SIMULATING INDONESIAN FUEL SUBSIDY REFORM:
A SOCIAL ACCOUNTING MATRIX (SAM) ANALYSIS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

FAHMAN FATHURRAHMAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
EARTH SYSTEM SCIENCE

SEPTEMBER 2014

Approval of the thesis:

**SIMULATING INDONESIAN FUEL SUBSIDY REFORM:
A SOCIAL ACCOUNTING MATRIX (SAM) ANALYSIS**

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ABSTRACT

SIMULATING INDONESIAN FUEL SUBSIDY REFORM: A SOCIAL ACCOUNTING MATRIX (SAM) ANALYSIS

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September 2014, 94 Pages

The debate over phasing out fuel subsidies in Indonesia is quite intense. One thing is clear: fuel subsidy needs to be removed due to a pressure to government budget and misallocation of subsidy. Based on National Social Economic Survey (SUSENAS 2008), the richest 40% household group gets 70% of fuel subsidies while the poorest 40% benefitted only from 15%. In addition, in 2012, fuel subsidies accounted for about 1.7% of GDP and this share is expected to grow as oil price and consumptions increase. However, phasing out the fuel subsidy could potentially result in adverse effects in the economy. The main objective of this study is to estimate the impacts of fuel subsidy in terms of sustainable development indicators from the economic, social, and environmental perspective. Another objective is to propose the policy options for the subsidy reform. Social Accounting Matrix (SAM) model is being used to simulate the impact analysis. The simulation results show that reallocation of fuel subsidy to other energy-related sector (i.e. Gas sector) would positively improve the economy. However, the policy would be paid off by increasing energy demand and CO_2 emissions. On the other hand, the reallocation of the subsidy directly to the poorest household groups will decrease the overall economic development, but positively impacts social development. Nevertheless, this option will also increase CO_2 emissions, but lowering down energy demand. Our results show that Indonesian government should consider a reallocation scheme of the fuel subsidy by taking economic, social, and environmental impacts into account.

Keywords: social accounting matrix, economic modelling, oil, energy policy, subsidy, sustainable development

ÖZ

ENDONEZYA'NIN AKARYAKIT TEŞVİK REFORMU SİMÜLASYONU: BİR SOSYAL HESAP MATRİSİ ANALİZİ

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Endonezya'da akaryakıt teşviklerinin zaman içinde kaldırılması oldukça yoğun tartışmalara konu olmaktadır. Hükümet bütçesine olan baskı ve teşviklerin doğru dağıtılmaması nedeniyle akaryakıt teşviklerinin kaldırılması gerekliliği ortadadır. Ulusal Sosyal Ekonomik Araştırma'sına (SUSENAS 2008) göre hane halkının en zengin %40'lık kesimi akaryakıt teşviklerinin %70'ini alırken, en fakir %40 sadece %15'inden faydalanmaktadır. Buna ek olarak, 2012 yılında, akaryakıt teşvikleri GSYİH'nın %1.7'sine denk gelmekte ve petrol fiyatıyla toplam tüketimdeki artış ile bu oranın artması beklenmektedir. Yine de bu teşviklerin zaman içinde kaldırılmasıekonomi üzerinde olumsuz etkiler oluşturabilir. Bu çalışmanın temel amacı akaryakıt teşviklerinin sürdürülebilir kalkınma indikatörlerine ekonomik, sosyal ve çevresel açıdan etkilerini tahmin etmektir. Çalışmanın bir başka hedefi de teşvik reformu için politika opsiyonları sunmaktır. Etki analizini simüle etmek için Sosyal Hesap Matrisi (SHM) modeli kullanılmıştır. Sonuçlara göre akaryakıt teşvikini başka bir enerji sektörüne (doğal gaz sektörü) aktarmak ekonomi için olumlu sonuçlar doğurmaktadır. Ancak, bu politika enerji talebi ve CO_2emisyonunda artışa yol açmaktadır. Diğer yandan, teşvikin en fakir hane halkı gruplarına doğrudan dağıtılması toplam ekonomik kalkınmayı azaltmakta, ama sosyal gelişimi artırmaktadır. Bu opsiyon da CO_2 emisyon artışına yol açmakta ama enerji talebini azaltmaktadır. Çalışmanın sonuçları Endonezya'nın akaryakıt teşvikinin yeniden dağıtımı için ekonomik, sosyal ve çevresel boyutlarını da hesaba katması gerektiğini göstermektedir.

