen with power generation.

LNG and CNG storage:

Natural gas is also stored above ground as liquefied natural gas (LNG) or compressed natural gas (CNG). Like salt caverns, LNG storage units are used to meet periods of extreme or peak demand. LNG storage can be built in areas where the geology does not provide for underground storage. LNG and CNG can also be transported to locations beyond the existing pipeline system. In some cases this "mobile storage" can be used to overcome situations where "piped-in" natural gas is unavailable or has been interrupted.

Storage Users

There are a number of direct storage users including local distribution companies (LDCs), natural gas producers, pipeline companies, and in some instances individual market participants.

LDCs use storage as a means to meet customer demand, primarily in the winter. LDCs purchase gas in the summer, inject it into storage, and then withdraw it in the winter if and when it is required.

Producers and pipeline companies use storage to balance fluctuating production or supply levels. For example, during a hurricane, producers may be forced to shut in some of their producing wells. During these

[1] In addition to stationary storage facilities, natural gas is contained/stored within the North American pipeline network. This gas is commonly referred to as line pack.

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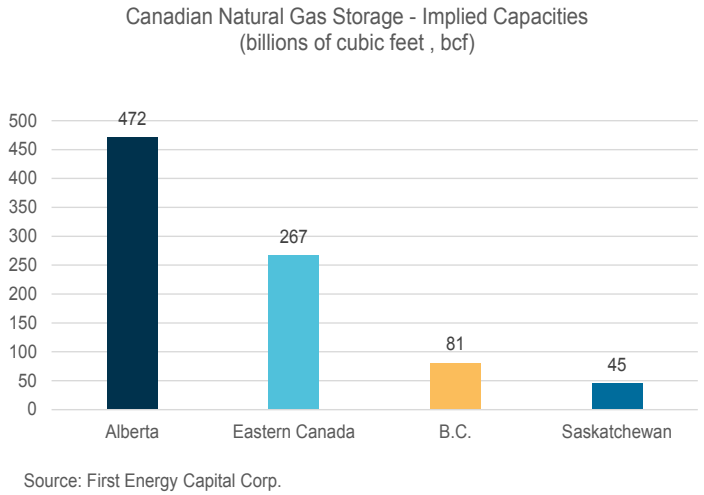
times, drawing on stored gas could allow a producer to continue to meet contractual supply obligations.

Storage is also used by larger market participants to manage their exposure to price fluctuations and escalations. They do so by buying and injecting natural gas into storage facilities during periods of low prices and withdrawing and selling the gas when prices rise.

Storage Location and Volumes in Canada

Natural gas storage facilities are situated in many regions across North America[2]. In Canada, the majority of storage is located in Western Canada - 587 billion cubic feet (bcf) - with Alberta having the greatest storage volume, and smaller storage capacity in British Columbia and Saskatchewan. Western Canadian storage is used primarily for managing producer and pipeline supplies.



Source: First Energy Capital Corp.

Storage in Eastern Canada is located primarily in southwestern Ontario. It is one of the most significant storage hubs in North America, and is used almost exclusively by LDCs and large end use customers to meet winter demand in the provinces of Ontario and Quebec. These facilities have a working capacity of just over 265 bcf. To put it into perspective this is equivalent to about 79,000 GWh of electricity or enough to power almost 11 million households for one year.

There is a small amount of storage capacity in Quebec and New Brunswick in the form of LNG storage. Development of a salt cavern storage facility, called the Alton Storage Facility, in Nova Scotia is underway with plans for it to be in operation by 2019. The ability to store natural gas in Nova Scotia will help ensure more supply is available for that province's natural gas consumers.

Canadian Storage Regulation

The regulation of storage facilities in Canada falls under provincial jurisdiction. If a storage facility is part of the regulated assets owned by an LDC, then the rates it may charge users are usually regulated by the provincial energy regulator. If a storage facility is not owned by an LDC, or is not part of the regulated assets-base of the LDC then its rates are market-based, set by a contract between the buyer and the storage seller. Storage rates in producing regions are mostly market-based, while in consuming regions storage rates are more often regulated. In all cases, facilities must comply with regulations for their safe design, construction, and operation.

North American Gas Storage Cycle

The North American facilities follow a 12 month storage cycle divided into an injection season (usually April to October) and a withdrawal season (usually November to March). North America storage levels typically peak at about 4-5 Tcf in October and then are drawn down to 1-2

[2] Source EIA: The United States has approximately 3.9 Tcf of storage divided among the Gulf Region (1.2 Tcf), East Region (2.2 Tcf) and West Region (0.5 Tcf).

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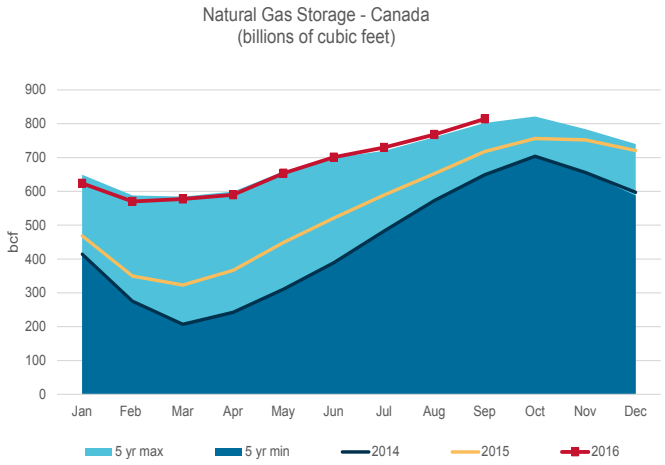
Tcf by April. In a geological storage facility about 20 per cent of facilities' capacity stays as "cushion gas" to ensure that the necessary pressure to safely operate the field is maintained and to prevent any infiltration of impurities.

The Outlook for the 2016-17 Heating Season

The abundance of natural gas in North America has led to a record breaking storage year in 2016 ensuring ample natural gas availability for the coming winter. In the current market environment these high levels of supply and storage suggest that natural gas will remain the most affordable energy for heating and other uses across North America.

More specifically Canadian natural gas storage levels as of August 2016 reached a new five-year maximum level of 770 bcf for the month (about 95 per cent full). Again this means that consumers in regions with ready access to pipeline and stored natural gas should expect their energy costs to remain very affordable.



Source: First Energy Capital Corp

CONCLUSION

Natural gas storage plays a critical role in balancing North American natural gas supply and demand and helping to ensure reliable and affordable energy services for customers. Storage plays a very important role in keeping natural gas prices relatively low for customers as it helps offset peak demand needs.

To meet the growing demand for storage and the unique requirements of certain users (e.g., gas-fired generators), investments in new facilities – both LNG, CNG and underground – are ongoing in Canada and the United States.

Going forward, storage development will help off-pipe communities and communities with constrained pipeline capacities to benefit from affordable and clean natural gas based energy solutions.

For more information, visit **www.cga.ca**.

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