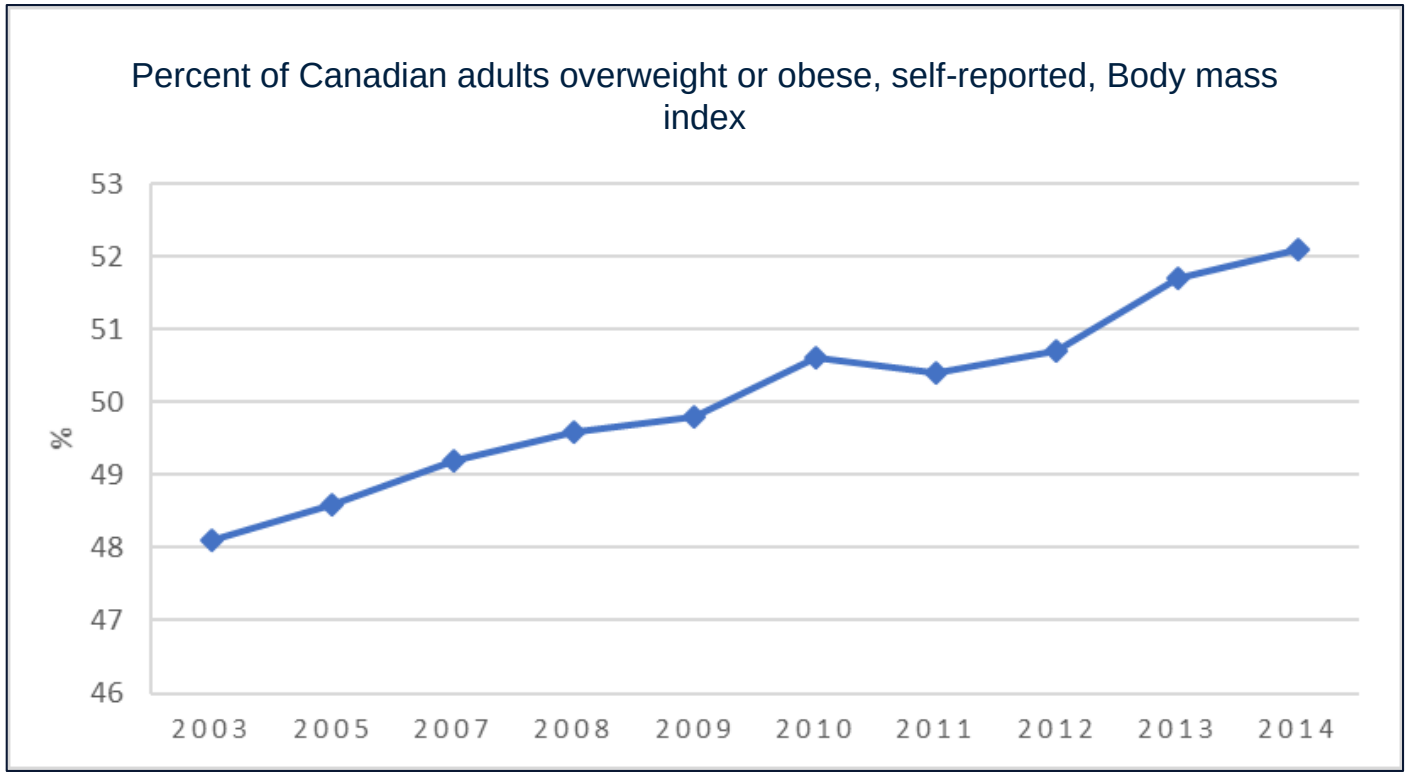
Transportation is a Social Determinant of Health: Proven Ways to Thrive via SMARTer Growth

HYPOTHESIS

- ✓ We can do better **with what we have** to sustain a desirable quality of life that promotes healthier, safer and more prosperous Okanagan residents and businesses and visitors

MOTIVATION 1: DIET & ACTIVITY

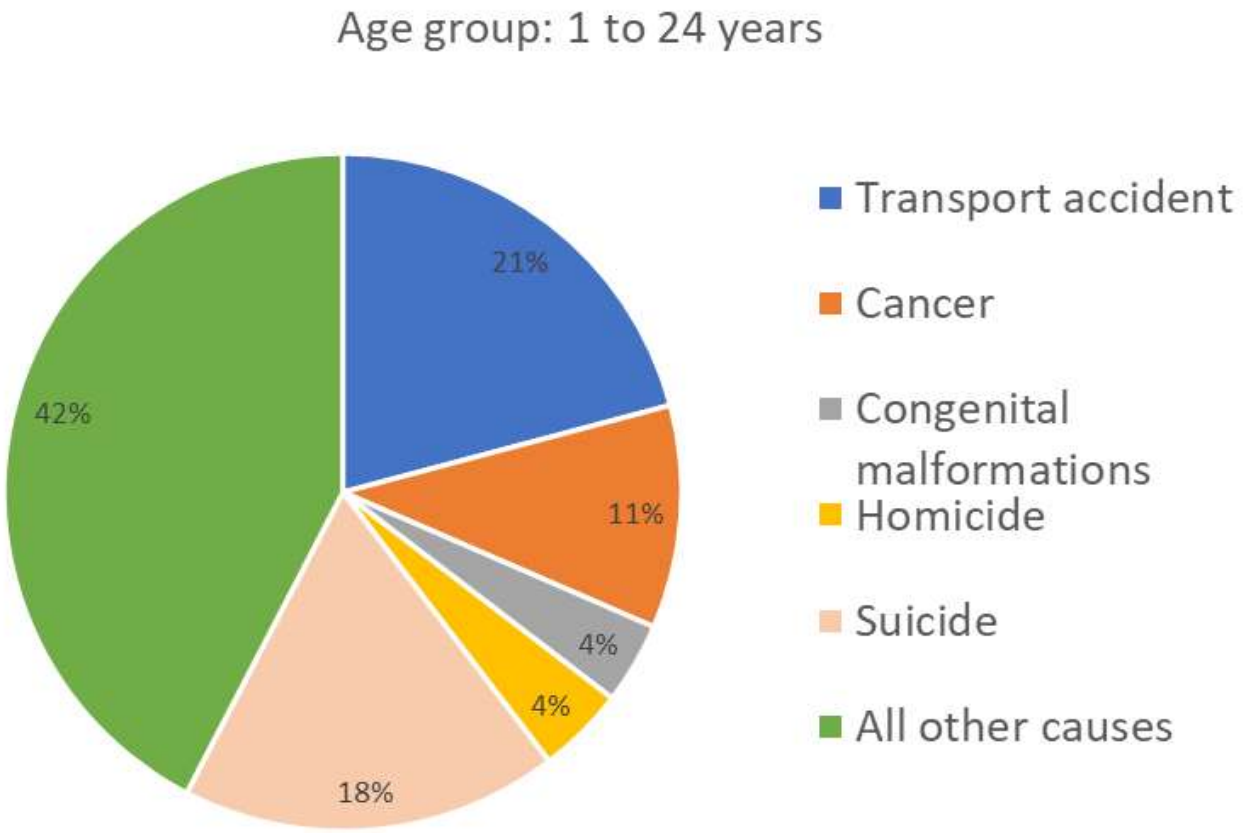
Obesity is the new Nicotene – we DRIVE, EAT, WASTE, SIT too much, and we know it, so what?