Anahtar Sözcükler: sosyal hesap matrisi, ekonomik modelleme, petrol, enerji politikası, teşvik, sürdürülebilir kalkınma

Dedicated To My Beloved Parents; *Joeliaty Sufwana* and *Asep Sufwana*

ACKNOWLEDGEMENTS

This work could not be completed without support from various people and institution. I would like to first express my humble gratitude to Prof. Uğur Soytaş and Dr. Bora Kat, supervisor and co-supervisor of the thesis, for all their constant advised, encouragement, support, and constructive criticism throughout the thesis work. I also would like to acknowledge Prof. Ayşen Yılmaz, the director of ESS department, for all her support during my master study in the ESS department. My study would not have been succeeded without her guidance. My deepest gratitude goes to my parents for their love, patience, unconditional support, and constant prayer. Last but not least, I am very pleased to acknowledge *Yurtdişi Turkler ve Akraba Topluluk Bakanligi* that have granted me a financial support to study in Turkey.

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LIST OF ABBREVIATIONS

ADO	Automotive Diesel Oil
BOE	Barrel of Oil
BPS	Indonesian Central Agency on Statistics
CPI	Consumer Price Index
ESDM	Indonesian Ministry of Energy and Mineral Resources
GDP	Gross Domestic Product
GHG	Green House Gases
GOI	Government of Indonesia
GW	Giga Watt
ICP	Indonesian Crude Prices
IDO	Industrial Diesel Oil
IDR	Indonesian Rupiahs
IEA	International Energy Agency
IO	Input-Output
LPG	Liquid Petroleum Gas
OPEC	Organization of Petroleum Exporting Countries
PLN	State-Owned Electricity Company
SAM	Social Accounting Matrix
SUSENAS	Indonesian National Social Economic Survey

CHAPTER 1

INTRODUCTION

In this thesis, economic, social and environmental impacts of fuel subsidy removal in Indonesia are studied. This first chapter serves as an introduction and background of the study, and gives a first insight on ‘whether the fuel subsidy needs to be removed by taking into account the social, economic, and environmental impacts of the removal’. First, the background of the study including the main arguments for the removal of fuel subsidy will be briefly explained. After that, the objective and significance of the study, research questions, and scope of the thesis will be presented in order.

The fuel subsidy policy has been one of the hot topics in Indonesian energy debate from time to time. The government policy is clear, which is to phase out fuel subsidy. Nevertheless, the government also realized that implementing this policy should be carefully planned due to adverse consequences that it may have on the society such as: rising inflation, increasing number of poor people, and increased unemployment.

The main arguments from the government to phase out fuel subsidy generally were: (1) Saving government budget from a deficit (caused by oil price hike) and (2) Fuel subsidy not reaching its target (poor society). Indonesian fiscal balance is threatened by decreasing oil revenues in terms of tax and non-tax revenues and also an increase in fuel subsidies (because of oil price volatility) (Dartanto, 2013). Fuel subsidies also affected the income distribution in Indonesia due to the fact that fuel subsidies are enjoyed by the non-poor groups, quite more than by poor groups. Based on SUSENAS (2008), more than 41% of gasoline subsidies benefitted the top richest income groups in Indonesia. More details as well as empirical results will be given in Chapter 2.

Indonesia is very dependent on petroleum for its energy supply. In 2011, petroleum accounted for 34% of primary energy supply which has the largest share among alternative sources (BPPT, 2012a). In addition, since mid-2003, Indonesia started to become an oil net-importing country and also has had a problem of decreasing oil production and increasing consumption. Crude oil production has fallen by approximately 3% per year, while overall fuel use has increased by almost 4% per year during the last 15 years (OPEC, 2012). These severe conditions are threatening Indonesian energy supply, especially its oil supply security.

This study aims to simulate various scenarios on fuel subsidy removal to see its impacts on the Indonesian economy-social-environment nexus. Those three criteria may be viewed as an implementation of sustainable development in a country. It has been mostly recognized that today's policy should not entirely focus on economic growth and employment. The fast environmental degradation and the stark threat of climate change make it essential to take the environmental criteria into consideration for policy making.

In that respect, we construct 4 different scenarios of subsidy removal. The scenario development is based on the energy structure as well as economic and environmental goals of Indonesia. The scenarios consist of 50% or 100% subsidy removal, and reallocation of the subsidy to the gas sector or to the poor households. For the simulations, Social Accounting Matrix analysis (SAM hereafter) will be applied. SAM is a representative of the economy where inter-institutional relationships can be identified. It is also able to show how the economic and social sectors are related. A SAM is primarily a data framework which serves as a dual-entry square matrix of transactions caused by the different activities, commodities and agents in the economic system. Columns in a SAM represent payments (or expenditures) and rows represent receipts (or incomes). Parra (2008) remarked that the advantage of SAMs over Input-output tables is that data from household surveys on incomes and consumption patterns can be incorporated into the analysis, so that economic-social relationship can easily be distinguished. One disadvantage of SAM and Input-Output analysis is that they only represent a snapshot of the economy for a particular year, hence the analysis is not dynamic. An in-depth explanation on SAM and the methodology used in the subject will be covered in chapter 3.

