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“Greening” the Fleet: Using a Lifecycle Modeling Tool for Procurement Decisions

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Issue

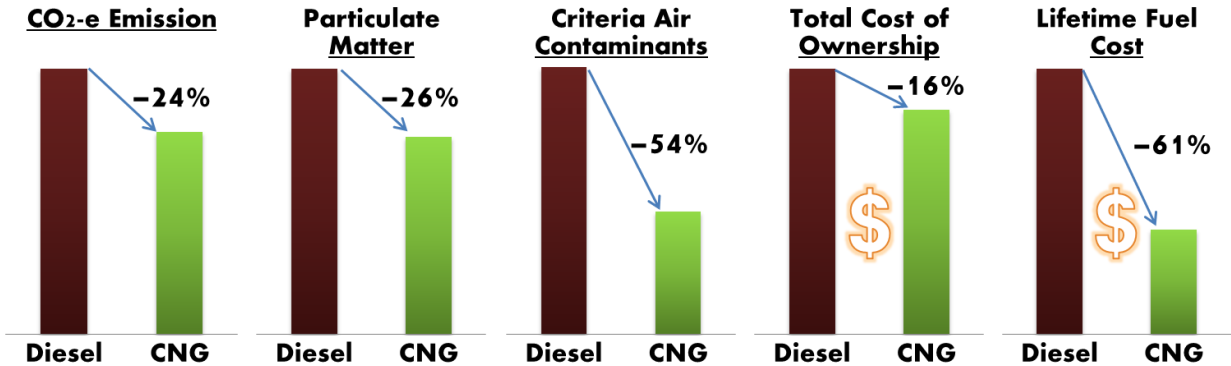
The transportation sector is the largest source of greenhouse gas (GHG) emissions in Canada, accounting for approximately one-third of Canada’s total GHG emissions.¹ Local air pollution from transportation is posing significant environmental and health risks for Canadians, especially for the 80% of the population who live and work in urban areas.² In that light, how can Canadian cities sustainably reduce emissions from the transport sector and gain environmental, health, and economic benefits? Choosing natural gas trucks is one viable option.

Case study

In collaboration with the City of Surrey, we conducted a lifecycle assessment of the 300-vehicle municipal fleet to evaluate viable low-carbon alternative fuel vehicles to replace the city’s existing gasoline and diesel vehicles, in an effort to reduce GHG emissions 20% by 2020. Since major impacts require major changes, we started by considering the most energy-and-emissions-intensive vehicles used in the municipal operations: heavy duty refuse-collection vehicles (RCVs).

When compared to existing diesel-powered trucks, we showed that switching to compressed natural gas (CNG) vehicles can reduce GHG emissions by 24% CO₂-equivalent per kilometre, and greatly reduce key air pollutants including particulate matter, sulfur oxides, and nitrogen oxides. Moreover, fuel cost estimations revealed that considerable cost savings may be realized by switching to CNG vehicles. Over a 10-year vehicle lifetime, significant fuel cost savings on the order of \$100,000 CDN per vehicle can be achieved. These cost savings are

equivalent to a two-year payback period on the additional capital investment of on-board CNG fuel storage and engine technology.³



Notably, both the federal and provincial governments in Canada offer significant tax incentives for CNG vehicle procurement and operation. For instance, the Clean Energy Vehicles for British Columbia (BC) program provides BC residents with up to \$2,500 off the pre-tax sticker price for CNG passenger vehicles and pickup trucks.⁴ In the medium to heavy duty vehicle segment, FortisBC provides funding of up to 70% of the incremental capital cost of CNG/LNG vehicles versus the cost of comparably equipped diesel powered vehicles.⁵

Tax incentives combined with today's historically low natural gas prices offers an opportunity for consumers and organizations to reduce emissions and cost simultaneously.⁶ At the same time, the durability of CNG-based engines has improved significantly as a result of recent engine development activities worldwide.⁷ As a consequence, the robustness of CNG engines is approximately on par with diesel engines. CNG combustion-based RCV pilot projects at various municipalities worldwide have shown that this level of performance can be achieved.⁸

Life Cycle Approach

To fully evaluate and assess the energy, emissions, and economic effects of alternative fuels and vehicle technologies, a lifecycle approach needs to be applied. This must include all the steps required to produce a fuel, to manufacture a vehicle, and to operate and maintain the vehicle throughout its lifetime including disposal and recycling at the end. A lifecycle approach provides better understanding of alternative choices in fuels and vehicle technologies and contributes to best practices in the decision making process. Failure to use such an approach can lead to false conclusions being drawn, especially for alternative vehicle technologies that employ fuels with distinctly varied primary energy sources and fuel processing pathways.⁹

Our research group has developed the Fleet Life Cycle Analysis (Fleet LCA) modeling tool, which is customized for vehicle fleets. The tool supports assessment of alternative and conventional fuel vehicles and provides unbiased reliable information upon which vehicle procurement and/or conversion decisions can be made. The tool predicts energy use, emissions, and cost of vehicle fleets in a user-friendly format, using realistic assumptions, real-time data, and sound methodology.

As a result of deploying the Fleet LCA tool, the City of Surrey made an informed decision to replace its entire RCV fleet with CNG vehicles as of October 2012. Application of the tool to

CNG pickup trucks and electric vehicles is in progress. The Fleet LCA tool will constructively address emissions across the whole vehicle fleet and help further energy and climate action plans at the municipal level.

Recommendation

1. A lifecycle approach, as facilitated by the Fleet LCA tool, should be applied when assessing the energy, emissions, and economic effects of vehicle fleets.

Conclusions

The pilot-study results indicate that the “Fleet Life Cycle Analysis” tool will assist public and private fleet operators in Canada to evaluate viable low-carbon alternatives to conventional vehicles. For fleet operators, the results show that moving in this direction can offer short payback times, save money, improve air quality, and help reduce greenhouse gas emissions. Work is underway to make this tool publicly available online later this year.

Acknowledgments

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Sources

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