

Status Quo of Fuel Economy Policies in Thailand

Scoping Study

August 2024

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1. Introduction and context

1.1. Objective of the study

The "Introducing Measures, Pathways and Roadmaps for Optimizing Vehicle Efficiency and Electrification (IMPROVE)" project has been funded by the German government's International Climate Initiative. The objective of the project is to address one of the key mobility challenges of our time: the need to accelerate the phase-out of the internal combustion engine, the transition to zero-emission vehicles and the improvement of energy efficiency. Over a four-year period, the project intends to ensure that the partner countries (Kenya, Colombia, Morocco, Thailand) adopt regulatory frameworks to address these challenges.

With this Thailand scoping study, the IMPROVE project aims to help our partners select appropriate regulatory instruments that appear feasible to implement. The study describes the regulatory status quo by vehicle type (passenger cars, 2/3 wheelers, freight vehicles), which vehicle-related policies and regulations are in place and which government department(s) are responsible.

The study further provides a detailed insight into the local type approval and registration process, the actors involved, and the data collected, with a particular focus on how CO₂ emissions are assessed and collected. The study clarifies what fleet data is collected by the authorities in this process and highlights missing data.

Based on the analysis, the study identifies options for vehicle efficiency regulation (defined as any regulatory measure that directly or indirectly improves the energy consumption or CO₂ emissions per kilometre of vehicles) in Thailand as a basis for analysis and discussion with policy partners and input to the extended steering group.

1.2. Executive Summary

As part of the project "Introducing Measures, Pathways and Roadmaps for Optimizing Vehicle Efficiency and Electrification" (IMPROVE), funded by the International Climate Initiative of the German government, this study aims to present the technical and political status quo regarding vehicle efficiency in Thailand.

This scoping study will support the selection of appropriate regulatory instruments that appear feasible for implementation under the IMPROVE project. Below are the main findings from the study:

Climate Change and Transport



- The energy sector accounted for approximately 70% of the total greenhouse gas emissions in 2019. Specifically, within the energy sector, transport was responsible for approximately 30% of the sector's emissions.
- During the **COP26**, Thailand pledged to achieve carbon neutrality by 2050 and net-zero GHG emissions by 2065. Also, the country pledged to enhance its NDC increasing the conditional target from 25% to 40% by 2030.
- Thailand's **Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)**, published in 2022, outlines a timeline for achieving net-zero GHG emissions in the transport sector. Mitigation measures will focus on efficient engine vehicles and renewable energy in 2025 and include the phase-down of internal combustion engines and the use of the most efficient internal combustion engine (ICE) vehicles. In 2045, the emphasis will then be on the most efficient ICE vehicles using biofuels and a high share of electric vehicles and fuel cell vehicles.
- The **30@30 electric vehicle strategy** aims for 30% of the domestically produced vehicles (for both domestic usage and export) to be electric vehicles in 2030. According to this plan, Thailand aims to produce 725,000 electric vehicles (passenger) and have 440,000 electric vehicles (passenger) for domestic usage in 2030.
- An **NDC Action Plan** is currently being developed and aims at enhancing passenger vehicle fuel efficiency. This revision process provides a window of opportunity to introduce new fuel economy instruments in Thailand.

Transport sector developments



- **Vehicle fleet:** From 2000 to 2022, the number of registered passenger and light commercial vehicles rose from almost 6 million to approx. 19 million growing at a rate of 5.4% per year, a rate similar GDP and GDP per Capita growth.
- **Motorisation rate:** Excluding motorcycles, the number of vehicles per 1000 people rose from 98 in 2000 to 288 in 2022. The number of vehicles per 1,000 people in the Bangkok Metropolitan Region, excluding motorcycles, was 686, compared to 402 in urban areas across the country and 170 in rural areas.

- When compared internationally Bangkok's motorisation rate is much higher than Tokyo, London, New York, and Singapore.
- **Vehicle age:** A notable proportion of vehicles in use are more than 20 years old, accounting for 17% of passenger vehicles, 35% of buses, and 33% of trucks.

Automotive Industry



- According to the International Organization of Motor Vehicle Manufacturers (OICA), Thailand ranked 10th in the world in motor vehicle production by the number of units.
- In 2022, Thailand produced **1.9 million motor vehicles**, of which the large majority are passenger and light commercial vehicles.
- Thailand is a **net exporter of vehicles**. In 2022, Thailand exported 17,551 million EUR of passenger and light commercial vehicles while imported only 1,191 million EUR. The main destinations of Thai exports are in the Asian-pacific region: Australia (28%), the Philippines (9%) and Viet Nam (7%).
- Thailand imported the majority of its passenger and light commercial vehicles from China, Indonesia, Japan, Malaysia and Germany. China is by far leading in the Battery Electric Vehicle (BEV) segment.
- **70%** of the cars sold in Thailand in 2022 are **second-hand vehicles** (within the country). The number of units sold per year ranged from 1.78 million units to 2.51 million units between 2018 to 2022.
- By the announcement of the Ministry of Commerce in 2019, Thailand has **banned the import of used cars**. Used vehicles are considered as “prohibited goods” or “goods that requires approval before importing”.

Vehicle testing and data management



- Thailand has its own **type approval** and vehicle testing regime which was revised to comply with UNECE regulations. Under the **ASEAN mutual recognition arrangement**, Thailand and other ASEAN member states ensure that have undergone type approval process in one country can enter the others' markets.
- Thailand is using the **New European Driving Cycle** (Urban and Extra Urban Cycles) to test vehicles on exhaust emissions, fuel consumption and CO₂.
- The **Thai Industrial Standard Institute** (TISI) approves the test result of CO₂ emissions and fuel consumption for local automotive manufacturers. For imports, prototypes have to be tested and approved by TISI before vehicles can be imported to Thailand.
- TISI does not transmit the results of the testing to other government agencies. The vehicle manufacturers themselves provide the data to the Office of Industrial Economics (OIE). The OIE collects CO₂ emissions, which the Excise Department uses to determine CO₂-based excise tax, and fuel economy information for “eco stickers”.

- The Department for Land Transport (DLT) is responsible for collecting **vehicle fleet statistics**, including data on newly registered vehicles and vehicle stock. The department also collects information on vehicle stock by age and newly registered vehicles by the type of fuel used. DLT also collects annual registration tax and currently studies for CO₂-based annual registration tax.

Vehicle Efficiency Efforts

- Thailand already has many fuel economy policies in place such as fuel economy labelling, import restrictions for used cars, and CO₂-based excise taxes. The country also has subsidies for electric vehicles.
- Fuel economy policies also are part of an enhanced NDC Action Plan for the transport sector.
- New cars are required to pay several charges: excise tax based on CO₂, tax to the Ministry of Interior (MOI) and value-added tax (VAT). For vehicles with small engines and low CO₂ emission, the excise tax rates will gradually lower for fuel efficient vehicles from 2022 to 2030.
- The current **tax scheme** is making **BEVs** more competitive against ICE vehicles. A domestically produced ICE vehicle with less than 3,000 cc that emits less than 150 gCO₂/km will have an excise tax rate of 25%. On the contrary, BEV vehicle will have an excise tax rate of only 2%.
- A **regulatory gap** can be identified in the **pick-up segment**, which is currently heavily under-taxed compared to its energy consumption. The special treatment is explained by the important role of pick-up cars for the Thai automobile industry and the local agricultural economy.
- **Fuel** in Thailand is subjected to **four taxes and two fees**. The taxes include the excise tax, tax to the MOI, VAT on the wholesale price and VAT on the retail price. The two fees collected are going to the Oil Fuel Fund for stabilizing domestic oil price and the Energy Conservation Fund for promoting renewable fuel and improving fuel efficiency.
- According to the Announcement of the Ministry of Industry every new car, both domestically produced and imported, have to display a **label** displaying vehicle information according to international standards (**eco sticker**).
- While there will be no eco sticker attached to a second-hand car, consumers can still look up the eco sticker information online at <https://www.car.go.th/>.
- The main challenge for the implementation of fuel economy standards is that it requires **a strong political mandate** to enable inter-ministerial cooperation and engagement with private sector stakeholders.

Summary Table for the IMPROVE Project Scoping Study in Thailand

Policy	Yes / No	Brief description	Source
Fuel economy labelling	Yes	Eco Sticker	Announcement of the Ministry of Industry on Displaying Vehicle Information According to the International Standard on 19th August B.E. 2558 (2015)
Import duties	Yes	Import duties reduction for BEVs	Cabinet Resolution on 15 th February 2022
Import restrictions	Yes	Restriction on used vehicles	Announcement of the Ministry of Commerce on 12th June 2019 Designating Used Vehicles as Prohibited Goods or Goods that Requires Approval Before Importing into the Kingdom B.E. 2562 (2019)
Purchase Tax / VAT	Yes	7% on top of price including customs, excise tax, and MOI tax	Revenue Code
Registration tax	Yes	The same tax as the annual tax	Motor Vehicle Act B.E. 2522 (1979)
Registration fee	Yes	Request fees, license plate fees, booklet fees, inspection fees	Motor Vehicle Act B.E. 2522 (1979)
Annual tax /fee	Yes	Annual tax paid during registration and annually	Motor Vehicle Act B.E. 2522 (1979)
CO ₂ tax	Yes	Excise tax on vehicle purchase based on CO ₂ emission	Ministerial Regulation on Excise Rates (No.22) B.E. 2565 (2022)
Fuel tax	Yes	Excise tax on fossil fuel portion of biofuel-blended finished fuel	Ministerial Regulation on Excise Rates (No.34) B.E. 2566 (2023)
Clean vehicle subsidy	Yes	50,000 to 100,000 THB subsidies for BEVs	<i>National Electric Vehicle Policy Committee Resolution on 1st November 2023</i>
Fuel economy standard	No	No fuel economy standard enforcement	TIS. 2335-2550
Others	Yes	30@30 target on EV production	Cabinet Resolution on 15 th February 2023
		Incentive from DEDE	Ministerial Regulation on the specification of highly efficient small gasoline engines (2018) Ministerial Regulation on the specification of small diesel engines with water cooling system (2018)

1.3. Context overview

Situated at the centre of Mainland Southeast Asia, Thailand is an upper-middle income country with a population of 66 million people and a GDP per capita in 2022 of 6,572 EUR, which ranked 4th in the region after Singapore, Brunei, and Malaysia. One notable aspect of Thailand's economic development is its automotive industry as the country is one of the world's leading automotive manufacturers. With the growth of the automotive industry driving the growth of the country and the country's economic growth driving spending on passenger vehicles, the country's economic development and its motorisation rate go hand-in-hand with one another.

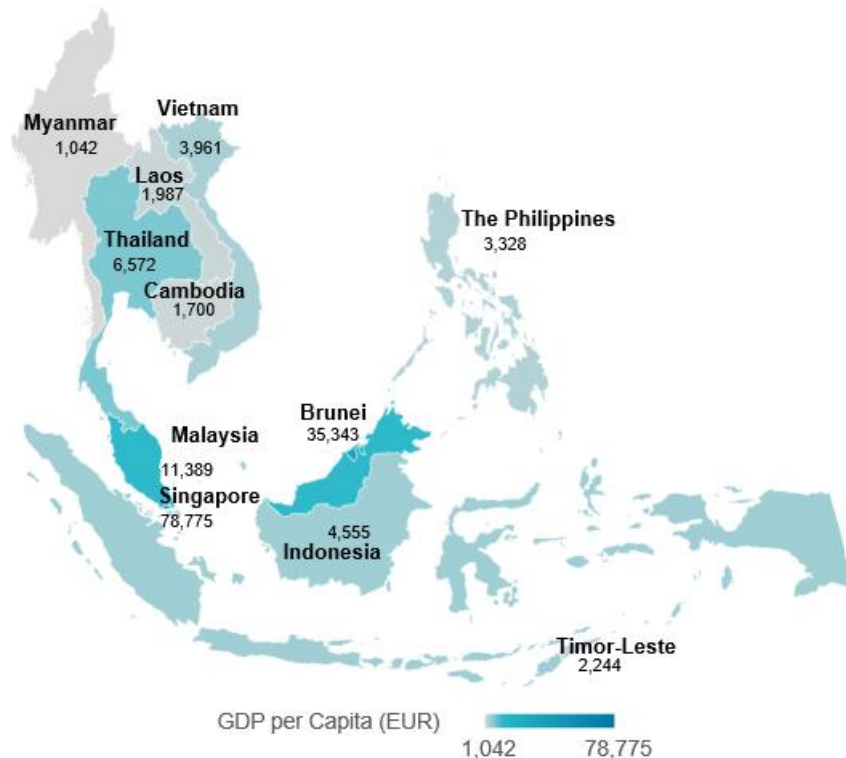


Figure 1: Map of Southeast Asian Countries and Their GDP per Capita (2022) in EUR^{1 2}

1.3.1. Motorisation trends

From 2000 to 2022, Thailand experienced significant economic growth as evident in the country's Gross Domestic Product (GDP) at current prices, as shown in Figure 2. Over this period, Thailand's GDP grew with a compound annual growth rate (CAGR) of 5.8%, from 5.1 trillion THB to 17.4 trillion THB.

¹ World Bank Group (2023) GDP per Capita (currentUS\$)

<https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2022&start=1960> (Accessed: May 2023)

² The data in USD in 2022 has been converted in EUR in 2022 according to <https://www.exchange-rates.org/exchange-rate-history/usd-eur-2022> (Accessed: May 2023)

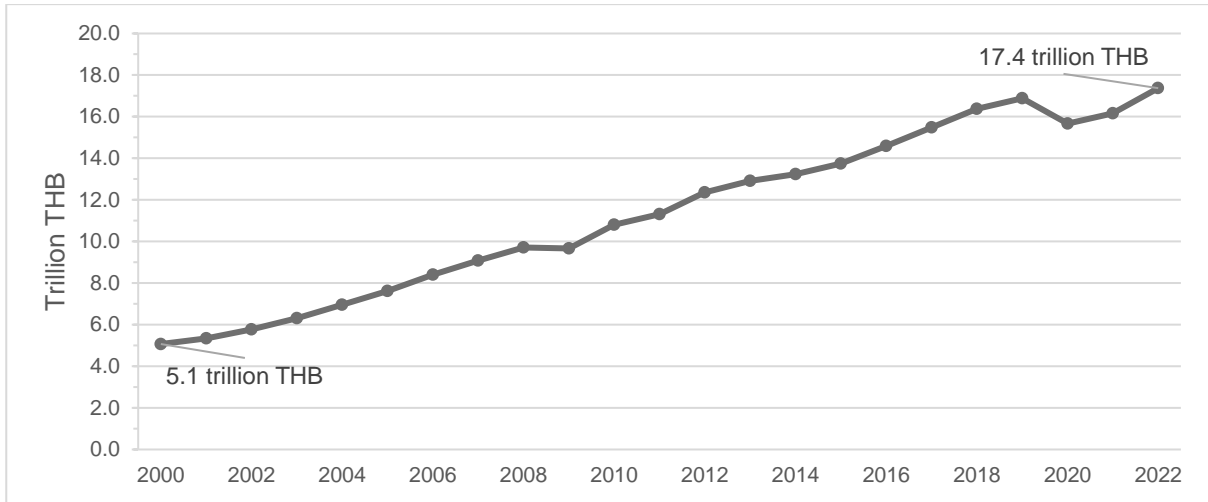


Figure 2: GDP at Current Prices (Trillion THB)³

The economic growth occurred despite the sluggish population growth rate of only 0.3% per year since 2000, a growth from 62 million to 66 million people, as shown in Figure 3. This has led to the growth of GDP per capita of 5.4% per year since 2000, which has resulted in a growth of more than three folds over the period, as shown in Figure 4. The rise in GDP per capita is a positive determinant of the motorisation rate in the country as people are more likely to be able to afford motor vehicles as their disposable income increases.

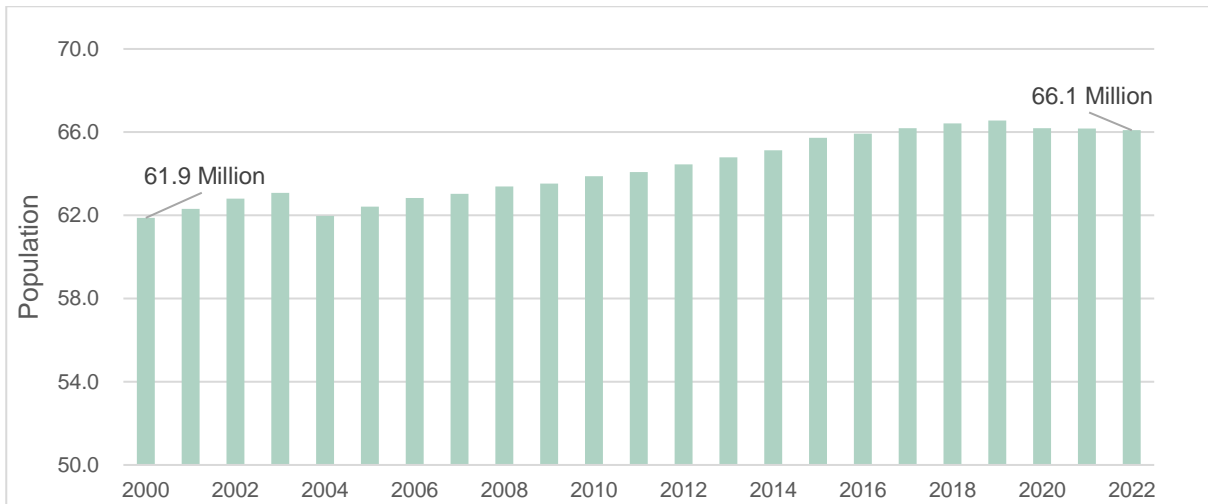


Figure 3: Thailand's Population (Million)^{4 5}

³ National Economic and Social Development Board (NESDB) (2022) *Economic Performance Report in Q1 2023*. Available at: https://www.nesdc.go.th/main.php?filename=QGDP_report (Accessed: May 2023).

⁴ National Statistical Office (NSO) (2022) *Demography Statistics: Population and Household*. Available at: <http://statbbi.nso.go.th/staticreport/page/sector/th/01.aspx> (Accessed: May 2023). and Department of Provincial Administration (2022) *Monthly Civil Registration Statistics*. Available at:

<https://stat.bora.dopa.go.th/stat/statnew/statMONTH/statmonth/#/view> (Accessed: May 2023).

⁵ Official date was revised downward in 2004

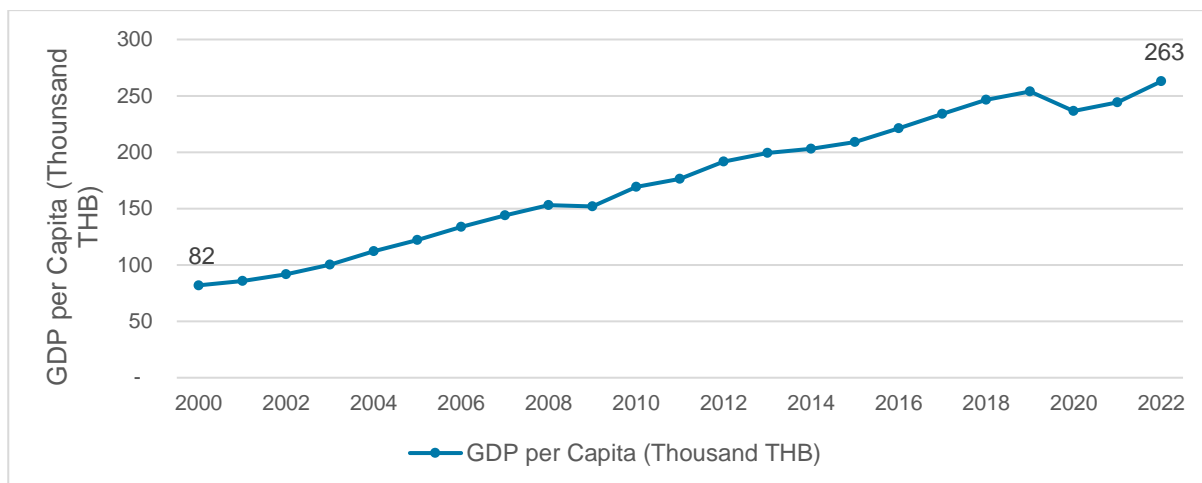


Figure 4: GDP per Capita (Thousand THB)⁶

Another positive economic determinant for the motorisation rate in Thailand is the change in the distribution of household income over time. According to Figure 5, from 2007 to 2021, the distribution of household income has become less concentrated. In 2007, the top 20% of the country, the 5th quintile, earned 49.2% of the household income, while the bottom 20%, the 1st quintile, earned 5.7%. In 2021, the share of household income of the top 20% decreased to 42.3%, while the share of the bottom 20% increased to 8%. The share of household income of the 20-40% range, the 2nd quintile, and the 40-60% range, the 3rd quintile, also increased from 9.6% and 14.2% in 2007 to 12.3% and 16.1% in 2021, respectively. As household income became more evenly distributed, it was more likely for people outside of the top 20% to have enough disposable income to afford motor vehicles, thus, increasing the motorisation rate.

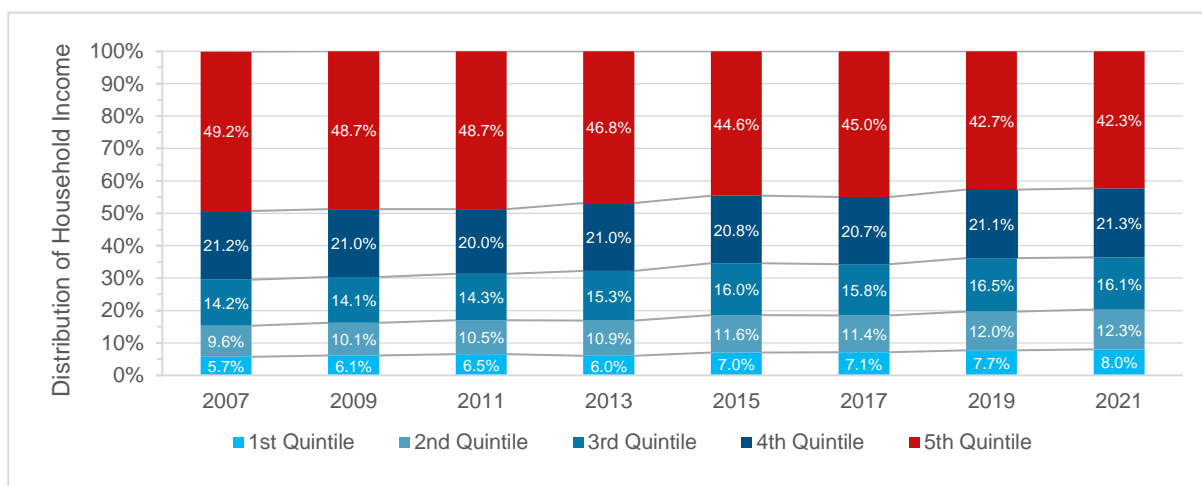


Figure 5: Distribution of Household Income from 2007 to 2021 (%)⁷

⁶ Author's calculation based on data from NESDB (2022) *Economic Performance Report in Q1 2023*. Available at: https://www.nesdc.go.th/main.php?filename=QGDP_report (Accessed: May 2023) and NSO (2022) *Demography Statistics: Population and Household*. Available at: <http://statbbi.nso.go.th/staticreport/page/sector/th/01.aspx> (Accessed: May 2023).

⁷ NSO (2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021) *Household Economic and Social Survey*. Available at: <http://www.nso.go.th/> (Accessed: May 2023).

The increase in registered motor vehicles in Thailand, shown in Table 1, is in line with many positive economic determinants, such as the increase in GDP per capita and a more evenly distributed income mentioned above. From 2000 to 2022, the number of registered passenger and light commercial vehicles rose from 5,988,129 to 18,979,317, growing at a rate of 5.4% per year, a rate similar to those of the GDP and GDP per Capita growth. However, the growth rates for the two and three wheelers (2W & 3W) are much slower, at only 2.2% per year.

Table 1: Number of Passenger and Light Commercial Vehicles and 2W & 3W Stocks from 2000 to 2022^{8 9}

Year	Passenger and Light Commercial Vehicle	2W & 3W
2000	5,988,129	13,830,018
2001	6,322,063	15,247,356
2002	6,905,739	16,590,789
2003	7,152,980	18,221,662
2004	6,471,321	13,213,361
2005	7,039,423	14,554,909
2006	7,988,688	15,785,545
2007	8,418,933	16,124,113
2008	8,848,168	16,431,633
2009	9,272,554	16,712,666
2010	9,903,138	17,304,907
2011	10,666,985	18,157,272
2012	11,841,807	19,151,995
2013	13,035,971	19,969,768
2014	13,805,162	20,310,406
2015	14,431,681	20,502,209
2016	15,013,790	20,479,839
2017	15,707,167	20,700,118
2018	16,507,866	21,082,128
2019	17,290,939	21,407,754
2020	17,860,481	21,571,406
2021	18,383,807	21,847,587
2022	18,979,317	22,284,344

Over the last two decades, Thailand has seen a considerable growth in motorisation rate. Figure 6 depicts the motorisation rate in Thailand by showing the number of vehicles per 1,000 people. Including motorcycles, the number of vehicles per 1,000 people in Thailand from 2000 to 2022 rose from 320 to 624. Excluding motorcycles, the number rose from 98 in 2000 to 288 in 2022, an increase of almost three folds. Figure 7 compares Thailand's

⁸ Department of Land Transport (DLT) (2022) *Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: May 2023).