Through the fuel subsidy reform, fuel subsidy will gradually decrease until fully eliminated. Given the fact that Indonesia is an emerging economy country, this policy will potentially have adverse effects on the economy and the society, especially to the bottom 20% poorest people in the society. So, full analysis of economic-social-environmental implication of fuel subsidy removal will be discussed.

In terms of fossil-fuel subsidy related studies, Ellis (2010) stated that “few studies to date have effectively integrated the assessment of all economic, environmental and social impacts”; this is becoming the significance of the study in approaching the issue. The study will fill the gap, where usually researcher only focused on economic and social aspects of the impact. In addition, the employed methodology (i.e. SAM) will further add to the richness of the literature on this subject. A study on this subject is essential for the government and can provide useful guidelines in implementing fuel subsidy reform.

To achieve the objective of the study, this research will answer the following questions: (1) what are the impacts of removing fuel subsidy on the economy, society and environment in Indonesia? (2) How SAM can explain the relationship of fuel subsidy to economy, social, and environment in Indonesia? (3) What is the most appropriate policy mix to minimize adverse effects of fossil fuel removal in Indonesia?

The study has several limitations. Applying SAM as a method for analysis has several restrictions such as: no assumption on supply constraints, constant return to scale, fixed commodity input structure, and homogenous sector output (Hara, 2008). In addition, due to limitation of available data, utility sector could not be segregated. Thus, the results of reallocation to gas sector might be over-estimated. However, the results show clear indices on how the reallocation of fuel subsidy to other sectors will affect economy, social, and environmental as a whole.

In the rest of the thesis, first an overview of Indonesian economy focusing on energy sector will be presented in Chapter 2. A brief account of the Indonesian economy and energy use structure will also be encompassed in this chapter, followed by more specific information on oil and fuel subsidy related issues. Chapter 2 will be concluded with the review of related literature on fuel subsidy studies as well as the methodology employed in this study, i.e., SAM analysis. Chapter 3 is dedicated to methodology and data. Next, in Chapter 4, simulation analysis and numerical results will be presented. Finally in Chapter 5, conclusion and policy recommendations will be summarized.

CHAPTER 2

INDONESIAN FUEL SUBSIDY OVERVIEW

2.1 INDONESIAN ENERGY IN BRIEF

2.1.1 Economic Overview

Indonesia is the 4th most populous country in the world with 241 million people (2011 census). It has five main islands, 30 medium-sized islands and over 10,000 smaller ones (BPS, 2011). Eighty percent of the population lives on the islands of Java and Bali; the rest is scattered widely among the country's 6,000 other inhabited islands. Split by the equator, Indonesia has a tropical climate characterized by heavy rainfall, high humidity, high temperature, and low winds ("Indonesia-Climate", 2014). With the coastal plains averaging 28°C, the inland and mountain areas averaging 26°C, and the higher mountain regions, 23°C. The main variable of Indonesian climate is not temperature or air pressure, but rainfall. The area's relative humidity is quite high, and ranges between 70 and 90 percent. Also, located in the equator region has made the area become rich for its biodiversity (Gaston, 2000). Indonesian territory lies in the intersection of Australian and Eurasian plate, which makes the region vulnerable to earthquake and volcanic eruptions.

Indonesia has a thriving economy at the intersection of the Pacific and Indian oceans, between Asia and Australia. The location is very strategic in reaching markets towards Asian countries, American continent, Australia, and Middle East and Africa. Indonesia's economy grew 6.5 percent in 2011, in line with the country's 3–6 percent growth rate since the Asian financial crisis of the late 1990s (see **table 1**).

Natural resource availability is substantial for its economic growth. Based on government data (ministry of economic affairs, 2011) Indonesia is the world's largest producer and exporter of palm oil, second largest exporter of coal, and the second largest exporter of cocoa and tin, and has the fourth and seventh reserves of nickel and bauxite respectively. These resources accounted for 68% of Indonesian exports. However, based on a report from McKinsey (2012) natural resources are not the only driver of Indonesia's growing economy. The report stated that the overall share of natural resources in the economy has declined over the past decade, while the service sector's share of the economy increased significantly. This is an indicator that although natural resources are an important driver of the economy, it is not the only one and its role is declining.

Economic growth is also influenced by Indonesia's demography. An important advantage of Indonesia's demographic composition in terms of economic growth is that the country has a young population. This young population mean potency for the workforce and consumption of commodities, which is assumed to drive the economic growth. Indonesia's total median age is 29.2 years (CIA WorldFactbook, 2014). It implies that one half populations are older than 29.2 years old, while the other half is younger. In 2014, about 26.2% of Indonesians were under fifteen years old, around 43% under twenty five years of age, and more than half of the population is under thirty years of age. This number tells us a great potential for productivity and thus can function as the engine of the national economy. This growing middle age people also will affect the future economy growth of Indonesia. With the current demographic composition, economic growth will be accelerated and Indonesia's economy is expected to be the 7th largest economy by 2030 (Mckinsey, 2012).

