

Transportation Sector Emissions and Policy in Indonesia

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Abstract:- Indonesia is considered to be a consumer of high levels of petroleum use and emissions control in the transportation sector. Further action needs to be taken to reduce the carbon intensity generated from the transportation sector, in the next 10 years there will be a multiplied increase. With the increase in urbanization, climate change and the increasing utilization of fuel consumption in the transportation sector in Indonesia, it provides a warning and a good opportunity to address issues related to exhaust gases from combustion products in the transportation sector. The formation of a good policy to overcome this needs to start from the formation of policies that discuss the problem of pollutants and greenhouse gases that can provide positive aspects for increasing efficiency and economic incentives of the country. Decisive policies need to be taken to reduce pollutants and global warming that is happening now and continues to increase with the development of the times.

Keywords:- Indonesian Transportation, Emissions Policy, Global Warming.

I. INTRODUCTION

The determination of the threshold by the IMO (International Maritime Organization) for SO_x that can damage health than the environment and CO₂ certainly can reduce global warming (Eide et al., 2013; Lindstad and Sandaas 2014; Lindstad et al., 2015). Emission Control Establishment is one of the steps taken by IMO.

In this study, Emission Control shows that Indonesia is a significant contributor to greenhouse gas emissions, one of which is from the increased use of fossil fuels. Among fossil fuels, oil is currently the main contributor to emissions. In recent decades this has experienced a very rapid increase in the use of coal for the survival of power plants. Can be said if viewed from an economic perspective that from this transportation becomes a very large consumer consumes fuel. Including land transportation which has the highest position in the use of fuel. There are some who use gasoline, gas and diesel in transportation modes, each of which produces emissions. The period is increasingly developing in today's global technology and efficiency is needed, which also needs to be considered in the projected development of the transportation sector. There is a power plant with a source of rising emissions and several manufacturers that have implications that depend heavily on electrical energy in various processes. a very

large source occurs in the exhaust gases produced by industry using fossil fuels.

Good management is one way to build an economy. Good skills are needed in providing workers, producing goods and consumers. Globally, transportation technology mainly relies on petroleum fuels (95 percent). At the time of 2004 in the world order, 6.3 Gton of CO₂ emissions (around 12 percent of the total) was the result of emissions generated from the transportation sector's exhaust gases. 74 percent is the biggest contributor to sea and land transportation. the low emissions from the transportation sector in Indonesia at a nominal 78 Mton of CO₂ emissions in 2004, only accounted for 23 percent of the total total. However, transportation currently has a larger share of transportation sector emissions, which constitutes 88 percent. future emissions will be greater because global transportation demand increases by 2 percent per year. In the next 10 years, Indonesia will experience an increase in emissions resulting from the transportation sector. Transportation that can produce emissions faster is that of freight transportation, Indonesia like other developing countries (Kahn Ribeiro, et al, 2007).

Subsidies provided by the government can hamper the improvement of the efficiency of all transportation over time. Fuel in Indonesia has become the main pillar of the growing transportation needs and the increasing number of operating fleets.

With increasing attention to issues of increasing emissions and the potential for funding from carbon markets and Other policies, looking at opportunities in the current conditions is an excellent time to plan comprehensively to deal with a problem of emissions resulting from the transportation sector. In terms of cost and health, it is a huge benefit if mapping can be done which focuses on the regulation of transportation standards and provides good standards for fuel quality, because the largest source of emissions is generated from vehicles. As a preliminary study and accompanied by a comprehensive study to provide an evaluation of the costs and opinion of transportation that is beneficial for Indonesia. The Indonesian government, which is directed at the Ministry of Transportation and the Ministry of Environment and the Agency for the Assessment and Application of Technology (BPPT), participates in handling emissions by preparing several studies on climate mitigation and identifying various problems and some input opportunities that have important characteristics in sector growth transportation

and economy (BPPT and KLH 2009). In another report, there is a detailed explanation of the current cycle of transportation as a whole in Indonesia (Kahn Ribeiro et al., 2007; BPPT and KLH, 2009). Focus identification and prioritized policies are the subject of this analysis which will provide completeness and encourage the government to take action on fiscal transportation. Technology requirements are the focus of this study and are prepared to seize opportunities in the transportation sector (BPPT and KLH, 2009).