⁹ Passenger and Light Commercial Vehicles include MV1, MV2, MV3, MV5, MV6, MV9, MV10, MV11 according to the definition of the Thailand Automotive Institute. 2W & 3W include MV4, MV7, MV12, MV17

motorisation rate with those of other countries according to data from the International Organization of Motor Vehicle Manufacturers (OICA). It shows that Thailand's motorisation rate is still low compared to those in many developed countries, such as 860 in the USA, 612 in Japan, 535 in Malaysia and 518 in Europe. From Figure 6 and Figure 7, it is noted that while Thailand has a significant growth in motorisation rate, there is still a lot of room for the motorisation rate to grow when comparing Thailand's motorisation rate to those of other developed countries and regions.

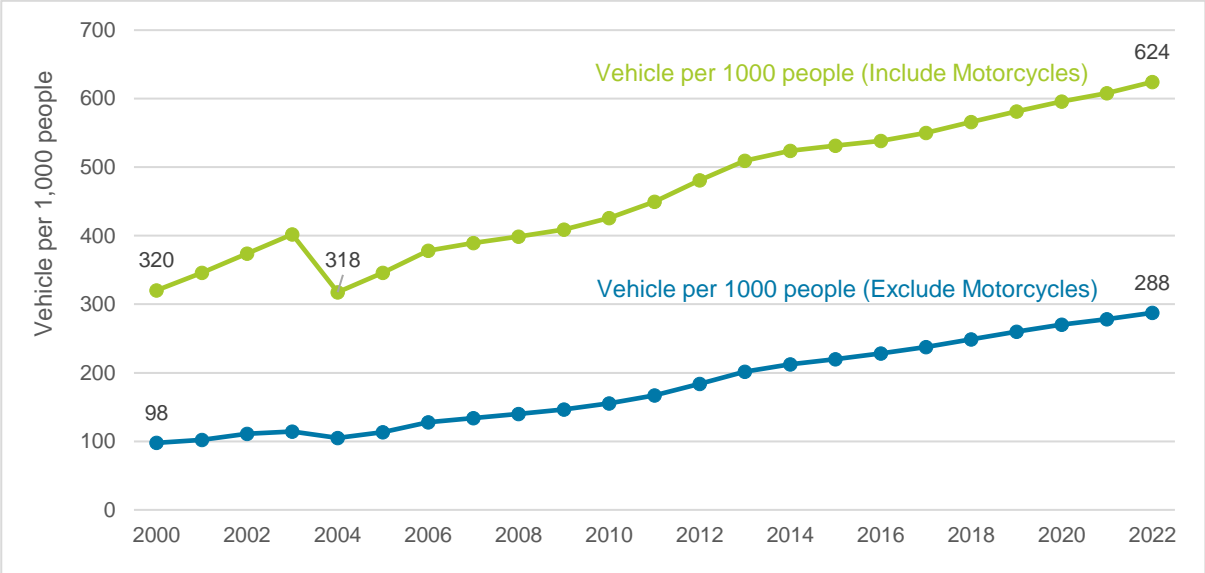


Figure 6: Motorisation Rate in Thailand (Number of Vehicles per 1,000 People)¹⁰

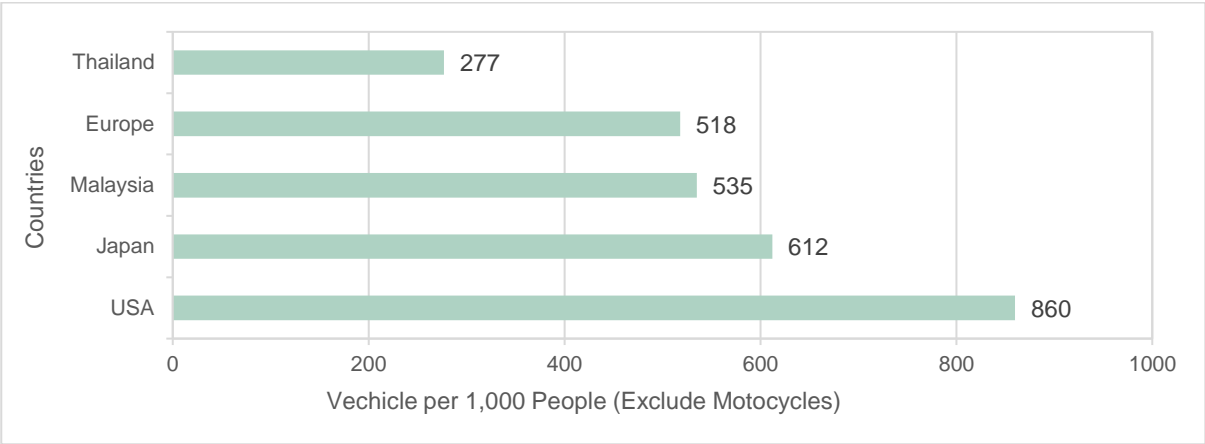


Figure 7: Comparison of Vehicles per 1,000 People in Selected Countries in 2020¹¹

However, when Thailand's motorisation rates are broken down by urban and rural areas, it is noted that there is a huge difference between the figures for the two areas. The contrast is even more stark when Bangkok is looked at separately. The number of vehicles per 1,000

¹⁰ Author's calculation based on data from DLT (2022) *Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: May 2023) and NSO (2022) *Demography Statistics: Population and Household*. Available at: <http://statbbi.nso.go.th/staticreport/page/sector/th/01.aspx> (Accessed: May 2023).

¹¹ International Organization of Motor Vehicle Manufacturers (OICA) (2020) *Motorization Rate 2020 - Worldwide*. Available at: <https://www.oica.net/category/vehicles-in-use/> (Accessed: May 2023).

people in the Bangkok Metropolitan Region (BMR)¹², excluding motorcycles, was 686, compared to 402 in urban areas across the country and 170 in rural areas, as depicted in Figure 8.

When compared to those of other major cities in the world, such as Tokyo, London, New York, and Singapore, it becomes apparent that Bangkok’s motorisation rate is much higher. It is shown in Figure 9 that in countries like Japan and the United States, the numbers of vehicles per 1,000 people in their major cities, i.e., Tokyo and New York City, are 286 and 249, which are lower than the countries’ average at 612 and 860. While in Thailand, the number of vehicles per 1,000 people in Bangkok is 686, according to Figure 8, while the figure is 288 for the entire country, according to Figure 6. This means that in the sample developed countries, vehicle ownership is more concentrated outside of major cities, and for Thailand, it is the opposite. This also implies that there is still a vast opportunity for the growth motorisation rate in the Thai rural areas.

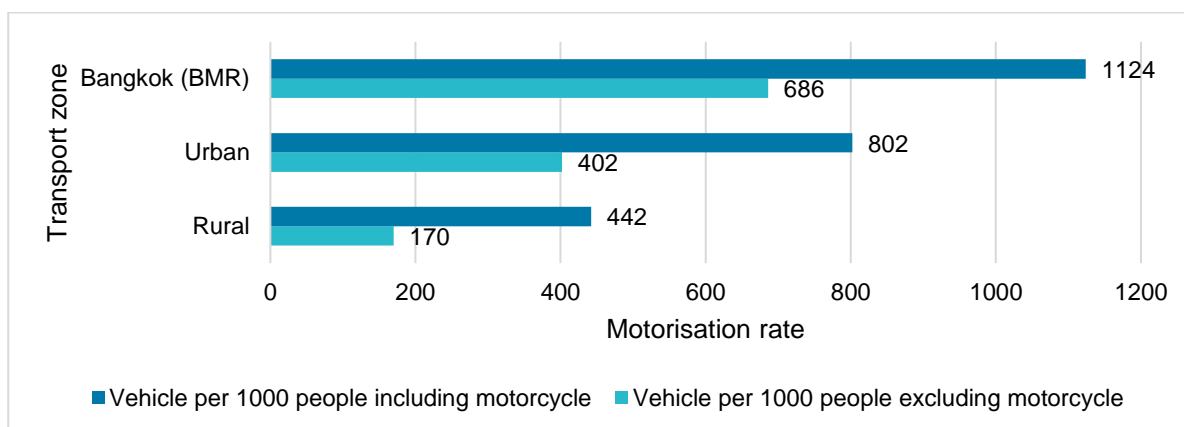


Figure 8: Comparison of Vehicle per 1,000 People in Bangkok Metropolitan Region (BMR), Urban Areas and Rural Areas in Thailand¹³

¹² The calculation selects Bangkok Metropolitan Region (BMR) which includes provinces neighbouring to Bangkok Metropolitan Administration (BMA) because vehicles in provinces neighbouring to BMA usually register in the BMA area.

¹³ Author’s calculation based on data from the DLT (2022), the National Statistical Office (2022), and the Bangkok Metropolitan Administration (2021). Vehicle registration data in urban areas is calculated from provincial vehicle registration data in provinces with city municipalities.

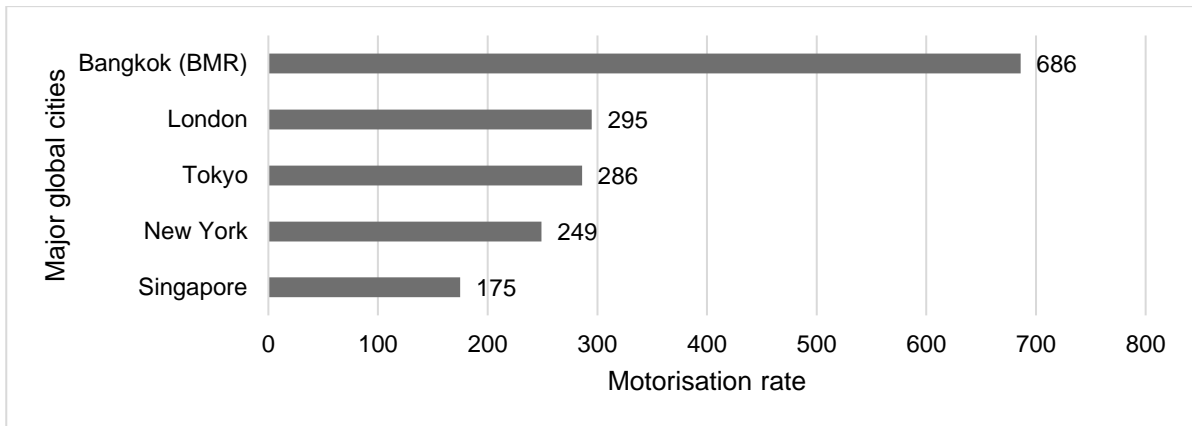


Figure 9: Comparison of Vehicle per 1,000 People in Bangkok and Selected Major Global Cities¹⁴

1.3.2. Climate objectives and industry strategies

According to the Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand experienced an increase in its total domestic greenhouse gas emissions (excluding the reduction from land use, land-use change, and forestry :LULUCF) from 245.90 MtCO_{2eq} in 2000 to 372.72 MtCO_{2eq} in 2019. Similarly, over the same period, the net greenhouse gas emissions (including LULUCF) rose from 200.46 MtCO_{2eq} to 280.73 MtCO_{2eq}.

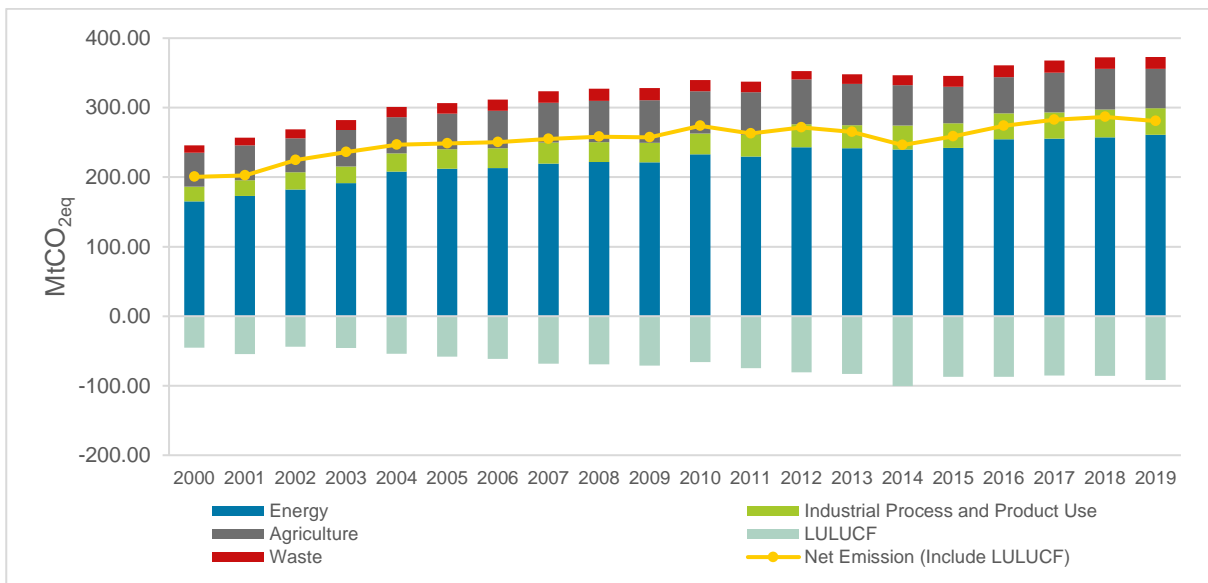


Figure 10: Thailand GHG Emission from 2000 to 2019¹⁵

¹⁴ Author's calculation based on data from the DMV (2018), Statistics Japan (2019), City of New York (2020), Greater London Authority (2020), Singapore National Population Talent Division (2022), Budget Direct Insurance (2023), Nimblefins (2023)

¹⁵ Office of Natural Resources and Environmental Planning (ONEP) (2019) *GHG Inventory*. Available at: <https://climate.onep.go.th/th/topic/database/ghg-inventory/> (Accessed: May 2023).

Table 2: Thailand GHG Emission from 2000 to 2019¹⁶

Year	Thailand's GHG Emission (MtCO _{2eq})						Net Emission (Include LULUCF)	Total Emission (Exclude LULUCF)
	Energy	Industrial Process and Product Use	Agriculture	LULUCF	Waste			
2000	165.09	21.27	49.07	-45.44	10.47	200.46	245.90	
2001	172.91	22.87	50.02	-54.44	11.28	202.64	257.08	
2002	182.32	24.94	48.69	-44.13	12.81	224.64	268.77	
2003	191.31	24.22	52.27	-45.89	14.28	236.18	282.07	
2004	208.18	26.04	51.96	-54.15	14.84	246.88	301.03	
2005	212.32	27.88	51.41	-58.34	15.17	248.44	306.78	
2006	213.02	28.77	53.87	-61.39	16.19	250.46	311.85	
2007	219.38	30.42	57.16	-68.40	16.57	255.14	323.53	
2008	221.72	28.90	59.06	-69.18	17.65	258.14	327.33	
2009	221.35	28.34	61.14	-71.20	17.46	257.09	328.29	
2010	233.11	29.96	60.69	-65.83	15.78	273.71	339.54	
2011	229.86	31.29	61.22	-74.64	14.90	262.63	337.27	
2012	242.87	33.48	64.25	-80.70	11.87	271.77	352.47	
2013	241.72	33.30	59.08	-83.11	13.98	264.96	348.08	
2014	239.74	34.82	58.00	-100.51	14.24	246.27	346.78	
2015	241.92	35.68	52.32	-87.34	16.00	258.58	345.92	
2016	254.54	37.19	52.30	-87.05	16.77	273.75	360.80	
2017	255.24	38.05	57.05	-85.38	17.67	282.64	368.02	
2018	257.34	40.12	58.49	-85.97	16.70	286.68	372.65	
2019	260.77	38.30	56.77	-91.99	16.88	280.73	372.72	

The energy sector accounted for approximately 70% of the total greenhouse gas emissions, contributing 260.77 MtCO_{2eq}, in 2019. Specifically, within the energy sector, transport was responsible for 76.92 MtCO_{2eq}, which constituted around 30% of the sector's emissions, as depicted in Figure 11.

¹⁶ ONEP (2019) *GHG Inventory*. Available at: <https://climate.onep.go.th/th/topic/database/ghg-inventory/> (Accessed: May 2023).

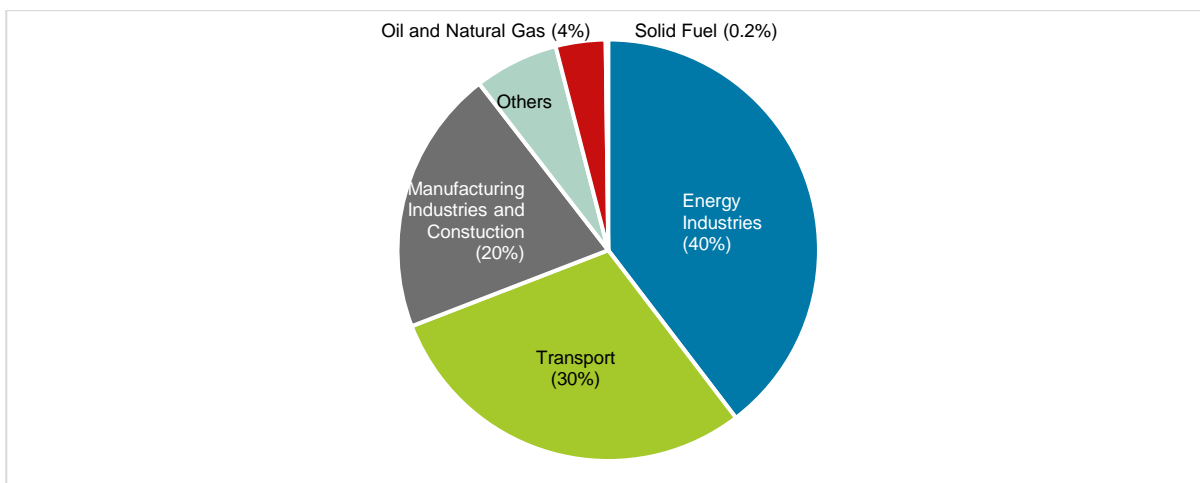


Figure 11: Thailand's GHG Emission from the Energy Sector (MtCO_{2eq})¹⁷

Further analysis of the transport sector shows that road transport played a substantial role in Thailand's emissions in 2019. A staggering 95.6% of the emissions originated from road transport, amounting to 73.57 MtCO_{2eq}. The remaining 4.4% of emissions were distributed among civil aviation (3.3%), water-borne navigation (0.7%) and railways (0.3%), as shown in Figure 12.

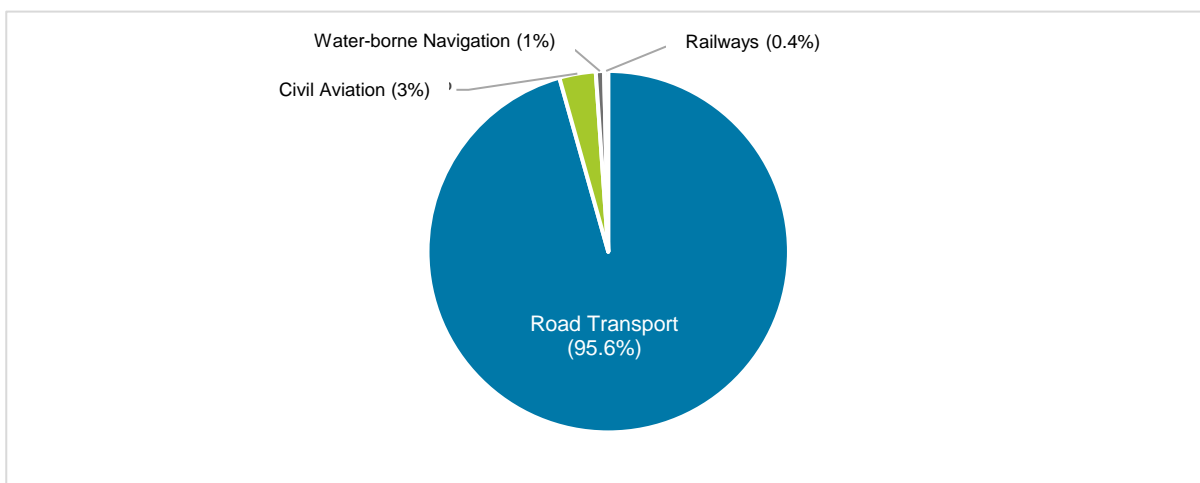


Figure 12: Thailand GHG Emission from the Transport Sector (MtCO_{2eq})¹⁸

During the COP26, Thailand pledged to achieve carbon neutrality by 2050 and net-zero greenhouse gas (GHG) emissions by 2065¹⁹. The pathways towards these goals can be visualized in Figure 13 and Figure 14. Notably, according to the pathways, Thailand is expected to reach the peak of GHG emissions from the energy sector in 2025 and it is the sector that needs to make the biggest reduction if Thailand is to achieve its goals.

¹⁷ ONEP (2022) *Thailand's Fourth Biennial Update Report*. Available at: https://www.onep.go.th/ebook/climate/Thailand_BUR4_final_28122022.pdf (Accessed: May 2023).

¹⁸ ONEP (2022) *Thailand's Fourth Biennial Update Report*. Available at: https://www.onep.go.th/ebook/climate/Thailand_BUR4_final_28122022.pdf (Accessed: May 2023).

¹⁹ Carbon neutrality plan aims for CO₂ emission offset with LULUCF to 0 in 2050. The net-zero GHG plan aims for all GHG emission offset with LULUCF to 0 in 2065.

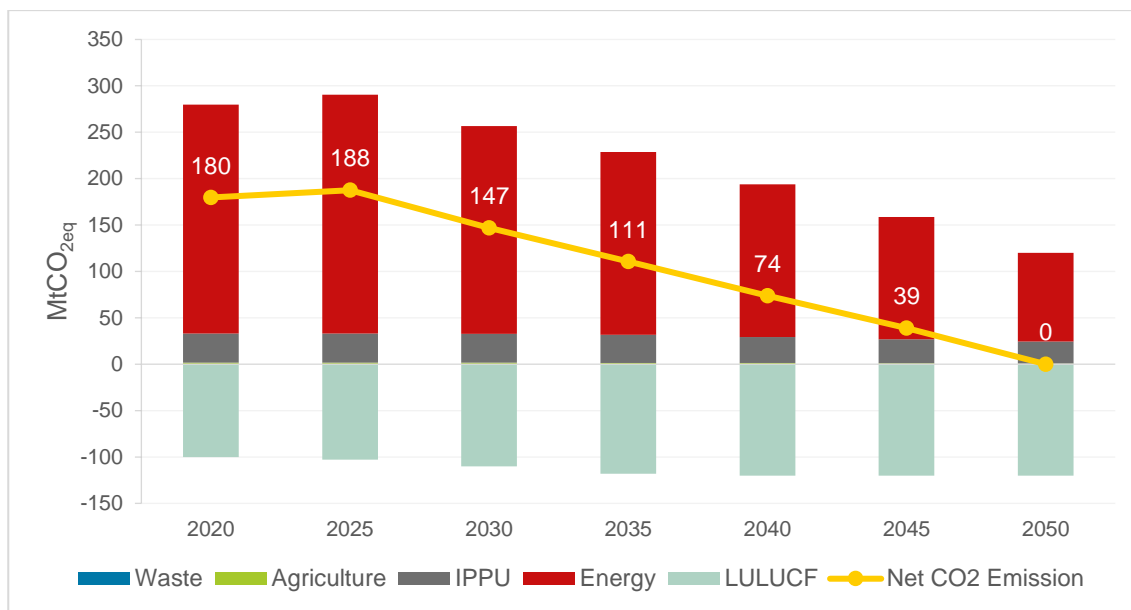


Figure 13: Pathway Toward Carbon Neutrality in 2050²⁰

Table 3: Pathway Toward Carbon Neutrality in 2050²⁰

Year	Waste	Agriculture	IPPU	Energy	LULUCF	Net CO ₂ Emission
2020	0.26	1.4	31.43	246.56	-100	180
2025	0.24	1.4	31.43	257.44	-103	188
2030	0.24	1.4	31.16	224	-110	147
2035	0.24	1.25	30.31	196.89	-118	111
2040	0.22	1	28.19	164.3	-120	74
2045	0.2	0.75	26.03	131.8	-120	39
2050	0.18	0.5	23.82	95.5	-120	0

²⁰ ONEP, GIZ, Thammasat University (2022, 18th July) The revision and update of Thailand's Long Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's National Determined Contribution (NDC)

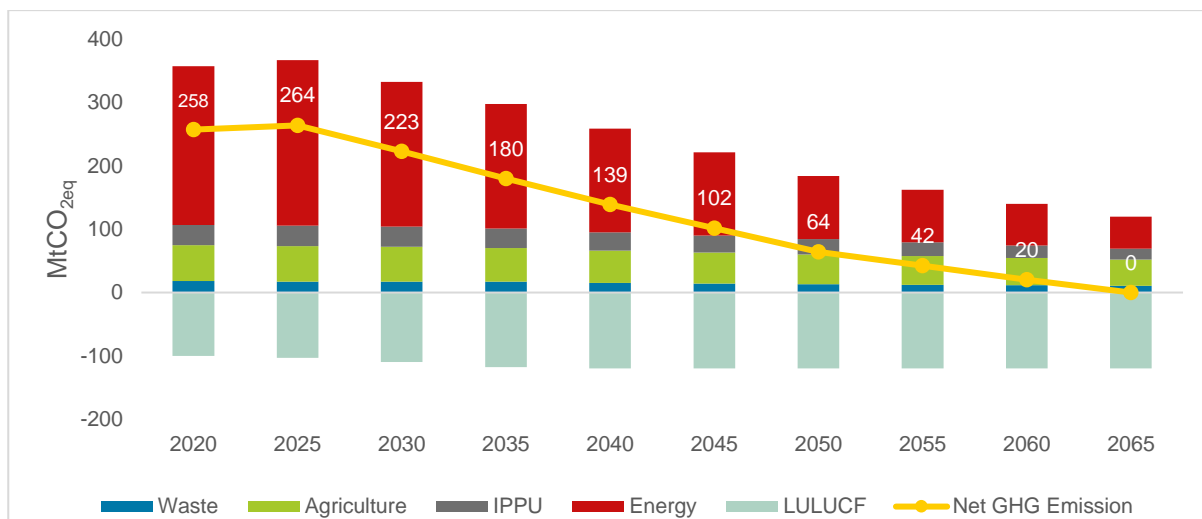


Figure 14: Pathway Toward Net Zero GHG Emission in 2065²⁰

Table 4: Pathway Toward Net Zero GHG Emission in 2065²⁰

Year	Waste	Agriculture	IPPU	Energy	LULUCF	Net GHG Emission
2020	18	57	32	250.77	-100	257.77
2025	17.17	56.23	32.17	261.62	-103	264.19
2030	17.39	55.07	31.9	228.63	-110	222.99
2035	17.19	53.09	31.03	196.77	-118	180.08
2040	15.37	51.11	28.86	163.84	-120	139.18
2045	14.19	49.13	26.65	131.8	-120	101.77
2050	13.07	47.15	24.39	99.48	-120	64.09
2055	12.33	45.17	22.06	82.81	-120	42.37
2060	11.58	43.19	19.69	65.81	-120	20.27
2065	10.84	41.2	17.28	50.69	-120	0

Additionally, Thailand has also pledged to enhance its Nationally Determined Contribution (NDC), increasing the conditional target from 25% to 40% by 2030. The revised NDC target requires a reduction in total emissions from all sources from 555 MtCO_{2eq} in a business-as-usual (BAU) scenario to 333 MtCO_{2eq} in 2030, as depicted in Figure 15.

