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Benefits of Intercity Passenger Rail in Climate Change Strategies for Ontario and Canada

Summary:

Transportation has been the most challenging sector in Ontario for reductions in greenhouse gas (GHG) emissions. Based on US data, GHG emissions from diesel-based intercity passenger rail travel in Canada are about 2 to 3 times lower per passenger-km than emissions from equivalent travel by car or personal truck. Intercity passenger rail can therefore play an immediate significant role, at low cost and with other social/economic benefits, in achieving climate change targets.

Background

Ontario's Climate Change Strategy is targeting a 20% reduction in GHG emissions by 2020 and an 80% reduction by 2050, versus a 1990 base. Only 7% reduction has been achieved to date (2014), largely from phase out of coal-fired power plants and from plant closures and efficiency improvements in the industrial sector. Disappointingly, emissions from transportation rose during the 1990 – 2012 period and now represent the largest emissions source, at 34% of the total.

Ontario's strategic plans to reduce emissions in transportation include support for urban public transit, active transportation, land use intensification and low/zero emissions vehicles. One area that received little attention is intercity travel by individuals. There are hundreds of thousands of trips made daily, and millions of passenger-km, between cities and towns – almost all of which are by car or personal truck. We believe that GHG emissions from these car/truck trips can be significantly reduced by using passenger rail.

USA GHG Emissions – Rail vs. Car/Truck

Although various US organizations, such as Texas Transportation Institute, Oak Ridges National Laboratory and the US Department of Energy[1] have estimated energy intensity by passenger travel mode, the most detailed and contemporary study was completed in 2015 by Transportation Research Board National Cooperative Rail Research Program[2]. The report was titled "Comparison of Passenger Rail Energy Consumption with Competing Modes."

Here, an emissions model (Multi-Modal Passenger Simulation or MMPASSIM) quantified energy consumption and GHG emissions of passenger rail and competing passenger modes for specific door-to-door trips. Four different simulations are possible:

- Single train simulation, which looks at only the rail portion of the trip
- Technology evaluation, which assesses changes in rail equipment, operating and infrastructure parameters

- Single train simulation with access modes, which looks at the entire door-to-door trip, including first and last mile
- Modal comparison

Some of the key results were:

- Twenty specific passenger rail single train trips were evaluated, such as New York City – Buffalo and Chicago-Quincey. Energy intensity ranged from 1000 to 2200 BTU/passenger-mile, depending on assumed load factor.
- A variety of technology improvements were looked at – optimal coasting, improvements to equipment (lower tare weight, seating density increase), bilevel rail cars, increased train length at constant load factor. These can improve energy intensity substantially. Electrification may/may not reduce GHG intensity depending on regional electricity generation profile and operating speeds.
- A modal comparison was undertaken for 13 specific door-to-door trips, such as Bethesda MD – New York City and New York City- Buffalo.
    - Auto mode with one occupant was 3 – 4 times more energy and GHG emissions intense than typical rail under average load factors.
    - During peak periods, when road congestion exists and rail operates at higher load factors, this ratio may go as high as 10 fold.
    - An auto with 4 passengers approaches the performance of intercity trains
    - There is a significant effect of train seating density and consist configuration (eg on-board amenities) on train GHG intensity.

Discussion

There are a number of adjustments that could be considered with these estimates for extrapolation to Canada:

1. The US personal vehicle fleet fuel consumption averages 21.6 miles per gallon[3], or 12.9 litres per 100 km. The Canadian vehicle fleet may be somewhat more fuel efficient.
2. VIA's equipment is older, on average, than AMTRAK's, suggesting it is likely less energy efficient
3. The load factor for Amtrak was only 21.3 passengers/vehicle[1]. It is probable that VIA Rail has a higher load factor. The VIA 2014 Annual Report states that they operated 1349M seat-miles and carried 808M passenger-miles, for an average occupancy of 60%. Also, the average number of passenger-miles per train-mile for VIA was 131. If a typical VIA train has 4 cars, this implies a load factor of over 30 passengers/vehicle.

Items 1 and 2 would reduce the relative advantage of passenger rail versus auto in Canada compared to the USA, while item 3 would increase it. Pending made-in-Canada data, it is reasonable to conclude that, for Canada, the GHG intensity of passenger rail is 3 to 4 times lower than the intensity of single-occupant personal vehicle use. If average personal vehicle occupancy is 1.5, the rail advantage is 2-3 fold.

References

1 – US DOE Transportation Energy Data Book, Edition 34, September 30, 2015, Table 2.14. This is based on USA-wide petroleum consumption data.

2- US Transportation Research Board, National Cooperative Rail Research Program Report 3, 2015

3 – US EPA Office of Transportation and Air Quality Report EPA-420-F-14-04a, May, 2014