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Implications of the Growing Deployment of Electric Vehicles in Thailand and Strategic Adaptation of the Fuel Supply Chain

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ABSTRACT

Thailand's transition toward electric vehicles (EVs), driven by the national "30@30 policy," is expected to significantly reduce oil consumption and reshape the country's fuel supply chain. This study examines the impacts of EV adoption on refined petroleum demand and assesses adaptation strategies for key operators across the petroleum supply chain, including refineries, traders, ethanol and biodiesel producers, oil depots, and transport operators. Three energy scenarios—High Oil Demand, National Energy Plan, and Low Oil Demand—were analyzed using the LEAP model and transport-sector energy models to project future energy use and supply under varying levels of EV penetration. The findings indicate that refined petroleum demand will peak around 2028-2030 before declining, with the most substantial reductions occurring in gasoline and diesel consumption, while aviation fuel and LPG remain relatively stable. The study identifies three main adaptation approaches for industry operators: core business development, business integration, and business transformation. Policy recommendations emphasize maintaining consistent fuel policies, strengthening infrastructure systems such as pipelines and fuel depots, and supporting business diversification toward low-carbon energy. Together, these measures are essential to ensure a smooth, balanced, and resilient transition in Thailand's energy and fuel sectors.

Keywords: Electric Vehicles, 30@30 Policy, Petroleum Supply Chain, Fuel Demand, Energy Transition, Adaptation Strategies
JEL Classifications: P280, Q420, Q470

1. INTRODUCTION

Thailand has joined the global community in tackling climate change. At the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) in Glasgow, the country pledged to achieve carbon neutrality by 2050 and net-zero greenhouse gas emissions by 2065 (ONEP, 2022). These commitments reflect the principle of equity and "common but differentiated responsibilities." They have already begun to reshape Thailand's development priorities, with the energy sector at the center of efforts to meet these ambitious goals.

Meeting these climate targets will require major shifts, particularly in energy policy, which must both sustain economic growth and competitiveness while cutting greenhouse gas emissions. To this end, the National Electric Vehicle Policy Committee has set out to position Thailand as a leading hub for electric vehicle (EV) production and key component manufacturing. Its flagship initiative, the "30@30 policy," aims for zero-emission vehicles (ZEVs) to account for at least 30 percent of total vehicle production by 2030 (EPPO, 2021). Specific EV development targets are outlined in Table 1.

To support this transition, the government has introduced a package of measures: plans for 12,000 public fast-charging outlets and 1,450 battery-swapping stations for electric motorcycles, alongside fiscal and non-fiscal incentives. These include support schemes for manufacturers adjusting to EV production, workforce development programs, updates to laws and regulations, and the promotion of smart grid technologies. Together, these efforts highlight how climate ambition is being translated into concrete actions for Thailand's energy and transport future (EPPO, 2021).

Table 1: Targets under Thailand's electric vehicle development plan set by the national electric vehicle policy committee

Vehicle type	ZEV targets by year		
	2025	2030	2035
Usage target			
Passenger cars/pickup trucks	225,000 units (30%)	440,000 units (50%)	1,154,000 units (100%)
Motorcycles	360,000 units (20%)	650,000 units (40%)	1,800,000 units (100%)
Buses/trucks	18,000 units (20%)	33,000 units (35%)	83,000 units (100%)
Three-wheelers	500 units (85%)	2,200 units (100%)	2,800 units (100%)
Ferries (large)	130 units (12%)	480 units (35%)	1,800 units (100%)
Urban rail cars	620 cars (70%)	850 cars (85%)	1,170 cars (100%)
Production target			
Passenger cars/pickup trucks	225,000 units (10%)	725,000 units (30%)	1,350,000 units (50%)
Motorcycles	360,000 units (20%)	675,000 units (30%)	1,850,000 units (70%)
Buses/trucks	18,000 units (35%)	34,000 units (50%)	84,000 units (85%)
Three-wheelers	500 units (85%)	2,200 units (100%)	2,800 units (100%)
Ferries (large)	130 units (12%)	480 units (35%)	1,800 units (100%)
Urban rail cars	620 cars (100%)	850 cars (100%)	1,170 cars (100%)

(TDRI, 2021)

It is anticipated that the 30@30 policy will contribute significantly to reducing the country's greenhouse gas emissions. However, this policy is also expected to affect demand for refined petroleum products and the operations of related businesses, including fuel producers, fuel traders, fuel transporters, and fuel storage facilities. Without adequate preparation to accommodate the growth of EVs, these businesses may encounter transition risks. The purpose of this study is to assess the extent of the impacts resulting from EV growth under the 30@30 policy, to explore adaptation strategies for stakeholders across Thailand's fuel supply chain, and to develop policy recommendations that will support a smooth transition.

2. OVERVIEW OF THAILAND'S TRANSPORT FUELS AND PETROLEUM SUPPLY CHAIN

2.1. Types of Fuels Used in Thailand's Transport Sector

Thailand utilizes a variety of fuels in the transport sector, as summarized in Table 2.

