

Prospects for Heavy-Duty CNG truck in the Japanese logistics industry

Naoko Fukutome
Tokyo Gas Co., Ltd.

September 17th, 2014

1. Background

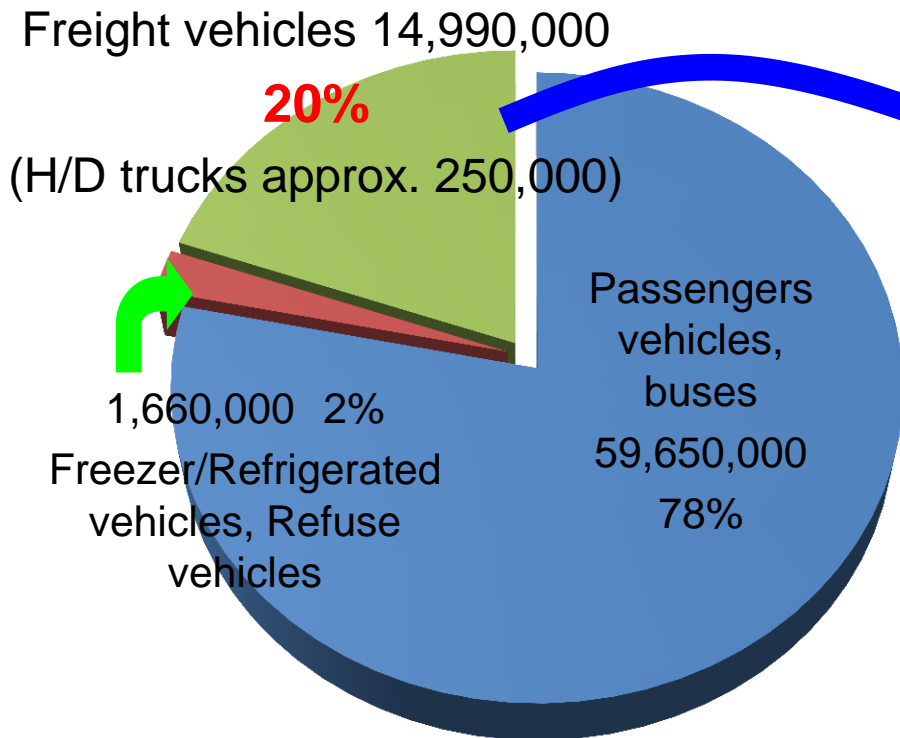
1-1 Energy/Fuel Security

- ◆ In Japan, the transportation industry depends on petrol or diesel, 98 % of its fuel. Especially, freight trucks are running with diesel.
- ◆ In 2011 “the Great Earthquake” hit Tohoku region, “Tsunami” hit a couple of petrochemical complexes. Freight companies experienced the shortage of fuel, especially for delivering relief supplies.

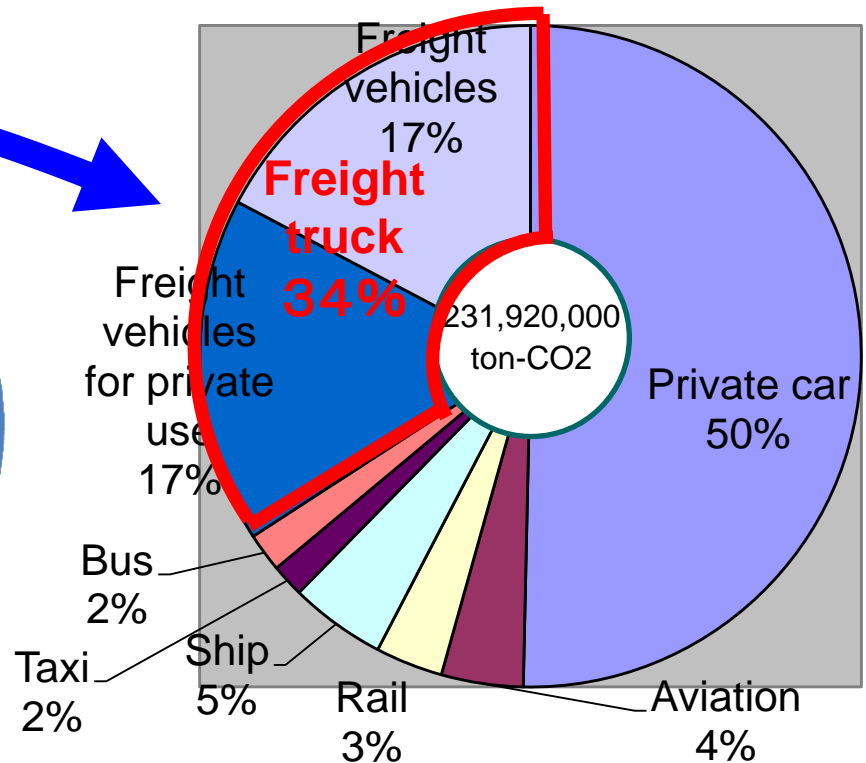
 Fuel Security : Business Continuity Planning

1-2 CO₂ emissions

- 20% of all running vehicles in Japan are trucks.
- 90% of freight vehicles is taken up by trucks.
- Freight trucks contribute 34% of CO₂ emissions.



