Note by SCBEIC

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NGV: Pros and Cons... how attractive are they for consumers?

Natural Gas for Vehicle is known as NGVs. Using NGVs is safe, environmentally friendly, and cheaper than using other kinds of fuel. However, a major obstacle to making the switch to an NGV is the fact that currently there are few NGV filling stations available. Advances in automobile energy efficiency also mean that many car users and some commercial operators may question whether or not choosing an NGV is worthwhile.

Global NGV use has been on the rise, especially in the NGV market-leading Asia-Pacific region, where number of NGV cars is more than 50% of total NGV cars in the world. The region also saw the highest growth rate in NGV[1] automobiles during 2002-2011, averaging 40% per year, compared to a global increase averaging 20%. Thailand also ranks in the top 10 of NGV countries, with Thai NGV automobiles accounting for up to 2% of all NGVs in 2011, a 27% increase from the previous year, and accounting for 8% of the nation's transport sector energy use (Picture 1).

What factors make NGV an interesting alternative for car users, especially compared to alternative fuel options such as liquid petroleum gas (LPG)?

First and foremost is the issue of cost. Fuel costs per distance traveled by NGV are lower than other kinds of fuel. Even though NGV is less efficient than LPG (1 kilogram of NGV allows for about 15 kilometers of travel, compared to 21 kilometers with LPG), with the current NGV and LPG[2] prices are 10.50 and 21.38 baht per kilogram respectively make the cost of traveling 1 kilometer using NGV is around 0.7 baht, while LPG expenses are around 1 baht. Therefore, NGV use is currently 34% cheaper than vehicles fueled with LPG, and up to 80-85% cheaper than vehicles powered by other fuels, such as gasohol or benzene[3].

Another advantage of NGV is safety. Natural gas quickly evaporates in the event of leakage and will not collect around the bottom of a container, unlike LPG. Furthermore, the flammability rate and ignition temperature are also less risky than other fuel types (Picture 2).

1 NGV (Natural Gas Vehicle) use highly pressurized natural gas (mostly methane) to power vehicles, stored in a very strong tank which is referred to as compressed natural gas (CNG).

2 Transport sector LPG.

3 The average cost of travel for each type of fuel: 4.64 baht/kilometer for benzene 95, 3.67 baht/kilometer for gasohol 95, and 3.39 baht/kilometer for gasohol 91.

Additionally, using NGV helps reduce pollution. Cars using benzene or diesel produce large amounts of dust and gases that are harmful to people and the environment. NGV has more complete combustion properties than other fuels, and will therefore reduce air pollution and improve public health. Research on automobile pollution conducted by the TNO Road-Vehicles Research Institute (Netherlands) found that cars using NGV are able to reduce their carbon monoxide (CO) output by 60% and nitrogen oxide (NOx) by 13% compared to cars using benzene. The quality of exhaust from cars running on NGV is also better than cars with LPG.

However, switching to NGV may not respond to consumer needs, given the relatively limited number of NGV filling stations. Thailand currently has about 21,000 petrol stations around the country, but there are only 474 NGV filling stations (Picture 3). In Bangkok, there is an average of one petrol station every 2 square kilometers and one LPG station every 6 square kilometers. However, that average goes up to one station every 12 square kilometers for NGV. As a result, owners of NGVs will face difficulties in finding filling stations. Furthermore, Ministry of Energy regulations state that NGV filling stations must be located more than 60 meters away from community areas such as hospitals, schools, or shopping malls. NGV stations also require a large area for compressor buildings and space for NGV transport vehicles to enter, exit, and make U-turns. As a result, the cost of investing in an NGV filling station is two to three times more than LPG stations, making it even more difficult to expand the number of these stations.

The costs of installing NGV equipment for benzene and diesel engines in light duty vehicles are also quite high, at 38,000-65,000 baht, compared to LPG equipment, which costs 15,000-43,000 baht. NGV tanks also hold less fuel than LPG tanks, resulting in NGV users having to stop at filling stations more frequently despite there being fewer NGV filling stations. Furthermore, NGV filling station waiting times can be more than half an hour[4]. It is therefore not surprising that switching to an NGV may not be such an attractive idea to many people.

However, from the view of the commercial transport sector, switching to NGV is worth the cost. The commercial transport sector has more consistent travel routes and delivery points, allowing them to optimize routes for NGV filling station stops. Therefore, they are not that affected by the relative scarcity of NGV stations. With NGV being cheaper compared to other fuel options, it has become the more attractive option for commercial transport vehicles.

