Infrastructure Development Investigation Project 2018

for Credit Acquisition between Two Countries

(International Contribution Quantification and JCM Feasibility Study)

Feasibility Study of the Project for Promoting the Spread of High-Efficiency Mobile Air Conditioners in Thailand

March 2019

The Ministry of Economy, Trade and Industry

Contractor: DENSO Corporation

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Chapter 1 Outline of the feasibility study

1.1 Purpose of the project

Through measures for spreading GHG reduction technologies, products, systems, services, and infrastructures into developing countries, Japan has constructed and implemented the "joint crediting mechanism (JCM) system" in order to quantitatively evaluate its contribution to the reduction and absorption of greenhouse gas (GHG) emissions and to achieve its reduction goals.

The JCM system construction has been agreed by 17 countries (Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Vietnam, Laos, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar, Thailand, and Philippines) as of February 1, 2018, and each country has started concrete operations in order, for example by holding a joint committee consisting of members from both governments and adopting regulations and guidelines necessary for the system operation.

In November 2016, the "Paris Agreement," a new international rule for measures against global warming, came into effect, and all the countries including developing ones joined it for the first time in history and started their efforts based on globally common "long-term goals" and nation-by-nation own contributions--reduction goals. Under the Paris Agreement all the countries concluded, many developing countries request the provision of funds and technologies from developed countries as a prerequisite for implementing the promised draft--new GHG emission reduction goal after 2020 (hereinafter called NDC).

Meanwhile, the "Japan Revitalization Strategy 2016" approved by the Cabinet in June 2016 specifies that private aid independent from governmental funds should be regarded as JCM in principle, provided Japanese companies show their contributions and developing countries agree on them. In order for the private sector to promote the initiative in such JCM projects in the future, the Japanese government plans to continue talking with developing countries toward the project operation and system construction.

The Ministry of Economy, Trade and Industry (METI) started the industry-academic-government platform for long-term measures against global warming in July 2016, and has worked on such measures toward the GHG reduction after 2030. On April 14, 2017, the ministry prepared and announced a report based on the results of discussions at the platform, the domestic investment expansion task force, and the overseas development strategy task force, the latter two being under the control of the first one. The report shows that Japan should contribute to global GHG reduction by using JCM and public finances including ODA and JBIC with its own excellent low-carbon technologies. However, the quantification of Japanese contributions has been limited to JCM, so the report tells that in the future, Japan needs to quantify the global reduction resulting from its services, to contribute to the reduction of the international emissions exceeding the Japanese ones, and to send a message to that effect aggressively.

In such situations, it is necessary not only to take overseas actions based on JCM but also to aim at contribution to the world-wide GHG reduction and to the further economic growth of Japan by giving other countries excellent low-carbon technologies, products, systems, services, and infrastructures Japanese companies has for reducing GHG emissions.

This feasibility study has four purposes: the first one is to clarify the usefulness of excellent low-carbon technologies and products, the second one is to estimate the mid- and long-term reduction potentials in Thailand, the third one is to promote the spread of the technologies and products, and the fourth one is to give developing countries contributions to GHG reduction. To realize the purposes, Japan runs a project for reducing energy-derived CO_2 emissions to show Thailand new policies and how to plan a program for spreading the technologies and products according to the policies.

1.2 Activities in the project

The Thai government submitted to the UN its NDC aiming to reduce the GHG emission by 20% as a BAU ratio by 2030. According to the data in 2011, the Thai transportation sector holds an about 27% share of the nationwide emission and the annual GHG emission reaches as much as
about 63 million tons. Accordingly, the promotion of energy savings in the automobile industry, a major sector in Thailand, is one of the most important actions against national climate change.

This feasibility study aims to inspect the possibility of reducing CO_2 emissions by spreading a high-efficiency mobile air conditioner (H-MAC) in Thailand.
The project in FY 2017 provided two key activities: quantifying CO_2 emissions reduced by using H-MAC and letting the governmental staff of Thailand understand the first activity. As a result, DENSO made sure that compared with the reference mobile air conditioner, H-MAC was able to reduce CO_2 emissions by 24.3% or 14.6 CO_2 g/km.
In consideration of the study results above, importance was given to the activities shown in Table **1-1** in FY 2018.

Table 1-1: Activities for the feasibility study

Activity	Objectives
i. Proposing policies and systems according to Thai needs	・ To reflect the proposal in measures for reducing CO_2 emissions. ・ To prepare standards for giving incentives. ・ To display H-MAC on the ECO-sticker. ・ To reduce the CO_2 excise tax from H-MAC.
ii. Working on how to plan a concrete project for industrialization	・ To evaluate the energy efficiency of typical cars on a category basis. ・ To establish testing procedures by reviewing the bench test. ・ To narrow the test parameters to reduce the man-hours of evaluation.

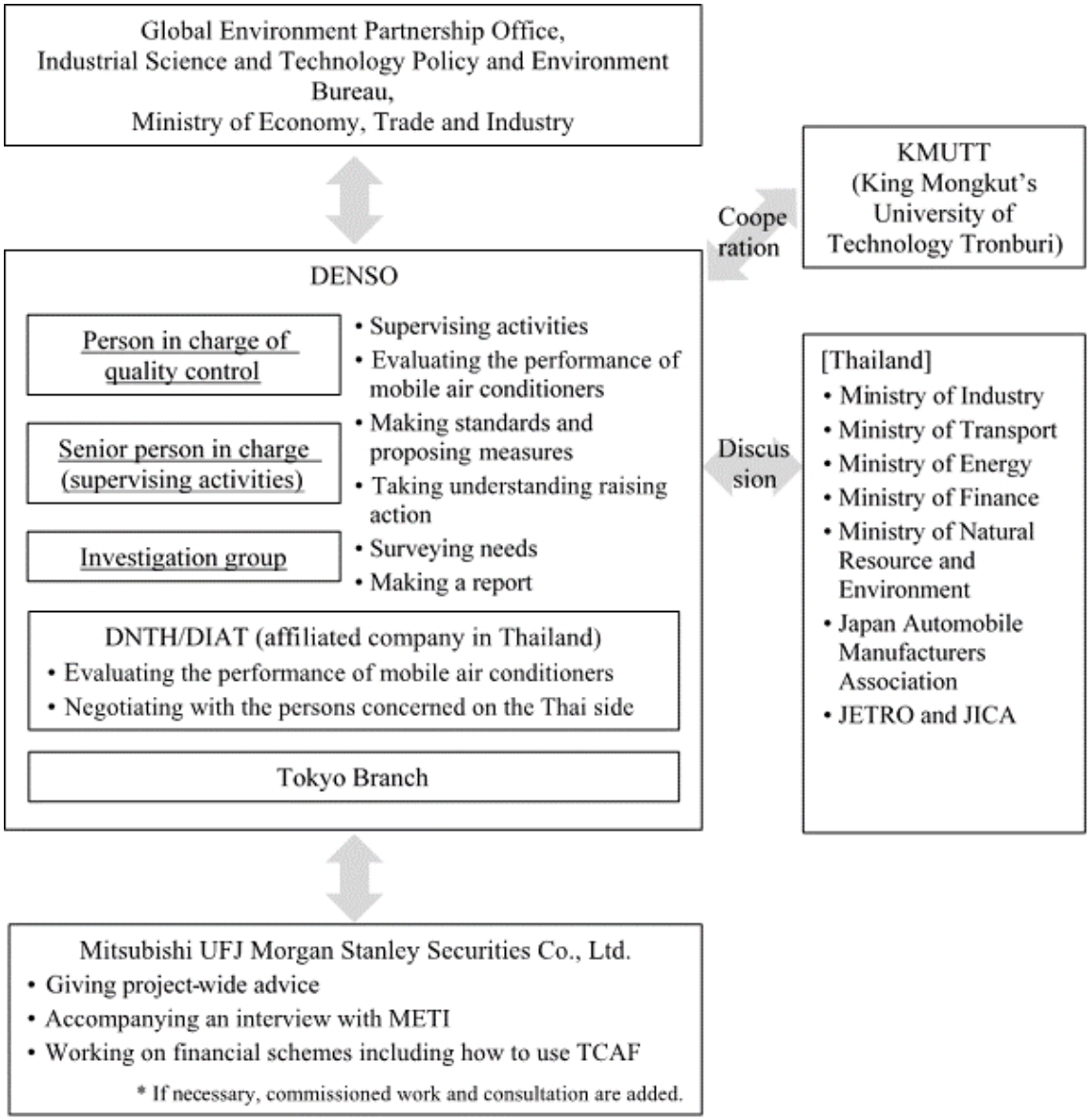
iii. Organizing issues with future industrialization, success factors toward future project development, and problems to be addressed	・ To check the usability of support systems provided by the Thai and Japanese governments as well as by the related organizations when measures are taken against a tax reduction due to the preferential CO_2 excise tax and equipment is introduced to third parties.
iv. Conducting activities necessary to cooperation with private companies and the governmental staff of developing countries	・ To investigate the CO_2 reduction policies of developing countries including Indonesia and usable schemes between governments. The former includes reduction goals, roadmaps for attaining them, and industry-by-industry reduction plans. ・ To hold a workshop in the counterpart country. ・ To let end users except governmental organizations deepen their understandings.

1.3 Project organization

In this feasibility study, DENSO Corporation supervised all the operations in collaboration with DENSO INTERNATIONAL ASIA CO., LTD (DIAT) and DENSO (Thailand) Co., Ltd. (hereinafter called DNTH), a corporate subsidiary, and King Mongkut's University of Technology Tronburi (KMUTT), a local supporter.

As a domestic collaborator and contractor, Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (MUMSS) gave a variety of aid to the operation.

Figure **1-1** shows the project organization.



Source: Data processed by the investigation group

Figure 1-1: Project organization

Chapter 2 Thailand's automobile policies and trends

2.1 Key policies and organizations for this project

This project aims to reduce GHG emissions by promoting energy-saving technologies for automobiles with the Thai ECO-sticker system, so it has the following key policies:

1) GHG reduction target (= NDC)
2) Energy efficiency plan (EEP)
3) Sustainable transport master plan
4) ECO-sticker system
5) Incentive system for energy-saving vehicles

For more information about Policies 1 to 4, see the "Investigation of the JCM Project Feasibility by Promoting the Spread of High-Efficiency Mobile Air Conditioners in Thailand in the Infrastructure Development Investigation Project 2017 for Credit Acquisition between the Two Countries (International Contribution Quantification and JCM Feasibility Investigation)." 2.2 presents an in-depth description of Policy 5.

Table 2-1 shows the outline of the concerned organizations of the government. This project consists mainly of the Ministry of Natural Resources and Environment (MONRE) that draws up GHG reduction plans, the Ministry of Transport (MOT) in charge of policies in the transportation sector, the Ministry of Industry (MOI) that controls the ECO-sticker system for automobiles, the Department of Alternative Energy Development and Energy Efficiency (DEDE) that belongs to the Ministry of Energy (MOE) responsible for energy-saving policies, the Ministry of Finance (MOF) in charge of excise tax rates for energy-saving vehicles, and the Board of Investment (BOI) that runs the system for recommending local production.

Table 2-1: Outline of the organizations concerned

Organization	Roles	Relations to this project
Ministry of Natural Resources and Environment (MONRE)		
Thailand Greenhouse Gas Management Organization (TGO)	・Plans policies and strategies for measures (CO_2 reduction) against climate change. ・Functions as a focal point for JCM.	・Is a department for contact with the Thai government about the JCM project.
Pollution Control Department (PCD)	・Manages air pollution (SOx and NOx).	・Takes charge of mainly emission control. ・Is one of the departments which should be convinced PM2.5 reduction by H-MAC spread..
Ministry of Transport (MOT)		
Office of Transportation and Traffic Policy and Planning (OTP)	・Plans policies in the transportation sector. ・Plans policies for reducing CO_2 emissions in the transportation sector.	・H-MAC has a direct effect on the reduction of CO_2 emissions promoted by OTP in the transportation sector.
Department of Land Transport (DLT)	・Implements policies in the land transportation sector. ・Tests vehicles for exhaust gas.	・Registers vehicles as a main duty. As of now, DLT little relates with this project but will be a supporter in the collection of car taxes.
Ministry of Industry (MOI)		
Office of Industrial Economics (OIE)	・Plans policies for industrial management. ・Controls ECO-stickers.	・Is involved directly in the reflection of H-MAC information in the ECO-sticker this investigation project aims at.

Thai Industrial Standards Institute (TISI)	・Develops national standards.	・Is involved in the standardization of evaluation tools.
Ministry of Energy (MOE)		
Department of Alternative Energy Development and Efficiency (DEDE)	・Promotes the development of alternative energy. ・Promotes energy saving.	・H-MAC is included in the energy-saving technologies DEDE promotes.
Energy Policy and Planning Office (EPPO)	・Plans general energy policies.	・Plans policies on the power supply side as a key duty, so EPPO little relates with this investigation project.
Ministry of Finance (MOF)		
Excise Tax Department (ETD)	・Controls preferential excise taxes for energy-saving products.	・The preferential excise tax for vehicles equipped with H-MAC can promote the air conditioner.
Board of Investment (BOI)		
Board of Investment (BOI)	・Determines or changes company types and conditions for encouragement as well as investment requirements and incentives according to the investment encouragement law.	・If H-MAC parts produced locally are exempted from corporate taxes, it can promote the air conditioner.

Source: Data processed by the investigation group

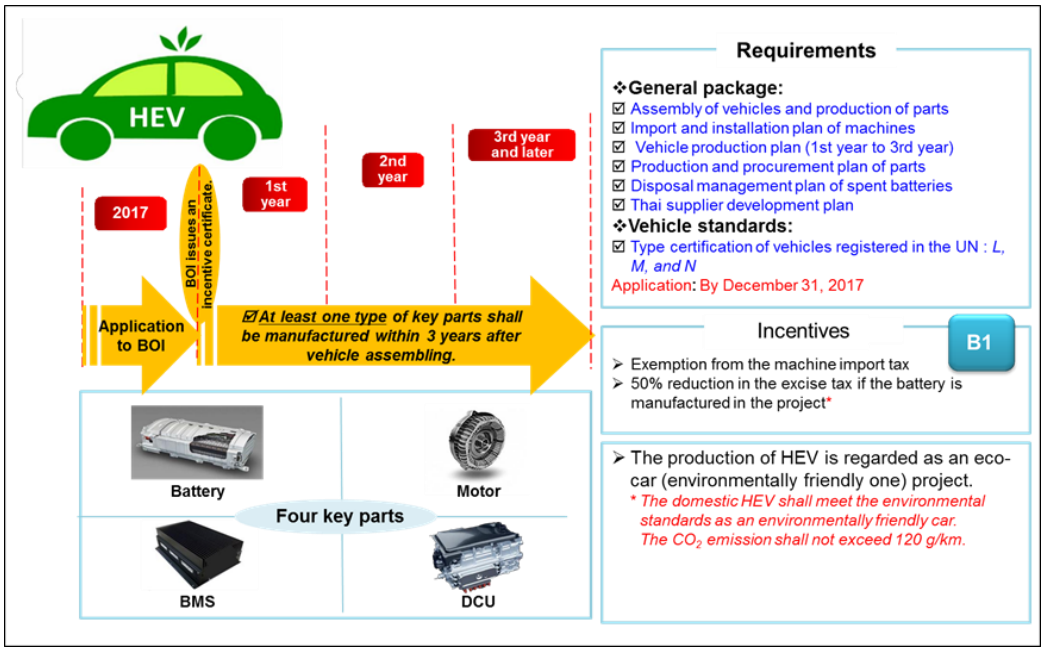
2.2 Incentive system for energy-saving vehicles

The local production of energy-saving vehicles can receive incentives from both BOI and preferential excise taxes.

