

# **Renewable natural gas (RNG) Decarbonize long-haul trucking today**

Presented at the HEC Montreal Chair in Energy Sector Management

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# RNG, a recognized source of renewable energy

RNG is recognized as a source of GHG reduction by:

- MELCCFP\* and MERN\*\*
- Treasury Board of Canada

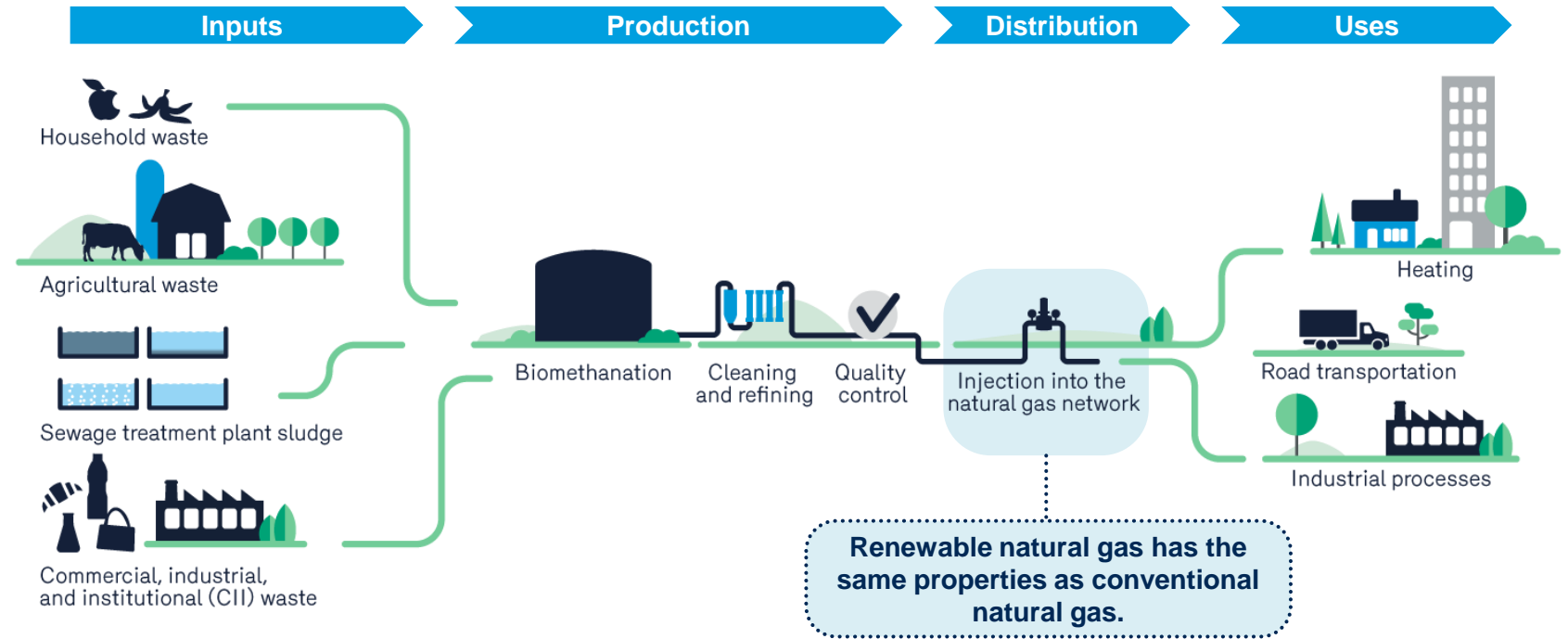
RNG is part of:

- The government's effort to lead by example
- The Plan for a Green Economy (PGE) and the budget allocated for RNG production
- Canada's plan to reach net-zero emissions

The Québec government has set a **target of RNG injection of 10% of volumes** by 2030



Renewable natural gas is injected into our network and interchangeable with conventional natural gas



\* Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs

\*\* Québec's Ministère de l'Énergie et des Ressources naturelles

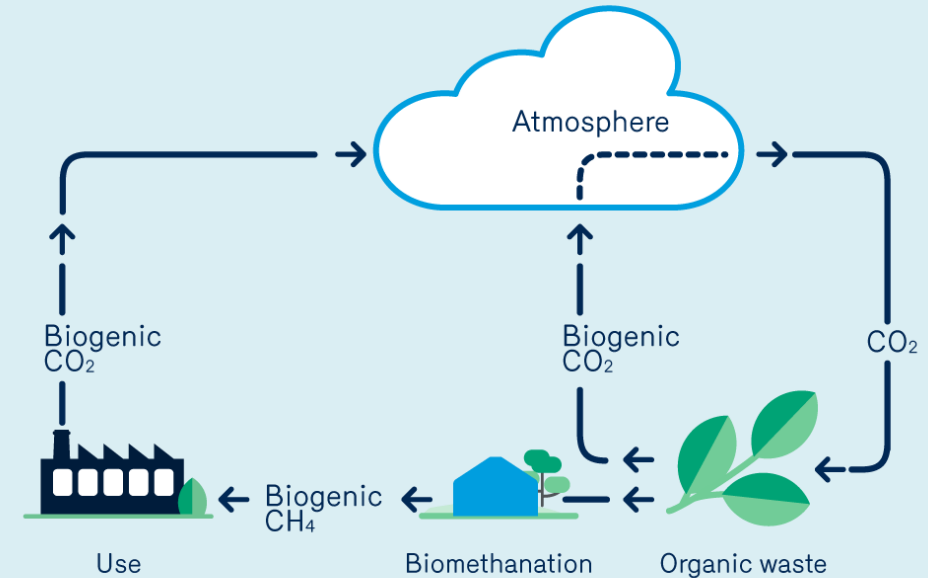
# Renewable natural gas (RNG) in a nutshell

RNG production **converts the biogenic GHG emissions** already generated by the normal activities of the sectors where organic materials originate, into value-added inputs for the biomethanation process.

For example, RNG production makes it possible to:

- capture and convert biogas, containing  $\text{CH}_4$  produced by landfills.
- avoid producing  $\text{CO}_2$ -emitting chemical fertilizers by substituting them for digestate, a by-product of the biomethanation process.
- avoid some methane emissions from manure and wastewater management.

**RNG production recovers energy that is already available and converts it. It has the same benefits as conventional natural gas but 100% renewable.**



Gas that is **interchangeable** with conventional natural gas since they both share the same pipes, **equipment**, benefits, and **applications**.



Derived from the biomethanation of organic matter and therefore **100% renewable**. Does not contribute to additional GHG emissions.



Energy that gives a second life to organic matter, contributes to the **circular economy** and can be **produced locally**.

