



STAFF REPORT ACTION REQUIRED

Health Benefits of Electrification of Rail Service

Date:	February 2, 2011
To:	Board of Health
From:	Medical Officer of Health
Wards:	All
Reference Number:	

SUMMARY

Metrolinx has recently released its GO Electrification Study, which examined the costs and benefits of electrification of the GO rail service. It compared a rail service using low-emission Tier 4 diesel engines to a service with different levels of electrification. The assessment looked at five factors: environment and health, user benefits/quality of life, social and community, economic, financial, and deliverability. The study concluded that electric trains provided opportunities for an improved service with lower running costs, and that electrification was currently cost-effective for the Lakeshore and Georgetown corridors. It could also become cost-effective on other corridors once ridership increases in the future.

The Electrification Study results showed that emissions of criteria air pollutants (carbon monoxide, hydrocarbons, nitrogen oxides, particulate matter, and sulphur dioxide) and greenhouse gasses would be twice as high with Tier 4 diesel as they would be if the Georgetown and Lakeshore corridors were electrified. The results also show that emissions of these same pollutants would be between 5 and 40 times higher from a Tier 4 diesel rail system than from a fully electrified system. The study also estimated that the health benefits of electrification would be \$11 million per year for electrification of the combined Lakeshore and Georgetown corridors, and nearly \$18 million per year if the entire system were electrified. The study also showed that electrification would reduce the air pollution impact on communities next to the rail corridors, and that these impacts would be eliminated once the whole system was electrified.

The report encourages the Ontario Minister of Transportation to provide the necessary funding to ensure electrification occurs as quickly as possible and also recommends that the Province make a commitment to electrification of the entire system, given the health benefits and improved service features such as reduced travel time.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. the Board of Health urge the Minister of Transportation to provide secure and dedicated funding to electrify the GO Transit rail service as soon as possible, starting with the Georgetown and Lakeshore corridors; and
2. the Board of Health request the Government of Ontario commit to electrification of the entire GO Transit rail service.

Financial Impact

There are no financial impacts from the adoption of this report.

DECISION HISTORY

City Council and the Board of Health (BOH) have supported electrification of GO Transit's rail services. On June 27-28, 2009, City Council requested Metrolinx to use electric vehicles for the Georgetown GO and Air Rail Link services. On November 16, 2009, the BOH requested the Minister of the Environment to ask Metrolinx to defer purchase of diesel locomotives for the Air Rail Link until additional information on the air quality impacts, human health impacts and electrification options became available.

ISSUE BACKGROUND

Metrolinx recently completed the GO Electrification Study that evaluated the use of diesel and electric trains for the GO rail system.¹ The study compared a rail service that used Tier 4 diesel engines to a service which was partially or totally electric and considered the following aspects in its assessment: environment and health, user benefits/quality of life, social and community, economic, financial, and deliverability.

Overall, the Electrification Study concluded that there are transportation and economic benefits to electrification. In particular it found the electrification of the Georgetown and Lakeshore corridors was currently cost-effective. The schedule provided in the Electrification Study suggests that electrification of these two lines would take up to 24 years, with the electrification of the Air Rail Link taking up to 12 years to complete.

Any of the electrification options would require significant capital investment, but would result in some operation and maintenance cost savings. While the Electrification Study

¹ Metrolinx. 2010. GO Electrification Study Final Report. Prepared for Metrolinx by Delcan JV Arup, in association with Steer Davies Gleave, Lura, Canac, LGL Limited, RWDI, LTK Engineering Services, Economic Development Research Group and DPRA. Available online at: http://www.gostransit.com/estudy/en/current_study/updates.aspx.

did not find strong justification for electrifying other corridors right now, Metrolinx notes that electrification of the Milton and Barrie corridors “may still be worthwhile in the longer term” as transportation demand increases on those corridors.

Metrolinx’ recommendations were forwarded to the Minister of Transportation, and the Minister has announced that the Ontario government is launching an environmental assessment for the electrification of the Air Rail Link.

COMMENTS

As many cities invest in high-speed, electric rail service, the use of diesel locomotives for regional passenger rail services is becoming less common around the world. Electric locomotives are an established and proven technology. Electric trains do not produce any direct air pollution emissions. However, the generation of electricity to power electric trains can be a source of indirect pollution emissions. Electric locomotives offer other advantages in that they are capable of greater speeds, faster acceleration and greater energy efficiency than diesel locomotives.

Developing less greenhouse gas (GHG)-intensive transportation options is one way to take action to mitigate climate change. Unlike diesel trains, electric trains have no direct GHG emissions; however, they may have some indirect GHG emissions, depending on how the electricity used to power them is generated.