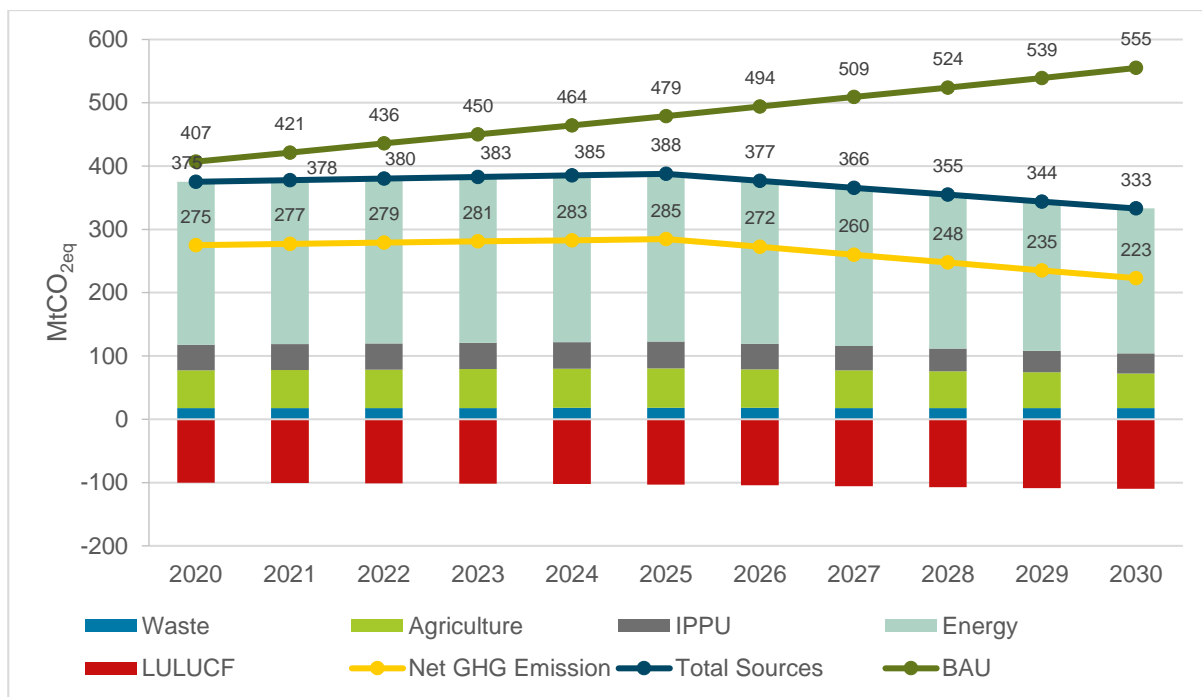


Figure 15: New NDC Action Plan (40% Reduction in 2030)²¹

Table 5: New NDC Action Plan (40% Reduction in 2030)²¹

Year	Waste	Agriculture	IPPU	Energy	LULUCF	Net GHG Emission	Total Sources	BAU
2020	17.56	59.68	40.7	257.34	-100	275	375	407
2021	17.66	60.25	41.06	258.8	-100.6	277	378	421
2022	17.75	60.82	41.41	260.26	-101.2	279	380	436
2023	17.84	61.39	41.77	261.72	-101.8	281	383	450
2024	17.94	61.97	42.13	263.19	-102.4	283	385	464
2025	18.03	62.54	42.49	264.65	-103	285	388	479
2026	17.9	61.04	40.37	257.44	-104.4	272	377	494
2027	17.78	59.55	38.25	250.24	-105.8	260	366	509
2028	17.65	58.06	36.13	243.04	-107.2	248	355	524
2029	17.52	56.56	34.02	235.84	-108.6	235	344	539
2030	17.39	55.07	31.9	228.63	-110	223	333	555

²¹ Data from ONEP in 2023

As of the time of the publication of this Scoping Study, the draft revision of the NDC Action Plan for the transport sector, which is in line with the new conditional target of 40% emissions reduction by 2030, is not yet officially approved by the cabinet. Once the plan is officially approved, the mitigation potential of the transport sector will be 45.61 MtCO₂eq in 2030 with most of the mitigation potential comes from electrification of transport and energy efficiency improvement, as shown in Table 6.

Table 6: Draft Version of the Revised NDC Action Plan (2021 – 2023) for the Transport Sector²²

Measures	Mitigation Potential (MtCO ₂ eq)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electrification of Transport	6.21	5.64	6.27	7.40	10.65	13.38	16.48	19.89	23.59	28.29
Energy Efficiency Improvement	4.14	4.03	4.60	5.41	6.95	8.10	9.37	10.72	12.15	13.94
Urban Mobility	0.65	0.59	0.62	0.70	0.91	1.05	1.21	1.37	1.55	1.78
Inter-urban Transport and Green Logistics	0.58	0.52	0.55	0.63	0.82	0.94	1.08	1.23	1.39	1.60
Overall	<u>11.59</u>	<u>10.78</u>	<u>12.04</u>	<u>14.14</u>	<u>19.33</u>	<u>23.47</u>	<u>28.13</u>	<u>33.21</u>	<u>38.67</u>	<u>45.61</u>

1.4. Automobile market overview

Thailand is one of the world's leading motor vehicle manufacturers. According to the International Organization of Motor Vehicle Manufacturers (OICA), Thailand ranked 10th in the world in motor vehicle production by the number of units, as shown in Figure 16. Almost all the 1.9 million motor vehicles produced in Thailand are passenger and light commercial vehicles. While many of the world's leading vehicle producing countries, such as China, USA, and Japan, also manufacture heavy trucks in large quantities, Thailand only produced 39,970 heavy trucks in 2022, according to the Thailand Automotive Institute.

²² Chulalongkorn University Academic Service Center (2023) *Strengthen Thailand's expertise to support long-term GHG mitigation planning in the transport sector (Final Report Submitted to GIZ)*, 197.

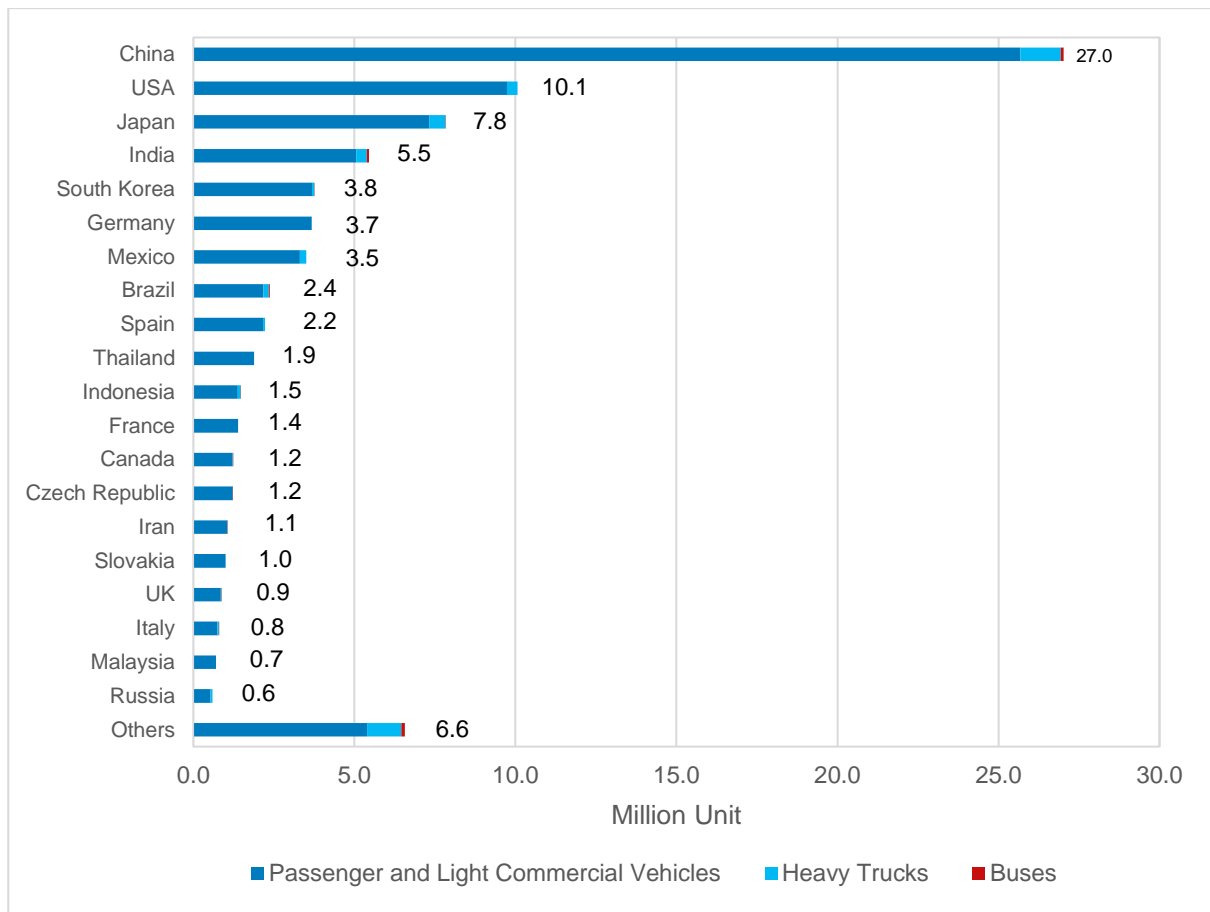


Figure 16: Global Motor Vehicle Production in 2022 (Million Unit)²³

Thailand is also one of the world's leading motorcycle manufacturers. According to the Thailand Automotive Institute, Thailand produced 2 million motorcycles in 2022, which made it rank 4th globally in motorcycle production by the number of units, as shown in Figure 17.

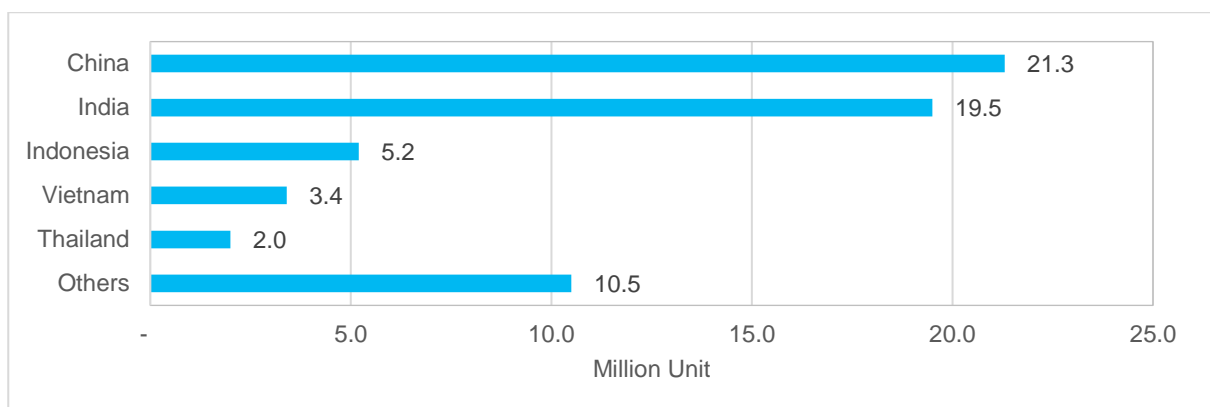


Figure 17: Global Motorcycle Production in 2022 (Million Unit)²⁴

²³ OICA (2022) *2022 Production Statistics*. Available at: <https://www.oica.net/category/production-statistics/2022-statistics/> (Accessed: June 2023).

²⁴ Author's calculation based on data from the Thailand Automotive Institute (TAI) (2022), Mega China Motor (2023), Society of Indian Automobile Manufacturers (2023), IDN Financials (2023)

1.4.1. Vehicle import

As one of the world's leading vehicle manufacturers, Thailand is a net exporter of vehicles, as illustrated in Figure 18. In 2022, Thailand exported 17,551 million EUR of passenger and light commercial vehicles while imported only 1,191 million EUR. Similarly, Thailand exported 2,777 million EUR of motorcycles and imported only 361 million EUR. Trucks and buses is the segment where Thailand is a net importer. In 2022, Thailand imported 795 million EUR of trucks and buses while it did not have any export.

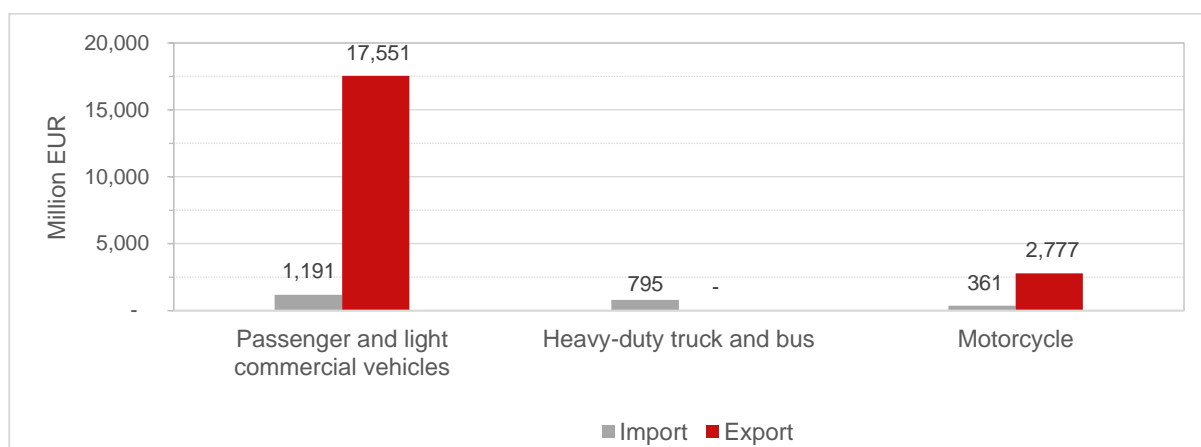


Figure 18: Thailand's Vehicle Import and Export Value in 2022 (Million EUR)²⁵

According to the International Trade Centre, Thailand imported the majority of its passenger and light commercial vehicles from China, Indonesia, Japan, Malaysia and Germany, as shown in Table 7. The country imported the majority of its heavy-duty trucks from China and Indonesia, its buses from South Korea, and its motorcycles from Vietnam. There is a notable trend in the passenger vehicle segment, where China's share in Thailand's imports increased from 1% in 2015 to 26% in 2022, as depicted in Figure 19. The trend was driven by Thailand's import of battery electric vehicles (BEV) from China, which rose from 0 EUR in 2015 to 59.3 million EUR in 2021 and to 397.5 million EUR in 2022, as shown in Figure 20, after the roll out of subsidies and incentives by the government in early 2022.

²⁵ Author's calculation based on data from the TAI (2022). The historical USD to EUR exchange rate in 2022 comes from www.exchange-rates.org.

Table 7: Thailand's Vehicle Import by Country of Origin (%)^{26 27}

Passenger Vehicle and Light Commercial Vehicle		Heavy Duty Truck		Bus		Motorcycles	
China	24%	China	37%	South Korea	73%	Viet Nam	57%
Indonesia	20%	Indonesia	28%	Indonesia	10%	Indonesia	29%
Japan	16%	Singapore	13%	Singapore	7%	Japan	6%
Malaysia	12%	Japan	11%	Japan	6%	China	3%
Germany	9%	India	3%	China	1%	Philippines	1%
Others	20%	Others	8%	Others	2%	Others	3%

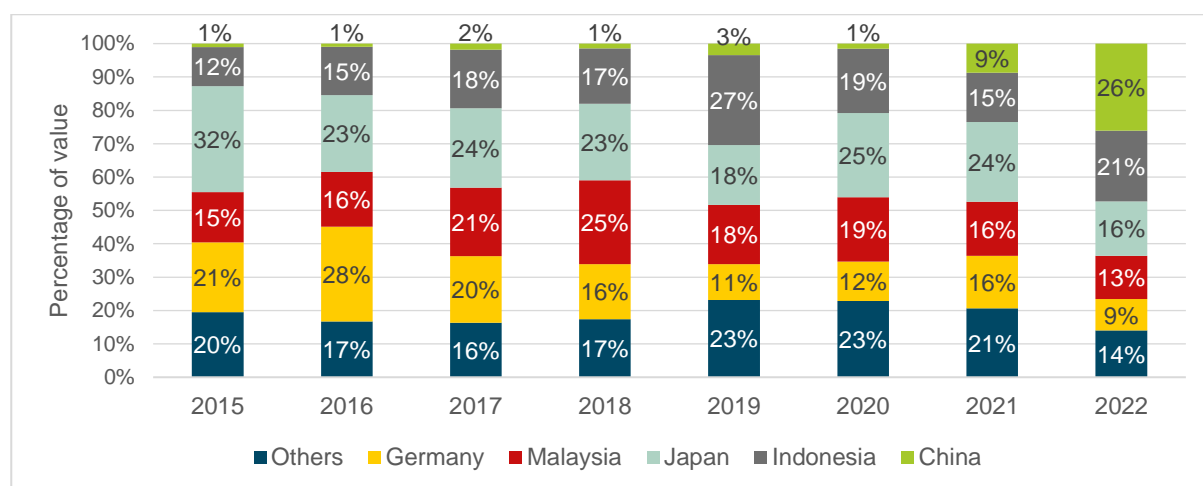


Figure 19: Thailand Passenger Car Import's Country of Origin (% of Value)^{26 28}

²⁶ Author's calculation based on data from International Trade Centre (2023) *Trade Map: Trade statistics for international business development*. Available at: <https://www.trademap.org/> (Accessed: June 2023).

²⁷ Passenger Vehicle and Light Commercial Vehicles come from HS Code 8703 and 870421. Heavy Duty Trucks come from HS Code 8704 exclude 870421. Buses come from HS Code 8702. Motorcycles come from HS Code 8711.

²⁸ Passenger cars come from HS Code 8703

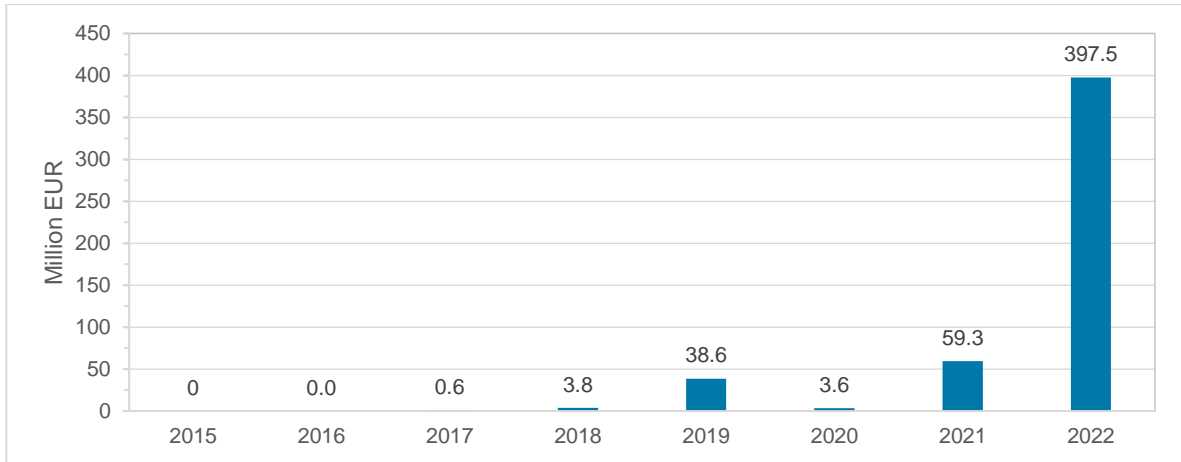


Figure 20: Thailand's BEV Import from China (Million EUR)^{26 29}

According to the Department of Land Transport (DLT), 70% of the cars sold in Thailand in 2022 are used cars, as shown in Figure 21. For the used cars, the number of units sold per year ranged from 1.78 million units to 2.51 million units during 2018 to 2022. For the passenger and light commercial vehicles, new car sales by the number of units ranged from 0.78 million units to 1.01 million units over the same time span.

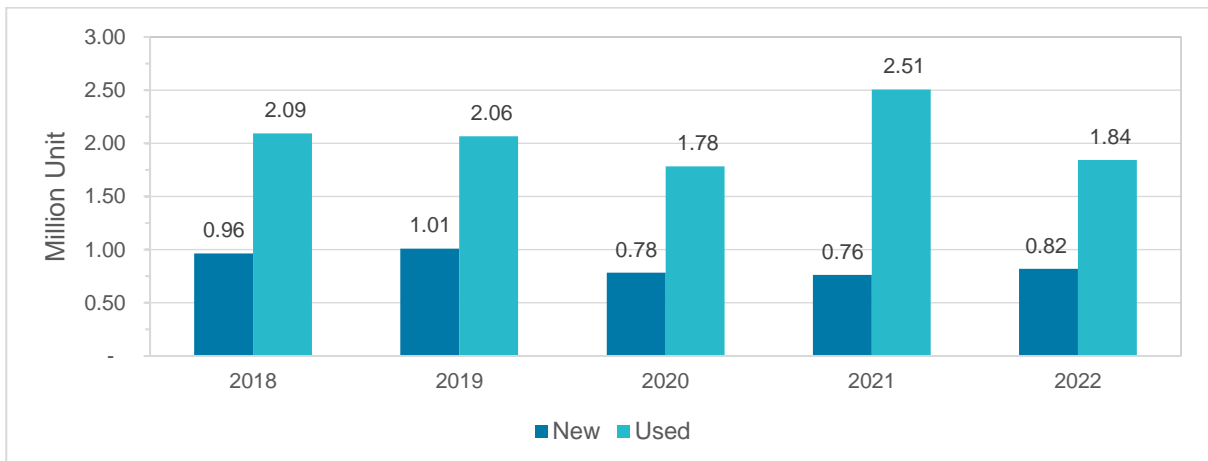


Figure 21: Passenger and Light Commercial Vehicle First-Handed and Second-Handed Sales Comparison (Million Unit)³⁰

As for the 2W & 3W segment, the number of new units sold from 2018 to 2022 ranged from 1.55 million units to 1.79 million while the number of used units sold during the same time span ranged from 1.23 million units to 1.31 million, as shown in Figure 22. Although the number of new units sold per year for the 2W & 3W segment was higher, it can be inferred that a large portion of 2W & 3W on the road in Thailand are used vehicles as well.

²⁹ BEVs come from HS Code 870380

³⁰ DLT (2022) *Transportation Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: June 2023).

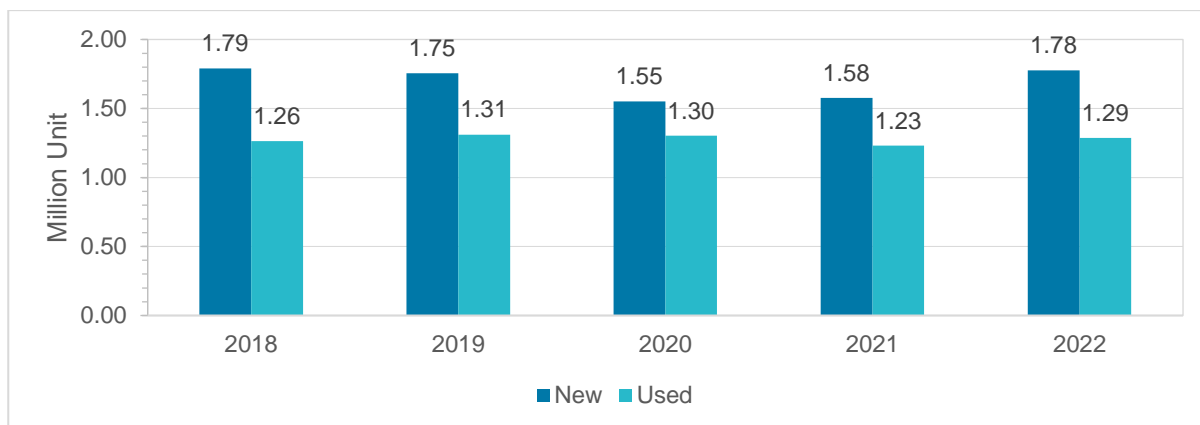


Figure 22: 2W & 3W First-Handed and Second-Handed Sales Comparison (Million Unit)³¹

It is also noted that Thailand has banned the import of used cars according to the Announcement of the Ministry of Commerce on 12th June 2019 designating Used Vehicles as Prohibited Goods or Goods that Requires Approval Before Importing into the Kingdom B.E. 2562 (2019)³². The ban is enacted to prevent pollution caused by used vehicles. Therefore, unlike in many developing countries that are vehicle importers, the import of used cars is not one of the main contributors of the GHG emission in the transport sector.

