

Foundation

ALYSIS RESEARC



## Refined Petroleum Products (RPPs) from Alberta's Crude Oil



- 77% of RPPs are transportation fuels
- 40% to gasoline
  - Primarily for personal mobility
- 33% to diesel
  - Primarily for freight transport

In 2016, Alberta-produced oil provides ~10X more transportation fuel than the province consumes.



...but what happens if transportation systems are disrupted?

#### We Live in a Time of UNIVERSITY OF CALGARY **Transformative / Disruptive Change**

Movies

Banking

**D** Books





# Why Would Freight Transportation Systems be Disrupted?



**Poor Load Factor.** Trucks driving empty or with excess trailer capacity reduces system efficiency;

**Limited Asset Utilization.** For safety reasons, Canadian regulation restrict drivers to <u>13 hours of drive time or 14 hours of on-duty time per day</u>. The truck asset is often unused for at least 10-11 hr /day;

**Low Productivity**. Waits at loading docks, intermodal terminals, border crossings and weigh stations further reduces efficiency and profitability;

**Labour Shortages.** A <u>driver shortage of 34,000 drivers</u> is projected within the next 7 years across Canada resulting from undesirable working conditions;

**Congestion.** Trucking contributes to road congestion / infrastructure problems, and reduces productivity

**Accidents.** In 2015, the trucking sector was linked to <u>417 fatalities in Canada</u> and over 2000 serious injuries;

**Air Pollution.** With <u>250,000 tonnes of nitrogen oxide</u> emissions, trucking in Canada contributes to acid rain and smog. It also generates high levels of particulate matter that is <u>linked to cardiac and respiratory diseases</u>.

**GHG Emissions.** Canada's freight sector currently accounts for <u>63 million</u> tonnes of  $CO_2$  emissions per year, 9% of national GHG emissions.

### **Disruptive Innovations**

- □ Autonomous Trucks
- Collaborative Transportation
   Management
- Physical Internet
- Block Chain
- □ Drones and hyperloops
- Digital Connectivity
- Electric Vehicles
  - Battery electric (BE)
  - Hydrogen fuel cell electric (HFCE)

The one that really matters to Alberta, but electric vehicles are the favoured choice for other disruptive innovations

Economic

Environmental

Health &



Tesla

Thor

# The Battle of the Electric Trucks

Nicola



### Battery Electric (BE)

Daiml

## In an autonomous, connected, big-data world, what kind of electric truck is better for Alberta / Canada / N. America?

Toyota



H<sub>2</sub> Fuel Cell Electric (HFCE)



# Alberta's Advantage in a H<sub>2</sub> Economy



<b>Resources</b>	<u>Infrastructure</u>	<u>Expertise</u>	<u>Need</u>
<ul> <li>Vast Oil &amp; Gas reserves;</li> <li>Geology that can sequester CO<sub>2</sub>;</li> <li>Excellent wind and solar potential.</li> </ul>	<ul> <li>Extensive pipeline infrastructure connected to other markets;</li> <li>Large trucking sector;</li> <li>H<sub>2</sub> production facilities</li> </ul>	<ul> <li>Skilled workforce in engineering, designing &amp; deploying large projects</li> <li>Innovators in energy space</li> </ul>	Province needs a strong, collective vision for a low C energy future

Alberta has an opportunity to take a leadership role in the production, distribution and use of zero carbon transportation fuels from its vast fossil and renewable resources.



# A Hydrogen Economy Ecosystem