Health Effects of Diesel

Diesel exhaust is a complex mixture of particles and gases. It includes substances that have been found in Toronto's air at levels of potential concern, including acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, nitrogen dioxide, particulate matter, polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). Many of the chemicals found in diesel exhaust are known carcinogens, and diesel exhaust itself is a probable carcinogen.

Emissions from both diesel and gasoline vehicles contribute to air pollution that already exists in Toronto. Diesel exhaust contains many of the same pollutants emitted from other vehicles, including some of the common air pollutants such as particulate matter, nitrogen oxides. Toronto Public Health’s 2007 report, *Air Pollution Burden of Illness from Traffic in Toronto*, highlighted health effects from traffic-related air pollution which include a broad range respiratory and cardiovascular effects, cancer, and hormonal and reproductive effects.

Diesel Contribution to Climate Change

The use of diesel fuel also results in the emission of greenhouse gases (GHGs) such as carbon dioxide (CO₂). The increase of GHGs in the atmosphere is changing the global climate, which is expected to affect the health of Toronto residents in a variety of ways, including:

- More extreme weather events, including heat waves;
- Increased air pollution;
- Increased vector-borne illnesses;
- Increased illnesses from food and water contamination; and,
- Increased disparities in health status.

Emissions from Tier 4 Diesel Relative to Electrification

Criteria air contaminants

Metrolinx considered emissions of nitrogen oxides (NO_x), sulphur dioxide (SO₂), fine particulate matter (PM_{2.5}), carbon monoxide and hydrocarbons. It found that emissions from the GO rail system of all these pollutants would be twice as high with Tier 4 diesel as they would be if the Georgetown and Lakeshore corridors were electrified. Health benefits from improved air quality next to these two corridors were valued at about \$11 million per year. The Electrification Study results also show that the emissions of NO_x, SO₂, PM_{2.5}, carbon monoxide and hydrocarbons from a Tier 4 diesel rail system would be 10, 5, 10, 40 and 30 times higher, respectively, than from a fully electrified system. The annual health benefit of full electrification of all seven rail corridors was valued at nearly \$18 million per year.

Greenhouse gases (GHGs)

The Electrification Study predicts incremental reductions in emissions of greenhouse gases (GHGs). Metrolinx estimates that GHG emissions from the GO rail system would be more than twice as high with Tier 4 diesel as they would be if the Georgetown and Lakeshore corridors were electrified (338,000 tonnes of GHGs each year, measured in carbon dioxide equivalents (tonnes CO₂e/year), compared to 151,000 tonnes CO₂e/year). Furthermore, GHG emissions from a Tier 4 system would be approximately 18 times higher than from a fully electrified system (19,000 tonnes CO₂e/year).

The GHG emissions reductions that could be achieved by upgrading Tier 4 diesel to electric trains on the Georgetown and Lakeshore corridors would enable Metrolinx to reach its target of 21 percent GHG reduction per passenger for their operations. It would also be an important contribution to the Ontario government's target of 6 percent GHG emissions reductions from freight and diesel transportation as set out in the Move Ontario 2020 plan.

Impacts on communities next to the rail corridors

To help compare the various options, the Electrification Study identified the "zone of influence" – the areas next to the rail corridors where emissions from diesel locomotives could have a measurable impact air quality. The number of diesel trains that use a specific part of the corridor determines the size of the zone, which varies from 20 to 450 metres when all trains are using Tier 4 locomotives. The size of the zone of influence reduces with electrification, and becomes zero once the service is fully electrified.

Impacts on physical activity

Improving access to and use of high quality transit has positive effects on health. For example, a recent study examined changes in body mass index that occurred after the introduction of electric light rail transit in a Charlotte, North Carolina neighbourhood.² The researchers found that use of the new transit line to commute to work was associated with an average reduction in body mass index of 1.18, and 81% reduced odds of becoming obese over time.

The Electrification Study indicates that the shorter travel times that are possible using electric trains are expected to make GO Transit more attractive, thus increasing the number of people who chose to travel by train rather than cars. The Study recognizes that as passengers make the modal shift from personal vehicles to electrified trains, they may incorporate more active transportation into their daily routines by walking or bicycling to and from GO Rail stations.

CONCLUSIONS

Metrolinx' Board of Directors recommended electrification of the Georgetown and Lakeshore rail corridors for primarily operational reasons. However, electrification of these corridors will also bring important health benefits, especially to the communities adjacent to these corridors. Electrification of all the corridors would result in additional benefits to more communities. By undertaking this initiative, Metrolinx will be making a real contribution to the overall effort needed to improve the health and quality of life for the broader population of Toronto.

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SIGNATURE

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² MacDonald J.M., Stokes R.J., Cohen D.A., Kofner A. and Ridgeway G.K. 2010. The effect of light rail transit on body mass index and physical activity. American Journal of Preventative Medicine. 39(2): 105-112.