Source: Statistics Canada, CANSIM Table 105-0501

MOTIVATION 2: SAFETY

Drivers make mistakes - We are driving ourselves to death, and we know it, so what?

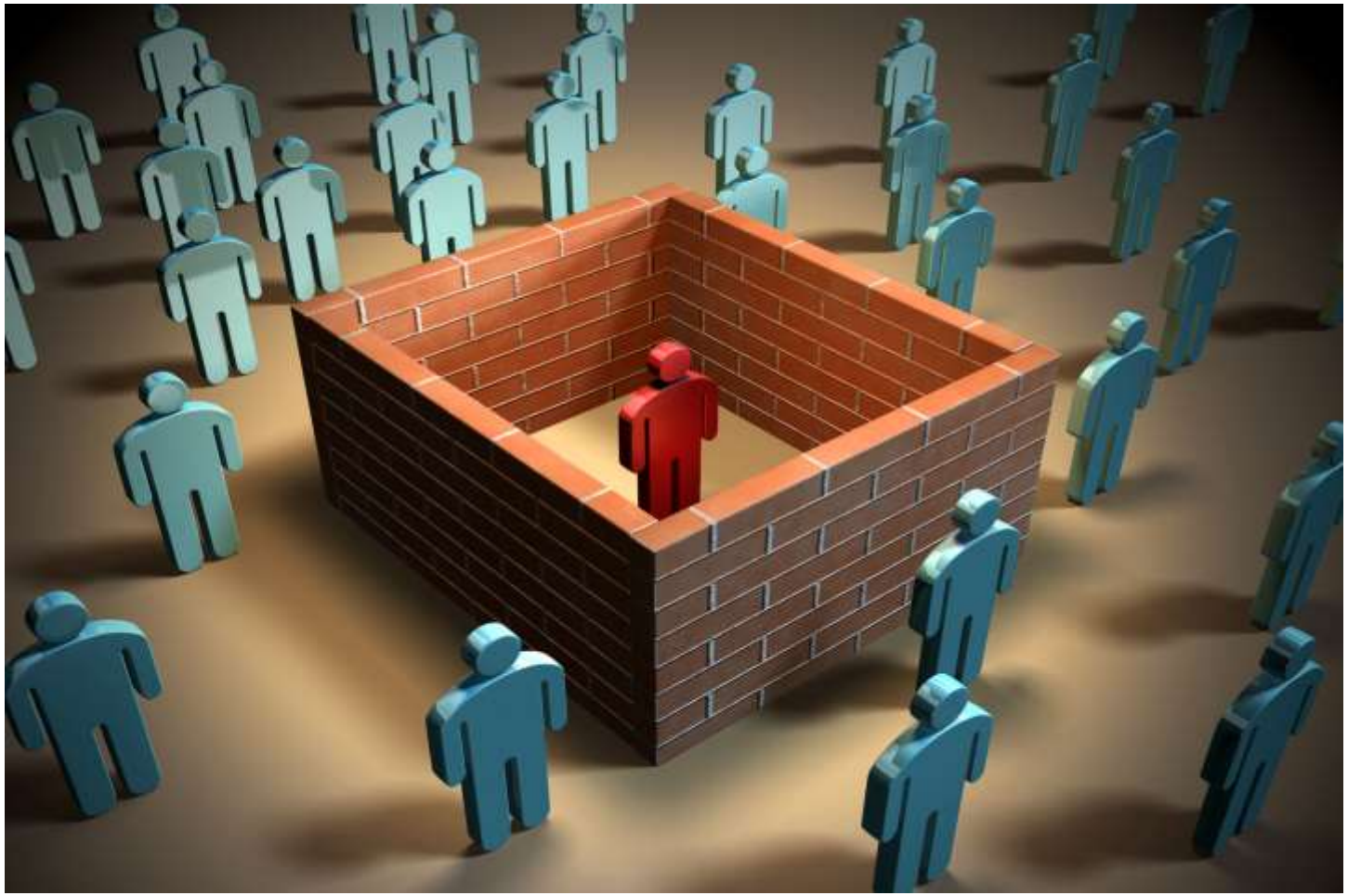


Road crash injury is a leading of death in Canada

Source: Statistics Canada, CANSIM Tables 102-0561 and 102-0540

MOTIVATION 3: LONELINESS

- Social Isolation is worse for our physical health than smoking 15 cigarettes a day, so what?



