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Assessing the impact of transport sector policies on reducing greenhouse gas emission in Indonesia

A Policy Assessment Report in the Framework of the Initiative for Climate Action Transparency

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Foreword

Indonesia is one of the fastest-growing countries in terms of economic development, and similar to other countries around the world, transport sector plays a vital role in supporting the growth. Yet, there are still challenges in making the transport sector more sustainable without imposing risks to national growth. Also, in line with the Paris Agreement, countries that are parties to the UNFCCC shall review their strategies, policies, investments and infrastructure to move them towards the goal of limiting global temperature increase to well below 1,5 degree Celcius.

However, despite all the ambitious targets to limit CO_2 emission, many parts of the world still report that emission from the transport sector is rising. On the other hand, the Government of Indonesia has committed to contribute to the global emission reduction target through the submission of Indonesia's Nationally Determined Contributions, which aims to reduce overall CO_2 emission by 29% (unconditionally) and up to 41% (with international support) by 2030 for the whole country.

In July 2019, with the funding support from the Initiative for Climate Action Transparency (ICAT), and the generous support from Research and Development Agency, Ministry of Transport Indonesia (Litbang Kemenhub), we have started this assessment on the impact of transport sector pricing policies on reducing GHG emission in Indonesia. This assessment is expected to be able to contribute to the fulfilment of the NDC targets through the specific calculation of GHG impact from fuel pricing policy, an incentive for energy-efficient vehicle and Electric Vehicle. It is expected that the relevant authority could adopt the methodology used in this assessment in order to complement the already established Measurement, Reporting and Verification (MRV) system.

Lastly, together with other key stakeholders, it is expected that the initiative for assessing GHG impact from transport pricing policies shall be escalated further to continue strengthening Indonesia's strategies to contribute to Paris Agreement as well as securing its national development.

Dr. Elly Sinaga
Team Leader

Executive Summary

The government of Indonesia (GoI) is actively involved in international climate negotiation in fighting against climate change. In its nationally determined contribution (NDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016, Indonesia committed to reducing its GHG emission by 29% below its Business as Usual (BaU) scenario by 2030 without international support (unconditionally), and up to 41% with international support (conditionally). Several measures are taken by the government to combat the increase of greenhouse gas (GHG) emission, including in the transport sector.

For the case of Indonesia, this study is aimed to better understand the impact of transport pricing policies on GHG emission from the road transport sector. Identification of several pricing policies that are being implemented and planned has been carried out. However, based on internal and stakeholders' consensus, only selected pricing policies are assessed: fuel pricing, Low-Cost Green Car (LCGC) and Electric Vehicle (EV). The reason for narrowing down the policies assessed is not only because of data availability and time constraint, but these three policies are thought to have the most significant impact. This study builds on and applies the ICAT Transport Pricing Guidance and Methodology (ICAT 2019).

Transport pricing guidance is used to estimate the GHG emission impact of selected transport pricing policies, but its application is adjusted to the local conditions in Indonesia, yet the main methodologies and approaches remain the same. Throughout the implementation of this study, the ICAT team from Switzerland (INFRAS) and the United States of America (VERRA) continuously provided their advice and support. The GHG emission impact and its calculation approach are listed below:

Ex-post analysis:

- Existing policies: Continuation of present transport-related policies without additional climate change mitigation efforts.
- Fuel pricing: Reduction in subsidy (subsidy reform) on gasoline and diesel fuel as implemented between 2013 – 2016.
- Low-cost green car (LCGC): Incentive for efficient vehicle purchase in the form of exemption of luxury tax for (i) spark-ignition internal combustion engine with cylinder capacity up to 1,200 cc and fuel consumption of at least for 20 kilometres per litre, and (ii) compression ignition engine (diesel or semidiesel) with the cylinder capacity up to 1,500 cc and fuel consumption of at least for 20 kilometers per litre.

Ex-ante analysis:

- Electric vehicle (EV): Series of incentives to boost production and use of Electric Vehicle in Indonesia, which includes incentives for EV manufacturers, infrastructure providers and transportation companies, as well as EV buyers.

This study was carried out between July and October 2019, and a Focus Group Discussion (FGD) was held in mid-September at ITL Trisakti in Jakarta to gather valuable input and feedback from key stakeholders on the study's methodology, sources of data, and result.

Assessment result of existing pricing policies of fuel pricing and Low-Cost Green Car (LCGC) shows varying results in CO_2 emission impact: On the one hand, fuel pricing is estimated to *reduce* CO_2 emissions overall by (-) 4.50% in the assessment year 2016 against 2013 base year. Looking at the consumption of gasoline only, the GHG emission impact has even been *reduced* by (-) 6.30%, while for diesel emissions *increased* slightly by (+) 0.90%. On the other hand, Low-Cost Green Cars (LCGC) are estimated to have overall *increased* GHG emission by (+) 13.7%. This impact value is calculated by comparing the total passenger cars with and without the intervention of Low-Cost Green Car (LCGC) measure in a similar engine category in 2017. While the Low-Cost Green Car initiative helped to bring into small circulation cars with slightly improved fuel economies, the substantial tax exemption subsidy lead to an increase in the number of vehicles (compared to the reference scenario without LCGC initiative) that resulted in a sharp increase in overall consumption and more than compensated any efficiency gains from the vehicles.

With regards to Electric Vehicle (EV), the Government of Indonesia (GoI) recently issued a Presidential Regulation No.55/2019 on Electric Vehicle, which mainly aims to boost the production and utilisation of Electric Vehicle in the country. Moreover, the Ministry of Industry has projected the targeted number of Electric Vehicle to be produced until 2035. Assessment on CO_2 emission impact is conducted and divided into five scenarios based on this target for 2035. The main scenario leads to a reduction in total GHG emission, assuming 30% electric cars and motorcycles in 2035 by (-) 7.5% with the current power mix. If Indonesia manages to increase the share of renewable power (hydro, wind, solar) from current 8% to 50% in 2035, the resulting emission reduction would be double at (-) 15.4%.

The results further show that there has been a significant reduction in CO_2 emission from the existing fuel pricing 2013 – 2016 and future projection of EV policies until 2035. Low-cost green cars (LCGC) policy is considered an ineffective policy to cut CO_2 emission due to its negative impact value – the results from this study indicate that the policy does not have a beneficial effect to reducing GHG emission and on the contrary leads to an increase in traffic and emissions. These findings can be used to inform and assist decision-makers in evaluating the impact of pricing policies.

Information collected in the present study illustrates the GHG emission impact of different transport policies and to what degree these policies reinforce each other and should be more co-ordinated between respective ministries and institutions so that the results can be maximized. Overall, the conclusions could help the Government of Indonesia (GoI) to achieve its Nationally Determined Contributions (NDCs) targets, that were pledged back in 2016.

Based on this study and to further meet the ambitious target of national GHG emission reduction, the Government of Indonesia (GoI) is recommended to take these following actions:

- Strictly monitor and regularly evaluate the implementation of transport policies, especially transport pricing policies and its relevance to the achievement of NDC targets;
- Start developing and implementing a vehicle fuel economy roadmap as soon as possible;
- Review or reconsider the implementation of LCGC policy as one of the policies of the low-GHG emission vehicle;
- Speed up the transition process into the implementation of EV policy and further ensure a more significant share of renewable energy within the electricity systems;

- Improve fuel quality by tightening the emission standards, introducing a more stringent fuel tax and other fiscal instruments to decarbonise the transport sector and introduce the scrappage policy; and
- Improve public transport quality and support to non-motorized transport (NMT).

For further development and implementation of these recommendations, the existing institutional set up in Indonesia can be used. However, the Government of Indonesia (GoI) is also encouraged to extend its cooperation and collaboration among key ministries responsible for emission from the transport sector such as the Ministry of Transportation (MoT), Ministry of Energy and Mineral Resources (MEMR), Ministry of Industry (MoI), Ministry of Environment and Forestry (MoEF), and Ministry of Finance (MoF). It is also recommended to engage cooperation from external partners and international organisations to further achieve the emission reduction targets of Indonesia's NDC.

On a technical level, the study identified gaps in the availability of data and tools to MRV ex-ante and ex-post impact of transport policies. Further work on the following aspects would clearly support Indonesia in its implementation of the NDC in the key sector of transport:

- Improved availability and access to transport sector activity data (fleet segmentation, mileage, trip distances etc.)
- Improved data on fuel consumption and emission factors for local vehicles, the age distribution of vehicle fleet, distribution of traffic situations etc. that allows for determining robust emission factors (e.g. with tools based on the "Handbook Emission Factors for Road Transport" HBEFA). In particular, with regard to the planned (partial) electrification of road transportation, the availability of comprehensive data is essential for assessing potential emission reductions (besides transport sector activity data, also the availability of robust grid emission factors and projections of grid emission factors is important).
- Improved and locally derived values for elasticities as applied in the ICAT guidance. This would also include data on cross-elasticities so that the pricing guidance could be also applied to evaluate (MRV) the impact of pricing and other transport policies on the city level and investigating their effect on mode shifts (e.g. from private cars to public transport – see option "C" in the ICAT pricing guidance).
- Improved data availability will also allow performing a more profound uncertainty assessment, which is important for assessing GHG impact for the NDC and future policy recommendations.

For all the three measures discussed in this report, it would be interesting to repeat or scale up the assessments within the next 1-3 years based on more comprehensive data. In particular, for the ex-ante assessment of Electric Vehicle, an ex-post assessment after the implementation of the measure would be interesting to verify the ex-ante estimations of GHG impact. Also, an analysis of key transport policy measures on a city level would help measuring (MRV) actions that support the much-needed transition to sustainable transport systems in Indonesian cities.

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Acronyms and abbreviations

ADB	:	Asian Development Bank
AFOLU	:	Agriculture, Forestry and Other Land Use
APBN	:	*Anggaran Pendapatan dan Belanja Negara* / National State Budget
APBN-P	:	*Anggaran Pendapatan dan Belanja Negara – Perubahan* / Revised National State Budget
ASEAN	:	Association of Southeast Asian Nations
BAPPENAS	:	*Badan Perencanaan Pembangunan Nasional* / National Development Planning Agency
BaU	:	Business as Usual
BKF	:	The Fiscal Policy Board
BUR	:	Biennial Update Report
CO_2	:	Carbon Dioxide
DEN	:	*Dewan Energi Nasional* / National Energy Council
EV	:	Electric Vehicle
FGD	:	Forum Group Discussion
GAIKINDO	:	*Gabungan Industri Kendaraan Bermotor Indonesia* / Association of Indonesian Automotive Industries
GCI	:	Global Competitiveness Index
GDP	:	Gross Domestic Product
GHG	:	Greenhouse Gas
$GtCO_2eq$	:	Gigatons of CO_2 Equivalent
ICAT		The Initiative for Climate Action Transparency
ITL Trisakti	:	Trisakti Institute of Transportation and Logistics
LCGC	:	Low-Cost Green Car
LULUCF	:	Land Use, Land Use Change and Forestry
MEMR	:	Ministry of Energy and Mineral Resources
MoEF	:	Ministry of Environment and Forestry
MoI	:	Ministry of Industry
MoPWH	:	Ministry of Public Works and Housing
MoT	:	Ministry of Transportation
MRV	:	Monitoring, Reporting and Verification
MTI	:	*Masyarakat Transportasi Indonesia* / Indonesia Transport Society
NDC	:	Nationally Determined Contribution
ORGANDA	:	*Organisasi Angkutan Darat* / Land Transport Organisation
PDRD	:	*Pajak Daerah dan Retribusi Daerah*/ Local Tax and Local Retribution
PELINDO	:	*Pelabuhan Indonesia* / Indonesia Port Corporation
PELNI	:	*Pelayaran National Indonesia*/ State-owned cruise company
PERTAMINA	:	State-owned oil and natural gas corporation
PP	:	*Peraturan Pemerintah* / Government Regulation
PPN	:	*Pajak Pertambahan Nilai* / Value Added Tax
PPNBN	:	*Pajak Penjualan Atas Barang Mewah* / Luxury Tax

RAN-GRK	:	*Rencana Aksi Nasional Penurunan Emisi Gas Rumah Kaca /* National Action Plan on Greenhouse Gas Emission Reduction
RON	:	The Research Octane Number
RUEN	:	*Rencana Umum Energi Nasional /* National Energy Plan
SOE	:	State-Owned Enterprise
TTW	:	Tank-to-Wheel
UNCRD	:	United Nations Centre for Regional Development
UNFCCC	:	United Nations Framework Convention on Climate Change
VFEL	:	Vehicle Fuel Economy Labelling
VKT	:	Vehicle Kilometers Travelled

Disclaimer

Findings, interpretations and conclusions expressed in this document are based on information gathered by the Trisakti Institute of Transportation and Logistics (ITL Trisakti) and its consultants, partners and other contributions. ITL Trisakti does not, however, guarantee the accuracy or completeness of information in this document, and cannot be held responsible for any errors, omissions or losses which emerge from its use.

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The Project Context

The project “Assessing the impacts of transport sector pricing policies on reducing GHG emission in Indonesia” aims to undertake an assessment using the guidance “Assessing the Greenhouse Gas Impact of Transport Pricing Policies” developed by the Initiative for Climate Action Transparency (ICAT). This includes assessing the expected and/or achieved change in GHG emission, sustainable development impact, and/or extent of transformational change resulting from a policy or action. It may also include engaging stakeholders in the assessment process, having a technical review done on the assessment results, and/or integrating the impact of non-state and subnational actions. The project timeline covered a period between July and October 2019 and was conducted within the territory of the Republic of Indonesia.

1 Introduction

The Initiative for Climate Action Transparency (ICAT) is currently (as of the period of this study) developing guidance for assessing the GHG emission impact of pricing policies in the transport sector. The methodology provides a stepwise approach for estimating the impact of higher fuel prices using price elasticities of demand. There are also additional methods provided in fewer details on estimating the impact of vehicle purchase incentives and road pricing policies. The methodology used in this assessment is part of the ICAT series of methodologies for assessing the impact of policies and actions. The purpose of these methodologies is intended to enable users that choose to asses greenhouse gas (GHG) emission impact, sustainable development impact and transformational impact of a policy to do so in an integrated and consistent way within a single impact assessment process.

For the Indonesian context, this study aims to apply the transport pricing guidance in a mutual understanding that is useful for Indonesia, particularly the responsible ministries, among others, the Ministry of Transport (MoT), the Ministry of Environment and Forestry (MoEF), the Ministry of Energy and Mineral Resources (MoMR), and the National Planning Ministry (BAPPENAS). This assessment should be useful for Indonesia since it provides a detail step-by-step guidance (to complement the existing Monitoring, Reporting and Verification or MRV systems) in measuring the impact of transport pricing policies, particularly fuel price on overall GHG emission reduction targets as pledged in Indonesia's Nationally Determined Contribution (NDC) submitted in 2016. This assessment is based on stakeholder consensus and built with reliable data and strict quality control.

1.1 Background

1.1.1 The international context of climate change and transport

The world has reached an agreement to attempt to limit the rise in global temperature this century to "well below 2 degrees Celsius" above the pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius (UNFCC 2016). The Paris Agreement requires all parties to put forward the best effort based on the respective countries through their NDC and to strengthen these efforts in the years ahead. It was agreed that in 2018, parties would take stock of the collective efforts to progress towards the goal set in the Paris Agreement and to inform the preparation of the NDC. There will also be a global stocktake every five years to assess the collective progress towards achieving the purpose of the Agreement.

The transport sector globally is a significant contributor to the total anthropogenic GHG emission, mainly through the consumption of fossil fuel. Moreover, the transport sector is a primary fossil-consuming sector and is estimated to account for 14% of the global GHG emission (US EPA 2010). GHG emission from the transport sector increased at a faster rate than any other energy end-use sector to reach 7.0 $GtCO_2eq$ in 2010 (IPCC 2014), and approximately around 80% of this increase has come from road vehicles. The final energy consumption for transport reached 28% of total end-use energy in 2010. According to these reports, there is already strong evidence to consider transport as a crucial sector for mitigation action to achieve the long-term target of the Paris Agreement.