A. Indonesian Transportation Sector

Explanation in this section explains several emission sources in detail based on the type of transportation mode,

fuel, number and type of various existing vehicles. GHG emission increases reached 6 percent per year, slightly faster than GDP (Ministry of Finance and World Bank, 2008). The main contributor at this time is oil, over the last few decades although fossil fuels have increased less than the emissions generated from coal users have accelerated. 75 million tons of CO₂ produced from aviation fuel, gasoline and diesel. These three types of fuel are ranked highest in their use (KLH, 2008). 91 percent is generated from the total, namely gasoline and diesel fuel. Focused on these 3 types of fuels which are assumed to be the main sources of mobility fuels. CNG, Biodiesel has been recognized from various fuels that will follow the future and renewable technology.

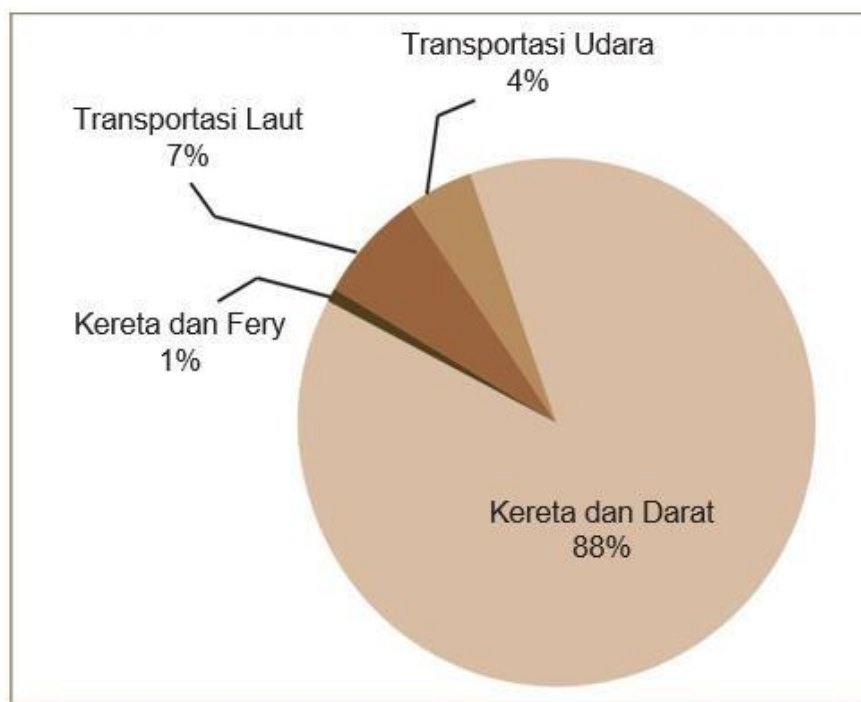


Fig 1:- Share of primary energy use in the Indonesian transportation sector (2005)
Source: Kajian Kebutuhan Teknologi Indonesia (BPPT and KLH, 2009).

There are only a few modes of transportation that utilize a portion of fuel. It can be seen in Figure 1. the level of consumption of each mode of transportation, approximately 88 percent of the total transportation sector land transportation is superior in primary energy use. Sea, air, rail and ferry transportation only consume a small amount of primary energy: 7 percent, 4 percent and 1 percent, respectively (BPPT and KLH, 2009).

So, based on the results of an analysis that focuses on the current portfolio of emissions and vehicle sources in Indonesia, steps to deal with emissions from the transportation sector must focus on large stocks and increasing use of environmentally friendly fuels. Reason arises for the sake of improving the level of fuel quality which will affect the acceleration process of building a policy foundation regarding transportation programs that include large emission sources comprehensively.

