2016 – Among Other Things a Strong Year for Natural Gas

Record year in 2016 for natural gas consumption, storage, & power generation.

US energy exports are on the rise.

Record year for US solar installations.

Carbon dioxide emissions down to a 25-year low.

Consumers are spending less of their incomes on energy than ever.
The rest of the world is looking to the US for new supplies of hydrocarbons, especially natural gas (LNG).
Natural gas prices exhibiting little variance this summer; current prices in line with prior years.

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<th>Dollars per Million BTU</th>
<th>Daily Natural Gas Prompt-Month Futures Price at Henry Hub</th>
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<td>Price Range 2009-2012</td>
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<td>2017</td>
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<td>2016</td>
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Graph showing natural gas prices from 2009 to 2017.
Higher drilling activity is beginning to have an effect; dry gas production is up.

Daily Dry Natural Gas Production
US Lower-48

Bcfd

2017

2016

Four-Year Range
2007-2010

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
LNG Exports

Dominion Energy Cove Point liquefaction project

Source: Dominion Energy Cove Point LNG, July 2017
New border-crossing pipelines are increasing US exports to Mexico.

US became a net exporter of natural gas during times in November.
## US Natural Gas Resource Estimates from the Potential Gas Committee

### Year-end 2016 assessment results

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<th>Mean Technically Recoverable Volumes (trillion cubic feet or Tcf)</th>
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<td><strong>Traditional gas resources (conventional, tight and shale reservoirs)</strong></td>
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<td><strong>Future gas supply in the U.S.</strong></td>
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Horizontal Drilling
Multi-Lateral Drilling

Micro Seismic Technology
Inflation-Adjusted Prices to Commercial Customers the *Lowest* since the Ford Administration

Natural Gas Prices to Commercial Customers

Source: Energy Information Administration, Short-Term Energy Outlook (Dec. 2016)

Source: Energy Information Administration and Bloomberg New Energy Finance.
Energy-related CO2 emissions fall below 5.2 billion metric tons in 2016 year, lowest since 1992.
However, there are different visions for domestic energy policy?

“It is very clear that we cannot afford to expand infrastructure and reliance on fossil fuels, including gas.”

“At the same time, we do need to ensure that coal energy is not backfilled with gas.”

Introducing, once again, Electrification. Decarbonization of power generation in the US and the elimination of fossil fuel appliances in homes and businesses.

“Beneficial Electrification”

“Strategic Electrification”

“Policy-Forced Electrification?”

“Wide-spread utilization of Dilithium crystals (23rd century)” – Gene Roddenberry
What is electrification?

• Proposals for mandatory, widespread/total electrification of residential home heating and water heating.

• Primarily justified as a GHG reduction and enabled by increasingly clean, renewable power grid.

• Not the historical gas/electric market competition.
Where is it being explored?

Ontario
Residential electrification was promoted by NGOs and then aggressively pursued by environmental agency. Concerns from generators and ISO and strong analytical pushback from gas industry have significantly stalled the activity.

Vancouver, BC
Plan to position Vancouver as the greenest city in the world. 100% renewable energy goal before 2050 Establishes a phased approached to achieve zero emissions in all new buildings by 2030. Some policies that effectively exclude gas have been initiated but may be delayed due to pushback from industry.

Denver
City task force this month recommended “Shift commercial buildings and 200,000 households off natural gas to heat sources that do not lead to carbon pollution.”

California, Alberta, Washington, Oregon, Others
Active discussion and analysis of electrification
Key Questions

• Will electrification actually reduce emissions?

• What is required on electricity infrastructure?

• Is electrification cost-effective compared to other alternatives?

• What are the implications to natural gas LDC’s
Examining the Cost of Electrification

- Quantify incremental generation capacity required to meet peak home and business space heating and water heating loads.

- Examine and quantify transmission infrastructure requirements.

- Identify the cost per unit of greenhouse gas emissions achieved through electrification. Compare to direct use of natural gas.

- Executive summary to identify key results.
Gas Peak Demand Can be Much Higher than Electric

Ontario Gas and Electric Demand*

- Natural gas demand peaks in the winter: 80 GWs.
- Electrical demand peaks in the summer: 25 GWs.
  Less than 1/3 of the natural gas peak.

* ICF December 16, 2016 Study on Ontario Markets for Union Gas and Enbridge Gas

- The cost of reducing carbon emissions in the residential sector can by much higher than in other sectors*
  - C$280/ton CO₂ reduced without new infrastructure.
  - C$380/ton CO₂ reduced including infrastructure.

Requiring C$1,600 in incremental costs per year per household.*
The abundance of North American natural gas is lowering energy costs to consumers and reducing emissions.

Advances in renewables *and* natural gas are taking place simultaneously. We should want to see cooperation, as well as competition.

Market forces may dictate outcomes, but industry must engage with and educate communities.