Table 2: Types of energy used in the transport sector in Thailand (UNDP, 2024)

Energy type	Main application
Road transport	
Gasoline (ULG95)	Passenger cars, motorcycles
Gasohol (E10, E20, E85)	Passenger cars, motorcycles
Diesel (B7, B10, B20)	Pickups, trucks, buses
LPG	Converted cars, taxis
NGV (CNG)	Public buses, gas trucks
Electricity	EVs
Rail transport	
High-speed diesel oil	Diesel locomotives
Electricity	Electric urban rail and future double-track system
Water transport	
Heavy fuel oil	Ocean-going vessels, large cargo ships
Marine diesel oil	Passenger ferries, fishing vessels, domestic cargo ships
LNG	Pilot projects for LNG-fueled vessels
Air transport	
Jet A-1	Commercial airlines
Aviation gasoline	Small aircraft, training flights
SAF	Emerging use as sustainable fuel

Remarks:

- ULG95 = Unleaded gasoline 95 (non-ethanol gasoline)
- E10/E20/E85 = Gasoline blended with 10%, 20%, and 85% ethanol
- B7/B10/B20 = Diesel blended with 7%, 10%, and 20% biodiesel
- LPG = Liquified petroleum gas
- NGV (CNG) = Natural gas for vehicles (compressed natural gas)
- LNG = Liquefied natural gas
- SAF = Sustainable aviation fuel.

Thailand's road transport sector employs a wider range of fuels than many countries, where gasoline and diesel dominate. This is driven by policies promoting biofuel blending to enhance energy security and support the agricultural economy (UNDP, 2024).

In the gasoline category, ethanol is blended into base gasoline to produce what is known as gasohol. Five types are available: Gasoline 95 (ULG95), which has an octane rating of 95 and no ethanol; Gasohol 91 (E10), with an octane rating of 91 and 10% ethanol; Gasohol 95 (E10), with an octane rating of 95% and 10% ethanol; Gasohol E20, with 20% ethanol; and Gasohol E85, with up to 85% ethanol for flex-fuel vehicles.

For the diesel fuel category, pure biodiesel (B100) is blended with diesel to produce blended diesel, which is mandated to contain between 5% (B5) and 9.9% (B9.9) biodiesel.

In addition to liquid fuels, gaseous fuels also play an important role. Liquefied petroleum gas (LPG), produced either through crude oil refining or natural gas separation, is widely used not only in households and industry but also as a substitute for gasoline in vehicles. Natural gas for vehicles (NGV/CNG), which is classified into two types: regular NGV, with a Wobbe index of 39-44 MJ/m^3, suitable for general vehicles; and special NGV, with a Wobbe index of 44-52 MJ/m^3, designed for specific vehicle types to deliver better performance, longer driving ranges, and reduced fuel costs (PTT, 2025).

2.2. Operators in Thailand's Petroleum Supply Chain

The petroleum supply chain, as defined by relevant Thai laws, consists of the following categories of operators:

1. Refineries: Oil fuel refineries, petrochemical and solution industrial plants, premises for production and distribution of oil fuel, and gas separation plants which produce and distribute liquefied petroleum gas (Office of the Council of State, 2019).
2. Section 7 fuel traders: Fuel traders with an annual trade volume of 100,000 metric tons or more for each type of fuel, or in total across all fuel types, or those trading only liquefied petroleum gas with an annual trade volume of 50,000 metric tons or more (Office of the Council of State, 2000).
3. Section 10 fuel traders (jobbers): Fuel traders with an annual trade volume below the threshold specified in Section 7, but exceeding the volume prescribed by the Minister for each type of fuel or for all types combined, or those with storage tank capacity exceeding the volume prescribed by the Minister (Office of the Council of State, 2000).
4. Section 11 fuel traders (retailers): Fuel traders conducting business through the operation or establishment of fuel service stations (Office of the Council of State, 2000).
5. Fuel transporter: Operators who transport petroleum fuels not owned by themselves, using vehicles or equipment specifically designated for the transportation of fuels (Office of the Council of State, 2000). The transportation may be conducted by land, water, pipeline, or any other means (Office of the Council of State, 1999).
6. Ethanol producers: Industrial operators that produce ethanol for blending with petroleum fuels for use as fuel (Excise Department, 2017)
7. Biodiesel producers: Licensed operators authorized to produce biodiesel (B100) for blending with diesel fuel at government-specified ratios, such as B7 and B10.
8. Fuel depots: An operator engaged in the storage of fuel in large volumes. The term also includes the licensed fuel depot area and its associated structures, tanks, pipelines, equipment, and tools, as well as facilities used for storing fuel intended as raw materials in the production process of refineries or fuel production plants (Office of the Council of State, 1999).

3. METHODOLOGY

This study started with an assessment of the potential impacts of EV growth under the 30@30 Policy through the development of plausible future scenarios. It then examined possible adaptation strategies for operators across Thailand's fuel supply chain and concluded with policy recommendations aimed at facilitating a smooth and sustainable transition for the country.

3.1. Assessment of the Impact of EV Growth under the 30@30 Policy on Energy Use and Supply

The impact of EV growth was assessed through three plausible scenarios, which subsequently served as the analytical framework for assessing the demand for refined petroleum products and biofuels.