B. Indonesia Transportation Policy Framework

The ongoing consideration of the Government's energy policy, which is related to finances with a high risk of maintaining the impact of domestic prices that tend to be less volatile at the global level, makes spending increases in billions of dollars a year and inequality if current prices are also at high oil prices. /rising price. In 2008, almost US \$ 15 billion was only for transportation fuel subsidies with a value of 47 percent of the total. accounting for around 13 percent of total expenditure in the country of Indonesia (Abdurahman, 2008; World Bank, 2007).

Despite the decline in world oil prices in early 2009, it is predicted that, when market prices return to normal, there will be an increase in fuel prices and a reduction in the state budget.

Sustainability also means compatibility between social and environment. In Indonesia's development for sustainable growth must be able to take into account all the

risks of minerals and fossil fuels (Bappenas 2007a). The relatively low per capita energy consumption and high energy intensity shows that in Indonesia the level of welfare is still low and the use of energy is inefficient. There is a negative impact of the over-dependence on natural resources including fossil fuel energy resources, environmental damage and damage to quality of life, and the disruption of several Indonesians who have long been involved in this (Bappenas, 2007a).

Following below are structural frameworks for the survey of several factors that affect emissions. The types of actions (upper lines) are explained, which include fuel

quality, changes in capital, maintenance of transportation equipment and fuel quality. of actions that can be seen and taken in each category that have the effect of potentially reducing harmful pollution emissions (for example; sulfates and particulates). As for some actions that do not have other potential that can affect greenhouse gases, do not have a high level of risk / not too dangerous for the local area. Seeing the development of Indonesia which is also good in its construction, visible progress is explained in the position of the yellow box, which shows the focus area of this discussion.

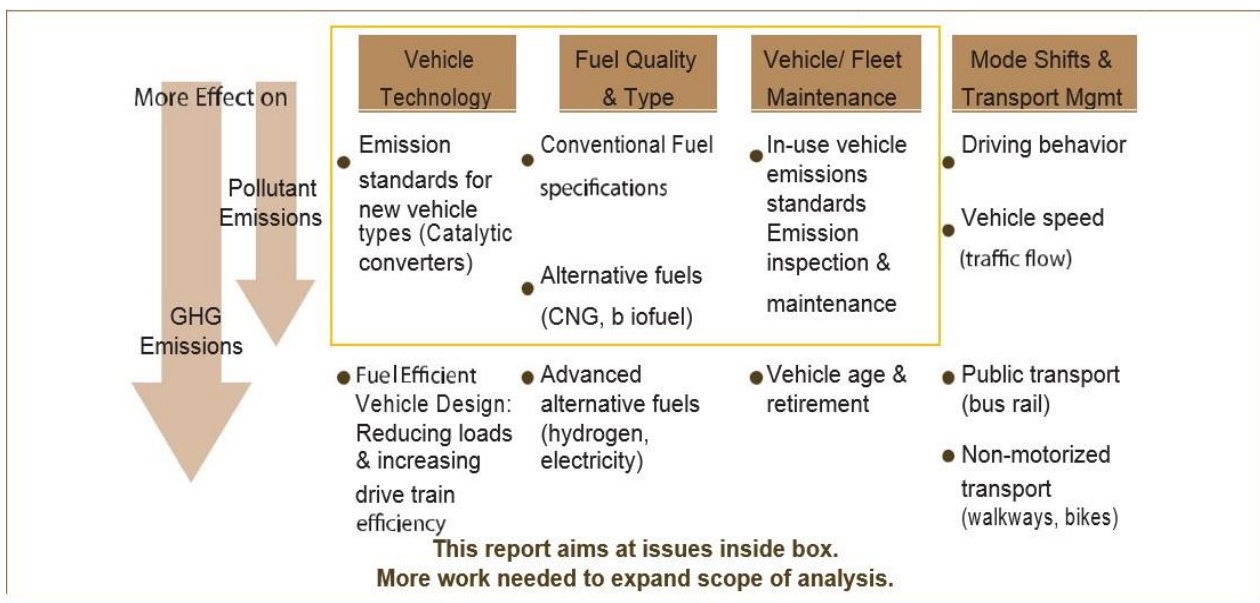


Fig 2:- Factors Affecting Emissions in the Transportation Sector.