Finally, the megatrend of energy concern and environmental protection on automotive innovation means that in the future hybrid and electric cars may become more popular than cars solely using fossil fuels like NGV. This can be seen in recent automobile design, which increasingly focuses on energy savings. A study by the International Energy Association (IEA) concluded that sales of electric and hybrid vehicles will increase rapidly from 2020, while sales of fossil fuel vehicles, such as automobiles using diesel, benzene, LPG, and NGV, will slowly decline.

Implication

NGV filling stations are businesses worth investing in, especially along new gas pipelines. PTT is planning to expand its natural gas pipeline network to develop natural gas

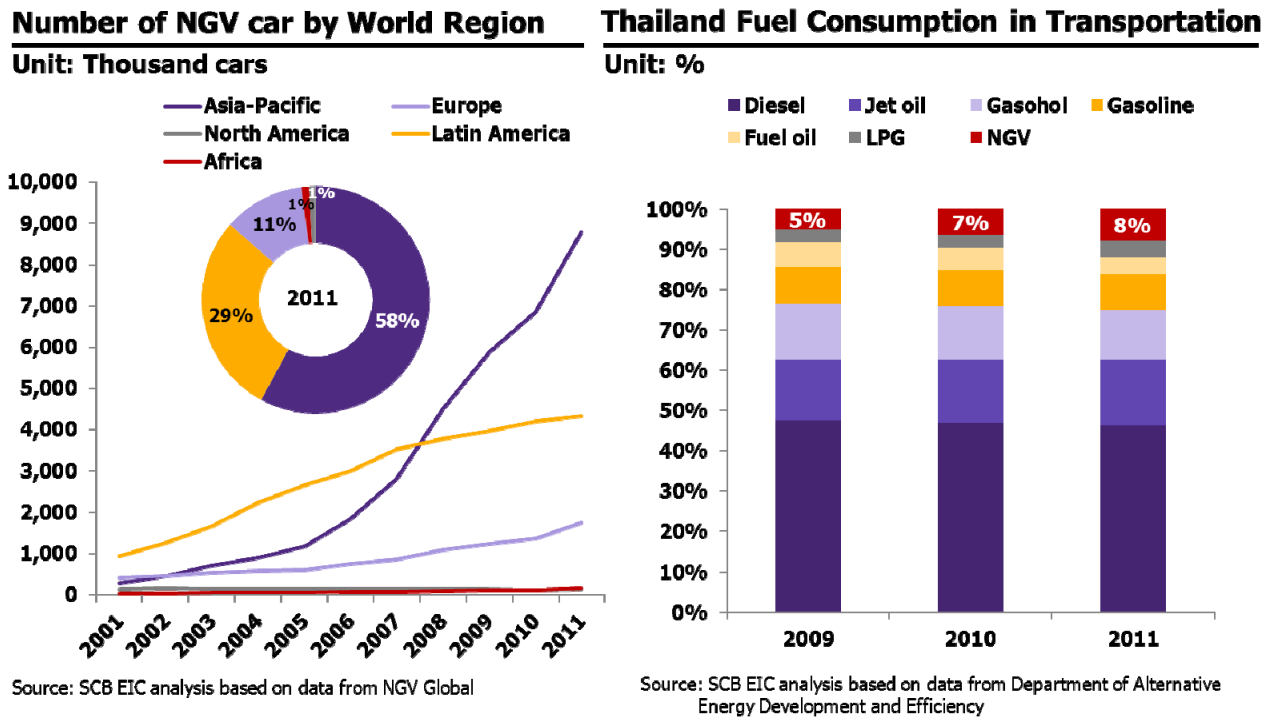
4 From interviews with customers and operators of NGV filling stations.

use in all regions. They also plan to add NGV stations along pipeline routes, which will offer good opportunities for investors seeking to open NGV stations. They should start by opening stations in areas that the pipelines will go through, or in small logistical hubs, before investing in surrounding areas. The Rayong-Kaeong Koi 4th Natural Gas Pipeline Project, scheduled for completion in 2014, will see pipelines extend from Rayong through to Chacheongsao, Prachinburi, and Nakorn Nayok. The Nakorn Sawan Overland Natural Gas Pipeline Project, expected to be completed in 2014, will run from Ayuthaya through Angthong, Chainat, to Nakorn Sawan. Finally, the Nakorn Ratchasima Overland Natural Gas Pipeline Project, scheduled to begin construction in the second quarter of this year and be completed in 2015, will feature a pipeline connecting Saraburi and Nakorn Ratchasima.