1.4.2. Local vehicle production & export

According to the Thailand Automotive Institute, from the 1.9 million motor vehicles produced in Thailand shown in Figure 16, 594,057 units are passenger cars, 1,242,658 units are pickup trucks, and 6,782 units are vans. Thailand only produced 48 buses and 39,970 trucks in 2022, as shown in Table 8.

Table 8: Vehicle Production in Thailand by Segment from 2018 to 2022³³

Vehicle Type		2018	2019	2020	2021	2022
Passenger and Light Commercial Vehicle	Passenger Car	877,015	795,254	537,834	594,690	594,057
	Pickup Truck	1,250,483	1,178,026	861,553	1,050,202	1,242,658
	Van	7,594	9,086	4,804	5,154	6,782
Heavy Duty Vehicles	Bus	529	259	237	29	48
	Truck	32,073	31,085	22,847	35,630	39,970
2W & 3W'	Motorcycle	2,063,076	1,948,480	1,615,319	1,780,654	2,015,940

³¹ DLT (2022) *Transportation Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: June 2023).

³² Ministry of Commerce (2019) *Announcement on 12th June 2019 Designating Used Vehicles as Prohibited Goods or Goods that Require Approval Before Importing into the Kingdom B.E.2562*. Available at: <https://www.dft.go.th/th-th/Detail-Law/ArticleId/13483/13483> (Accessed: June 2023).

³³ TAI (2022) *Domestic Vehicle Production Statistics*. Available at: <https://data.thaiauto.or.th/auto/auto-stat/auto-stat-production/auto-production-volume-thai.html> (Accessed: June 2023).

The market share of domestic passenger and light commercial vehicles is illustrated in Figure 23, based on the unit of passenger and light commercial vehicle registration in 2022. From this data, Toyota has the highest market share, with 288,000 newly registered vehicles in 2022, accounting for 34% of the total newly registered vehicles in 2022. Isuzu came in second with 204,000 newly registered vehicles, which made up 24% of the market share.

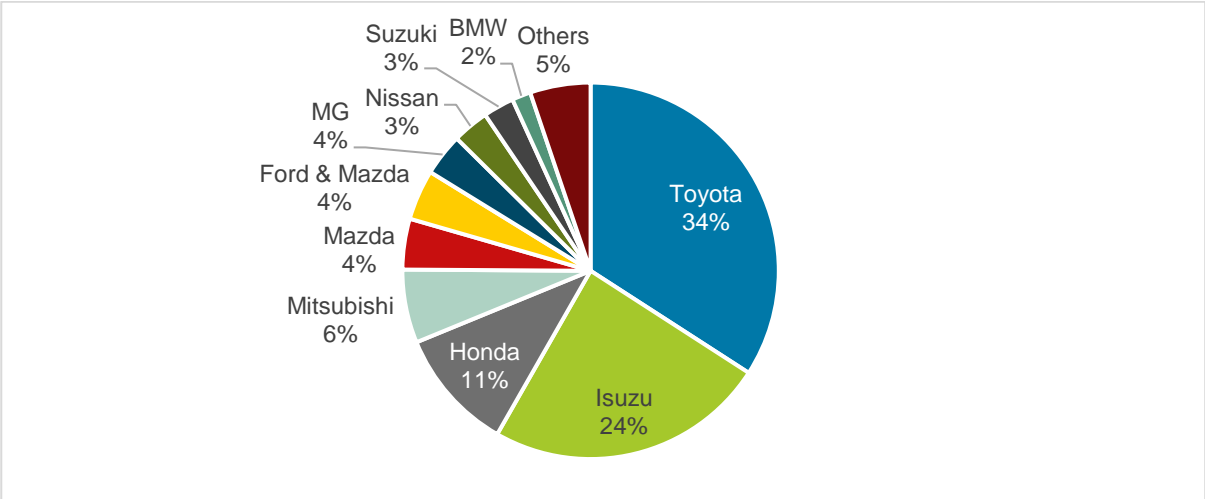


Figure 23: Passenger and Light Commercial Vehicle Registration in 2022 (%)³⁴

According to the Thailand Automotive Institute, more than half of passenger and light commercial vehicles produced in Thailand serve the export market. From 2015 to 2022, on average, 56% of passenger and light commercial vehicle sales were export sales while 44% were domestic sales, as depicted in Figure 24.

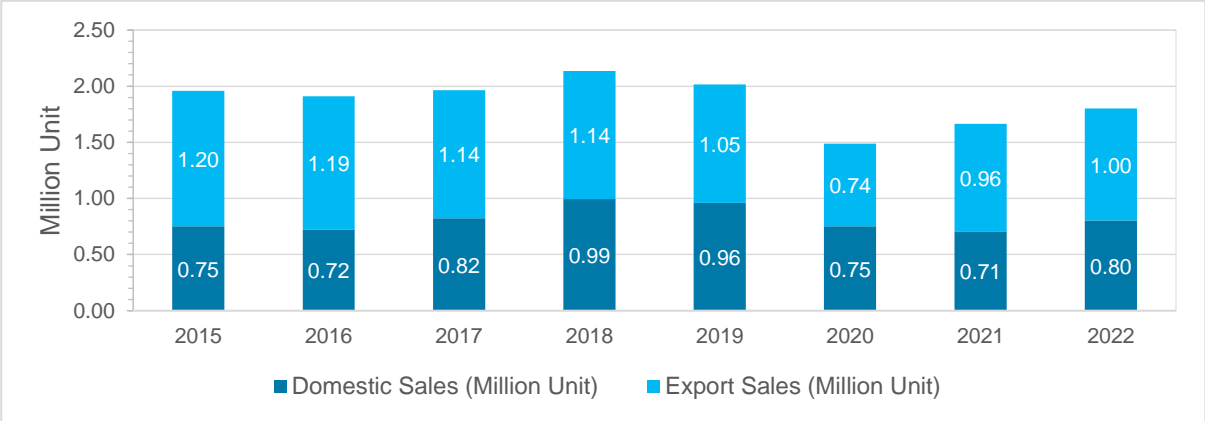


Figure 24: Thailand's Passenger and Light Commercial Vehicle Domestic and Export Comparison (Million Unit)³³

According to the International Trade Centre, Australia is the largest export destination of passenger and light commercial vehicles manufactured in Thailand. In 2022, 28% of the

³⁴ DLT (2022) *Transportation Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: June 2023).

export value came from export to Australia. The Philippines and Vietnam came in far second and third with 9% and 7% of export value respectively, as shown in Figure 25.

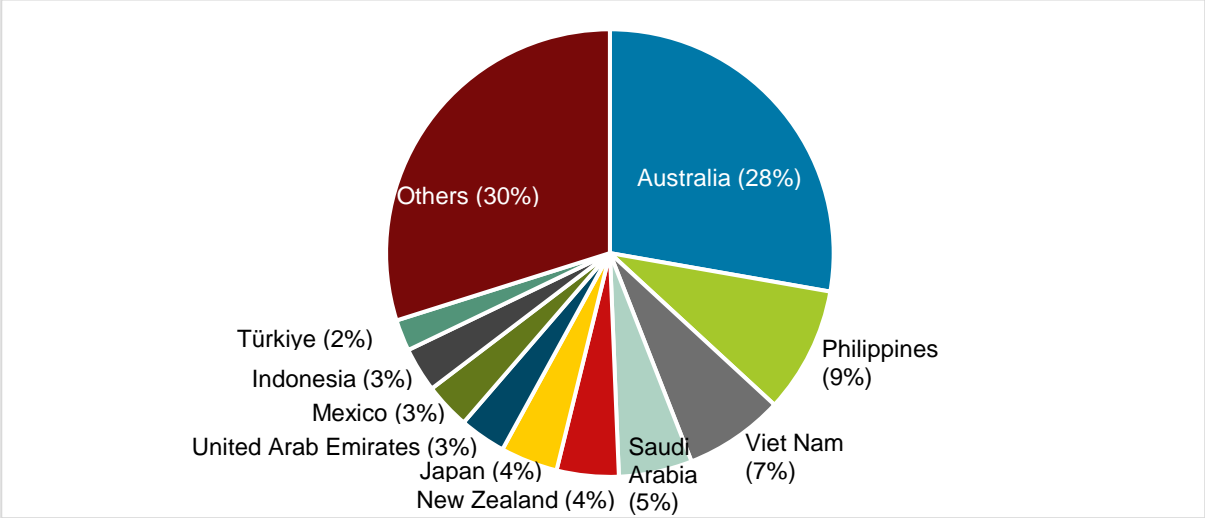


Figure 25: Passenger and Light Commercial Vehicle Export Destination in 2022 (% of Value)^{26 34}

For motorcycles, Honda accounted for 70% of the market share in 2022 with more than 1 million newly registered motorcycles. Yamaha accounted for 20% of the market with 284,000 newly registered motorcycles, as shown in Figure 26.

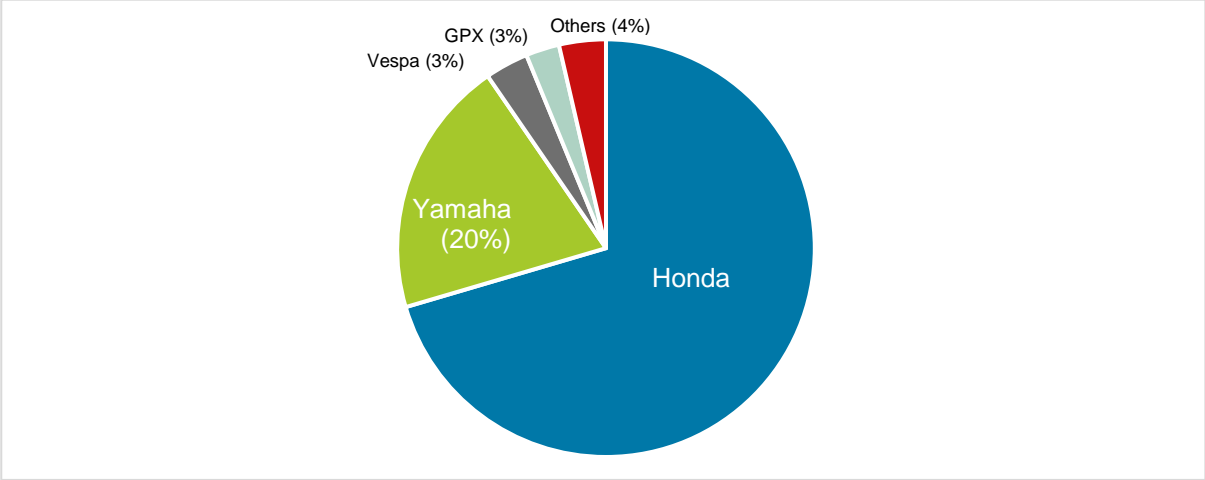


Figure 26: Motorcycle Registration in 2022 (Thousand Unit)³⁴

For the motorcycle segment, the majority of the motorcycles produced serve the domestic market. From 2015 to 2022, on average, 65% of the motorcycle sales are domestic sales, while 14% are completely-built-up (CBU) export sales and 21% are completely-knocked-down (CKD) export sales, as shown in Figure 27.

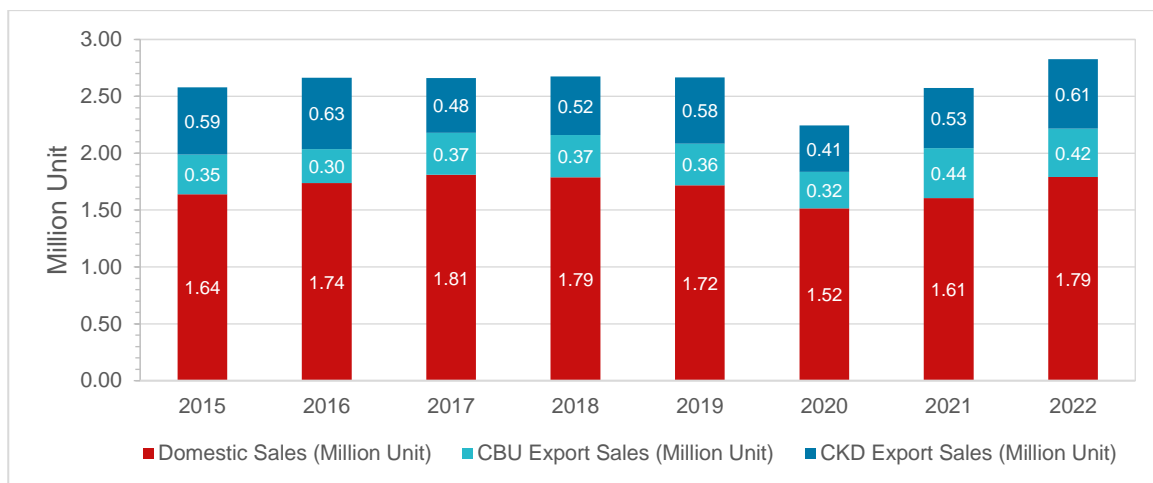


Figure 27: Thailand's Motorcycle Domestic and Export Comparison (Million Unit)³⁵

For motorcycles, Belgium was the largest export destination in 2022, accounting for 18% of the export value. China, the United States, the United Kingdom and Japan came in second, third, fourth and fifth respectively with 17%, 13%, 11% and 9% of export value respectively, as shown in Figure 28.

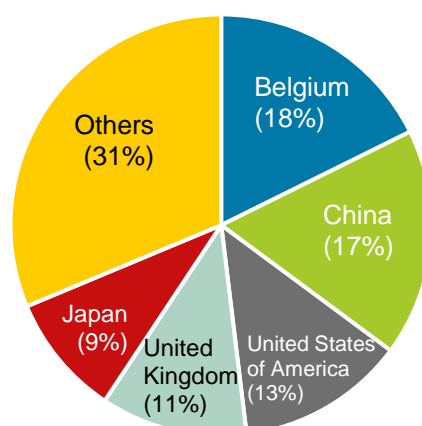


Figure 28: Motorcycle Export Destination in 2022 (% of Value)^{26 36}

1.4.3. Fleet and GHG data

In Thailand, the data on different aspects of vehicles are collected by different government agencies. The **Department for Land Transport (DLT)** is responsible for collecting vehicle fleet statistics, including data on newly registered vehicles and vehicle stock. The department also collects information on vehicle stock by age and newly registered

³⁵ TAI (2022a) *Motorcycle Export*. Available at: <https://data.thaiauto.or.th/auto/motorcycle-stat/stat-motorcycle-export/stat-motorcycle-export-volumn.html> (Accessed: June 2023). And TAI (2022b) *Domestic Motorcycle Production Statistics*. Available at: <https://data.thaiauto.or.th/auto/motorcycle-stat/stat-motorcycle-production-volumn/stat-motorcycle-production-volumn-thai.html> (Accessed: June 2023).

³⁶ Motorcycles come from HS Code 8711

vehicles by the type of fuel used. On the other hand, data on vehicle export and import, categorized by harmonized code, is collected by the **Customs Department**.

The **Thailand Automotive Institute (TAI)**, an organization affiliated with the Ministry of Industry, gathers and shares data on vehicle production, domestic sales, exports and imports in terms of the number of units. They provide valuable insights into the automotive industry in Thailand.

Thailand has its own CO₂ emissions testing regime for vehicles. Tests are carried out by the TAI or other certified technical services. The **Thai Industrial Standard Institute (TISI)** approves the test result of CO₂ emissions and fuel consumption for automotive manufacturers, but it does not transmit the results to the **Office of Industrial Economics (OIE)** which has to collect CO₂ emissions and fuel economy for “eco stickers”. The OIE collects CO₂ emissions and fuel economy data by asking vehicle manufacturers to enter the data. Then, the vehicle manufacturers have to submit the same data to the **Excise Department** to calculate the CO₂-based excise tax.

There is no official quality check on the data registered by the manufacturers, but the regulation specified that the manufacturers are responsible for the accuracy of the data provided to the OIE and that they cannot display different data to the consumers whether in the eco stickers, owner’s manuals, catalogues, marketing materials, and in communication channels of all types.³⁷

Using the data from the DLT to examine Thailand's vehicle stock by the type of fuel used, it is evident that the majority of sedans and motorcycles run on petrol. Meanwhile, vans, pickup trucks, buses and trucks primarily use diesel fuel. Taxis and other commercial cars primarily utilise natural gas. Although hybrid electric vehicles and battery electric vehicles are gaining traction, they still represent a small fraction of the passenger vehicle and motorcycle fleets, as depicted in Table 9. All in all, Thailand’s vehicle fleet still mostly runs on the traditional fossil fuel.

Table 9: Thailand's Vehicle Stock by Fuel Type as of 2022³⁰

Vehicle Type		Petrol	Diesel	Natural Gas	Electricity	Hybrid
Passenger and light commercial vehicle	Sedan	6,991,631	3,468,071	576,000	13,551	292,510
	Van	31,779	384,131	26,573	5	1
	Pickup truck	200,882	6,741,015	131,785	73	1
	Other commercial car	3,982	3,393	82,073	165	665
Heavy-duty vehicle	Bus	3,913	104,681	22,307	1,212	2
	Truck	564	942,818	27,981	26	-
2W & 3W	Motorcycles	22,255,170	-	-	16,540	9,023
	3-Wheelers	1,930	4	1,607	61	-

For the vehicle fleet that mainly relied on fossil fuel, the age of vehicles in use is a crucial determinant of greenhouse gas emissions in the transport sector. In Thailand, the average age of passenger vehicles exceeds 10 years while the average ages of buses and trucks

³⁷ Ministry of Industry (2015) *Announcement on Displaying Vehicle Information According to the International Standard on 19th August B.E. 2558*. Available at: <https://car.go.th/landing-page/news> (Accessed: June 2023).

exceed 13 years. Furthermore, a notable proportion of vehicles in use are more than 20 years old, accounting for 17% of passenger vehicles, 35% of buses, and 33% of trucks, as shown in Table 10.

Table 10: Thailand's Vehicle Stock by Age as of 31st December 2022^{38 39}

Vehicle age	Passenger and Light Commercial Vehicle	2W & 3W	Bus	Truck
Less than 1 Year	841,220	1,752,062	2,348	44,547
1 Year	733,496	1,539,542	1,433	41,600
2 Year	770,319	1,441,167	3,095	32,680
3 Year	985,611	1,650,649	6,024	42,729
4 Year	950,241	1,504,929	5,607	46,289
5 Year	874,710	1,438,096	4,891	37,834
6 Year	767,616	1,295,539	4,940	39,114
7 Year	756,963	1,170,708	5,719	37,729
8 Year	860,838	1,097,547	5,560	46,555
9 Year	1,245,639	1,234,778	5,715	65,359
10 Year	1,210,622	1,235,162	5,386	46,544
11-15 Year	3,150,998	3,811,997	19,060	147,319
16-20 Year	2,528,689	2,158,273	17,113	187,608
More than 20 Year	3,289,553	953,895	45,875	409,247
Total units	18,966,515	22,284,344	132,766	1,225,154
% above 20 Year	17%	4%	35%	33%
Average Age	>10.8	>8.0	>13.3	>13.1

When we look at the improvement in fuel economy in Thailand since the GIZ report on “Fuel Efficiency Policies in the Land Transport Sector in Thailand” was written in 2019⁴⁰, which aggregated fuel economy data from 2013 to 2018, it is noted that the automobile sector has shown a positive trend in fuel economy in almost every vehicle segment. The weighted average of fuel economy of Thailand’s passenger and light duty vehicle fleet in Thailand has improved from 6.64 to 5.99 litre/ 100km, as shown in Figure 29, if fuel economy improvement from electric vehicles is not taken into account. If the improvement from the increase in electric vehicle sales is incorporated, the average fuel economy in 2023 would be 5.40 litre/ 100 km. The improvement from electric vehicles mainly occurred in the B-Segment: Hatchback, the Premium segment, and the B-SUV segment which had penetration from electric vehicles in 2023.

³⁸ Author’s calculation based on data from DLT (2022) *Transportation Statistics*. Available at: <https://web.dlt.go.th/statistics/> (Accessed: June 2023).

³⁹ Passenger and Light Commercial Vehicles include MV1, MV2, MV3, MV5, MV6, MV9, MV10, MV11 according to the definition of the Thailand Automotive Institute. 2W & 3W include MV4, MV8, MV12, MV17

⁴⁰ GIZ (2019) *Fuel Efficiency Policies in the Land Transport Sector in Thailand, Report 3: Revised CO2-based Excise Tax with Cost-Benefit Analysis*.

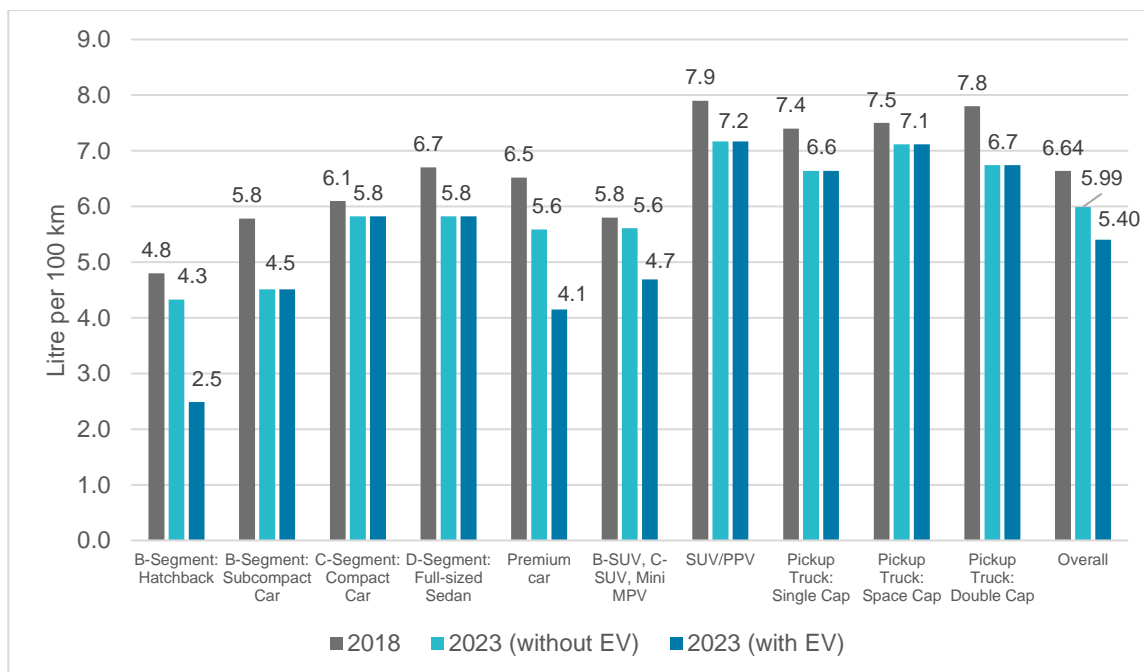


Figure 29: Fuel Economy Improvement in Thailand from 2018 to 2023 (Litres per 100 km)^{41 42}

In summary, even though Thailand already has the NDC Action Plan for the transport sector with fuel economy policies already included, it is still uncertain whether the country can successfully implement the fuel economy policies and achieve its mitigation target because implementing fuel economy policies requires inter-ministerial cooperation, engagement with private sector stakeholders, and policy measures that will disrupt the short-term economy such as fuel price increase or vehicle cost increase due to higher standards. Therefore, implementing fuel economy policies in Thailand still requires technical assistance in enhancing inter-ministerial cooperation and engagement with private sector stakeholders and studying different fuel economy policy mechanisms to design the policies that are tailored to the Thai context to ensure that they are successfully implemented.

⁴¹ Author's calculation based on data from GIZ (2019) *Fuel Efficiency Policies in the Land Transport Sector in Thailand, Report 3: Revised CO2-based Excise Tax with Cost-Benefit Analysis*.

⁴² Data from the Eco Sticker database in 2023 calculated in a similar manner to the report in 2019 by using weighted average fuel economy of each model in each segment. The models used in the calculation represents more than 90% of the market share in each segment. The report in 2019 and this report use sales volume and categorisation for marketing purpose from Headlight magazine which is not in line with official categorisation. The data from headlight also does not specify the ratio of hybrid vehicle sales in each model except for subcompact crossover. Therefore, the change in fuel economy in this chart solely represents the change in ICE vehicles.

2. Regulatory status quo in Thailand

2.1. Type approval

Thailand’s type approval regulations were revised according to the DLT’s 10-year plan on Vehicle Type Approval System Establishment Plan B.E. 2543-2552 (2000-2009) to make them in line with UNECE regulations, so the country could consider joining the UNECE World Forum for Harmonization of Vehicle Regulations (WP.29). In 2006, Thailand assented to the UNECE 1958 Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations.

In 2021, Thailand signed the ASEAN Mutual Recognition Arrangement on Type Approval for Automotive Products (APMRA). According to the APMRA, ASEAN member states shall accept the test results from the listed technical services (TS) that are authorized by the ASEAN Automotive Committee (AAC). Once a regulated automotive product is tested by a listed technical service, the product can enter the market of ASEAN member states without being subjected to re-testing, as illustrated in Figure 30. The agreement aims to create a single market and production base through regulatory harmonization and reduction of technical barriers to trade in the automotive sector. The scope of the APMRA covers 19 products, as shown in Table 11.

