Transitioning Heavy Duty Trucking in Alberta:
A. Magnitude of the Challenge

Zachary Redick, BSc
Graduate Student, Dept. Civil Engineering, University of Calgary

David B. Layzell, PhD, FRSC
Principal, The Transition Accelerator
Director, CESAR, U Calgary

Alex de Barros, PhD
Professor, Dept. Civil Engineering, University of Calgary

INTRODUCTION

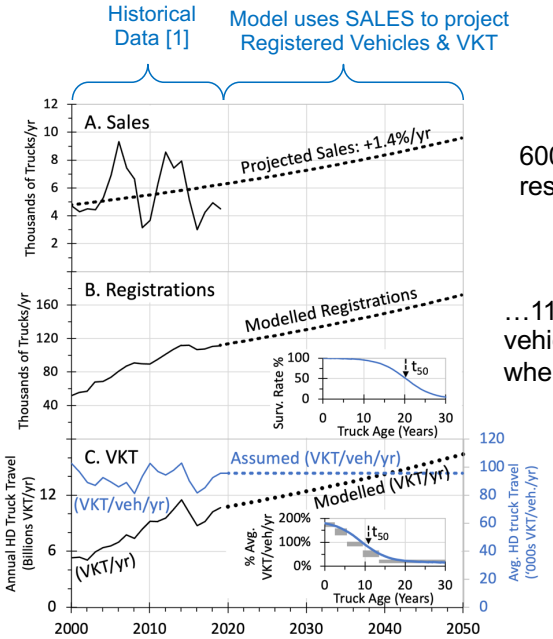
To address climate change, Alberta's heavy duty freight sector (Class 8, 15+ t GVW) must transition to near 100% sales of zero-emission vehicles (ZEVs) by 2040. ZEV options include battery electric (BEV) for short haul and hydrogen fuel cell electric (FCEV) for long haul.

This study uses scenario modeling to explore the implications of achieving Canada's target of:

- ❑ 35% ZEV sales by 2030 and near 100% by 2040, **OR**
- ❑ only 95% ZEV sales by 2040

…including an assessment of the required energy system transformation and what target is most credible.

MODEL OF HD TRUCKS IN ALBERTA



NOTE:

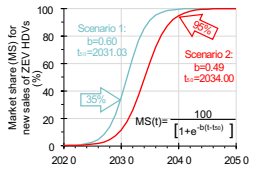
6000+ sales/yr, resulting in…

…110,000+ reg'd vehicles on road, where …

…each vehicle drives an avg. of ~96,000 km/yr, resulting in 10+ billion km/yr.

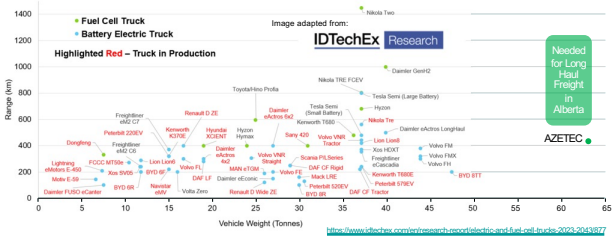
SCENARIOS:

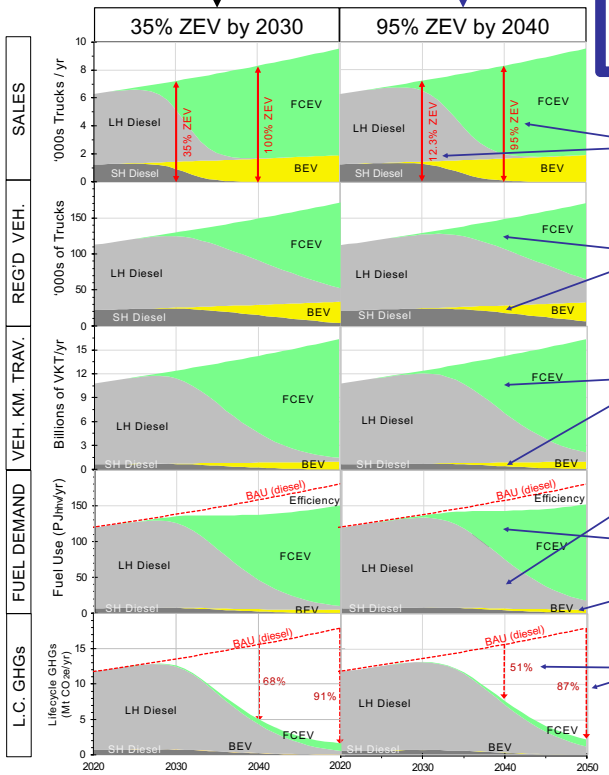
- ❑ 20% of ZEV sales are for short haul (SH, avg. 30,000 VKT/yr) so they transition to BEV
- ❑ 80% of Sales are for long haul (LH, avg. 112,000 VKT/yr
- ❑ Transitions occurs in 'S curves' to achieve either 35% sales by 2030 or 95% sales by 2040.



RESULTS & DISCUSSION

Achieving 35% HD ZEV sales (~2500 sales in Alberta) by 2030 is highly unlikely, since the fueling infrastructure is not in place and the vehicles the sector needs are not yet in production:





However, a target of **95% ZEV sales by 2040** may still be possible, but not without a coordinated effort and major investment to:

- ❑ Produce vehicles that meet the needs of Alberta's Short Haul (SH) and Long Haul (LH) markets to achieve about **12% of sales by 2030, 95% by 2040.**
- ❑ Be able to support **10,279 BEVs** and **41,111 FCEVs** on the road by 2040,
- ❑ …where these ZEVs are performing similarly to diesel ICE vehicles of a similar age so they account for **54%** (**7.72 billion km/yr**) of HD VKT/yr by 2040.
- ❑ This transition would reduce diesel demand by **54%** compared to business-as-usual (BAU) by 2040,
- ❑ …create a market for **1,316 t H_2/d** (=**20%** of current industrial H_2 production in Alberta, but low GHG), and
- ❑ …require the generation of **0.670 TWh/yr** of low GHG electricity **(=0.9%** of current grid size) by 2040.
- ❑ Assuming deployment of state-of-the-art technologies for low GHG H_2 and electricity production, the life cycle GHG emissions from the sector would be reduced by **51% in 2040** and by **87% in 2050**.
- ❑ The remaining emissions would need to be addressed using negative emission technologies

The cost of achieving this net-zero transition will be explored in a companion study.

ACKNOWLEDGEMENTS

Graduate student funding to ZR for this work was provided by:

- The AZETEC Project through CESAR at the university of Calgary,
- NSERC through the Integrated infrastructure for Sustainable Cities (IISC) project at the University of Calgary,
- Research funding from the Transition Accelerator and NSERC to DL and AB, respectively