## Existing and future RNG production sites





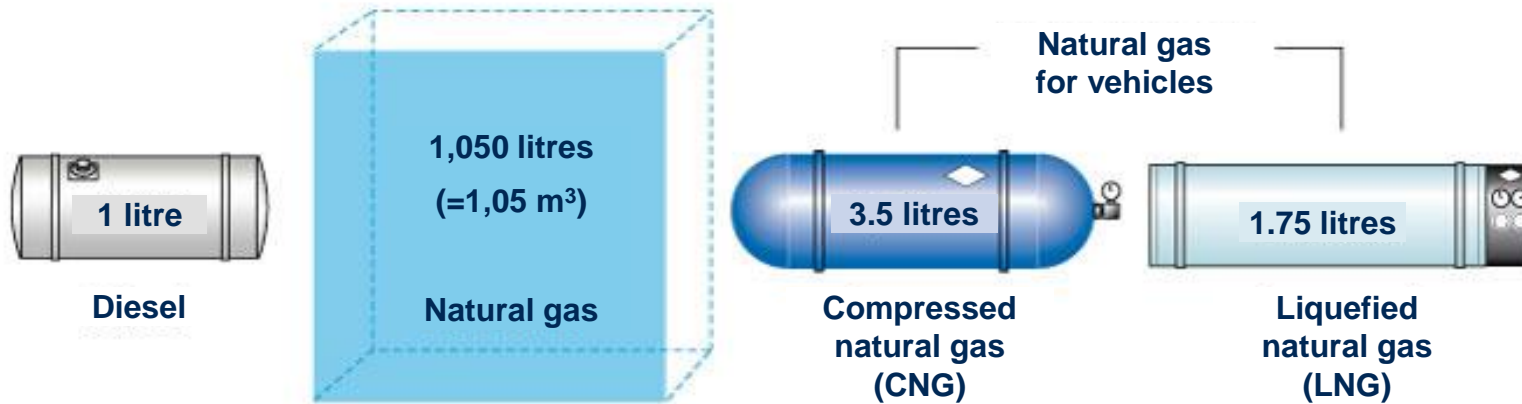
# Supply infrastructure



R-CNG refueling stations are located on the gas network

Compressed natural gas (CNG) is a natural gas composed primarily of methane. It is compressed to a pressure of **3,600 psi** for storage in vehicle tanks.

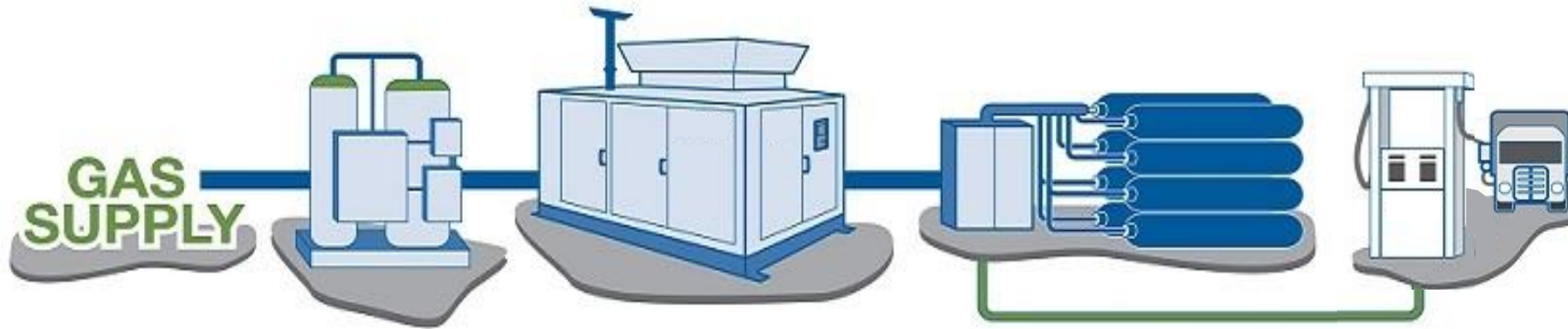
At 3,600 psi, natural gas takes up **300 times** less space than 1 m<sup>3</sup> of natural gas at ambient temperature and pressure.



Although there are two ways of storing gas for transportation use, CNG has been heavily adopted by the fleet for convenience and supply reasons.



# Schematics of CNG station and real-life installations



Compression equipment (station)