Source: SwissContact, 2009. Analisis Kualitas Bahan Bakar dan Isu Polusi Udara di Sektor Angkutan Jalan. kertas masukan teknis untuk rendah pilihan karbon studi Bank Dunia. Dengan modifikasi dari Kahn Ribeiro, et al, 2007.

In the framework within which transportation policy is explained, it has the effect of raising standards and reducing emissions over time as technology develops and can provide more stringent emissions control changes. The rhyme about the issue of Indonesia's greenhouse gases is starting little by little to begin the application of fuel quality and vehicle standards. however, Indonesia's weakness is lacking in this level of emphasis on standardization from less than a long time ago which other countries have applied it openly and more decisively. For problems

regarding fuel and emissions below is a more detailed explanation. Illustrated below is about the elements that are important spearheads of the framework, aiming at actions implementing elements in Indonesia and those that include the value of opportunities, constraints, and magnifiers of interest that are heavily involved when carrying out policy renovations. The following table describes guidelines for an article explaining some guidelines for reducing emissions and greenhouse gases.

Strategi	Tindakan	Pertimbangan Biaya-Manfaat	Peluang/Rintangan	Pemangku Kepentingan Utama
1. Perbaikan standar emisi (Teknologi Kendaraan)	Perbaiki dan pelaksanaan standar emisi terhadap kendaraan baru dan impor	<ul style="list-style-type: none"> - Tidak ada biaya tambahan langsung bagi pemerintah - Biaya diteruskan kepada pemilik kendaraan - Berkurangnya polusi udara dan emisi CO₂ karena kendaraan yang masuk ke pasaran lebih bersih 	<ul style="list-style-type: none"> - Sebagian besar negara Asia telah mengadopsi standar emisi > Euro 2 - Dapat mendorong pembelian kendaraan yang lebih bersih dengan memberikan pengurangan pajak kepada pembeli kendaraan - Kendaraan baru dapat diuji di negara asal 	Lembaga pemerintah pusat: Kemenkeu, Kementerian Energi dan Sumber Daya Mineral, KLH, Kementerian Perindustrian, Kementerian Perhubungan Industri otomotif dan industri bahan bakar
	Perbaiki dan pelaksanaan standar emisi terhadap kendaraan yang sedang digunakan	<ul style="list-style-type: none"> - Biaya diteruskan kepada pemilik kendaraan - Berkurangnya emisi dari polusi kendaraan (dengan inspeksi rutin) 	<ul style="list-style-type: none"> - Juga perlu diperketat karena standar kendaraan baru ditingkatkan - Menjadi dasar inspeksi emisi rutin 	Pemda Pemilik kendaraan Sektor swasta
2. Peningkatan inspeksi dan pemeliharaan	Pelaksanaan inspeksi emisi rutin sebagai bagian dari program kelaikan jalan	<ul style="list-style-type: none"> - Biaya diteruskan kepada pemilik kendaraan - Berkurangnya emisi dari polusi kendaraan hanya jika dilaksanakan secara efektif. 	<ul style="list-style-type: none"> - Memerlukan mekanisme pelaksanaan - Jaminan kualitas dan audit yang diperlukan untuk mencegah korupsi - Manfaat tambahan dalam hal keamanan dan polutan konvensional 	Pemda Pemilik kendaraan Sektor swasta
3. Bahan bakar yang lebih bersih, Peningkatan standar dan kualitas bahan bakar	Peningkatan standar dan kualitas bahan bakar	<ul style="list-style-type: none"> - Investasi mahal tetapi manfaatnya melebihi biaya - Berkurangnya polusi udara secara signifikan - Memungkinkan teknologi kendaraan hemat bahan bakar masuk ke pasar 	<ul style="list-style-type: none"> - Prasyarat penggunaan alat kontrol emisi dan pelaksanaan standar kendaraan baru - Harmonisasi standar bahan bakar perlu dibarengi dengan harmonisasi standar emisi - Kendaraan solar & bahan bakar berkualitas rendah (berkadar sulfur tinggi) memerlukan perhatian 	Lembaga pemerintah pusat: Kemenkeu, Kementerian Energi dan Sumber Daya Mineral, KLH Industri bahan bakar
	Penggunaan bahan bakar alternatif (CNG dan bahan bakar nabati/biofuel)	<ul style="list-style-type: none"> - Biaya tinggi (khususnya untuk biofuel) - Mungkin membutuhkan insentif ekonomi untuk mendorong penggunaannya - Berkurangnya polusi udara dan emisi CO₂ 	<ul style="list-style-type: none"> - Dapat menggantikan solar untuk mengurangi emisi GRK & polutan konvensional - CNG lebih diutamakan daripada biofuel - Standar yang lebih ketat untuk kendaraan solar telah berjalan di Eropa (daripada melarang kendaraan solar) 	Lembaga pemerintah pusat: Kemenkeu, Kementerian Energi dan Sumber Daya Mineral, KLH, Kementerian Perhubungan, Kementerian Perindustrian Industri bahan bakar
4. Penyempurnaan perencanaan transportasi dan pengelolaan kebutuhan lalu lintas	Tata guna lahan dan perencanaan transportasi	<ul style="list-style-type: none"> - Dibutuhkan insentif pajak, subsidi, kebijakan penetapan harga - Berkurangnya polusi udara konvensional dan emisi CO₂ - Manfaat tambahan dalam pengelolaan transportasi perkotaan, lingkungan perkotaan 	<ul style="list-style-type: none"> - Dibutuhkan pendekatan terpadu - Kemauan politik yang signifikan dan kapasitas teknis yang dibutuhkan - Integrasi perencanaan transportasi dan perencanaan kualitas udara - Kegiatan multi sektoral yang kompleks - Manfaat yang tinggi dari segi GRK dan polutan konvensional 	Perencana dan pembuat keputusan nasional
	Pengelolaan kebutuhan perjalanan			Pemerintah daerah
	Opsi transportasi massal publik			
	Transportasi non kendaraan bermotor			