MOTIVATION 4: AGING BABYBOOMERS

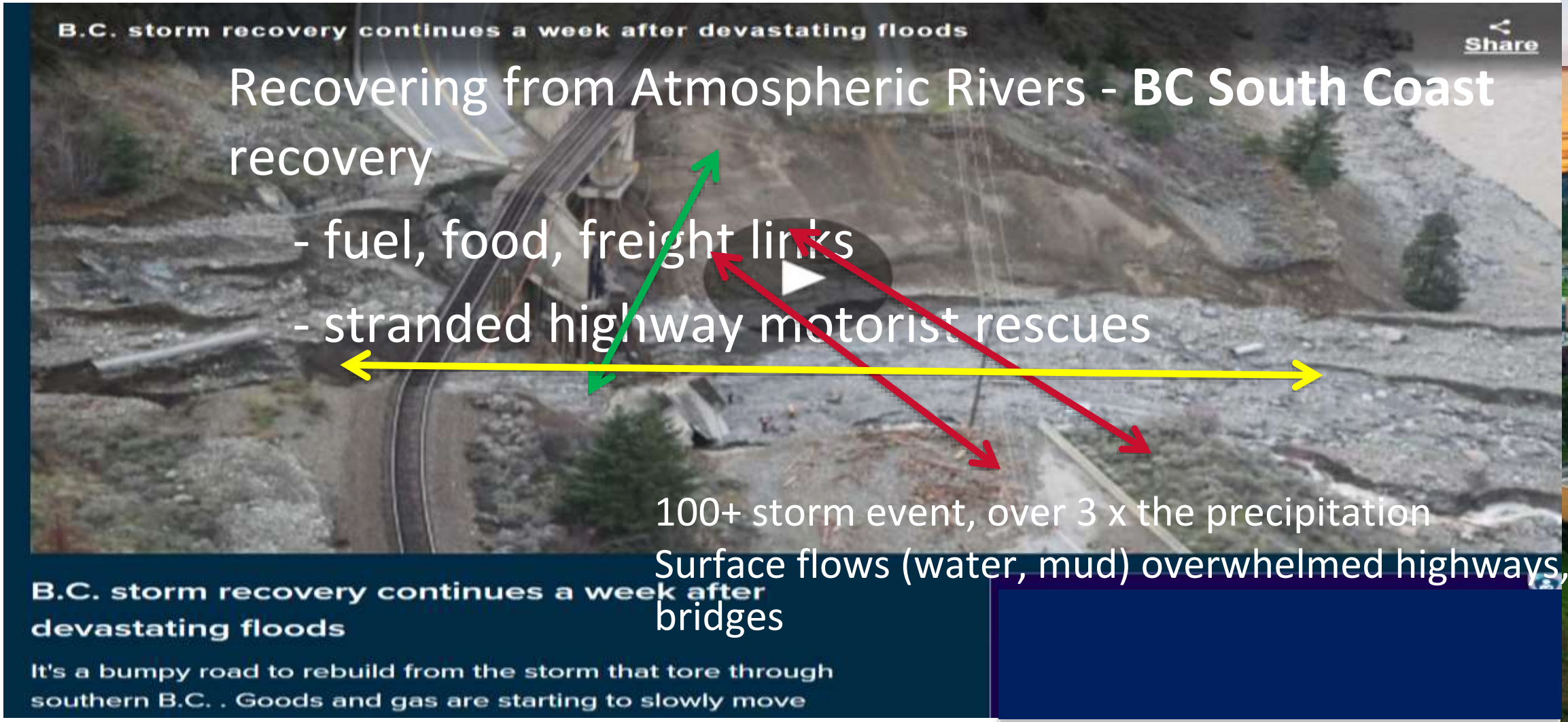
- As a proportion of our community, more of us are old – who will care for us?

MOTIVATION 5: ACCESS & EQUITY

- As we age, we're going to give up driving ourselves – who will drive us? Greyhound?

MOTIVATION 6: RESILIENCY

- The key to a resilient community (physical recovery, mental health, hope for the future) starts with a **sense of community** = life is a team sport!

