NOTE

SCB Economic Intelligence Center

Electric vehicle...turns an oil business challenge into opportunities

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Global EV growth may result in oil requirement deceleration in the next 10 years, and it's a real challenge for oil business.

Giant oil companies' strategy has changed to invest more in electric energy businesses and value chains.

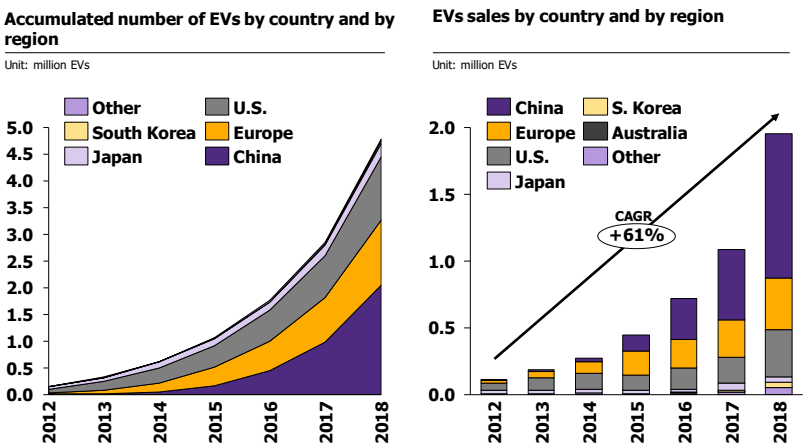
You can see investment opportunities for Thai entrepreneurs in oil and other businesses when EV dominates the market; for example, investment in EV charging stations, battery recycling business, battery reusing business and investment in foreign EV battery startups, etc.

Global number of EVs tends to increase rapidly. Now there are approximately 5 million EVs[1] all around the world. Though EV represents only 0.4% of all cars, and EV sales represents around 2.5% of total car sales, EV market grow rapidly by 61% per year (between 2012-1018). From 100,000 units in 2012, EV sales reached 2 million units in 2018. Today China and the US gain the most two highest EV sales in the world, accounting for 55% and 18% respectively. The major factors to encourage using EV are cheaper battery price, its performance and price which are competitive with Internal

[1] EVs in this article include Plug-in Hybrid (PHEV) and Battery (BEV) passenger cars which represent 90% of total EVs market share.

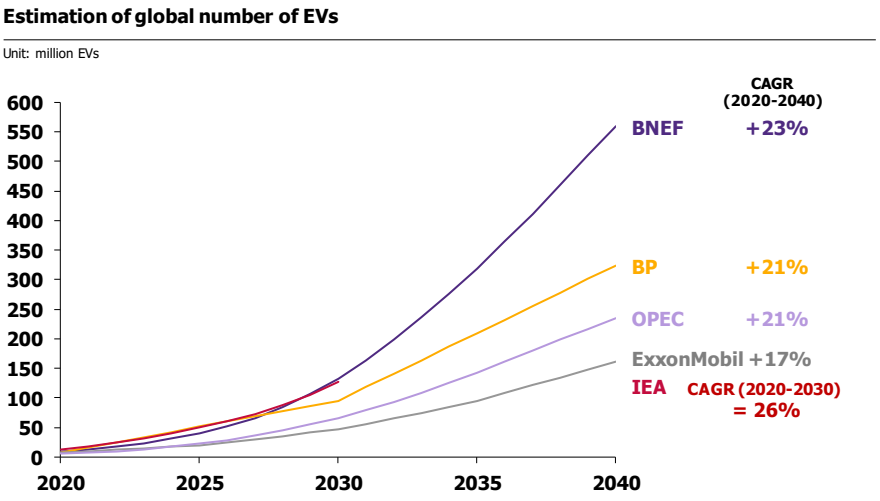
Combusion Engine Vehicles (ICEVs), supportive government policies, eco trend encouraging less carbon emission, and infrastructure development to support EVs such as charging stations and charging time, etc. Many organizations, such as Bloomberg New Energy Finance (BNEF), BP, OPEC, ExxonMobil and International Energy Agency (IEA), estimate that global number of EVs is likely to grow greatly by 17% - 26% per year in the next two decades. There could be 150 - 550 million EVs on the road all around the world by 2040; accounting for 31% - 55% of total car sales.