<The number of Vehicles>

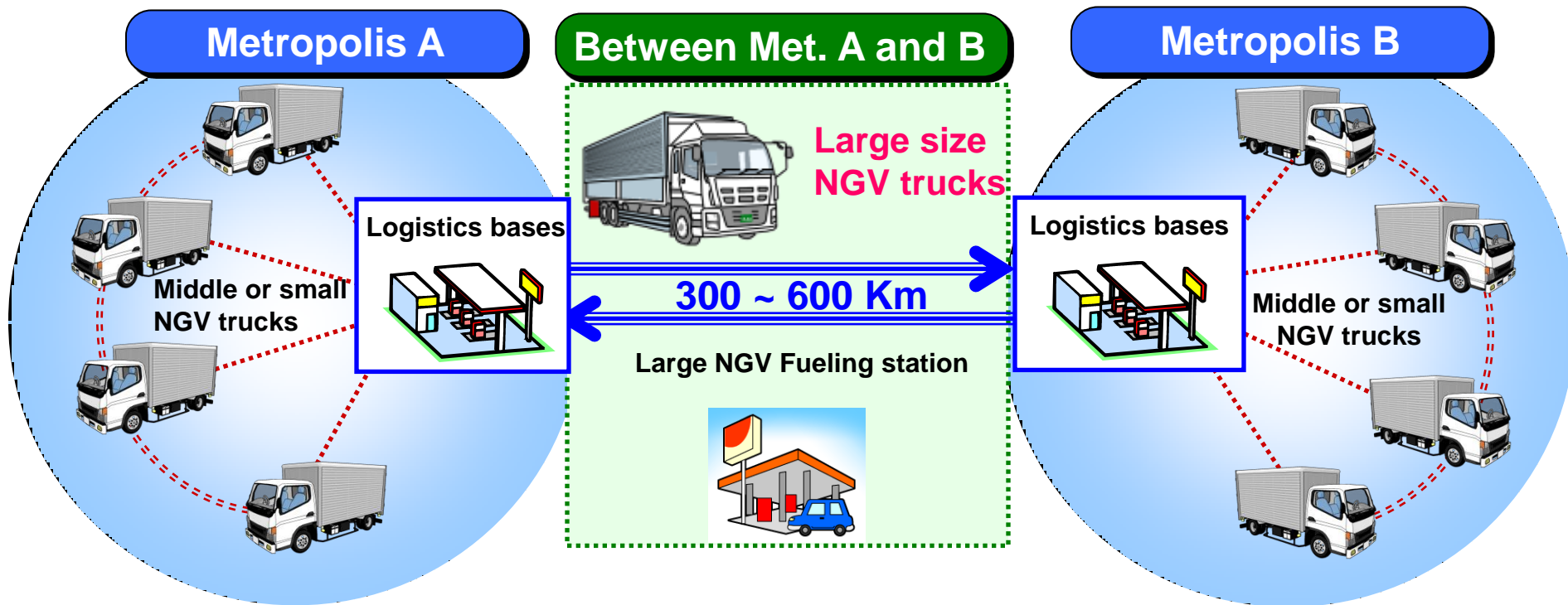


< CO₂ Emissions from Transportation industry >

2. Aims

Our strategy is to introduce heavy-duty (GVW 25 tons or more) NGV trucks for long distance and inter-city transport.

➔ To deploy HD NGV trucks in the logistics industry.



Japan Gas Association and Tokyo Gas, Keiyo Gas, Shizuoka Gas, Toho Gas, Osaka Gas, Hiroshima Gas, Saibu Gas and Hokkaido Gas expect large size NGV trucks to become a good solution to diversify truck fuel and to reduce CO₂ emissions.

3. Method: Demonstration project

December 2011 – March 2014

Outline

JGA (with 8 city-gas companies) owns
3 HD CNG trucks (GWV 25t) through LEVO*

LEVO lends them to freight companies to use them
as trial.

Each operator uses it for 4 to 6 months to;

- Collect data on economic performance, CO₂ reduction potential
- Find advantages/ disadvantages in the practical use of CNG trucks
- Find problems of this retrofit truck

Participants

Nippon Express, Sagawa Express, Yamato Transport, Tonami Transportation, Suntory Logistics, Fukuyama Transporting, etc. Total 15 operators