Table 1:- Strategy Summary and Evaluation Criteria for Options to Improve Transportation Source: Kemenkeu = Kementerian Keuangan
 KLH = Kementerian Negara Lingkungan Hidup

II. NEW VEHICLE TECHNOLOGY

Other countries have adopted Euro emission standards, unlike Indonesia which has lagged behind but has not applied these standards like other countries. In the Asian region, there are no provisions regarding vehicle emission standards, and some of these Asian countries are still arguably in a new stage in the implementation of this program with some European requirements. It is required that new vehicles in Indonesia gradually apply

standardization to new vehicles by meeting the Euro 2 standard (Minister of Environment Decree No. 141 of 2003). The enactment of this standard began January 1, 2017 at the time after the elimination of lead-based gasoline throughout Indonesia. Euro 2 standard in which explains that gasoline is free of additives which gasoline contains lead which can damage the catalytic converter, 90 percent results from the exhaust filter which can reduce exhaust gas emissions.

Vehicle sales in Indonesia in 2006 amounted to 24 percent of vehicles that met Euro 2 standards. The passage of time in 2007 all vehicles without exception must meet Euro 2 standards in accordance with the decision of the Indonesian Automotive Industry Association. Regulations imposed on diesel are not more than 500 ppm when referring to the Euro 2 standard (see table 2). Whereas gasoline vehicles have the same sulfur threshold. The high

sulfur in combustion can have an impact on catalytic converters found in solar and gasoline vehicles. Low sulfur below 50 ppm will have an effective impact on the catalytic converter. But in Indonesia for diesel engines themselves still have sulfur levels of more than 500 ppm, whereas for Indonesia new diesel vehicles do not use emissions control devices.

