THE RENEWABLE NATURAL GAS TECHNOLOGY ROADMAP FOR CANADA

Paul Cheliak
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PRESENTATION OVERVIEW

The Natural Gas Market

The Natural Gas Transportation Market

Renewable Natural Gas Roadmap
The Natural Gas Market
CANADA’S NATURAL GAS PIPELINE INFRASTRUCTURE

Utilities serve 20 million Canadians
Natural gas meets 30% of Canadian energy needs
Canada has 500,000 km’s of natural gas pipeline
HOW CANADA USES ENERGY

Energy final demand - Canada - by type (%)

- Natural gas: 30.8%
- Electricity (hydro, nuclear): 22.5%
- RPP: 38.1%
- All others*: 8.5%

Source: StatCan 128-0016

*Coal, NGLs, coke, coke oven gas, steam
In 2013, Canada exported over half its gas to the US.

Less than 0.5% of Canada’s natural gas use is for transportation.
NATURAL GAS PRODUCTION AND RESOURCES

 Marketable natural gas production - Canada + U.S. (billions of cubic feet)

Source: U.S. Energy Information Administration, Canada National Energy Board
NATURAL GAS: ONGOING AFFORDABILITY

Energy commodity prices - Canada
($/mmBtu)

Source: StatsCan 326-0009, Kent Group, CGA
RESIDENTIAL ENERGY USE AND COST IN CANADA

Residential Space & Water Heating Energy Choices in Canada

- Natural gas 56%
- Electricity 25%
- Wood 9%
- Heating oil 8%
- Propane & Coal 2%

Residential Space & Water Heating Costs - Canada, 2013

- Natural Gas
  - Space Heating $1,078
  - Water Heating $1,161

- Propane
  - Space Heating $3,045

- Electricity
  - Space Heating $3,001

- Heating Oil
  - Space Heating $3,472

Source: StatsCan, Hydro Quebec, Kent Marketing, Canadian Gas Association

Source: NRCan End Use Database
The Natural Gas Transportation Market and the connection to RNG
THE CANADIAN NGV LANDSCAPE

NGV's in Canada by Vehicle Type - 2013

- Forklifts (2000)
- Ice Resurfacer (400)
- Transit (106)
- Refuse (421)
- Highway Tractor (294)
- Light-duty (9,524)

4 major CNG transit fleet projects and 11 new refuse projects

3 billion cubic feet consumed in 2013, equal to 61 million litres of diesel

12 new highway tractor projects launched including use of both CNG and LNG tractors

23 new refueling stations serving:
- Return-to-base refuse, transit, trucking fleets
- Regional trucking corridors
NATURAL GAS: AN AFFORDABLE VEHICLE FUEL

Comparing British Columbia Transportation Fuel Prices

- **RNG at $12/GJ (~ $1.50/GJ Carbon Tax)**
- **Gas Commodity Cost**
- **Compression/liquefaction cost**

Source: Kent Group Marketing, Fortis BC, CGA
RENEWABLE NATURAL GAS TECHNOLOGY ROADMAP FOR CANADA

The Steering Committee
CANADA'S RNG POTENTIAL

**RNG Production Potential**

**RNG Carbon Offset Potential**

10% of the potential is a year's supply of gas for 1 million homes in Canada or equal to 1 billion liters of diesel.

10% of the potential is = 2.5 million cars of the roads.

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**Figure 1: Potential Methane Production from Canadian Wastes**

Canada total = 1292 bcf/year

Source: Potential Production of Methane from Canadian Wastes, Alberta Research Council, August 2008

**Figure 2: GHG Reductions due to Production of Renewable Natural Gas**

Canada total = 108.9 Mt CO₂eq / year

Source: Potential Production of Methane from Canadian Wastes, Alberta Research Council, August 2008
THE RNG ROADMAP VISION

Vision

• Canada’s has a fully developed RNG marketplace by 2020 that helps meet the energy needs of Canadians, supports growth and innovation for business, and offers a solution to issues associated with waste and emissions.
RNG ROADMAP: TARGETED ADOPTERS

**Municipalities** are both producers (landfills, source separated organic treatment facilities, wastewater treatment plants) and consumer (heating of public facilities, fueling of their fleets).

Large industry and power generation account for more than 50% of natural gas consumption. RNG as a compliance option would allow industry to become a major adopter of RNG.

For **transportation**, RNG can reduce vehicle emissions by 95% vs Conventional diesel or gasoline.
RNG ROADMAP RECOMMENDATIONS

- Introduce Policy Tools to spur the Market
- Collaborate and Invest in Technology Solutions
- Provide Education/Awareness to Key Stakeholders
- Explore the Use of Renewable Natural Gas for Vehicles
- Determine Green Attributes and Encourage Waste Diversion Policies to Support RNG
Implement the recommendations: two working groups have been formed including (i) RNG technology solutions (gasification) and ii) RNG in transportation markets.

Socialize the findings and the Roadmap with governments, municipalities and industry looking for pilot project and implementation opportunities.

Present the findings and disseminate the Roadmap to industry, government and other interested stakeholders.
Natural gas vehicle operators can refuel with RNG at two CNG stations in Quebec (Berthierville and Montreal).

### Canadian RNG Projects

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity (m3/h)</th>
<th>Litres of diesel</th>
<th>Number of homes</th>
<th>In Operation</th>
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<td><strong>EXISTING</strong></td>
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<td>Berthierville (QC)</td>
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<td>2013</td>
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<td>2014</td>
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<td>BFI Landfill (QC)</td>
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<td><strong>PLANNED</strong></td>
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<tr>
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<td>1348</td>
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<td>Richmond (BC)</td>
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<td>Saint-Hyacinthe</td>
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- **10 projects by 2016**
- ~80 million litres of diesel equivalent
- Fuel for 30,000 homes
• QUESTION: If gas commodity costs are $4.00/GJ, how does an RNG producer make money?

• ANSWER: Policy driven credits provide additional value for RNG.

• US EPA Federal Renewable Fuel Standard 2 provides $4-7/GJ.

• California LCFA provides another $2.25/GJ.

• With credits, RNG projects become attractive as shown (note $2/GJ is taken off for pipeline transport to California).

Source: Coalition for RNG
Customers pick their % blend of RNG (5%-100%)
RNG ‘premium’ supports RNG projects
Over 6,500 customers in BC
No impact on non-RNG customers
Impact on Cost Sample:
  - 5% RNG blend
  - $14/GJ RNG supply
  - Annual cost: ~$40 per household
CANADIAN RNG PROJECTS: VALUE IN THE US CREDIT MARKET

Value of RNG in US Market over 20 Year Period ($million's)

Abbotsford (BC)
Kelowna (BC)
Chilliwack (BC)
Hamilton (ON)
BFI Landfill (QC)
Richmond (BC)
Salmon Arm (BC)
Delta (BC)
Saint-Hyacinthe
RNG: A BUSINESS OPPORTUNITY FOR BIOECONOMY LEADERS

First: RNG is a renewable fuel for transportation. It could be another ‘tool’ in the toolbox for biodiesel or ethanol producers.

Second: Where renewable fuel producers have digesters within their operations, RNG offers a business opportunity to harness methane from those digesters.

Third: Skate where the puck is going to be….to NGV’s and by extension RNG.
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