CGA By the Numbers:  
Natural Gas: Reliable Energy When We Need it Most

This issue of By the Numbers comes as a long cold winter shows signs of finally letting up — a winter made much more tolerable thanks to reliable natural gas. We dive into electricity data from the Independent Electricity System Operator (IESO) and show how natural gas plays an important role beyond direct heating, ensuring the reliability of electricity supply as well.

OVERVIEW

Since ringing in the new year, Canadians have experienced record-low temperatures which have in turn resulted in new all-time highs for energy consumption for winter energy needs. For example, in Saskatchewan, previous natural gas records were broken five times this past winter, peaking at 1.66 PJ. For comparison, this is almost double the province’s average daily consumption of 0.87 PJ between December 2020 and February 2021. On the electric side, records were broken in parts of British Columbia, Alberta, Saskatchewan, and Québec.

What has also been telling this winter is just how resilient and reliable the natural gas system has been — from the supply of gas that kept flowing uninterrupted, to the safe operation of the underground infrastructure and storage system that meets our peak winter heating needs. At the same time, Canadians using electricity witnessed the constraints and limitations of the electric grid as system operators in several jurisdictions ordered consumers to limit their electricity use as demands were outpacing generation capacity.

For example, in January 2022, in Québec, where 97% of its electricity generation capacity is hydro or wind, Hydro-Québec reached a new record of 39,900 MW. In response to the high demand, the utility called for customers to reduce electricity consumption.

KEY FINDINGS

1. Amid temperatures that dipped below -30°C during the 2021–2022 winter season, gas operators delivered energy to homes and businesses without issue, but electric system operators saw tremendous strain on the electrical grids and in response, sometimes called for customers to reduce electricity consumption.

2. Focusing on Ontario, where the electricity supply is diverse (nuclear, hydro, gas, intermittent wind and solar), the reliability of electric power was guaranteed thanks to the availability of the flexible gas-powered generation option in periods of high demand.

3. While there is significant wind and solar capacity in Ontario, that doesn’t always equal available power because both are intermittent — there were nine instances in January 2022 where natural gas made up more than 90% of the electricity not supplied by nuclear and hydro. At some points, gas-powered electricity was meeting more demand than hydro, to help Ontarians handle the severe cold.

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for users to reduce their electricity consumption during -30°C temperatures. Hydro-Quebec stated in a news release: “Hydro-Quebec is asking the population to voluntarily use less electricity on Friday, January 21, throughout the day, and during the morning of Saturday, January 22, 2022.” Further, in December, the Alberta Electricity System Operator asked consumers to reduce electricity use and to avoid charging their electric vehicles due to system capacity constraints.

“Hydro-Quebec is asking the population to voluntarily use less electricity on Friday, January 21, throughout the day, and during the morning of Saturday, January 22, 2022.”

- Hydro-Québec

These examples show the limitations of the electric system when facing extreme cold. Further, these should be warning signs for policy makers who are promoting mass electrification of heating. For certain, as our energy systems and energy use adjust to meet government emission reduction targets, policy makers and system owners/operators will need to stay particularly focused on ensuring we have the options necessary to guarantee system reliability and resiliency — and this is where natural gas is key. Natural gas is not just vital to meeting heating needs, it also serves an important role in the electric grid. Many electricity operators rely on natural gas to balance the grid, particularly during the extreme cold when demand is high.

Let’s look at the example of Ontario. The province has a diverse electricity mix, relying on various sources including nuclear, hydro, natural gas, and renewables like wind and solar. The pie chart shows the installed electricity capacity in Ontario by fuel.

**FIGURE 1: INSTALLED CAPACITY IN ONTARIO (MW)**

Let’s look at the example of Ontario. The province has a diverse electricity mix, relying on various sources including nuclear, hydro, natural gas, and renewables like wind and solar. The pie chart shows the installed electricity capacity in Ontario by fuel.

Source: IESO

Figure 2 shows Ontario’s hourly power generation mix in the month of January 2022. We see that the share of nuclear and hydroelectricity are relatively constant throughout the month at nearly 75%. Nuclear and hydro provide the baseload, but since they possess low capability to adjust or store the electricity that is generated, they are not enough to meet incremental demand. So how does the electric grid meet the remaining 25% of demand? Considering that the average electricity demand in January 2022 was 19,423 MW, this leaves another 5,152 MW that needs to come from sources other than nuclear and hydro. With nearly 5,300 MW of solar and wind capacity, it seems natural that these sources can generate the remaining demand.

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Looking at Figure 2, we see that this is far from the case. Rather, Ontario relies primarily on natural gas to meet incremental demand. While wind and solar are critical parts of the electric grid, they are both intermittent and cannot always be relied upon, whereas gas-powered generation is readily available at the turn of a switch. There were nine periods in the month where natural gas made up more than 90% of the electricity demand that was not generated by nuclear or hydro. For the full month, natural gas accounted for 16% of all electricity generated while wind and solar only accounted for 10%.

The gap widens when we consider peak demand periods such as during extreme cold temperatures. The table below shows the power generation mix during the five coldest days in Ontario in January 2022. On the days that Ontarians needed energy the most, natural gas provided up to 29% of its electricity needs — sometimes exceeding hydroelectric supply — while wind and solar accounted for less than 11%. When we examine utilization, this represents 44% of Ontario’s natural gas capacity and 26% of its wind and solar capacity.

A diverse energy mix is an asset in many ways, but the value really becomes apparent when system resilience and reliability are put to the test — as often happens in a Canadian winter. Natural gas and the infrastructure that delivers it, demonstrate time and again why they are so critical to the energy system we have in Canada. This winter made it all the more evident.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature (°C)</th>
<th>Total Energy (MWh)</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Wind / Solar</th>
<th>Gas</th>
</tr>
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<tbody>
<tr>
<td>Jan 29, 2022</td>
<td>-24.3</td>
<td>490,848</td>
<td>53%</td>
<td>22%</td>
<td>4%</td>
<td>21%</td>
</tr>
<tr>
<td>Jan 26, 2022</td>
<td>-23.2</td>
<td>499,421</td>
<td>52%</td>
<td>20%</td>
<td>8%</td>
<td>21%</td>
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<tr>
<td>Jan 21, 2022</td>
<td>-22.5</td>
<td>500,610</td>
<td>47%</td>
<td>20%</td>
<td>5%</td>
<td>29%</td>
</tr>
<tr>
<td>Jan 15, 2022</td>
<td>-22.2</td>
<td>492,229</td>
<td>49%</td>
<td>22%</td>
<td>6%</td>
<td>23%</td>
</tr>
<tr>
<td>Jan 11, 2022</td>
<td>-22.2</td>
<td>498,441</td>
<td>48%</td>
<td>21%</td>
<td>11%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: IESO

*4 Calculated as the average min temperature in five major cities: Toronto, Ottawa, London, Windsor, and Sudbury.*