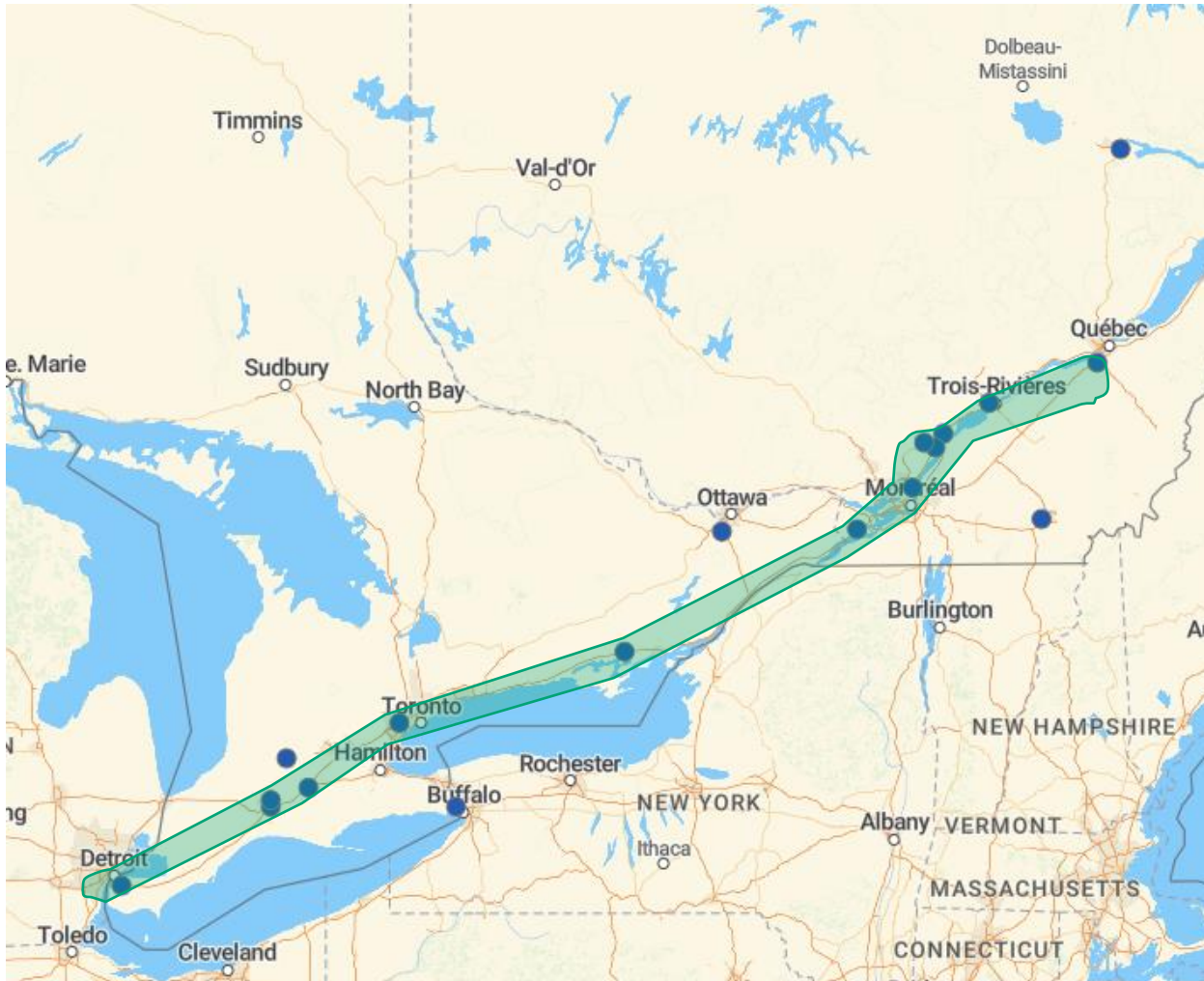


Quick fill dispenser: 5 to 10 minutes per truck





# CNG stations between Quebec and Windsor (Detroit)



There are 642 public access CNG stations in the US and Canada

- 25 are located in Canada
- 13 are located along the Quebec-Windsor corridor

Maximum distance between stations: **250 km**  
Average truck autonomy: **900 km**





# Optimal solution for displacing diesel

The cleanest combustion engines currently offered on the market, with important environmental benefits:

Cummins engine emissions under ftp cycle from l'EPA <sup>1</sup>					
	Carbon monoxide	Nitrogen oxide	Particulate matter	Carbon dioxide	Nitrous oxide
Pollutants and Green House Gases	CO	NO <sub>x</sub>	PM	CO <sub>2</sub>	N <sub>2</sub> O
Difference vs EPA standards	-90%	-95%	-90%	-16%	-80%