2.2.1 BOI's incentive system for the local production of energy-saving vehicles

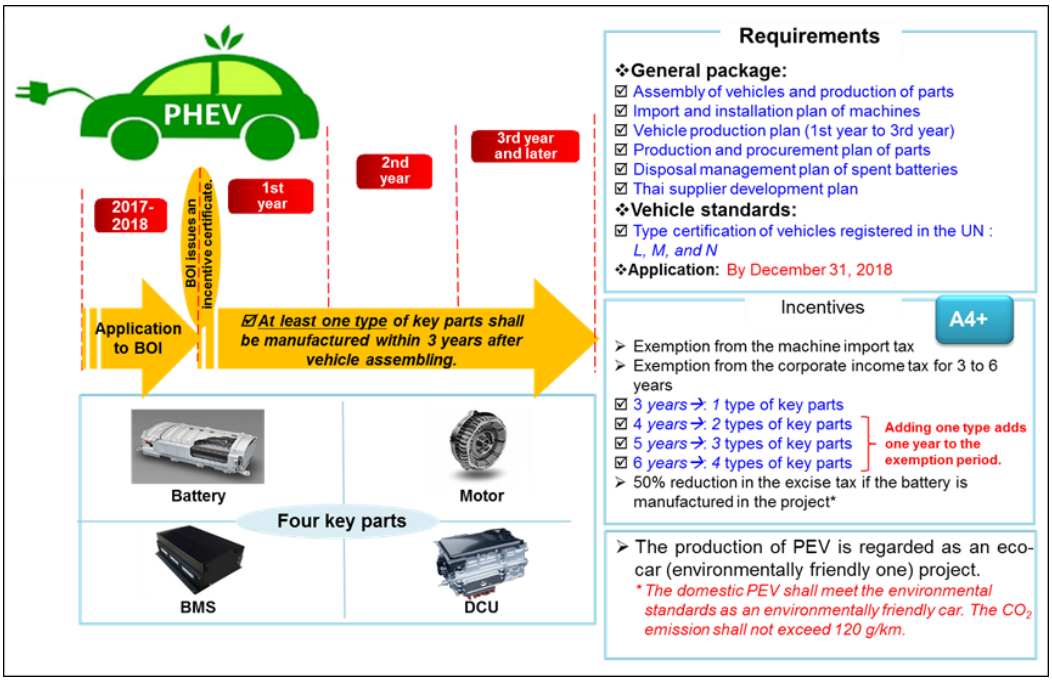
To promote the local sale and production of energy-saving vehicles, BOI sets up an incentive system for EV vehicles following Phases I and II of the eco-car system, and gives priority to the policy for promoting the spread of such vehicles through the local production.

The Thai incentive system has a feature--the EV vehicle is defined to include a battery electric vehicle (BEV), a hybrid electric vehicle (HEV), and a plug-in hybrid electric vehicle (PHEV). The latter two vehicles are chosen as an intermediary action until the spread of BEV or in consideration of a diversity of end user needs. Moreover, the incentive system applies to key EV parts. Figure 2-1, Figure 2-2, Figure 2-3, and Figure 2-4 show the incentive systems for HEV, PHEV, BEV, and key EV parts respectively. If a vehicle meets the requirements, it can receive an exemption from the machine import tax, a reduction in the excise tax, and an exemption from or reduction in the corporate income tax.



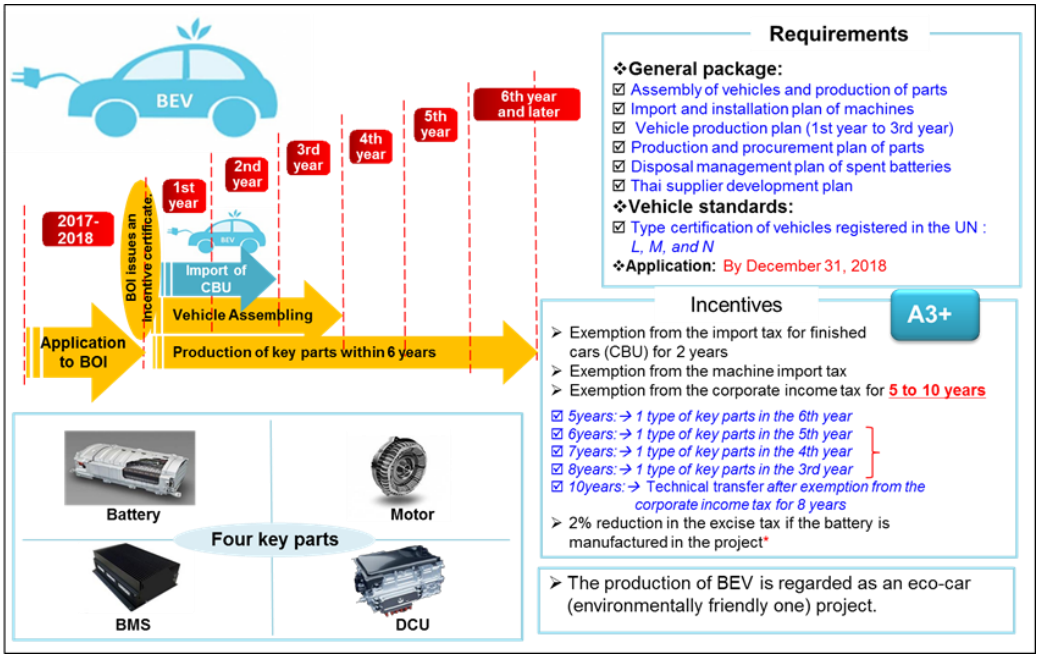
Source: https://www.asean.or.jp/ja/wp-content/uploads/sites/2/2017/08/03-20170801-03-J-EV-FINAL.pdf

Figure 2-1: Outline of the incentive system for HEV



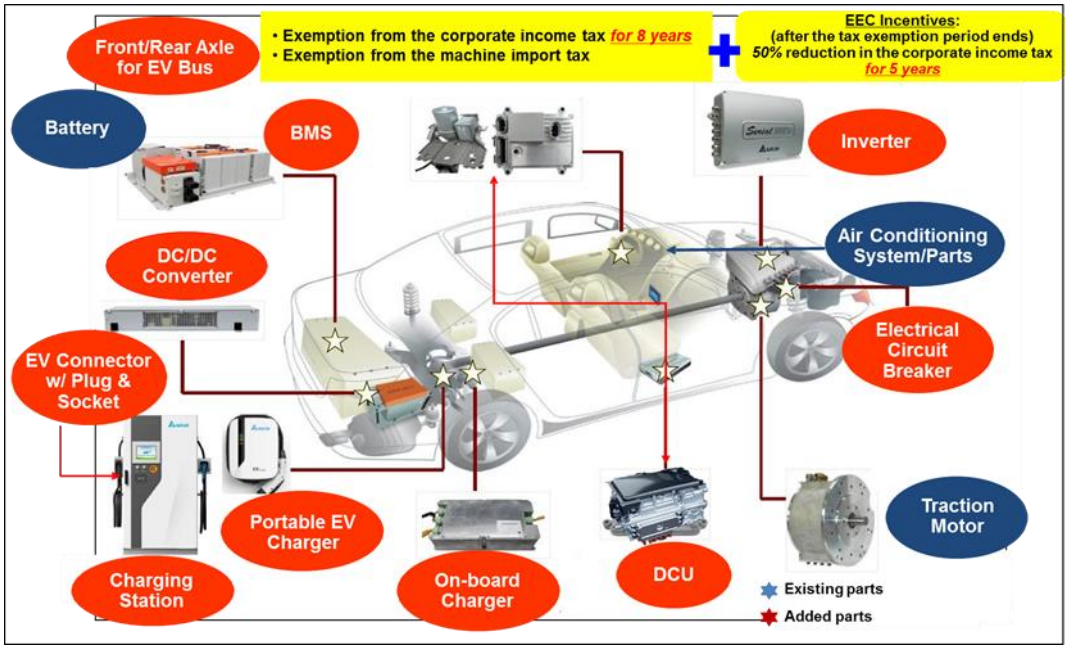
Source: https://www.asean.or.jp/ja/wp-content/uploads/sites/2/2017/08/03-20170801-03-J-EV-FINAL.pdf

Figure 2-2: Outline of the incentive system for PHEV



Source: https://www.asean.or.jp/ja/wp-content/uploads/sites/2/2017/08/03-20170801-03-J-EV-FINAL.pdf

Figure 2-3: Outline of the incentive system for BEV



Source: https://www.asean.or.jp/ja/wp-content/uploads/sites/2/2017/08/03-20170801-03-J-EV-FINAL.pdf

Figure 2-4: Outline of the incentive system for key EV parts

2.2.2 Incentive system for excise taxes imposed on energy-saving vehicles

As mentioned in Section 2.2.1, the energy-saving EV can get the excise tax reduction in cooperation with the incentive system of BOI. Table 2-2 shows that the tax reduces by 50% for HEV rated at an engine displacement of 3,000 cc or less or by 75% for the other EV.

Table 2-2: Excise taxes reduced for energy-saving vehicles

Vehicle category	CO_2 emission or engine displacement	Tax rate (%)		
		E10[1]/E20[1]	E85[1]/NGV[1]	Hybrid/BOI[1]
Passenger car with up to 9 seats	≤ 100 g/km	25[2]	20[2]	8/4[2]
	101-150 g/km	25	20	16/8
	151-200 g/km	30	25	21/10.5
	> 200 g/km	35	30	26/13
	> 3,000 cc	40	40	40
PPV[3]/DC[3]/Space cab[3]/Pick up	≤ 175 g/km	18[2]/8/4/2.5		
	≤ 200 g/km	20[2]/10/4/2.5		
	> 200 g/km	25/13/6/4		
	> 3,250 cc	40		
Eco Car (E10/E20/ Diesel) /E85, B10	≤ 100 g/km	12[2]/10[2]		
	101-120 g/km	14		
EV/FCV/EV BOI[1]	-	8/2		

Source: Data processed by the investigation group

2.2.3 Effect of the incentive system on energy-saving vehicles

The excise tax reduction for EV in cooperation with BOI has a great impact on the sales, so each car manufacturer made an application for producing HEV locally because the investment was expected to return. According to Thansettakij, a Thai newspaper, on September 23, 2018, BOI approved investment incentives to motor-driven vehicles or parts made by Toyota, Honda, Nissan, Mercedes Benz, BMW, and MG. However, no company made an application for the production of BEV because the incentive was not enough to the investment.

Table 2-3 shows the excise tax rate of CH-R (HEV) produced by Toyota winning the first approval, and Table 2-4 indicates the vehicle price. The excise tax rate of CH-R/HEV is 4%. The price is THB1,152,811 (about JPY3,930,000[4]) with no approval from BOI, but the tax rate reduces it to THB 1,069,000 (about JPY3,650,000) by THB 83,812 (about JPY290,000). As a result, CH-R is cheaper than Honda HR-V gasoline vehicle THB 1,099,000 (about JPY3,750,000) belonging to the same Segment C. Thanks to this incentive, low fuel consumption, and design Thai people like, CH-R got an order of 3,000 vehicles for a month from December 2017 to January 2018. The breakdown showed that HEV had a 75% share. The results tell that the government's incentive system has a great effect on the sales promotion of energy-saving vehicles.

[1] E10/E20/E85 uses gasoline including alcohol and the numerical values shows the content. NGV is a natural gas vehicle. BOI is a BOI-certified hybrid car.
[2] This vehicle is obliged to have ABS (Antilock Brake System) and ESC (Electronic Stability Control).
[3] PPV: Pickup passenger car; DC: Double cab; Space cab: Vehicle with a narrow rear seat for children.
[4] Exchange rate: 1THB = 3.41JPY

Table 2-3: Excise tax rates of CH-R

Vehicle type	Old tax rate	New tax rate	Tax rate based on BOI approval
HEV (CH-R)	10%	8%	4%

Source: Data processed by the investigation group

Table 2-4: Vehicle prices

	Toyota CH-R/HEV	Toyota Prius/HEV	Toyota Camry/HEV	Honda HR-V/gasoline
Price including tax (THB)	1,069,000 (about JPY 3,650,000)	1,190,000 (about JPY 4,060,000)	1,673,000 (about JPY 5,700,000)	1,099,000 (about JPY 3,750,000)

Source: Data processed by the investigation group

2.3 Trends in the fuel efficiency regulations of ASEAN

In general, fuel efficiency regulations have a significant impact on the reduction of CO_2 emissions from automobiles, but ASEAN enforces no regulations as of now. Note that the association runs regulations for fuel-efficiency labels and an incentive system for taxes, both having an effect on CO_2 reduction. This project aims at an incentive system as a means of developing such mechanisms. To build up the system in Thailand and to spread it into ASEAN in the future, importance should be given to grasping country-by-country systems. Table 2-5 shows whether key members of ASEAN have the regulation for fuel-efficiency label and incentive system for taxes, and the following subsections presents the outline of country-by-country systems.

Table 2-5: Availability of the regulation for fuel-efficiency labels and the incentive system for taxes in the key members of ASEAN

Country	Fuel consumption label	Incentive for taxes
Thailand	Yes	Yes
Indonesia	No	Yes
Vietnam	Yes	No
Philippines	Yes	No
Malaysia	Yes	Yes
Singapore	Yes	No

Source: Data processed by the investigation group

2.3.1 Thailand

DENSO already completed an investigation of Thailand. For information about the Thai regulation and system, see Section 2.3 of the “Investigation of the JCM Project Feasibility by Promoting the Spread of High-Efficiency Mobile Air Conditioners in Thailand in the Infrastructure Development

Investigation Project 2017 for Credit Acquisition between the Two Countries (International Contribution Quantification and JCM Feasibility Investigation).”

2.3.2 Indonesia

Indonesia has no regulations for fuel-efficiency labels. The country has low-cost green car (LCGC) regulations and a preferential tax system for low-carbon emission vehicles (LCEV) to reduce the excise tax according to the displacement. Moreover, Indonesia recently works on the excise tax based on CO_2 emissions, so attention should be paid to the trend. For more information, see Chapter 4.