To express its commitment in reducing GHG emission and as a follow up to the Paris Agreement, where countries need to explain and communicate their commitment to take mitigation action, Indonesia submitted its first NDC in November 2016 (Kementerian Lingkungan Hidup dan Kehutanan 2016). Indonesia's NDC describes the plan for a transition to become a low emission country and to become well adapted to climate change. Emissions from Land Use, Land Use Change and Forestry (LULUCF) sector are still the highest source, followed by the energy sector, of which transport is a part. To achieve the GHG emission reduction target of 29% below the Business as Usual (BaU) level without international support (unconditionally) and 41% with international support (conditionally) by 2030. It is forecasted that the entire energy sector, including transport, will achieve reductions of 11% (unconditionally) and 14% (conditionally).

1.1.2 The Indonesian context of country characteristics, climate change and transport

Indonesia is an archipelagic country, where about 16,056 islands are stretched across the country and with a land area of about 1.9 million square kilometres (BPS Statistics Indonesia 2018). The country consists of five larges islands, namely: Borneo, Papua, Sulawesi, Sumatra and Java. Despite the broad geographical area, which is mostly water, around 57% of Indonesia's population lives in the island of Java, as the country's capital, Jakarta, sits in the western part of the island (BPS Statistics Indonesia 2018). Therefore, the rate of motorisation in Java is also much higher compared to the rest of the country.

Figure 1 Map of Indonesia (Google Maps 2019)

According to the government official record (BPS Statistics Indonesia 2018), the climate is nearly entirely tropical with an average temperature ranging between 28˚C for the inland area and down to 23˚C in higher mountain area and with relative humidity between 70 – 90%. Moreover, Indonesia is also one of the rainiest places on earth, where the average annual rainfall is around 3,175 millimetres, and this heavy rainfall is linked with the monsoon (the wet season is from September to March and the dry season is from March to June).

Being the largest economy in the Association of Southeast Asian Nations (ASEAN), the country's gross domestic product (GDP) per capita has risen from $807 in 2000 to $3,877 in 2018 (The World Bank 2018). The country is also considered as the world's fourth most populous country after the United States, being home for around 260 million people, of which approximately 25,9 million are still living below the poverty line.

In 2016, total GHG emission in Indonesia reached 1,461,367 GgCO_2e with Agriculture, Forestry and Land Use (AFOLU) as the primary contributing sector, followed by the energy sector, which includes fossil-fuel combustion-related emissions from transport. According to Indonesia's Biennial Update Report 2 (BUR 2) that was submitted in 2018, there was a reduction of emission in the energy sector, reaching about 128,076 GgCO_2e in 2015 and 184,509 GgCO_2e in 2016 or equivalent to 4.46% and 6.43% below the NDC baseline emissions in 2030 respectively. This reduction corresponds to the total emission reduction in 2014 and 2015, as shown in Figure 2.

The major energy consumers in Indonesia are the household, industry, and transport sector with their shares of 33.7%, 30.6%, and 30.2% in 2016 (Ministry of Environment and Forestry, MEF 2018). In the second biennial update report (BUR), it is stated that the transport sector has the highest growth in energy consumption in 2016, reaching about 6.7%. The second BUR further mentioned that transport is responsible for the release of 133,518 GgCO_2e (Figure 2). Unfortunately, a greater breakdown of emission from transport into transport modes, vehicle types, or fuel consumption was not covered in the second BUR. It also does not provide a forecast or projection of the future of GHG emission scenarios. Nevertheless, it should still be considered as a reliable information source for this assessment.

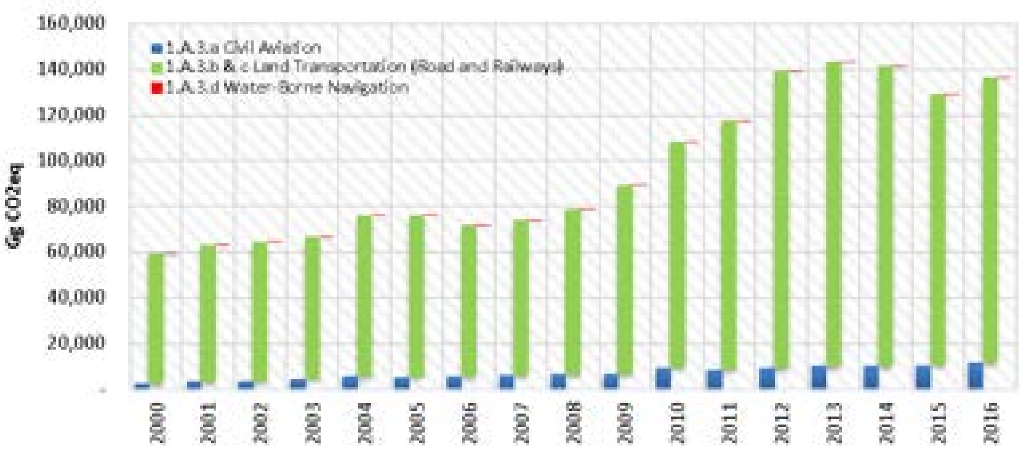


Figure 2 GHG emission in the transport sector in Indonesia, 2000 – 2016 (Ministry of Environment and Forestry, MoEF 2018)

Indonesia's economy is still expected to grow continuously, and transport is considered to be the backbone for growth. Currently, road transport dominates the mobility of people and goods, serving approximately 85% of passenger transport and 90% of freight (ADB 2016).

The government is still investing heavily in building infrastructure, particularly the expansion of road infrastructure. The total transport-related energy consumption is expected to grow continuously because of the rapid increase of urbanisation in the country, which could be interpreted as an increase in public transport demand, increase in private vehicle ownership and increase of goods transport (logistics). Altogether, this increase in demand for transport and its annual emission growth poses a severe challenge for the country's commitment to reduce its total emission.

The motor vehicle number is rapidly growing, as illustrated in Figure 3. As of 2018, there are 138,556,669 registered motor vehicles in Indonesia where 82% of total vehicles is dominated by motorcycles, followed by 11% private cars, 5% trucks, and 2% buses (BPS Statistics Indonesia 2018).

The motor vehicle population has increased seven-fold, with an annual growth rate of 12.4% from 2000 to 2017.

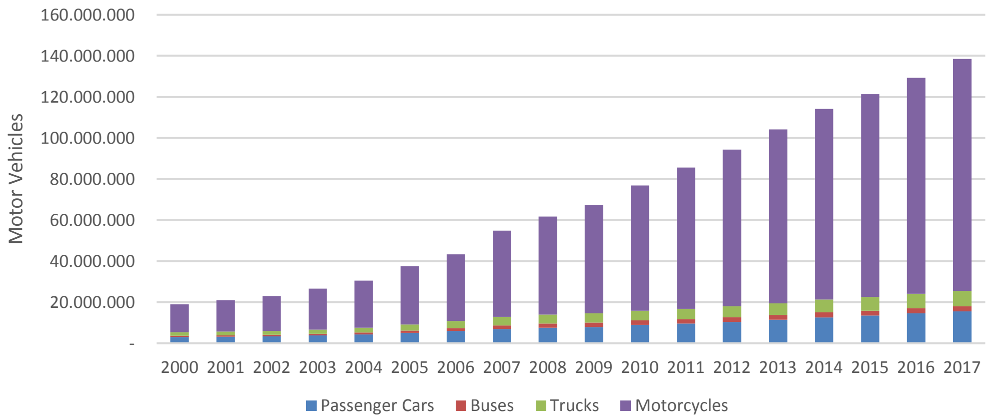


Figure 3 Number of motor vehicles by type based on national registration data (BPS, 2016)

The breakdown of transport energy consumption into types of vehicles can be seen in Figure 4**.** In 2015, road-based transport (truck, motorcycle, bus and passenger car) dominated 86% of energy demand whereas passenger transport overweighed freight transport with 72% of energy demand. Freight transport has a significant share. Passenger cars account for 29% of transport energy demand even though they make up only 11% of the registered vehicles. For trucks, which are 5% of all vehicles, this relationship is even more disproportionate. Motorcycles account for the significant share of transport fuel consumption, due to their large number.

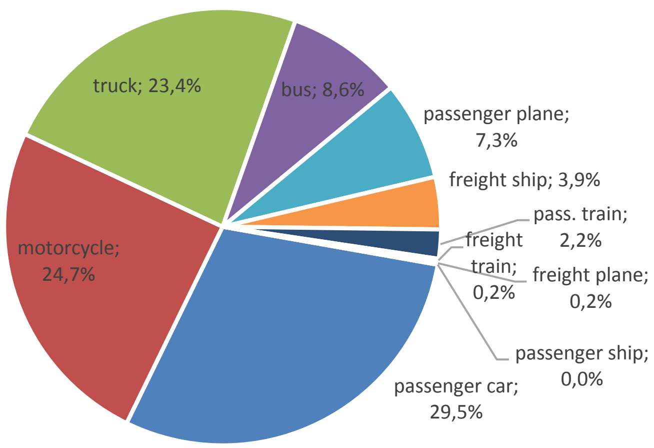


Figure 4 Transport energy demand in 2015 by vehicle type (source: (DEN 2016))

Transport Pricing Policies in Indonesia

Although not yet well understood by the public, there are several transport pricing policies introduced and implemented by the government. Some of the most notable policies include reduction of fuel subsidy for gasoline and diesel, Low-Cost Green Car (LCGC), and toll road fee-charging. Chapter 2 of the assessment highlights an overview of transport pricing policies in Indonesia. Chapter 3, 4, and 5 subsequently supply more information related to selected transport pricing policies which are fuel pricing, LCGC and Electric Vehicle (EV) policies and their impact on GHG emission.

1.2 The objectives of assessing the GHG emission impact of transport pricing policies

The specific project objective is to help Indonesia to better understand the impact of a fuel pricing policy on the mileage and GHG emission from the transport sector. The guidance mentioned here is designed to be applied in a much narrower scope and not to compete with existing GHG emission reporting mechanism in the country (MRV, PEP, etc.), but rather to provide more in-depth analysis of specific economic instruments such as pricing policy (tax, excise, subsidy, retribution, etc.) within the transport sector in order to complement and enrich available data and information related to GHG emission in Indonesia. Although within this assessment, other measures will be included, the analysis should be limited on pricing policies, e.g., the incentive for EV in combination with fuel tax, carbon tax and road pricing policy.

Furthermore, other specific objectives of the project include:

1. To identify the existing transport pricing policies that have been implemented and planned in the case study;
2. To better understand the impact of policies and actions on GHG emission and sustainability;
3. To communicate and inform decision making through the policy impact assessment of pricing policies;
4. To improve capacity building on policy assessment methods and processes; and
5. To provide constructive feedback during the process and shape the final versions of the guidance documents.

The general objective of this project is to apply selected guidance that has been developed by ICAT, in this case, the Transport Pricing Guidance for assessing the GHG impact. A case study of Indonesia is selected for the application of the guidance since several important pricing policies have been implemented in the field such as the removal of fuel subsidies, implementation of toll road pricing, vehicle taxes (registration tax, import duty, luxury tax, value-added tax), tariffs for online ride-sharing (Uber, Gojek), biofuel, Low-Cost Green Car (LCGC) and Electric Vehicle (incentive for fuel-efficient/clean car). The selection of the policies is based on a strategic assessment described under Chapter 3. As a case study country, Indonesia receives technical assistance given by ICAT and the assessment team, so that past and existing measures related to transport pricing policies could be evaluated and valuable lessons synthesized to ensure that future policy related to transport pricing are shaped, which ultimately puts Indonesia in a more strategic position compared to the neighbouring countries in the context of sustainable transport.

1.3 Study boundaries

This study focuses on assessing the GHG emission impact of selected road transport pricing policies which build on ICAT's transport pricing guideline. Only limited transport pricing policies are assessed according to the potential GHG emission impact, internal and stakeholder's consensus, and data collection. The selected policies are fuel price policy, Low-Cost Green Car (LCGC) and Electric Vehicle (EV) which cover the intervention area at the national level. The assessment of GHG emission targets mainly on CO_2 emission. Timeline of analysis is decided according to the selected policies. Additional system boundaries are explained in detail according to the specific assessment.

The present assessment analysis mostly concentrates on the apparel system, for which robust data is available. The study uses data to integrate considerations about transport activity, fuel consumption and emission factors. Where no data is available, assumptions approved by the technical experts are used and fine-tuned as necessary. All these points fit under the selected policies and the following points summarise the boundaries:

- Primary and secondary data used for the calculation were compiled from the national data, mainly released by the responsible ministries for energy, transport, statistics and environment (in the context of emission). This also includes data on fuel consumption for the transport sector (gasoline and diesel).
- The assumption adopted is that 100% of gasoline and diesel is consumed by road transport ruling out the possibility of fuel smuggling to neighbouring countries and fuel consumption for non-road vehicles (agriculture machine, lawnmower, construction, river and waterway transport and mining activity).

1.4 Stakeholders for sustainable transport in Indonesia

Transport initiatives, activities, and projects are becoming increasingly complex. The emergence of more engaged stakeholder groups has added even more complexity to the decision-making process (Macharis 2005). Relevant stakeholders are described in Table 1, as well as their roles and responsibilities, and their interests in transport development in Indonesia.

Table 1 Sustainable transport stakeholders in Indonesia (MoT and GIZ 2018)

Stakeholders	Roles in Sustainable Transport Issues
Public Sector at National Level	
Ministry of Transport (MoT)	Leading ministry in the transport sector responsible for formulating national policies, implementing policies, formulating technical policies in the transport sector and implementing and monitoring governance and tasks in the transport sector
Ministry of Environment and Forestry (MoEF)	Leading ministry responsible for coordinating activities related to climate change; the national focal point for the United Nations Framework Convention on Climate Change (UNFCCC)
Ministry of Industry (MoI)	Carries responsibilities in fuel economy; formulation and implementation of policies, including industry standardisation, industry technology, and transport, maritime, vehicles and equipment
Ministry of Energy and Mineral Resources (MEMR)	Carries responsibilities in fuel quality, new and renewable energy, and energy conservation
National Development Agency (BAPPENAS)	Responsible for national mid-term and long-term development planning and coordination among line ministries on sectoral issues, including the transport sector
Ministry of Public Works and Housing (MoPWH)	Responsible for providing public infrastructure and housing including the construction of new roads
Ministry of Finance (MoF)	Carries responsibilities in distribution, allocation, and managing yearly *Anggaran Pendapatan dan Belanja Negara* or APBN (the state budget and

	expenditure) and developing fiscal policies (e.g. related to fuel economy issues)
Ministry of Trade	Responsible for developing regulations to improve the distribution of goods and services; regulates licenses and tariffs for importing vehicles
Traffic Police *(Polisi Lalu Lintas)*	Responsible for vehicle registration and law enforcement related to road traffic
Public Sector at Local Level	
Local Governments	Responsible for distributing, allocating, and managing yearly *Anggaran Pendapatan dan Belanja Daerah or* APBD (local budget and expenditure), including budgeting for the transport sector in the region
Local Planning Agencies (BAPPEDA)	Responsible for elaborating national into regional mid-term development plans to serve as planning guidelines for sectoral offices in the local governments, including budgeting
Local Transport Offices (Dishub)	Responsible for developing and implementing transport strategies and activities in the region, including providing urban transport services and conducting vehicles testing
Local Environmental Agencies (BPLHD, BLH)	Responsible for environment-related activities as mandated by MoEF, e.g. improving air quality, permitting construction, and project safeguards
State-Owned Enterprises	
Indonesian state-owned public transit bus company (DAMRI)	Provides public transport in cities, mandated by MoT
Indonesia Port Corporation (PELINDO)	Indonesia state-owned port operator companies (Pelindo I, Pelindo II, Pelindo III, and Pelindo IV) that manage 114 ports across Indonesia, including its four main ports: Belawan, Tanjung Priok, Tanjung Perak, and Makassar
Angkasa Pura	State-owned companies (Angkasa Pura I and Angkasa Pura II) that manage 39 airports across Indonesia
Private Sector	
The Association of Indonesia Automotive Industry (GAIKINDO)	Key private sector stakeholder representing firms that produce and import automotive vehicles
Indonesia Motorcycles Industry Association (AISI)	Key private sector stakeholder representing firms that produce and import motorcycles
Land Transport Organisation (ORGANDA)	The organisation of motorised road transport entrepreneurs (both passenger vehicles and freight)
Indonesia Trucking Association (APTRINDO)	Facilitates interaction amongst truck operators
Indonesia Logistics and Forwarders Association (ALFI)	Communication platform for freight forwarding companies
Indonesia National Ship-Owners Association (INSA)	Protects and promotes the interests of ship companies
Indonesia Courier Service Companies Association (ASPERINDO)	Facilitates communication between freight forwarding companies and represents them in the trade chamber
Inland Waterways and Ro-Ro Operators Association (GAPASDAP)	Facilitates communication between inland waterways and ro-ro operators
Informal Service Providers (i.e. *angkot* owners, individual truck owners)	Groups or individual public transport owners providing public transport or freight services, operating mainly in neighbourhoods or local areas, with specific routes and no minimum service standards
Consulting firms and research institutions	Contractors for feasibilities studies, planning, design, and implementation of projects and activities related to sustainable transport