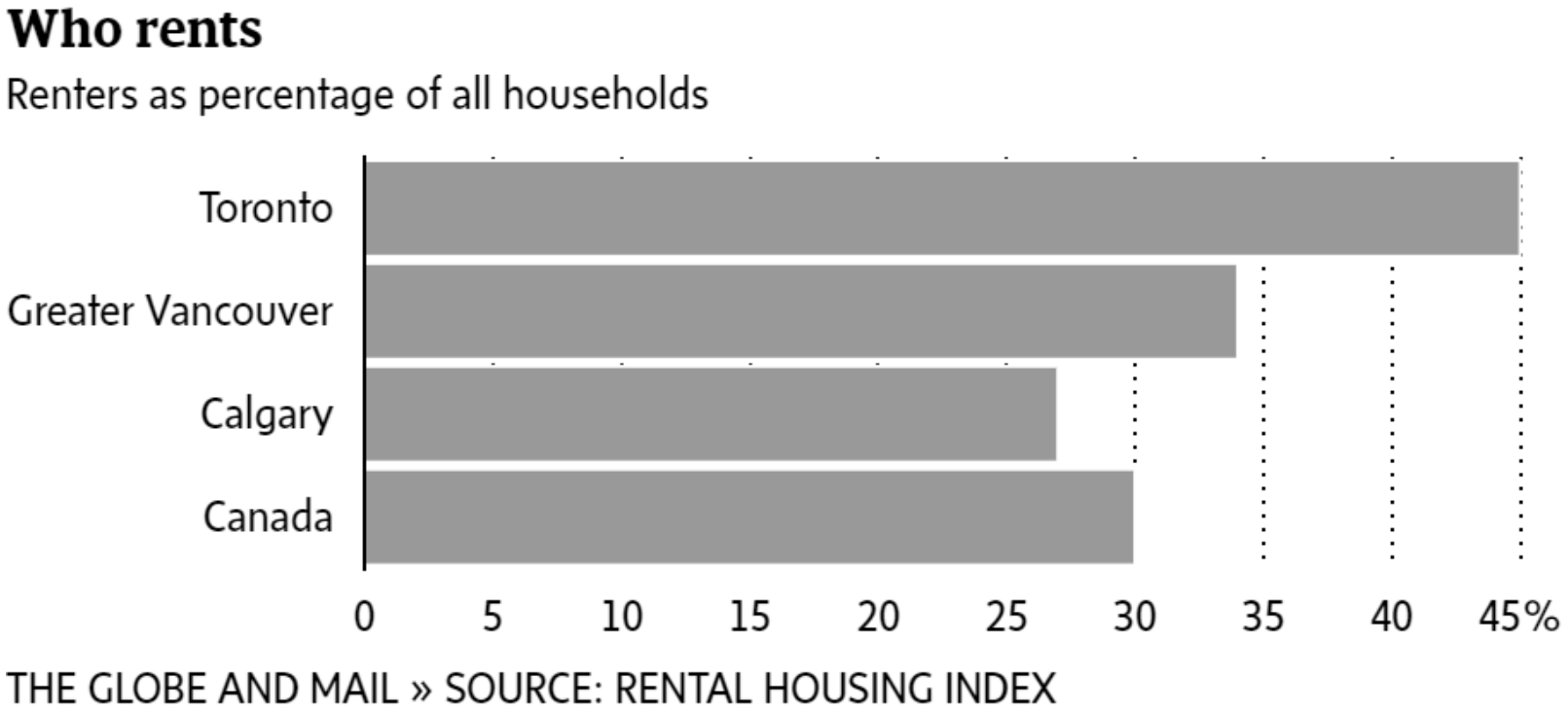


MOTIVATION 7: AGING IN PLACE

- Sense of community starts with knowing and trusting your neighbors – more of us want (need?) to age in place – how do we do this ‘here’, especially when many of our friends, families and services we need (want?) aren’t?

MOTIVATION 8: AFFORDABILITY

Housing prices are high, and rental vacancies are low, what can we do to increase the supply and make it more affordable?

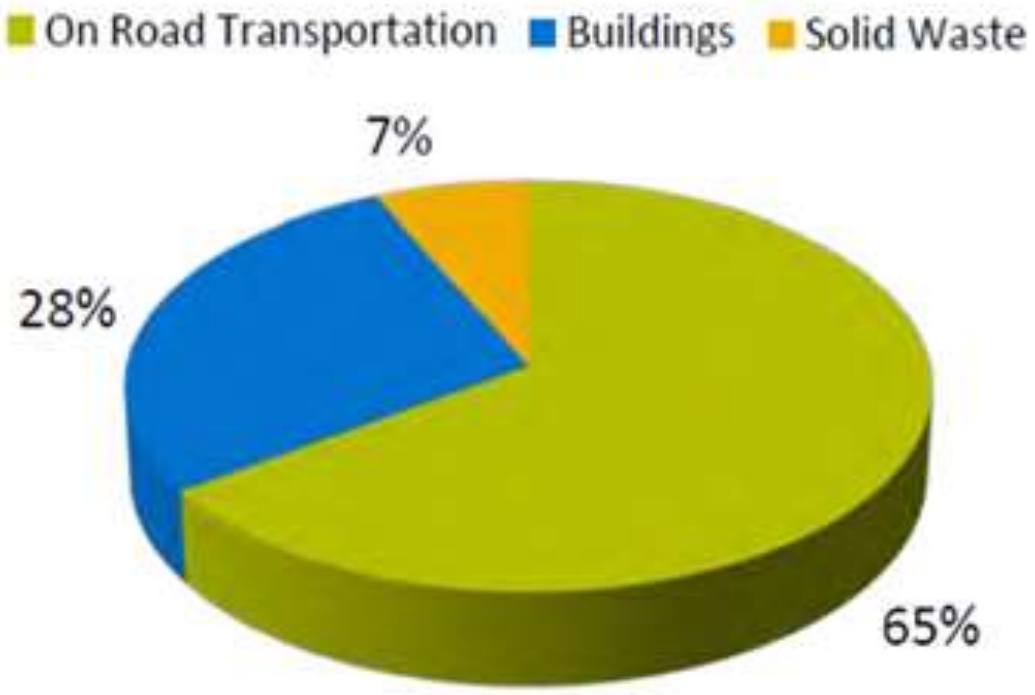


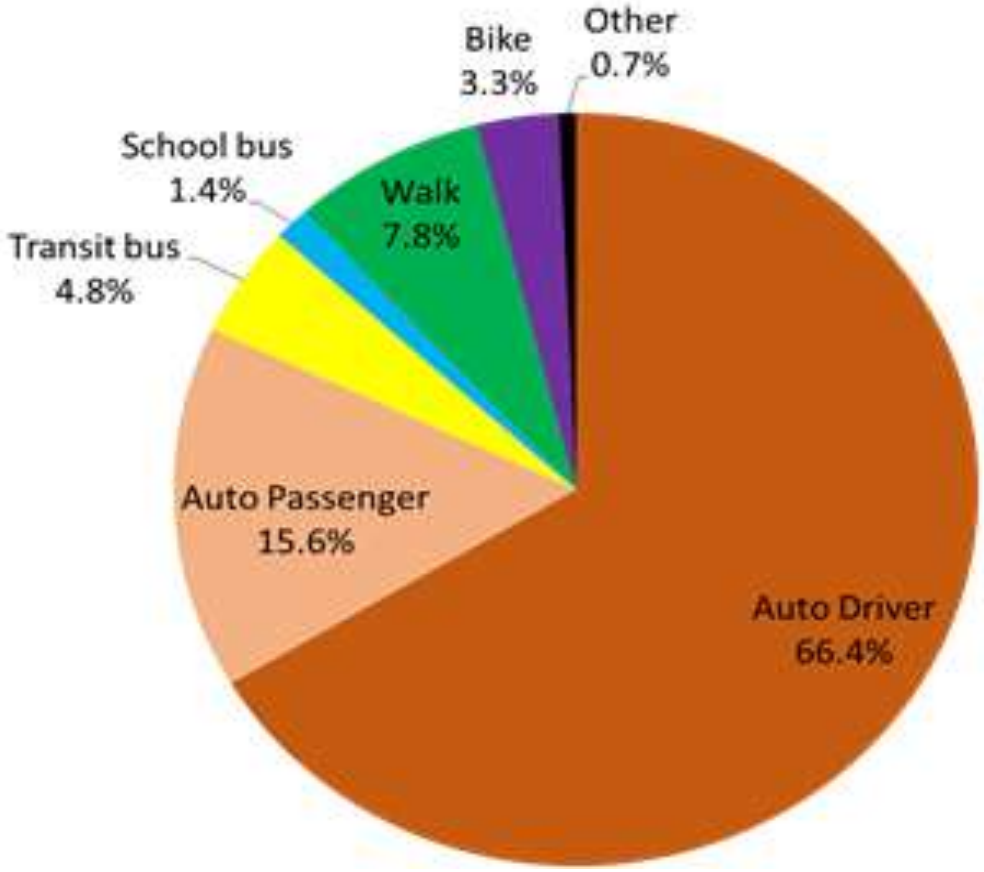
MOTIVATION 9: LEARN FROM HISTORY!