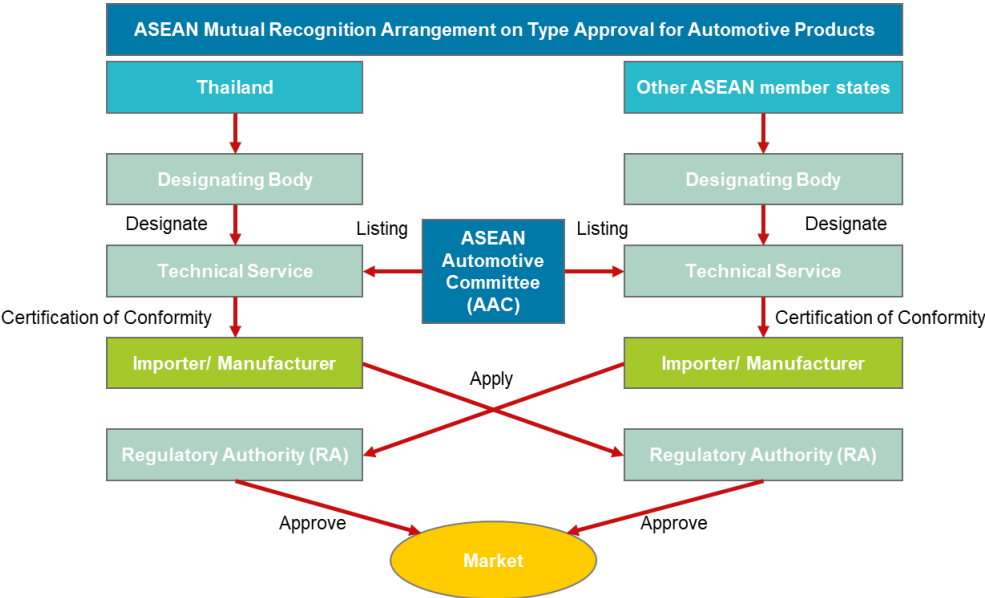


Figure 30: Cross-border Type Approval Process under APMRA⁴³

⁴³ TISI (2019) *Hearing on entering the APMRA agreement on 30th July 2019*. Available at: https://www.tisi.go.th/data/banner/pdf/ASEAN_APMRA-30Jul62rev1.pdf (Accessed: June 2023).

Table 11: Scope of Automotive Products under the APMRA⁴⁴

No.	Automotive Product	UN Regulation
1	Braking System	R13
2	Braking System	R13H
3	Safety-belt anchorage	R14
4	Safety-belt and Restraint System	R16
5	Seats	R17
6	Head Restraints	R25
7	Audible Warning Device	R28
8	Pneumatic tyre	R30
9	Speedometer	R39
10	Exhaust Emission	R40
11	Noise	R41
12	Safety Glazing Materials and their Installation	R43
13	Devices for Indirect Vision	R46
14	Exhaust Emission	R49
15	Sound Emission	R51
16	Pneumatic tyre	R54
17	Pneumatic tyre	R75
18	Steering equipment	R79
19	Exhaust Emission	R83

Key stakeholders according to the APMRA include a Designating Body (DB), a single body appointed by each member state with the responsibility to designate and monitor technical services to perform relevant conformity assessment; a Regulatory Authority (RA), an entity that exercises a legal right to control the import, use or sale of automotive products within a member state's jurisdiction and take enforcement actions; and a Technical Service (TS), a body or bodies that performs the inspection, testing and issuance of results for the automotive products.

For Thailand, the key stakeholders according to APMRA include the DLT, which serves as the RA. The Thai Industrial Standard Institute (TISI) serves as the RA and the DB, while the Thailand Automotive Institute serves as the TS.

⁴⁴ ASEAN Mutual Recognition Arrangement on Type Approval for Automotive Products (APMRA) (no date) Available at: <https://agreement.asean.org/media/download/20210205131820.pdf> (Accessed: June 2023).

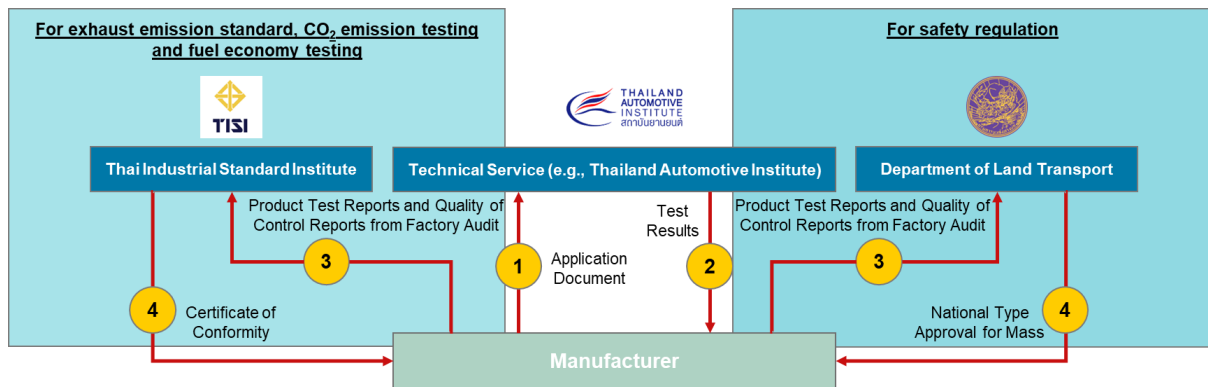


Figure 31: Steps for Vehicle Manufacturers to Get Type Approval Certificates⁴⁵

As depicted in Figure 31, manufacturers in Thailand need to get the approval from the TISI on exhaust emission standards and the DLT on safety standards before their products can be legally sold in Thailand.

Firstly, the manufacturers have to send applications to the certified technical services.⁴⁶ Secondly, the manufacturers have to send their products to the technical services for testing and the technical services will write product test reports. Thirdly, the technical services will conduct factory audit and write quality of control reports. Fourthly, the two reports will be sent to the TISI and the DLT for revision and approval. Finally, once both reports are approved, the manufacturers will obtain the certificates of conformity from the TISI and the national type approvals for mass from the DLT.

After the type approval certificates are granted, an inspection of the conformity of production can also take place. For example, if an automotive product is certified by the Thailand Automotive Institute for TIS. 2335-2550, a standard on carbon dioxide emission and fuel consumption, the manufacturer will receive the TAI MARK certificate. Then, the institute will conduct an annual factory audit to ensure conformity of production and a random product testing at least once a year.

2.1.1. Exhaust emission standards

While the DLT's regulations focus on safety, the exhaust emission and fuel consumption standards for type approval belong to the TISI. As shown in Table 12, the exhaust emission standards in Thailand mainly refers to the UNECE R83, except the TIS. 2915-

⁴⁵ Compiled from many TIS standards and announcements of the DLT

⁴⁶ The technical services that can provide test results for manufacturers to submit the TISI must be:

- Industrial product inspectors and industrial production inspectors according to Section 5 of the Industrial Product Standard Act B.E. 2511 (1968)
- Industrial product inspectors and industrial production inspectors with ISO 17025-2005 or TIS 17025-2548.

If the technical services are not under Section 5, they will require approval from the TISI.⁴⁶

The technical services that can provide test results for manufacturers to submit the DLT must be industrial product inspectors and industrial production inspectors with:

- ISO 17025-2005
- TIS 17025-2548
- ISO 17020-1998
- or TIS 17020-2542.

2561 standard for 2W & 3W, which refers to the Commission Implementing Regulation (EU) No 901/2014, and the TIS. 2320-2552 for heavy-duty vehicles, which refers to the European Community Directive 1996/96/EC amended by Directive 2001/27/EC.⁴⁷

Table 12: Examples of TIS Standards on Exhaust Emission and Fuel Consumption

TIS Standard	Vehicle Type	Topic	International Standard
2540-2554	Passenger and Light Commercial Vehicle (Petrol)	Exhaust Emission	UNECE R83
2550-2554	Passenger and Light Commercial Vehicle (Diesel)	Exhaust Emission	UNECE R83
2555-2554	Passenger and Light Commercial Vehicle (Natural Gas)	Exhaust Emission	UNECE R83
2350-2551	2W & 3W	Exhaust Emission	N/A
2915-2561	2W & 3W	Exhaust Emission	Commission Implementing Regulation (EU) No 901/2014
2315-2551	Heavy Duty Vehicle	Exhaust Emission	N/A
2320-2552	Heavy Duty Vehicle	Exhaust Emission	European Community Directive 1996/96/EC amended by Directive 2001/27/EC
2335-2550	Passenger and Light Commercial Vehicle	Carbon dioxide Emission and Fuel Consumption	UNECE R101
2560-2554	Passenger and Light Commercial Vehicle	Testing Methods for Exhaust Emission	UNECE R83

The current exhaust emission standards in Thailand, such as the TIS. 2540-2554 and the TIS. 2550-2554, still comply with the Euro 4 standard. The emission standards for carbon monoxide (CO), total hydrocarbon (THC), non-methane hydrocarbon (NMHC), nitrogen oxide (NOx), hydrocarbon and nitrogen oxide (HC+Nox) and particulate matter (PM) are shown in Table 13.

In 2019, the Thai government planned to improve the country's emission standard from Euro 4 to Euro 5 in 2021 and to Euro 6 in 2022, so the TISI drafted the TIS. 3016-2563, TIS. 3017-2563, TIS. 3018-2563 and TIS. 3019-2563. However, in 2020, the National Environmental Committee moved the deadline for the implementation of Euro 5 standard to 2024 and Euro 6 to 2025. In February 2023, the cabinet approved a resolution that the Euro 5 and Euro 6 standards will be implemented in 2024 and 2025 respectively. Passenger and light duty vehicles will skip Euro 5 in 2024 but have to comply with Euro 6 in 2025. Therefore, in 2024 and 2025, it is possible that the emission standards according to Table 14 will be in force instead of the standards in Table 13.

⁴⁷ Compiled from many TIS standards

Table 13: The Current Exhaust Emission Standard in Thailand⁴⁸

TIS Standard	Vehicle type	Reference Mass (kg) ⁴⁹	Emission from Engine (mg/km)				
			CO	THC	HC+Nox	Nox	PM
2540-2554	Passenger car (Gasoline) with GVM ⁵⁰ ≤ 2,500 kg	Unspecified	100	100		80	
	Passenger car (Gasoline) with GVM > 2,500 kg, or trucks and passenger car modified from trucks with GVM ≤ 3,500	≤ 1305	100	100		80	
		1305-1760	181	130		100	
		>1760	227	160		110	
2550-2554	Passenger car (Diesel) with GVM ≤ 2,500 kg	Unspecified	500	250	300	25	25
	Passenger car (Diesel) with GVM > 2,500 kg, or trucks and passenger car modified from trucks with GVM ≤ 3,500	≤ 1305	500	250	300	25	25
		1305-1760	630	330	390	40	40
		>1760	630	390	460	60	60

Table 14: Possible New Emission Standards for Thailand in 2024 and 2025⁵¹

TIS Standard	Vehicle Type	Reference Mass (kg)	Emission from Engine (mg/km)					(#/km)	
			CO	THC	NMHC	HC+Nox	Nox	PM	PN
3016-2563 (Euro 5) – Petrol	Passenger Vehicle	Unspecified	1000	100	68		60	4.5	
	Heavy Duty Vehicle ≤3.5t	≤ 1305	1000	100	68		60	4.5	
		1305-1760	1810	130	90		75	4.5	
		>1760	2270	160	108		82	4.5	
	Heavy Duty Vehicle 3.5-12t	Unspecified	2270	160	108		82	4.5	
3017-2563 (Euro 6) – Petrol	Passenger Vehicle	Unspecified	1000	100	68		60	4.5	6x10 ₁₂
	Heavy Duty Vehicle ≤3.5t	≤ 1305	1000	100	68		60	4.5	6x10 ₁₂
		1305-1760	1810	130	90		75	4.5	6x10 ₁₂
		>1760	2270	160	108		82	4.5	6x10 ₁₂

⁴⁸ Thai Industrial Standard Institute (TISI) (2011) *TIS. 2540-2554*. Available at: <https://www.tisi.go.th/data/standard/fulltext/TIS-2540-2554m.pdf> (Accessed: June 2023). And TISI (2011) *TIS. 2550-2554*. Available at: <https://www.tisi.go.th/data/standard/fulltext/TIS-2550-2554m.pdf> (Accessed: June 2023).

⁴⁹ Reference Mass is the mass of the vehicle in running order less the uniform mass of the driver of 75 kg and increased by a uniform mass of 100 kg.

⁵⁰ GVM or Gross Vehicle Mass is the maximum your vehicle can weigh when fully loaded as specified by the manufacturer.

⁵¹ MReport (2020) *TIS. Euro 5 and Euro 6 standard certification for production and import*. Available at: <https://www.mreport.co.th/experts/business-and-management/123-TIS-Standards-Euro-5-and-Euro-6> (Accessed: June 2023).

TIS Standard	Vehicle Type	Reference Mass (kg)	Emission from Engine (mg/km)						(#/km)
			CO	THC	NMHC	HC+Nox	Nox	PM	
	Heavy Duty Vehicle 3.5-12t	Unspecified	2270	160	108		82	4.5	6x10 ₁₂
3018-2563 (Euro 5) – Diesel	Passenger Vehicle	Unspecified	500			230	180	4.5	
	Heavy Duty Vehicle ≤3.5t	≤ 1305	500			230	180	4.5	
		1305-1760	630			295	235	4.5	
		>1760	740			350	280	4.5	
	Heavy Duty Vehicle 3.5-12t	Unspecified	740			350	280	4.5	
3019-2563 (Euro 6) – Diesel	Passenger Vehicle	Unspecified	500			170	80	4.5	6x10 ₁₁
	Heavy Duty Vehicle ≤3.5t	≤ 1305	500			170	80	4.5	6x10 ₁₁
		1305-1760	630			195	105	4.5	6x10 ₁₁
		>1760	740			215	125	4.5	6x10 ₁₁
	Heavy Duty Vehicle 3.5-12t	Unspecified	740			215	125	4.5	6x10 ₁₁

As for the standard for the testing method, the TISI has issued the TIS. 2560-2554 standard, which refers to the UNECE R83. The TIS. 2560-2554 has 5 testing types, as shown in Table 15. The testing types that require driving cycles are Type I: verifying the average exhaust emissions after a cold start, Type IV: evaporative emissions and Type V: durability of anti-pollution devices. Type I and type IV testing only require a chassis dynamometer for driving cycle testing, while Type V testing requires a chassis dynamometer as well as tracking or road testing.

Table 15: Testing Types that Driving Cycle is Prescribed⁵²

Testing Type (UNECE R83)		TIS. 2560-2554	Driving Cycle	Driving Cycle Testing Equipment
Type I	Verifying the average exhaust emissions after a cold start	✓	✓	Chassis dynamometer, Exhaust gas-sampling system, Analytical equipment, Gases, Others
Type II	Carbon monoxide emissions at idling speed	✓	✗	
Type III	Emission of crankcase gases	✓	✗	
Type IV	Evaporative emissions	✓	✓	Chassis dynamometer, Evaporative emission

⁵² Ministry of Industry. (2012, July 9). Announcement no.4417 (B.E. 2555) in accordance with the Industrial Standard Act B.E. 2511 on setting industrial standard for testing vehicle exhaust emission. *Royal Gazette, Book 129 Extra Section 108* ¶, 6.

Testing Type (UNECE R83)		TIS. 2560-2554	Driving Cycle	Driving Cycle Testing Equipment
				measurement enclosure, Fixed-volume enclosure
Type V	Durability of anti-pollution devices	✓	✓	Chassis dynamometer, Track, Road
Type VI	Verifying the average low ambient temperature carbon monoxide and hydrocarbon exhaust emissions after a cold start	×		

2.1.2. CO₂ and fuel economy testing

As for the standard on carbon dioxide emission, fuel consumption and fuel economy, Thailand has issued the TIS. 2335-2550 standard, which refers to UNECE R101. The standard indicates that if the emissions of CO₂, fuel consumption, the electric energy consumption and electric range of the vehicle type⁵³ submitted for approval pursuant to this regulation have been measured according to the conditions specified in the regulation, approval of that vehicle type shall be granted.

According to TIS. 2335-2550, the calculation of the density of CO₂ is Q_{CO2} = 1.964 g/litre. Moreover, the fuel economy data, displayed in litres per 100 km (for petrol, diesel, and LPG) or in m³ (for natural gas) are calculated by the following formulae⁵⁴:

- For vehicles with a positive ignition engine (petrol) and compression ignition engine (diesel)

$$FC = \left(\frac{0.1154}{D} \right) \times [(0.866 \times HC) + (0.429 \times CO) + (0.273 \times CO_2)]$$

- For vehicles with a positive ignition engine (LPG)

$$FC_{norm} = \left(\frac{0.1212}{0.538} \right) \times [(0.825 \times HC) + (0.429 \times CO) + (0.273 \times CO_2)]$$

- If the composition of the fuel used for the test differs from the composition that is assumed for the calculation of the normalised consumption, a correction factor cf may be applied, on the manufacturer's request, as follows:

$$FC_{norm} = \left(\frac{0.1212}{0.538} \right) \times (cf) \times [(0.825 \times HC) + (0.429 \times CO) + (0.273 \times CO_2)]$$

- For vehicles with a positive ignition engine (natural gas)

$$FC_{norm} = \left(\frac{0.1336}{0.654} \right) \times [(0.749 \times HC) + (0.429 \times CO) + (0.273 \times CO_2)]$$

⁵³ Emission of CO₂ and fuel consumption are for ICE vehicles. Electric energy consumption and electric range are for electric vehicles. Hybrid vehicles require all of these indicators to be measured.

⁵⁴ Ministry of Industry. (2007, December 6). Announcement no.3778 (B.E. 2550) in accordance with the Industrial Standard Act B.E. 2511 on setting industrial standard for passenger internal combustion engine, hybrid, and type M1 N1 electric vehicles: carbon dioxide emissions, fuel consumption, electricity consumption, and electric vehicle driving range. *Royal Gazette, Book 124 Extra Section 190* 1, 49.

Whereas:

FC = the fuel consumption in litre per 100 km (in the case of petrol, LPG or diesel) or in m³ per 100 km (in the case of natural gas)

HC = the measured emission of hydrocarbons in g/km

CO = the measured emission of carbon monoxide in g/km

CO₂ = the measured emission of carbon dioxide in g/km

D = the density of the test fuel.

$C_f = 0.825 + 0.0693 \times n_{\text{actual}}$

n_{actual} = the actual H/C ratio of the fuel used

To conduct exhaust emission test and fuel economy test, the New European Driving Cycle (NEDC), specifically the driving cycle for the Type I testing, which includes the Urban Cycle (UDC) and the Extra-Urban Cycle (EUDC) testing on chassis dynamometers, is applied. The UDC was designed to represent city driving conditions characterised by low vehicle speed, low engine load, and low exhaust gas temperature. On the other hand, the EUDC was designed to represent high speed driving conditions as the maximum speed for the cycle reaches 120 km/ hour. The UDC and the EUDC driving cycle are shown in Figure 32.

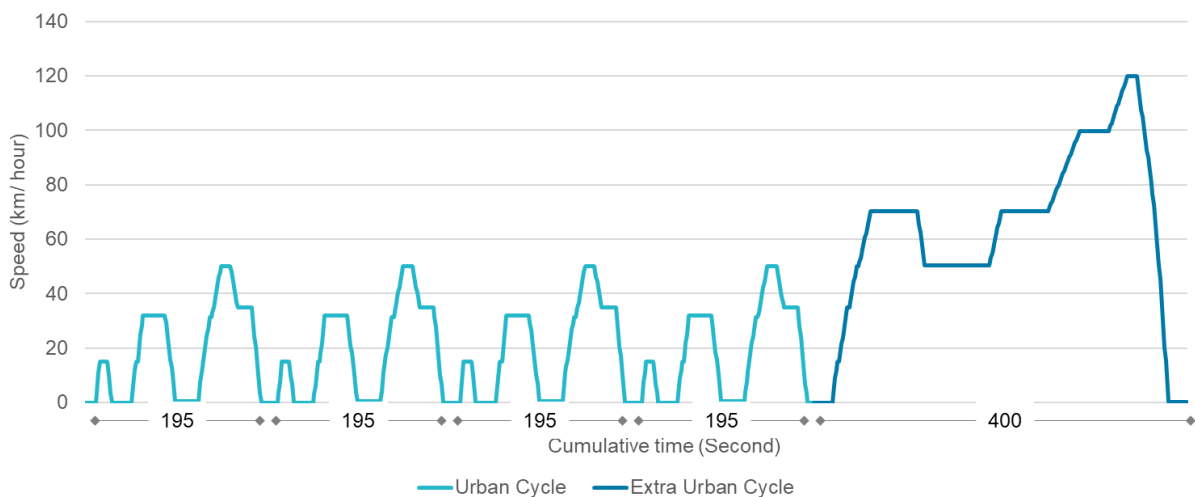


Figure 32: Driving Cycles for Fuel Economy Testing [Error! Bookmark not defined.](#)

For imported vehicles, the NEDC driving cycle also applies. The prototypes of the imported vehicles have to be tested in Thailand and approved by the TISI before the vehicles can be imported into Thailand. There is an exception for the vehicles from ASEAN countries under the APMRA agreement mentioned in Figure 31, where the vehicles can be tested in home countries.

2.2. Import regulations

According to the Announcement of the Customs Department 106/2561 on the criteria, procedure, and condition of the electronic customs clearance process for completely-built-up (CBU) vehicles, the **Customs Department** is the government agency that regulates vehicle importation, inspects vehicles according to customs procedure and shares documents electronically with the DLT through the National Single Window (NSW) systems.

At the point of vehicle importation, the Customs Department will collect the information on the brand, the year of manufacture, the chassis number, the engine number and the type of fuel. For ICE vehicles, information on the engine volume in cylinder capacity (cc) and the horsepower will be collected. For electric vehicles, electric power in watts will be collected. For hybrid vehicles, the engine volume in cylinder capacity (cc), the horsepower, and the electric power in watts will be collected. The CO₂ emission and fuel consumption data are not collected by the customs department. However, the government collects CO₂ emission and fuel consumption data of imported vehicle as a vehicle prototype for testing has to be imported and tested by TISI before the vehicle can be imported.

2.3. Vehicle registration

The vehicle registration process in Thailand is shown in Table 16. The documents needed for the registration focus on the evidence of vehicle purchase, the identity of the owner and the evidence of insurance. Prior to the registration, the vehicle has to undergo an inspection and the data will be submitted to the DLT.⁵⁵ However, there is no test on the vehicle's fuel economy.⁵⁶ This means that the DLT does not detain the information on CO₂ emission and fuel economy. The information is at the OIE in the eco sticker database.

⁵⁵ The data collected include chassis number, engine number, type of engine, type of fuel, the engine volume in cylinder capacity (cc), horsepower, number of axles, number of wheels, number of tyres, braking system, sound emission, CO emission, HC emission, exhaust emission control device, audible warning device, vehicle speed, vehicle lights, windscreen, windscreen wiper, wheel alignment, steering wheel, axles, wheel, tyre, fuel tank, pipe, suspension system, vehicle colour, number of seats, vehicle weight and vehicle carrying capacity in weight. <https://www.dlt-inspection.info/dlt/index.php?ref=inspection-works&ref2=showlawcar>

⁵⁶ DLT (n.d.) *Inspection Items*. Available at: <https://www.dlt-inspection.info/dlt/index.php?ref=inspection-works&ref2=showlawcar> (Accessed: June 2023).

Table 16: Registration Processes for New and Second-handed Vehicles⁵⁷

	New Vehicle Registration	Used Vehicle Registration
Documents Needed	<ol style="list-style-type: none"> 1. Document guaranteeing vehicle acquisition and sale 2. Document declaring the sale by manufacturers 3. Evidence of vehicle acquisition e.g. receipts, contracts 4. Evidence of vehicle insurance 5. Evidence of vehicle owner identity e.g. citizen card 	<ol style="list-style-type: none"> 1. Blue vehicle license booklet 2. Copy of citizen ID card or juristic person document and citizen ID card of the authorize director 3. Purchase contract, receipt, and tax invoice 4. Document requesting the transfer and document for receiving the transfer
Process	<ol style="list-style-type: none"> 1. Submit a registration request 2. Submit a vehicle for inspection 3. Requesting cutting from the vehicle account at DLT 4. Pay fees and annual tax 5. Receive receipt, license plate, tax sticker, and blue vehicle license booklet 	<ol style="list-style-type: none"> 1. Submit a vehicle for inspection 2. Requesting the ownership transfer and pay fees 3. Receive vehicle registration booklet, receipt, tax sticker, and license plate

If ownership of the vehicle changes, the registration process and documents needed will be as shown in Table 16. Vehicle inspection and data collected by DLT are similar to those of new vehicles. When a vehicle is de-registered, the process is also handled by the DLT, who manages the vehicle fleet database.

2.4. Taxation

2.4.1. Purchase taxes

When Thai consumers purchase a new car, they are required to pay several additional charges, including excise tax based on CO₂, tax to the Ministry of Interior (MOI) and value-added tax (VAT). Moreover, as Thailand is a major car manufacturer and exporter, the government has implemented a high import tariff on imported vehicles. This import tariff is intended to protect and promote the domestic automobile industry by making imported vehicles more expensive compared to locally produced cars.

For domestically produced vehicles, the taxes that consumers have to pay during purchase include excise tax, tax to the MOI and VAT, as shown in the following equation.

$$\text{Domestic Retail Price} = \text{Factory Price} + \text{Excise Tax} + \text{MOI Tax} + \text{VAT}$$

⁵⁷ Office of the Official Information Commission (n.d.) *Manual for Samut Songkram Province DLT Officials*. Available at: <http://www.oic.go.th/FILEWEB/CABINFOCENTER3/DRAWER012/GENERAL/DATA0000/00000061.PDF> (Accessed: June 2023).