Accumulated number of EVs and EV sales by country and by region



Source: Analysis by EIC based on BNEF information

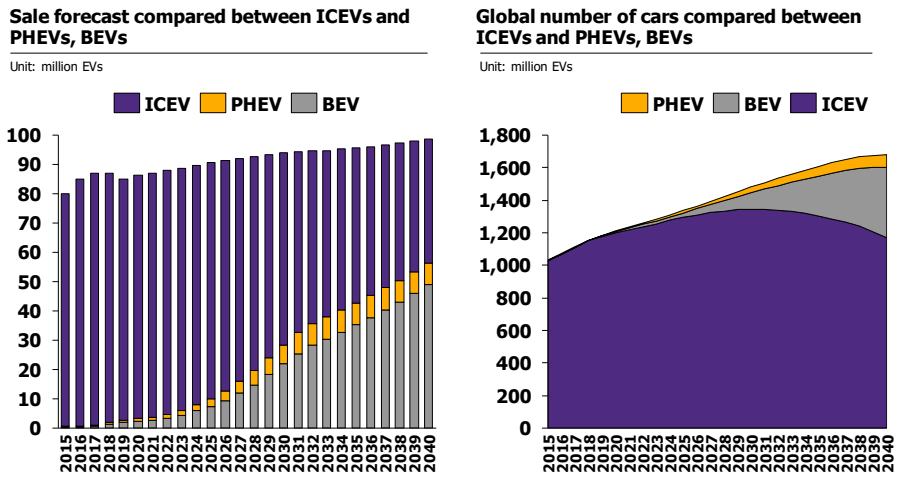
Estimation of global number of EVs, compared between many organizations



Source: Information from IEA, ExxonMobil, OPEC, BP, BNEF

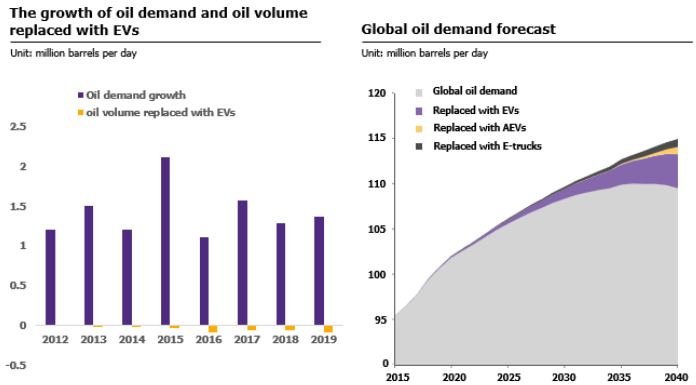
EV boom may slow down oil demand growth in the next decade. Bloomberg NEF estimates that the number of EVs that will replace ICEVs in 2019 represents the reduction of oil demand of 96 thousand barrels per day. It's such a small reduction, compared with the growing fuel demand all over the world. Information in 2019 shows the growth in demand for fuel of 1.4 million barrels per day. In 2018, fuel demand was 99.2 million barrels per day while in 2019 it is 100.6 million barrels per day. However, today there are many countries, such as France, Taiwan, Canada, that implement the policy that gradually reduces the usage of ICEVs and then intend to stop using them by 2040; passenger cars will be the first target. When ICEVs growth is slowing and EVs are gaining more market share, the effect on oil demand will be sighificant. Wood Mackenzie estimates that in the next 10 years, global fuel demand will grow slower and reach its peak in around 2035, then it will gradually be reducing at last. This situation will certainly and inevitably affect the oil business.

Sales forecast and global number of cars; compared between ICEVs and PHEVs, BEVs.