3.1.1. Definitions and assumptions for scenario development

Three scenarios in this study reflect plausible pathways of energy use and supply under different conditions, while sharing a common goal of achieving carbon neutrality by 2050. Three scenarios were developed and are defined as follows:

1. National Plan Scenario: This scenario aligns with the National Energy Plan targets and policies for achieving carbon neutrality by 2050. It emphasizes the expansion of EVs under the 30@30 policy, expected to substantially reduce refined petroleum demand, alongside measures to improve energy efficiency and management, expand renewable energy, and explore future options such as carbon capture utilization and storage (CCUS), green hydrogen, and partial reliance on carbon offsets.
2. High Oil Demand Scenario: This scenario reflects conditions where oil demand remains relatively high due to limited progress in energy efficiency and constraints on EV market expansion. Both EVs and internal combustion engine (ICE) vehicles continue to coexist, while GHG mitigation relies largely on energy management measures, requiring greater use of carbon offset activities.
3. Low Oil Demand Scenario: This scenario represents the largest decline in oil demand, driven by intensive energy efficiency improvements and EV growth consistent with the 30@30 policy. It also incorporates SAF adoption and long-term hydrogen use in transport. With fossil fuel demand sharply reduced, the need for CCUS and carbon offsets is minimized.

A summary of the assumptions applied in each scenario is presented in Table 3.

3.1.2. Models for the analysis of energy and refined petroleum demand

The energy account model was employed to analyze national energy balances, while the stock turnover model was applied to provide a more detailed assessment of the transport sector. Together, these tools deliver a comprehensive understanding of energy and refined petroleum demand, reflecting the dynamics of Thailand's energy system.

3.1.2.1. Energy account model

The energy account model used in this study was developed with the Low Emission Analysis Platform (LEAP) as the primary analytical tool. The structure of the model is illustrated in Figure 1.

The calculation process began with an analysis of final energy demand in the demand analysis module. This step considered energy use across economic sectors and key drivers influencing demand, such as economic growth, demographic changes, and energy prices.

The demand for each type of energy was then used as input for the transformation analysis module. This module incorporated variables related to the energy supply system, including conversion efficiency, capacity and shares of different fuel production, and import/export requirements. The outputs from this module were subsequently applied in the resource analysis module to estimate primary energy demand for Thailand's energy system.

Table 3: Assumptions for the analysis of energy use and supply across scenarios[1]

Parameters	High oil demand	National plan	Low oil demand
1. Overview of energy use and supply			
GDP growth	Average annual growth rate of 2.6-3%		
Population growth	Average annual growth rate=0.13%; population peak in 2030		
Overall energy intensity	Decline of 1.8% per year compared with 2010	Decline of 2% per year compared with 2010	Decline of 3% per year compared with 2010
Share of renewable energy	50-60% of primary energy supply		
2. Transport sector			
Fuel consumption	Average annual growth of 0.5%	Average annual growth of 0.75%	Average annual growth of 1%
Modal shift and transport patterns	• Expansion of mass transit systems (e.g., Mass Rapid Transit or MRT) in Bangkok and its vicinity reduces vehicle-kilometers traveled (VKT) by private cars, motorcycles, vans, buses, and trucks by 5%, 20%, 2%, 10%, and 5%, respectively, in 2050. • Intercity rail reduces passenger VKT for intercity-transport by 15% in 2050. • Intercity rail and freight rail reduce truck VKT for logistics by 7% in 2050.		
Battery electric vehicles (BEVs)	Share of sales: • EV cars: 30% in 2050 • EV motorcycles: 72% in 2050 • EV buses and EV taxis: 100% (from 2035-2040 onward) Share of stock in 2050: • EV cars: 20% • EV motorcycles: 58% • EV buses: 69% • EV taxis: 100%	Share of sales: • 100% of new vehicle sales are EVs across all types between 2030-2040 (per 30@30 policy). Share of stock in 2050: • EV cars: 70% • EV motorcycles: 95% • EV pickups: 43% • EV trucks: 79% • EV buses: 69% • EV taxis: 100%	
Fuel cell electric vehicles (FCEVs)	Private vehicles • FCEV deployment begins in 2040. • Stock reaches 5,000 vehicles by 2050.	Trucks • FCEV deployment begins in 2035. • Stock reaches 17,000 vehicles by 2050. Private vehicles • FCEV deployment begins in 2035. • Stock reaches 404,000 vehicles by 2050.	
Biofuels	Average blending rates: • Ethanol: ≤10-15% • Biodiesel: ≤7%	Average blending rates: • Ethanol: ≤20% • Biodiesel: ≤7-10%	
SAFs/bio-jet	Not deployed	SAF/bio-jet use begins in 2025. Share reaches approximately 20% of total jet fuel consumption by 2050.	

3.1.2.2. Transport sector energy use model

The model for analyzing energy use in the transport sector was based on the end-use approach, which utilized activity-level data on travel and transport, together with energy intensity, to estimate energy consumption. The transport sector was divided into four modes: road, rail, water, and air. For each mode, different types of energy and fuels were considered, although the degree of model resolution was constrained by data availability.

The equations applied in the transport sector energy use model were as follows:

1. Road Transport Energy Use Model

The road transport energy use model employs a bottom-up (or end-use) analytical approach to estimate aggregate energy demand, derived from travel demand and the fuel consumption rates of different vehicle types in the transport system, as shown in Equation (1).

$$ED(t)=\sum_{i}\sum_{j}\left[V_{stock,i,j}(t)\times VKT_{stock,i,j}(t)\times FE^{-1}_{stock,i,j}(t)\right] \quad (1)$$

Where:

$ED(t)$ = Total energy demand in year t (MJ)

$V_{stock,i,j}(t)$ = Number of vehicles of type i using fuel type j in year t (units)

$VKT_{stock,i,j}(t)$ = Average travel distance of vehicles of type i using fuel type j in year t (kilometers)

$FE_{stock,i,j}(t)$ = Average fuel efficiency of vehicles of type i using fuel type j in year t (vehicle-kilometers per MJ)

t = Calendar year

i = Vehicle type

j = Fuel type.