2.3.3 Vietnam

Vietnam has introduced fuel consumption labels to vehicles with seven seats or less (Figure 2-5) since 2015 and to vehicles with nine seats or less (Figure 2-6) since 2019.

Source: First APEC Workshop on Policy Dialogue on Fuel Economy Platform, April 26-27, 2018, Bangkok, Thailand

Figure 2-5: Example of fuel consumption labels for vehicles with seven seats or less

Source: First APEC Workshop on Policy Dialogue on Fuel Economy Platform, April 26-27, 2018, Bangkok, Thailand

Figure 2-6: Example of fuel consumption labels for vehicles with nine seats or less

Vietnam has no incentive system for excise taxes as of now, and the tax rate is proportional to the engine displacement as shown in Table 2-6. Change to the excise tax based on CO_2 emissions is considered for the spread of H-MAC.

Table 2-6: Vehicle-by-vehicle excise tax rates

No.		Vehicle category	Excise tax rate (%)
			After January 2018
1		Passenger car with 9 seats or less	
	a	- Engine displacement < 1,500 cc	35
	b	- Engine displacement: 1,500 to 2,000 cc	40
	c	- Engine displacement: 2,000 to 2,500 cc	50
	d	- Engine displacement: 2,500 to 3,000 cc	60
	e	- Engine displacement: 3,000 to 4,000 cc	90
2		Vehicle that uses a combination of gasoline and electricity or biofuel so that the gasoline has an about 70% share of the fuel consumption	70% of the excise tax imposed on the same vehicle category
3		Biofuel vehicle	50% of the excise tax imposed on the same vehicle category
4		Electric car	
	a	- Passenger car with 9 seats or less	15
	b	- Passenger car with 10 to less than 16 seats	10
	c	- Passenger car with 16 to less than 24 seats	5
	d	- Cars for both passengers and goods	10

Source: First APEC Workshop on Policy Dialogue on Fuel Economy Platform, April 26-27, 2018, Bangkok, Thailand

2.3.4 Philippines

Philippines plans to introduce a voluntary fuel-efficiency label (Figure 2-7) from January 2019 and a fuel-efficiency label for all vehicles from 2021. The excise taxes are proportional to the vehicle prices (Table 2-7). Change to the excise tax based on CO_2 emissions is considered for the spread of H-MAC.

Source: DOE Department Circular No.: DC 2016-04-0005 Annex B.9.-PPR 09-PCCV: 2016

Figure 2-7: Example of fuel-efficiency labels for vehicles

Table 2-7: Vehicle-by-vehicle excise tax rates

Vehicle price	Excise tax rate
0.6 million pesos (about 1.26 million yen[5]) or less	4%
More than 0.6 million to 1.0 million pesos (about 2.11 million yen)	10%
More than 1.0 million to 4.0 million pesos (about 8.43 million yen)	20%
More than 4.0 million pesos	50%

Source: Fuel economy development in the Philippines, 1st APEC Workshop on Policy Dialogue on Fuel Economy Platform 26-27 April 2018

2.3.5 Malaysia

Malaysia plans to introduce a voluntary fuel-efficiency label for energy efficient vehicles (EEV) (Figure 2-8) from January 2019 and a fuel-efficiency label for all vehicles from 2021.

[5] Exchange rate:1PHP＝2.1JPY

Source: http://marii.my/national-emission-test-centre-launch/

Figure 2-8: Example of fuel-efficiency labels for vehicles

EEV is a vehicle based on a policy for positioning Malaysia as a production base in Southeast Asia according to the National Automotive Policy (NAP 2014). The country aims to let EEV have an 85% share of the domestic automobile production by 2020. To let EEV meet the global standards, Malaysia sets up fuel consumption efficiency (L/km) for energy-saving vehicles. Table 2-8 shows the fuel-efficiency requirements for EEV set forth in NAP 2014.

Table 2-8: Fuel-efficiency requirements for EEV

Category		Vehicle weight (kg)	Fuel efficiency (L/100 km)
A	Micro car	800 or less	4.5
	City car	801 to 1,000	5.0
B	Super mini car	1,001 to 1,250	6.0
C	Mall family car	1,251 to 1,400	6.5
D	Large family car	1,401 to 1,550	7.0
	Compact executive car		
F	Luxury car	1,801 to 2,050	11.0
J	Large 4 X 4	2,051 to 2,350	11.5
Others	Others	2,351 to 2,500	12.0

Source: NAP 2014

The excise tax rate is proportional to the engine displacement (Table 2-9), so change to the excise tax based on CO_2 emissions is considered for the spread of H-MAC.

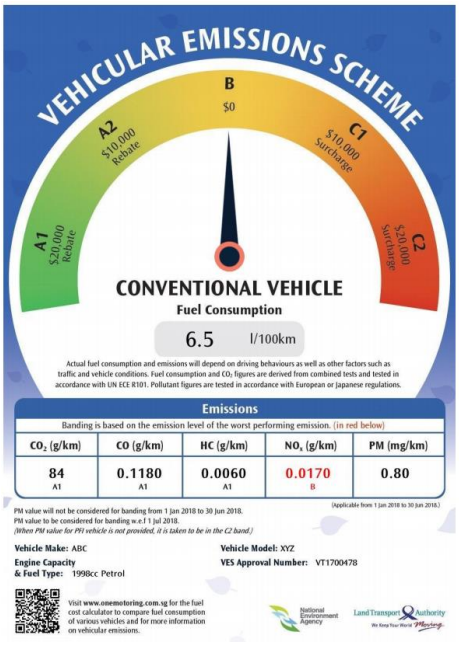
Table 2-9: Vehicle excise taxes

Station wagon, sports car, or racing car		Four-wheel-drive vehicle		MPV or van	
Displacement (cc)	Tax rate (%)	Displacement (cc)	Tax rate (%)	Displacement (cc)	Tax rate (%)
Less than 1,800	75	Less than 1,800	65	Less than 1,500	60
1,800 to 2,000	80	1,800 to 2,000	75	1,500 to 1,800	65
2,000 to 2,500	90	2,000 to 2,500	90	1,800 to 2,000	75
2,500 or over	105	2,500 or over	105	2,000 to 2,500	90
-	-	-	-	2,500 or over	105

Source: http://www.meti.go.jp/meti_lib/report/2016fy/000441.pdf

2.3.6 Singapore

In Singapore, a fuel-efficiency label for vehicles in a showroom for automobile dealers has been introduced since April 2009 and changed it to the label shown in Figure 2-9 since January 2018. The country has a complexed automobile tax system. Table 2-10: Refunded and imposed taxes depending on the amounts of exhaust gases shows the relationship between CO_2 emissions and tax rates. A large amount of refund or penalty tax is imposed depending on the extent of requirement achievement. It is considered to be significant to study about the tax reduction effect of H-MAC.



Source:
https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/costs-of-owning-a-vehicle/tax-structure-for-cars.html

Figure 2-9: Fuel-efficiency label in Singapore

Table 2-10: Refunded and imposed taxes depending on the amounts of exhaust gases

Vehicles registered from January 1, 2018 to December 31, 2019							
Band	CO_2 (g/km)	HC (g/km)	CO (g/km)	NO_x (g/km)	PM* (mg/km)	Rebate**	Sur-charge
A1	A1 ≤ 90	A1 ≤ 0.020	A1 ≤ 0.150	A1 ≤ 0.007	A1 = 0.0	S$20,000	—
A2	90 < A2 ≤ 125	0.020 < A2 ≤ 0.036	0.150 < A2 ≤ 0.190	0.007 < A2 ≤ 0.013	0.0 < A2 ≤ 0.3	S$10,000	—
B	125 <B ≤ 160	0.036 < B ≤ 0.052	0.190 < B ≤ 0.270	0.013 < B ≤ 0.024	0.3 < B ≤ 0.5	0	0
C1	160 < C1 ≤ 185	0.052 < C1 ≤ 0.075	0.270 < C1 ≤ 0.350	0.024 < C1 ≤ 0.030	0.5 < C1 ≤ 2.0	—	S$10,000
C2	C2 > 185	C2 > 0.075	C2 > 0.350	C2 > 0.030	C2 > 2.0	—	S$20,000

* PM is not applicable to cars registered from 1 January 2018 to 30 June 2018 (both dates inclusive).

** The rebate is subject to a minimum ARF payable of S$5,000.

Source:
https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/costs-of-owning-a-vehicle/tax-structure-for-cars.html

Chapter 3 Negotiation with the stakeholders

DENSO had a meeting with the relevant stakeholders at the time of two field surveys conducted in June and November 2018. Moreover, DENSO invited the Ministry of Finance (MOF) to Japan in

August 2018 and the Ministry of Energy (MOE), Ministry of Industry (MOI) and so on to Japan in February 2019 . In November 2018, Japanese METI, Thai MOE, and JETRO jointly held a public-private workshop on Clean Energy Technology between Japan and Thailand. DENSO presented H-MAC at the workshop to make a wide appeal for the importance of attention to increase the efficiency of the mobile air conditioner in a hot region such as ASEAN. As a summary of this fiscal year's project, DENSO held a workshop for all relevant stakeholders in Bangkok in February 2019. The outline and the agenda of discussion in this fiscal year are shown below.

Table 3-1: Outline of field survey

Month of survey	Attendee	Agenda
June, 2018	DEDE OIE OTP KMUTT JETRO JICA	- Report about feasibility study progress - Confirmation about government policy review, e.g. review of NDC action plan - Exchange of opinions about future action plan
November, 2018	DEDE OIE KMUTT	- Report about feasibility study progress - Confirmation about government policy review, e.g. review of ECO-sticker and NDC actin plan - Exchange of opinions about test method, standard, test facility introduction and future action plan

Table 3-2: Outline of invitation to Japan

Month of invitation	Attendee	Agenda
August, 2018	ETD KMUTT	- Explanation about manufacturing process and components of mobile car air conditioners (MAC) - Explanation about the difference between normal MAC and H-MAC - Explanation about the potential of CO2 emission reduction by H-MAC spread - Share about CO2-emission-base excise taxation
February, 2019	DEDE OIE TISI ETD KMUTT others	- Explanation about manufacturing process and components of MAC - Explanation about the potential of CO2 emission reduction by H-MAC spread - Explanation about test facility for MAC and test method - Discussion about standardization, introduction way of test facility and promotion way of H-MAC spread

Table 3-3: Outline of workshop

Month of event	Name of workshop	Attendee	Agenda
November, 2018	Public-private workshop on Clean Energy Technology between Japan and Thailand	MOE TGO IEA METI JETRO others	- Explanation about the potential of CO2 emission reduction by H-MAC spread in Thailand and ASEAN

February, 2019	Workshop on feasibility Study of CO2 emission reduction by promoting the spread of H-MAC (FY2018)	DEDE OIE TISI OTP ETD TAIA KMUTT JETRO	- Report about FY2018 project results - Share about performance test results of MAC for pickup truck and so on - Explanation about the potential of CO2 emission reduction by H-MAC spread H-MAC - Proposal of test method and standardization idea - Discussion about standardization, promotion way of H-MAC spread and so on

Chapter 4 Investigation of the possibility of a spread into other countries

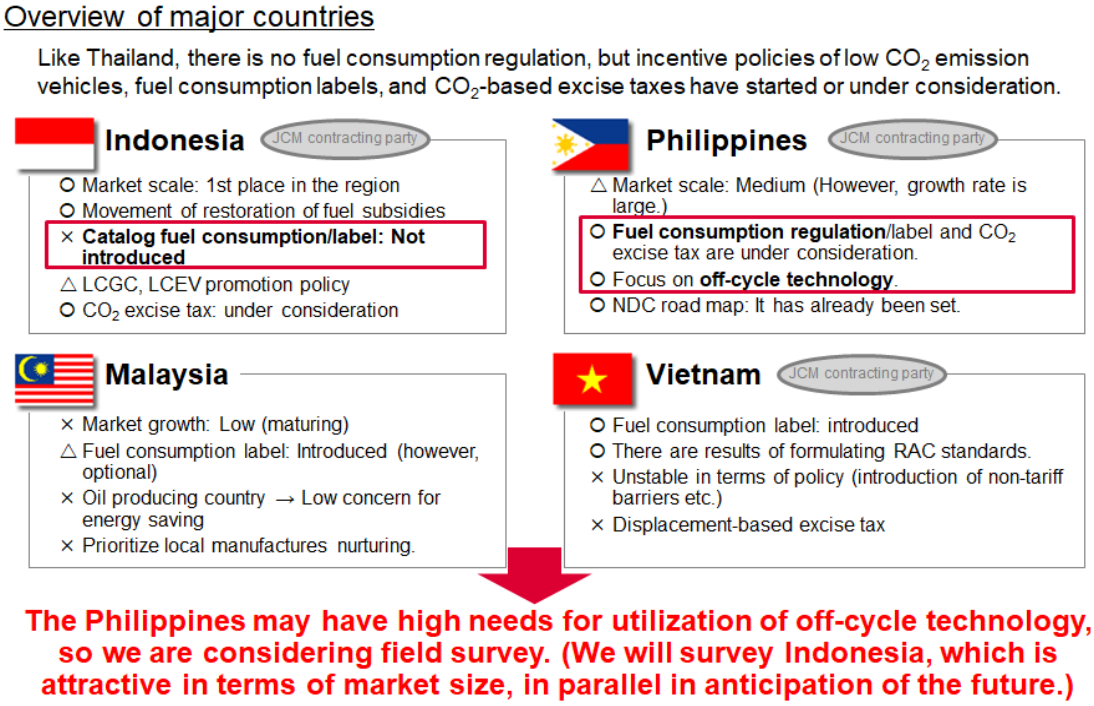
The project in the last fiscal year and this fiscal year has been promoting activities in Thailand. However, the CO_2 reduction effect of H-MAC is an effective technology even in ASEAN countries with high annual average temperatures.

Therefore, we conducted a feasibility study on the promotion activities of H-MAC in other ASEAN countries.

Selection of the surveyed countries was decided by comparing market size, regulation trend, etc. The comparison table is shown on Figure **4-1**. As a result of the study, the Philippines was regarded as the first priority country, and field survey was conducted along with a survey by collecting information.

As Indonesia has the largest market size in the region, a survey only by collecting information was conducted.

The result showed that the promotion activities of H-MAC were a little too early to start in both countries. The results are reported below.



Source: Data processed by the investigation group

Figure 4-1: Comparison of potential for expansion on major countries in ASEAN

4.1 Survey of relevant policies in Indonesia

4.1.1 Market trends

In the automobile industry, Indonesia accounts for about one-third of the annual sales of ASEAN--a top share of the market. This is because the population is about 258 million people and the class of middle-income earners is expanding rapidly. In the production, Indonesia ranks second following Thailand in the ASEAN area, but the difference from Thailand is expected to be shortened for the next 10 years. Therefore, the Indonesian government looks forward to the automobile industry because it will tow the growth of the national economy.