Source: BNEF's information

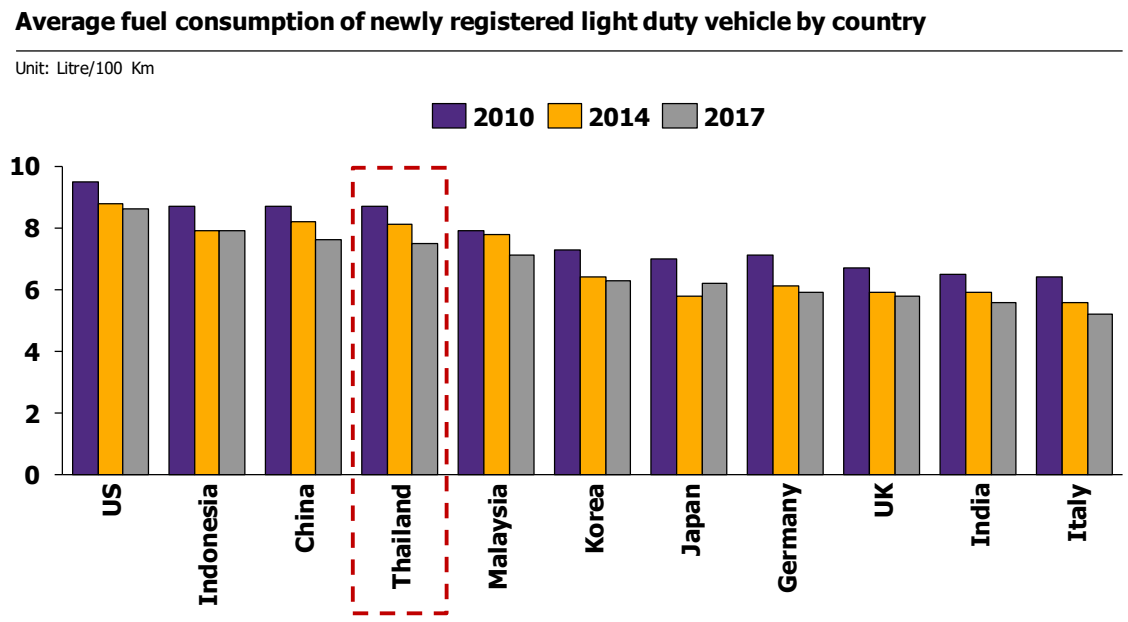
The growth of oil demand and oil volume replaced with EVs, and forecast of global oil demand replaced with EVs, Autonomous Electric Vehicle (AEVs) and E-trucks by Wood Mackenzie



Source: Information from Wood Mackenzie, IEA and Bloomberg NEF

However, one major factor that affects oil demand more than the growth of EVs is fuel efficiency or fuel economy of ICEVs. Many types of car have been consecutively developing their fuel economy. According to the information of the International Energy Agency (IEA), light duty vehicle[2] , in Thailand, burnt approximately 8.7 litres/100 kilometres in 2010 and then number reduces to 7.5 litres/100 kilometres in 2017. Moreover, engine technology development, popular vehicle size as well as environmental policy affect a level of fuel efficiency. Many countries set the target of fuel efficiency for car manufacturers in order to reduce Carbon dioxide emissions. China, for example, introduces a policy that stipulates fuel consumption of cars sold domestically at average 20 kilometres/1litre by 2020 while the European Union aims at 24 kilometres/1litre by 2021. These requirements are another factor that pushes the manufacturers to invest, develop and distribute EVs to increase the average of fuel efficiency and decrease carbon dioxide emission average from the cars under their marques. Anyhow, Bloomberg NEF estimates that by 2040, the better fuel efficiency all over the world will reduce fuel consumption of 7.5 million barrels per day; while the EVs will reduce the fuel consumption to 6.4 million barrels per day.