2. Rail Transport Energy Use Model

The rail transport energy use model consists of urban rail transport, which covers only passenger transport, and intercity rail transport, which includes both freight and passenger transport. The estimation of energy demand in the rail transport sector is primarily based on activity data and energy intensity, as shown in Equation (2):

$$E = A \times I \quad (2)$$

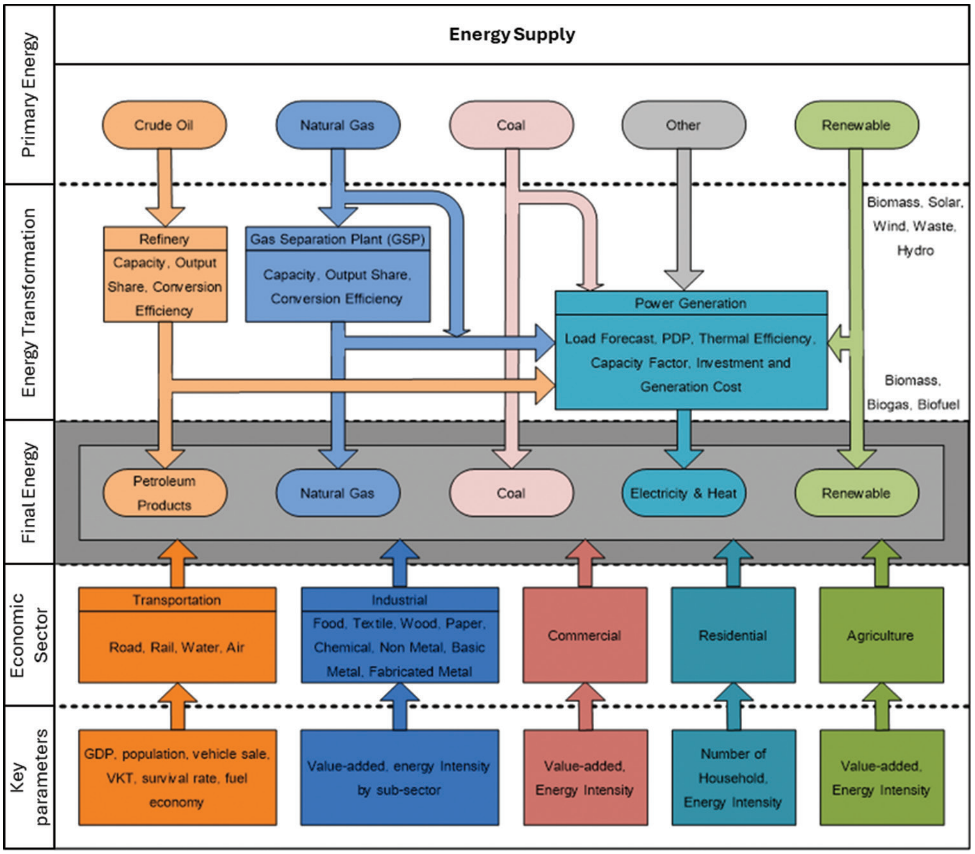
Where:

E = Energy demand (MJ)

A = Rail transport activity level (passenger-kilometers (pkm) or passenger transport and ton-kilometers (tkm) for freight transport)

1 All assumptions were determined based on the research team's judgment, except for GDP growth, which was adopted from the projection in the *Power Development Plan 2018 Revision 1 (PDP2018 Rev.1)*—the official projection available at the time of this study (Ministry of Energy, 2020)

Figure 1: Overall structure of energy model development (Wangjiraniran et al., 2022)



I = Energy intensity (MJ/pkm for passenger transport and MJ/tkm for freight transport)

3. Water Transport Energy Use Model

The water transport energy use model consists of two categories: domestic water transport and international water transport. Domestic water transport comprises both freight and passenger transport, while international water transport primarily involves freight transport.

The estimation of energy demand in the water transport sector is primarily based on activity data and energy intensity, as shown in Equation (3):

$$E = A \times I \quad (3)$$

Where:
E = Energy demand (MJ)
A = Water transport activity level (pkm for passenger transport and tkm for freight transport)
I = Energy intensity (MJ/pkm for passenger transport and MJ/tkm for freight transport).

4. Air Transport Energy Use Model

The air transport energy use model consists of domestic air transport and international air transport, both of which include passenger and freight transport.

