



Fails to meet criteria	Not promising	Meets in some respects	Potentially meets criteria	Meets criteria
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\* For explanation of criteria see Box B, page 22

# ASSESSMENT TABLE: Heavy-duty vehicles (Long-haul freight)

	Credible			Capable		Compelling			Priority approach
	Maturity	Economic viability	Social acceptability	Fit for purpose	Net-zero pathway potential	To critical stakeholders	Related costs and benefits	Economic development opportunities	
<b>Hydrogen Fuel Cell</b>									
	Fuel cells: mature but not scaled up. Hydrogen from methane: mature. Hydrogen from electrolysis: still developing Fueling infrastructure virtually nonexistent	Vehicle purchase cost higher and distribution of hydrogen very expensive. Hydrogen from methane (even with CCS) currently much cheaper than hydrogen from electrolysis	Some concerns over safety of hydrogen fueling	<b>Yes.</b> High torque	<b>Yes.</b> If hydrogen is made from decarbonized electricity such as renewables or from fossil sources with CCS and offsets.  Longer term viability of fossil-based hydrogen depends on CCS and offset availability	Compelling to some truck manufacturers and trucking firms.	Improved driving (torque), lower maintenance, no air pollution, noise reductions.  Concerns with fuel cell recycling.  Potentially 'anchor tenant' for hydrogen economy	Opportunities for fuel cell manufacture, vehicle manufacture and hydrogen production (especially for Alberta with hydrogen from methane and wind/solar/geothermal hydrogen production)	<b>High</b>  Potentially part of net zero emission world.
<b>Electric</b>									
<b>Battery electric</b>	Still emerging. Energy densities of current battery technology needs improvement.  New chemistries may be required.	Higher costs of vehicles as compared to diesel	No particular concerns	Not at present. Good torque but limited load capacity because of batteries. Concerns over cold weather	<b>Yes.</b>  Ultimately depends on net zero electricity and decarbonized supply chain (steel aluminum, plastics)	Potentially compelling if battery charge/weight issue addressed	Improved driving (torque), lower maintenance, no air pollution, noise reductions	job opportunities for research, design, assembly, and maintenance	<b>High</b>  Potentially part of net zero emission world
<b>Catenary electric</b>	Technologies mature when deployed in other applications (trolley buses). Still at pilot stage for this application	High cost of vehicles compared to diesel. High cost of infrastructure roll out with Canadian distances	Uncertain	Yes. If infrastructure existed at appropriate scale.  Range concerns for battery driven mode	<b>Yes.</b>  Ultimately depends on net zero grid GHG electricity and decarbonized supply chain (steel aluminum, plastics)	Potentially compelling if infrastructure built out  But concerns over vehicle flexibility off the catenary network	Improved driving (torque), lower maintenance, no air pollution, noise reductions  Concerns over impact on other road users.	job opportunities for research, design, assembly, and maintenance	<b>Medium</b>  Potentially part of net zero emission world
<b>Biodiesel</b>									
	<b>Mature</b>	More expensive than diesel because of distributed nature of the resources and costs associated with handling, transport and processing	No particular concerns	<b>Yes.</b> Similar torque and horsepower as diesel-powered engines	Perhaps. Depends on feedstock, processing, distribution. But lack of feedstock precludes general application	Somewhat compelling for particular producers and consumers.	Can use existing infrastructure. Safer to handle and transport than diesel.  But does not address air and noise pollution. Negative impacts of land use change.	Potentially new markets for biomass.	<b>Very Low</b>  Not scalable  Does not facilitate transition.  Air pollution emissions

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	Maturity	Economic viability	Social acceptability	Fit for purpose	Net-zero pathway potential	To critical stakeholders	Related costs and benefits	Economic development opportunities	
<b>Natural gas</b>									
<b>Compressed or liquified NG</b>	Mature	Natural gas is currently inexpensive, but there are also compression and distribution costs	No concerns, except it is a fossil fuel	Weak: low torque, power	Not compatible with net zero (30% GHG reduction from diesel).	Weak from trucking firms. Interest from existing gas suppliers	Can use existing pipeline infrastructure and engine designs. Air pollution not addressed.	Short term expansion of NG markets	Not a priority Fossil fuel option Does not facilitate transition
<b>Renewable NG (biogas)</b>	Biogas production technologies still developing	Medium	No particular concerns,	Weak: low torque, power	Not practical at scale. Lack of necessary feedstocks. Applicable in specific contexts.	Weak from trucking firms. Some interest from possible biomass suppliers.	Can use existing pipeline infrastructure and engine designs. Air pollution not addressed	Some local opportunities	Low Not scalable. Does not facilitate transition. Air emissions
<b>Synthetic NG (power from low-carbon sources, C from bio or air capture)</b>	Early research stage	Very high costs	No particular concerns,	Weak: low torque, power	In principle, but requires cheap H2 production and cheap air capture to be competitive	Still at research phase	Can use existing pipeline infrastructure and engine designs. Air pollution not addressed	Remote	Low Very immature technology Air emissions