Development Agencies	
Indonesia Climate Change Trust Funds (ICCTF)	A national mechanism designed to attract international climate funds and channel them into national climate mitigation and adaptation-related programmes in line with National Action Plan on GHG Emission Reduction (RAN-GRK) and national development goals
Development Agencies	Provide resources, including funds and technical assistance, to work on sustainable transport issues
Non-Government Organisations, Communities and Media	
Indonesia Transport Society (MTI)	Knowledge hub, a think-tank, and expert network
Indonesia Logistics Society (MLI)	The organisation of logistics professionals
Indonesian Logistics Association (ALI)	The organisation of supply chain and logistics professionals
Transportation user association (i.e. train users community/KPKa)	Important groups for participation process in public transport activities
Non-governmental organisations related to transportation and environment	Play important roles as multipliers and raise awareness at both national and local levels
Local, national, and international media	Campaign for awareness-raising on sustainable transport

Soon after the commitment to reduce GHG emission by 26% (unconditionally) and up to 41% (with international support) by 2020 from BaU, which was pledged in the past in 2009, Indonesia has taken serious follow-up by establishing several policies and regulations related to climate change issues led mainly by BAPPENAS. Another major milestone came soon after the change of administration from former President Soesilo Bambang Yoedhoyono to President Joko Widodo back in 2014. The new government was inaugurated in October 2014, and main roles and responsibilities (*tupoksi*) of relevant ministries were adjusted to accommodate more emphasis on climate change. The most notable change was the merging of the Ministry of Environment and the Ministry of Forestry, which later became the Ministry of Environment and Forestry (MoMF), and ultimately influenced the division of responsibilities among other ministries regarding climate change. Table 2 below captures the overview of responsibilities of the key ministries.

Table 2 Roles and responsibilities of key stakeholders within climate change and energy

Sector	Responsible Agency	Roles in Climate Change and Energy
Climate Change	Ministry of Environment and Forestry (MoEF)	Following Presidential regulation (Perpres) No. 7/2015, enacted in January 2015, MoEF's Directorate-General (DG) of Climate Change (DG-PPI) was established. The organisational structure of the new ministry, including the DG Climate Change and its directorates, was established under the MoEF Regulation (PermenLHK) No. P. 18/MENLHK-II/2015 in May 2015. Since then, activities related to climate change issues are coordinated by MoEF.
	National Development Planning Agency (BAPPENAS)	BAPPENAS was the lead agency that coordinated activities related to climate change before 2015.
Energy	Ministry of Energy and Mineral Resources (MEMR)	MEMR is the primary institution governing issues related to the energy sector. The main tasks and functions *(Tupoksi)* of MEMR are formulating national policies, implementation policies, and technical policies in the area of energy and mineral resources and implementing government affairs in the area of energy and mineral resources. MEMR is comprised of several DGs with

		specific responsibilities including (1) DG of Oil and Gas, (2) DG of Minerals and Coal, (3) DG of Electrification, and (4) DG of New & Renewable Energy and Energy Conservation (DG-EBTKE).
	Others	Other ministries and institutions are also involved and have jurisdiction over some areas of the energy sector, including the MoF, BAPPENAS, Ministry of State-Owned Enterprises (MSOE), Ministry of Environment and Forestry (MoEF), the Coordinating Ministry of Economic Affairs (CMEA), and the Coordinating Ministry for Maritime Affairs (CMMA) (ADB 2015). The National Energy Council (DEN) was also established in 2007 (based on Law No. 30/2007) to design and formulate national energy policy, establish a national energy plan (RUEN), establish actions to manage crises and emergency energy situations, and monitor implementation of inter-sectoral energy policies (DEN, 2015).
	State-Owned Enterprises	According to (ADB 2015), 'state-owned enterprises (SOEs) play a key role in the Indonesian energy sector. They function as corporations but are simultaneously charged with mandates to work towards the goals and needs of the state. Ownership functions are exercised by MSOE, which seeks to ensure that enterprises are efficient, well-managed, and profitable. Line ministries and agencies regulate compliance with laws and policies. MoF must agree on matters of tariffs, budget allocations, public service obligations, and subsidies; while BAPPENAS oversees central planning.' In the energy sector, the SOEs' line ministry is MEMR. The SOEs Pertamina and PGN, together with international and local companies under production sharing contracts, operate the oil and gas sub-sector.
	Ministry of Industry	The Ministry of Industry (MoI) plays an important role in fuel economy issues. The DG of Metal, Machinery, Transportation Equipment and Electronics Industry (DG-ILMATE) is tasked with formulating and implementing policies to improve competitiveness, the business environment, industry and the service industry, industry standardisation, industry technology, and transport and maritime vehicle and equipment. Policies related to the car industry, including carbon taxes, are coordinated by MoI through DG-ILMATE.
	Local governments	Since 1999, local governments have effectively controlled the development of energy resources and permit issuances for infrastructure projects. Since then, there has been confusion and even conflict over jurisdiction of the various levels of government (ADB 2015).

Within the stakeholder map, the MoT has the responsibility as the appointed regulator for transport-related activities. The Minister reports directly to the President regarding the progress of activities that fall under the strategic planning of the MoT. MoT's main tasks and responsibilities *(Tupoksi)* consist of (1) formulating national policies, implementation policies, and technical policies in the transport sector; (2) implementing and monitoring governance and tasks in the transport sector; (3) managing state assets under MoT's purview (4) monitoring and implementing transportation-related duties, and (5) delivering evaluation reports, advice, and making decisions related to transport. Land transport policies and technical standards are formulated and implemented by the DG of Land Transport (DG-Land). These include permit issuance, certification, accreditation, and recommendations in the area of land transport, river, lake and ferriage, railways, and urban transport.

The Centre for Sustainable Transport Management (PPTB) was established under the office of the

Secretary-General of MoT in 2015. Its tasks are to prepare supportive policies related to environmental governance and improve governance and innovation systems of sustainable transport services. The Greater Jakarta Transportation Management Agency (BPTJ) was established in 2015 through Presidential Regulation No. 103/2015, to provide an integrated transport system in the area of Jakarta, Bogor, Depok, Tangerang, and Bekasi. The organisation and management of BPTJ was established under the Transport Ministerial Regulation PM No. 3/2016.

In the transport sector, the MoPWH and its offices (*Dinas Pekerjaan Umum)* have the responsibility of building roads and bridges, with MoT responsible for building terminals, airports, seaports, and railways.

2 Overview of Transport Pricing Policies

The development of sustainable transport policies in Indonesia involves complex political cross-institutional processes. These policies include the implementation of pricing policies in the road transport sector, such as fuel subsidies removal, motor vehicle taxes, parking pricing and tariffs for online ride-sharing (Gojek, Uber). The success of any transport pricing policies can only be achieved if the impact in different sectors can be evaluated. On one side, most of the transport pricing policies are issued out of the MoT. On the other side, the impact of the policies covers not only a positive impact but also a negative impact in many sectors such as transport and environment sectors. Table 3 summarises the transport pricing policies being implemented and planned in Indonesia. The pricing policies marked grey are further assessed in this study.

Table 3 List of transport pricing policies

Type of Policy	Specific Policy	Issued by	Description	Regulation	Status/Time	Area
Fuel price policy	Reduced fuel subsidies	Ministry of Finance (MoF)	Reduction of fuel subsidies by increasing the fuel price and following the market price	Presidential Decree (Perpres) No.191/2014 on Supply, Distribution and Retail Price of Fuels and Minister of Energy and Mineral Decree No.27/2016 on Retail Price Calculation of Fuels	Since 2014	National
Road pricing	Road tolls	Ministry of Public Work under Badan Pengatur Jalan Tol (MUJt)	Increase of toll price of urban freeways and national freeways	Government Regulation No.15/2015 on Calculation of Toll Road Fees	Since 2015	Metropolitan, Cities
	Electronic road pricing		Traffic restrictions in certain areas/ specific corridor-based levies to encourage the shift to public transport	Not yet issued	In planning	Jakarta
Public transit fare reforms	More convenient payment system		• Cashless system • Mode integration electronic pricing system	Incorporated in local regulations (sub-national)	• Since 2013 • Since April 2019	Greater Jakarta
Carbon vehicle tax		Ministry of Industry	New motor vehicles tax according to CO_2 emission (gr/km)	Not yet issued, however, included in the National Energy Plan	In planning	National
Increased vehicle tax	Progressive tax	Ministry of Finance (MoF)	Increases tax for 2nd, 3rd, and so on private motor vehicles	Law of the Republic of Indonesia No. 28/2009 concerning Local Taxation and Charges, Article 6: "Private motor vehicles ownership of second, third and so on, 2%-10% more tax	Since 2009	National

Less tax for a greener car	Low-Cost Green Car (LCGC)	Ministry of Industry	The incentive is given to the automobile industry producing LCGC	Law of the Republic of Indonesia No. 41/2013	Since 2013	National
	Electric vehicle	The President	Presidential regulation to accelerate EV production and utilisation in Indonesia and to target Indonesia as a basis for EV production in the region	Presidential Decree No.55/2019	Since 2019	National

Note: information compiled by the assessment team from various online and off-line sources

2.1 Fuel price policy

Indonesia has made various efforts to reform fossil fuel subsidies and experimented with implementing various policy measures, all with varying degrees of success in several affected sectors. Fuel subsidy removal is defined as one of the most common and complex transport pricing policies in Indonesia. The main pressure behind the decision to implement this policy is the budget capacity of the government. In this case, the pressure comes from the budget deficit, limited capacity of fuel production with continuously higher demand and increasing dependency on fuel imports, exchange rate fluctuation and high fuel world price. Besides, the government realised that fuel subsidies are also not fully correctly targeted to solve the poverty problem. Within this assessment, a more in-depth look is needed into the state's revenue and expenditure (through Fiscal Policy Board/BKF) to understand the public budget on fuel policy.

International Monetary Fund (IMF) has done extensive research work on inequalities from subsidy benefits. The bulk of the subsidies go to the wealthiest 40% of the population in almost all countries with large fossil fuel subsidies (Del Granado et al. 2010). International best practices have demonstrated that there are always better ways of targeting support to vulnerable households and those with lower incomes.

The impact of fuel price policy/fuel subsidy removal has been investigated in certain areas such as poverty (Akhmad 2014), toll-road travel behaviour (Burke et al. 2017), economic sectors (Setyawan 2014), and fiscal balance and poverty (Dartanto 2013). So far, only limited studies explicitly explored the impact of GHG emission from fuel subsidy reforms such as the one conducted by ADB (Asian Development Bank 2015).

As in most countries, removal of subsidised fuel (gasoline and diesel) creates advantages and disadvantages. The subsidy cut helps to push the public to utilise public transport or more efficient vehicles as the cost for using private vehicle is getting higher. However, many experts believe that the public affected by this decision, primarily belong to the low-income category. Therefore, ideally, the policy of subsidised fuel removal should be accompanied by several supporting policies, particularly to address the socioeconomic aspect but also to raise environmental and sustainability concerns.

Figure 5 illustrates the fuel price (only gasoline with research octane number (RON) 88 and diesel) development in Indonesia in the last two decades under different Presidential administration. The fuel price increases began in 1998, shortly after the Asian financial crisis in 1997, which worsened the Indonesian domestic economic situation. The dramatic increase (71%) in fuel subsidies ignited public protest, and violent riot has pushed Suharto to his resignation in 1998. During the next short-term administration under President BJ. Habibie, there was no change in fuel prices. However, in the next regime of Abdurrahman Wahid, fuel prices raised by 12% and 20% in October 2000 and April 2001. In the Megawati Soekarnoputri era, fuel price raised four-times up to 64%. While President Soesilo Bambang Yudhoyono (SBY), he was recorded seven-time rising fuel prices, raised the gasoline premium type up to 370% in his ten years of rule. This policy had to be taken by SBY because in 2004 Indonesia turned from being a net exporter to a net importer of oil.

In early 2014 when President Joko Widodo (Jokowi) newly served as president, he cut fuel subsidies by rising fuel prices. Besides, the government introduced a strategic formula for fuel prices. The price for each fuel type is dynamic according to the fluctuations of global market fuel prices. Also, the government introduced various non-subsidised gasoline with a higher octane number. Currently, non-subsidised fuel prices are set by retailers. In addition, one fuel price policy is also implemented in Indonesia. That means the price of fuel is the same in all parts of Indonesia.

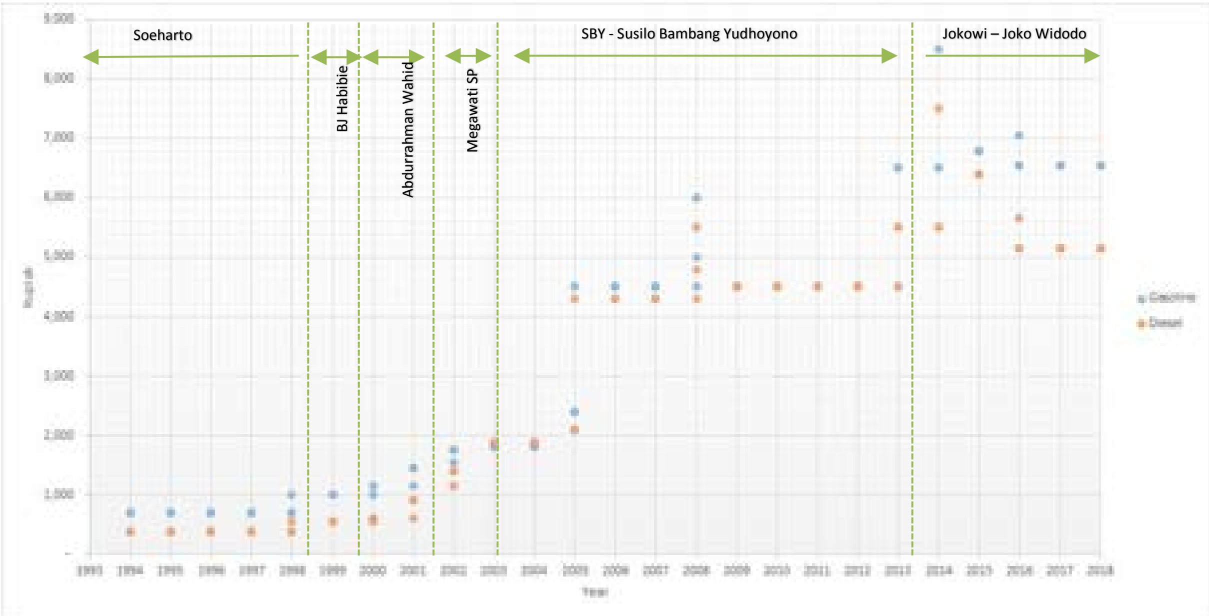


Figure 5 Gasoline (only RON 88) and diesel fuel price in Indonesia (prices in IDR, compiled from various sources and processed by ITL team)

An official statement from the MEMR highlighted that the removal of subsidies for gasoline and reduction of diesel subsidy (fixed subsidy amount for diesel is IDR 1,000 per litre, equal to 7 US cent) is already in place since 2016 (Detik 2016). The Government intends to keep up with oil and gas infrastructure development to compensate the subsidy cuts, that means for a single rupiah withdrawn from the fuel subsidy, the same rupiah will be allocated to improve infrastructure and connectivity of the regions. This approach is expected to narrow down the gap between high and low-income Indonesians and equalise the prices of goods across the country (including the price of fuel, which is often found to be higher in the remote and isolated areas due to high transport costs).