The estimation of energy demand in the air transport sector is primarily based on activity data and energy intensity, as shown in Equation (4):

$$E = A \times I \quad (4)$$

Where:
E = Energy demand (MJ)
A = Air transport activity level (pkm)
I = Energy intensity (MJ/pkm)

The energy intensity of air transport depends on several factors, including aircraft type, flight phase (landing and take-off [LTO] and cruise), passenger load, and travel distance. Accordingly, the average energy intensity for an entire flight is calculated as shown in Equation (5):

$$I_{avg} = \frac{F_{LTO} + \left(F_{Cruise} \times D\right)}{LF} \quad (5)$$

Where:
I_{avg} = Average energy intensity (liters per passenger)
F_{LTO} = Average fuel consumption during the landing and take-off phase (liters per available seat [AS])
F_{cruise} = Average fuel consumption during the cruise phase (liters per AS-km)
D = Average travel distance (km)

AS = Number of available seats in the aircraft (seat capacity)
LF = Average load factor, expressed as passengers per seat

For freight transport, the activity level is measured in ton-kilometers (tkm), while energy intensity is expressed in MJ/tkm, calculated from the average fuel consumption over the transport distance.

3.1.3. Analysis of energy use in other sectors

In the industrial sector, sub-sectors are categorized into groups such as food and beverages, textiles, wood and furniture, paper, chemicals, non-metallic industries, basic metals and fabricated metals. For each sub-sector, analyses are conducted by disaggregating energy consumption by type of energy and fuel. The energy demand analysis model for this sector is based on a top-down analytical approach, primarily considering economic activity drivers and energy intensity as key determinants. Previous study (Tanatvanit et al., 2003), has found that the "value of production" or "value added of the industrial sector" has been identified as the most significant factor influencing energy consumption in the industrial sector. Accordingly, the fundamental economic activity data for each industry, obtained from the Office of the National Economic and Social Development Council (NESDC), are used as a proxy for industrial activity data. Meanwhile, the energy intensity variable is determined based on the overall fuel consumption structure of the industrial sector. Equation (6) presents the method for estimating energy demand in the industrial sector.

$$E = \sum_j (A_j \times I_j) \quad (6)$$

Where:
E = Energy demand in industrial sector (MJ)
A = Industrial value added (USD)
I = Energy intensity (MJ/USD)
J = Industrial subsector.

For the residential, commercial, and other sectors, the analysis is disaggregated by types of energy and fuels usage. The energy demand analysis for these sectors is based on a top-down analytical approach, primarily considering activity data and energy intensity. Previous studies (Sasaki et al., 2015) have found that the most influential driving factor affecting household energy consumption — and therefore commonly used in forecasting future household energy demand — is the number of households. This factor serves as a proxy for the number of basic electrical appliances, which may vary by region. Meanwhile, floor area is considered a key determinant in assessing energy demand in the service commercial, as Thailand's tropical climate leads to a high share of energy use from air conditioning. However, due to limitations in available statistical data on floor area and the diverse characteristics of building types, this study employs value added in the commercial sector as a proxy variable to reflect overall activity in a top-down modeling approach.

Accordingly, the relationship between energy demand, activity level, and energy intensity in these sectors can be expressed as shown in Equation (7).

$$E = A \times I \quad (7)$$

Where:
E = Energy demand in residential sector (MJ)
A = Average number of households is calculated by number of populations by average household size (households)
I = Energy intensity (MJ per household).

3.1.4. Results of energy and refined petroleum demand analysis

The findings indicate that the demand for refined petroleum products and biofuels is expected to decline, as illustrated in Figure 2 (with the share distribution shown in Figure 3). All three scenarios demonstrate the oil peak during the period 2028-2030. However, in the long term, the magnitude of the impact varies across the scenarios, as described below.

In the High Oil Demand scenario, oil demand is projected to continue rising in the short term, driven by economic recovery following the COVID-19 pandemic, before noticeably slowing down. The primary factor behind this shift is the rapid expansion of the EV market, which is becoming more competitive. Other factors, such as transport modal shifts and fuel efficiency enhancements, are expected to have a minor impact. Oil demand is anticipated to peak around 2030, after which it will gradually decline. Nevertheless, despite this downward trend, overall demand for refined petroleum products in 2050 is projected to remain higher than 2020 level, and the share of refined oil consumption is expected to remain relatively unchanged over time.

- Gasoline is expected to be the most affected fuel, with consumption in 2050 decreasing by about 12.6% compared with 2020. This decline is mainly driven by the growth of EVs in passenger cars and motorcycles. Diesel will be less affected because electric trucks may still face limitations in entering the market. However, diesel use is expected to fall in the industrial and power generation sectors due to the growing share of renewable energy.
- Aviation fuel is projected to keep increasing in both the short and long term as the aviation sector recovers. It is not significantly influenced by the rise of EVs.
- LPG demand is likely to remain generally stable, with a slight slowdown over time due to slower population growth. Household cooking will remain the main driver of demand, while use in the transport and industrial sectors is expected to decline.
- Fuel oil will not be directly affected by EVs but is expected to decline significantly due to reduced water transport and greater use of renewable energy in industry.
- Biofuels will be less affected than gasoline and diesel, supported by renewable energy policies. Their average blending share is expected to rise, with ethanol reaching up to 10-20% and biodiesel up to 7%.