The growing boost in the economy will also affect energy consumption. A study by Shahbaz et.al. (2013) discussed that Indonesian economic growth and energy consumption are co integrated. It means there is a long run equilibrium relationship between those two variables. The study also found an indication of a CO_2 emission increase by economic growth and energy consumption rise. In another word, the rise in GDP will simultaneously follow up by rising energy consumption and CO_2 emissions. The positive economic growth (simultaneously with rising energy demand) will have to be fulfilled by continuity of energy supply to safeguard energy security of the country. Careful planning of energy policy is needed not only for successful economic growth, but also to minimize adverse effects to the environment.

Table 1 Selected Indonesian Indicators

Indicator	**Year**						
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Population (million person)	219.90	222.70	225.60	228.50	231.40	237.60	241.60
Annual change (%)	1.30	1.30	1.30	1.30	1.20	2.70	1.70
GDP (current price) (trillion Indonesian Rupiahs)	2774.30	3339.20	3950.90	4948.70	5606.20	6446.90	7422.80
GDP growth (%)	5.70	5.50	6.30	6.00	4.60	6.20	6.50
GDP per-capita (Indonesian Rupiahs)	12,616,189	14,994,163	17,512,855	21,657,330	24,227,312	27,133,418	30,723,510
Inflation (%) [1]	17.10	6.60	6.60	11.10	2.80	6.96	3.79
Price Index (annual change) (%)	10.50	13.10	6.40	9.80	4.80	5.10	5.40
GDP deflator (annual change) (%)	14.30	14.10	11.30	18.10	8.30	8.20	8.10
Energy production							
Crude petroleum (thousand metric tons)	52,882	58,222	55,543	59,893	54,904	54,684	52,235
Annual change (%)	-11.58	10.10	-4.60	7.83	-8.33	-0.40	-4.48
Coal (thousand metric tons)	152,722	193,761	216,947	240,250	256,181	275,164	353,271
Annual change (%)	15.39	26.87	11.97	10.74	6.63	7.41	28.39
Natural gas (terajoules)	2,877,910	2,649,206	2,498,044	2,587,533	2,744,596	2,890,084	2,761,875
Annual change (%)	-2.48	-7.95	-5.71	3.58	6.07	5.30	-4.44
Electricity (million kwh)	127,370	131,710	142,441	149,436	157,337	169,786	183,421
Annual change (%)	5.97	3.41	8.15	4.91	5.29	7.91	8.03

Source: Asian Development Bank (2013) (available online at: http://www.adb.org/sites/default/files/KI/2011/pdf/INO.pdf) except [1]

[1] Indonesia's Central Bureau (available online at: http://www.bps.go.id/inflasi/excel.php?kota=0000&th1=2011&th2=2014)

2.1.2 Energy Sector Overview

Indonesia consumes energy in many forms such as: Petroleum, Coal, Natural Gas, Firewood, and Renewables. Indonesia's total primary energy consumption increased by almost 30% between 2005 and 2011 (ESDM, 2012). Petroleum continues to account for the most significant share of Indonesia's energy mix, at 34% in 2011. Coal consumption has tripled over the decade, accounting for 22% of the total energy consumption in 2011, surpassing gas as the second most consumed fuel. The bigger picture of the Indonesian energy consumption pattern can be seen through Indonesian Energy Balance in **Figure 1**.

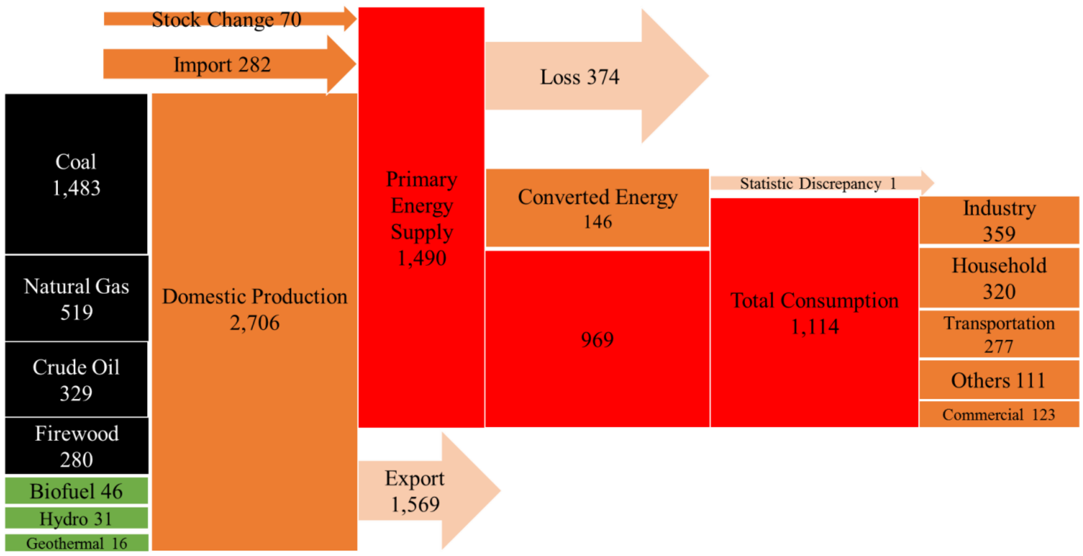


Figure 1 Indonesian Energy Balance 2011 (in million barrels of oil equivalent (BOE))