Average fuel consumption of newly registered light duty vehicle by country



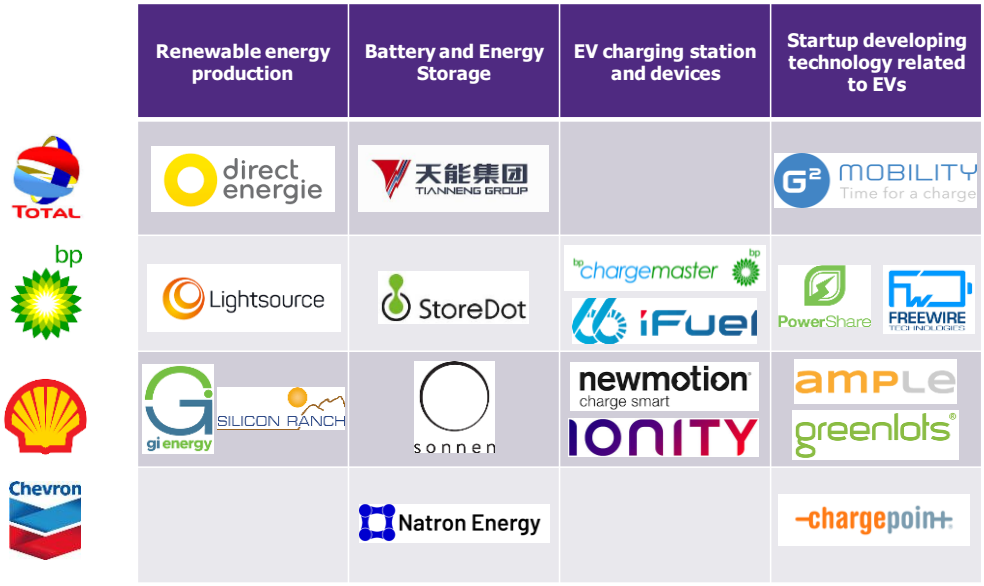
Source: Analysis by EIC from IEA in Fuel Economy in Major Car Markets report, published on 20th Mar 2019

[2] Light duty vehicle includes passenger car and passenger truck.

Though EV trend is coming, it will take a while for EVs to surpass ICEVs in a ratio. However, EIC views that giant oil companies have shifted their strategies to invest more in electric energy business along the value chains.

The value chains start from the upsteam business which is an electricity generation from renewable energy, like solar and wind, to battery business and energy storage business and finally to downsteam business like EV charging station. Mostly, oil companies are likely to invest in clean tech startups. There are approximately 250 startups that are now running business related to electric energy and are granted around 20 thousand million USD from capital venture companies (according to Reuters). Big oil companies invest in startups as well; BP and Shell invest in startups doing EV charging infrastructure business while Chevron invests in startups that develop battery technology and energy storage. These oil giants see the opportunities to make money from startups as well as prevent any risks to their main business: fuel.

Examples of giant oil companies that invest in businesses related to electricity between 2018-2019



Source: Analysis by EIC based on companies and news agencies' information

Example of strategies of oil companies to handle the growth of EVs.

Ev growth urges oil giants to adapt; Total, for example, steps into battery and electricity generation from gas and renewable energy business. One of the strategies that Patrick Pouyanné, Total CEO, adopts to prevent the risks from deceleration in oil demand or even its reduction in the future when EVs replace ICEVs more in the next two decades is to look for an

opportunity in electricity generation business. Total has invested in electricity generation from solar and wind business as well as take over solar PV and battery companies. In April 2018, Pouyanné announced an acquisition of Direct Énergie, a power generation and transmission company, with 1.4 billion euros. Its capacity to generate electricity from gas and renewable energy is 1.35 GW., coincided with Total's strategy to extend their portfolio in gas-electricity business along value chains in order to produce the energy with low carbon and plan to improve their asset ratio in renewable energy business from 5% in 2018 to 20% by 2035. After Direct Énergie takeover, Total became the 3rd biggest player in electricity business in France, next to Electricite de France (EDF), electric utility state owned company, and Engie. And recently in April 2019, Total has set up a joint venture with Tianneng Group, a Chinese giant, in production and distribution of lithium-ion battery for EVs, e-bikes and energy storage devices around the world.

BP focuses on expanding EV charging stations in order to support EV growth and move on to a low carbon society. In May 2018, BP paid 130 million pounds for the acquisition of Chargemaster, the UK's biggest EV charging company. It designs, builds, sells and maintains EV charging units with more than 6,500 public EV charging points across country. BP estimated that UK's EV market will rapidly grow; that number of EVs would reach 12 million units by 2040, increasing from 135 thousand units in 2017. The first target of BP Chargemaster was to debut ultra-fast charging point with 150KW; a 100-mile ride took only 10 minutes in charging. We will see these charging points in 1,200 BP's gas stations by 2019.

And recently BP has invested in PowerShare, Chinese startup providing online platform to connect the EV drivers, charging stations and power producers. The driver can find a charging point and pay via mobile phone, and the power producers can supervise the operation via Cloud in order to balance EV's charging demand and their power generation capacity. BP expands the investment in China because of the belief that Chinese EV market is the world's biggest market.