In the National Plan scenario, oil demand is expected to keep rising in the short term due to economic recovery after the COVID-19 pandemic. It is projected to reach its peak slightly earlier than in the High Oil Demand scenario, around 2028. After that, oil demand is expected to decline rapidly, driven by the 30@30 policy, which aims for all new vehicles sold to be electric

Figure 2: Demand for refined petroleum products and biofuels

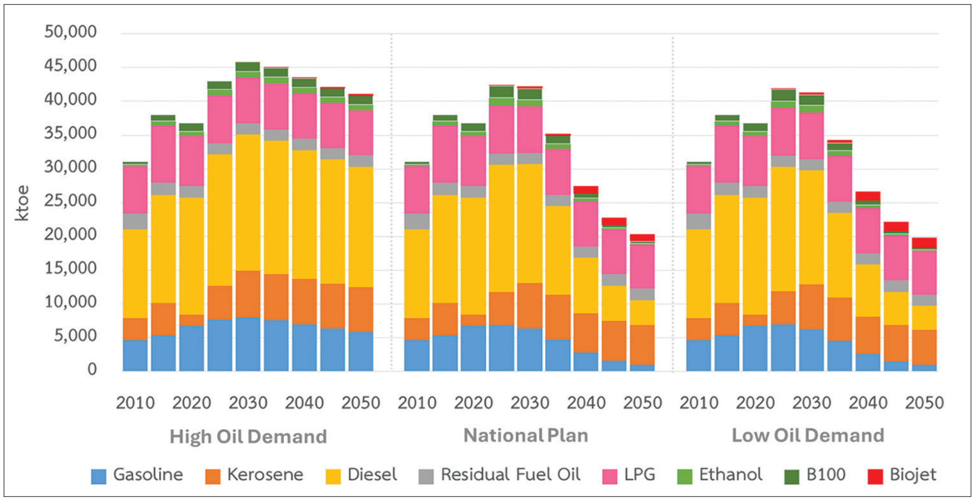
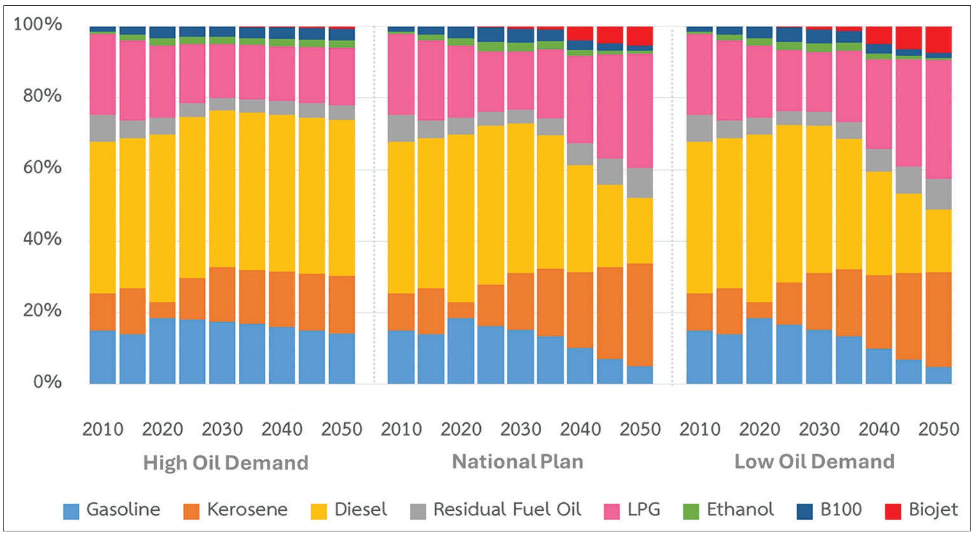


Figure 3: Proportion of demand for refined petroleum products and biofuels



between 2030 and 2040. This transition leads to a significant change in the share of refined oil consumption, mainly due to the decline in gasoline and diesel demand. There are also minor impacts from other measures, such as changes in transport modes and improvements in fuel consumption, similar to those in the High Oil Demand scenario.

- Gasoline and diesel are expected to be significantly affected by the growth of EVs across all categories, including passenger cars, motorcycles, pickup trucks, and heavy trucks, which have been major consumers of these fuels. By 2050, gasoline demand is projected to decline by 79% and diesel by 72% compared with 2020 levels.
- Aviation fuel is projected to keep increasing in both the short and long term, supported by the recovery of the aviation sector and unaffected by the growth of EVs. The sharp decline in gasoline and diesel demand also leads to a substantial rise in the share of aviation fuel.
- LPG demand is expected to remain generally stable, with a slight slowdown over the long term due to slower population growth. The use of LPG for household cooking remains a key driver of demand, while consumption in the transport and industrial sectors is expected to decline significantly. The reduction in gasoline and diesel use also results in a notable increase in LPG's share.
- Fuel oil is not directly affected by EVs, but its consumption is expected to fall significantly due to reduced water transport activity and increased renewable energy use in industry.
- Biofuels will be less affected than gasoline and diesel, supported by renewable energy promotion policies. Their average blending share is expected to increase, with ethanol reaching up to 20% and biodiesel up to 10%.

In the Low Oil Demand scenario, the trend in fuel demand is similar to that in the National Plan scenario. Oil demand is expected to rise in the short term and reach its peak around 2028. After that, demand will decline rapidly due to the 30@30 policy, which aims for all new vehicles for sale between 2030 and 2040 to be electric. In the longer term, oil demand may also be affected by the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) measure in the aviation sector, which could lead to greater use of SAF, as well as the development of FCEVs for heavy trucks.