Unfortunately, there are only a handful of studies investigating the impact of fuel subsidy removal. Within this assessment, fiscal policies related to fuel (subsidy and tax) are one of the focus areas to deliver conclusions from the perspective of environmental impact to help the government regulate the pricing policy further.

In 2016, the MEMR stated that fuel consumption from the transport sector in Indonesia has grown by 128% between the year 2000 and 2014, which makes transport as the sector with the highest growth in terms of energy consumption. The Biennial Update Report 2 (BUR 2) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2018 also stated that the transport sector is the second-highest energy consumer after industry and followed by household. Furthermore, the International Energy Agency (IEA) through its "Energy Efficiency 2017", a special report on Indonesia" outlined that from 2000 to 2015, energy demand for the transport sector is the highest in the country, where the energy demand for passenger vehicle grew almost four-fold compared to the previous years (IEA 2016). Considering this, the fuel price policies have to be investigated to reveal the most effective measures in transport pricing (as well as other economic instruments such as tax and duty) on transport energy demand curves.

The overall responsibilities of fuel price policy fall into the domain of the Ministry of Finance (MoF). Nevertheless, there are at least two more important state actors involved, which are the MMER and the state-owned oil and gas state-owned company PERTAMINA.

2.2 Low-Cost Green Car (LCGC)

Since 2013, the Indonesian government has introduced the "Low-Cost Green Car" or commonly known as LCGC programme. The policy is based on tax cuts for cars with a cylinder capacity of less than 1,200 cc. To accommodate the LCGC policy, the Indonesian government issued the Government Regulation or PP No. 41/2013, which incorporates fiscal incentives, mainly in terms of tax deduction. 0% tax rate is applied for cars with engine capacity up to 1,200/1,500 cc of both diesel and gasoline type that achieve fuel economy of at least 20 km per litre of gasoline-equivalent (Clause 3, article 1). As a comparison, a regular car is a subject for import tax, luxury tax (PPNBM), and VAT. However, this policy has driven a significant increase in car sales between 2013 – 2018 (from 45.000 units in 2013 to 225.000 units in 2018)[1].

Despite the good intention of improving fuel efficiency, and contribution to the national automotive industries' objective, there are conflicting goals: although the policy may create new domestic jobs and improve fuel economy compared to larger cars, the result for Indonesia could be worsened congestion, reduced modal share for public transport and the rising concern of air pollution and noise pollution (MoT and GIZ 2018). The risk of 'rebound effects' from promoting LCGC should be assessed carefully. Despite all the controversies, the MoI plans to propose a new carbon tax scheme for Low Carbon Emission Vehicles (LCEV), which is a step further compared to LCGC, where tax rate will be decided based on CO_2 emission (Ministry of Industry 2017a).

2.3 Electric Vehicle

Electric vehicle (EV) policy has been awaited for some time; finally, the government officially issued the Presidential Regulation No. 55/2019 to accelerate the EV programme only in August 2019. This new regulation requires all EV manufacturers to set up production facilities in Indonesia. The regulation also requires the industry to continue to innovate in further improvement of EV products in Indonesia. Furthermore, the regulation opens new opportunities for university, local government and

[1] Summarized from GAIKINDO wholesales data

industry to make joint efforts in accelerating the EV programme. The auto industry immediately responded positively to this policy; however, other regulations concerning electricity, creating a conducive environment for EVs, including charging infrastructure and especially incentives such as 0% luxury tax (PPNBM) for EV products/parts (Ministry of Industry 2017a) are still awaited. The policy is targeted to promote both electric two-wheelers, three-wheelers, electric cars, as well as other vehicles such as trucks and buses.

The regulation also requires the government to have a target to reduce the domestic production of conventional vehicles (using fossil fuels) gradually, until production closure by 2040. The government is currently developing a roadmap to achieve this target. Since this is a relatively new policy, there is not much information and data available. This assessment collected key information to anticipate the policy impact. Earlier study supported by ADB to assess the feasibility of electric busses in Jakarta, recommends that Jakarta starts with a minimum of 100 electric buses to serve the TransJakarta BRT networks (Grutter Consulting 2019).

The decree also aims to make Indonesia as the centre for EV production within the South East Asian (SEA) region. A recent report by consultants Bain & Company estimates that the ASEAN region's annual new investment in passenger EV will grow to US$ 6 billion by 2030, and will require another US$ 500 million in new charging infrastructure (The Asean Post 2019). Furthermore, with EV related investment such as telecommunications, ICT, passenger services and fleets and their management, it predicts that the EV market in ASEAN could become one of the largest growth segments for the next decade.

President Joko Widodo considers that Indonesia is a strategic place for businesses to start designing an affordable and competitive EV industry. The government estimates that 60% of key components of an EV is the battery, and Indonesia has access to produce raw materials such as cobalt and manganese (The Jakarta Post 2019). Currently, most electric cars available on the Indonesian market were about 40% more expensive compared to internal combustion engine (ICE) powered cars. Furthermore, national government also supports the government of Jakarta to start with electric bus and electric taxis to serve public transport.

The BKF is working on a government regulation that could provide a legal basis to give fiscal incentives on EV, such as removing the luxury taxes. However, government regulation may take longer time to enactment.

2.4 Existing national system for tracking emissions in the transport sector

Indonesia has set up the country GHG emission tracking system, through PEP (*Pemantauan, Pelaporan dan Evaluation*/Monitoring, Reporting and Evaluation) for GHG emission reduction as stated in the National Action Plan on GHG Emission Reduction (RAN-GRK). The BAPPENAS and the MoEF are leading the process. The transport sector is included as a sub-sector under the energy sector, which is the sector responsible for the second-largest emission after agriculture, forestry and land use or AFOLU (BUR 2). Indonesia's BUR 2 submitted in December 2018 also contains updates of the country's emission inventory which maps out specific emissions from transport activity.

2.5 Criteria for selection of potential transport pricing policy

This project, with support from ICAT team based in Europe and the US, has prioritised several transport pricing policies for the assessment. The main considerations were: (i) relevance to the ICAT Guidance, (ii) potential emission reduction, (iii) data quality, (iv) relevance in national strategy and national climate change strategy and NDC. ICAT provides methodological guidance for assessing the GHG emission impact of pricing policies in the transport sector. The methodology in this assessment strictly follows the approaches stated in the guidance, mainly touching upon (i) fuel subsidy removal, (ii) increased fuel tax of levy, (iii) road pricing (tolls and congestion pricing), and (iv) vehicle purchase incentives for more efficient vehicles. ICAT methodology only focuses on motorised transport.

It has been agreed with ICAT team that the guidance is applicable to the case country, especially the policies that are related to the MoT. However, it should be kept in mind that the approaches should be realistic and that the selected policies are based on team consensus and backed with reliable and consistent data. The guidance allows for analysis of policies at any level of government (national, subnational, municipal), in all countries and regions, covering policies that have been implemented, on-going and policies that are under consideration, giving flexibility in this project to select the most appropriate policies, yet keeping the focus on pricing policies.

The policies selected for analysis within this assessment are limited to fuel pricing (subsidy reduction), Low-Cost Green Car (LCGC), and Electric Vehicle (EV) as listed in the table below:

Table 4 Policies included in the assessment

Guidance	Area	Selected Policies	Timeline	Justification
Pricing policies	National, Indonesia	Fuel pricing policies	Ex-post (2013 - 2016)	This policy would be the focus of the assessment since it is the most obvious pricing policy
Low-Cost Green Car (LCGC)	National, Indonesia	Vehicle purchase incentives for more efficient vehicles	Ex-post (2013 – 2017)	Could be included, although it is not fully accepted as a positive pricing policy
Electric Vehicle (EV)	National, Indonesia	Vehicle purchase incentives for more efficient vehicles	Ex-ante	The plan for EV is included in the national energy planning, and the Presidential Decree No. 55/2019 that was issued in August 2019. This policy covers the electric car and electric two-wheelers

Approach B[2] was selected for analysis as fuel sales data kept for individual provinces separates gasoline and diesel sales. The approach estimates the GHG emission impact separately for gasoline and diesel vehicles. Approach B is also applicable due to MRV implementation in Indonesia, were line ministries should report emission from various sectors, including transport.

[2] ICAT Guidance for assessing GHG impact of transport pricing policies offers approaches A, B, and C, where approach A is less complex and approach C is the most complex. Calculation methods and data requirements follow the selection of the approach.

3 Estimating Overall Baseline Emissions

3.1 Approach

The approach for estimating the overall baseline emissions analyses the total use of gasoline and diesel, which are relevant for the estimation of the overall GHG emission. The baseline for other policies and measures (LCGC and EV) is assessed independently in chapters 4, 5 and 6, with a more restricted boundary system.

For this assessment of nationwide fuel pricing policy, the baseline scenario was constructed by using fuel price and consumption trends, macroeconomic instruments and several related fuel pricing policies prevailing in the Indonesian context.

The baseline of 2013 is used as the subsidy cut for fuel was implemented in late 2014 after the change in administration under the new president Joko Widodo. 2016 is considered as the impact year as fuel consumption patterns of both gasoline RON 88 and diesel have changed within the given timeline.

A concrete approach for estimating the baseline emission for gasoline and diesel in calculating the impact of fuel pricing measure is listed below (as in section 7.2.2 of the ICAT Guidance):

- Developing data requirements list, based on the causal chain for fuel pricing policy covering fuel price for diesel and gasoline, gasoline and diesel consumption, GDP, vehicle population, vehicle sales, per capita income, etc.
- Compiling data and checking data quality on fuel price, gasoline and diesel consumption, number of vehicles, and other supporting data. For this assessment, the period is 2000 – 2016.
- Identifying and converting the appropriate data metrics for the baseline, such as energy unit and volume.
- Selecting the assessment period for fuel pricing by using ex-post approach for the 2003 -2016 period. The Year of 2013 is chosen for the base year since fuel subsidies were still in place and the government was about to cut the subsidies. Gasoline and diesel were subsidised until 2013 and starting in 2014 the government slowly reduced the fuel subsidy and allocated some of the national budget for infrastructure development. Therefore, the year 2016 is selected for the assessment year.

3.2 Baseline scenario

The expected baseline scenario demonstrated the trend in emissions from gasoline and diesel consumption without the intervention of pricing policy. A clear baseline scenario is needed to compare the impact of various policy options. Also, the baseline scenario depends on whether a national or local policy already exists. In the baseline scenario, the fuel prices are adjusted by using the Purchasing Power Parity (PPP) conversion factor. PPP conversion factor is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as the US dollar would buy in the US. The method refers to Chapter 7.2 of the ICAT guidance, where baseline calculation for Approach B can be achieved by multiplying activity data with an emission factor for determining the base year emissions. The data encompass vehicle fuel use for 2013.

3.3 A list of influencing policies and actions

As in any baseline, GHG emission impact assessments from pricing policy are uncertain projections due to other influencing policies and actions. Here are some of the policies that may influence the fuel pricing policy.

National policies:

- Biofuel
- Fuel switch (gasoline/diesel to CNG/NGV)
- LCGC policy
- Ride-sharing/ride-hailing (Grab, Gojek, other on-demand transport applications)
- Electric Vehicle (future)

Local policies:

- Parking policies
- Road toll charges
- Public transport expansion (BRT)
- Vehicle restriction (motorcycle restriction and "odd-even" policy in Jakarta)
- Truck restriction (on several major roads in most metropolitan and big cities, including Jakarta)

3.4 Methods and assumptions

The method chosen for the estimation of baseline emissions refers to Chapter 7.2 of the ICAT Guidance. Emissions are estimated by multiplying the activity data with the local emission factors. All information used for the baseline of GHG emission impact of fuel pricing used secondary data published by the respective agencies. Activity data, in this case, annual vehicle fuel use and local emission factors are acquired and released by the National Energy Council (DEN 2016) and the MEMR (Kementerian ESDM 2017).

Assumptions of the baseline calculation include the selection of emission factor for gasoline with RON 90 and fuel price adjustment to PPP (Local Currency Unit/LCU per international $).

3.5 Uncertainty and sensitivity

The following points should be considered as uncertainties:

- Fuel prices change over time being influenced by the global fuel price. The average fuel prices are compiled from different sources such as PERTAMINA and various media. The numbers are then adjusted by using the Consumer Price Index (CPI)
- Uncertainty over the share of biofuels in diesel and gasoline

3.6 Baseline parameters

Generic values used to calculate the baseline emission from fuel pricing policy can be found in the following tables:

Table 5 Measurement units and its conversions

1 USD	13,209 IDR
1 BOE	0.0061179 TJ
1 BOE	0.1589873 KL

Note: USD = US Dollar, IDR = Indonesian Rupiah, BOE = Barrels of Oil Equivalent, TJ = Terajoule, KL = Kilolitre

Table 6 Emission factor for gasoline RON 88 and diesel (source: MEMR, 2017)

Emission factor for CO_2 from gasoline and diesel	
RON 92	72.60 Ton/TJ
RON 88	72.97 Ton/TJ
RON 95	69.30 Ton/TJ
RON 90*	72.79 Ton/TJ
ADO**	74.43 Ton/TJ

* RON 90 emission factors are extrapolated with the fuel being relatively new

** ADO is assumed to be "regular diesel" that is widely used by HDV and several LDV (including passenger car and small trucks)

Table 7 Consumer price index (CPI)

Consumer Price Index (CPI)*	2013	2016
United States (The World Bank)	106.834	110.067
Indonesia	116.91	136.966

* CPI is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them.

3.7 Estimated baseline emissions for gasoline RON 88 and diesel

Table 8 Measurement unit and step-by-step baseline calculation for diesel and gasoline

Fuel Type	Unit	2013	2014	2015	2016	2017
STEP A - Total fuel demand for land transport per fuel type (*a*)						
Premium (RON 88)	BOE	180.032.770	181.285.166	171.521.392	132.299.039	76.235.045
Pertamax (RON 92)	BOE	5.348.905	6.685.565	17.372.180	30.071.138	38.923.235
Pertamax Plus, Pertamax Turbo, Pertamax Racing Fuel (RON 95+98+100)	BOE	998.281	974.216	1.753.335	2.303.127	2.390.115
Pertalite (RON 90)*	BOE	0	0	2.389.870	36.513.784	91.121.102
Automotive Diesel Oil (ADO)	BOE	74.201.166	67.082.522	81.755.492	45.466.726	51.465.809
Total Energy Consumption	BOE	260.581.122	256.027.469	274.792.270	246.653.814	260.135.306
STEP B - Conversion of litre of fuel to energy unit (TJ) - (*b*)						
Premium (RON 88)	TJ	1.101.416	1.109.078	1.049.344	809.387	466.396
Pertamax (RON 92)	TJ	32.724	40.901	106.281	183.971	238.127
Pertamax Plus, Pertamax Turbo, Pertamax Racing Fuel (RON 95+98+100)	TJ	6.107	5.960	10.727	14.090	14.622
Pertalite (RON 90)	TJ	0	0	14.621	223.386	557.466
Automotive Diesel Oil (ADO)	TJ	453.953	410.402	500.169	278.159	314.861
STEP C - Base Year Emissions (tCO_2e) - (*BYE*)						
Premium (RON 88)	tCO_2e	79.962.791	80.519.051	76.182.404	58.761.527	33.860.319
Pertamax (RON 92)	tCO_2e	2.387.861	2.984.573	7.755.297	13.424.372	17.376.129
Pertamax Plus, Pertamax Turbo, Pertamax Racing Fuel (RON 95+98+100)	tCO_2e	423.239	413.036	743.358	976.452	1.013.332
Pertalite (RON 90)	tCO_2e	0	0	1.064.255	16.260.292	40.577.982

Automotive Diesel Oil (ADO)	tCO_2e	33.787.691	30.546.198	37.227.573	20.703.390	23.435.088
TOTAL BASE YEAR EMISSIONS (tCO_2e)	tCO_2e	**116.561.582**	**114.462.859**	**122.972.887**	**110.126.032**	**116.262.850**

*Pertalite (gasoline with RON 90) was only introduced to the market starting 2015

** yellow highlights are the values for 2013 base year

Figure 6 illustrates the CO_2 emission only from various types of gasoline, whereas Figure 7 shows the total CO_2 emission from diesel and various types of gasoline. Emissions growth resulting from the consumption of premium RON 88 (subsidised gasoline) fuel type clearly continued to increase from the year 2000 and reached the emission peak with about 80,519,051 tCO_2e in 2014. This fact is in line with the increasing economic growth, population, vehicle population and mobility growth.

