

L'Accélérateur de transition

Hydrogen and the Transition to Net-Zero Energy Systems

Public Policy Forum: Hydrogen Workshop Panel Sept 09, 2020



David B. Layzell, PhD, FRSC. Research Director, The Transition Accelerator Professor & Director, Canadian Energy Systems Analysis Research (CESAR) Initiative, U. Calgary, E: dlayzell@ucalgary.ca; W: www.transitionaccelerator.ca NET-ZERO EMISSIONS BY 2050 ...Committed to by Canada and 72+ other Countries*



How can Canada 'win'?
What are the best transition pathways?

Outline

- 1. Role for hydrogen in the transition to net-zero
- 2. The environmental footprint of 'blue' and 'green' hydrogen
- 3. Economics of hydrogen energy systems
- 4. How to get there from here?

Net-Zero means changing the 'energy carriers' supporting end-use demand



Why Hydrogen (H₂) is Needed?

1. Some sectors need chemical, not electrical energy carriers

- **Freight Transport**: *esp. HD, long distance, off road*
- **Fleet vehicles**: *esp. large fleets, heavily used (limited refuel time)*
- □ Heavy Industry: e.g. Steel, cement, chemicals
- □ Space Heating: *esp. in cold regions, where heat pumps perform poorly*

2. Complements low carbon electricity generation

- □ Hydro, Nuclear, Wind, Solar: when supply exceeds demand, make H₂
- \Box H₂ as source of electricity: *esp. for long term (days* \rightarrow *seasonal) (see* <u>*Ref*</u>)

3. Complements Biofuel production

□ *H*₂ increases biocarbon conversion efficiency

4. More resilient, interconnected energy system

One, not three energy systems (transport, electricity, thermo-chemical)

The Environmental Footprint of 'Blue' and 'Green' Hydrogen





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Canada: A Low-cost Producer of 'Blue' & 'Green' H₂

Alberta can make blue hydrogen at 1/2 the wholesale cost of diesel, 1/3rd the retail cost of diesel



Adapted from Asia Pacific Energy Research Centre. 2018. Perspectives on H₂ in the APEC Region. (Figure 3.4) <u>https://aperc.ieej.or.jp/file/2018/9/12/Perspectives+on+Hydrogen+in+t</u> <u>he+APEC+Region.pdf</u>

Economics of Blue Hydrogen Supply at Scale in Alberta





Create 'Hydrogen Nodes'

Regions/corridors across Canada that have:

- \Box Ability to make low-cost <u>waste</u>, <u>blue</u> or <u>green</u> H₂;
- \Box Substantial nearby markets for the H₂;
- □ Ability to connect the two (ideally pipelines);
- Scale of supply/demand where the economics works without sustained public investment;
 - □ Engaged industry, governments and academics

Example:

The Alberta Industrial Heartland (Near Edmonton, Alberta)



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Thank you

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