Table 4: Summary of the potential impacts of EV growth on Thailand's fuel supply chain operators and the adaptation strategies

Fuel supply chain operators	Short term (5-10 years) (2023-2032)	Medium term (11-15 years) (2033-2037)	Long term (16-28 years) (2038-2050)
Oil refineries			
Impacts	• Impacts remain limited as EV adoption is still not widespread. The reduction in gasoline demand will be more significant than that of diesel.	• Impacts increase significantly due to the rapid growth of EV adoption. • Refineries must reduce production capacity, leading to lower utilization rates and a decline in overall refining efficiency. • Other petroleum products, such as LPG, aviation fuel, fuel oil, asphalt, and lubricants, are also affected. This results in an imbalance in overall product output, causing challenges in supply and distribution management.	
Adaptation strategies			
Core business development	• Prepare for adjustments in production. • Seek export markets.	• Implement production improvements. • Export products to international markets.	• Transform refinery operations into commercial petroleum product import terminals and storage facilities for new types of fuels.
Business integration	• Strengthen linkages with the petrochemical industry and high-value product manufacturing.		
Business transformation	• Invest in various renewable energy businesses, such as renewable power generation, energy storage systems, and battery production for EV	• Invest in bio-refinery and oleochemical industries to produce biofuels such as bio-hydrogenated diesel (BHD) and SAF, as well as in CCS/CCUS and hydrogen businesses.	
Petroleum traders (Sections 7, 10, 11)			
Impacts	• The impact is not severe as EV adoption remains limited, with a greater effect on gasoline sales than diesel sales. • For traders under Section 11, the impact is expected to be more significant in major urban areas, where gasoline passenger cars and motorcycles are predominantly used.	• The impact is expected to increase significantly in the future, potentially affecting the business scale and viability of operations.	
Adaptation strategies			
Core business development	• Adjust business plans to align with evolving market conditions.		• Downsize operations within the gasoline and diesel supply chains, including a reassessment of the necessity of maintaining Section 10 traders within the business value chain.
Business integration	• Develop EV charging service businesses. • Establish EV battery swapping service operations.	• Explore opportunities in the renewable energy sector, particularly in hydrogen energy development.	
Business transformation	• Develop additional business ventures such as convenience stores, food and beverage services, vehicle maintenance and repair, and electric motorcycle rental	• Explore new energy-related businesses, including lithium mining, renewable power generation, electricity storage systems, and EV battery manufacturing. • Diversify into non-energy business ventures, such as pharmaceuticals and medical research, and logistics services for non-fuel products.	
Ethanol producers			
Impacts	• The impact from EV adoption is limited; however, trade licensing restrictions still prevent ethanol producers from selling to sectors other than fuel blending.	• The impact is expected to increase, though to a lesser extent than that on fossil fuels. However, if the existing issues remain unresolved, the situation could worsen and eventually affect sugarcane and cassava farmers who provide the key raw materials for ethanol production.	
Adaptation strategies			
Core business development	• Promote E20 as the primary fuel and seek policy adjustments to permit ethanol distribution outside the Section 7 trading framework.		
Business integration	• Develop SAF businesses.		
Business transformation		• Develop bio-refinery businesses	

(*Contd...*)

Table 4: (*Continued*)

Fuel supply chain operators	Short term (5-10 years) (2023-2032)	Medium term (11-15 years) (2033-2037)	Long term (16-28 years) (2038-2050)
Biodiesel producers			
Impacts	• The impact from EV adoption remains limited; however, several persistent challenges persist, including high feedstock costs, the effects of biofuel price subsidies, low competitiveness in global markets, and policy inconsistencies.	• The impact is expected to increase (though to a lesser extent than for fossil fuels). Nevertheless, if these issues remain unresolved, the situation could worsen and effect oil palm farmers who supply the primary feedstock for biodiesel production.	
Adaptation strategies			
Core business development	• Improve the efficiency of feedstock and market management.		
Business integration	• Develop value-added industries such as oleochemicals, sustainable aviation fuel from hydroprocessed esters and fatty acids (HEFA), and high-value bio-based products.		
Business transformation		• Develop bio-refinery businesses	
Oil depots			
Impacts	• The impact varies with the demand for oil storage facilities and extends to tank rental services. • Oil depots may face limitations in expanding or establishing new facilities in the future.		• The impact could become severe enough that some depots—whether operated by oil companies or independent entities—may eventually be forced to cease operations.
Core business development		• Lease storage facilities for non-fuel products	• Merge or invest jointly with other operators.
LPG terminal			
Impacts	• Although not directly affected by EVs, LPG pricing policy adjustments may influence the competitiveness of LPG-powered cars, which in turn could have negative impacts on LPG terminals.		
Adaptation strategies			
Core business development	• Reduce the proportion of the LPG business in the transport sector and increase its share in the household sector.		
Business transformation	• Invest in renewable energy businesses, such as solar energy.		
Oil transporters (by Road)			
Impacts	• The impact is minimal because the operators are already engaged in transporting various goods, not limited to petroleum.		
Adaptation strategies			
Core business development	• Expand into transporting other types of goods.		
Oil transporters (by Pipeline)			
Impacts	• The impact is minimal.	• The impact is significant due to the decline in oil transport volumes.	
Adaptation strategies			
Core business development		• Expand the customer base and service areas both domestically and internationally.	