Business model of Shell is to be a sustainable business. A clear strategy to handle EV growth is to expand the investment in EV charging stations. In 2017, Shell acquired NewMotion, a giant charging provider with more than 30,000 points in Europe, and partnered with IONITY in order to provide ultra-high speed EV charging stations. They shared the goal of making sure that the drivers can have a long drive across Europe without concerning about lacking charging points. Shell-IONITY provided ultra-high speed charging up to 350kW that took less than 10 minutes in charging (compared with Tesla Model X that took 40 minutes in charging to get 80% of battery) with flat-rate price at eight pounds / one charging. Shell planned to install 400 charging stations in Europe by 2020. Moreover, Shell also invested 31 million USD in Ample, a startup that developed autonomous robotics and EV charging batteries. And in 2019, Shell expand the investment to the US; they acquired Greenlots, a LA startup that develops EV charging technology and software in order to provide the service for those who want to install charging stations, EV drivers, power generators and logistics companies.

Apart from investment in EV charging stations, Chevron's also interested in startups developing a new type of battery. In 2018, Chevron and Daimler, an automotive corporation, invested 240 million USD together in ChargePoint in order to expand EV charging station network in North America and Europe, from more than 57,000 stations all around the world previously. And recently in 2019, Chevron has invested in Natron Energy, a company that develops Prussian Blue technology which is the battery with high voltage but low cost, in order to support a high quality energy storage system in charging station. Nevertheless, the US's oil companies still invest in alternative energy business much less than those from Europe. In 2018, the investment in such business came from European firms around 70%.

Thai oil and petrochemical companies make a strategy to expand in new businesses as well; such as EV charging station and battery business. PTT, one of Thai oil companies, sees EV industry potential for gaining more market share in the future, so they plan to expand into a new territory: an EV business. PTT invests in research and development in the technology of energy storage in battery and hydrogen as well as builds a plant for a prototype battery at Vidyasirimedhi Institute of Science and Technology, Rayong. The plant produces the lithium-ion and lithium-sulphur batteries that can charge 3 times quicker than the normal ones. The associated companies like Thai Oil, PTT Global Chemical and IRPC plan to buy the licence for producing those batteries. They plan to set up a plant in the Eastern Economic Corridor of Innovation (EECi). In addition, PTT has opened 14 PTT EV stations and continue the EV Wall Charger development in order to sell to individual EV users. PTT also signs MOU with the six car manufacturers to develop EV technology together.

For Bangchak, they invest in lithium mine in Argentina. It is estimated that the production is starting in April - May 2020. Moreover, Bangchak plans to invest in startups that develop energy innovation. Recently in 2019, Bangchak has invested in the American startup named Enevate. Their expertise is in producing technology of lithium-ion battery for EV. Their battery can charge 10 times faster. Bangchak will build on the technology to develop quick charge station where you can charge as quick as you gas up. Moreover, Bangchak also plans to invest with Provincial Electricity Authority (PEA) on installing 62 stations in Bangchak gas stations every 100 kilometres along the main roads by 2021.

For other brands like Caltex and Susco, they install charging in some of their gas stations under the trademark of EA Anywhere, by Energy Absolute company, in order to offer energy alternatives for the EV drivers in Thailand.

Examples of Thai oil and petrochemical companies that extend their investments and plan to invest in business related to EV

	Business related to battery	Charging station	EV and parts production	Startup developing technology related to EVs
PTT	Prototype battery plant	√	Signed MOU with 6 big car manufacturers to develop EV technology	√
Thaioil	Plan to buy a license of Lithium battery production			√
	Invested in Lithium mine in Argentina	√		√
SUSCO		√		
		√		
GC	Plan to buy a license of Lithium battery production		EV parts production	
IRPC	Plan to buy a license of Lithium battery production		EV parts production	

Source: The analysis by EIC based on companies and news agencies' information

Aside from Thai oil companies, other companies from different sectors have extended their investments and services to serve EVs growth as well. CP All, for example, installs EV chargers in front of 21 branches of 7-11 in order to support the growth of EV in the future and to serve every group of customers round the clock. As well as Robinson Department Store, TCC Group and car services like A.C.T and Cockpit, they install charging stations in their areas in order to expand the services for their customers.