Due to the introduction policy of various types of gasoline with higher RON, the CO_2 emission of premium has led to a declining trend since 2014. In addition to the fuel subsidy reform, the government also formulated in 2014 a strategic formula for fuel prices where the price for each fuel type is dynamic according to the fluctuations in global market prices. This reduction is considered as a wise step for a better quality of fuel and impact on the environment. Besides, it brought a positive impact on the government budget, since less amount of fuel is subsidised.

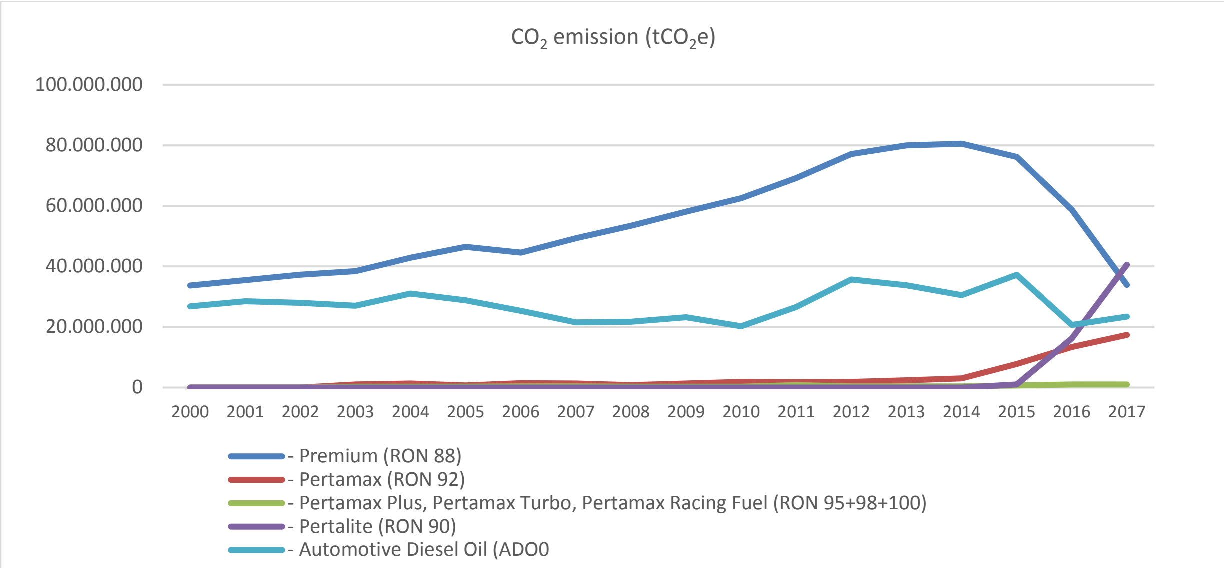


Figure 6 CO_2 emission based on gasoline types

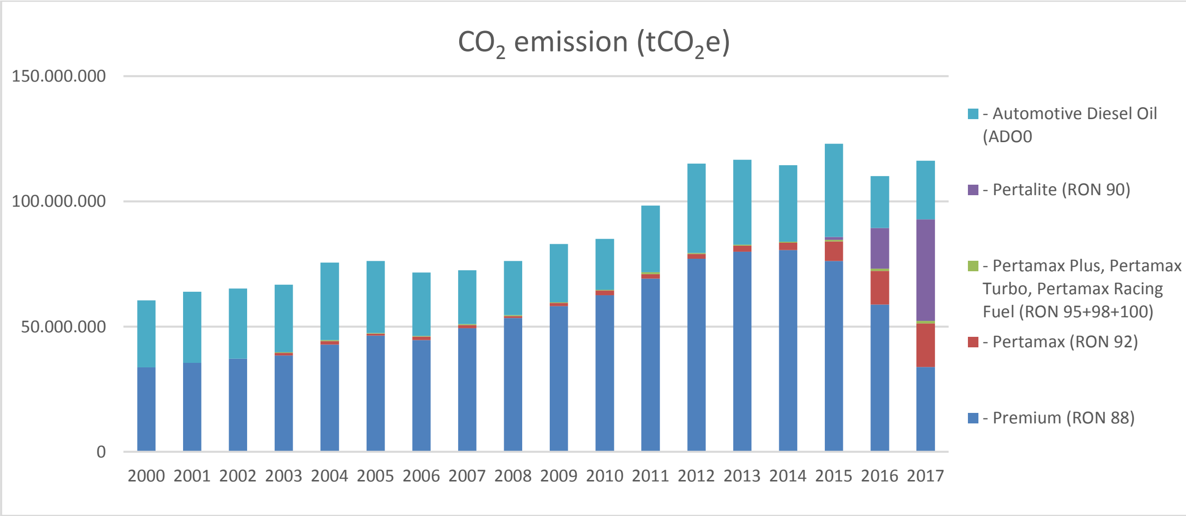


Figure 7 Baseline of total CO_2 emission

4 Estimating GHG Emission Impact of Fuel Pricing Policy

4.1 Fuel pricing policy in Indonesia

As discussed in section 2.1 of this report, fuel subsidy removal was introduced on 1January 2015. President Joko Widodo officially removed the subsidy for gasoline RON 88 and set a fixed amount of IDR 1,000 (7 US Cent) subsidy for diesel. The price for gasoline and diesel has been fluctuating since the beginning of January 2015. This chapter analyses the impact of policy intervention by using the baseline of 2013 and impact year of 2016.

4.1.1 Overview of steps

This assessment was conducted ex-post by using Approach B of the ICAT Transport Pricing Guidance. Estimation of baseline emission and estimation of GHG emission impact from the policy intervention are analysed. The fuel pricing policy in this assessment is considered as an individual policy, and the area of intervention covers the whole country as mentioned earlier, where the central government regulates the fuel prices. The assessment considered the time range of 2013 – 2016, with data used for this calculation compiled from various sources including the central statistical agency and MEMR.

The criteria of the fuel pricing policy within this assessment include: (i) prices of gasoline RON 88 and diesel, which have been adjusted with Consumer Price Index (US-CPI) 2016, (ii) price elasticity for gasoline and diesel, adjusted with US-CPI 2016, and (iii) consumption of gasoline RON 88 and diesel for transportation sector in Indonesia.

Key recommendations from the assessment cover the following points:

- There is a total GHG emission reduction of 3,952,798.3 tCO_2 or minus (-) 6.30% for the period 2013 – 2016. This finding indicates that the removal of subsidy for gasoline RON 88 contributes to the reduction of total emission from the transport sector.
- For diesel, since the price is still slightly subsidised in an explicit amount of IDR 1,000 per litre (while gasoline price could be assumed to be slightly subsidised due to the fixed price set by the government, regardless of the fluctuation in the world crude oil price) the total GHG emission impact in terms of emission reduction is 180,440 tCO_2 or plus (+) 8.00% against 2013 baseline. The calculation indicates that instead of a decreased emission, there is a slight increase in terms of emission from diesel consumption, because diesel price decreased in 2016, compared to the 2013 baseline.

4.1.2 Policy to be assessed

As described earlier, this assessment covers only GHG emission impact from fuel pricing policy of gasoline RON 88 and diesel for the transportation sector in Indonesia. The fuel pricing policy was not related to other policy interventions relevant to fuel consumption and GHG emission reductions. As mentioned in section 3.1, studies on GHG emission impact from fuel subsidy reform are limited. Data is compiled from various online and offline sources; however, issues on data quality and source reliability have been addressed with the technical consultants.

4.2 Identifying impact: how fuel pricing policies reduce GHG emission

The causal chain, as in Figure 6.2 of the ICAT Guidance on Transport Pricing (version June 2019) was adopted. Intermediate impact of fuel pricing leads to the GHG emission impact. The GHG impact is the accumulation from the intermediate impact within the time range of 2013 – 2016. A focus group discussion (FGD) was held on 18 September 2019 where the majority of key stakeholders agreed with the results adding several shifts to be considered as additional factors decreasing emission such as a private car to public transport, road to railway, and motorised to non-motorised transport shifts.

However, Indonesia's NDC requires the country to reduce GHG emission by 29% in 2030, compared to BaU emission. The transport sector is one of the key sectors in reaching the emission reduction target, especially having in mind that BAPPENAS estimates suggest that the transport and energy sector could account for approximately 50% of BaU emission by 2030. BAPPENAS translate the NDC commitments into national development targets, thus making the NDC even more strategic for sustainable development targets in Indonesia.

4.2.1 Identifying GHG emission impact from fuel pricing policies

Potential impact of both gasoline and diesel subsidy cuts are grouped according to the causal chain adopted from the guidance:

Direct impact (the immediate result of fuel price increase/decrease and its relevance to transport activity)

- **Reduced vehicle travel by vehicles using higher fuel price**. Vehicle use is reduced as people tend to avoid unnecessary trips, better plan their daily trips or modify/change their trip patterns.
- **Shift to higher occupancy rates**. As fuel prices increase, people optimise vehicle capacity, thus resulting in higher occupancy rates of private vehicles.
- **Shift to other transport modes**. Other transport modes such as public transport gain passengers, as private vehicle users, shift to public transport.
- **Shift to more fuel-efficient vehicles**. People shift to more fuel-efficient vehicles as in the long run this option saves money.
- **Revenue is available for transport expansion**. The government allocates more funds for public transport subsidies and other infrastructure for public transport, thus creating the "pull" effect for more share in public transport (in addition to the "push" effect from increasing fuel price).

Indirect impact (long term result or delayed onset deriving from fuel price increase/decrease)

- **Increasing demand for more efficient or EV**. People shift from combustion engine vehicles to EV due to cheaper running costs. However, although Electric Vehicle could reduce GHG emission and local air pollution, this positive impact might be offset by the emission from the energy sector. The government needs to assess if it needs to build new power plants to meet the demand for energy from EV use.

Causal Chain

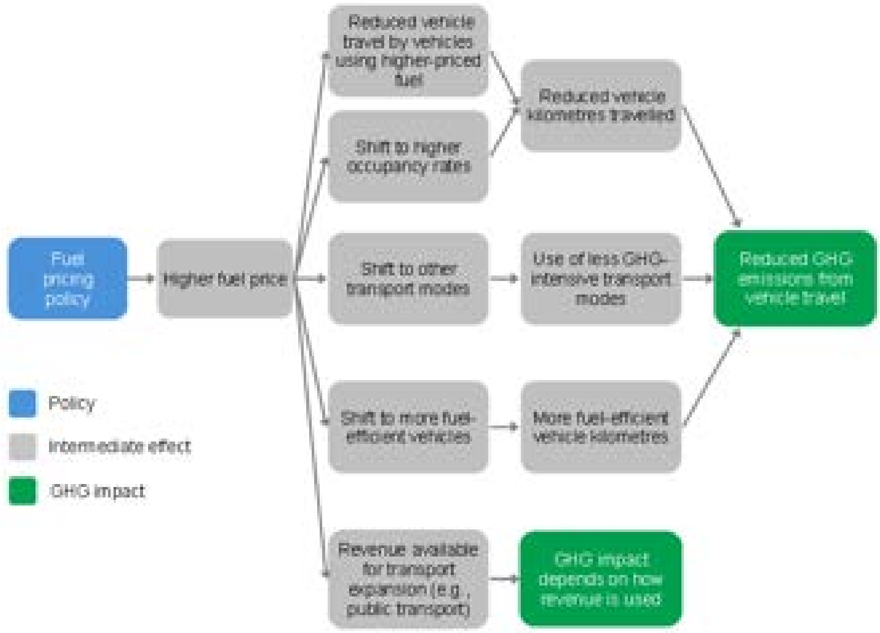


Figure 8 Causal chain for fuel pricing (adopted from ICAT Guidance on Transport Pricing)

4.2.2 GHG assessment boundary

Assessment boundaries identified in the design and calculation of the GHG emission impact from the fuel pricing policy are as follows:

Boundaries:

- Fuel price (historic data from 2013 – 2016); the prices have been adjusted for inflation.
- Adjusted elasticity for gasoline and diesel
- Fuel use of both gasoline RON 88 and diesel

Assumptions:

- Fuel subsidy cuts since 2014
- Increase in per capita income and GDP for Indonesia according to the national statistical agency (BPS)

Justification (expert judgement):

- Gasoline is used for passenger cars and motorcycles. This assessment does not consider the consumption of gasoline for agriculture, construction and other activities although the fuel data that has been collected may include gasoline used for small engines, e.g. lawnmower, portable agriculture pump, generator, etc.
- Diesel is used for heavy-duty vehicles (HDV/trucks) and buses only, although few passenger cars are using diesel engines. Diesel used for agriculture, construction and other activities is not yet consider into the calculation, although the fuel data collected may include the use of diesel for tractors, construction equipment, mining activities, generator, etc.

4.3 Estimating baseline emission

Baseline emission for both gasoline and diesel has been discussed in greater detail in Chapter 3. Table 9 below summarises the baseline emission.

Table 9 Baseline emission

Parameters based on fuel type (2013)	Unit	Value
Fuel demand gasoline RON 88	BOE	180.032.770
Fuel demand diesel	BOE	74.201.166
Litre to energy unit gasoline RON 88	TJ	1.101.416
Litre to energy unit diesel	TJ	453.953
Base year emission gasoline RON 88	tCO_2e	79.962.791
Base year emission diesel	tCO_2e	33.787.691

4.4 Estimating GHG emission impact (ex-post)

The assessment used country-specific price elasticity data, which has been adjusted to CPI. Initially, it was decided to calculate the GHG emission impact of gasoline (RON 88) and diesel as a result of subsidy cuts. Data was calculated for the baseline of 2013 before the policy intervention (subsidy cuts) and the assessment year of 2016. However, since diesel is still subsidised with a fixed amount of IDR 1,000, the separate calculation was made for gasoline and diesel. Estimation of GHG emission impact from gasoline and diesel are shown below.

Adjusted price elasticity for gasoline RON 88 and diesel

The guidance offers a default value for both gasoline and diesel price elasticity for several countries including Indonesia as estimated by Dahl (2012). GHG emission impact was calculated by using both default and adjusted elasticities. Annex 1 report shows the variables for calculating adjusted gasoline and diesel elasticities.

Gasoline RON 88

The calculation for gasoline RON 88 in this assessment follows table 8.7 of the guidance: GHG emission impact calculation using Approach B. However, as mentioned before, the table is slightly modified to separate gasoline and diesel calculations.