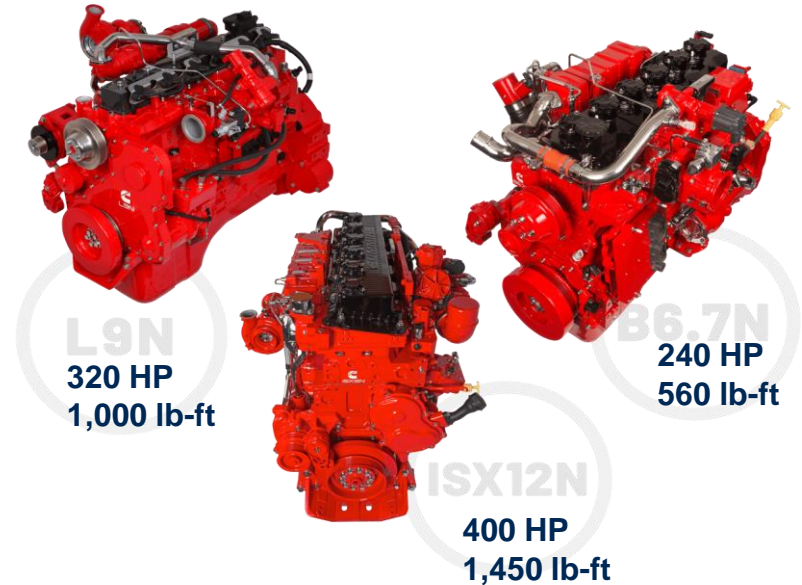
<sup>1</sup> Données tirées du certificat de conformité telles que compilées par la California Air Resources Board (CARB), moteur JCEXH0540LBN, année-modèle 2018.

<sup>2</sup> Technologie Near Zero est appliquée à tous les moteurs Cummins 8,9L et 11,9L à gaz naturel depuis l'année-modèle 2018

- **Certified EPA et CARB**
  - Meets EPA standards for CO<sub>2</sub> and NO<sub>x</sub> for the year 2027
- **Less noisy** than diesel: -10dB
- **3-way catalyzer** for treatment of exhaust gases
  - No more **urea**
  - No more **particulate filter**
  - Reduction of **20% of sensors**
- **Spark ignition**
- **80% parts = diesel engine**
- **Maintenance costs = diesel engine**
- **Cold weather performance demonstrated**



+ 85,000 engines manufactured  
+ 30 years of experience



No more diesel particulate filters (DPF)!

# New natural gas high-power engine coming to market in 2024



## Engine 15L 100% NG (X15N)

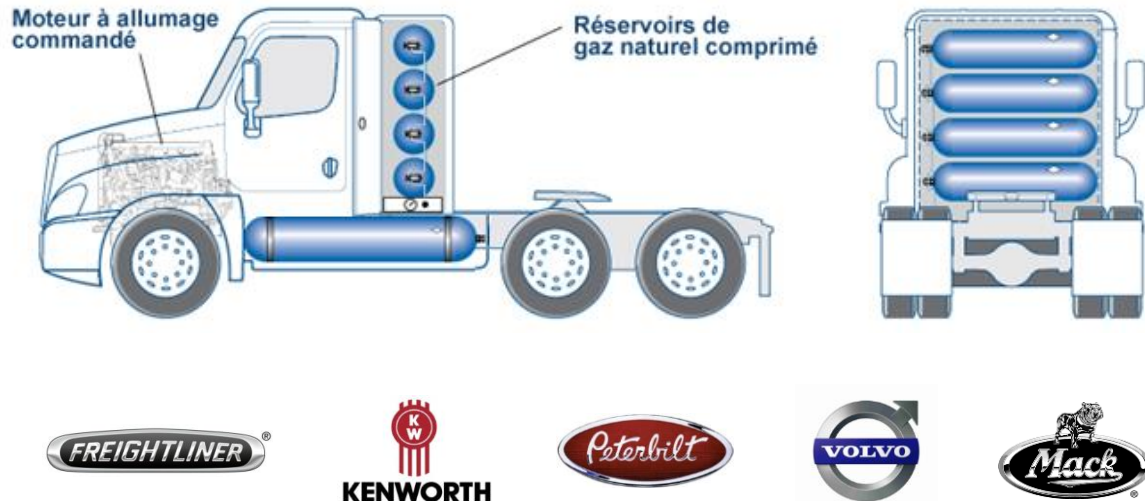


Power nodes  
400 to 500 HP  
1,450 to 1,850 lb-ft



- Start of production **2023**; deliveries **2024**
- **Announced** introduction in chassis by **PACCAR (Peterbilt and KW)**
- Weight reduction of **300 lbs** compared to X15 diesel
- **Compatible with transmission:** Endurant HD (Eaton-Cummins) and eventually from other manufacturers
- **500 HP** of maximum power
- **Efficiency improved by 10%** compared to the ISX12N
- **Reduction of GHG by 10%** compared to the ISX12N
- Will meet emissions standards of the **EPA and CARB of 2024 and 2027**
- **No diesel particulate filter (DPF)**

# CNG Trucks



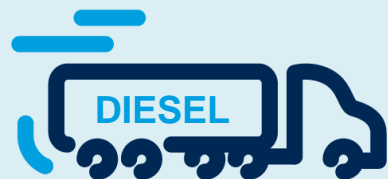
**Average incremental cost:** \$90,000 but varies depending on the tanks' size selected.