Table 4-1: Automobile sales in ASEAN

Country	2014	2015	2016	2017
Indonesia	1,208,019	1,013,291	1,062,716	1,079,534
Thailand	881,832	799,632	768,788	871,650
Malaysia	666,465	666,674	580,124	576,635
Philippines	234,747	288,609	359,572	425,673
Vietnam	133,588	209,267	270,820	250,619
Singapore	47,443	78,609	110,455	116,148
Brunei	18,114	14,406	13,248	11,209
ASEAN	3,190,208	3,070,488	3,164,742	3,331,468

Source: Data derived from the ASEAN Automotive Federation by the investigation group[6]

Table 4-2: Automobile production in ASEAN

Country	2014	2015	2016	2017
Thailand	1,880,007	1,913,002	1,944,417	1,988,823
Indonesia	1,298,523	1,098,780	1,177,797	1,216,615
Malaysia	596,418	614,664	545,253	499,639
Philippines	88,845	98,768	116,868	141,252
Vietnam	121,084	171,753	236,161	195,197
ASEAN	3,984,877	3,896,967	4,020,496	4,041,526

Source: Data derived from the ASEAN Automotive Federation by the investigation group

4.1.2 Policies for GHG reduction and energy-saving promotion

(1) Key policies and organizations for this project

The purposes of this project are to spread energy-saving technologies for vehicles and to reduce GHG emissions in Indonesia. The Coordinating Ministry of Economic Affairs (CMEA) and the Ministry of Energy and Mineral Resources (MEMR) take the initiative in realizing the policies shown below. The former is in charge of GHG reduction planning, while the latter controls the departments that save energy according to energy policies.

- GHG reduction goal (NDC)
- National energy conservation master plan (RIKEN : Rencana Induk Konservasi Energi Nasional)
- National energy plan (RUEN : *Rencana Umum Energi Nasional*)

Indonesia now takes GHG emission reduction measures in the transport division according to the Sustainable Urban Transport Programme Indonesia (SUTRI), but the main activities will end by

[6] https://www.indonesia-investments.com/business/industries-sectors/automotive-industry/item6047

2020. Therefore, DENSO made an investigation of the three mid- or long-term policies after 2020 as shown above.

Table 4-3: Outline of the organizations concerned

Organization	Roles	Relations to this project
CMEA		
Coordinating Ministry of Economic Affairs	・ Organizes the national GHG reduction plan (NDC).	・ Can be a coordinator at an inter-organization dialogue about how to add H-MAC promotion as an NDC action.
MEMR		
Ministry of Energy and Mineral Resources	・ Promotes energy saving. ・ Systemizes standards.	・ Controls the pursuit of energy-saving performance including the introduction of tax benefits. ・ Can be a counterpart of this project in the fuel-efficiency regulations. ・ Controls the standards and tests for high-efficiency devices.
Ministry of Industry (MOI)		
Directorate General of High Technology Based Leading Industry (for car manufacturers)	・ Promotes Industry 4.0.	・ Can be a contact department for sharing information about the systems related to this project because the directorate general has a certain organizing function.
Ministry of Finance (MOF)		
Directorate General of Customs and Excise	・ Determines the excise tax rate. ・ Makes a survey of systems.	・ Can be a receiver for system proposals because the directorate general has a role for working on the future CO_2-based tax system. ・ Can be a consignee for sharing system information.
Ministry of Transport (MOT)		
Directorate General of Land Transportation	・ Improves the efficiency of public vehicles. ・ Operates the vehicle inspection system.	・ Has a suitable relation with this project as of now. ・ Can be a counterpart when this project applies to public vehicles.
Indonesian Investment Coordinating Board (IICB)		
Investor Relations Unit		・ Has the possibility of starting a preferential investment system.

Source: Data processed by the investigation group

(2) GHG reduction policies

The Indonesian government signed the Paris Agreement and submitted its NDC to UNFCCC in 2016. The contribution sets up two goals: one is to reduce GHG by 29% of the BAU in 2030, and the other

is to increase the contribution to reduction to 41%. According to the NDC and energy sector, the transportation sector specifies the GHG reduction goal as follows: Firstly and particularly in the process of pursuing the high efficiency of the transportation sector, H-MAC is expected to have contributions.

- Improving the energy usage efficiency.
- Raising the usage ratio of electric power, compressed natural gas, and biofuel.
- Building up an efficient urban transport system in consideration of limitations on private cars, energy saving, and environments.

Table 4-4: NDC-based identification of mitigation actions toward GHG reduction in the energy sector

Mitigation action	Progress	Reduction goal (million tCO_2e)	Supervisor
General provision	GHG reduction policy based on RUEN and RUPTL in 2016		MEMR
Final efficiency of energy and fuel consumption	1. Operation and audit of energy, program for saving energy and water, application of LED lights to public roads, and energy-efficiency labels 2. Measures for raising the efficiency of transport activities 3. Environmentally friendly buildings	96.33	MEMR, MOT, and MoPW
Introduction of clean coal technology (CCT) to power plants	4. Introduction clean power technology to fuel power plants with gas or steam as cogeneration 5. Plan for developing USC and IGCC power plants	31.80	MEMR
Introduction of renewable energy to electrical products and biofuel to the transportation sector (Mandatory B30)	Introduction of hydraulic, geothermal, bioenergy, photovoltaic, and wind power generation Development of biofuel in the transportation sector	170.42	MEMR MOT
Additional gas distribution lines and compressed natural gas stations (SPBG)	Promotion of gas usage networks for households and carriers as well as of change from kerosene to LPG	10.20	MEMR

Source: Data derived from NDC by the investigation group

(3) Energy-saving plan

In 2005, Indonesia announced the National Energy Conservation Master Plan (Rencana Induk Konservasi Energi Nasional or RIKEN). In 2011, the president issued an order based on the plan for

the transportation sector to reduce the energy consumption by 15% by 2025, and the Indonesian government showed goals for reducing the economic efficiency of energy by 1% every year and for improving the energy elasticity until 2025.

Table 4-5: Energy-saving potential

Sector	2013 Energy consumption (Unit: Million BOE*)	Possible rate of energy storage (Unit: %)	2025 Energy storage goal (Unit: %)
Industry	355 (42%)	10-30	17
Commerce	324 (39%)	15-35	20
Transportation	100 (12%)	15-30	15
Consumer appliance	36 (4%)	10-30	15
Others (agriculture, construction, and mining)	23 (3%)	25	NA

* BOE = Barrels of Oil Equivalent

Source: Data processed by the investigation group according to Indonesia Energy Sector Assessment, Strategy, and Roadmap, Asian Development Bank, July 2016, Page15, Table 5

(4) Energy plan

The mitigation actions for attaining the NDC goals in the transportation sector are set forth in the National Energy Plan (RUEN：*Rencana Umum Energi Nasional*) specified in the No. 22 order issued by the president in 2017, which is derived from the No. 79 government ordinance "National Energy Policy (KEN：*Kebijakan Energi Nasional*)" showing an introduction plan in multiple sectors in 2014. According to the energy plan, the transportation sector's final energy demand is expected to be 75.2 Mtoe (30.3% of the whole) in 2025 and 169 Mtoe (26.3%) in 2050. Gasoline, which accounted for 96% in 2015, still holds a top share but has reduced in inverse proportion to a rise in the share of other and various energy sources, such as biofuel, gas, and electric power. As a result, the share will reduce to 83.5% in 2025 and 72.9% in 2050.

Table 4-6: Records and forecasts of final energy demand in the transportation sector on an energy type basis (2015 to 2050)

Energy type	2015	2016	2017	2018	2019	2020	2025	2030	2040	2050
Gasoline	47.6 (96.0 %)	48.7 (94.3 %)	50.1 (93.1 %)	51.7 (91.8 %)	53.3 (90.5 %)	54.7 (89.0 %)	62.8 (83.5 %)	71.6 (79.7 %)	94.8 (76.2 %)	123.2 (72.9 %)
Biofuel	1.8	2.6	3.2	3.9	4.6	5.5	9.6	14	21.3	31.2
Liquefied natural gas	0.2	0.4	0.5	0.7	0.9	1.2	2.6	3.7	7	11.9
Electric power	0.02	0.02	0.03	0.03	0.04	0.1	0.2	0.5	1.3	2.7
Total	49.6	51.7	53.8	56.3	58.9	61.5	75.2	89.7	124.4	169.0

Source: Data processed by the investigation group according to the Presidential Decree no 22 year 2017 on National Energy Plan, Attachment 1, Section 4.2.3, Table 50[7]

To achieve the final energy demand goals in the transportation sector as shown above, Indonesia will conduct the following activities based on RUEN, so H-MAC will be expected to contribute particularly to the automobiles in Items 6 and 11.

Table 4-7: Activities and goals based on RUEN

1) The transportation sector promotes change from gasoline to LNG by constructing 632 LNG stations (SPBG) in 15 cities to increase the total capacity to 282 MMSCFD by 2025 and increasing the stations to 2,888 to attain 1,291 MMSCFD in total capacity by 2050.
2) Developing electric and hybrid vehicles to produce 2,200 cars and 2,100,000 motorcycles in 2025.
3) Making policies for using gasoline and ethanol cars (flexible fuel engines).
4) Giving financial incentives to the production of electric cars and motorcycles that conform to the corresponding regulations for the automobile industry.
5) Drawing up a roadmap to use biofuel as a gasoline mixture for land, marine, and air transportation as well as for trains (biodiesel, bioethanol, and biofuel) until 2050.
6) Drawing up a roadmap to take measures for imposing carbon taxes on the consumption of fossil fuels. Note that a low-carbon gas or LCEV program runs for control.
7) To increase the usage rate of public transport means to 30% of the sector by 2025, Indonesia develops a main system for urban and public transportation including railways, trains, buses, and stations toward airports.
8) Developing airport trains, such as mass rapid transit (MRT), light-rail transit (LRT), and streetcars, in 13 cities.
9) Developing traffic management to limit trucks going into cities by installing the intelligent

[7] https://www.esdm.go.id/assets/media/content/content-rencana-umum-energi-nasional-ruen.pdf

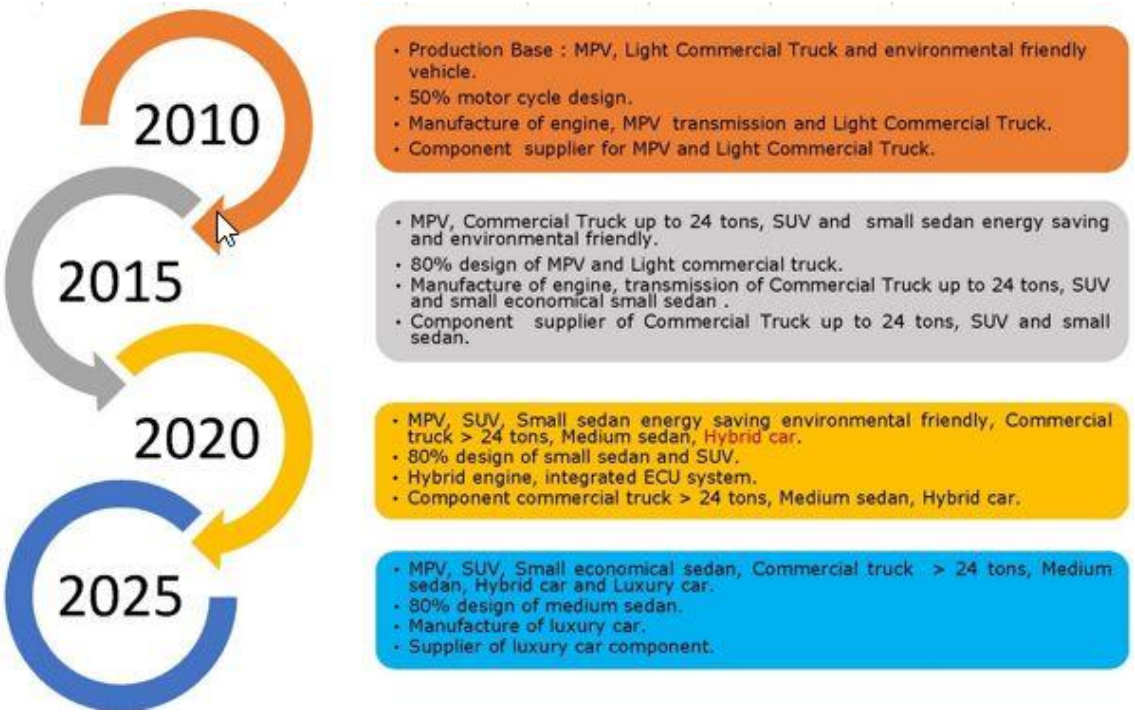
transport system (ITS) in 24 cities and the area traffic control system (ATCS) at 50 places.
10) Drawing up a policy draft to make a road maintenance budget according to the governmental income.
<u>11) Developing fuel-efficiency standards for vehicles particularly private cars before 2020.</u>
12) Building up a high-speed marine road system (regular marine transport of goods) by providing 150 ships.

Note: The underlined activities have the possibility of working with the H-MAC promotion project.

Source: Data derived from RUEN by the investigation group

4.1.3 Preferential tax system for promoting low-carbon automobiles

In 2015, to lead the automobile-related fields as one of domestically important industries, the Indonesian government issued the No. 14 government ordinance for the master plan for developing the domestic industries (RIPIN : *Rencana Induk Pengembangan Industri Nasional*) from 2015 to 2035, resulting in a roadmap for such fields. The roadmap pays attention to how to handle sedans by 2025, so DENSO expects H-MAC to be used widely.



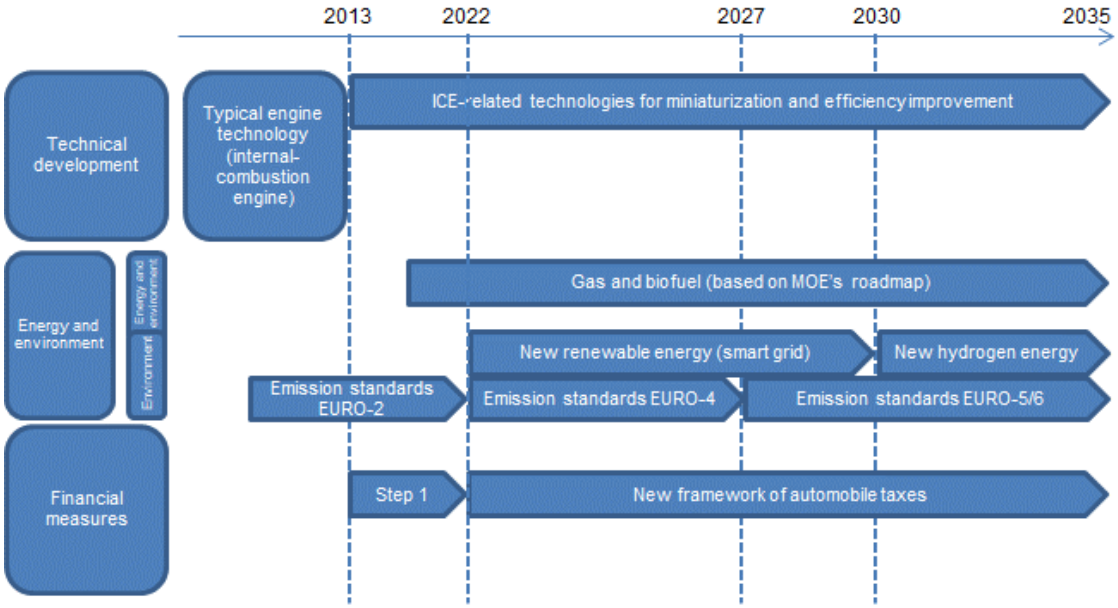
Source: Data processed by the investigation group according to the Presentation by Directorate General of Electricity, Ministry of Energy and Mineral Resources in Indonesia Energy Efficiency and Conservation Conference / IEECCE 2018, 18 September 2018.