Source: Own calculation based on Indonesia Energy Statistics 2012

From **Figure 1** we can see the bigger picture of Indonesian energy production and consumption patterns. Domestic energy production reaching the total of 2,706 mill. BOE dominated by coal production of 1,483 mill. BOE, followed by natural gas, crude oil, firewood, and renewables. 42% of domestic production were exported, while the rest are supplied for domestic consumption. From the figure, we can see that Indonesia is a net-exporter of energy. The country energy needs can be fulfilled by domestic production.

Indonesian total primary energy consumption was 1,114 mill. BOE in 2011. It is consumed by industry, household, transportation, commercial, and other sectors as much 359, 320, 277, 111, and 123 mill. BOE respectively. The industry holds largest consumption of final energy followed by households in the second place, while the transportation sector surpasses commercial sector in the third place. This figure tells us how large domestic production is and also how much the magnitudes of the final energy users are. However, it lacks information on the sectoral share of primary energy supply which is important for meeting the energy consumption of the country. The following **Figure 2** can fill those gaps. **Figure 2** shows the Indonesian primary energy consumption by sources and sectors. The left side is the primary supply of energy by its sources. Here we can see the shares of primary supply of energy. Petroleum fulfilled most of Indonesia's primary energy by 34%, followed by coal, natural gas, firewood, and renewables to 22%, 19%, 19%, and 6% respectively. Those primary energy sources are then consumed by the final consumption sectors on the right side. We can see that electricity generation consumed most of the energy needs by 27%. From that amount, 66% of electricity is consumed by households and commercial, while the rest is for industry. On the other hand, industry, household & commercial, and transportation sectors hold 23%, 21%, and 20% shares in the Indonesian primary energy consumption profile.

