# Report to Georgian Bluffs on the 2024 Green Truck Summit and Work Truck Show

March 15, 2024; *minor revisions October 14, 2024*

## Summary

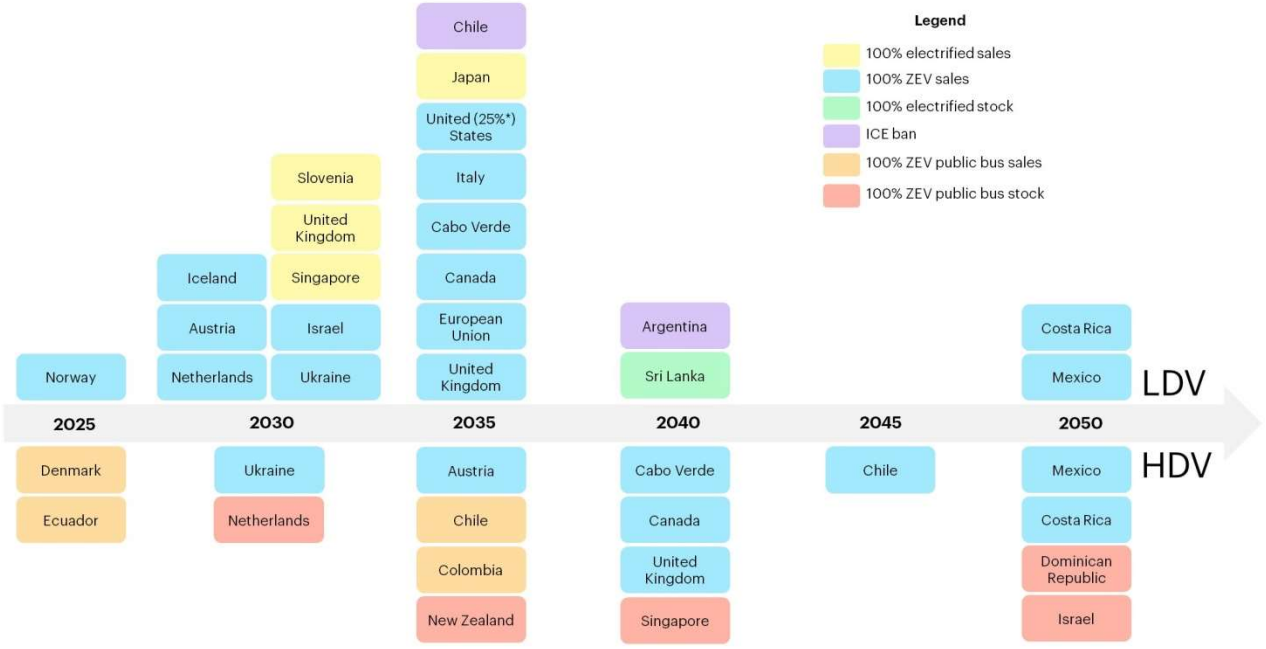
Driven by global regulations and by competitive pressures, all the global truck manufacturers that currently supply trucks to Georgian Bluffs are in a race to create a full suite of commercially competitive zero emission (ZEV) trucks by the mid 2030s. Some ZEV trucks are already commercially available.

## The Global Regulatory Environment for ZEV Trucks

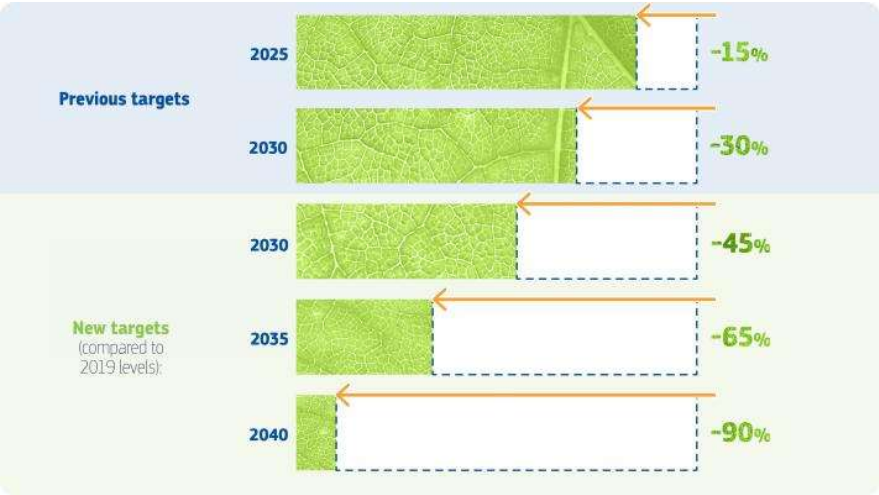
Pursuant to international agreements on greenhouse gas (GHG) emissions reduction, including The Paris Agreement of 2015, all countries in the developed world, including Canada, have created legislation mandating the near-full adoption of ZEVs by 2040. A summary of the UK ZEV mandate, which is typical, is below:

> Under the ZEV Mandate, 80% of new cars and 70% of new vans sold in the UK must be zero emission by 2030. This percentage will increase to 100% by 2035. The UK will phase out new, non-zero emission heavy goods vehicles (HGVs) weighing 26 tonnes and under by 2035, with all new HGVs sold in the UK to be zero emission by 2040.