Whereas:

$$\text{Excise Tax based on CO}_2 \text{ emission} = \frac{\text{Factory Price} \times \text{Excise Rate}}{1 - (1.1 \times \text{Excise Rate})}$$

$$\text{MOI Tax} = \text{Excise Tax} \times 0.1$$

$$\text{VAT} = (\text{Factory Price} + \text{Excise Tax} + \text{MOI Tax}) \times 0.07$$

For imported vehicles, consumers have to pay customs tariff, excise tax based on CO₂, tax for MOI, and VAT. The customs tariff is calculated from the CIF (cost, insurance, and freight) price as shown in the equation below.

$$\text{Imported Retail Price} = \text{CIF Price} + \text{Customs Tariff} + \text{Excise Tax} + \text{MOI Tax} + \text{VAT}$$

Whereas:

$$\text{Customs Tariff} = \text{CIF Price} \times 0.8$$

$$\text{Excise Tax based on CO}_2 \text{ emission} = \frac{(\text{CIF Price} + \text{Custom Tariff}) \times \text{Excise Rate}}{1 - (1.1 \times \text{Excise Rate})}$$

$$\text{MOI Tax} = \text{Excise Tax} \times 0.1$$

$$\text{VAT} = (\text{CIF Price} + \text{Custom Tariff} + \text{Excise Tax} + \text{MOI Tax}) \times 0.07$$

2.4.2. Current vehicle excise taxes based on CO₂

Prior to 2016, vehicle excise taxes were based solely on engine sizes in cubic centimetres (cc) of cylinder capacities. In 2016, Thailand started to implement vehicle excise taxes based on tailpipe CO₂ emission, but the policy still did not include CO₂ excise taxes for motorcycles⁵⁸. In 2022, the Thai government issued the current excise tax scheme for vehicles based on tailpipe CO₂ emission to further increase the incentives for vehicles with lower CO₂ emission and electric vehicles. This excise tax scheme also starts implementing CO₂ excise taxes for motorcycles.

2.4.2.1. Passenger vehicles and buses with ≤ 10 passengers

The excise taxes for passenger vehicles, as depicted in Table 17, and buses with fewer than 10 passengers, as shown in Table 18, are calculated mainly based on engine sizes and CO₂ emission. The larger the engine size and the more CO₂ the vehicle emits, the higher the excise tax rate will be for the vehicle.

A mechanism for gradual phasing is also included in the excise tax scheme. For vehicles with small engines and low CO₂ emission, the excise tax rates will gradually lower from 2022 to 2030. For example, the excise tax rate for a passenger car that emits less than

⁵⁸ Based on the Cabinet Resolution on 18th December 2012 but the policy was in effect on 1st January 2016.

100 gCO₂/km will be gradually lower from 25% in 2022 to 15% in 2030. For vehicles with large engines and high CO₂ emission, on the other hand, the excise tax rate will gradually rise. For example, the excise tax rate for a passenger car that emits more than 200 gCO₂/km and has an engine size of less than 3,000 cc will become gradually higher from 35% in 2022 to 38% in 2030.

Table 17: Excise Tax Rate for Passenger Cars (Code 06.01) under the Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565 (2022)^{59 60}

Type	Engine (cc)	Emission (gCO ₂ /km)	Tax Rate (%)								
			2022	2023	2024	2025	2026	2027	2028	2029	2030 onward
Passenger Car	≤3,000	≤100	25	25	25	25	13	13	14	14	15
		>100 to ≤120	25	25	25	25	22	22	24	24	26
		>120 to ≤150	25	25	25	25	25	25	27	27	29
		>150 to ≤200	30	30	30	30	29	29	31	31	33
	>3,000	>200	35	35	35	35	34	34	36	36	38
			40	40	40	40	50	50	50	50	50
PPV	≤3,250	≤185	20	20	20	20	18	18	18	18	18
		>185 to ≤200	20	20	20	20	20	20	20	20	20
	>3,250	>200	25	25	25	25	25	25	25	25	25
			40	40	40	40	50	50	50	50	50
PPV (Biodiesel 19-20%)	≤3,250						16	16	16	16	16
							18	18	18	18	18
							23	23	23	23	23
							50	50	50	50	50
PPV (HEV)	≤3,250	≤175	18	18	18	18					
PPV (PHEV)							10	10	10	10	10

⁵⁹ Ministry of Finance (2022) *Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565*. Available at: https://webdev.excise.go.th/act2560/files/legal/T_0001_1.PDF (Accessed: June 2023).

⁶⁰ Tax rates from Table 17 to Table 20 from 2026 to 2030 are for vehicles with Advance Driver Assistance System (ADAS). If the vehicles do not have ADAS, the tax rates will be increased.

Table 18: Excise Tax Rate for Buses with Fewer than 10 passengers (Code 06.02) under the Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565 (2022)⁶¹

Type	Engine (cc)	Emission (gCO ₂ /km)	Tax Rate (%)								
			2022	2023	2024	2025	2026	2027	2028	2029	2030 onward
Bus with ≤ 10 passengers	≤3,000	≤100	25	25	25	25	13	13	14	14	15
		>100 to ≤120	25	25	25	25	22	22	24	24	26
		>120 to ≤150	25	25	25	25	25	25	27	27	29
		>150 to ≤200	30	30	30	30	29	29	31	31	33
		>200	35	35	35	35	34	34	36	36	38
	>3,000	40	40	40	40	50	50	50	50	50	

For HEVs, PHEVs, BEVs, FCEVs (fuel cell vehicles), eco cars and cars fuelled by ethanol ≥ 85% or natural gas, the same excise tax rates will apply to both passenger vehicles and buses with fewer than 10 passengers. As shown in Table 19, the low excise tax rates to incentivise HEVs, eco car and cars fuelled by ethanol ≥ 85% or natural gas will phase out in 2025. The low excise tax rates for PHEVs will be in place in 2026. Similarly, the low excise tax rate of 1%, a decrease from 8% in 2022 to 2025, to incentivise fuel cell vehicles will also be in place in 2026, while the excise tax rate for BEVs is fixed at 2%.

Table 19: Excise Tax Rate for Passenger Cars (Code 06.01) and Buses with Fewer than 10 Passengers (Code 06.02) under the Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565 (2022)⁶¹

Type	Engine (cc)	Emission (gCO ₂ /km)	Tax Rate (%)								
			2022	2023	2024	2025	2026	2027	2028	2029	2030 onward
HEV	≤3,000	≤100	8	8	8	8	6	6	8	8	10
		>100 to ≤120	16	16	16	16	9	9	11	11	13
		>120 to ≤150	16	16	16	16	14	14	16	16	18
		>150 to ≤200	21	21	21	21	19	19	21	21	23
		>200	26	26	26	26	24	24	26	26	28
	>3,000	40	40	40	40	40	40	40	40	40	
HEV with BOI	≤3,000	≤100	4	4	4	4					
		>100 to ≤150	8	8	8	8					

⁶¹ Ministry of Finance (2022) Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565. Available at: https://webdev.excise.go.th/act2560/files/legal/T_0001_1.PDF (Accessed: June 2023).

Type	Engine (cc)	Emission (gCO ₂ /km)	Tax Rate (%)								
			2022	2023	2024	2025	2026	2027	2028	2029	2030 onward
		>150 to ≤200	10.5	10.5	10.5	10.5					
		>200	13	13	13	13					
PHEV (≥80km/charge, fuel tank ≤ 45 litres)	≤3,000						5	5	5	5	5
PHEV (<80km/charge, fuel tank ≥ 45 litres)	≤3,000						10	10	10	10	10
PHEV	>3,000						30	30	30	30	30
BEV			2	2	2	2	2	2	2	2	2
BEV with BOI			0	2	2	2					
Fuel Cell Vehicle			8	8	8	8	1	1	1	1	1
Eco Car	≤1,300		14	14	14						
	≤1,400		14	14	14						
	≤1,300	100	12	12	12	12					
	≤1,500	100	12	12	12	12					
Eco Car (Ethanol ≥85%)	≤1,300	100	10	10	10	10					
Eco Car (Biodiesel 10%)	≤1,500	100	10	10	10	10					
Ethanol ≥85%		≤150	20	20	20	20					
	≤3,000	>150 to ≤200	25	25	25	25					
		>200	30	30	30	30					
	>3,000		40	40	40	40					
Natural Gas		≤150	20	20	20	20					
	≤3,000	>150 to ≤200	25	25	25	25					
		>200	30	30	30	30					
	>3,000		40	40	40	40					

2.4.2.2. Pickup trucks

As shown in Table 20, excise tax rates for pickup trucks are extremely low compared to the rates for passenger vehicles even though the engines of pickup trucks are larger and they emit more CO₂ emission. The highest excise tax rate for pickup trucks is only 13%, compared to the highest excise tax rate for passenger vehicles at 50%. The 13% excise tax rate is for pickup trucks that emit more than 200 gCO₂/ km. This rate is almost equal to eco cars that emit less than 100 gCO₂/ km. There are two reasons why excise tax rates for pickup trucks are low. First, pickup trucks are one of the country's main export products or the "product champions" of the country. As shown in Table 8: Vehicle Production in

Thailand by Segment from 2018 to 2022, in the first chapter, the pickup truck segment has the highest share of production volume in the country. Second, the low-income population in the country, especially in rural areas or in the agricultural sector, heavily relies on pickup trucks. The increase in excise tax rates for pickup trucks will impact the cost of living for these vulnerable populations.

Table 20: Excise Tax Rate for Pickup Trucks (Code 06.03) under the Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565 (2022)⁶¹

Cap	Engine (cc)	CO ₂ Emission (g/km)	PM Emission (g/km)	Fuel	Tax Rate (%)									
					2022	2023	2024	2025	2026	2027	2028	2029	2030 onward	
No cap	≤3,250	≤200	≤0.005		2	2	2	2						
				Biodiesel 19-20%	2	2	2	2						
			>0.005		2.5	2.5	2.5	2.5						
					3	3	3	3						
		>200	≤0.005		Biodiesel 19-20%	3	3	3	3					
						3	3	3	3					
			>0.005			4	4	4	4					
			≤185							3	3	3	3	3
			>185 to ≤200							4	4	4	4	4
			>200							5	5	5	5	5
			≤185		Biodiesel 19-20%					2	2	2	2	2
	>185 to ≤200		Biodiesel 19-20%					3	3	3	3	3		
	>200		Biodiesel 19-20%					4	4	4	4	4		
Space cap	≤3,250	≤200	≤0.005		3	3	3	3						
				Biodiesel 19-20%	3	3	3	3						
			>0.005		4	4	4	4						
		>200	≤0.005		Biodiesel 19-20%	5	5	5	5					
						5	5	5	5					
			>0.005			6	6	6	6					
			≤185							4	4	4	4	4
			>185 to ≤200							6	6	6	6	6
			>200							8	8	8	8	8
			≤185		Biodiesel 19-20%					3	3	3	3	3

Cap	Engine (cc)	CO ₂ Emission (g/km)	PM Emission (g/km)	Fuel	Tax Rate (%)												
					2022	2023	2024	2025	2026	2027	2028	2029	2030 onward				
		>185 to ≤200		Biodiesel 19-20%					4	4	4	4	4				
		>200		Biodiesel 19-20%					7	7	7	7	7				
			≤0.005		9	9	9	9									
		≤200		Biodiesel 19-20%	9	9	9	9									
			>0.005		10	10	10	10									
			≤0.005		12	12	12	12									
		>200		Biodiesel 19-20%	12	12	12	12									
			>0.005		13	13	13	13									
		≤185							8	8	8	8	8				
		>185 to ≤200							10	10	10	10	10				
		>200							13	13	13	13	13				
		≤185		Biodiesel 19-20%					6	6	6	6	6				
		>185 to ≤200		Biodiesel 19-20%					9	9	9	9	9				
		>200		Biodiesel 19-20%					12	12	12	12	12				
Double cap	≤3,250	≤175	≤0.005	HEV	6	6	6	6									
		≤175		HEV, Biodiesel 19-20%	6	6	6	6									
		≤175	>0.005	HEV	8	8	8	8									
				PHEV						5	5	5	5	5			
				BEV						0	0	0	0	0			
				BEV (Other than designated by the Director)						10	10	10	10	10	10		
				Fuel Cell						0	0	0	0	1	1	1	1
				Fuel Cell (Other than designated by the Director)						5	5	5	5	5	5	5	

2.4.2.3. Motorcycles

For motorcycles, the excise tax rates are lower for vehicles that emit lower emission and higher for vehicles that emit higher emission. However, excise tax rates for every segment of the ICE/HEV motorcycles will gradually increase from 2022 to 2030, as shown in Table 21, while the excise tax rate will be constantly low for electric motorcycles.

Table 21: Excise Tax Rate for Motorcycles (Code 07.01) under the Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565 (2022)61

Type	Emission (gCO ₂ /km)	Tax Rate (%)								
		2022	2023	2024	2025	2026	2027	2028	2029	2030 onward
ICE/ Hybrid	≤ 50	3	3	3	3	4	4	4	4	5
	>50 to ≤ 90	5	5	5	5	6	6	6	6	10
	>90 to ≤ 130	9	9	9	9	10	10	10	10	15
	> 130	18	18	18	18	20	20	20	20	25
EV < 48 Volt		0	0	0	0	0	0	0	0	0
EV ≥ 48 Volt as specified by the Director of Excise Department		1	1	1	1	1	1	1	1	1
EV ≥ 48 Volt (others)		5	5	5	5	10	10	10	10	10

The current tax scheme is making BEVs more competitive against ICE vehicles. As exemplified in Table 22, a domestically produced ICE vehicle with less than 3,000 cc and that emits 150 gCO₂/km will have an excise tax rate of 25%, according to Table 17. On the contrary, BEV vehicle will have an excise tax rate of only 2%, according to Table 19. With the same manufacturer's suggested retail price of 1,000,000 THB, the ICE vehicle will be priced at 1,475,862 THB after tax, while the BEV vehicle will be priced at 1,094,070 THB after tax.

Table 22: Example of After-Tax Price Comparison for Domestic ICE Vehicles and BEVs⁶²

Unit: THB	Domestic ICE Vehicle (≤ 3,000 cc, 150 gCO ₂ /km)	BEV
Manufacturer's Suggested Retail Price (MSRP)	1,000,000	1,000,000
Excise Tax	344,828	20,450
MOI Tax	34,483	2,045
VAT	96,552	71,575
Overall	1,475,862	1,094,070

As of now, most of the BEVs sold in Thailand are imported vehicles that receive government's subsidies. The manufacturers will get the subsidy under a condition that they have to start producing the vehicles locally in 2024 or 2025. Apart from the government reducing the customs tariff of BEVs from 80% to 40%, many of the BEVs in Thailand are imported from China, which has a free trade agreement (FTA) with Thailand, so the customs tariff of BEVs can be as low as 0%. The reduction in customs tariff rate combined with the excise tax rate of 2% for BEVs can make the imported BEVs much more competitive, compared to the imported ICE vehicle with the same CIF price. As shown in Table 23, for imported vehicles with equal CIF price 1,000,000 THB, the after tax price of ICE vehicles can be 2,656,552 THB, while the after tax price of a BEV can be 1,531,697 THB, 42% lower than the ICE vehicle price. An after-tax price of a BEV with FTA can be 1,094,070 THB, 59% lower than the ICE vehicle price. The competitive price after tax below still has not factored in the direct subsidy from the government.

Table 23: Example of After-Tax Price Comparison of Imported ICE Vehicles and BEVs⁶²

Unit: THB	Imported ICE Vehicle (≤ 3,000 cc, 150 gCO ₂ /km)	BEV	BEV (with FTA)
CIF Price	1,000,000	1,000,000	1,000,000
Customs Tariff	800,000	400,000	0
Excise Tax	620,690	28,630	20,450
MOI Tax	62,069	2,863	2,045
VAT	173,793	100,204	71,575
Overall	2,656,552	1,531,697	1,094,070

⁶² Author's calculation based on information from Ministerial Regulation on Ministry of Finance (2022) Ministerial Regulation on Excise Tax Rate (No. 23) B.E. 2565. Available at: https://webdev.excise.go.th/act2560/files/legal/T_0001_1.PDF (Accessed: June 2023).

As shown in Figure 33, the number of new BEVs registered skyrocketed after the cabinet resolution on 15th February 2022 adopted policy recommendations from the National Electric Vehicle Policy Committee (EV Board) to provide subsidies and reduce customs tariffs and excise taxes. In 2022 alone, the number of new BEVs was higher than the numbers from 2015 to 2021 combined. In 2023, the number of newly registered passenger BEVs increased by eight times from the number in 2022.

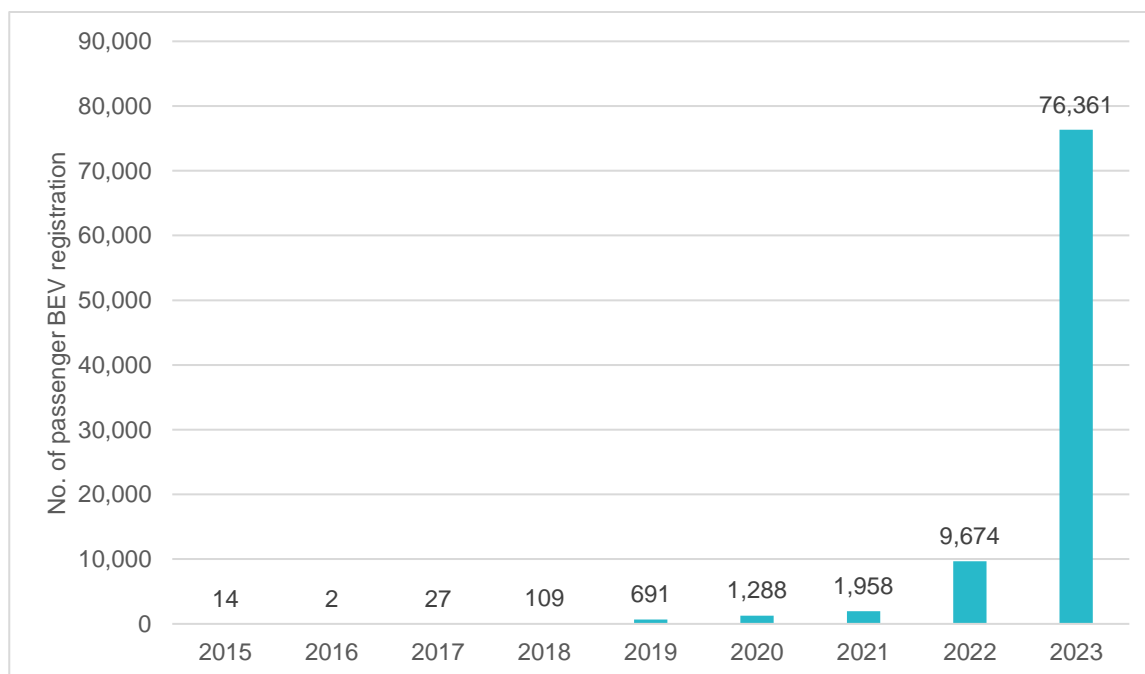


Figure 33: Number of New BEV Registration in Thailand from 2015 to 2023⁶³

2.4.3. Registration fees

At vehicle registration, the vehicle owners have to pay the following fees:

- Request fee: 5 THB
- License plate fee: 200 THB (100 THB per plate)
- Blue vehicle registration booklet fee: 100 THB
- Vehicle inspection fee: 50 THB (10 THB for motorcycles)
- Annual taxes (Details are shown in 2.4.4.)
- Vehicle transfer request fee: 100 THB (for used vehicle)

2.4.4. Annual taxes

In Thailand, vehicle owners have to pay an annual tax to the DLT when the vehicle is registered. There are three modes of calculation for different types of vehicles. For passenger vehicles with fewer than 7 passengers, the taxes are collected based on the

⁶³ DLT (2022) *Fee and tax rates*. Available at: <https://www.dlt.go.th/th/fees-and-tariffs/> (Accessed: June 2023).

engine size, as shown in Table 24. For passenger vehicles with more than 7 passengers, inter-provincial taxis, taxis, buses and trucks, the taxes are collected based on the weight of the vehicles, as shown in Table 25. For motorcycles, the annual tax is 100 THB per unit of vehicle, as shown in Table 26.

For passenger vehicles with fewer than 7 passengers, the reduction in annual tax for vehicles older than 5 years may be counter-productive in incentivizing consumers to shift towards newer and more energy-efficient vehicles. However, the DLT is currently addressing this issue and is developing a new structure of annual tax rates that is based on CO₂ emission without reduction after 5 years.

In addition to the revision of the annual tax rates, in November 2022, a DLT policy to reduce annual tax for EVs was put in effect by the Royal Decree on Reducing Annual Tax for Electric Vehicles B.E. 2565 (2022). The policy reduces annual taxes for EVs by 80% for the first three years after vehicle registration.⁶⁴

Table 24: Annual Tax for Passenger Vehicles by Engine Size (cc)⁶⁵

Passenger Vehicles with ≤ 7 passengers	Tax by cc (THB)
First 600 cc	0.05
601 – 1,800 cc	1.5
From 1,800 cc onward	4
For juristic persons that do not provide leasing	Tax increase (%)
	200
For vehicles older than 5 years	Tax reduction (%)
6 th year	10
7 th year	20
8 th year	30
9 th year	40
10 th year onward	50

⁶⁴ The Royal Gazette (2022) *Royal Decree on Reducing Annual Tax for Electric Vehicles B.E. 2565 (2022)*. Available at: https://www.ratchakitcha.soc.go.th/DATA/PDF/2565/A/069/T_0051.PDF (Accessed: August 2023).

⁶⁵ DLT (2022) *Fee and tax rates*. Available at: <https://www.dlt.go.th/th/fees-and-tariffs/> (Accessed: June 2023).

Table 25: Annual Tax by Weight of the Vehicles⁶⁵

Weight (kg)	Unit: THB						
	Passenger Vehicles with > 7 Passengers	Inter-Provincial Taxis	Taxis	Buses and Trucks			
				Fixed-Route	On demand	Fixed Route (Carrying ≤ 4,000 kg)	For Personal and Internal Business Use
≤ 500	150	450	185	300	450	300	150
501-750	300	750	310	400	600	400	300
751-1,000	450	1,050	450	500	750	500	450
1,001-1,250	800	1,350	560	600	900	600	800
1,251-1,500	1,000	1,650	685	700	1050	700	1000
1,501-1,750	1,300	2,150	875	900	1,350	900	1,300
1,751-2,000	1,600	2,550	1,060	1,100	1,650	1,100	1,600
2,001-2,500	1,900	3,000	1,250	1,300	1,950	1,300	1,900
2,501-3,000	2,200	3,450	1,435	1,500	2,250	1,500	2,200
3,001-3,500	2,400	3,900	1,625	1,700	2,540		2,400
3,501-4,000	2,600	4,350	1,810	1,900	2,850		2,600
4,001-4,500	2,800	4,800	2,000	2,100	3,150		2,800
4,501-5,000	3,000	5,250	2,185	2,300	3,450		3,000
5,001-6,000	3,200	5,700	2,375	2,500	3,750		3,200
6,001-7,000	3,400	6,150	2,560	2,700	4,050		3,400
≥ 7,001	3,600	6,600	2,750	2,900	4,350		3,600

Table 26: Annual Tax per Unit of Vehicle⁶⁵

Annual tax by a unit of vehicle (THB)	
Motorcycle	100
Motorcycle Sidecar	50
Car Trailer	100
Road Roller	200
Agricultural Tractor	50

2.4.5. Fuel taxes

Fuel in Thailand is subjected to four taxes and two fees. The taxes include the excise tax, tax to the MOI, VAT on the wholesale price and VAT on the retail price. The two fees collected are going to the Oil Fuel Fund (Oil Fund) and the Energy Conservation Fund (Consv. Fund)

The two main levers for the government to control the fuel price are the excise taxes and the fees to the Oil Fund. When the fuel price is high, the government can reduce the fuel prices by reducing the excise tax rates on fuel and subsidising the fuel prices with the funding from Oil Fund. When the fuel price is low, the government can maintain the usual excise rates to maintain its revenue and collect fees on top of the fuel prices to the Oil Fund.

For example, as illustrated in Figure 34, on the 20th of July 2023, the diesel price included 1.34 THB per litre for the excise tax and an additional 4.04 THB per litre as a fee directed to the Oil Fund. However, on the following day, 21st July 2023, the excise tax reduction measure expired, leading to a significant increase in the excise tax per litre, which rose to 5.99 THB. In response to this excise tax hike, the government made a decision to cease the collection of the fee to the Oil Fund for diesel. Instead, it began providing a subsidy of 1.59 THB per litre for diesel in order to maintain the retail price steady at 31.94 THB per litre. It is noted that revenue or loss in excise tax collection has direct impact on national budget; whereas increase or decrease in Oil Fund has no direct impact on national budget. Government usually strategize increase or decrease in excise tax rate and fee to Oil Fund. This measure was taken to offset the impact of the higher excise tax and to keep the retail diesel price unchanged for consumers.