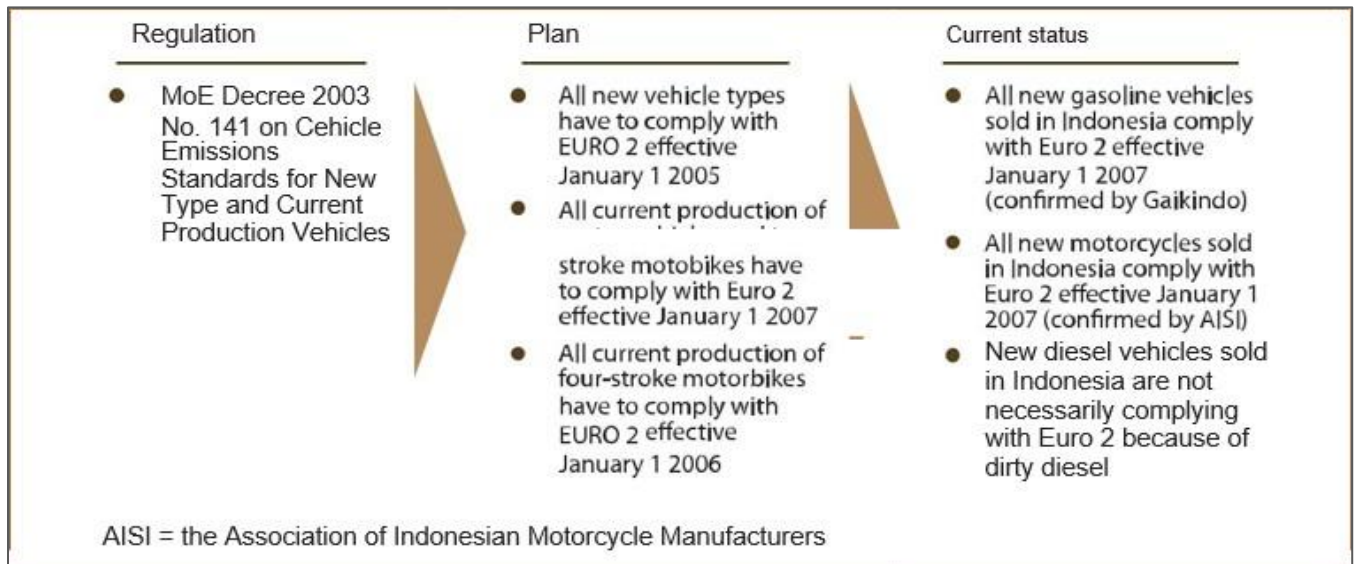


Fig 3:- Status of Application of Emission Standards for New Vehicles

Standar	Bensin		Solar
	Sulfur (ppm)	Timbal	Sulfur (ppm)
Euro 1	0	NA	Na
Euro 2	0	500	500
Euro 3	0	150	350
Euro 4	0	50 ^a	50 ^a
Euro 5 ^b	NA	NA	50 ^a

ppm= bagian per juta, NA = belum berlaku
 a. 10 ppm adalah pada tahap terakhir adopsi oleh Uni Eropa b. Khusus truk solar bermuatan berat Sumber: ADB, 2006

Teknologi Pengendalian Emisi | Sepeda Motor

Untuk menanggulangi masalah pemilik sepeda motor yang memodifikasi knalpot dengan mencabut konverter, pihak pabrik dapat merancang sepeda motor sedemikian rupa sehingga knalpot tidak dapat dimodifikasi. Opsi ini jauh lebih hemat biaya daripada inspeksi rutin terhadap setiap sepeda motor di pusat inspeksi tetap.

Table 2:- European standards for gasoline and diesel according to vehicle emission standards driven by gasoline and diesel.

First China, Singapore and India have started to apply Euro 2 than Indonesia (table 3). in 2008 in China already implemented another Euro 3 as well as its next-door neighbor Singapore which implemented Euro 4 since 2009. India plans to switch to Euro 3 nationally and to Euro 4 for major cities in 2009.