- ✓ All of the above motivations are related, and can be addressed at least in part through STRATEGIC, system-based planning and design of our community **Land Use & Transportation (LU & T)** policies and infrastructure and services – this is **SMARTer Growth:**

- ✓ Parks 1 minute walk from homes
- ✓ Protected neighborhood CORE
- ✓ Barrier free walk / bike networks
- ✓ Safer < 30 km/h 'calmed' roads
- ✓ Safer roundabout intersections
- ✓ Mix of densities & corner stores
- ✓ Quality community bus service
- ✓ Co-Housing (cohousing.org)
- ✓ **Regional passenger tram-trains**

ONE LAST MOTIVATION: CC





- Transportation contributes most of our GHG **emissions = Climate crisis**
- **We drive too much, but what CHOICES do we have = Social Inequity**
- BC has committed to **reducing** its GHG **emissions = Opportunity**

WHAT CHANCE DOES PASSENGER RAIL HAVE IN AN AUTO-ORIENTED VALLEY?

- Get a strategy in place now; without a vision, people (& hope) perish
  - Us, Land Use, Transport, Environment, Economy & Governance
- What do we want our Valley to look & feel like in 30 to 50 years?
  - What aspects of our Quality of Life do we want to sustain?
    - Thriving tourism economy
    - Bio-diversity & Natural beauty
    - Equitable Access & Safe Mobility
    - Affordable & available housing for all
    - Peaceful enjoyment & socially connected
  - How will we stay CONNECTED?
    - Local AT networks & transit
    - Regional & national passenger rail = Hydrail tram-trains

Problem: Can we afford a regional passenger rail?

Demand

- North American railway system continues to grow

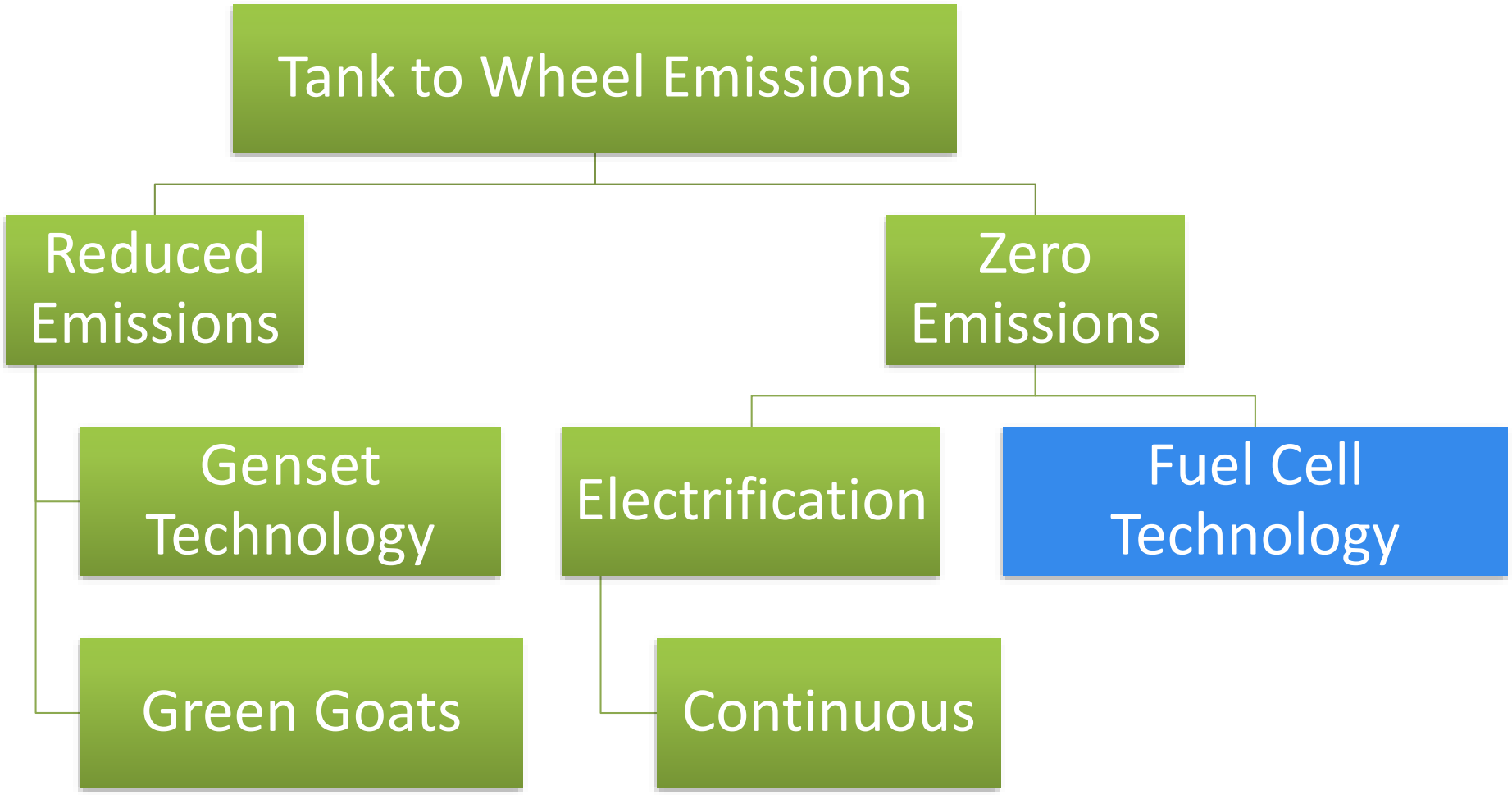
Emissions

- System is outdated and diesel powered

Cost

- Traditional electrification is an expensive solution

Solutions


Tank to Wheel Emissions
Reduced Emissions
Zero Emissions
Genset Technology
Green Goats
Electrification
Continuous
Fuel Cell Technology