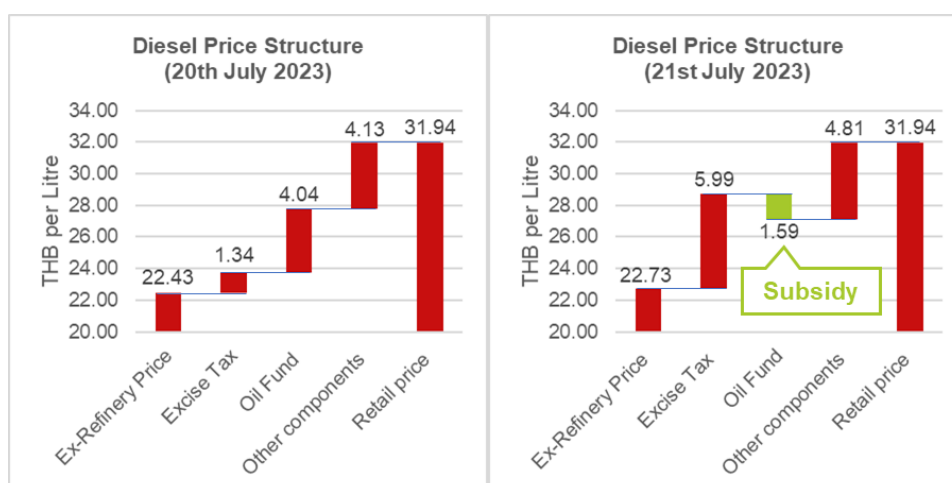


Figure 34: Diesel Price Structure Comparison: Before and After 20th July 2023^{66 67}

The decision whether to collect fees or to subsidise oil prices is made by the Committee on Energy Policy Administration (CEPA), which is chaired by the Minister of Energy.

⁶⁶ Oil and Fuel Fund (2023) *Price Structure of Petroleum Product in Bangkok*. Available at: <https://www.eppo.go.th/index.php/th/petroleum/price/structure-oil-price?orders=publishUp&issearch=1&orders=publishUp&issearch=1> (Accessed: July 2023).

⁶⁷ Other components include the MOI tax, VAT on wholesale price, VAT on retail price, and the marketing margin.

However, the decision on the usage of the Oil Fund, which is politically sensitive, is usually made at the cabinet level.

2.4.5.1. Diesel

The excise taxes for diesel are normally around 6 THB per litre. As shown in Table 27, the price structure on 17th February 2022 included 6 THB of excise tax per litre and 3.8 THB per litre of subsidies by the Oil Fund. The subsidies were done to fix the diesel price below 30 THB per litre. On 18th February 2022, the government started the diesel excise tax reduction scheme to help fix the diesel price below 30 THB per litre to help ease the financial burden on the Oil Fund.

On 14th June 2022, at one of the worst points of the fuel price surge in 2022, the government raised the price ceiling for diesel to 35 THB per litre and the government had to use both the excise tax reduction by almost 4.7 THB per litre (from 6 THB to 1.3 THB per litre) and the subsidy by the Oil Fund by 10 THB per litre to maintain the diesel price at 34.9 THB per litre, as illustrated in Table 27.

In early 2023, the global oil price was stabilising, therefore, the government started collecting fees from diesel back into the Oil Fund to help the Oil Fund pay off its debt from the subsidies in 2022. As shown in Table 27, before the excise tax reduction scheme expired after 20th July 2023, the government collected 4 THB per litre of diesel back into the Oil Fund. However, after the excise tax on diesel has returned to 6 THB per litre, the government has to subsidise the diesel price by 1.6 THB per litre to maintain the diesel price below 32 THB per litre.

While the Oil Fund may not always subsidise the fuel price, the mechanism in place to subsidise the fuel price when the price rises may prove counter-productive for the attempt to incentivise fuel economy as the subsidised price may not reflect the actual market price and may steer consumers towards over-consumption of fuel.

Table 27: Diesel Price and Tax Structure Comparison: Before and After 20th July 2023

Unit: THB/Litre	17th February 2022			14th June 2022			20th July 2023			21st July 2023		
	B7	Diesel	B20	B7	Diesel	B20	B7	H-Diesel	B20	B7	Diesel	B20
Ex-Refin	24.2	24.2	24.2	39.8	39.8	39.8	22.4	22.4	22.4	22.7	22.7	22.7
Excise Tax	6.0	6.0	6.0	1.3	1.3	1.3	1.3	1.3	1.3	6.0	6.0	6.0
MOI Tax	0.6	0.6	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6
Oil Fund	-3.8	-3.8	-3.8	-10.0	-10.0	-10.0	4.0	4.0	4.0	-1.6	-1.6	-1.6
Consv. Fund	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Wholesale Price (WS)	27.0	27.0	27.0	31.3	31.3	31.3	28.0	28.0	28.0	27.8	27.8	27.8

Unit: THB/Litre	17th February 2022			14th June 2022			20th July 2023			21st July 2023		
	B7	Diesel	B20	B7	Diesel	B20	B7	H-Diesel	B20	B7	Diesel	B20
VAT (WS)	1.9	1.9	1.9	2.2	2.2	2.2	2.0	2.0	2.0	1.9	1.9	1.9
WS&VAT	28.9	28.9	28.9	33.5	33.5	33.5	30.0	30.0	30.0	29.7	29.7	29.7
Marketing Margin (MM)	1.0	1.0	1.0	1.3	1.3	1.3	1.9	1.9	1.9	2.1	2.1	2.1
VAT (MM)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Retail Price	29.9	29.9	29.9	34.9	34.9	34.9	31.9	31.9	31.9	31.9	31.9	31.9

2.4.5.2. Petrol

For petrol prices, the Thai government both collect excise taxes and collect fees to the Oil Fund, as shown in Table 28. The structure of excise taxes and fees for petrol prices follows a particular pattern based on the ethanol content in the fuel. Essentially, the higher the ethanol content, the lower the excise tax rates and fees that are deposited into the Oil Fund. For instance, the ULG95 fuel, which contains no ethanol, bears the highest excise tax rate and contributes the largest fee to the Oil Fund. On the other hand, Gasohol E85, with the highest ethanol content, enjoys the lowest excise tax rate and incurs the lowest fee for the Oil Fund. The policy did not change during the energy price surge in 2022 and the Oil Fund is often criticised that it collects fees from petrol users to subsidise diesel users.

Table 28: Petrol Price and Tax Structure Comparison: Before and After 20th July 2023

Unit: THB/Litre	20 th July 2023					21 st July 2023				
	ULG95	Gasohol				ULG95	Gasohol			
		95 E10	91	95 E20	95 E85		95 E10	91	95 E20	95 E85
Ex-Refin	21.9	21.9	21.4	22.3	27.0	22.1	22.1	21.7	22.5	27.1
Excise Tax	6.5	5.9	5.9	5.2	1.0	6.5	5.9	5.9	5.2	1.0
MOI Tax	0.7	0.6	0.6	0.5	0.1	0.7	0.6	0.6	0.5	0.1
Oil Fund	9.4	2.8	2.8	0.8	0.8	9.4	2.8	2.8	0.8	0.8
Consv. Fund	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Wholesale Price (WS)	38.5	31.1	30.7	28.9	28.9	38.7	31.4	31.0	29.1	29.0
VAT (WS)	2.7	2.2	2.2	2.0	2.0	2.7	2.2	2.2	2.0	2.0
WS&VAT	41.2	33.3	32.9	30.9	31.0	41.4	33.6	33.1	31.1	31.0

Unit: THB/Litre	20 th July 2023					21 st July 2023				
	ULG95	Gasohol				ULG95	Gasohol			
		95 E10	91	95 E20	95 E85		95 E10	91	95 E20	95 E85
Marketing Margin (MM)	3.6	3.7	3.8	3.8	4.1	3.4	3.4	3.6	3.6	4.1
VAT (MM)	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3
Retail Price	45.0	37.3	37.0	34.9	35.4	45.0	37.3	37.0	34.9	35.4

2.5. Subsidies/ incentive programs

While there are mechanisms in place to subsidise the fuel price in Thailand, there are no direct subsidies for fuel-efficient vehicles. However, there are subsidies for electric vehicles according to the resolution of the National Electric Vehicle Policy Committee (EV Board) meeting on 1st November 2023. The subsidy schemes for BEVs are shown in Table 29. Electric vehicles that cost less than 2 million THB may receive subsidies up to 100,000 if the manufacturers commit to producing BEVs and their key components locally, such as batteries, PCU inverters, traction motors, etc.

Table 29: Subsidies and Incentives for BEVs in Thailand⁶⁸

Type	Price	Battery size	Subsidy	Incentive	
Electric passenger vehicle	Less than 2 million THB	Less than 50 KWh	20,000 - 50,000 THB per unit	Decrease CBU import duties up to 40% (2024-2025)	Decrease excise tax from 8 to 2%
		more than 50 KWh	50,000 - 100,000 THB per unit		
	2 - 7 million THB	more than 50 KWh	N/A	N/A	
Electric pickup truck	Less than 2 million THB	more than 50 KWh	50,000 - 100,000 THB per unit	N/A	N/A
Electric motorcycle	Less than 150,000 THB	More than 3 KWh	5,000 - 10,000 THB per unit	N/A	N/A
Condition					
<ul style="list-style-type: none"> - For 1 vehicle imported, the manufacturer has to produce 2 vehicles domestically in 2026 or; - For 1 vehicle imported, the manufacturer has to produce 3 vehicles domestically in 2027 - Imported CBU vehicles have to pass TIS standards and international standards tested by the Automotive and Tyre Testing, Research and Innovation Centre (ATTRIC) - For local assembly/production of BEV, key components such as a battery, PCU inverter, Traction Motor, etc. must be sourced locally. (For passenger vehicles and pickup trucks) 					

⁶⁸ Infoquest (2023) *National Electric Vehicle Policy Committee Approved Measures 3.5 (2024-2027) According to Vehicle Type and Battery Size*. Available at: <https://www.infoquest.co.th/2023/347533> (Accessed: December 2023).

For manufacturers, the Board of Investment of Thailand (BOI) used to have incentives directly for fuel-efficient vehicles or “eco cars” that use 5 litres/100km and emit less than 120 gCO₂/km (in the first phase) and 4.3 litres/100km and emit less than 100 gCO₂/km (in the second phase). The first phase of the policy started in 2006 until 2012, and the second phase started in 2013 and will expire in 2025. Apart from the excise tax incentives for eco cars mentioned in Table 19, the Criteria and incentives for the first and second phases of the eco car policy from the BOI are shown in Table 30.

Table 30: Criteria and incentives for eco cars from the BOI

	1 st Phase (2006-2012)	2 nd Phase (2013-2025)
Criteria	<ul style="list-style-type: none"> Fuel consumption: 5 litre/ 100km Emit ≤120 gCO₂/km EURO 4 Standard Safety: UNECE R94, UNECE R95 Rev.1 Actual production: more than 100,000 units per year in 5th year Produce at least 4 out of 5 key engine parts Minimum investment: 5 billion THB 	<ul style="list-style-type: none"> Fuel consumption: 4.3 litre/ 100km Emit ≤100 gCO₂/km EURO 5 Standard Safety: UNECE R94, UNECE R95 Rev.1, Anti-lock Braking System (ABS), Electronic Stability Control System (ESC) Actual production: more than 100,000 units per year in 4th year Produce at least 4 out of 5 key engine parts Minimum investment: 6.5 billion THB (5 billion THB for existing phase 1 companies)
Incentives	<ul style="list-style-type: none"> 8 years corporate income tax exemption Exemption of import duties on machinery 90% reduction in import duties on raw materials for 2 years 	<ul style="list-style-type: none"> 6 years corporate income tax exemption (7 years if investing 500 million THB and 8 years if investing 700 million THB developing Thai auto parts suppliers and mould & die manufacturers) Exemption of import duties on machinery 90% reduction in import duties on raw materials for 2 years

In addition to the eco car incentives, the BOI incentives in 2023 for the automotive industry, as depicted in Table 31, gives priority to battery and cell production in Thailand, so these products are put under the A1 scheme (corporate income tax exemption of 8 years without cap), the highest level of incentives. For the EV investment projects with the value of more than 5 billion THB and that include key components, such as batteries, traction motors and battery management system (BMS), the corporate income tax

exemption will be 8 years. For other types of hybrid and electric vehicles, including buses, trucks and 2W & 3Ws, the corporate income tax exemption is 3 years.

Table 31: Board of Investment's Incentives for Automotive Sector in Thailand⁶⁹

Code (BOI)	Product	Scheme	Corporate Income Tax Exemption
3.4	Engines	A3-A4	3-5 Years
3.5	Vehicle Parts	A1-B	0-8 Years
3.5.4.1	Batteries with Cell Production Process	A1	8 Years (no cap)
3.6	ICE Vehicles	B	0 Years
3.7 – 3.12	HEV, PHEV, BEVs (Passenger Cars, Motorcycles, Buses, Trucks, E-Bikes)	A2-A4	3-8 Years
3.8	BEVs with Investment More than 5 billion THB (Project Include Key Components)	A2	8 Years
3.13	Fuel Cell Vehicles	A2	8 Years
3.14	Fuel Cell or Parts	A2	8 Years

In 2011, Thailand used to have the “First Car Policy”, which was partly introduced in order to help the automotive industry to recover from the great flood in 2011 in Thailand as well as to promote the use of high-efficiency vehicles defined as “Eco-Cars⁷⁰”. The First Car Policy provided up to 100,000 THB of tax rebate for first-car buyers, focusing on the eco-car segment. After the First Car Policy was terminated in 2014, there was a sharp drop in vehicle sales as the sharp rise in demand in the previous years had been propped up by the policy. The termination of the First Car Policy may have also contributed to the slight drop from 2013 to 2015 in the fuel economy of the passenger and light commercial vehicle fleet from 6.98 to 7.08 litres/100 kilometres⁷¹ as the demand for eco-cars from 2012 to 2014 were unusually high and consumers who would have bought eco-cars in later years already bought the vehicles during the time when the policy was enacted. It can be summarised that the First-Car Policy could not make a long-term impact on fuel economy as it did not shift the consumer’s preference toward a more fuel-efficient vehicle.

2.6. Fuel economy/ energy efficiency

According to the Announcement of the Ministry of Industry on Displaying Vehicle Information According to the International Standard on 19th August B.E. 2558 (2015), every new car both domestically produced and imported, has to have a label displaying vehicle information according to international standards (eco sticker) attached to either its

⁶⁹ Thailand Board of Investment (2023) *Investment Promotion Guide*. Available at: https://www.boi.go.th/upload/content/BOI_A_Guide_EN.pdf (Accessed: June 2023).

⁷⁰ The Eco-Cars are defined as vehicles emitting less than 120 gCO₂ per km (phase I) and 100 gCO₂ per km (phase II).

⁷¹ GIZ (2019) Fuel Efficiency Policies in the Land Transport Sector in Thailand, Report 3: Revised CO₂-based Excise Tax with Cost-Benefit Analysis, 44.

windshield or side window before being transported to dealers or motor shows. Only the customer or someone who receives the power of attorney from the customer can take off the eco sticker.

As illustrated in Figure 35, the eco sticker contains six key pieces of information: first, manufacturer or importer information including company name, address, website, and trademark; second, basic information about the car, including brand, model, chassis number, car frame code, engine code, engine, transmission system, car weight, tire size, number of seats and fuel type; third, standard equipment and accessories, electronic systems both hardware and software, wheels and tires and other equipment; fourth, performance data of new cars, such as fuel consumption in the form of litres per 100 kilometres and CO₂ emissions in g/km, the emission standards and the safety level of the car; fifth, the registration number or ID of the eco sticker and the sticker's QR Code; and lastly, suggested retail price and excise tax rate.

- What Eco sticker says?**
- 1. Manufacturer or importer information** including company name, address, website, trademark
 - 2. Basic information** of the car including brand, model, model, chassis number, car frame code, engine code, engine, transmission system, car weight, tire size, number of seats, fuel type
 - 3. Standard equipment and accessories**, electronic systems both hardware and software, wheels and tires, other equipment
 - Performance data of new cars such as **fuel consumption** in the form of litres per 100 kilometres and **CO₂ emissions in g/km**, the emission standards, and the safety level of the car.
 - Registration number or ID of ECO Sticker and sticker's QR Code
 - Suggested retail price and excise tax rate



Figure 35: Information Displayed on Eco Stickers in Thailand⁷²

⁷² Author's analysis based on information from Eco Sticker (2022). Available at: <https://www.car.go.th> (Accessed: June 2023).

While there will be no eco sticker attached to a second-hand car, consumers can still look up the eco sticker information online at <https://www.car.go.th/>. The online information portal also allows consumers to compare different models as well, as depicted in Figure 36.

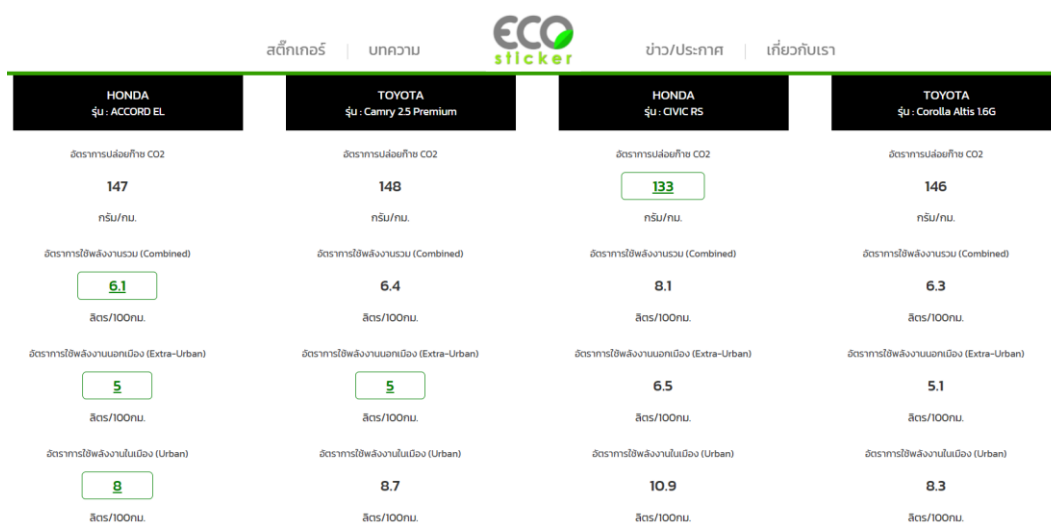


Figure 36: Eco Stickers Information Online and Comparison Among Different Models⁷³

2.7. Fuel economy/ CO₂ fleet standards

At present, Thailand does not have a mandatory standard on CO₂ emission and fuel economy. The country has TIS. 2335-2550 standard, which refers to the UNECE R101 and indicates that the approval shall be granted if the emissions of CO₂ and fuel consumption and/or the electric energy consumption and electric range of the vehicle type submitted for approval pursuant to this regulation have been measured according to the conditions specified in the regulation. The standard, however, does not limit the amount of CO₂ emission or provide a limit to fuel consumption per 100 kilometres.

The Department of Alternative Energy Development and Efficiency (DEDE) has issued three voluntary fuel consumption standards. One is for highly efficient motorcycles, where fuel is measured in kilometre per cubic decimetre, called the Ministerial Regulation on the specification of highly efficient motorcycles. The standard for gasoline engines is called the Ministerial Regulation on the specification of highly efficient small gasoline engines with water cooling system. The standard for diesel engines is called the Ministerial Regulation on the specification of small diesel engines with water cooling system. The standards for gasoline and diesel engines are measured in gram per kilowatt-hour.

The rationale of the regulation is to allow vehicle producers with the engines that achieve these standards to submit the results to the DEDE to receive funding from the Energy Conservation Fund. However, these policies still need further regulation in the form of Ministerial Announcements to further clarify the testing standards and methods.

⁷³ Eco Sticker (2022) Available at: <https://www.car.go.th> (Accessed: June 2023).

2.8. Zero/low emissions vehicles mandates

On 15th February 2022, the Thai cabinet passed a Cabinet Resolution which adopted policy recommendations and the 30@30 mandate proposed by the National EV Policy Board. This mandate sets a target for 30% of domestic vehicle production to be electric vehicles (EVs) by 2030. The specific numerical targets in terms of units are depicted in Table 32.

To encourage investment and establish Thailand as a hub for EV manufacturing in the ASEAN region, the National Electric Vehicle Policy Committee has implemented various measures, such as subsidies and tax incentives, as shown in Table 29.

Table 32: 30@30 Target in 2030⁷⁴

30@30 Targets in 2030	
Domestic Production (Unit)	
Passenger Vehicles and Pick Up Trucks	725,000
Motorcycles	675,000
Buses and Trucks	34,000
Domestic Usage (Unit)	
Passenger Vehicles and Pick Up Trucks	440,000
Motorcycles	650,000
Buses and Trucks	33,000
Charging Station (Unit)	12,000
Battery Swapping Station (Unit)	1,450

In summary for the chapter, the fuel economy policy instrument that Thailand already has in place is the customer information in the form of “eco stickers.” For the standards, Thailand has many standards and regulations for the automotive sector in line with the UNECE regulations. However, the country still does not have a fuel economy standard that restrict the vehicle’s consumption/ emission per distance. As for the fiscal instruments, Thailand’s CO₂-based excise tax on pickup trucks is still lower than those in other segments even though the pickup trucks emit more greenhouse gas. In the next chapter, from the review of regulatory status quo, the stakeholders will be analysed and mapped in order to identify the stakeholders that are needed to be engaged to push for the fuel economy policy moving forward.

⁷⁴ Energy Policy and Planning Office (2021) *Means of Supporting Electric Vehicles*. Available at: <https://www.eppo.go.th/index.php/en/component/k2/item/17415-ev-charging-221064-04> (Accessed: June 2023).

3. Cooperation Stakeholder analysis

3.1. Stakeholder Mapping

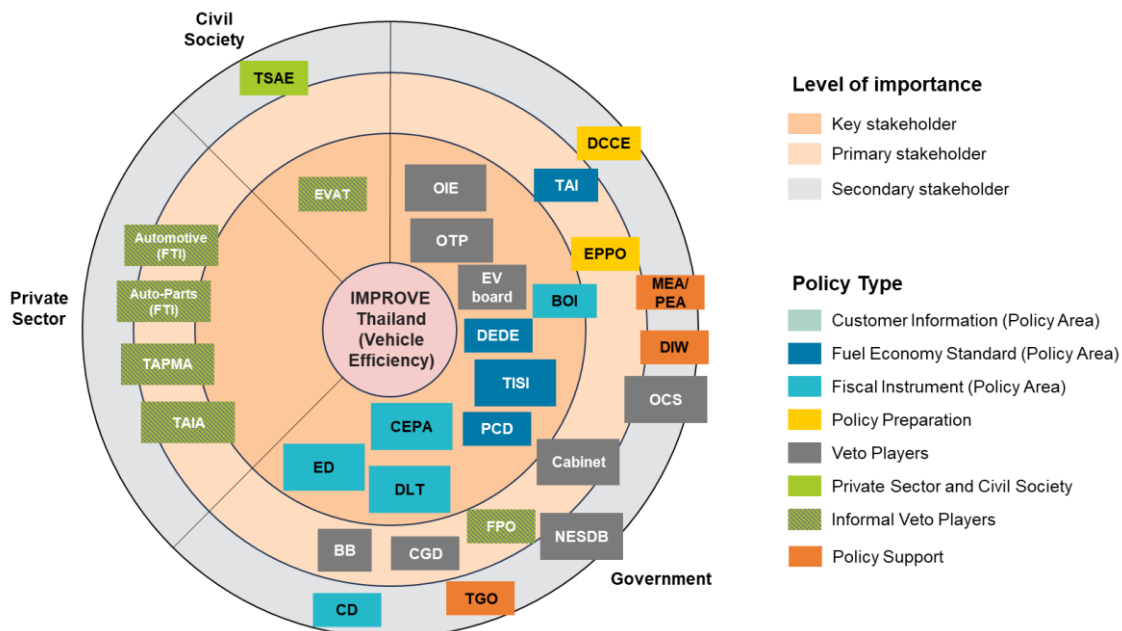


Figure 37: IMPROVE Project Stakeholder Map

Table 33: Glossary of Acronyms for the Stakeholder Map

Acronym	Organization	Sector
Automotive (FTI)	Automotive Group of the Federation of Thai Industries	Private
Autoparts (FTI)	Auto-Parts Group of the Federation of Thai Industries	Private
BB	Budget Bureau	Government
BOI	Board of Investment of Thailand	Government
CEPA	Committee on Energy Policy Administration	Government
CD	Customs Department	Government
CGD	Comptroller General Department	Government
DCCE	Department of Climate Change and Environment	Government
DEDE	Department of Alternative Energy Development and Efficiency	Government
DIW	Department of Industrial Works	Government
DLT	Department of Land Transport	Government
ED	Excise Department	Government
EPPPO	Energy Policy and Planning Office	Government
EVAT	Electric Vehicle Association of Thailand	Civil Society
EV Board	National Electric Vehicle Policy Committee	Government
FPO	Fiscal Policy Office	Government
MEA	Metropolitan Electricity Authority	Government
NESDB	National Economic and Social Development Board	Government
OCS	Office of the Council of State	Government

Acronym	Organization	Sector
OIE	Office of Industrial Economics	Government
ONEP	Office of Natural Resources and Environmental Policy and Planning	Government
OTP	Office of Transport and Traffic Policy and Planning	Government
PCD	Pollution Control Department	Government
PEA	Provincial Electricity Authority	Government
TAI	Thailand Automotive Institute	Government
TAIA	Thai Automotive Industry Association	Private
TAPMA	Thai Auto-Parts Manufacturers Association	Private
TGO	Thailand Greenhouse Gas Management Organization	Government
TISI	Thai Industrial Standards Institute	Government
TSAE	Society of Automotive Engineer - Thailand	Civil Society

3.2. Stakeholder interests, relationships and networks

There are three groups of stakeholders, i.e., government agencies, private sector industry associations and civil society organizations. Policy areas in vehicle fuel efficiency that government agencies in Thailand can cover include customer information, fuel efficiency standard and fiscal instrument. Some government agencies may not directly involve with the three policy areas but may involve in policy and planning preparation or serve as veto players for the policies either in the formulation process or the budget process.

