Pathway to Market for a Superior Fuel
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Big Picture: Climate Change & CO2 Levels at 409.5 ppm

Where Are We Going?
- Climate Change Effects
- Electrical Short Circuits
- Government Misfires
- Carbon Recycling Awareness

We Must Align Large Companies, Governments and Risk Takers

Procurement and Balance Sheet Focus On ONE Market
Map 1: Electric Power Carbon Intensity by Province

Electricity: Alberta CI = 220 g-CO2/MJ, Saskatchewan = 184 g-CO2/MJ
Map 2: Canadian Wind Atlas and Renewable Power

Wind Power: Alberta, Saskatchewan, Yukon & Northern British Columbia
Agriculture Centers: Alberta, Saskatchewan, Manitoba
Map 4: Power Opportunities in Remote Communities

CANADA’S DIESEL DEPENDENT COMMUNITIES

POPULATION

- ≤ 500
- 501–1,500
- 1,501–2,500
- 2,501–5,000
- > 5,001

Electricity Transmission Lines


What Is The Best Path to Market?

Current Facts and Challenges:
- Despite the Advantage of DME, We Are Not There...
- Electric Vehicles Have Dominated the Conversation
- Diesel Engines Have Been Vilified Rather Than Companies
- Transportation is an End Game, Not an Entrance

Where is the Opportunity?
Innovative Disruption: How Can a Challenger Turn the Tide
People Still Need to Eat, Dress and Live in a House
Innovator’s Dilemma: The Challenger Attacks the Low Value Margins
Diesel Consumption by Community Size

Diesel Used vs. Population for 132 Remote Communities (Liters/Year)

Factor | Total
---|---
Number | 136
Population | 91,427
Fuel Used (Megaliters) | 255.9
Per Person (Liters) | 2,800

Slope = 1665 Liter/Person
Conventional DME Production Using Reforming

Feedstock (Methane, Water and Carbon Dioxide) → Synthesis Gas (Hydrogen & Carbon Monoxide) → Methanol and Excess Hydrogen → Pure Methanol → Dimethyl Ether & Water

**Block 1 (Reforming)**
Steam Reformation of Natural Gas and Some CO2

**Block 2 (Methanation)**
Modular Syngas to Methanol with Additional Hydrogen

**Block 3 (Dehydration)**
Methanol Dehydration to DME Under Broad Patent

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Local Power and Heat Process Flow

Each Person Need About 2,500 kW-hrs
A DME Generator Produces 15,000 kW-hrs @ 38% Efficiency with 1400 Watts Peak

- Coolant Water
- Air
- Dimethyl Ether
- Household Loads
- Fuel & Coolant
- Power
- Heat
- Household Use
- Electric Inverter
- Dimethyl Ether Motor Generator
- Liquid Heat Exchanger
- Gas Heat Exchanger
- Exhaust Gas
- Thermal Heating Loop
- Household Hot Water
- Heat Pump Connection
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Components for Remote Generation and Microgrid

**Power Sources**

**Transmission**

**Power Loads**

**Power Applications**

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**Vast Amounts Natural Gas and Biomass for Co-produced Renewable Fuel**

Each Person Needs 2,500 kW-hrs per Year
### New York City Class 8 Work Truck Fuel Usage

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td># of NYC (Heavy) Trucks w/ Biodiesel Mix 2017</td>
<td>10,247</td>
</tr>
<tr>
<td># of NYC (Heavy) Trucks w/ ULSD #2 Diesel 2017</td>
<td>953</td>
</tr>
<tr>
<td>Total NYC Combination (Heavy) Trucks 2017</td>
<td>11,200</td>
</tr>
<tr>
<td>Total Annual NYC Bio Diesel Fuel Consumption (in Gallons) 2017 (Reduction by 4% and 2%) Est.</td>
<td>11,219,599</td>
</tr>
<tr>
<td>Total Annual NYC ULSD #2 Diesel Fuel Consumption (in Gallons) 2017 Est.</td>
<td>3,942,021</td>
</tr>
<tr>
<td>Total Annual NYC Fuel Consumption (in Gallons) 2017 Est.</td>
<td>15,161,620</td>
</tr>
<tr>
<td>Average Annual of NYC (Heavy) Trucks Total Consumption Per Truck (in Gallons)</td>
<td>1,354</td>
</tr>
<tr>
<td>Average U.S. Diesel PADD 1 Rack Price Per Gallon (including all taxes) for 2017</td>
<td>$2.211</td>
</tr>
<tr>
<td>Estimated Annual Retail Cost of Diesel Fuel Consumed by Combination Trucks in the NYC 2017</td>
<td>$33,526,890</td>
</tr>
<tr>
<td>Pro-Forma Total Annual NYC Consumption (in DME Liters)</td>
<td>107,385,706</td>
</tr>
<tr>
<td>@ Production Rack Cost for DME (490 $/tonnes) Est. 2017 DME Replacement Costs</td>
<td>$38,562,207</td>
</tr>
<tr>
<td>Total Cost of New Plant (Expect Payback in 3-4 Years)</td>
<td>$83,871,207</td>
</tr>
</tbody>
</table>
Rural Applications: Irrigation and Pumping

A Major Application (US Case)

- Croplands Irrigated: Grain, Oilseed, Vegetables, Nursery, Greenhouse..
- 52 Million Acres Irrigated per Year
- 88.5 Million Acre-Feet of Water
- $2.6 Billion Spent on Equipment
- At 200 kW-hr (720 MJ) per Acre-Foot or About 53 Gallons DGE
- 33% Fuel, ~ 1.54 Billion Gallons

Many Small Engines, Easy Switch

We Can Produce DME Near Users Willing to Switch to a Higher Performing, Similar Costing Alternative
Conclusion: Not Easy Being Green

Conclusion:

- Kermit the Frog “People tend to pass you over ’cause you’re not sparkles on the water or stars in the sky”
- Richard Feynman: “There’s always room at the bottom”
- Clayton Christensen: “People don’t want to buy a quarter-inch drill. They want a quarter-inch hole.”

Green Things Need DME to Achieve (Green)³
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