- **If more NGV stations are opened, switching to an NGV will become a more attractive option for consumers.** NGV stations as a business also have a bright future, not only a result of an increasing number of consumers but also the current low number of NGV stations would be advantage for the investors in term of having many channels to expand NGV stations.

- **Even though NGVs may fulfill consumers' needs today, the automobile industry will have to make long-term plans to best fulfill their future needs.** For example, the Energy Reform Company has come up with a new innovation for future cars called "Energy 4.0". This technology allows for both NGV and LPG systems to be installed in hybrid cars for the first time in the world, making it possible for cars to use 4 different types of fuel, namely gasoline, electricity, LPG, and NGV, without reducing performance and doubling the rate of energy savings.

Picture 1: NGV use has increased dramatically, especially in the Asia-Pacific region. Thailand's NGV use has increased continuously when compared to other fuels used in the transport sector



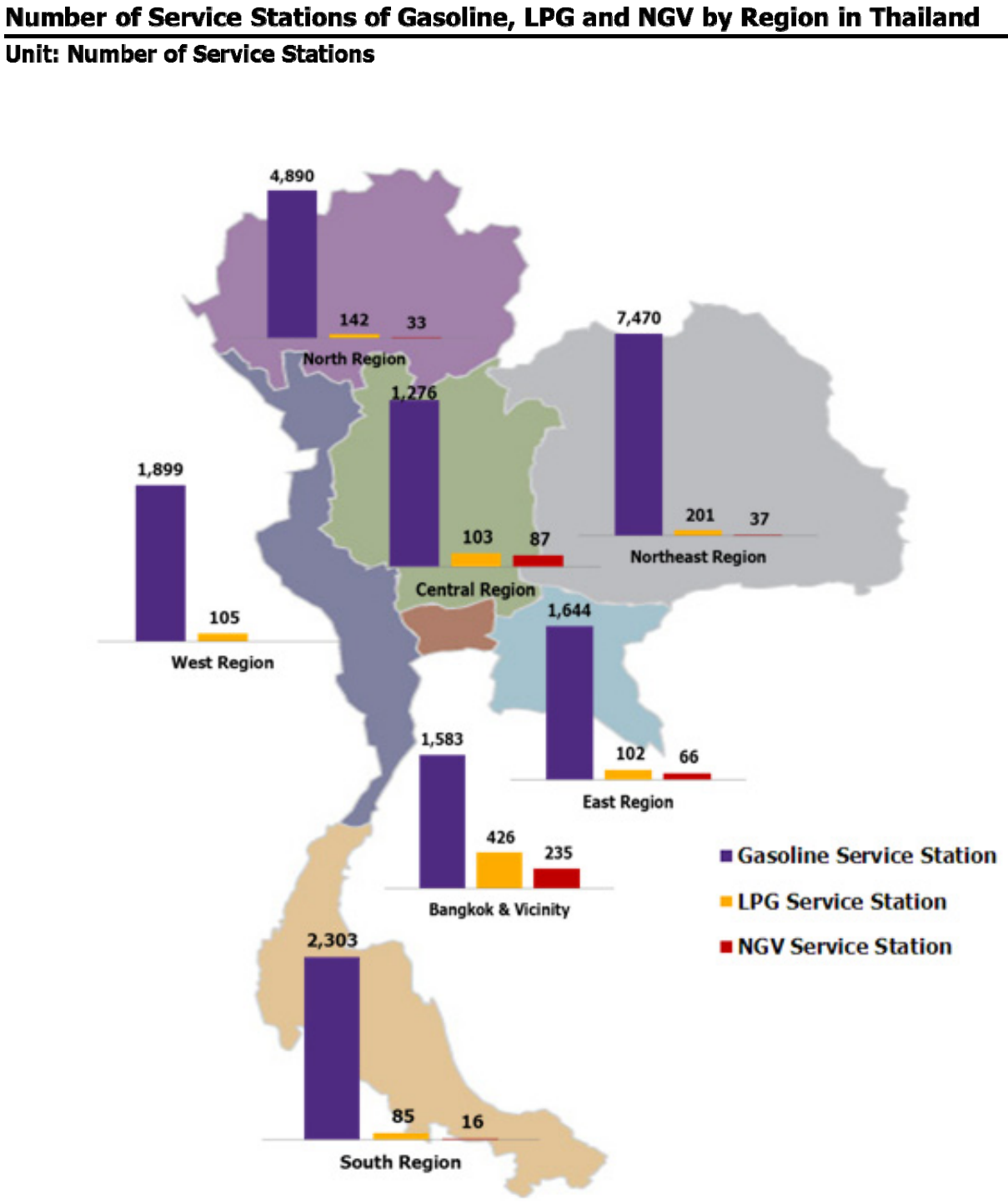
Picture 2: NGV is considered a safe fuel. In the case of leakage, gas would quickly evaporate and has low flammability