Using the definition of the key stakeholder as “*actors who are able to use their skills, knowledge or position of power to significantly influence a project*”⁷⁵,” **for example, agencies that directly hold the policy instrument to implement the policies**, the key government stakeholders on vehicle efficiency related to this project include the OIE, TISI, DEDE, PCD, CEPA, DLT, ED, EV Board, BOI, and the OTP. The OIE is directly responsible for the Eco Stickers regulation, which is the key component of the customer information policy area. OIE is also responsible for the formulation of the upcoming phase of the eco car policy after the phase 2 expires at the end of 2025. Moreover, the OIE also serves as an assistant secretariat of the EV Board.

For the fuel economy standard policy area, the TISI is responsible for the fuel efficiency testing standard and exhaust emission standards, the DEDE has the standards to specify highly efficient motorcycles, gasoline engines and diesel engines, and the PCD has the responsibility to set the Euro 5 and Euro 6 emission standards. For the fiscal instrument policy area, the CEPA is responsible for deciding whether to collect fees on top of petroleum prices into the Oil and Fuel Fund or to use the fund to subsidize oil prices, the DLT is responsible for the registration fee and annual tax, and the ED is responsible for the excise tax collection that can be set to incentivize low-emission and highly efficient vehicles, such as excise tax on vehicles based on CO₂ emission and fuel economy and excise tax on petroleum fuel.

⁷⁵ GIZ GmbH (2015) *Cooperation Management for Practitioners: Managing Social Change with Capacity WORKS*, Springer Gabler, 129.

The OTP serves as a key veto player for the project as the agency is overseeing the NDC action plan for the transport sector and it has to make sure that the project is in line with the government's target in the transport sector and that the project contributes the NDC action plan in the transport sector.

The EV Board also serves as a key government veto player as setting a corporate average fuel economy standard will involve electric vehicle policies as companies that produce electric vehicles will be more likely to achieve the fuel economy target. Therefore, the EV Board, which oversees the overall picture of the country's electric vehicle policies will likely involve with the setting of the standard as well. The BOI, as the secretariat of the EV Board also plays a crucial role in agenda setting for the board. Additionally, the BOI is also responsible for providing investment incentives for phase 2 and the upcoming phase of the eco car policy.

The definition for the primary actors is the *“actors who are directly affected by the project, either as the designated beneficiaries or because they stand to gain – or lose – power and privilege as a result of the project”⁷⁵*, **for example, agencies that have key performance indicators related to the success of the project or will require more resources as a result of the project.** From this definition, the primary government stakeholder is the cabinet which has the mandate to implement policies it has announced to the parliament and has to be responsive to the public. The cabinet also serves as a vital veto player in this stakeholder map because many of the possible policy instruments to promote vehicle efficiency require the cabinet's approval. As for the current policies, the enforcement of the TIS standard requires a Royal Decree, the excise tax rates and customs duties rates require Ministerial Regulations. Both the Royal Decrees and the Ministerial Regulations require the cabinet's approval. If the policy instrument is at the Ministerial Announcement level, it can be approved at the ministry level and does not have to be submitted to the cabinet. An example of a current policy at the Ministerial Announcement level is the eco sticker policy.

EPPO is a primary actor for the project as it serves as the secretariat of the CEPA and a board member of the Oil and Fuel Fund. If the project involves electrification, EPPO will also serve as a primary actor for the project as an assistant secretariat of the National Electric Vehicle Policy Committee. As well, the TAI will be directly affected by the policy as it may require further investment to increase its capacity to conduct testing if a fuel economy standard is in place.

FPO serves as a primary informal veto player for the project and BB and CGD serve as formal primary veto players. If the policy requires the use of government's budget, FPO will give recommendation on cost-benefit analysis for BB consideration for approval before the budget is submitted to the cabinet, then to the parliament. CGD will then list fuel-efficient vehicle for government fleet consideration.

The secondary actor is defined as the *“actors whose involvement in the project is only indirect or temporary”⁷⁵* or *actors that are not directly involved but may nevertheless exert influence”⁷⁵*, **for example, service providers or agencies that do not yet involve but have the authority to do so.** With this definition, the secondary government stakeholders include CD, OCS, NESDB, DCCE, TGO, DIW, and MEA/ PEA. The CD has customs duties reduction for electric vehicles but does not have a policy directly on vehicle efficiency.

The OCS and NESDB serve as veto players. If a regulation requires approval from the cabinet, the regulation will have to be submitted to the OCS for revision. The NESDB has a role to review the annual plan and 5-year plan of every government agency. For the proposed plan to be put into the annual or 5-year plan and be implemented, the regulation requires approval from the NESDB.

DCCE serves as a secondary stakeholder as the success of the project will have an impact on the NDC target. Moreover, if a trading scheme for fuel economy standard or a super credit system is implemented, vehicles that validate their CO₂ emissions through eco-stickers should be eligible for participation in carbon footprint initiatives and carbon credit projects governed by the TGO.

DIW also serves as a secondary stakeholder as it controls vehicle production process and safety. MEA and PEA are also placed in the stakeholder map as secondary stakeholders as their involvement and support is essential in a case that a fuel economy standard that relates to an electric vehicle policy such as a corporate average standard or a super credit system for electric and low emission vehicles are implemented.

The primary stakeholders of the project from the private sector are the TAIA, TAPMA, automotive group of the FTI and auto-parts group of the FTI. These industry associations include all the vehicle and vehicle parts manufacturers who will stand to gain or lose from the vehicle efficiency policies. The Thai economy's reliance on these private stakeholders also makes them informal veto players of the project.

It is also noted that the directories of the TAIA and the automotive group of the FTI and the TAPMA and the auto-parts group of the FTI can be overlapped. It is common for the industry groups of the FTI to set up separate industry associations of their own to become juristic persons since an industry group of the FTI is not considered a juristic person. Only FTI as a whole is a juristic person.

The key civil society informal veto player for the project includes the EVAT, which represents academic and private interests regarding electric vehicles. The more the fuel economy policies are intertwined with electric vehicle policies, the more involvement the EVAT will have on the project.

The secondary civil society of the project includes the TSAE, which is an academic and professional association where experts affiliated with the association can provide inputs for the project and further connect the projects with additional stakeholders.

3.3. Barriers and challenges

There are barriers and challenges for stakeholders to cooperate and pass additional policies in the field of fuel economy in both the government and the private sector.

In the government sector, the barrier for the fuel efficiency policy is the lack of mandate by the government. Without the mandate, the government agencies will not have the fuel efficiency policy on their agendas. The challenges for the policy is that the authorities to implement fuel efficiency policies are fragmented across many ministries and departments. Customer information is mainly with the OIE and the Ministry of Industry. Standards are with the TISI at the Ministry of Industry, the DEDE at the Ministry of Energy and the PCD at the Ministry of Natural Resources and Environment. Fiscal instruments

are with the ED at the Ministry of Finance and the DLT at the Ministry of Transport. Without a mandate or agenda from political leaders or from international agreements, it is unlikely that these agencies will work together toward the same goal of vehicle fuel efficiency.

For the private sector, the policies to promote vehicle fuel efficiency may undermine the benefits of the vehicle and vehicle parts manufacturing sector in Thailand, which is one of the country's largest industry and export sectors. The policy to set a strict fuel economy standard may increase the cost for producers which will eventually be pushed on to the consumers. The policy to set excise tax rates based on fuel economy and CO₂ emission cannot be effectively enforced on the pickup truck segment even if the pickup truck's fuel economy and CO₂ emission are worse than other segments of passenger and light commercial vehicles. This is because pickup trucks are considered "product champion," one of Thailand's leading export products and the majority of pickup truck consumers are low-income people in the agriculture sector that the government believes it has to subsidise.

In summary, the different barriers and challenges from public and private stakeholders will have to be mitigated in order to push the improvement of fuel economy policy forward. In the next chapter, the analyses of the findings will be made into a summary table of what policies are already in place and a SWOT analysis of developing fuel economy policy in Thailand.

4. Analysis of findings

4.1. Summary table

Table 34: Summary Table for the IMPROVE Project Scoping Study in Thailand

Policy	Yes / No	Brief description	Source
Fuel economy labelling	Yes	Eco Sticker	Announcement of the Ministry of Industry on Displaying Vehicle Information According to the International Standard on 19th August B.E. 2558 (2015)
Import duties	Yes	Import duties reduction for BEVs	Cabinet Resolution on 15 th February 2022
Import restrictions	Yes	Restriction on used vehicles	Announcement of the Ministry of Commerce on 12th June 2019 Designating Used Vehicles as Prohibited Goods or Goods that Requires Approval Before Importing into the Kingdom B.E. 2562 (2019)
Purchase Tax / VAT	Yes	7% on top of price including customs, excise tax, and MOI tax	Revenue Code
Registration tax	Yes	The same tax as the annual tax	Motor Vehicle Act B.E. 2522 (1979)
Registration fee	Yes	Request fees, license plate fees, booklet fees, inspection fees	Motor Vehicle Act B.E. 2522 (1979)
Annual tax /fee	Yes	Annual tax paid during registration and annually	Motor Vehicle Act B.E. 2522 (1979)
CO ₂ tax	Yes	Excise tax on vehicle purchase based on CO ₂ emission	Ministerial Regulation on Excise Rates (No.22) B.E. 2565 (2022)
Fuel tax	Yes	Excise tax on fossil fuel portion of biofuel-blended finished fuel	Ministerial Regulation on Excise Rates (No.34) B.E. 2566 (2023)
Clean vehicle subsidy	Yes	50,000 to 100,000 THB subsidies for BEVs	National Electric Vehicle Policy Committee Resolution on 1 st November 2023
Fuel economy standard	No	No fuel economy standard enforcement	TIS. 2335-2550
Others	Yes	30@30 target on EV production	Cabinet Resolution on 15 th February 2023
		Incentive from DEDE	Ministerial Regulation on the specification of highly efficient small gasoline engines (2018) Ministerial Regulation on the specification of small diesel engines with water cooling system (2018)

4.2. SWOT analysis

From the review of Thailand's motorisation rate, its climate target, its automotive sector, regulatory status quo, and stakeholder mapping, the SWOT analysis for developing fuel economy policies for the country is as the followings:

- Strength
 - As the world's top 10 vehicle manufacturer, Thailand has a strong base and infrastructure of automotive manufacturers and their supply chains. Therefore, Thailand has the capacity to enforce the fuel efficiency standards directly at the domestic manufacturers without having to rely on the vehicle imports.
 - Thailand already has many fuel economy policy instruments in place that the country can build on further such as, the eco stickers, the CO₂-based excise taxes, and the DEDE standards etc.
 - Unlike many other developing countries, Thailand has data availability on CO₂ emission and fuel economy as the country has type approval and CO₂ testing framework. Thailand also already used CO₂ tailpipe emission and fuel economy data to calculate excise tax.
- Weakness
 - The government's authorities to implement the fuel economy policies are fragmented across many ministries and department. Without a mandate in fuel economy, it is unlikely that different government agencies will work together toward a shared goal of improving fuel economy.
 - The Thai economy is heavily reliant on the automotive sector for export, investment, and employment. Therefore, the fuel economy policy may have to take the private sector's interest into account and the cost that the policy can push on the private sector can be limited.
- Opportunity
 - Thailand's commitment to the international community to reduce GHG emissions by 40% from the business-as-usual scenario by 2030 is an opportunity for the country to form a mandate to improve the country's fuel economy as the measure can be a "quick-win" to reduce a significant amount of GHG emissions in a short period of time. On the other hand, many foreign automotive manufacturers also need to follow headquarters' pledge for carbon neutrality, which support fuel efficient vehicle to be sold in the market e.g. voluntary CAFE.
 - There are many best practices, know-how, and lesson learned from peer countries that Thailand can draw from in order to develop further fuel economy policies, such as the Corporate Average Fuel Economy (CAFE) standard of the United States, the Low Emission Vehicle (LEV) program of California, or the European Union's Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles.

■ Threat

- The risk of political instability in the country may hinder any mandate for a policy change. Over the past decades, Thailand has experienced periods of political unrest, including frequent changes in government, protests, and military interventions. The volatility often leads to a lack of continuity in policymaking. Without a stable political environment, Thailand may struggle to realize a substantial change in the area of fuel economy and the decarbonisation of the transport sector.
- The presence of the country's large automotive sector holds the potential to exert significant influence over policy makers, potentially obstructing the approval of more ambitious policies.

In summary, Thailand already has many fuel economy policies in place such as fuel economy labelling, import restrictions for used cars, and CO₂-based excise taxes. The country also has the strength as one of the world's leading vehicle manufacturers. The other side of the coin is that the Thai government may have to compromise with the private automotive sector on fuel economy as the country heavily relies on the sector economically.

Moreover, to push for the improvement of fuel economy policy, the fragmented authorities of government agencies will have to be navigated through. The risk of political instability in the country may also hinder substantial changes in policies. The success in developing further fuel economy policies depends on aligning the interests of the government agencies that have to comply with the climate targets and the private sector that seeks to stay competitive in the fast-changing market landscape.

5. Summary and conclusion

Thailand, ranked among the world's top 10 vehicle manufacturers and being a developing country, is expected to witness a continuous increase in its motorisation rate. However, without further fuel economy policies in place, the expansion and aging of the country's vehicle fleet might impede its progress in achieving critical targets. These include the more committed Nationally Determined Contribution (NDC) target by 2030, carbon neutrality by 2050, and net zero greenhouse gas (GHG) emissions by 2065.

Currently, Thailand already has a customer information policy implemented through "eco stickers." However, it lacks a mandatory fuel economy standard that applies to vehicle producers. Additionally, while CO₂ excise taxes exist for vehicles, they are lower for pickup trucks emitting more greenhouse gases than other passenger and light commercial vehicles.

To enhance the existing fuel economy policies, it is vital to address and overcome barriers and challenges presented by various stakeholders in Thailand. One significant challenge is the fragmented authority over fuel economy policies among numerous ministries and departments within the public sector. Without a strong political mandate to drive climate change mitigation efforts through fuel economy policies, cooperation among these entities might prove difficult. On the other hand, the private sector may raise concerns about the potential cost increase for vehicle producers due to a stronger fuel economy standard, which could be passed on to consumers. Similarly, a higher vehicle excise tax based on CO₂ emissions might disproportionately affect lower-income individuals in the agricultural sector who rely on pickup trucks.

Considering a SWOT analysis of the findings, Thailand's strengths lie in having a domestic automotive manufacturing sector and an auto-parts supply chain. The country also benefits from having established fuel economy policy frameworks such as "eco stickers" and the CO₂-based excise tax. However, the weaknesses stem from the fragmented authority across government agencies and a reliance on the domestic automotive sector, which could lead to compromises in policy implementation. On the bright side, the country has opportunities to draw from its climate commitment to establish a robust mandate on fuel economy, learning from the experiences of peer countries. On the other hand, political stability remains a potential threat, as an unstable environment may hinder the nation's efforts to achieve substantial progress in fuel economy and decarbonization.

Furthermore, Thailand has an advantage in data availability of vehicle CO₂ emissions and fuel economy as the country has a type approval and CO₂ emission testing framework and has used the data to calculate excise tax on vehicle purchases based on CO₂ emission.

Looking ahead, the next step for Thailand involves addressing these challenges and capitalizing on its strengths to formulate and enforce stronger fuel economy policies. Establishing a steering structure to foster collaboration among government entities will be crucial to driving impactful change. Moreover, engaging with the private sector and finding a balanced approach to enforce fuel economy standards while considering the economic impact on consumers is essential. By leveraging its climate commitments and learning from successful examples, Thailand can build a stable and sustainable foundation to tackle climate change and decarbonise its transport sector.

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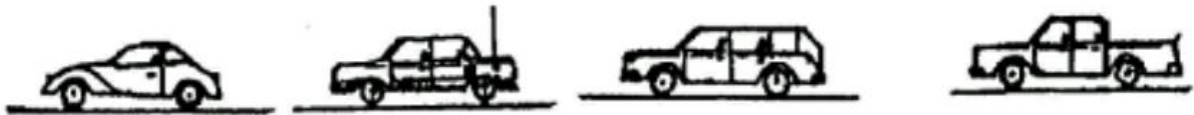
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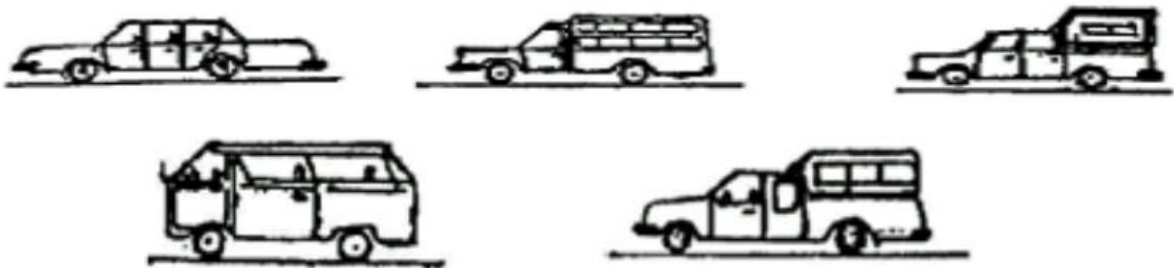
Appendixes

Vehicle Definition

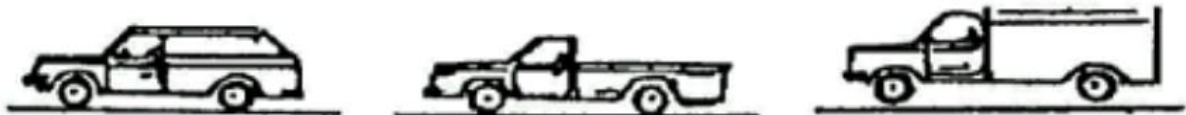
- Motor Vehicle (MV) 1: Personal passenger vehicles transporting no more than 7 passengers



- Motor Vehicle (MV) 2: Personal passenger vehicles transporting more than 7 passengers



- Motor Vehicle (MV) 3: Personal truck



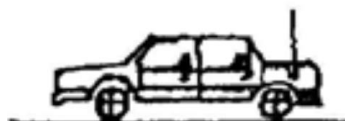
- Motor Vehicle (MV) 4: Personal motorcycle



- Motor Vehicle (MV) 5: Cross-province taxi



- Motor Vehicle (MV) 6: Taxi transporting no more than 7 passengers



- Motor Vehicle (MV) 7: Fixed route taxi



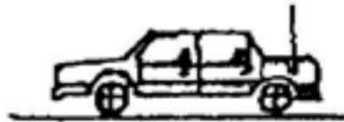
- Motor Vehicle (MV) 8: Motorcycle taxi



- Motor Vehicle (MV) 9: Business service vehicle



- Motor Vehicle (MV) 10: Touring business vehicle



- Motor Vehicle (MV) 11: Rental car



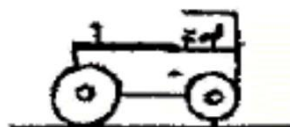
- Motor Vehicle (MV) 12: Motorcycle



- Motor Vehicle (MV) 13: Tractor



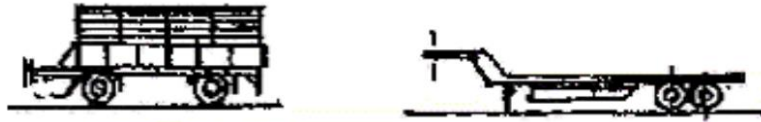
- Motor Vehicle (MV) 14: Road roller



- Motor Vehicle (MV) 15: Farm vehicle



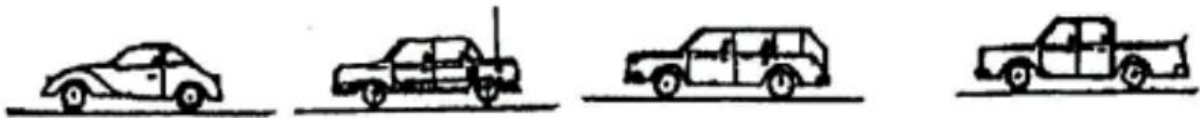
- Motor Vehicle (MV) 16: Automobile trailer



- Motor Vehicle (MV) 17: Public motorcycle



- Motor Vehicle (MV) 18: Electronic platform taxi



Examples of vehicle price calculation including purchase taxes

From 2.4.1, if a passenger vehicle has a manufacturer's suggested retail price (MSRP) of 500,000 THB, has an engine size of less than 3,000 cc and emits 160 grams of CO₂ per kilometre, it will have an excise tax rate of 30%, as depicted in Table 35. The excise tax rate will be calculated according to the formula shown in Table 17 and will be at a rate of 223,880.6 THB. The tax to the MOI will be 10% of the excise tax and have a value of 22,388.06 THB. The VAT will be 7% of the MSRP, excise tax, and MOI tax combined and will have a value of 52,238.8 THB. All in all, if a passenger car with an engine of less than 3,000 cc and emitting 160 grams of CO₂ per kilometre has a MSRP of 500,000 THB, the consumer will have to pay the retail price of 798,507.46 THB for the vehicle. In this example, the price including taxes is 59.7% higher than the MSRP.

Table 35: Example of a Tax Calculation for a Domestically Produced Vehicle⁷⁶

Item	THB	Formula
(1) Manufacturer's Suggested Retail Price (MSRP)	500,000.00	
(2) Excise Tax based on CO₂	223,880.60	$\frac{500,000 \times 0.3}{1 - (1.1 \times 0.3)}$
(3) MOI Tax	22,388.06	$223,880.6 \times 0.1$
(4) VAT	52,238.80	$(500,000 + 223,880.6 + 22,388.06) \times 0.07$
SUM	798,507.46	(1) + (2) + (3) + (4)

For example, if an imported passenger vehicle has a CIF price of 500,000 THB, it will have a customs tariff of 400,000 THB and the excise tax will be 402,985 THB as calculated in Table 36. The MOI tax will be 10% of the excise tax, which is 40,298.5 THB. VAT will be 94,029.84 THB. All in all, if an imported vehicle has a CIF price of 500,000 THB, the consumer will have to pay 1,437,313.41 THB for the vehicle. In this example, the price including taxes is 187.5% higher than the CIF price. The imported price after taxes is 80% higher than the domestic price after taxes.

Table 36: Example of a Tax Calculation for an Imported Vehicle⁷⁶

Item	THB	Formula
(1) CIF Price	500,000	
(2) Custom Tariff	400,000	$500,000 \times 0.8$
(3) Excise Tax based on CO₂	402,985.07	$\frac{(500,000 + 400,000) \times 0.3}{1 - (1.1 \times 0.3)}$
(4) MOI Tax	40,298.5	$402,985.07 \times 0.1$
(5) VAT	94,029.84	$(500,000 + 400,000 + 402,985.07 + 40,298.5) \times 0.07$
SUM	1,437,313.41	(1)+(2)+(3)+(4)+(5)

⁷⁶ Author's calculation based on information from Pattanakit Accounting Tax & Training (n.d.). Available at: <https://www.pattanakit.net/index.php?lay=show&ac=article&id=538617388&Ntype=120> (Accessed: June 2023).

Safety standards

As shown in Table 37, type approval regulations of the DLT mainly involve safety standards that apply to products, such as the braking systems, safety belts, safety belt anchorages, seats, head restraints, audible warning devices, speedometers, noises and sound emission, safety glazing materials and devices for indirect vision.

Table 37: Department of Land Transport's Type Approval Regulations Comparing to UNECE Regulations Standards and Comparable TIS Standards⁷⁷

Automotive Products	DLT Regulations	UNECE Regulations	TIS Standards ⁷⁸
Braking System	Announcement of the Department of Land Transport on specification, characteristics and installation of signal horns and to prescribe criteria, methods and conditions for certification of braking systems B.E. 2559	R13, R13H	Not specified (TIS. 1466-2551)
Safety-belt anchorage	Announcement of the Department of Land Transport on specification, characteristics and installation of signal horns and to prescribe criteria, methods and conditions for certification of seat belt anchorages B.E. 2560	R14	TIS. 1467-2550
Safety-belt and Restraint System	Announcement of the Department of Land Transport on specification, characteristics and installation of signal horns and to prescribe criteria, methods and conditions for certification of seat belts B.E. 2560	R16	Not specified (TIS. 721-2551)
Seats and Head Restraints	Announcement of the Department of Land Transport on specification, characteristics and installation of signal horns and to prescribe criteria, methods and conditions for certification of seats and head restraints B.E. 2560	R17	TIS. 896-2549
Audible Warning Device	Announcement of the Department of Land Transport on specification, characteristics and installation of signal horns and to prescribe criteria, methods and conditions for certification of signal horns and horns installation forms for cars. and motorcycles B.E. 2559	R28	TIS. 771-2550

⁷⁷ Compiled from many announcements of the DLT

⁷⁸ TIS is a standard certified by TISI

Automotive Products	DLT Regulations	UNECE Regulations	TIS Standards⁷⁸
Speedometer	Announcement of the Department of Land Transport on specification, characteristics and installation of speedometers and prescribing criteria, methods, and conditions for accreditation of speedometers for automobiles and motorcycles B.E. 2557	R29	TIS. 2308-2549
Noise	Announcement of the Department of Land Transport on specification of characteristics, performance and collaboration system and prescribing criteria, methods and conditions for design certification of energy generators Powertrain and exhaust systems of motorcycles B.E. 2554	R41	TIS. 2355-2550
Safety Glazing Materials and their Installation	Announcement of the Department of Land Transport on specifications of the installation of safety glazing materials and criteria, methods and conditions for certification of safety glazing materials installation B.E. 2558	R43	Not specified (TIS. 2602-2556)
Sound Emission	Announcement of the Department of Land Transport on specification of characteristics, performance and collaboration system and prescribing criteria, methods and conditions for design certification of energy generators Powertrain and exhaust systems of cars B.E. 2559	R51	TIS. 2264-2549
Devices for Indirect Vision	Announcement of the Department of Land Transport on Specification, Characteristics, and Installation of Visual Devices of Motorcycles and determine the criteria, methods and conditions for the certification of optical devices and the type of installation of visual equipment of motorcycles, B.E. 2557	R81	TIS. 2330-2550

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