Table 10 GHG emission impact calculation for gasoline RON 88 using Approach B

Label	Approach B	Unit	Data collection/calculation	The base year 2013 and Assessment year 2016
A	Baseline gasoline use ($F_{gasoline,y}$)	TJ	Taken from table 9 (Chapter 3)	1,101,416
B	Baseline gasoline emission ($BE_{gasoline,y}$)	tCO_2	Taken from table 9 (Chapter 3)	79.962.791
C	Gasoline own-price elasticity ($\varepsilon_{gasoline}$)	-	Adjusted elasticity using CPI	-0.26
D	Relative gasoline price increase	%	Relative price increase adjusted to inflation	24.24%
E	Anticipated gasoline use	TJ	Taken from table 9 (Chapter 3)	809,387.4
F	Anticipated gasoline emission	tCO_2	Taken from table 9 (Chapter 3)	58,761,526.8
G	Anticipated total GHG emission impact (emission reduction)	tCO_2		-3,952,798.3
H	Anticipated relative impact	%		-6.30%

Diesel

The assessment for diesel also follows table 8.7 of the guidance: GHG emission impact calculation using Approach B to calculate diesel. The table is slightly modified to separate gasoline and diesel calculations.

Table 11 GHG emission impact calculation for diesel using Approach B

Label	Approach B	Unit	Data collection/calculation	The base Year 2013 and Assessment year 2016
A	Baseline diesel use ($F_{gasoline,y}$)	TJ	Taken from table 9 (Chapter 3)	453,953
B	Baseline diesel emission ($BE_{gasoline,y}$)	tCO_2	Taken from table 9 (Chapter 3)	33,787,691
C	diesel own-price elasticity ($\varepsilon_{gasoline}$)	-	Adjusted elasticity using CPI	-0.38
D	Relative diesel price increase	%	Relative price increase adjusted to inflation	-2.31%
E	Anticipated diesel use	TJ	Taken from table 9 (Chapter 3)	278,159.2
F	Anticipated diesel emission	tCO_2	Taken from table 9 (Chapter 3)	20,703,390
G	Anticipated total GHG emission impact (emission reduction)	tCO_2		180,440
H	Anticipated relative impact	%		0.88%

Table 12 Inflation adjustment for gasoline RON 88 and diesel prices

Correction for inflation	Gasoline RON 88	Diesel
Price 2013 (in IDR)	4,500	4,500
Price 2016 (in IDR)	6,550	5,150
CPI Indonesia 2013 vs 2016	1.17	1.17
Price 2016 (in IDR, with inflation adjusted)	5,591	4,396
Percentage of price difference (increase/decrease)	**24%**	**-2%**

Figure 9 explains the steps of calculation to estimate GHG emission impact for gasoline RON 88 and diesel.

Label	Unit	BaseYear: 2013	Assessment Year: 2016	
1 Baseline fuel use (A,B)				
- Premium (RON 88)	TJ	1,101,416		
- Automotive Diesel Oil (ADO)	TJ	453,953		
2 Base Year Emissions (C,D)				
- Premium (RON 88)	tCO2e	79,962,791	62,714,325	*
- Automotive Diesel Oil (ADO)	tCO2e	33,787,691	20,522,950	*
			*) Ex-Post: Calculated - Scenario if there is **no subsidy removal**	
3 Price Elasticity (E,G)			Adjusted Price Elasticity	
- Premium (RON 88) - □gasoline			-0.26	
- Automotive Diesel (ADO) - □diesel			-0.38	
4 Relative Price Increase (F,H)				
- Premium (RON 88)			24.24%	-->
- Automotive Diesel (ADO)			-2.31%	
5 Fuel used (I, J)**				
- Premium (RON 88)	TJ		809,387.4	
- Automotive Diesel Oil (ADO)	TJ		278,159.2	

) Ex-Post: From **real data - Scenario if there is **subsidy removal**

Correction for inflation:

	Gasoline	Diesel
Price 2013	4500	4500
Price 2016	6550	5150
CPI Indonesia 2013 vs 2016	1.17	1.17
Price 2016 (inflation corrected	5591	4396
Price change	24%	-2%

Figure 9 Step-by-step calculation for calculating GHG emission impact for gasoline RON 88 and diesel

4.4.1 Results, interpretation and uncertainties

According to the guidance, the GHG emission impact is the change in GHG emission that results from the policy. For most transport pricing policies being assessed using this methodology, the relevant GHG emission impact is likely to be reduced emission from reduced vehicle travel, shifts to other transport modes and shifts to more fuel-efficient vehicles.

Gasoline

According to the calculation, there is a relative impact of -6.30% in the assessment year 2016 against a 2013 base year. The increase in gasoline price has led to the reduction of gasoline used and total emission from gasoline use. As listed earlier in this chapter, the impact (reduction) in GHG emission from this policy intervention may accumulate from these following impacts: (i) reduced vehicle travel, (ii) shift to higher occupancy rates, (iii) shift to other transport modes, and (iv) shift to more fuel-efficient vehicles including EV. Further research is needed in order to map out exact emission.

Diesel

There is a relative impact of +0.88% in the assessment year 2016 against 2013 base year. There seems to be an increase of diesel fuel used for transport sector compared to the situation where the diesel price is adjusted in parallel to the national price index and is at the same price level as in 2013 (taking inflation into account).

Sensitivity analysis, as shown in Table 13, provides a better overview of the impact of both gasoline and diesel.

Table 13 Sensitivity analysis of fuel pricing policy

Assessment	Price change		Emission (million tCO_2eq)		Impact
	Gasoline	Diesel	Scenario 1 (Baseline): 2013	Scenario 2: 2016	
Ex-post (Gasoline + Diesel)	24%	-2%	83,2	79,5	-4.50%
Ex-post (Gasoline)	24%		62,7	0,8	-6.30%
Ex-Post (Diesel)		-2%	20,5	20,7	0.90%

Non-GHG benefits and potential risks

In most countries, including Indonesia, policy interventions for mitigation of GHG have been analysed in terms of their costs and potential for reducing GHG emission. However, non-GHG benefits could also emerge which may be more critical for the local communities than the direct GHG related benefits. For example, GHG emission reduction, local air pollutants such as particulates (PM_{10} and $PM_{2.5}$), Nitrogen Oxides (NO_x), Sulfur Oxide (SO_x), Surface Ozone (O_3) and Volatile Organic Compound (VOC) could also fall as the relation between GHG emission and local air pollution is assumed to be roughly linear. However, further studies need to be implemented to investigate this hypothesis.

Fuel pricing policy may also bring certain risks, such as more economic challenges for low-income households, as the increase in fuel price almost always contributes to inflation. Furthermore, the projected increase of Electric Vehicle (EV) due to high fuel cost may bring a different challenge for the environment related to battery use. Used battery recycling is a hazardous activity, and currently, Indonesia is not progressing well here. Many Used Lead Acid Batteries (ULAB) are being recycled by household industries with minimum or no safety and environmental consideration, thus increasing the risk of lead poisoning in the area. This may add up the health costs for treatment of health problems related to lead poisoning and possible loss of economic opportunities due to early deaths and permanent disabilities.

5 Estimating GHG Impact of Low-Cost Green Car (LCGC) Policy

5.1 LCGC policy in Indonesia

As explained in subchapter 2.2, the LCGC programme has been implemented since 2013. On one side, the LCGC promises significant impact on climate and environmental issues such as improvement of fuel efficiency and reduction of subsidised fuel consumption. On the other side, it may lead to conflicting results such as encouraging more people to buy and use private cars, increase in VKT, and the increasing concerns over air pollution and noise.

5.1.1 Overview steps

This assessment estimates GHG emission reduction from the transport-environment perspective of LCGC policy as an individual pricing policy for the national area. The ex-post approach is used for this policy by using the year of 2013 as the base year and 2017 as the assessment year. The calculation is based on the ICAT’s pricing guidance but modified to accommodate the specific policy intention of LCGC. The following steps are taken in the estimation: (1) identify the data availability and quality; (2) assess the total emission of LCGC on the road; (3) estimate the total emission of non-LCGC (if LCGC policy was not in place, and if purchase budget of total LCGC is allocated for non-LCGC); (4) evaluate the impact of overall LCGC policy at assessment year.

Primary and secondary data are collected and used for this calculation as described in Table 14. Unfortunately, LCGC data is not available in the government official statistics. However, this type of data can be gathered from retail automotive sales data which is provided by GAIKINDO. Moreover, disaggregation of sales data is needed for specific LCGC category. VKT and fuel consumption data are not commonly collected as a basic transport statistical data in Indonesia, even more so for the specific vehicle categories like LCGC. Therefore, an online survey was conducted to gather this type of data. Around 100 LCGC cases were collected from different cities in the country. Local EF data was provided by the Ministry of Energy and Mineral Resources (MEMR).

Table 14 Data for LCGC calculation

No	Data category	Type of data	Source
1	Primary	Number of LCGC	Retail sales data from GAIKINDO
2	Primary	EF for RON 92	Ministry of Energy and Mineral Resources
3	Secondary	VKT of LCGC	An online survey conducted by the ITL team
4	Secondary	Fuel consumption of LCGC per fuel type	An online survey conducted by the ITL team
5	Secondary	Elasticity for a purchase incentive	Transport pricing guideline
6	Primary	Price for LCGC	Retail sales data from GAIKINDO
7	Primary	Price of a similar car (Non-LCGC)	Retail sales data from GAIKINDO

5.1.2 Policy to be assessed

The LCGC policy consists of a purchase incentive for low GHG vehicles. In this case, LCGC incentive includes an exemption from luxury goods sales tax for cars with engine capacity up to 1,200 cc and with the minimum fuel consumption of 20 km/litre. Similar sales tax exemption also applies to diesel vehicles up to 1,500 cc with the same minimum fuel consumption as gasoline. This type of vehicle must also be assembled in Indonesia, and 84% of the components must be locally produced. Another LCGC category such as hybrid and EV cars is not yet included since the number of hybrid and EV available on the road is less significant. However, the forecast for EV potential emission reduction is assessed in the next chapter (Chapter 6).

5.2 Identifying impact: how pricing policies reduce GHG emission

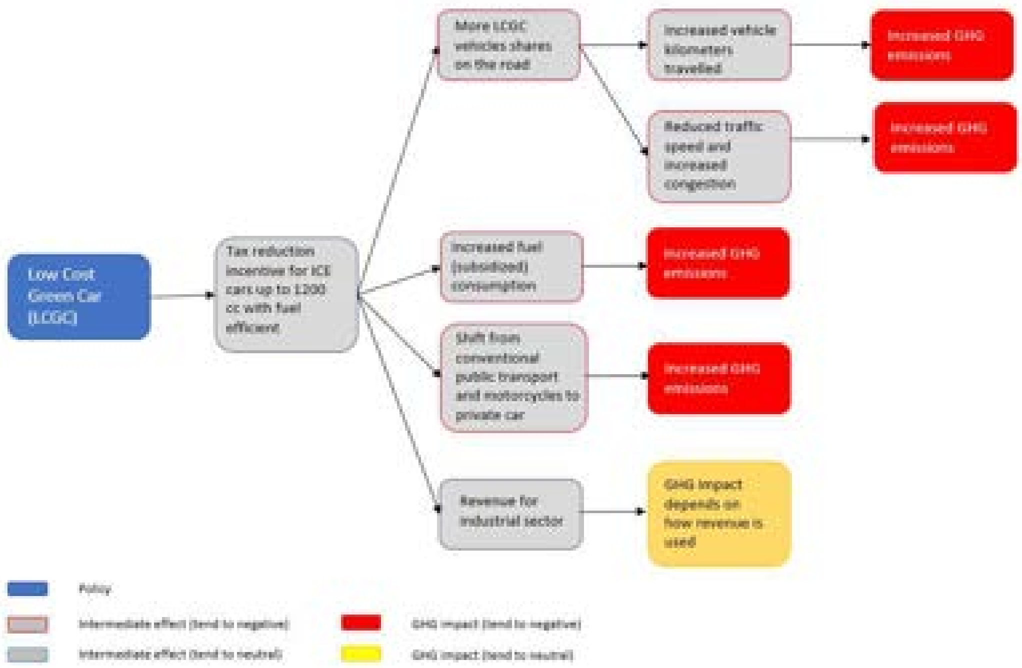


Figure 10 Causal chain for LCGC (modified from ICAT Guidance on Transport Pricing)

Figure 10 shows a causal chain that is modified from ICAT Guidance (Chapter 10.2). It is necessary to modify the casual chain in order to accommodate the specific policy and local condition in Indonesia.

The intermediate and direct impact

LCGC policy only brings significant impact to air pollution and GHG emission if the policy focuses on the introduction of the new technology vehicles such as hybrid and EV cars. From transport perspective, introduction of LCGC with conventional ICE (Internal Combustion Engine) using gasoline and smaller engine capacity may lead to increased sales, larger market share, mode shift from public transport to LCGC (if the public transport quality is poor), higher VKT, reduced traffic speed, more traffic in an urban area, burdened roads and parking infrastructure. From environment perspective, uncontrolled larger share of LCGC in urban areas may lead to more fuel consumption with impact on the local air pollution, GHG emission and increased noise level. Still, this remains unproven to date with the lack of studies on the impact of LCGC in the transport-environment sector.

In 2013, 19% of total LCGC was distributed in the capital city of Jakarta, whereas 28% of the sales were found in Jabodetabek (Jakarta greater area) (Sulistyo 2015). A double subsidy may be enjoyed by LCGC users since there is no guaranty (due to lack of control on-site) that LCGCs use non-subsidized fuel type. Double subsidy means (1) exemption from sales of luxury goods and (2) fuel price. Therefore, this LCGC policy has to be carefully monitored and reviewed over time.

The following information explains the GHG assessment boundary, assumptions and justification used to estimate the potential GHG reduction of the LCGC policy;

Boundaries:

- Fuel price (historic data from 2013 and 2017), the prices have been adjusted to inflation
- Adjusted elasticity for gasoline

Assumptions:

- Emission impact of LCGC policy is assessed only for the year of 2017:
  - LCGC number on the road
  - If the LCGC is not available, car buyers are assumed to buy a similar car to LGCC
- The lifespan of LCGC: vehicles existing in 2013 are assumed to be on the road during the assessment period
- The consumer price index uses the World Bank data for 2013 and 2017
- All LCGC vehicles use gasoline. Fuel share of gasoline (based on an online survey) is
  - Premium RON 88 for 13.25%
  - Pertamax RON 92 for 57.45%
  - Pertamax Plus, Pertamax Turbo, Pertamax Racing Fuel (RON 95+98+100) for 29.30%
- VKT is assumed constant over the years, based on a limited online survey
- LCGC is assumed to be used entirely in an urban area, supported by facts from an online survey
- Average fuel consumption of LCGC is taken based on a random LCGC user survey; the LCGC age (deterioration) factor is not considered

Justification (expert judgement):

- Due to the limited data and their limited quality, the methodology is adjusted based on the consultation with experts
- Fuel consumption of LCGC is adjusted according to the GFEI

5.3 Estimating GHG impact (ex-post)

According to GAIKINDO, the number of LCGC on the road sharply increased from 45,348 vehicles in 2013 to 850,373 in 2017, with an average LCGC growth rate of 108% over the time interval. In 2017, the LCGC represented 5.49% and 0.611% of the total passenger cars and total motor vehicles share. The LCGC population is expected to keep growing unless the government takes serious inventions.

The table below shows the parameters and steps used to estimate the impact of LCGC.

Table 15 Parameters and steps to estimate the emission impact of LCGC policy

No	Steps/Parameter	2013	2017
1	Assessing the emission of LCGC on the road		
	LCGC number	45,348	850,373
	Fuel consumption (litre/km)	0.063	0.063
	VKT (km/year)	10,899	10,899
	Fuel used (KL) - Gasoline RON 88 - Gasoline RON 92 - Gasoline RON 95 + 98 + 100	 4,159.3 18,027.1 9,194.6	 77,995.2 338,046.6 172,417.7
	EF CO2 (Ton/TJ) - Gasoline RON 88 - Gasoline RON 92 - Gasoline RON 95 - Gasoline RON 95 + 98 + 100	 72.97 72.60 69.30	 72.97 72.60 69.30
	Total Emission (t CO2 eq)	**86,756.7**	**1,626,875.9**
2	Assessing the emission of PC without LCGC measure (the same PC category)		
	Elasticity incentive purchase	-0.3	-0.3
	Average LCGC price (IDR)		115,166,667
	Average non LCGC price for a similar type (IDR)		197,500,000
	Number of non-LCGC		667,992
	Fuel consumption of non-LCGC (litre/km)		0.071
	VKT (km/year)		10,899
	Total Emission (t CO2 eq)		**1,431,303.4**
3	**The emission impact of LCGC policy**		**+13.66%**

As shown in Table 15, the impact on CO_2 emission from implementing the LCGC policy in 2017 is +13.66%. The emission impact value is generated by comparing the total emission of passenger cars with and without the intervention of LCGC measure in a similar engine category for 2017. The attempt to reduce environmental impact by introducing LCGC fails. Instead of reducing GHG emission, this policy increases CO_2 emission.