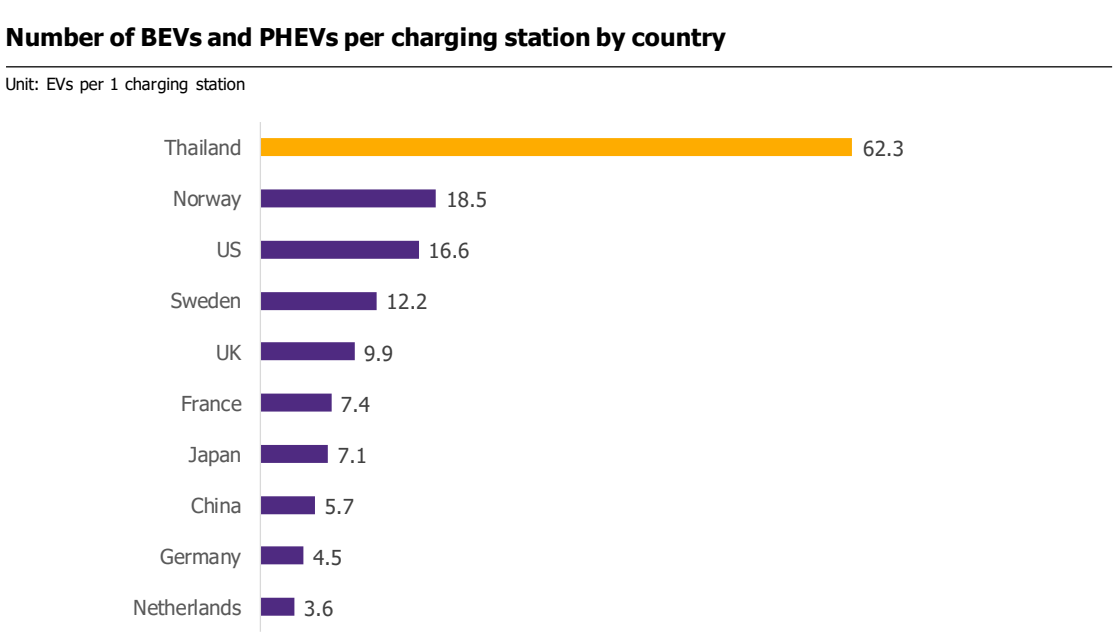
Investment opportunities in businesses related to EVs

Now EV driving still isn't widespread in Thailand. According to the Department of Land Transport's information, in 2018 passenger 120,000 HEVs and PHEVs and 150 BEVs represented 1.2% of all passenger cars all over the country. However, the government still promoted the investment and the use of EV in Thailand more, for example, a corporate income tax exemption and excise tax reduction for EV manufacturers who are supported by BOI, an investment subsidy on charging station, etc. The government intend to gain 1.2 million PHEVs and BEVs and 690 charging stations all around the country by 2036. Nonetheless, no matter how soon or late EV trend comes, EIC views that Thai vehicle industry will slowly change, depending on global trend that is more eco-friendly. And that's the business opportunities to prepare for the coming EV growth.

Though EV growth is regarded as a challenge to oil business, EIC sees it will be the chances for Thai entrepreneurs to invest in a new business like EV charging stations that will grow together with EV growth. In other words, gas station owners may add more value to their own places, to maximize the utilization of their assets and profitability from the

attracted EV drivers to come for other services like grocery stores and coffee shops. According to the Electric Vehicle Association of Thailand's information, there are around 220 charging stations in Thailand, most of them cluster in big department stores and modern office buildings in Bangkok. However, EIC sees that the entrepreneurs still have an opportunity to expand charging stations. Comparing the ratio between EVs and charging stations between 2017 - 2018 in Thailand, one station can support charging for 62 BEVs and PHEVs averagely, while other countries supporting EVs like China, Japan and the US, the ratio respectively represents 6, 7 and 17 per one charging station. In addition, any private sectors interested in installing charging stations can request for support from The Board of Investment Office (BOI) and can claim an income tax deduction for five years.