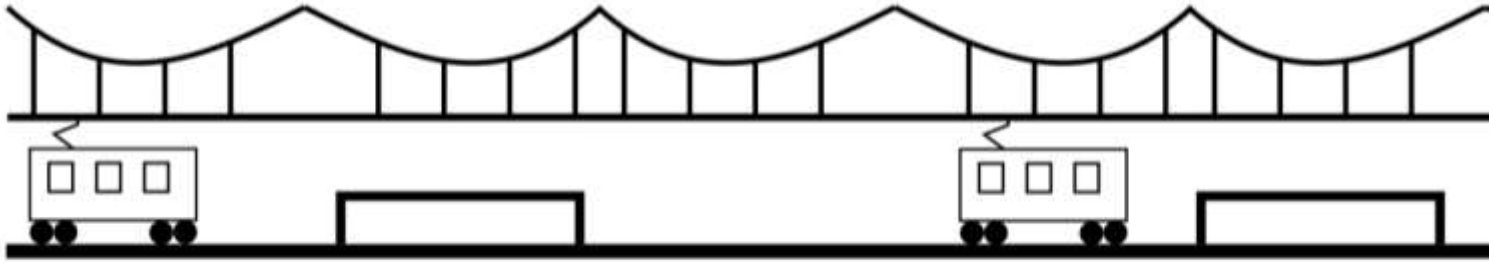
Continuous Electrification

Advantages:

- Unlimited power supply
- Improved acceleration
- Safer in case of derailment
- Partial regenerative braking
- Zero tank-to-wheel emissions

Disadvantages:

- Very costly (4 – 5 million USD)/km
- Electromagnetic Interference
- Conductor energy loss is significant
- Safety concerns for crews, accidents



Discontinuous Electrification

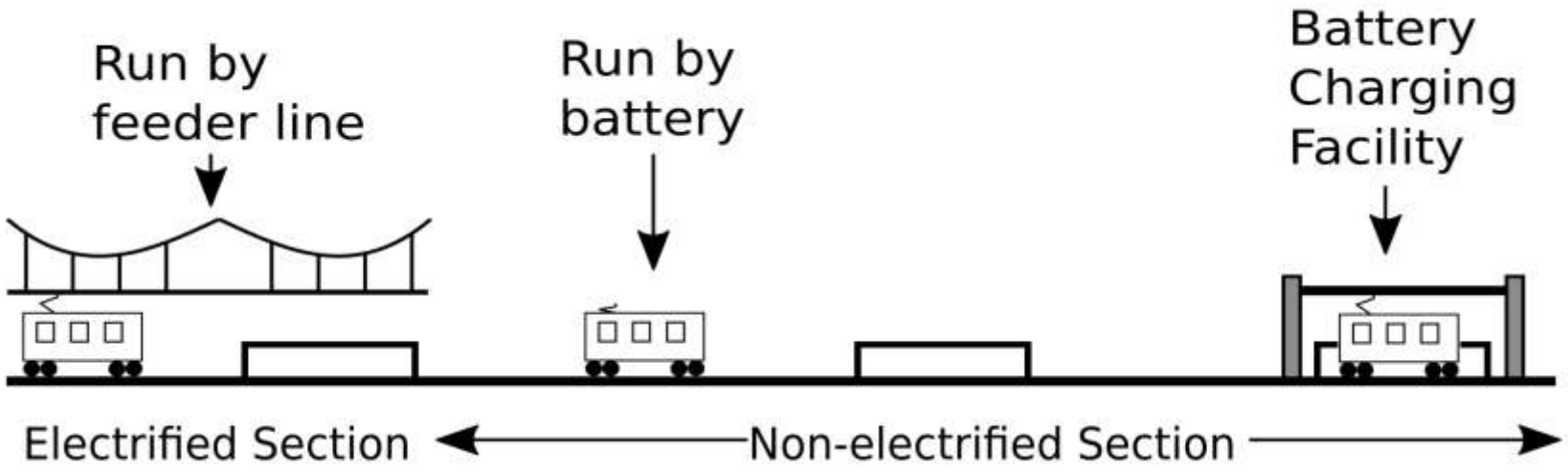
(Hirose, Hiroshi, Kouji Yoshida, and Kenichi Shibanuma)

Advantages:

- Reduced infrastructure cost
- Acceleration rates are unaffected
- Safety factor maintained
- Higher levels of regenerated energy
- Reduced stress on feeder substations
- Zero tank-to-wheel emissions

Disadvantages:

- Increased powertrain & infrastructure costs
- Will not work on long distances, heavy loads



Why might we consider Hydrogen?

- ❑Safer than conventional fuels
- ❑Zero Emissions
- ❑Ubiquitous
- ❑Longer distances, heavier loads
- ❑Multiple production pathways
- ❑Higher power efficiency than diesel
- ❑International Hydrogen Agreement
- ❑Canadian Hydrogen Strategy
- ❑Just Transition

REGIONAL & GLOBAL ENERGY INTERCONNECTION
RGEI
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

CLEAN ENERGY MINISTERIAL

Why not H2? (Short term challenges)

- ❑Currently 4x the cost of diesel to produce (at current scales)
- ❑Balance of plant costs for higher pressures (more space)
- ❑Onboard storage for heavy loads over long distances (use tenders)

https://www.cleanenergyministerial.org/initiatives-campaigns/regional-and-global-energy-interconnection-rgei-initiative/