These changes will significantly alter the share of refined oil consumption, mainly due to the decline in gasoline and diesel demand. There will also be minor impacts from other measures, such as changes in transport modes and improvements in fuel consumption, similar to those in the High Oil Demand scenario.

- Gasoline and diesel will be strongly affected by the growth of EVs across all categories, including passenger cars, motorcycles, pickup trucks, and heavy trucks, as well as by the adoption of FCEVs. By 2050, gasoline demand is expected to fall by 85.7% and diesel by 78.8% compared with 2020 levels.
- Aviation fuel is projected to continue increasing in both the short and long term, supported by the recovery of the aviation sector and not affected by EVs. However, the CORSIA measure may influence the fuel mix by promoting greater use of SAF, even though it will not significantly reduce total demand. The sharp decline in gasoline and diesel consumption will also lead to a significant increase in the share of aviation fuel.
- LPG demand is expected to remain broadly stable, with a slight slowdown over time due to slower population growth. The use of LPG for household cooking remains a key driver

of demand, while consumption in the transport and industrial sectors is expected to decline significantly. The reduction in gasoline and diesel use will also increase LPG's share noticeably.
- Fuel oil is not directly affected by EVs; however, the decline in water transport activities and the increasing use of alternative energy in the industrial sector have led to a noticeable reduction in fuel oil consumption.
- Biofuels will be less affected than gasoline and diesel, supported by renewable energy promotion policies. Their average blending share is expected to increase, with ethanol reaching up to 20% and biodiesel up to 10%.

3.2. Examination of Adaptation Strategies of Fuel Supply Chain Operators

Different types of operators are expected to be affected in different ways. In this study, interviews were conducted with operators across the supply chain based on three main adaptation approaches:
- Approach 1: Core business development - continuing to invest in the core business while expanding investments to align with climate goals
- Approach 2: Business integration - investing in the core business alongside new businesses that are related or connected to existing operations
- Approach 3: Business transformation - shifting investment toward entirely new businesses that differ fundamentally from the original operations.

Based on the analysis of EV impacts presented earlier and the interview results, the potential implications for operators across Thailand's petroleum supply chain and their possible adaptation strategies are summarized in Table 4.

4. CONCLUSIONS AND POLICY IMPLICATIONS

The 30@30 policy will accelerate the transition toward EVs. This transition requires not only business operators to adapt, but also the government to prepare for the integration of new energy sources and to implement measures to mitigate potential impacts, ensuring a smooth transition. This has led to policy recommendations concerning fuel management, infrastructure development, and business adaptation — structured across three timeframes based on projected changes in fuel demand: (1) the short term, representing a turning phase from growth to slowdown (2023-2032); (2) the medium term, during which the rate of oil demand decline accelerates (2033-2037); and (3) the long term, when the decline stabilizes and reaches a new equilibrium (2038-2050).

4.1. Fuel Policy Formulation

The transition to EVs will directly affect oil demand in the land transport sector, particularly for gasoline and diesel. In the short term (2023-2032), fuel types should be streamlined to enhance efficiency and reduce costs. It is recommended that E20 be designated as the standard gasoline starting in 2027, while ULG95 should be classified as a premium fuel with prices determined by market mechanisms. For diesel, B7-B10 should serve as the baseline blend, adjustable according to price trends and technological readiness. At the same time, NGV and LPG usage should be gradually reduced, accompanied by policies that promote the shift toward EVs.

In the medium to long term (2033-2050), this policy direction should be maintained to ensure consistency for fuel users while allowing businesses sufficient time to adapt and pursue new opportunities.

For the aviation sector, although it is not directly impacted by EV adoption, it faces growing pressure from international environmental measures. Therefore, preparation for the use of SAF is essential. In the short term, blending should begin at low levels (2-5%), gradually increasing as technology advances and production costs decrease. Over the medium and long term, the SAF blending ratio should reach 20% by 2050, supporting carbon neutrality goals and compliance with the CORSIA framework.

4.2. Infrastructure Development

Although oil demand is expected to decline in the future, pipeline and oil storage systems will continue to play an essential role in maintaining energy security and promoting efficient resource utilization.

For the pipeline system, in the short term, safety and environmental standards should be strengthened to encourage the use of pipelines instead of road transport, while existing systems should be upgraded to improve efficiency. In the medium and long term, the pipeline network should be expanded to connect with neighboring countries, thereby increasing transport capacity and maximizing the utilization of existing infrastructure.

For oil storage facilities, in the short term, existing depots should be upgraded to handle multiple fuel types and support multimodal transport systems — including pipelines, roads, and railways. New value-added services such as customized fuel blending should be introduced, together with enhanced safety standards. In the medium and long term, storage facilities should be further developed to accommodate new fuel types and non-petroleum products, thereby enhancing flexibility and resilience in response to changing market conditions.

4.3. Business Adaptation

Operators within the oil industry value chain must urgently develop strategies to cope with a declining market. The adaptation can be categorized into three main approaches: (1) core business development, which focuses on improving production processes, optimizing feedstock management, and expanding export markets; (2) business integration, which involves investing in petrochemical industries, high-value bioproducts, and sustainable aviation fuel (SAF); and (3) business transformation, which emphasizes transitioning toward bio-refineries, green hydrogen, renewable energy, and EV-related businesses. These strategic shifts not only help compensate for the decline in oil-related revenues but also create added value and strengthen the country's long-term economic potential.

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