Figure 4-2: RIPIN-based strategies shown in the Indonesian automobile roadmap

(1) Industry 4.0

The Indonesian Ministry of Industry executes "Industry 4.0," a roadmap focusing on new opportunities to develop digital technologies, such as IoT and AI. The time span falls roughly into three parts, and the short-term plan aims at technological application to improve the productivity of internal-combustion engine (ICE) vehicles. In this field, H-MAC is expected to have contributions as a technology for increasing the energy efficiency of cars.

In addition, Industry 4.0 shows "ICE downsizing technologies and efficiency improvement," so DENSO thinks that H-MAC has the possibility of contributing to them.



Source: Data processed by the investigation group according to Presentation by Directorate General of Metal, Machinery, Transportation and Electronic Industries, Ministry of Industry, Indonesia Energy Efficiency and Conservation Conference / IEECCE 2018, 18 September 2018.

Figure 4-3: Automobile 4.0 Roadmap

(2) Tax system for automobiles

Indonesia imposes the following taxes on the import and sale of cars.

- Withholding tax
- Value-added tax
- Vehicle excise tariffs
- Vehicle fuel tax
- Import duty

The withholding tax is 0.45% of the price at which cars are purchased whether or not they are imported, or 5% for part of high-class cars. The value-added tax is 10%, which is imposed as consumption one. In addition to the value-added tax, the vehicle excise tariffs, which range from

10% to 125%, are imposed on vehicles having certain quality or higher in accordance of the classification table shown below.

Moreover, Indonesia imposes the vehicle fuel tax on the storage, distribution, and sale of gasoline according to a presidential order. As a result, the fuel price includes the value-added tax (10%) and the fuel tax (5-10%). Each local government determines the fuel tax, which is 5% for subsidized gasoline including diesel fuel and most of general types of fuel, or 10% in Bali.

Table 4-8: List of vehicle excise tariffs

Vehicle type	Tire-driven system	Motor system engine	Displacement (CC)	Excise tax rate
Passenger car with less than 10 seats				
- Sedan or station wagon	All types	Spark-ignition system	≤ 1,500	30%
			> 1,500 to 3,000	40%
			> 3,000	125%
		Diesel system (including partial one)	≤ 1,500	30%
			> 1,500 to 2,500	40%
			> 2,500	125%
- Other	4 x 2	Spark-ignition system	≤ 1,500	10%
			> 1,500 to 2,500	20%
			> 2,500 to 3,000	40%
			> 3,000	125%
		Diesel system (including partial one)	≤ 1,500	10%
			> 1,500 to 2,500	20%
			> 2,500	125%
	4 x 4	Spark-ignition system	≤ 1,500	30%
			> 1,500 to 3,000	40%
			> 3,000	125%
		Diesel system (including partial one)	≤ 1,500	30%
			> 1,500 to 2,500	40%
			> 2,500	125%
Passenger car with 10-15 seats	All types	All types	All types	10%

Double-cab car	All types	All types	All types	20%
Special-purpose vehicle				
- All types of golf carts				50%
- Durable vehicle able to run on snow, sandy beaches, and mountain roads				60%
- Caravan trailer or semitrailer for living or camping				125%
Two-wheel vehicle			> 250 to 500	60%
			> 500	125%

Source: Data processed by the investigation group according to the Indonesia Pocket Tax Book 2018 by Pricewaterhouse Coopers Indonesia, pages 60-61.

(3) Low-cost green car (LCGC) regulation

In 2013, the president issued the No. 41 order, which was called the "low-cost green car regulation," to change the vehicle excise tax. Cars that meet the following requirements were exempted from part of the excise tax, resulting in a rise in the motivation of producing small cars featuring high fuel efficiency.

- Engine rated at 1,200 cc or less
- Price: Up to 1.2 million rupees (IDR) (about 0.93 million yen)
- Domestic assembly and domestic production of most of parts in use
- Fuel efficiency:
  - 25% tax exemption for 20 to 28 km/L
  - 50% tax exemption for 28 km/L or over

Table 4-9: Incentives to the excise tax for automobiles

Excise tax reduction rate	Requirements
25%	Car equipped with advanced diesel/gasoline engine technology, dual gasoline gas engine (converter kit CNG/LGV), biofuel engine, hybrid engine, or engine special to CNG/LGV rated at 20-28 km/L in consumption of petroleum or another similar fuel
50%	Car equipped with advanced diesel/gasoline engine technology, biofuel engine, hybrid engine, or engine special to CNG/LGV rated at 28 km/L or over in consumption of petroleum or another similar fuel
100%	Low-cost green car or low-carbon and gas emission program-based car, both meeting the following requirements, except sedan and station wagon 1. Spark ignition up to 1,200 cc or 2. Compression ignition up to 1,500 cc at 20 km/L or over in consumption of petroleum or another similar fuel

Source: Data processed by the investigation group according to the Indonesia Pocket Tax Book 2018 by Pricewaterhouse Coopers Indonesia, page 72

It is said that the policy above had an effect on first car buyers who pay attention to the fuel price

that already started to rise because the government announced a new policy for fuel subsidies in early 2015 to determine the reduction of the subsidies. Actually, 1.8 million passenger cars, 35% of the remainder, will be sold by 2020 due to a potential shift from motor-cycles to low-cost cars.

(4) Low-carbon emission vehicle (LCEV)

Indonesia continuously talks about the construction of a regulatory system toward the spread of low-carbon cars (electric vehicles), and the Ministry of Industry plans to reduce the import tax rate for EV drastically from 5% to up to 40% and to abolish the 40% excise tax for EV. Currently, EV is about 30% more expensive that the existing cars sold domestically. If its price reduces, the demand increases, resulting in an expectation of increasing the investors who make an investment actively. RUEN also presents a plan for EV promotion measures.

In 2016, the Ministry of Energy and Minerals issued the No. 28 order for the power tariffs shown by PT PLN to specify the regulation for EV tariffs supporting the introduction of recharge stations. EV is classified into Category L requiring a cost of 1,650 IDR/kWh.

The global trends show that the conventional cars will change to EV in the near future. Following the low-cost green car introduced in 2013, LCEV supports the Indonesian government's promise by reducing GHG emissions, securing the safety of energy, and developing the domestic automobile industry. The process of making policies for low-carbon cars is shown below.

1) The Ministry of Industry and Mitsubishi Motors conducted joint research in electric cars and adapted them to the society. The latter donated 10 electric cars and 4 low-carbon rechargers.
2) Toyota and a university in Indonesia made a comprehensive investigation of electric cars.
3) There was a movement toward the establishment of a new CO_2-based excise tax and a tax system for promoting domestic EV.

(5) Introduction of CO_2 emission-based vehicle excise taxes

As the second phase of LCGC and measures for promoting LCEV further, the Ministry of Industry makes a draft proposal for the CO_2-based excise tax. The new system will define the excise tax according to the CO_2 emission levels. In the second phase of LCGC, the fuel efficiency is set at 100 g/km or 23 km/L as a CO_2 emission limit. This new proposal is currently subjected to operational and technical checks in the final process. The last step is approval from the minister.

Table 4-10: Proposed modification of the vehicle excise tax

Vehicle type		CO_2 (g/km)	E/G volume (cc)		
			< 1.5	1.5 to 3.0	> 3.0
For passengers	Passenger car (with less than 10 seats)	< 150	15%		40%
		151 to 200	20%		40%
		201 to 250	25%		40%
		> 250	40%		50%
	Passenger van (with more than ten seats)	< 250	15%		30%
		> 250	20%		30%
New energy vehicle	EV / FC	All types	0		
For commercial use	Pickup truck (single cab)	< 150	0		20%
		150 to 200	2%		20%
		> 200	5%		30%
	Heavyweight vehicle	All types	0		
LCGC 2nd phase	LCGC	< 100	0	N/A	
LCEV program	Pickup truck (single cab)	< 100	0		20%
	Plugin hybrid car	101 to 125	2%		20%
		126 to 150	5%		20%

Source: Data derived from CNN Indonesia by the investigation group[8]

Like Thailand, Indonesia can conduct a campaign for letting the people understand change to the CO_2-based vehicle excise tax system that reflects the GHG reduction effect of H-MAC in the tax. However, it is necessary to investigate the government's acceptance including the timing further.

(6) President's draft proposal for promoting the production of domestically branded cars

Indonesia plans to draw up a draft proposal for building up a tax system for the import and production of automobiles to promote EV manufacturing. The proposal will include a high tax rate imposed on the import of completed cars, step-by-step tax rates according to the localization degree of assembly, beneficial tax rates for parts, and incentives to domestically branded EV. The EV needs to meet the following requirements:

- ✓ The motor power is less than 15 kW or that of 2wd cars.
- ✓ The motor power is less than 60 kW or that of 4wd cars.

8 https://www.cnnindonesia.com/teknologi/20180808120621-384-320481/bocoran-baru-konsep-harmonisasi-ppnbm-kendaraan?

- ✓ The vehicle is made in Indonesia.
- ✓ Indonesia has part or all of the intellectual property.
- ✓ Indonesia commands a 51% share of the industry.

(7) Fuel subsidies

Indonesia has a long history of giving subsidies to the production and consumption of fossil fuels. In general, the subsidies are used to achieve goals, for example the production and independence of larger energy, economic growth, and access to low-cost energy resources. The government determines the amount of subsidies as part of the national budget every year to give the fuel-related ones to gasoline (particularly Class RON-88 called premium), diesel (particularly diesel oil for cars), kerosene, and electric power. Regarding LPG, another petroleum product, subsidies are given to kerosene in the program that has run since 2007 to promote a shift from kerosene to LPG. Such subsidies are old-fashioned ones for consumers for the government to keep the price lower than the market one and to make up for the income of PT Pertamina, a state-owned enterprise and unique seller for subsidized fuel.

President Joko Widodo reformed the fossil fuel subsidies for petroleum products in the second half of its regime. Of them, the gasoline subsidies were abolished in fact, and the diesel ones reduced to 1,000 IDR per liter as a fixed rate though the final price varied depending on the market. As mentioned above, Indonesia carries reforms toward a gradual reduction in fuel subsidies without GHG emissions in mind. This means that the reform is not always consistent with the promotion of low-carbon vehicles.

Table 4-11: Fuel subsidies scheme

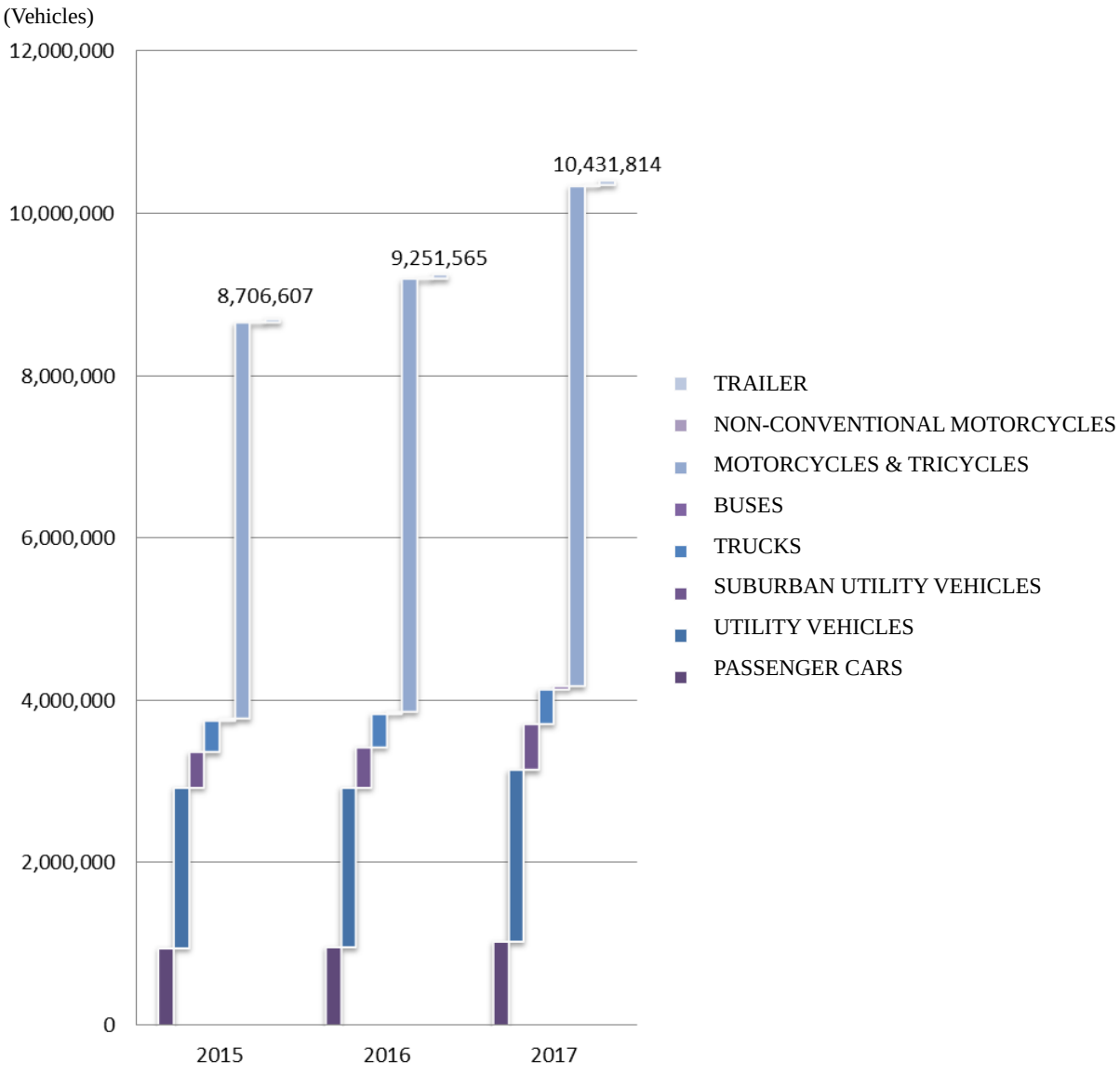
Fuel	Subsidiary policy
Gasoline	Allocated compensation To keep the price consistent all over Indonesia, the government gives subsidies to remote areas as a compensation for the delivery cost. The subsidiary rate is 2% for fuel carriers. The retail price determined in the market is fixed so that the profit rate is 5-10% of the basic market price used by the government.
Diesel	Fixed subsidies The price varies depending on the market at a specified subsidiary rate of 1,000 IDR per liter.
Kerosene	Fixed price The amount of subsidies varies with time but the price is fixed to 2,500 IDR per liter.
LPG	Fixed price The fuel price of 3-kg cylinders is fixed to 5,000 IDR per kg. Formally, no subsidies are given to 12-kg cylinders, so PT Pertamina already sells them with a loss.