It would be good to estimate the LCGC emission impact from total passenger cars and motor vehicles separately. However, due to the limited data (passenger cars data is not available in the disaggregated form), this is not possible.

A sensitive factor is found during the assessment, namely the parameter of fuel consumption (litre/km). This factor has to be taken carefully because it influences a wider impact range (±15%) of the policy.

Table 16 Fuel consumption (litre/km) of non-LCGC and their emission impact

Fuel consumption (litre/km)	CO_2 emission impact	Remarks
0.071	+13.66%	GFEI (2017), adjusted to an urban area
0.073	+0.15%	GFEI (2017)
0.082	-1.34%	Online survey

A further investigation is needed to identify the factors that influence the rapid growth of LCGC. The current models allow many users of public transport and motor vehicles to switch to LCGC.

6 Estimating GHG Impact of Electric Vehicle (EV) Policy

As described in the introduction chapter, Electric Vehicle (EV) is included in this assessment. The decision to include EV is relevant to the whole EV development in Indonesia, as the President just signed the Presidential Regulation to accelerate EV production in mid-August 2019. For a relatively new policy that will affect transport, energy, industry and environment sectors, this assessment on EV could provide a better picture for the key decision-makers and to once again highlight the positive impact from the implementation of EV policy.

6.1 Describing the selected policies

Referring back to the section 2.3, the Presidential Regulation No.55/2019 on Electric Vehicle aims to boost the production and utilisation of EV in Indonesia and to make the country the centre for EV manufacturing within the ASEAN region.

6.1.1 **Overview steps**

The ex-ante approach is used to estimate the GHG emission impact which forecasts potential CO_2 emission reduction as the result of EV policy intervention. The vehicle data is mainly gathered from motor vehicles registration provided by the national statistical agency (BPS). Future projections of vehicle fleets are performed by using a moving average approach based on the vehicle data from the last five years. Once the projection is performed, the results are validated with vehicle production targets of the Ministry of Industry (MoI) (see Fig. 13, p.44). If the projection of vehicle follows vehicle industry targets, then the projection of vehicles is multiplied with energy consumption (Kwh/Km), to get the energy consumption figures for EV (disaggregated by type of vehicle). Then, the grid emission factors are included so that the emission estimation of each EV type can be calculated. In the end, the BaU emission is compared without EV policy intervention with the calculated GHG impact. Assumptions for energy consumption are explained in the following subchapter.

6.1.2 **Policy to be Assessed**

The policy intervention assessed is only limited to the EV. Other policies, such as energy and manufacturing process are not included in this assessment.

6.2 Identifying impact

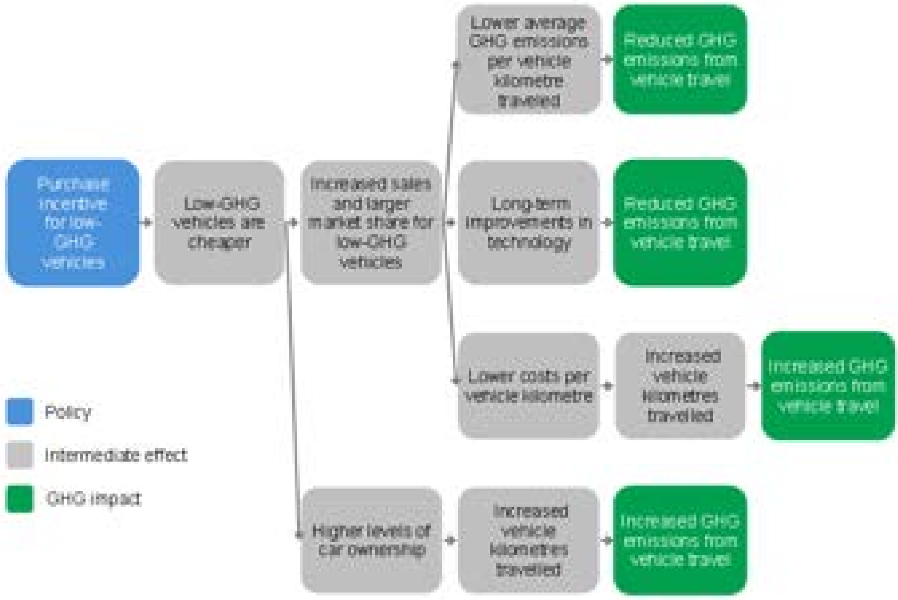


Figure 11 Causal chain for (adopted from ICAT Guidance on Transport Pricing)

For the GHG emission impact from EV policy, the causal chain is adapted from ICAT Guidance for purchase incentive for low GHG vehicle but with some adjustment such as the national target for EV implementation and energy mix electricity grid in Indonesia.

Intermediate impact

EV policy may bring an intermediate impact such as reduction of the local air pollutants from road transport such as particulates (PM_{10}, $PM_{2.5}$), CO, noise and vibration and other classical problems of conventional vehicles. However, there are some risks as well that need to be assessed continuously such as environmental problems associated with used EV battery and safety concerns regarding EV batteries (particularly lithium batteries) from spontaneous ignition or chemical spilling. As we know, the lifespan of EV batteries is generally guaranteed for eight years or 100,000 km. However, for reduced average speed as commonly found in most Indonesian cities, the battery lifespan may be reduced as well, especially because of the stop-and-go driving pattern due to traffic jam. Furthermore, the battery recycling industry in Indonesia has been highlighted due to the lack of health and environment protection considerations (Paddock 2016).

While EV policy could be considered to also contribute to the GHG emission reduction from fuel use, energy sources for EV are still primarily coal-fired power plants where Indonesian coal fleet operates at an efficiency well below its design value, needing additional effort to upgrade and retrofit these coal-fired power plants and closing the smallest, least efficient units simultaneously (Cornot-Gandolphe Marh 2017).

Direct Impact

Our calculation indicates that there is (-) 410% of reduction in GHG by 2035 if the EV policy is implemented as planned compared to the BaU scenario. Reduction in GHG is mainly caused by the shift in fuel use (from gasoline and diesel to electricity).

6.3 GHG assessment boundary

When designing and calculating the GHG impact from EV policy, the team agreed that the assessment boundary for this assessment on fuel pricing policy covers several areas as follows:

Boundaries:

- Number of EV vehicle is calculated based on the projection until the year 2035 (according to the MoI's vehicle production targets)
- A grid emission factor is an average calculation based on the data compiled from the (Joint Crediting Mechanism; Coordinating Ministry for Economic Affairs 2016)
- Vehicle population is projected based on the vehicle statistics using a moving average approach

Assumptions:

1. Emission Factor for CO_2:
   - Gasoline (RON 92, according to engine specification): 72,60 Ton/TJ
   - Electricity: 0,835 ton CO_2eq./MWh (average value of all grid emission factors in Indonesia)
2. Fuel used (Kwh/Km) EV:
   - Passenger car: 0,100 Kwh/km
   - Motorcycle : 0,050 Kwh/km (KumparanOTO 2017)
3. Fuel used (Litre/km) Non EV:
   - LCGC and vehicle bellow 1.200 cc of cylinder capacity: 0,063 Litre/km [3]
   - Motorcycle: 0,019 Litre/km (Cengkareng Motor)
4. Average VKT:
   Passenger car/motorcycle: approximately 30 km/day or 10.898,69 km/year[4]

Justification (expert judgement):

Grid Emission Factor: 0,42 ton CO2eq./MWh for power plant generated by coal and renewable energy (mix 50:50)

[3] Calculated from online survey by ITL team during the period of June – August 2019

[4] Calculated from online survey by ITL team during the period of June – August 2019

6.4 Estimating GHG impact (ex-ante)

Vehicle statistics for Indonesia used for vehicle projection are compiled from BPS with the vehicle production target until 2035 coming from the MoI. Projection of future GHG emission consists of BaU scenario and EV policy intervention.

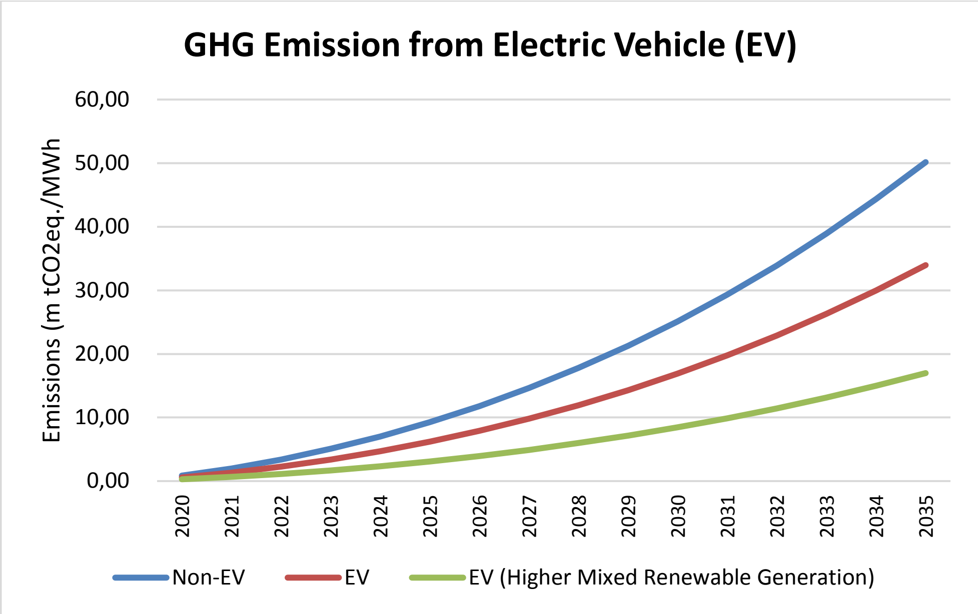
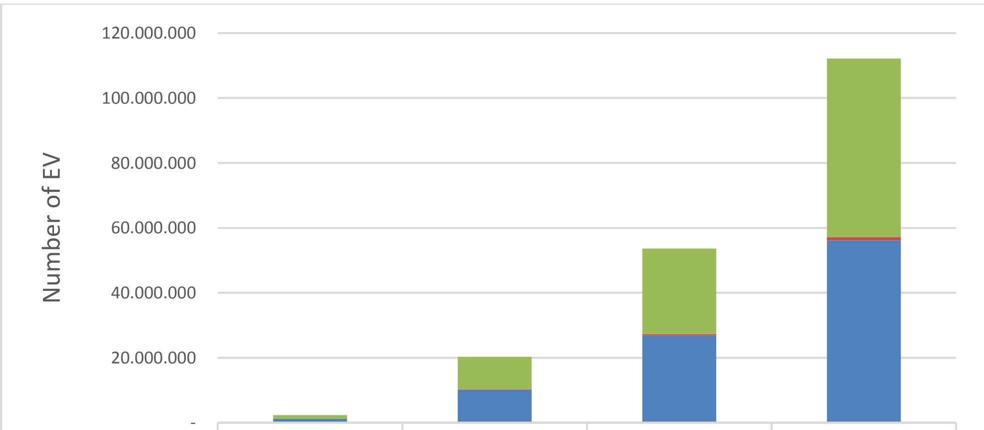


Figure 12 GHG emission with EV policy intervention until 2035



	2020	2025	2030	2035
Motorcycle	1.153.668	9.968.221	26.300.609	55.013.021
Passenger Car	21.934	191.931	512.989	1.087.253
Total	1.175.602	10.160.152	26.813.598	56.100.274

Figure 13 Number of Electric Vehicle projection until 2035 (source: ITL team)

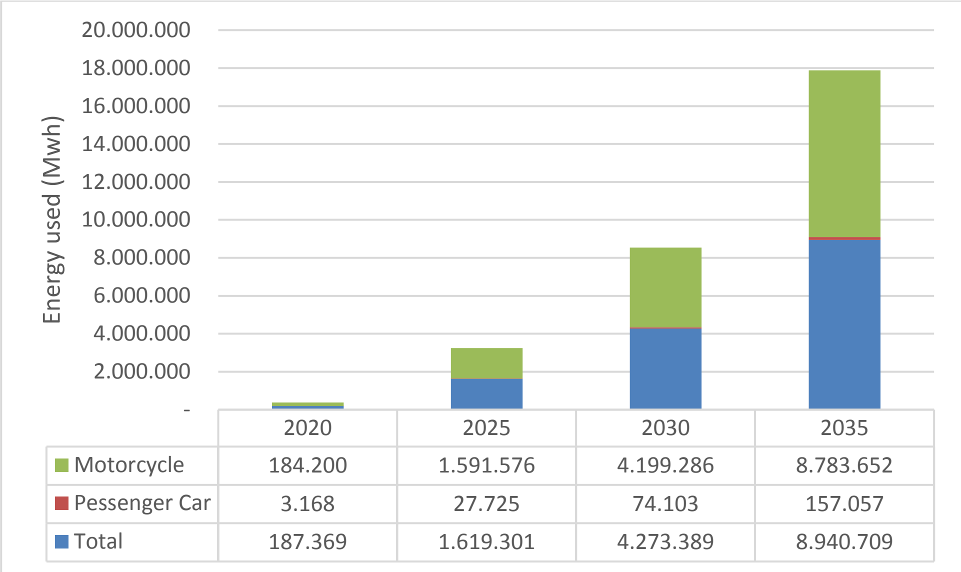


Figure 14 Fuel used for the Electric Vehicle until 2035 (Source: ITL team)

The policy impact of EV on GHG emission reduction is rather positive; however, the government must look for ways to improve the energy mix by increasing the share of renewable energy. Currently, within the energy mix, renewable energy represents only 8% of the total mix. Further incentives also need to be highlighted by the government as calculation here indicates that potential GHG impact could be up to -15.39%. Table 17 highlights the sensitivity analysis for EV policy both with current energy mix and 50% renewable projection.

Table 17 CO_2 emission impact of EV policies in 2035

Scenario	Business as Usual		Scenario Intervention				CO_2 Emission Impact
	Ron 92 Emission Factor (ton CO_2eq./TJ)	Emission (tCO_2eq)	Ron 92 Emission Factor (ton CO_2eq./TJ)	Grid Emission Factor (ton CO_2eq. /MWh)	Emission from Fossil Fuel (tCO_2eq)	Emission from Electric (tCO_2eq)	
(1) E-Car + E-Motorcycle	72,60	50.156.813,55	-	0,84	33.957.766,05		-32,30%
(2) E-Car	72,60	26.605.907,10	-	0,84	20.345.703,61		-23,53%
(3) E-Motorcycle	72,60	23.550.906,45	-	0,84	13.612.062,44		-42,20%
(4) All New Vehicles, 70% Fossil Fuel: 30% Electric	72,60	215.605.608,70	72,60	0,84	165.448.795,15	33.957.766,05	-7,51%
(5) All New Vehicles, 70% Fossil Fuel; 30% Electric, Power plant generated by coal and renewable energy (mix 50:50)	72,60	215.605.608,70	72,60	0,42	165.448.795,15	16.978.883,03	-15,39%

7 Overall GHG Impact of Selected Policies

This chapter summarises the overall GHG impact of selected policies. Three different policies, which are fuel pricing, LCGC and EV policies have been selected, assessed and explained in the previous chapters. The impact of CO_2 emission on fuel pricing and LCGC policies has been assessed by using ex-post approach while EV policy has been assessed using the ex-ante approach in accordance with the ICAT's guidance. Table 18 describes the results.