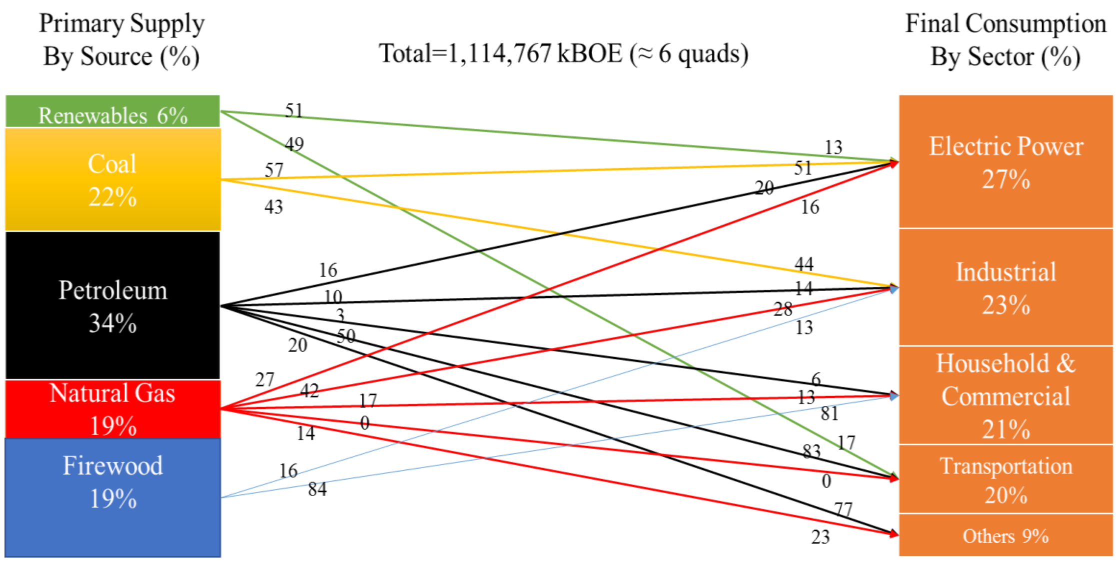


Figure 2 Indonesian Primary Energy Consumption by Sources and Sectors 2011

Source: Own calculation based on Indonesia Energy Statistics 2012

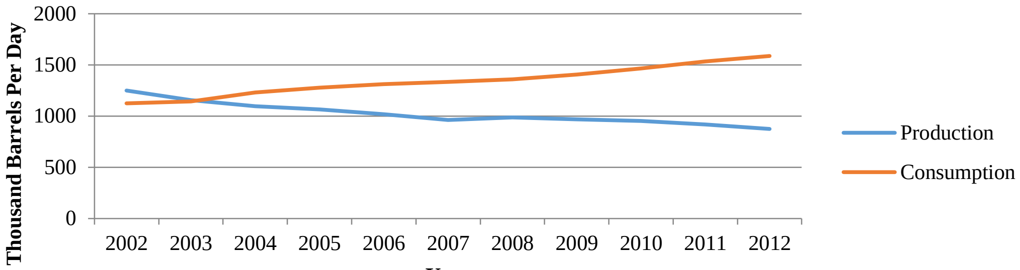
We can also read **Figure 2** from two ways: the supply side and the consumer side (demand side). Let's say from supply side, we focused on Petroleum. Petroleum has supplied 16% of its product for electricity generation, 10% for industry, 3% of household & commercial, 50% for transportation, and 20% for others (e.g. raw material input). From here we can clearly infer that most of the petroleum product is consumed by the transportation sector. Thus, the problem in the supply side of petroleum will mostly hurt the transportation sector than any other sector. This argument is further clarified by seeing from the consumer side of the transportation sector. We can see that the transportation sector is highly dependable to petroleum to fulfill their demand with an 83 % consumption from petroleum, while other sectors only hold a relatively small amount (renewables 6% and natural gas 0%).

Those two figures (**Figure 1** and **Figure 2**) have been able to explain nicely the macro picture of the Indonesian energy structure. The following sub-chapter will discuss briefly the micro picture of Indonesian energy resources.

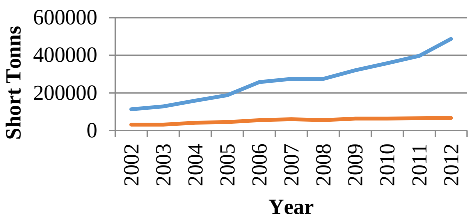
2.1.3 Fossil Fuel Resources

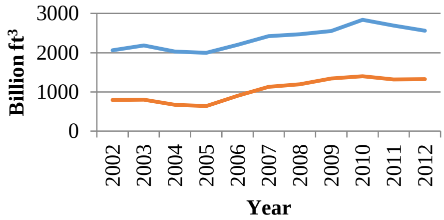
Oil

Indonesia has not been an oil net-exporter country since 2004 because of declining oil production and increase in domestic demand. Crude petroleum output has fallen by approximately 3% per year, while overall fuel use has increased by almost 4% per year during the last 15 years (OPEC, 2012). Due to this reason, Indonesia is suspended from its membership in OPEC. **Figure 3a** illustrates the production and consumption history in Indonesia during 2002-2012. The gap between production and consumption (after 2003) is met through imports. The primary reason for the decline in oil production is aging of reserves and lack of investment to explore new reserves. On the other hand, robust economic growth, population growth, and fuel subsidies have made the demand for energy to rise. Many experts suggested that Indonesia will meet oil scarcity in the next following years if no new reserves are explored. The lack of investment in the country is derived from a lack of infrastructure, lack of incentive for foreign investment, and bureaucratic barriers.



(a)





(b) **(c)**

Figure 3 Indonesian Production and Consumption 2002-2012 **(a)** Oil **(b)** Coal **(c)** Natural Gas

Source: based on data from the IEA

As has been presented in the previous chapter, petroleum is the main primary energy driving the country that accounted for 34% of Indonesian primary energy supply. However, oil also becomes the main problem of energy security in Indonesia. Oil is the only energy source that could not be met by domestic production. It is clear that oil has become the main challenge of Indonesian energy security. To solve the problems there are three ways that could be followed, supply control, demand control, or both. Supply control can be translated as increasing production capacity of domestic supply. While, on the demand side control, the alternatives can be to decrease the demand (by taxes, resource substitution, energy efficiency practice, and subsidy removal).

Coal

Coal is the second most important energy source in Indonesia, which accounts for 22% of primary energy supply of the country. As shown in **Figure 2**, coal only used for 2 purposes: Electricity production and industrial purpose. Industrial consumers are cement, iron and steel, and pulp and paper industries. Coal production has been intensified in the past decade. There was an incredible increase of more than 300% coal production from the year 2002 (112,629 thousand ton) to the year 2012 (488,112 thousand ton). **Figure 3b** illustrates domestic production and consumption of coal over the period 2002-2012. The gap between those productions and consumption are export commodities. According to the projected scenario by BPPT (2012b), domestic coal demand will further rise up and account for 48% share of primary production in 2030. The production is estimated to be 817 million tons or almost twice the level in 2012. This means that the GHG emissions burden of the country will keep increasing. Hence, coal may not be a sustainable development alternative for Indonesia.