The chart immediately below, from the International Energy Agency's 2023 report, Global EV Outlook, summarizes global zero-emission vehicle mandates and internal combustion engine bans ("LDV" is an acronym for "light duty vehicle", a vehicle under 8.500 lbs gross weight. "HDVs" are vehicles over that weight) :



To supplement the chart above, below are the EU objectives for GHG emissions reductions for heavy duty vehicles, announced in January 2024 (Source: https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles/reducing-co2-emissions-heavy-duty-vehicles_en):




## Response of the Global Truck Manufacturers (OEMs) to These Government Mandates

### Generally

All the global truck OEMs are now competing in a decade-long marathon to meet these mandates. The technological challenges involved in this are so great that the OEMs are partnering together in alliances such as the Joint Electric Truck Scaling Initiative (JETSI, see jetsiproject.com) and Powering America's Commercial Transportation (PACT, see pactcoalition.org). All the major truck OEMs have electrification advisory services for fleets wanting to electrify, which you can find on their websites.

### Overview of low or zero emissions technologies: BEV, H2FC, H2ICE, other clean fuels

Brief summaries of these technologies:

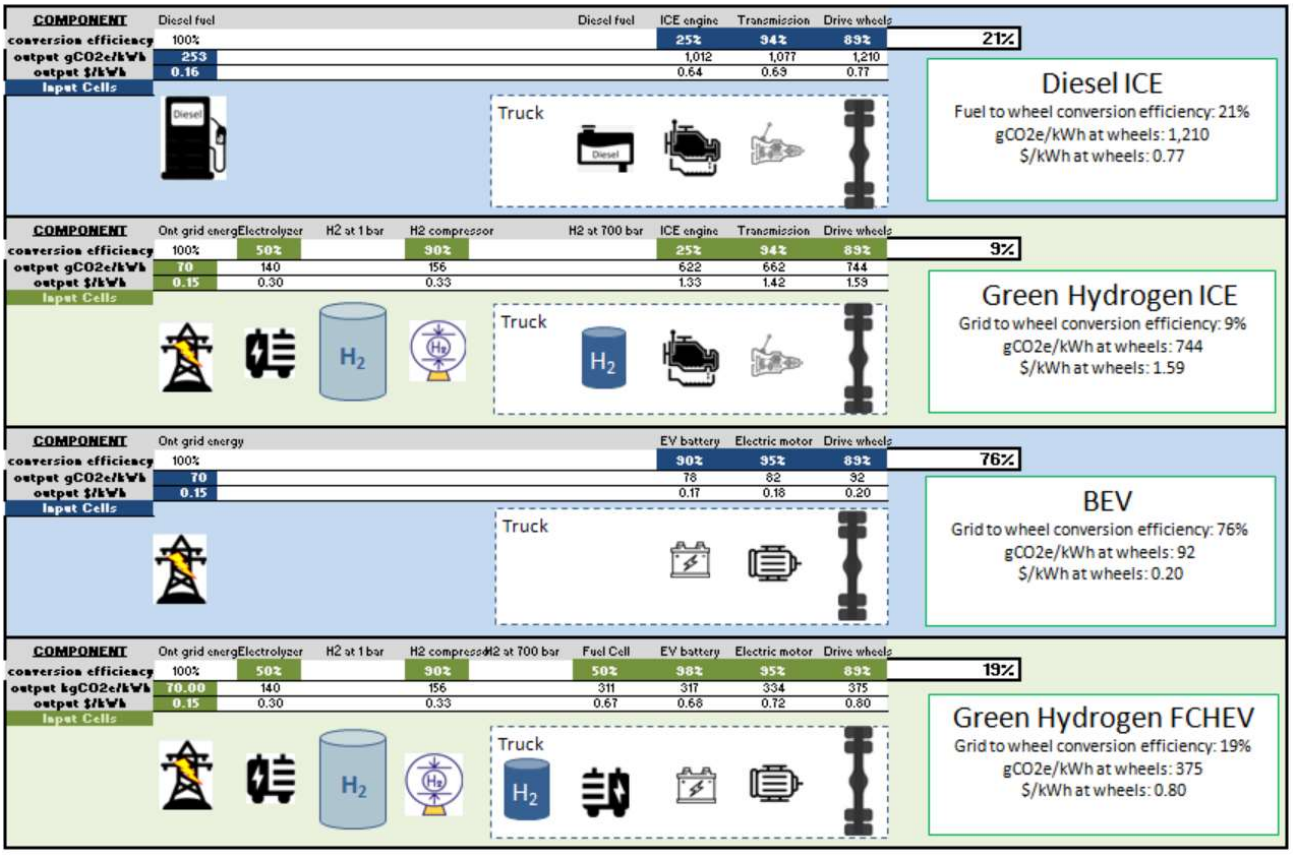
**BEV:** battery electric vehicle, storing grid energy in an electrochemical battery and using this energy in one or several electric motors to drive the truck

**H2FC:** hydrogen fuel cell vehicle, storing energy in hydrogen in an on-board tank, converting this stored energy to electricity with a fuel cell and using this charge an electrochemical battery and then using this energy in one or several electric motors to drive the truck

**H2ICE:** hydrogen internal combustion engine vehicle, storing energy in hydrogen in an on-board tank, converting this stored energy to mechanical energy with an internal combustion engine to drive the truck

**Clean fuels:** fuels other than fossil fuels than can be burned in internal combustion engines. These include hydrogen, ammonia, bio-fuels, and electrofuels (or "e-fuels"), which are created by using electricity to create a hydrocarbon fuel from captured carbon dioxide and electrolytically created hydrogen.