**Autonomy averaging 900 km and up to 1,600 km, according to the configuration of the tanks.**

## Class 8 – North American Freight



# Quebec – Windsor case study: DIESEL vs R-CNG



Price per litre	\$1.65 / L
Price per Km	\$0.58 / km
Fuel cost for trip	\$678.60



Price per litre	\$1.06 / DLE
Price per Km	\$0.42 / km
Fuel cost for trip	\$491.40

## DIESEL vs R-CNG

Assuming average distance travelled per year is 150,000 Km

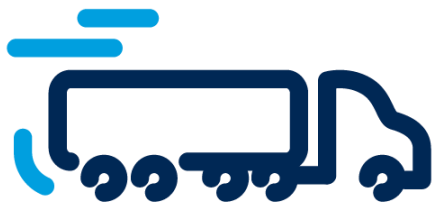
DIESEL engine	Parameters	R-CNG Engine
52 500	Annual consumption (L/year)	60 000
35 L / 100 km	Efficiency	40 DLE / 100 km
\$0	Incremental cost of CNG vs. diesel	\$90 000
\$0	Grant Écocardonnage (MTQ)	(\$27 000)



**2.6 year ROI**  
To recoup net incremental cost



**-145 tCO<sub>2</sub>e (-99,4%)**  
Annual GHG reduction



Quebec City

1,170 km

Windsor





# Strength, Weaknesses, Opportunities & Threats (SWOT)

## Strength

- Public infrastructure to deliver R-CNG to HD trucks deployed and growing
- Refueling easy and fast (5-10 minutes)
- RNG is available now and its production across North America is expanding
- Major trucks OEM offer Cummins NG engines today and their integration is done directly on the manufacturing line
- Provincial support (Ecocamionnage) to reduce upfront capital costs for trucking companies when purchasing CNG truck
- Interesting ROI to buy a CNG truck and run it using R-CNG
- Minimal impact on total payload carried compared to other ALT-fuels
- Existing CSA codes for installing CNG stations, maintenance infrastructure, CNG tanks, etc.

## Opportunities

- Introduction of 15L (X15N) engine in 2024
- Clean Fuel Regulation (CFR) offers credit generation opportunities for RNG
- Companies with ESG targets requesting their carriers reduce emissions

## Weaknesses

- Incremental cost of CNG truck compared to diesel equivalent (capital allocation)
- Albeit the growing number of maintenance facilities, more are required to provide smooth operation for carriers along different routes
- Rental companies are moving slowly to incorporate ALT-fuel offerings to customers
- Variability in maintenance costs is very dependent on trucking maintenance culture and processes
- Cost of maintenance shop upgrade to repair and maintain CNG trucks
- Small number of technicians trained to maintain CNG trucks
- OEMs all have their powertrain solution for diesel, offering NG engines impacts profitability

## Threats

- Price of diesel
- ZEV focus not encompassing a lifecycle approach
- A long decisional process that can be subject to market fluctuations
- The driver shortages in the industry impact the ability of freight carriers to focus on the introduction of alt-fuels
- Freight carrier pricing model with fuel surcharge for diesel
- Economic uncertainties slowing down investments
- Truck supply chain is still sluggish even post Covid (impacting diesel trucks as well)



# Recommendations



ZEV conceptually focuses only on tailpipe emissions. A full lifecycle approach should be considered to include technologies such as RNG.



Increase the financial incentives for fleets at the purchase of a CNG truck when using RNG.



Continue to support the deployment of public CNG stations (using RNG) to open new trucking corridors which will encourage adoption.



Support the transformation of maintenance infrastructures (repair shops) to increase and improve the service offering.

**We are ready now to deliver a net-zero carbon long-haul transport solution!**

# Thanks for your attention!

For any questions,  
please reach out

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