Natural Gas

Natural gas is another important energy resource available in the country. It currently accounts for 19% in the Indonesian primary energy mix. Most of it is used for industrial purpose. Natural gas-similar as coal- is an export commodity product due to its huge reserves and quite a low domestic demand. This puts natural gas as a possible immediate solution to energy needs and emission reduction of Indonesia. **Figure 3c** shows the production and consumption trends of natural gas along with the magnitude of natural gas surplus in the country.

To sum up fossil fuel resources in Indonesia, **Table 2** is presented below. Crude oil has proven reserves of 3.85 billion barrels while the current production reaches 315 million barrels in a year, making it last for the next 12 years. Natural gas has 141 TSCF proven reserves with the rate of production of 2.55 TSCF a year that will last for the next 55 years. Coal is the most abundant energy resource with 30.8 billion ton proven reserve. The 2012 production rate is 488 million ton that make coal still available for the next 63 years.

Table 2 Summary of Indonesian Fossil Fuel Resources, 2012

Energy Resources	Proven Reserves (R)	Productions (P)	R/P Ratio (years)
Crude Oil	3.85 billion barrels	315 million barrels	12
Natural Gas	141 TSCF	2.55 TSCF	55
Coal	30.8 billion ton	488 million ton	63

Source: EIA from web http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm

2.1.4 Renewable Resources

Renewables are still less utilized alternative energy sources compared with fossil fuel resources. The consumption of renewables accounted for 6% of total primary energy use distributed mostly for electricity generation (51%) and the rest is for the transportation sector in the form of biofuels (49%). Up until 2011, Indonesia has utilized renewables for generating 21.926 billion kWh of electricity.

Indonesian renewable resources are abundant but still in minimal utilization. Notably the most important renewable resources in Indonesia are geothermal, hydro energy, and biomass. Indonesia has the world's largest proven geothermal reserves. Probably because of geographically Indonesia is passed by active volcanic mountain range, throughout the country which geothermal resources usually available. The utilization of geothermal is the 3rd largest after the United States and Philippines. In 2009, the utilization of geothermal is 0.8 GW. Hydro power has been utilized by Indonesia for generating electricity for decades. Its generation capacity reaches 4.2 GW. Resources are abundant estimated to be 845 million BOE. Both geothermal and hydro is used for electricity production. Other renewables used for another purpose, such as for transportation sector and heat generation. Biomass in the form of biofuels are used for those kind of purpose and become one of the most important renewable resources in Indonesia. In 2011, biofuel utilization is accounted for 17% of energy used in the transportation sector. Although renewables provide another sustainable development path and Indonesia clearly has a potential to increase the share of renewable sources, their use is currently limited and they are not considered as close substitutes for oil unlike natural gas. Summary of Indonesian renewable resources can be seen through the **Table 3**.

Table 3 Summary of Indonesian Renewable Energy Resources

Types	Resources	Equivalent Value	Existing Utilization
Hydro	845.00 million BOE	75.67 GW	4.2 GW
Geothermal	219.00 Million BOE	27.00 GW	0.8 GW
Mini/Micro Hydro	0.45 GW	0.45 GW	0.084 GW
Biomass	49.81 GW	49.81 GW	0.3 GW
Solar	-	4.80 kWh/m^2/day	0.008 GW
Wind	9.29 GW	9.29 GW	0.0005 GW
Uranium	24.112 ton* e.q. 3 GW for 11 years	-	-

* Resources only exist in Kalan region – West Kalimantan

Sources: Indonesian Ministry of Energy and Mineral Resources, 2007

2.1.5 Energy Policy

Indonesia has planned to achieve an 'optimal' primary energy mix by the year 2025. Presidential decree No.5/2006 noted a primary energy mix target which consists of Oil (less than 20%), Natural gas (more than 30%), Coal (33%), liquefied coal (more than 2%), Biofuel (more than 5%), Geothermal (more than 5%), and other renewables (more than 5%). In the future energy mix, renewables were expected to account for no less than 15% of total primary energy supply (current state is 6%). To achieve such ambitious goals, ministry of energy and mineral resources issued a Ministerial Decree no.32/2008 that obliges several energy stakeholders to increase biofuel use for their energy needs.

Furthermore, Presidential Decree No. 5/2006 together with the Law on Energy (Law No. 30/2007)[1] stipulated that the energy price shall be adjusted gradually towards its economic price and the adjustment shall be accompanied by supporting measures for the poor. The supporting measures include development of energy infrastructure, including improved access to energy; government-business partnerships; social empowerment; subsidy funds; research and development; and education and training.

Up until now, there are 4 policy measures that are being taken by the GOI. These measures basically target to achieve the energy mix goal, decrease dependency on oil, and increase share of renewables. Those policies are: energy diversification, feed-in-tariff, energy conservation, and energy subsidy (BPPT, 2013).