Number of BEVs and PHEVs per charging station by country between 2017-2018



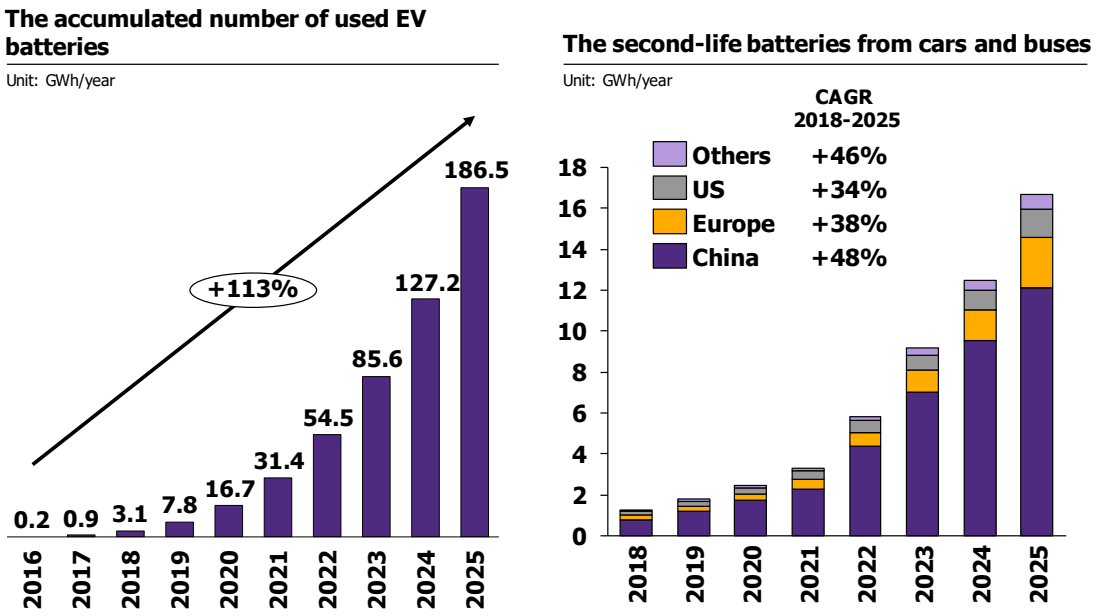
Remark: Information of Thailand based on 2018, other countries' based on 2017

Source: Analysis by EIC from information of IEA, Department of Land Transport and Electric Vehicle Association of Thailand

Moreover, battery reusing business can grow when EVs gain more market share. Bloomberg estimates that by 2025, used battery can reach 200 GWh/year, increasing from 3 GWh/year in 2018; and China will dominate used battery recycling market. EV battery lasts approximately 8-10 years and when its lifetime ends, it becomes trash that causes a serious pollution problem if not properly disposed due to the dangerous components such as lead, cobalt and chromium. However, despite its deterioration, 70% of electric power is still active and can be reused as a second-life battery for electricity storage. In 2019, for example, Toyota will use expired Prius hybrid battery to store an electric

energy from 7-11's solar panels in Japan, while Nissan Leaf battery will be used with electric posts in Namie, not far from Fukushima Daiichi, the nuclear plant that was restored after Tsunami in 2011.

The number of used EV batteries and second-life batteries from cars and buses



Source: Analysis by EIC based on information of BNEF and Circular Energy Storage

EV battery recycling business is important as it reduces waste and recycle minerals in batteries. Due to the fact that one component in battery like mineral is a limited resource, many recycling companies and startups attempt to study and develop recycling technology that will extract minerals efficiently. For example, a Canadian startup named Li-Cycle can retrieve 90% of lithium, cobalt, copper and graphite from recycling a battery. Or Umicore, an European renowned materials technology and recycling company, has developed 'Hydrometallurgy' technology that can extract lithium in battery with a single process. Umicore sees that by 2025, there will be more than 100,000 tons of used batteries that need to be recycled.

EIC sees that the entrepreneurs can start with investing in battery recycling business or EV battery startup overseas. We may have to wait until EV market in Thailand grows so big that enough deteriorated batteries can make a profit for recycling business. For reusing battery business, the entrepreneurs can join EV manufacturers to be an integrator who turns expired battery into power storage, or be a middleman who sells used batteries to customers from other industries.

Though a transition from ICEVs to EVs reduces oil demand growth and it's regarded as a challenge to oil companies, there are still some opportunities

for both oil firms and entrepreneurs from other industries to extend their investment in businesses related to EVs. In the near future, Thai vehicle industry will slowly change, depending on global trend that is more eco-friendly. And that's the business opportunities to prepare for the coming EV growth.

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