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A new look at an old idea: Powering autos from the grid

By Richard Gilbert
Globe and Mail Blog

Electricity that powers electric motors is the best replacement for fossil fuels that power internal combustion engines. As discussed in my last post, connecting to the grid while in motion is the best means of powering electric vehicles. Two other ways of powering electric vehicles, using batteries or an on-board source of electricity such as a fuel cell, are likely to prove disappointing.

Grid connection is a well-established, reliable, efficient process that has been in widespread use for powering electric trains, streetcars, and trolleybuses for more than 100 years. Most transit journeys in Canada's three largest cities are made by grid-connected electric traction.

Could electric automobiles and trucks be powered while in motion? Certainly trucks have been and still are. Electric trucks powered from overhead wires are used to move material in several mines in North America and Africa and to move freight on roads in cities in Russia and the Ukraine.

Canada saw the first successful application of modern trolley assist, i.e., adding an electric motor powered from overhead wires to a diesel truck. Equipping trucks with trolley assist at the Quebec Cartier iron ore mine at Lac Jeannine provided a persuasive example of the efficiency of electric traction. There was no direct connection to Quebec's grid and so the power was provided from a diesel generator. Between the addition of trolley assist to trucks in 1970 and depletion of the iron ore and mine closure in 1977, diesel fuel consumption was reduced by 87 per cent below prior use.

This was an optimal situation for electric traction: heavy loads transported up steep slopes. Such extraordinary efficiencies are not achieved in regular road traffic. However, under almost any circumstances, energy can be saved through use of electric motors rather than internal combustion engines.

What may become even more important is that switching to electric traction would reduce emissions and oil dependence, particularly in the five provinces where most electricity is not generated from fossil fuels (B.C., Manitoba, Ontario, Quebec, Newfoundland and Labrador). Reducing oil dependence is especially important for Ontario and Quebec, where just about all oil and oil products come from or via another country.

Could trucks with electric motors moving on Canadian highways get their power from overhead wires? It could be practicable. Imagine an expressway with wires strung over one lane. Trucks with automatically extending and retracting poles – such as trolley buses have in many places – could power their electric traction motors from these wires. Control and monitoring systems would ensure that only authorized connections occurred and assign the costs of infrastructure and electric power appropriately.

Wires could be affordable. Stringing them along Highway 401 and Autoroute 20 between Toronto and Montreal would cost in the order of $500-million, which could be recovered in a few years from charges for their use, which would be lower than the equivalent cost of diesel fuel. The challenge would be securing a sufficient shortening of the period between installation of the wires and use of them by enough trucks to pay down the cost of installation. Trucks using the wires would gain from growing benefit as diesel fuel becomes scarcer or more expensive, or both.

For movement where there are no wires, these trucks could have batteries – charged from the wires – or auxiliary diesel engines. Electric trucks powered from batteries, as big as anything on Canadian roads, move shipping containers around the Port of Los Angeles, limited only by their 80-kilometre range per four-hour recharging time.

Battery powering of trucks would not work on the highway. Four-hour stopovers every 80 kilometres would be intolerable. Batteries can be charged much more quickly, even in 15 minutes, but with much wear on the battery, high costs for charging stations, and challenges for grid operators to provide the required bursts of power. Moreover, even a 15-minute stop every hour would not be acceptable.

Trolley trucks for highways is a patented concept in Germany but not yet in North America.

Wireless powering has been mooted as an alternative, to avoid unsightly wires. Power would be transmitted from a source at or buried in the roadway. This is likely to be expensive, and inefficient or dangerous, or both.

Could connection to overhead wires work for smaller vehicles? Probably not. The poles would have to be too long, making them less controllable. Car drivers could be less inclined to exercise the discipline of staying in one lane.

Alternatives posed for cars include reaching out to power rails at the side of a lane. Another would have rails at the road surface or slightly below it. Both types of solution could be expensive and potentially hazardous. They would likely work only if access to a lane equipped in this way were tightly regulated and if drivers relinquished control of their vehicles to a centralized system.

Nevertheless, personal electric vehicles powered while in motion could become an increasingly appealing prospect as fossil fuels become less available. In my next post, I'll discuss another way of doing this. For decades, what is known as personal rapid transit has been advocated as the system of the future. That future may at last be getting closer.

Richard Gilbert is a Toronto-based consultant who focuses on energy and transportation. His latest book is Transport Revolutions: Moving People and Freight without Oil*, written with Anthony Perl.*