Source: Data processed by the investigation group according to the fossil fuel subsidy reform: lessons from the Indonesian case; Institut du dévelopment durable et des relations internationals / IDDRI, Table 14.

4.2 Survey of relevant policies in Philippines

4.2.1 Market trends

In Philippines, registered cars are increasing rapidly in parallel with the urbanization and a rise in city population. The total number was about 10.4 million in 2017, which was 19.6% greater than that in 2015. The following figure shows trends in the number of type-by-type vehicles registered.



Source: Data derived Land Transportation Office 2018 by the investigation group

Figure 4-4: Trends in the number of type-by-type vehicles registered all over Philippines

Passenger cars used for a trip tend to increase. According to the data in 2012, the trip length per passenger car was 15% longer than that in 1996 in the Manila metropolitan area, while that of Jeeps and public buses showed a 7% reduction. The passenger and public vehicles attained a 69% and 41%

rise respectively in travel distance per car.[9]

Since the number of vehicles and the traffic volume increase rapidly, the Philippine transportation sector increases its energy consumption, resulting in a 37% share of the whole consumption of the country. The road transport has a top share--80% of the transportation sector--and it is expected to increase continuously by 6.4% in annual average.

The increase of passenger cars running on roads not only degrades the environment but also causes economic and social issues because the GHG emissions have an effect on climate change, the air pollution has an impact on health, traffic jams become serious, and traffic accidents increase.

4.2.2 Policies for GHG reduction and energy-saving promotion

(1) Key policies and organizations for this project

This project aims to reduce GHG emissions through the promotion of energy-saving technologies for automobiles, so it relates mainly to the following policies:

- GHG reduction
- Energy-saving promotion
- Preferential tax system for low-carbon vehicles

Table 4-12 shows the outline of the subordinate organizations of the government. The key organizations involved in this project include the Climate Change Commission (CCC) in charge of GHG reduction plans, the Department of Energy (DOE) in charge of fuel measures for private cars, the Department of Finance (DOF) managing the preferential tax system for low-carbon vehicles, and the Board of Investment (BOI) recommending the automobile industry to green business.

Table 4-12: Outline of the organizations concerned

Organization	Roles	Relations to this project
Climate Change Commission (CCC)		
Policy Research and Development Division	・ Organizes the national GHG reduction plan (NDC).	・ Can be a coordinator at an inter-organization talk about how to add H-MAC promotion as an NDC action.

[9] JICA and NEDA 2014. Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas (Region III & Region IV-A), Final Report, March 2014
http://www.neda.gov.ph/wp-content/uploads/2015/03/FR-MAIN-TEXT.-12149605_01.pdf

Department of Energy (DOE)		
Energy Utilization Management Bureau	・ Promotes energy saving.	・ Controls labels showing the energy-saving performance and fuel efficiency. ・ Can be a counterpart of this project
Energy Research and Testing Lab	・ Systemizes standards.	・ Controls the standards and tests for high-efficiency devices.
Ministry of Finance (MOF)		
Fiscal Policy Division	・ Determines the excise tax rate	・ Has the role of working on the future CO_2-based tax system.
Research and Information Office	・ Makes a survey of systems.	・ Can be a consignee for sharing system information.
Board of Investment (BOI)		
-	・ Implements a variety of preferential systems for foreign affiliated manufacturers.	・ Has the possibility of contributing to the cost reduction of H-MAC by using the preferential tax system as an investment program if the air conditioner is produced in Philippines.
Department of Transportation (DOT)		
Road Transport and Infrastructure Division	・ Makes public cars efficient. ・ Operates the vehicle inspection system.	・ Little relates to this project as of now. ・ Can be a counterpart when this project applies to public vehicles.
Department of Natural Resources and Energy (DNRE)		
Climate Change Division	・ Conducts general NDC affairs.	・ Little relates to this project because the division may have a certain organizing function but DONRE is responsible for forestry, waste, and adaptation.
Air Quality Management Bureau	・ Enforces the air purification law.	・ Has a substantially low relation though the bureau manages the exhaust gas standard for cars and is interested in this project proposing CO_2 reduction from the exhaust gas.

Source: Data processed by the investigation group

(2) GHG reduction policies

The Philippine government has formed organizations to take measures against climate change. For example, it introduced a climate change act in 2009, enforced the National Framework Strategy on Climate Change in 2010, started the National Climate Change Action Plan 2011-2028 (NCCP) in 2011, and established the Climate Change Commission (CCC) as an inter-organization group under the control of the president by modifying the climate change act in 2012. NCCP regards measures in the transportation sector as one of important fields.

Strategic and important fields set forth in NCCP

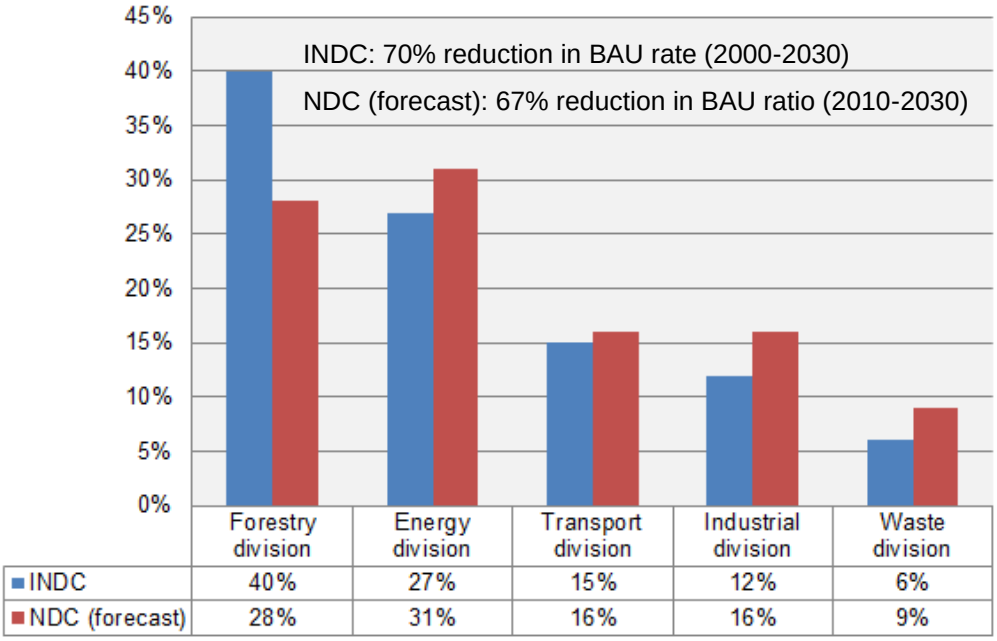
- Safety and security of food
- Conservation of water resources
- Stabilization of ecosystems and environments
- Safety and security of human beings
- Climate-smart industries and services
- Sustainable energy and transport
- Improvement of knowledge and capacity

Source: Climate Change Commission, "Roadmap to Resilience: NCCP and NDC" (March 2018)

President Duterte signed the document related to the Paris Agreement in February 2017 and ratified it in March. The draft of INDC, which was submitted to UNFCCC in October 2015, showed that Philippines would reduce GHG emissions by 70% as a BAU ratio by 2030, provided the developed country side would give financial support, technical aid, and capacity building. However, the country said, "We will pursue the mitigation measures as one of adaptation actions" to regard the GHG emission reduction--the former--as the complementary one of the latter.

After the submission of INDC, the organizations concerned had consultation with each other to finalize NDC. The results of a local hearing survey clearly showed that to submit NDC to UNFCCC by 2020, Philippines planned to finalize it as a draft in June 2019 and to announce the draft from September to the year end. Accordingly, the three items will remain unknown until June 2019: the final goal of reducing GHG emissions, sectoral GHG reduction actions, and the amount of GHG emissions to be reduced.

According to the information disclosed as of January 2019, the GHG reduction goal will be modified to be lower than 70% shown in INDC (67% in July 2017). Note that it is expected that the forestry division will reduce its reduction goal significantly, while the others including the transport division will increase their reduction goals.

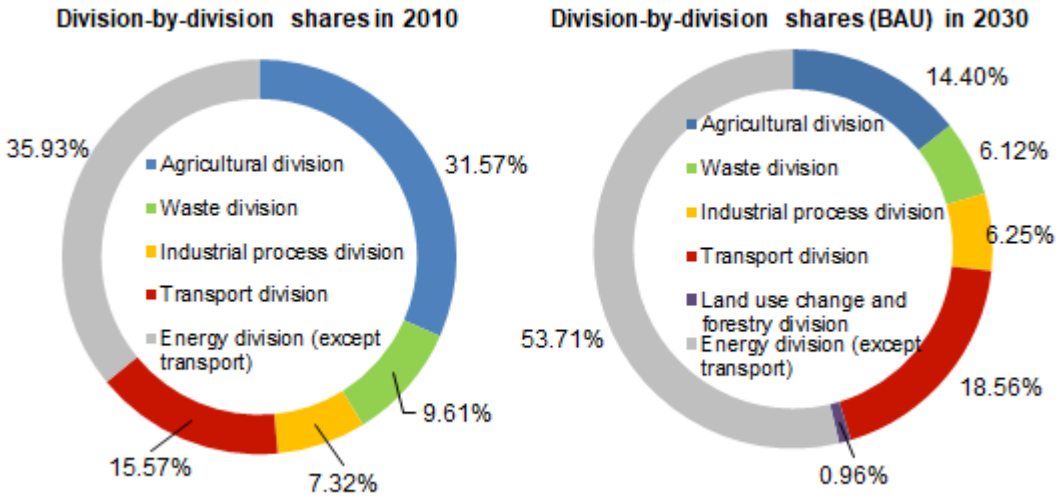


	Forestry division	Energy division	Transport division	Industrial division	Waste division
INDC	40%	27%	15%	12%	6%
NDC (forecast)	28%	31%	16%	16%	9%

Source: Data processed by the investigation group according to Climate Change Commission "NDC Process and Overall Targets" (July 2017)[10]

Figure 4-5: GHG emission reduction goals shown in INDC and NDC (forecast)

Note that the transport division, which commanded a 15.57% share of the whole GHG emissions in 2010, is expected to have a 18.56% share in 2030 and to rank second following the energy division.

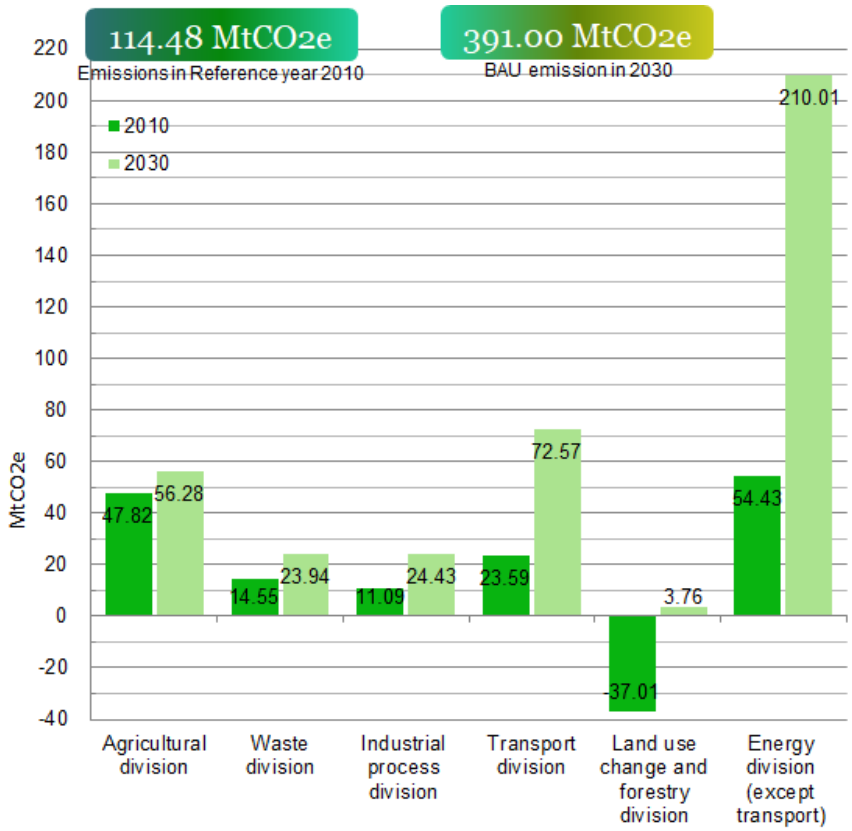


Source: Data processed by the investigation group according to Climate Change Commission, "Roadmap to Resilience: NCCP and NDC" (March 2018)

Figure 4-6: Sectorial shares of the GHG emission (2010 and 2030)

[10] http://climate.gov.ph/images/NDC/3_NDC-Forum_Phil-Senate_fma-lecb_071617.pdf

Figure 4-7 shows the sectoral BAU values of GHG emissions in 2010 and 2030.



Source: Data processed by the investigation group according to Climate Change Commission, "Roadmap to Resilience: NCCP and NDC" (March 2018)

Figure 4-7: GHG emissions (BAU values in 2010 and 2030)

The transport division changed its measures and gas reduction forecasts several time in the domestic consultation process. Table 4-13 shows the latest formal information as of June 2018. Importance is given to biofuel, measures for pubic vehicles including jeepneys and tricycles special to Philippines, and infrastructure construction.

Table 4-13: NDC actions (forecasts) in the transport division

Action	**GHG emission reduction in total between 2015 and 2030 Potential ($MtCO_2e$)**
Biofuel	76.31
Bus and bus rapid transit (BRT)	6.17
Compressed natural gas (CNG) bus	0.27
Jam charge	4.27
Driver training	9.44
Electric lightweight delivery car	0.77
Electric motorcycle and tricycle	2.94
Euro IV car inspection system	1.83
Improvement of lightweight truck's efficiency	3.98
Improvement of jeepneys	20.51
Vehicle inspection system	11.54
Railway	3.74
Road maintenance	18.72
Exchange of 2-stroke tricycles	0.11
Total	160.06

Source: Data processed by the investigation group according to Climate Change Commission, "Roadmap to Resilience: NCCP and NDC" (March 2018)

(3) Energy-saving policies in the transportation sector

INDC and the draft of NDC mentioned above show the emissions in 2010 and the emission forecasts in 2030, both being derived from fuel consumption data given by a "top-down approach." Meanwhile, some reports indicate forecasts calculated from traffic data given by a bottom-up approach. Most of the forecasts based on the bottom-down approach are greater than those based on the top-down approach. The draft of NDC expects that the whole transportation will emit about 73 million tCO_2 of GHG in 2030, while a survey made by the World Bank in 2010 shows that only the road transportation division will emit 80 million tons of CO_2 in 2030[11].