The application of Euro 4 in European countries has been running longer than Indonesia, and set the sulfur content level with a maximum limit in fuel that is 50 ppm, and for now the condition is only 10 ppm.

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Indonesia								Euro 2								
Malaysia	Euro 1				Euro 2				Euro 4							
Singapore ^a	Euro 2															
Singapore ^b	Euro 2						Euro 4									
Thailand	Euro 2			Euro 3									Euro 4			
Vietnam								Euro 2								
India ^c	Euro 1					Euro 2					Euro 3					
India ^d	Euro 2					Euro 3					Euro 1					
china ^a	Euro 1			Euro 2			Euro 3			Euro 4						
china ^e	Euro 1		Euro 2			Euro 3			Euro 1 (Beijing only)							

Table 3:- Application of Euro emission standards for new vehicles in Asian countries.

Source: bensin, b. Solar, c. negeri Seluruh, d. Kota gede, e. Beijing, Guangzhou, Shanghai Sumber: Inisiatif Udara Bersih 2008.

III. QUALITY OF FUEL

Reducing the sulfur content in diesel fuel allows transportation to meet Euro 2 standards - reducing emissions by up to 90 percent - and reducing negative health impacts. This requires encouragement from the government to help Indonesian oil refineries produce low sulfur fuels. For sulfur content in Indonesia does not have strict specifications even though in this country for fuel does not contain much lead. Pollutants are very dangerous for human survival because sulfur is oxidized to sulfur dioxide (SO₂) and mixed with sulfate which makes it particulate. The highest risk of the impact of these pollutants is an increased risk of cancer and problems in the respiratory organs (McGranahan and Murray, 2003). For the time being, in Indonesia most of the oil refineries have not been able to produce fuels with low sulfur content, and the need for government incentives to support in order to be able to make it happen. From increasing the quality and efficiency of fuel will provide significant additional benefits. In various developing countries in addition to GHG emissions, the combustion results of transportation vehicles make two items that impact on air pollution (Colville et al, 2001). Contribution of pollutants in Indonesia from the transportation sector amounts to 45-65 percent of the total PM10, which is a very dangerous pollutant for human health (Bappenas, 2006). The status of air pollution in Indonesia is now very far from the word air quality standards set by the World Health Organization (WHO).

With the breakdown of the following costs around US \$ 500 million per year in Jakarta US \$ 100 million per year in Surabaya (Bappenas, 2006). The increase in air pollutants generated from vehicles greatly affects the economic expenditure of each year, namely the health costs that can arise due to the impact of these pollutants.

IV. ALTERNATIVE FUELS

A very mature consideration of alternative fuels for the realization of a reduction in greenhouse gas emissions and a scope that includes the extent to the survival and economic growth of agriculture, forest products, and state security which also includes services that require fuel. 60 percent of

the country's oil output is earmarked for transportation, in the near future imported commodities rise more expensive due to consumer demand. Do not forget also the use of fuel subsidies provided by the government is also used for the transportation sector. The need for encouragement to switch to using fiscal incentives and renewable alternatives is nothing but a step to realize carbon reduction in the transportation sector in Indonesia.