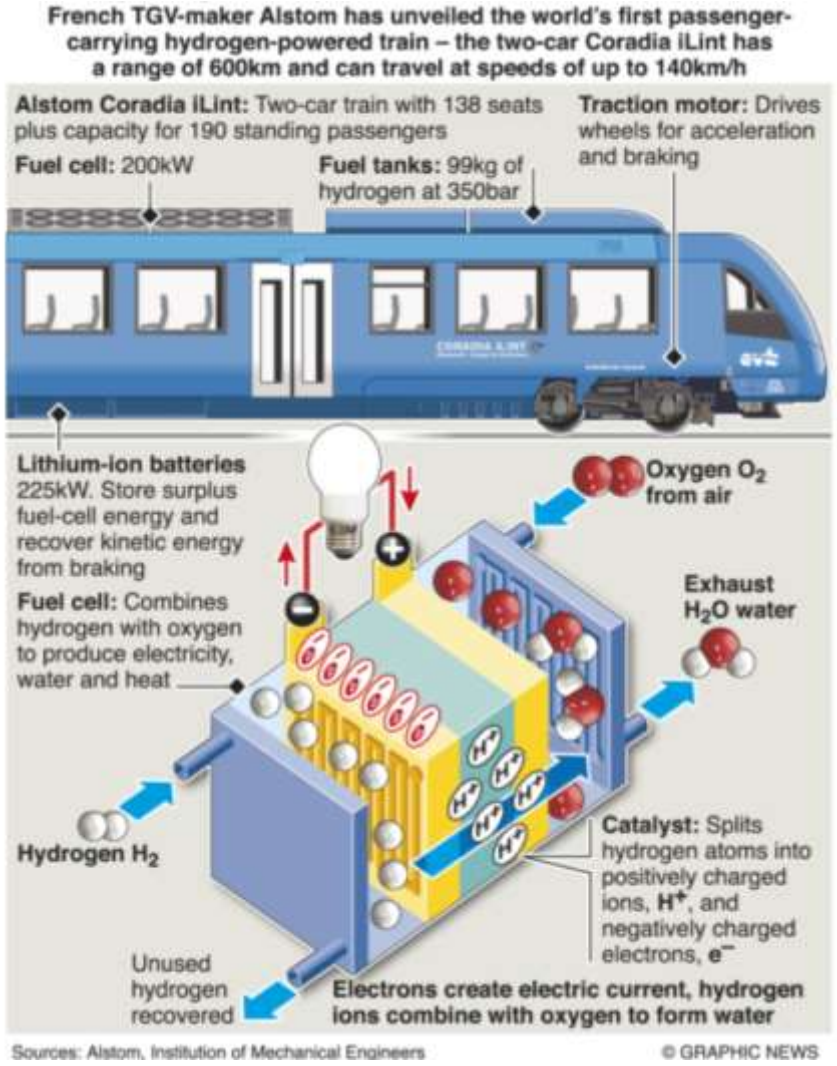
Hydrogen Fuel Cells

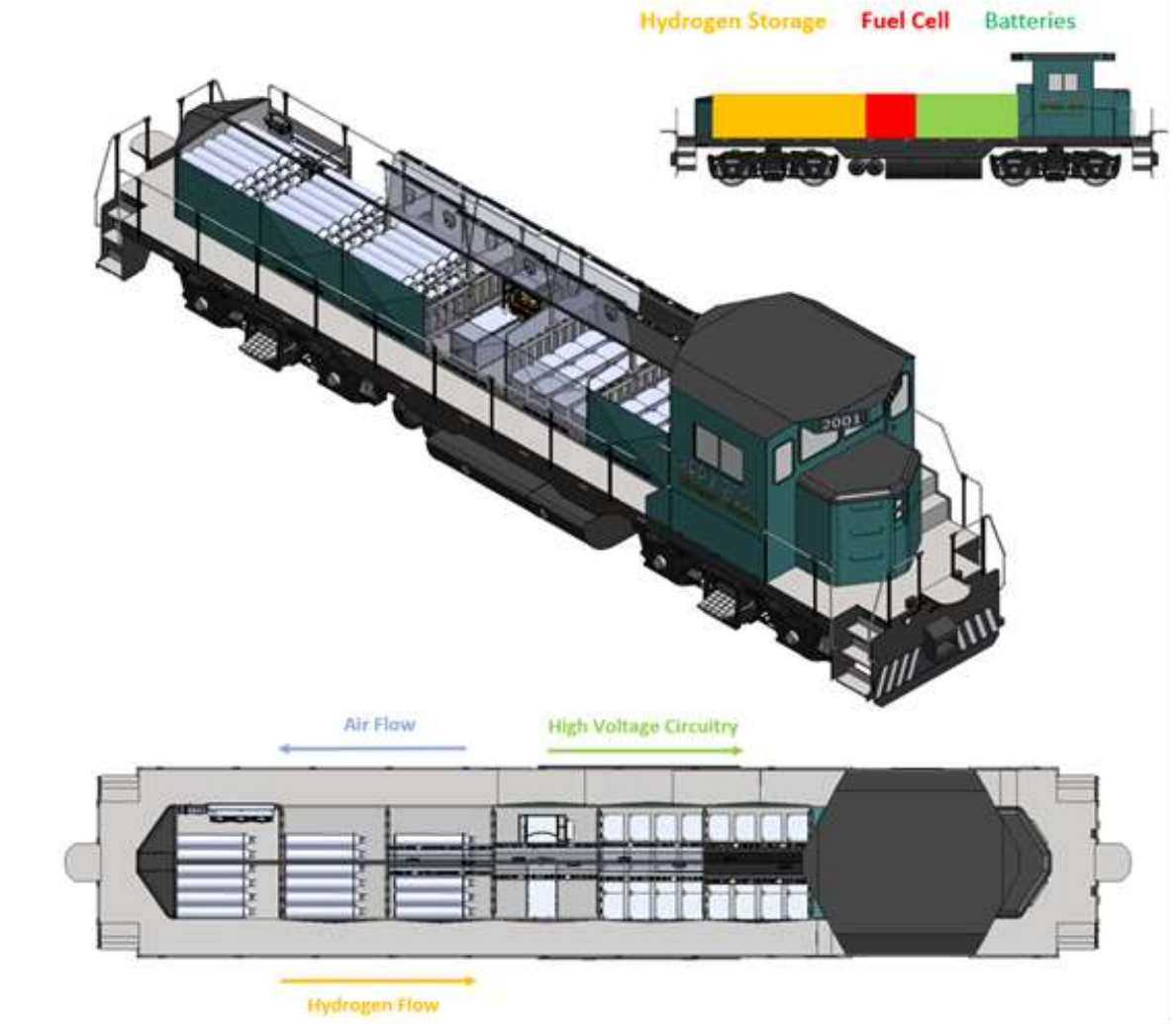
Figure 1: Basic diagram of a PEMFC.
Source: http://www.toyota.com/fuelcell/fcv.html

Advantages:
Less costly, more efficient
Onboard power
Proven technology

Disadvantages:
Not yet common in NA
Fuel storage tank volume
Research questions for NA

Fuel Cell-Battery (FCB) Model Configuration





Hydrail Success Stories

1999-2002: Fuel cell mining locomotive. By Vehicle Projects LLC

2003: Successful test of a hydrogen powered motorized bogie by Railway Technical Research Institute (RTRI), and East Japan Railway Company (JR East)

2005-2007: Fuel cell-battery hybrid shunt locomotive, Vehicle Projects LLC & BNSF Railway Company

2006: Fully functioning Hydrail railcar, Railway Technical Research Institute (RTRI) in Japan.