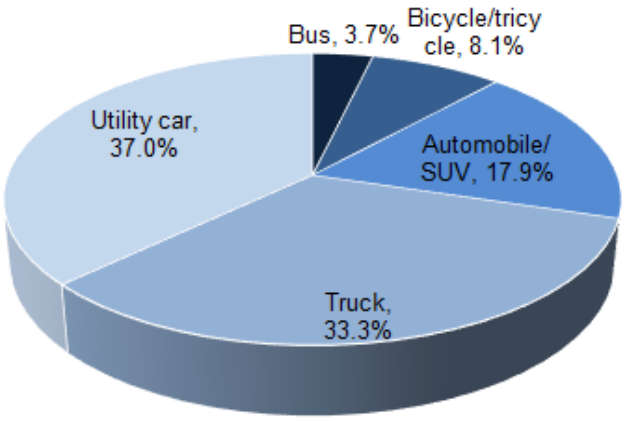
Note that the road transport holds a more than 95% share of the transport means in Philippine, and the GHG emission data on a vehicle type basis shows that the sum of public cars and trucks command a 70% share of the traffic volume.

[11] ASEAN German Technical Cooperation | Energy Efficiency and Climate Change Mitigation in the Land Transport Sector "The Philippines Stocktaking Report on Sustainable Transport and Climate Change (2016) " https://www.transportandclimatechange.org/download/the-philippines-stocktaking-report-on-sustainable-transport-and-climate-change/

Table 4-14: Transport means shares (2005)

Transport means	Number of trips (thousand times)	Share	Passenger kilometrage (million km)	Share
Road	1,551,894	98.31%	325,235	97.52%
Railway	4,132	0.26%	227	0.07%
Water channel	16,370	1.04%	4,307	1.29%
Air route	6,224	0.39%	3,748	1.12%
Total	1,578,620		333,517	

Source: Data processed by the investigation group according to ASEAN German Technical Cooperation, "The Philippines Stocktaking Report on Sustainable Transport and Climate Change (2016)"



Source: Data processed by the investigation group according to ASEAN German Technical Cooperation, "The Philippines Stocktaking Report on Sustainable Transport and Climate Change (2016)"

Figure 4-8: Breakdown of the GHG emissions on a vehicle type basis (2010)

In such situations and as shown in Table 4-13, the transportation sector requires measures against GHG emissions mainly from public vehicles, which DENSO confirmed at a meeting with the Department of Transportation (DOTR) during a local survey. Notwithstanding, DOTR said that it was rather highly interested in the GHG reduction effect of H-MAC. The department added that private companies took the initiative in doing bus business and had the high possibility of introducing vehicles equipped with H-MAC positively if it would be clear for the air conditioner to improve the fuel efficiency and to reduce the cost, resulting in a rise in income. CCC also told that it would introduce H-MAC to public vehicles as a trigger at inroads into the market. This investigation proved that it was expected to work on how to introduce H-MAC to public vehicles from the viewpoint of contribution to measures for the transport division as shown in the present draft of NDC.

(4) Energy-saving policies

Philippines depends highly on imported fuels, so its electricity charge ranks second following the Cambodian one in ASEAN. To mitigate the effect of change in crude oil price and capital investments in the power transmission facilities, the government has promoted energy saving as measures for national safety and security. In 2001, the Electricity Power Industry Reform Act (EPIRA) obliged the Department of Energy (DOE) to promote the efficient use of electric power and the management of the demand side, and after that, a variety of measures has been taken as follows:

- Obligation to make an audit of designated consumers according to the Energy Efficiency and Conservation Act in 2001.
- Obliging the governmental organs and national enterprises to save energy according to the Administrative Order Nos.103, 110, and 126 in 2004.
- Obliging the companies that consume not less than 1 or 2 Mtoe of petroleum per year to report the resulting consumption or the energy-saving result respectively in accordance with the Department Circular 93-03-05.
- Obligation to run a demand management program and power-saving measures for consumers and power distributors, to conduct an educational power-saving campaign for the consumers of power distribution business, and to instruct the distributors to make compliance checks in accordance with the Department Circular 2014-08-0014.

In 2017, the government drew up the Philippine Energy Efficiency Road Map (from 2017 to 2040) to show long-term energy-saving goals and to introduce new policies shown below.

- Obliging every local government to draw up an energy-saving plan, to reinforcing the energy performance and labeling system, designated consumer's duties, consumer-side management, and ODE organizations, and to introduce an incentive system in accordance with the new Energy Efficiency and Conservation Act.
- Introducing to oblige the industrial, commercial, and transportation sectors to conform to the minimum energy performance in accordance with the modified Department Circular 93-03-05.
- Reinforcing the ESCO certification system in accordance with the modified Department Circular 2008-09-0004.
- Reinforcing the government's energy management program in accordance with the modified Administrative Order No. 126.

The roadmap shows that the transport division shall aim to reduce the energy consumption by 4,500 ktoe every year by 2040.

Table 4-15: Division-by-division plans for reducing the energy consumption

Annual energy reduction (ktoe) by 2040		Estimated reduction ratio per year (Total reduction by 2040)	
Transport division	4,500	1.9%	(25%)
Industrial division	3,000	1.3%	(15%)
Household division	1,000	1.2%	(20%)
Commercial division	1,200	1.9%	(25%)
Agricultural division	300	0.9%	(10%)
Total	10,000	1.6%	(24%)
Improvement of energy strength over economy			3%

Source: Data processed by the investigation group according to DOE, "Philippines Energy Efficiency Road Map (2017-2040)"[12]

The roadmap shows the following strategies of the transport division and the energy-saving incentives to tax systems and technologies specified in the mid-term strategies are compatible with the policies proposed and promoted by this project.

Table 4-16: Transport division's strategies in the Philippine energy-saving roadmap

Short term (2017-2020)	Middle term (2021-2030)	Long term (2031-2040)
● Development of the minimum fuel efficiency ● Vehicle conversion risk management and EV program ● Reconstruction of the adjustment mechanism	● Promotion of energy saving through the tax system ● Promotion of specific vehicle technologies ● Driver training and vehicle management program	● Energy saving in other than the road transportation sector (marine and air) ● Urban planning and reintegration of transport fuel use ● Traffic jam tax

Source: Data processed by the investigation group according to DOE, "Philippines Energy Efficiency Road Map (2017-2040)"

In order to promote the strategies above and to strengthen the energy-saving system as a national way of life, the Upper House discussed the new Energy Efficiency and Conservation Act and approved it on January 16, 2019 during the period of this investigation. A hearing given to DOE on the day has clearly showed that the act will come into effect after approval from the president within six months.

The new act specifies energy consumption labels as one of key policies, and introduces a mandatory energy efficiency rating and labeling system to specific home appliances, such as refrigerators and air conditioners, as a compulsory test system.

Sections 13 and 14 of the act show that DOE shall introduce a system for setting and labeling the minimum energy performance of products including vehicles to be sold in Philippines[13]. There is

[12] https://www.senate.gov.ph/lisdata/2639423555!.pdf
[13] S. No. 1531
https://www.senate.gov.ph/lisdata/2639423555!.pdf

information to the effect that manufacturers will voluntarily start to put such a label to their passenger cars in 2019, so consumers are expected to raise their interests in the environmental performance of automobiles. In addition, the hearing indicates that DOE plans to work on labeling for other than the fuel efficiency.

Note that the Upper House aimed to pass the Electric, Hybrid and Other Alternative Fuel Vehicle Incentives Act of 2016 (Senate Bill 460) in the same session but the bill was carried over to the next session. This is because there are already partially relevant laws, for example the act for excise taxes to be described in the next section, and the influence of specific politicians reduces. As a result, priority is given to fuel incentives based on fuel labels in the GHG emission reduction of general passenger cars.

4.2.3 Preferential tax system for low-carbon automobiles

(1) Excise tax

In December 2017, Philippines enforced the Tax Reform for Acceleration and Inclusion Act (TRAIN) to alter the excise tax system for the first time in 20 years. Part of the excise tax for vehicles had a nominal tax rate, but the whole excise tax followed ad valorem tariffs, and 100% and 50% tax exemptions are given to complete EV and hybrid cars respectively.

A hearing given by DOF showed that the most possible reason why Philippines did not move to a CO_2-based tax system for gasoline cars as introduced in Thailand was that the government worried about a reduction in tax income because of its policy for giving importance to investments in infrastructures. Moreover, it took 20 years to reform the tax system, so the possibility of modifying it in the near future is very low.

Table 4-17: Comparison of the vehicle excise taxes before and after the enforcement of the TRAIN act

Philippine Internal Revenue Act of 1997 (PIRC)		TRAIN Act (RA 10963)	
Prices (net) defined by producers or importers	Tax rate	Prices (net) defined by producers or importers	Tax rate
> 600,000 PHP	2%	> 600,000 PHP	4%
600,000 to 1,100,000 PHP	12,000 + 600,000 PHP	600,000 to 1,000,000 PHP	10%
1,000,000 to 2,100,000 PHP	40% of part exceeding 112,000 + 1,1 00,000 PHP	1,000,000 to 4,000,000 PHP	20%
2,100,000 PHP or over	60% of part exceeding 512,000 + 2,1 00,000 PHP	4,000,000 PHP or over	50%

Note: PHP = Philippine pesos (about 2 yen/PHP)

Source: Data derived from the TRAIN act by the investigation group[14]

[14] https://www.bir.gov.ph/images/bir_files/internal_communications_1/TRAIN%20matters/RA-10963-RRD.pdf

The excise tax for fuels applies to most part of public vehicles, and the tax rate significantly reduces particularly in diesel oil for automobiles though it was very low originally. However, gasoline still has the highest tax rate. Therefore, the modified TRAIN act does not change the situation in which private car owners, who account for most part of gasoline users, pay higher taxes than public vehicle users who rely on diesel oil.

Table 4-18: Comparison of the fuel excise taxes before and after the enforcement of the TRAIN act

Fuel type	Excise tax *(PHP/liter)*			
	PIRC	TRAIN Law[15]		
	1997	2018	2019	2020
Naphtha and other similar distilled oil	4.80	7.00	9.00	10.00
Leaded gasoline	5.35	7.00	9.00	10.00
Unleaded gasoline	4.35	7.00	9.00	10.00
Aviation jet fuel	3.67	4.00	4.00	4.00
Kerosene	0.60	3.00	4.00	5.00
Diesel oil	1.63	2.50	4.50	6.00
LPG	1.63	2.50	4.50	6.00

Source: Data derived from the TRAIN act by the investigation group

(2) Preferential investment system

When there is no possibility of modifying the vehicle excise tax from a short- or mid-term point of view, in the financial field, the spotlight is on various investment incentives introduced by the Board of Investment (BOI). Such incentives have the possibility of reducing the H-MAC price and of giving a price advantage to vehicles equipped with the H-MAC in manufacturing activities in Philippines.

The following shows the outline of key investment incentives.

Table 4-19: Key investment incentives

System	Outline	Incentives
(1) Pioneer status system based on the Omnibus Investment Code of 1987 (EO 226)		
	Companies registered by BOI can get an advantage in the fields recommended in the investment priorities plan (IPP) list. (See Table 4-20) [Pioneering company] • Manufacturing and processing (assembling and packing products or	• Exemption from the corporate income tax (6 years for pioneering companies and 4 years for other companies. The exemption period extends to up to 8 years if companies meet specific

[15] For the period covering 2018 to 2020, the scheduled increase in the excise tax on fuel as imposed in this Section shall be suspended when the average Dubai crude oil price based on Mean of Platts Singapore (MOPS) for three (3) months prior to the scheduled increase of the month reaches or exceed Eighty dollars (USD 80) per barrel.

	materials that are not made in Philippines) • System for design, production method, scheme, means, processing, or manufacturing, or variation in parts, material, or completed product, provided it is new or not yet prototyped • Agricultural activity or service indispensable to the achievement of the national self-supply program • Production of a new fuel or equipment used to produce a new energy source • Other business that meets the standards set forth in IPP edited every year.	requirements.) • Additional deduction for the labor cost • Unlimited use of manufacturing facilities on commission • Employment of foreigners as a supervisor, engineer, or consultant • Duty-free import of livestock for breeding purposes or genetic material • Exemption from the tax for domestic livestock for breeding purposes or genetic material • Exemption from the money corresponding to a variety of domestic taxes imposed on materials, supplies, or semifinished products used for imported products • Use of a bonded factory or warehouse • Exemption from the pierage, import tax, and surcharge • Simplification of the clearance procedures
(2) Comprehensive automotive resurgence strategy program (CARS)		
	• This program is introduced to call a strategic investment in the production of automobiles and their parts by activating the Philippine automobile industry and developing it as a local manufacturing hub. • The major purposes are innovation, technology transfer, environmental production, and support to small and middle companies. • The program applies to three models, and Mitsubishi Mirage and Toyota Vios are already chosen. The third model is expected to be selected from public vehicles (PUV).	• The subsidies are 9 billion PHP (180 million US dollars), provided the production shall be 200,000 cars or over for six years.
Green Jobs Act (RA 10771)		
.	• This act came into effect in April 2016 so that the Philippine government introduced carbon-free policies to raise the labor power able to cope with change in main local industries. The following shows four requirements for	The company, which has a green jobs certificate, can get the following incentives: • 50% exemption from the tax derived from the expenses for skills training and R&D

	getting incentives based on the act. (1) The company shall join any of the 14 industries shown in the green industry list. (See Table 4-21) (2) The company shall get a green jobs certificate from a designated organ. (See Table 4-22) (3) The product or service provided by the company shall conform to the specific environmental standards announced later by CCC. (4) The company shall conduct its activities in five fields. (See Table 4-22) • The National Green Jobs HRD plan made to promote the act applies to the following industries: (1) Agriculture (including fisheries) (2) Industries - Manufacturing (electronic devices or automobiles) - Management of solid waste or sewage - Renewable energy - Service (tourism, IT, EV, wholesale, retail, or medical care)	• Exemption from the customs tariff and other taxes imposed on the import of equipment and material that contribute to the promotion of green employment

Note: The underlined activities have the possibility of working with the H-MAC promotion project.