Biofuel. "Biofuel" (biofuel) is an alternative fuel class that includes various fuels obtained from vegetable oil extraction or sugar fermentation. At present the products that are widely used are Ethanol and Biodiesel, which are combined between ethanol combined with gasoline and for biodiesel intended as a diesel mixture, with the development of ongoing research. In Brazil, the raw material for ethanol is sugarcane, while ethanol in the United States uses more corn as its main raw material. Another difference if in the Asian region that uses palm oil and *Jatropha curcas* is used as biodiesel raw material, because palm oil is the cheapest raw material among others and is available so that it can be used to produce biodiesel directly. If the use of biodiesel with a content of 20 percent can be used on engines that have not been changed and can be said to have not been modified, however if using fuels that are sourced from petroleum, the costs can be swollen to more than double the use of mixed fuels. Biodiesel has been in great demand as a source of renewable fuels. However, the results of recent research identify the risks of important weaknesses - the costs of emissions when used and competition with food needs - which need to be carefully assessed. The benefits of GHG emissions from the use of biofuels are still widely debated because of the complexity of various life-age analyzes to produce this fuel. How to process oil palm trees is one thing that needs to be considered. land management is very important between the needs of oil palm plantations which often turn natural forests into fields that can affect peatlands, because management of land management is very important that is useful for releasing and storing carbon, loss of benefits from GHG from sources such as this that affect spatial planning (Kahn Ribeiro et al, 2007). Competition occurs when raw materials are needed between the use of fuel as what is only used as food such as corn, which often arises trade competition and food production. the high price

of biofuels needs to be analyzed further because commercially they should have a fairly high price or can be subsidized by the government.

Other fuels can be used in Indonesia, namely CNG or Solid Gas as an alternative. It is unfortunate for CNG suppliers in Indonesia to be minimal and poorly coordinated between CNG users and providers. Poor service and the lack of charging terminals which is one of the factors of CNG is not acceptable in Indonesia. It can also be concluded that CNG can not be played for in terms of relatively small profits due to low prices, which ultimately producers were reluctant to produce further. With a low price tariff CNG does not provide much profit for the manufacturer, the factor is that the supply distance between terminals tends to be far and sparse, looking at the maintenance time of the CNG cylinder itself. LNG can actually also be another alternative to CNG but the costs used during processing are very high, so that it is more burdensome to the producers if using LNG as a relevant alternative fuel. But what happens to vehicles that are now equipped with exhaust gas treatment equipment, the range of non-CO₂ emissions from combustion of gasoline engines is almost similar to the CNG combustion, it needs to be taken into account that weakens CNG as a low-pollutant alternative fuel, CNG still favored because produces less CO₂ (Kahn Ribeiro, et al. 2007).

The use of hybrid-electric vehicles with alternative fuels (electricity) currently can only be a few modes of use which basically only improve the efficiency of transportation with gasoline fuel. Electric transportation tends to use two power, fuel and electricity. From these two energies we can get engine efficiency. With a source of electricity in low-speed vehicles and engine power is used when the engine is needed for rough movements and nothing else requires high flexibility on engine power. On vehicles that require high speed, fuel can be used. Hybrid cars that can adjust to the state of needs that depend on the speed needed and various road conditions. More than a quarter less hybrid vehicles are economical than when compared to other conventional vehicles that are fueled, and less cut pollutants produced from hybrid vehicles.

V. CONCLUSIONS

Given Indonesia's relatively low level of income, lack of capital, tend to be weak rules that control exhaust emissions, increasing emissions on the road, it does not take long if the area will be a source of pollutants if there is no strict policy. A simple policy is needed to reduce the growth of existing pollutants, with rules that propose common interests economically and health. In particular, the country of Indonesia, which is a net oil importer, showed an increase in fuel subsidies and an increase in the price of crude oil in the world. Making it a unique fact that needs to be considered for greenhouse gas policies that provide increased savings on fuels used in transportation.

➤ Main short:

1. Reducing sulfur levels and improving quality and consistency in diesel fuel.
2. Overall application of vehicles according to the Euro standard from Euro 2 standards to Euro 4.
3. Make it easier for public vehicles to use CNG by eliminating various obstacles, including charging terminal issues, prices, distribution, and safety regulations.
4. The policy in determining vehicle tax is in accordance with the level of emissions produced or the level of fuel consumption.
5. The policy of determining the label for CO₂ emissions on vehicles sold in Indonesia, so that in the end consumers can make mature decisions for purchases accompanied by very complete information.
6. Expand investment in refining capacity and regulate current subsidy policies. Providing quality and fuel capacity according to domestic needs.

Providing integrated standard regulations covering vehicle standards and emissions produced, effectively in the presence like this will prosper the people of Indonesia

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