The figure below shows the relative delivered energy costs at the wheels, in dollars and in GHG emissions, of these technologies, based only on the primary energy cost and carbon intensity and the conversion efficiencies of the elements of the "primary energy to wheels" chain:




This simple analysis is incomplete, though usefully accurate. It does not account for the capital costs or operating costs of the equipment to generate the green hydrogen, nor the energy benefits of regenerative braking, which are available to the BEV and FCHEV. The xls file "Georgian Bluffs fleet summary template", which accompanies this report, has a sheet, "Emissions estimates by vehicle type" that has a live version of this figure wherein the input cells can be changed.

It can be seen from the figure above that, according to this simple but materially accurate analysis, the BEV is the clear winner on fuel costs and emissions. So why consider the H2FCHEV configuration at all? Because it's possible that, in some applications, the higher energy density and quicker refueling times of hydrogen will justify its higher costs and associated GHG emissions. This has yet to be determined commercially.

## Notes by OEM

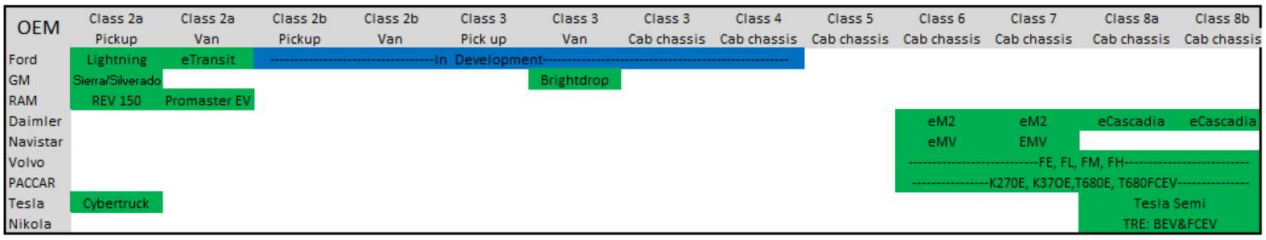
**Ford:** Displayed at least two Lightnings at the show, including a crew cab version. Also displayed several eTransits as well as Ford's charging system for truck EVs. Chatting with senior engineers, learned that they're current working on EV versions of the F250, 350 and 450 as well as "ground up" version of an e-Transit

**GM:** Displayed a Silverado/Sierra EV as well as several BrightDrops. Announced that they're working on BEV and H2FC versions of trucks in classes 2-6.

**Daimler (Freightliner):** Made the keynote address at the Green Truck Summit (which I'll try to send you, Niall). Chatting with an engineer, got an "off the record" estimate of 2035 as the date by which their Class 6-8 ZEVs would be commercially competitive with their currently competitive diesel ICEs

**Navistar (now owned by Volkswagen group):** Declared that their primary development focus is ZEVs, not ICEs of any kind. Aim to be 50% ZEV by 2030, 100% by 2040. EV school busses is a current focus

## Table of Current ZEV Availability by OEM and Comments




The table above shows the ZEVs currently available from the OEMs shown. In many cases the vehicles currently available are too expensive or have too short a range to be commercially competitive in most applications. Broadly, the technological challenges for the next 15 years are to reduce costs and increase range, so that the ZEVs are cheaper and functionally better than current ICE trucks.

## Conversation with USDOE/Clean Cities folks

Here's the Clean Cities site: https://cleancities.energy.gov/

I've attached with this report a copy of "AFLEET" an xls tool created by the USDOE to assist fleets in estimating emissions and Total Cost of Ownership (TOC) for fleets.

The USDOE folks definitely have a "different countries but the same planet" attitude about helping Canadian municipalities, at least at a high level, with emissions reductions.

Related to this, the Canadian consultant to the National Truck Equipment Association (NTEA), our trade association, found this contact to help us with our efforts in Canada: Joyce Henry, Director General, Office of Energy Efficiency, NRCAN: joyce.henry@NRCan-RNCan.gc.ca

## Implications of all this for Georgian Bluffs

Assuming the truck OEMs are successful in meeting their own targets to create commercially competitive ZEVs, there will be a full suite of practical ZEV trucks available for Georgian Bluffs (GB) sometime in the 2030s. There are already some practical ZEV trucks available to do some of GB's work.

## Proposed next steps

Put together a fleet replacement plan for GB using different assumptions about the timing of ZEV availability for the various types of trucks in the GB fleet. Calculate the GHG emissions reductions achieved under different assumptions.