Source: Data processed by the investigation group according to BOI, "Omnibus Investment Code of 1987," and DOIT, "Comprehensive Automotive Resurgence CARS) Strategy Program" and "Philippine Green Jobs Act of 2016"[16]

Table 4-20: Business fields in which an investment is recommended

Field	Requirements
(1) Manufacturing that meets all the requirements	Manufacturing activity of semifinished products, completed products, or consumer goods (including the production of machines, devices, or parts for prefabricated houses) Manila is excluded if the program is not a modernization type.
(2) Agriculture, fisheries, or forestry	Manila is excluded if the program is not a modernization type.
(3) Strategic services	An investment is made in the following business fields: • Integrated circuit design, creative work, knowledge-based industries (e.g. contact center, data analysis, animation making, and software development), and maintenance, repair, and overhaul (MRO) of aircrafts • Recharge and fuel stations for renewable energy cars, industrial waste treatment, telecommunication (limited to newcomers), and cutting-edge engineering, procurement, or construction of industrial plants or infrastructures
(4) Health care	Drug rehabilitation facility
(5) Apartment houses	Manila is excluded if the house is not a low-rent flat.
(6) Infrastructure and	

[16] http://boi.gov.ph/wp-content/uploads/2018/02/EO-226-omnibus-investments-code.pdf

distribution	
(7) Innovation accelerating business	R&D, clinical testing, and incubation center construction
(8) Inclusive business (IB) models	Project operated for a large- or medium-sized farming or tourism company to give business opportunities to petty, small, or middle firms
(9) Project related to environment and climate change	
(10) Energy	Efficient use of conventional fuels or natural resources, power generation from waste heat or other waste, and construction of power storage systems

Note: The underlined activities have the possibility of working with the H-MAC promotion project.

Source: Data derived from the JETRO website by the investigation group.

Table 4-21: List of green industries (draft)

1	Power generation by using any of all kinds of renewable energy (except hydraulic one with dam)
2	Technology and service for using material or resources efficiently
3	Conversion of material having an environmental into sustainable one
4	Material-to-raw-material recycling or material-to-product recycling (e.g. circular economy)
5	Technology and service for preventing or controlling environmental pollution
6	Restaurant that procures 100% of materials from producers approved according to the Philippine Organic Agriculture Act or by a governmental certification agency
7	Technology and service for mitigating climate change
8	Spread and enlightenment of environmental training and education
9	Adaptation to climate change and disaster risk management
10	Diversification, conservation, and restoration of ecosystems (e.g. plantation, restoration of mangroves, and resuscitation of corals)
11	Service based on environmental value
12	Low-carbon mass transport system and electric car
13	Change from high-carbon enhancement processes to low-carbon digital economy
14	Financial service for lending money only to companies shown in the green industry list

Note: The underlined activities have the possibility of working with the H-MAC promotion project.

Source: Data processed by the investigation group according to Department of Labour and Employment, "Green Jobs" and documents from CCC[17]

[17] http://climate.gov.ph/images/CCCWeek2017/Green-Jobs/Green-Jobs--HRD-Plan---DOLE.pdf

Table 4-22: Designated agencies that issues a green jobs certificate (draft)

1	Philippine Department of Agriculture
2	Green Choice Philippines
3	United States Department of Agriculture (Certified Organic)
4	Green Seal
5	Cradle to Cradle Certification
6	Greenguard Indoor Air Quality Certification
7	FSC
8	Rainforest Alliance
9	Building for Ecologically Responsive Design Excellence (BERDE)
10	US Green Building Council
11	Excellence in Design for Greater Efficiencies

Source: Data processed by the investigation group according to Department of Labour and Employment, "Green Jobs"

Table 4-23: Five business fields

1	Improvement of the energy and resource efficiency
2	Control of GHG emissions
3	Reduction of waste and pollution
4	Protection and conservation of ecosystems
5	Adaptation support to the effect of climate change

Note: The underlined activities have the possibility of working with the H-MAC promotion project.

Source: Data processed by the investigation group according to Department of Labour and Employment, "Green Jobs"

Chapter 5 CO_2 reduction potential in the ASEAN

This chapter describes the expected CO_2 emission reduction potential through the spread of H-MAC. The following shows the estimated potential Thailand has and the expected effect of expansion to the ASEAN region.

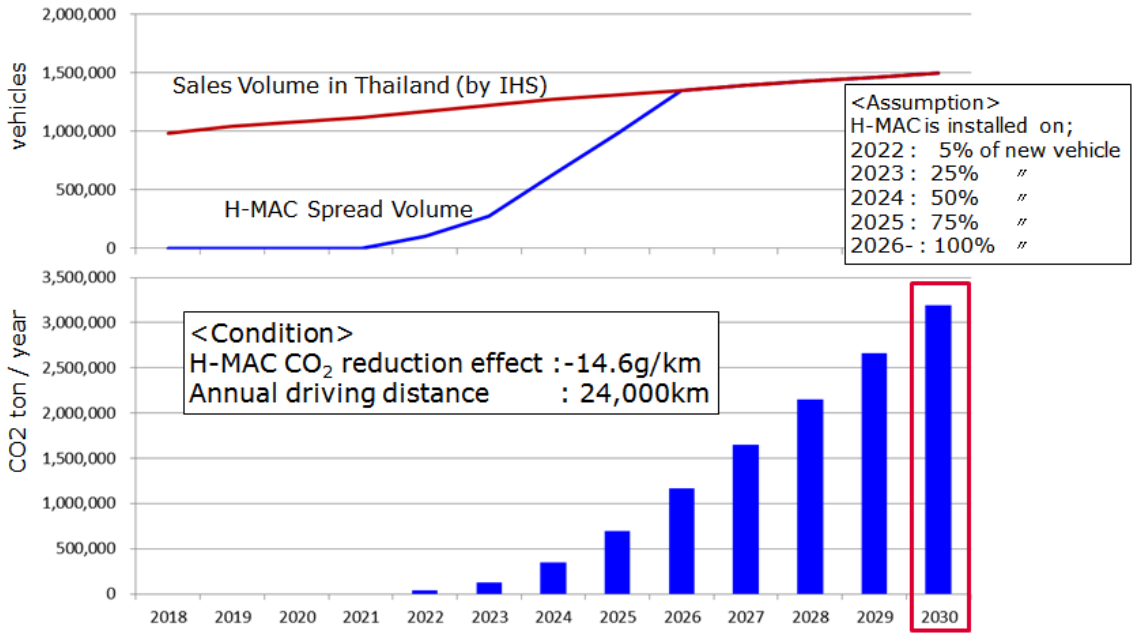
5.1 Estimated potential in Thailand

DENSO estimated the potential of reducing CO_2 emissions in Thailand from 2022 to 2030 in accordance with the following prerequisites:

<Prerequisites>

- Collecting and using estimated data on the vehicle sales in Thailand provided by IHS.
- Assuming that H-MAC will start to spread from 2022, its equipment will increase at the rates shown in Figure 5-1 every time each car will be subjected to model change, and the rate of new cars will reach 100% in 2026 after five years.
- Using 14.6 gCO_2/km (= 0.35 tCO_2/car annually) as the CO_2 reduction effect of H-MAC quantified in the project of the previous fiscal year.
- Assuming that the annual travel distance is 24,000 km, an average value in Thailand.

Figure 5-1 indicates the estimation results based on the above. The reduction will be about 3,170,000 tCO_2 in 2030. The draft of nationally determined contributions (NDC), which the Thai government made to reduce CO_2 emissions according to the Paris Agreement, shows a reduction of 8 million tCO_2 as a goal to be achieved by energy saving by 2030 in the transportation sector. If H-MAC will be popular as shown in the prerequisites, it will be able to reduce the CO_2 emission by about 40% of the goal, which means that the potential is high.



Source: IHS data processed by the investigation group

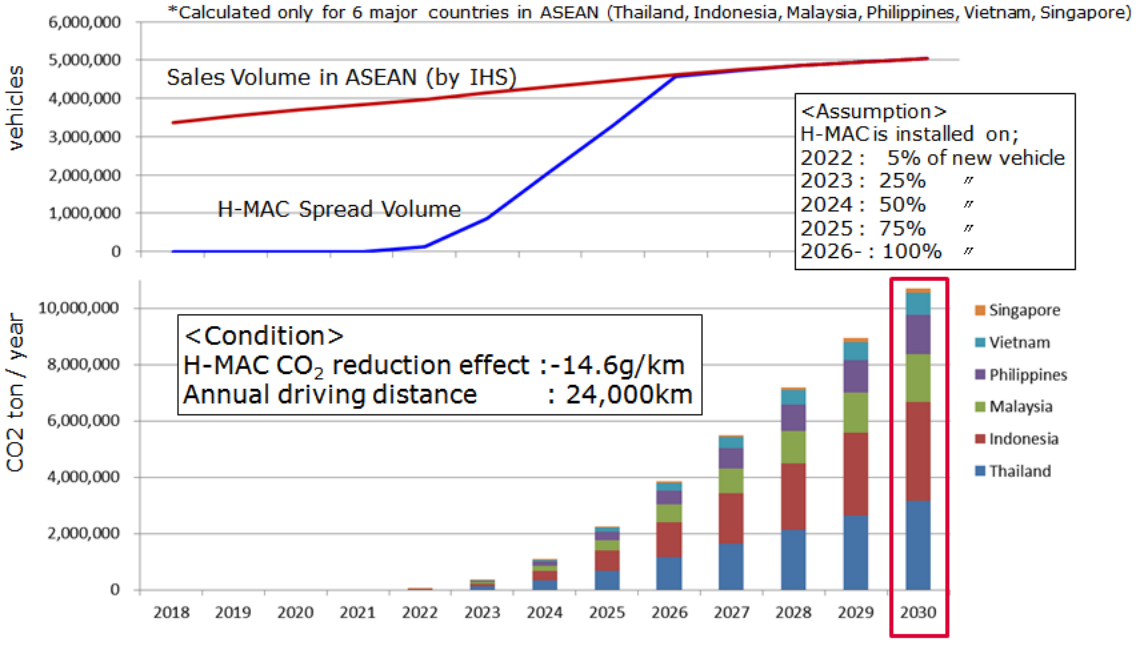
Figure 5-1: CO_2 reduction potential in the Thai market

5.2 Estimated potential in the ASEAN market

Like the Thai potential shown in the previous section, the ASEAN potential of reducing CO_2 emissions from 2022 to 2030 was estimated in accordance with the following prerequisites:

<Prerequisites>

- Collecting and using estimated data on the vehicle sales provided by IHS.
- Target six main countries in the ASEAN area: Thailand, Indonesia, Malaysia, Philippines, Vietnam, and Singapore.
- Assuming that H-MAC will start to spread from 2022, its equipment will increases at the rates shown in Figure 5-2 every time each car will be subjected to model change, and the rate of new cars will reach 100% in 2026 after five years.
- Using 14.6 gCO_2/km (= 0.35 tCO_2/car annually) as the CO_2 reduction effect of H-MAC quantified in the project of the previous fiscal year.
- Defining 24,000 km, an average value in Thailand, as the annual travel distance common to all the target countries.



Source: IHS data processed by the investigation group

Figure 5-2: CO_2 reduction potential in the ASEAN market

Figure 5-2 shows the estimation results. The total reduction will be about 10.7 million tCO_2 in 2030, which means that the expansion of H-MAC to the ASEAN countries has a great effect because the area features high annual mean temperatures and the large energy consumption of air conditioners.

Chapter 6 Policy proposal and subjects toward the future

6.1 Issues in the operation of the steering committee

As a result of running the project in FY 2018, the relevant organizations of Thailand and TAIA have understood that the high-efficiency technology of H-MAC not only reduces CO_2 emitted from vehicles but also reduces PM 2.5, an issue to be quickly addressed in Thailand, extends the travel distance by reducing the battery power consumption of EV to be promoted in the future, and decreases CO_2 emitted from power plants.

However, it has been revealed there are some concerns that DEDE plans a budget for evaluation facility but it is not enough, the start of steering committee crossing several ministries is postponed and others.

Starting the committee requires talks with the departments concerned by a top-down or bottom-up means.

The former means needs important support from METI that worked together in FY 2017 and FY 2018. In FY 2019, Japan and Thailand will be the host countries of G20 and ASEAN respectively. To use this opportunity to a maximum extent, METI plans to recognize this project as one of the best-practice cooperation between Japan and Thailand, to continuously support the promotion in Thailand, and to spread it to the ASEAN area. DENSO looks forward to such support very much.

DENSO will cooperate with them on giving presentations about CO_2 emissions reduction due to the prevalence of H-MAC at public-private workshop between Japan and Indonesia (scheduled on March 2019) and such meeting the request of The Ministry of Economy, Trade and Industry.

The bottom-up means has two important activities. One is to promote standardization with KMUTT as it has been. DENSO thinks that this method is effect because TISI, which controls the national standards of Thailand, suggests that there are various standard-making approaches and multiple makers can make an inevitable proposal for criteria.

Regarding the budget for evaluation facilities, DENSO continues to work on the usability of public support systems in Japan when introducing the tester for mobile air conditioners. TISI says that the introduction of new facilities is not always necessary and there are many options: using an existing laboratory, testing with maker's equipment and an institute's witness, and utilizing a technical service in other countries. Therefore, it is necessary to review them in the future.

The other is an activity for preferential taxes. Regarding the use of the ECO-sticker system linked to the vehicle excise tax and a new excise tax system based on CO_2, it is necessary to pay attention to the local trends and to work on the preferential H-MAC scheme. Cooperation with vehicle manufacturers is especially important in the study of the vehicle excise tax. It is important to cooperate with TAIA and vehicle manufacturers that participated in the seminar in building up the preferential scheme and making approaches to the departments concerned.

6.2 Activities for raising end user's understanding

The project of this fiscal year has an action plan for raising end user's understanding. DENSO conducted two key activities. The first one is to participate in public-private seminars and workshops other than the local one held in February 2019, and the second one is to survey the possibility of

joining a variety of events locally held to get understanding widely from end users.
The first activity includes (1) presentation at the "Japan-Thailand Government-Private Workshop on Clean Energy Technology" in November 2018, (2) exhibition at the "Event Related to Transportation and Climate Change" held by OTP and GIZ in January 2019, and (3) presentation at a workshop called "the 13th Regional Workshop on the Ozone Depleting Substances Program in East Asia" held by the World Bank in February 2019.
At the OTP-GIZ second event[18], DENSO exhibited the technologies and effects of the cold-storage evaporator and SCX.
The presentation made at the 13th workshop held by the World Bank in February was the same as that at the Japan-Thailand workshop in last November.
To investigate the possibility of participating in a variety of local events, DENSO chose the ASEAN Sustainable Energy Week 2019 (ASE 2019) to be held in June 2019 and the Smart Energy Technology Asia (SETA 2019) to be held in October 2019. There is no other event matching with the schedule of this fiscal year, so no presentation is planned in this project. DENSO will draw up and implement a concrete plan at an early stage.
Moreover, KMUTT plans to present a paper about the results of researches that have been completed at a major academic conference abroad.

[18]In addition to the panel exhibition, we also listened to the presentation on the day.

（様式2）

二次利用未承諾リスト

Feasibility Study of the Project for Promoting the Spread of High-Efficiency Mobile Air Conditioners in Thailand

Infrastructure Development Investigation Project 2018 for Credit Acquisition between Two Countries(International Contribution Quantification and JCM Feasibility Study)

DENSO Corporation

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（様式2）