Specifications of Engine

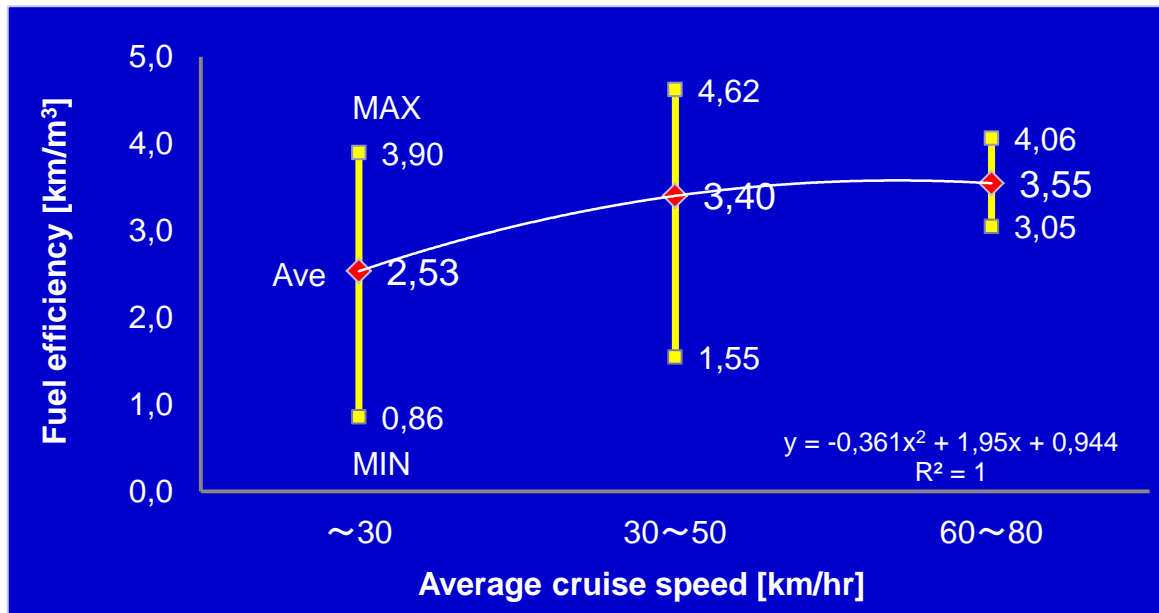
	Base Engine	CNG
Bore × Stroke	120 × 145mm	←
Number of Cylinders	6	←
Displacement	9,839 cc	←
Ignition System	Compression self-ignition	spark ignition
Fuel injection system	Common rail	Single point injection
Compression ratio	17.0	11.0

- ◆ Isuzu GIGA converted (retrofit) to CNG by Kyodo and HKS.
- ◆ In May 2014, modified SPI to MPI and continue the trial for another year.

4. Results

4-1 Fuel Efficiency

- ◆ The faster average speed, the higher average fuel efficiency;
 - Cruise mainly along inter-city express-way, the average cruise speed reaches around and between 60 to 80 km/h
 - ➔ Fuel efficiency becomes higher, average 3.55 km/m³.
 - Cylinder capacities are 721L, 793L, and 821L
 - ➔ the cruise distances for practical operations are 400 to 450 km.



4-2 CO₂ emissions

- ◆ Compare under express-way cruise hypothetically;
 - Company A, cruise 310 km everyday, inter-city express-way
 - average cruise speed around 50 ~ 65 km/h
 - average fuel efficiency 3.60 ~ 3.85 km/m³
 - ➔ CO₂ reduction 5 % ~ 10 % compared to diesel vehicle
(CO₂ emission coefficient; CNG 2.23 kg-CO₂/Nm³, Diesel 2.25 kg-CO₂/L)

Hypothetically?

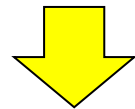
- ✓ The comparison was not on exactly the same condition.
cruise distance, engine size, type of vehicle
weather, road condition, etc.
- ✓ High-way Mode Test: this retrofit engine: 4.56 km/m³

4-3 Voices from drivers

- ◆ With SPI engine, torque on low speed was weak
 - ✓ Poor to accelerate at a steep slope
 - ➡ ◆ Modified to MPI engine
 - ✓ ‘I don’t feel any difference between this CNG truck and Diesel trucks I used to drive.’ (by the driver)
- ◆ No smell like oil/diesel, almost No PM
 - ✓ ‘I was so proud of myself when my customer told me, “Nothing less expected from you, using such a clean vehicle, and being the first one to use a CNG large truck!”’
- ◆ Quite quiet, Quite less vibration from engine
 - ✓ ‘Much less tiredness while driving.’
 - ✓ ‘Goodbye backache!’

5. Conclusion

- The circumstances of NGVs in Japan has changed:
 - Diesel engines have become much cleaner
 - Automobile companies are more interested in PHEV, EV, or more advanced FCV
- The key drivers to promote NGVs are:
 1. Energy diversification in transport sector
 2. Reduction of green house gas

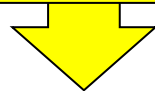


Demonstration project

We found that using HD CNG trucks can be a good solution.



Logistics companies are longing for OEM NGVs with high-efficiency engine.



ISUZU will launch HD CNG trucks with MPI engine in 2015 as OEM

Thank you very much for your precious time...