Table 18 Results of the policies assessment

Policies	Timeline	CO_2 emission impact	Remarks
Fuel pricing policies (Chapter 4)	Ex-post (2013 - 2016)	-4.50 %	Price change for gasoline +24% and diesel -2%. The base year is 2013 and the assessment year is 2016.
Low-Cost Green Car (LCGC) (Chapter 5)	Ex-post (2013 – 2017)	+13.66%	The base year is 2013 and the assessment year is 2017. The emission impact value is generated by comparing the total emission of passenger cars on the road with and without the intervention of LCGC measure in a similar engine category.
Electric Vehicle (Chapter 6)	Ex-ante	-15.39%	Projection year is 2035 with the assumption that all new vehicles consist of 70% fossil fuel, 30% EV, and power plant generated by coal and renewable energy (mix 50:50)

Based on selected policies assessed, fuel pricing and EV policies are proven as effective transport policies to combat the increase in CO_2 emission. LCGC policy is considered ineffective in reducing CO_2 emission; in fact, it increases emission by +13.66% in 2017 compared to 2013. It should be noted that the policies are assessed independently as a single measure. However, the emission impact of these three policies is connected. Despite rising fuel prices at the time LCGC was introduced, the tendency of consumers to buy these vehicles is still high. This fact is proven by LCGC car sales data published by GAIKINDO.

In ICAT's guidance, this assessment has been completed by using the Approach B for ex-ante and ex-post. However, in the methodology, some adjustments and assumptions were needed to accommodate the local condition of the case study and the availability and quality of the data. In general, better data acquisition would certainly be able to estimate the impact of different policies more closely. Still, the existing results can be used to inform and help the decision-makers to evaluate the impact of the policies in the transport-environment sector, especially CO_2 emission, since the government has been committed to further decarbonise the transport sector.

8 Conclusions and recommendations

This chapter provides the brief findings, conclusions and recommendations from the assessment covering all three policies as well as input collected from stakeholders' consultation and the focus group discussion held in September 2019.

Impact of fuel pricing and incentives for efficient and environmentally-friendly vehicles such as LCGC and EV are closely connected. However, the connection between the fuel price and EV is the strongest, since the maximum impact of GHG reduction in the shift from ICE to EV can only be achieved if the fuel is taxed and EV is given incentives. For LCGC, the assessment pointed out that although the policy intervention for LCGC aims to provide an incentive to more efficient and environmentally-friendly vehicles, without strict control in the field and higher fuel price, LCGC policy could not contribute to the effort to decarbonise the transport sector. Instead it is found to contribute to the increase of GHG overall emission from the transport sector.

8.1 Fuel Pricing

For gasoline, although there are already good signs of GHG reduction as a result from subsidy cuts on gasoline RON 88, the government should still implement more stringent effort to further decarbonize the transport sector in order to meet the emission reduction target of 11% (unconditionally) and 14% (with international support) within the energy sector by 2030 as pledged in Indonesia's NDC.

Another option to consider is that the government, especially MoT and MoI should start developing fuel economy roadmap for Indonesia, as cars generally do not undergo fuel economy tests. The average fuel economy values are usually based on studies or lab-testing under certain conditions or drive cycles that reflect the real traffic condition. There are already several guideline documents ready for calculating the average fuel economy, such as made available by the Global Fuel Economy Initiative (GFEI) (GFEI 2017) and recently by ASEAN in the form of ASEAN Fuel Economy Roadmap for the Transport Sector 2018 – 2025: with focus on Light-Duty Vehicles (ASEAN and GIZ 2019).

As of today, only voluntary labelling by manufacturers based on test data and type approval is available. The LCGC programme has an average fuel economy estimate of 20 km/litre or 128 gCO_2/km, however according to the MoI these values are to be replaced by Low Carbon Emission Vehicles (LCEV) The programme foresees a 50% LST reduction for advanced technology vehicles (e.g., hybrids and alternative fuels) and cars with fuel economy greater than 28 km/L.

To even accelerate the decarbonization target, the central government could apply various fiscal policies to new cars (car registration tax), which has been accommodated under the Government Regulation No.41/2013 (the basis for LCGC policy). However, this regulation may need revision in terms of the tax base where a tax rate should be based directly on CO_2 emission. As for the in-use vehicles, the Act, No 28/2009 on Local Government Taxes and Retributions, could be revised to drive the local government regulations for vehicle tax and fuel tax. Currently, Act No.28/2009 regarding Local Tax and Local Retribution (also known *as Pajak Daerah dan Retribusi Daerah* or PDRD) already regulates the amount of tax charged to every litre of fuel consumed by the public which is 5% of its price before tax (Ministry of Finance 2000). At least 70% of the revenue from the fuel tax should belong to the local government. DKI Jakarta is one of the provinces with the highest revenue from the fuel tax, and other provinces include West Java, East Java, Central Java and Banten. Recently, the Ministry of Internal Affairs instructed the provincial governments to reduce the fuel tax to control the price over the increasing global oil price (Tribunnews 2018). Therefore, an increase of fuel tax up to 10%, as this is the maximum amount of tax allowed by Act No.28/2009, may further reduce emission from fuel use.

For diesel, the assumption is that diesel is consumed mainly by high duty vehicles and buses, and therefore the decrease of diesel price as calculated in this chapter earlier is suspected to cause even higher diesel consumption (mainly by HDV) than if the price would have increased with inflation, which ultimately brings adverse impact to urban freight.

HDV has been estimated to account for up to 45% of road transport energy demand by APEC (APERC 2016), which underlines the need to reform the freight and logistics sub-sector to make it cleaner and more efficient. Furthermore, government regulations governing the efficiency standards of HDV are projected to begin in 2025 to reduce the energy consumption of trucks and buses by 12% in 2050. The improvement assumption in the efficiency of trucks and buses is in accordance with the recommendations of the IEA (BPPT 2019). Furthermore, recommendations could be focused on modal-shift of goods/freight transport from road to a railway or short sea shipping, as these two policies are supported by the MoT already, but this needs to be communicated to all stakeholders, and the series of public awareness campaigns need to be conducted.

Another approach to address issues related to emission from the use of diesel that the MoT may consider is to review the ministerial regulations or decrees, and re-confirm if all relevant regulations have been updated based on the latest Acts and Government Regulation, especially considering the recent developments on EURO 4 emission standard and Electric Vehicle policy framework. Outdated regulations relevant to the usage of diesel vehicles should be revised or updated, and this assessment report could be used as evidence.

Finally, if the subsidy for fuel, particularly diesel, is given to the public company for transportation such as PELNI (state-owned cruise company), the impact to overall GHG emission from diesel use will be reduced. For the future policies, Indonesia needs to keep a close look into the fuel price issue and the government should adjust the fuel price based on inflation rates and international oil price movement.

8.2 Low-Cost Green Car

The LCGC is successfully introduced on the road. This fact is confirmed due to the highest average growth of LCGC from 2013 to 2017. Unfortunately, this policy was introduced more in consideration of automotive industrial development than on environmental sustainability. This policy is not encouraging travellers to use the public transport system. This policy is also against the blueprint announced by the MoT to support public transport improvement. As a result, more cars are driving on the road, especially in urban areas which leads to the disadvantages of traffic jams, longer travel time and air pollution.

This policy is claimed as an excellent solution to shift the users to non-subsidised fuel. This is difficult to validate due to the lack of control of LCGC users at the fuel stations. Besides, there is no substantial penalty to the LCGC users if they use the subsidised fuel. Yearly fuel consumption of LCGC should be regularly estimated and monitored, to avoid the high consumption of subsidised fuel by vehicles which may burden the state budget in the future.

The LCGC programme is expected to further decarbonise the transport sector in order to meet the emission reduction target. Instead of reducing the emission, this policy contributed to CO_2 emission by +13.66% in 2017. This impact value was calculated by comparing the total emission of passenger cars with and without the intervention of LCGC measure in a similar engine category in 2017. Therefore, this policy needs to be monitored and reconsidered so that it becomes more multi-sectoral, targeting not only industrial benefits but also sustainability in the transport, environment, health and finance sectors.

The central government with support from the local government should accelerate the improvement of service quality and encourage more people to use public transport and non-motorized transport. Considering the impact of LCGC policy in terms of consumer and user perspective, it is enjoyed only by the upper-middle class while the lower class still struggles with the quality of public transport where improvements are slow. It would be more equitable if the government could implement carbon emission-based vehicle schemes (CEVS) for cars. In this case, only cars with low CO_2 emission will qualify for rebates, whereas cars with high CO_2 emission will get a surcharge.

At the same time, in order to educate and increase the environmental awareness of motor vehicle consumers, the government should introduce vehicle fuel economy labelling (VFEL). The so-called fuel efficiency label refers to information that is displayed about the vehicle in the showroom or online. In ASEAN, this policy has been implemented in Singapore, Thailand and Vietnam. A review and evaluation of VFEL implementation in different countries can be seen in more detail (APEC 2015). This policy is an inexpensive measure without further economic impact on the consumers but challenging from the perspective of lobbying the automotive industries.

8.3 Electric Vehicle

The calculation made throughout the assessment pointed out the benefit in terms of GHG impact from EV policy intervention. Therefore, it is recommended that the government should keep on promoting the use of EV. There has been a progressive movement on this issue (marked by the Presidential Decree on EV), and soon the Government Regulation concerning fiscal incentive for EV will also roll out.

Currently, the price of an EV is almost double compared to conventional internal combustion engine car, and if there are incentives for EV purchase, then the GHG impact from the policy should be even higher. Since the data showed that EV policy intervention brings a significant impact in terms of GHG emission, apart from the fiscal incentive, the government should consider developing standards for charging infrastructure, battery replacement options and environmentally friendly approaches for disposal, collection and recycling of used EV batteries. The government is also recommended to put more investment in research and innovation for EV to meet the local conditions in Indonesia (weather pattern, traffic pattern, and customer preference for MPV over sedan).

The government should ideally consider that EV policy could contribute to the overall effort to increase energy security in Indonesia, as it has been widely known that Indonesia's energy security is going to lower rank (Ministry of Industry 2017b). The electric motorcycle is still considered to play a limited role in policymaking, despite being the prevalent and space-efficient mode of transport particularly in very dense traffic such as in Indonesia's major cities (Jakarta, Surabaya, Medan, other cities).

The key message to highlight is that EV implementation helps reduce GHG emission. However, the challenge right now is to improve the energy mix with more share of renewable energy. At the moment, renewable energy represents only 8% of the total energy mix. Furthermore, the assessment made here pointed out that the target for EV policy can only be achieved if there are fiscal incentives given, such as subsidy for EV. Currently, the calculation made in this assessment does not consider the price of EV, and it could be assumed that the price for EVs will be different in the future. Finally, it is recommended that the government increases the amount of renewable or clean energy within the energy mix with at least 50% so that the maximum positive impact of EV policy in decarbonising the transport sector could be achieved.

8.4 Overall conclusions

The results further show that there has been a significant reduction in CO_2 emission from the existing fuel pricing 2013 – 2016 and future projection of EV policies until 2035. While LCGC policy is considered an ineffective policy to cut CO_2 emission due to its negative impact value, the results from this study indicate that they have not beneficial effect to reducing GHG emission and on the contrary lead to an increase in traffic and emissions. These findings can be used to inform and assist decision-makers in evaluating the impact of pricing policies.

Information collected in the present study illustrates the GHG emission impact of different transport policies and to what degree these policies reinforce each other and should be more co-ordinated between respective ministries and institutions so that the results can be maximized. Overall, the conclusions could help the Government of Indonesia (GoI) to achieve its Nationally Determined Contributions (NDC) targets, that were pledged back in 2016.

Based on this study and to further meet the ambitious target of national GHG emission reduction, the Government of Indonesia (GoI) is recommended to take these following actions:

- Strictly monitor and regularly evaluate the implementation of transport policies, especially transport pricing policies and its relevance to the achievement of NDC targets;
- Start developing and implementing a vehicle fuel economy roadmap as soon as possible;
- Review or reconsider the implementation of LCGC policy as one of the policies of the low-GHG emission vehicle;
- Speed up the transition process into the implementation of EV policy and further ensure a bigger share of renewable energy within the electricity systems;
- Improve fuel quality by tightening the emission standards, introducing a more stringent fuel tax and other fiscal instruments to decarbonise the transport sector and introduce the scrappage policy; and
- Improve public transport quality and support to non-motorized transport (NMT).

For further development and implementation of these recommendations, the existing institutional set up in Indonesia can be used, however the Government of Indonesia (GoI) is also encouraged to extend its cooperation and collaboration among key ministries responsible for emission from the transport sector such as the Ministry of Transportation (MoT), Ministry of Energy and Mineral Resources

(MEMR), Ministry of Industry (MoI), Ministry of Environment and Forestry (MoEF), and Ministry of Finance (MoF) (through relevant directorate responsible for taxation issues). It is also recommended to engage cooperation from external partners and international organisations to further achieve the emission reduction targets of Indonesia's NDC.

8.5 Need for further work in MRV of transport policies

On a technical level, the study identified gaps in the availability of data and tools to MRV ex-ante and ex-post impact of transport policies. Further work on the following aspects would clearly support Indonesia in its implementation of the NDC in the key sector of transport:

- Improved availability and access to transport sector activity data (fleet segmentation, mileage, trip distances etc.)
- Improved data on fuel consumption and emission factors for local vehicles, age distribution of vehicle fleet, distribution of traffic situations etc. that allows for determining robust emission factors (e.g. with tools based on the "Handbook Emission Factors for Road Transport" HBEFA). In particular with regard to the planned (partial) electrification of road transportation, the availability of comprehensive data is important for assessing potential emission reductions (besides transport sector activity data, also the availability of robust grid emission factors and projections of grid emission factors is important).
- Improved and locally derived values for elasticities as applied in the ICAT guidance. This would also include data on cross-elasticities so that the pricing guidance could be applied also to evaluate (MRV) the impact of pricing and other transport policies on the city level and investigating their effect on mode shifts (e.g. from private cars to public transport – see option "C" in the ICAT pricing guidance).
- Improved data availability will also allow to perform a more profound uncertainty assessment, which is important for assessing GHG impacts for the NDC and for future policy recommendations.

For all the three measures discussed in this report, it would be interesting to repeat or scale up the assessments within the next 1-3 years based on more comprehensive data. In particular for the ex-ante assessment of Electric Vehicle (EV), an ex-post assessment after the implementation of the measure would be interesting to verify the ex-ante estimations of GHG impact. Also, an analysis of key transport policy measures on a city level would help measuring (MRV) actions that support to the much-needed transition to sustainable transport systems in Indonesian cities.

9 Annex

Annex 1. Adjusted gasoline and diesel price elasticity

Label	Variable	Value	Unit	Remark/Note
A	Fuel price gasoline RON 88 (2013)	6,000	IDR/Litre	
	Fuel price gasoline RON 88 (2016)	6,675	IDR/Litre	
	Fuel price diesel (2013)	5,250	IDR/Litre	
	Fuel price diesel (2016)	5,275	IDR/Litre	
	CPI 2013 (Indonesia)	116.91		
	CPI 2016 (Indonesia)	136.966		
	Fuel price gasoline RON 88 in 2016 (adjusted to inflation)	5,697.6	IDR/Litre	
	Fuel price diesel in 2016 (adjusted to inflation)	4,502.6	IDR/Litre	
B	Per capita income (annual average)	47,957,000	IDR	
C	PPP conversion factor Indonesia for 2016 (assessment year)	4,085.95		
D	Gasoline RON 88 price adjusted to PPP (2016)	1.39	USD/Litre	
	Diesel price adjusted to PPP (2016)	1.10	USD/Litre	
E	Range of fuel price from default gasoline price elasticity (guidance table 8.2)	30		
	Range of fuel price from default diesel price elasticity (guidance table 8.2)	80		
	Range of income per capita from default gasoline price elasticity (guidance table 8.3)	12,000		
	Range of income per capita from default gasoline price elasticity (guidance table 8.3)	18,000		
	US CPI 2016 (assessment year)	110.067		
F	**Adjusted gasoline RON 88 price elasticity (>= 80)**	**-0.26**		
G	**Adjusted diesel price elasticity (>= 80)**	**-0.38**		

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