2007: A retrofit railcar to Hydrail, East Japan Railway Company (JR East).

2016: Hydrail passenger tram-train in service (Coradia iLint, Alstom) in Europe

Why not our Valley, BC, Canada & NA?

Hydrail is economically feasible in BC's Okanagan Valley

- ✓Passenger tram-trains (light rail) using on-board electric power (i.e. no overhead wires) between the US Border and Kamloops
- ✓It would cost less than widening Highway 97 for tourism/population growth, and has GREATER sustainability benefits than roads (QoL, AQ, safety, equity, health, noise, congestion).
- ✓Communities: OCP processes, station planning, and partnerships

BEST: We are working with BC Industries & Communities (Loop, Ballard, Southern Railway of BC, Hydrogen-in-Motion) to bring made-in-BC, zero-emission tram-trains to our Valley.

The Techno-Economic Case for Re-Deploying Inter-City Regional Tram-Train Passenger Rail in Canada - Case Study of the Okanagan Valley, BC

Available for viewing on YouTube: "The Future of Sustainable Transportation"

A 4 minute introduction to our vision for the OVER PR in not just the Okanagan Valley, but across North America – revitalizing passenger transit via tram-trains!

BC is already a leader in this H2 & HFC Tech

"Hydrogen can play a major role in B.C.'s low-carbon energy systems. It's versatile, safe and clean when produced from B.C. electricity or renewable natural gas. It produces zero-emissions when it's used and can be stored and transported as a liquid or a gas."

CleanBC plan

"The majority of hydrogen fuel cell activities and facilities are in British Columbia (31%)."

Canadian Hydrogen and Fuel Cell Sector Profile, 2016

SRY Rail Link

H2M Hydrogen In Motion

LOOP ENERGY

Cariboo Central Rail Road A JDS Company

Azimuth Solar Products Inc.


September 2018 Hamburg, Germany
No barriers
HYDRAIL Tram-Trains: Staying Connected
Sustaining Environment, Economy
& Quality of life for all generations

But WHY Do We Need It?

CONNECTEDNESS

This railway will become the long-term backbone to public transit in Okanagan Valley

REDUCE CONGESTION

Widening highways for automobiles is expensive and causes more congestion in the long run. It also creates more noise and air pollution.

REDUCE COLLISIONS

In Kelowna alone, there were 4,200 road collisions 2011 to 2015, costing ICBC (ie BC taxpayers) over $1.5 Billion!

How will it affect our Communities?

❖Shifting Expenditures:

Creating regional income and Local jobs

❖Station Areas (Re)Development:

New (more) Housing & Services
Transit Revitalized & Improved

❖SMARTer Growth:

Increased accessibility
Enhanced Livability
Reduced Congestion & Crashes

OVER PR – Okanagan Valley Electric Regional Passenger Rail

What it is NOT:

- $250 million/mile Skytrain (ALRT) rising 50 feet in the air on concrete guideways
- Heavy, noisy, stinking, vibrating diesel trains rumbling along
- A panacea - it would provide more & safer CHOICES

What it IS:

- A 20 (+/-) year opportunity to sustain our Quality of Life
- Zero-emission, passenger rail serving our communities
- A SMARTer Growth approach
- Connects our Thompson-Okanagan
  - o People - seniors, youth, visitors
  - o Markets - tourism, airports, USA, wine
- Addresses many of our needs:
  - o Congestion & Safety
  - o Housing & Affordability
  - o Aging-in-place & Staying connected

Between Cities – at Hwy 97 speeds
Operates like a Regional Commuter Rail

- **Tram-Trains = LRT = Light rail transit**
  - **Uses made-in-BC Ballard Fuel Cells**
  - **200 passengers (+/-)**

In Cities – at city speeds & stations
Operates like a Tram

- **ENABLING 'Gateway' Technology Traits:**
  - No overhead wires, nor 3rd rail power
  - On-board, zero emission, electric power
  - Barrier-free imbedded rails in cities
  - More economic than highways

COSTS & BENEFITS of SMARTer Growth (Hydrail)

- **OVER PR is economically feasible NOW!**
- ROADS: **$10 to $20 Million**/km PLUS a 2nd crossing @ $500+ Million
  - **$5 Billion** US to Vernon + to Kamloops to meet forecast travel demand
- RAIL: **$5 Million**/km
  - **$1.5 Billion** from the US to Vernon (rail to Kamloops exists)
  - Annual operating costs offset by fares, stations, safety, AQ, tourism benefits
  - Rail brings **$3.5 Billion savings** to taxpayers PLUS:
    - Safer, cleaner, healthier connections for Tourism, Youth & Seniors
    - Supports Climate Change, Sustainability, Affordability, Health, Safety, Accessibility, Housing & Increased Transit Ridership Objectives
- **Next question: Where could these savings be applied in our community?**

Tram-Trains benefits outweigh costs in the long term for all Okanagan residents, visitors & businesses

- Transport 2030
  - Equity & Inclusion
  - Middle Class Affordability
- Tourism & Service Workers
  - Year-round affordable access
  - Access to affordable housing
- UN SDG
  - Climate Action 2050
  - Lower Environmental Impacts
  - Community resilience (heat, drought, fire, smoke, flood)
- Lower Lifecycle Costs
  - Social, TRC & Env Benefits
  - CAPEX, OPEX
- Aging in Place
  - Access to Regional Services
  - Social Connection
- Safety & Congestion
  - Vision Zero (road deaths)
  - Lost Productivity & Reputation

Promoting safer and healthier growth, supporting local economies

Dr Gord Lovegrove Associate Professor UBC School of Engineering
Departmental Science Advisor, Transport & Infrastructure Canada, Government of Canada
Founder, SMARTer Growth Partnership

Research to help resolve emerging challenges impacting the sustainability of our global community

P.Eng., M.B.A., Ph.D., FITE, MCSCE, MASCE
The University of British Columbia | Okanagan | Kelowna
gord.lovegrove@ubc.ca | 1-250-808-9377