Comparison of Various Properties between NGV and Other Fuels

Properties	NGV	LPG	Gasoline	Diesel
State	Gas	Gas, collected in liquid state with pressure at 7	Liquid	Liquid
Weight	lighter than air, and will dissipate in the atmosphere rapidly if it leaks ★	heavier than air, and will accumulate near the ground in case it leaks, not safety	heavier than air	heavier than air
Flammability limit (% of quantity)	5 – 15 %	2.0 - 9.5 %	1.4 – 7.6 %	0.6 – 7.5 %
Ignition Temperature	650 °C ★	481 °C	275 °C	250 °C
Wastage per distance	~0.7 baht/kilometer.	~1 baht/kilometer.	~4 baht/kilometer.	~ 2.5 baht/kilometer.
Retailed Price as of 12 Feb 2013	10.5 baht/kilogram.	21.38 baht/kilogram.	48.35 baht/litre	29.99 baht/litre

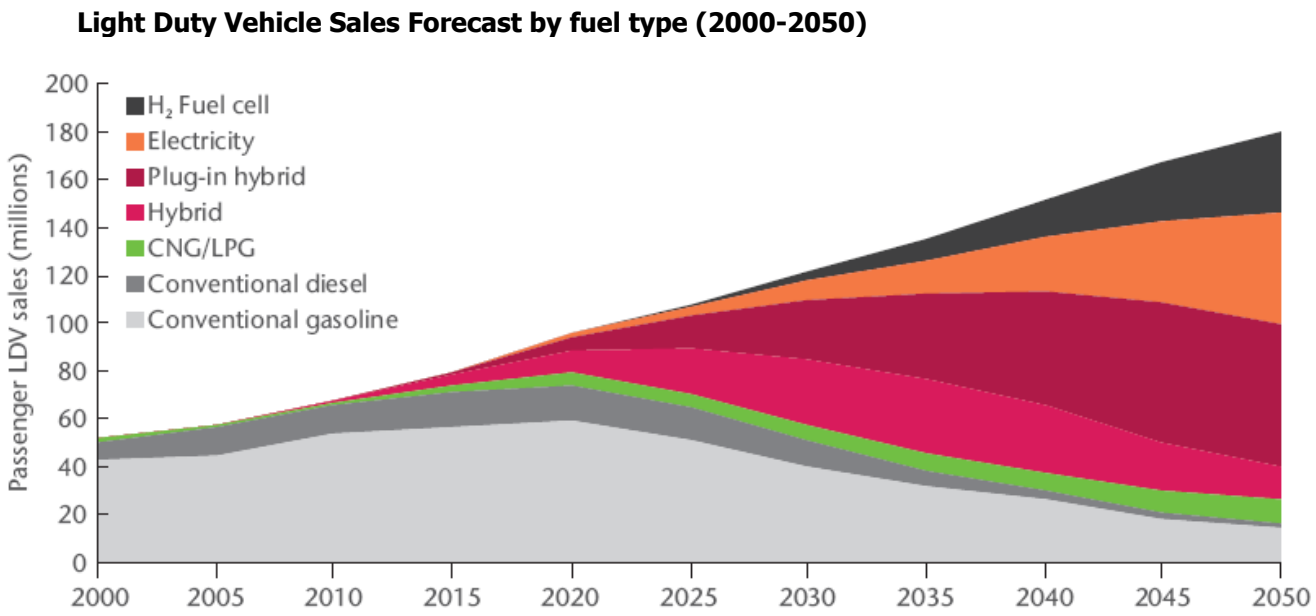
Source: SCB EIC analysis based on data from PTT and EPPO

Picture 3: Currently, there are 474 NGV filling stations in Thailand, compared to 21,000 petrol stations scattered across the country, which reflects the difficulty in accessing NGV stations.



Source: SCB EIC analysis based on data from Department of Energy Business

Picture 4: Hybrid and electric cars are becoming the cars of the future



Source: International Energy Association (IEA)

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