The main objective of energy diversification is to reduce oil dependency. This policy is implemented through several substitution programs. In 2007, GOI launched 'kerosene to LPG' substitution program. It significantly reduces fuel consumption in the household sector from 40% in 2008 to 6% in 2011. Oil to gas substitutions in transportation sector also on the way. However, it is challenged by the lack of infrastructure available for distribution and processing of natural gas.

Feed-in-tariff policy is subject to encourage renewable energy utilization. This policy enables setting up a purchase price of electricity by PLN (state-owned electricity company) from power plant generated from renewable energy sources. The energy

[1]Law of Republic of Indonesia No. 22 of 2001 regarding Oil and Natural Gas. Undang-Undang Republik Indonesia Nomor 22 Tahun 2001
tentang Minyak dan Gas Bumi.

conservation policy has an objective to reduce energy efficiency by 1% annually. Energy efficient practice is implemented in industry and household sectors by energy labeling, energy auditing, and introducing new technology. In Energy subsidy domain, the objective was to eliminate inefficient energy subsidies. Currently, energy subsidies are formed as fuel and electricity subsidies. These subsidies are needed to phase out due to implicating budget deficit, promote wasteful consumption, and worsening income distribution. However, implementing the policy also potentially resulting adverse effect on economic, social, and environment thus, needs a careful planning. A more in depth discussion about subsidy (particularly fuel) will be discussed in the next sub-chapter.

2.1.6 Energy and Climate Change

As one of the longest coastline country, Indonesia is directly affected by climate change threats, notably from the rising sea level. In addition, rising atmospheric temperature will also be a threat to agriculture sector. Thus, it is giving a threat to food security and well-being of the society. Indonesia is also one of the largest GHG emitters that emits 834.6 Mt CO_2 eq. of GHG emissions in 2011 (ranked 8th globally) (WRI, 2014). The energy sector is the largest contributor to these emissions, accounted for 60% of the total emissions. However, if land use change and forestry (LUCF) is taken into account, the energy sector will be the second.

GOI is a party to the United Nation Framework Convention on Climate Change (UNFCCC).[2] Following up the climate change convention, on 1998, GOI decided to take step further and signing a Kyoto Protocol.[3] As a developing country, Indonesian participation in the protocol is on a ‘voluntary’ participation basis. And also it enables market based mitigation efforts to be implemented in Indonesia.

[2]This refers to United Nations Framework Convention on Climate Change (UNFCCC). UNFCCC is an international environmental treaty negotiated at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. The objective of the treaty is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

[3]The Kyoto Protocol is recognized as the most important global agreement of the late twentieth century, not only for fixing greenhouse gases (GHG) emission limits to be achieved by industrialized nations by 2012, but also for providing three flexible mechanisms through which industrialized countries can achieve their emission reduction objectives. These mechanisms: Joint Implementation (JI), Emission Trading (ET) and the Clean Development Mechanism (CDM).

In the national policy, climate change is stated as one of the priority subjects in the National Midterm Development Plans 2010-2014.

“Conservation & Environmental Utilization Supports Economy growth & Sustainable Welfare in accordance with the risk mastering & management in the context of climate change.”

PRIORITY 9: Environment & Disaster Management. Indonesia National Midterm Development Plans 2010-2014

In addition, through presidential regulation no. 61/2011 on the national action plan for greenhouse gas reduction, 26% GHG reduction is warranted to achieve by the year 2020. Energy is one of the sectors that are included in the regulation to reduce its GHG emissions. Policy package mandated by the regulation in the energy sector is: increased energy saving, fuel switching (to cleaner one), enhanced renewable energy utilization, utilization of clean technology. Those policy packages are then derived into several detail action plans, notably substituting in gas for oil, reorganized transportation system, and constructing renewable energy derived power plants. However, this presidential regulation is lack of measures regarding energy subsidy.

2.2 FUEL SUBSIDY REGIME IN INDONESIA

2.2.1 Definition of subsidy

Van Beers and De Moore (2001) noted that subsidy can be defined as any domestic price that deviated from the global market price. Furthermore, De Moore (1997) defined: “Subsidies comprise all measures that keep prices for consumers below market level or keep prices for producers above market level or that reduce costs for consumers and producers by giving direct or indirect support”. In the case of energy subsidy, it is generally defined as “any government action that lowers the cost of energy production, raises the revenue of energy producers, or lowers the price paid by energy consumers” (IEA, OECD, and World Bank, 2010, cited in GSI, 2011).

Subsidy can be formed in a variety of support mechanisms. They might be in the form of direct cash transfer to producers or consumers or may be reflected as tax exemptions and rebates. There are several mechanisms that are employed by the government to impose energy subsidies, as identified by The OECD (Varangu and Morgan, 2002) and the United Nations Environment Program (UNEP, 2008):

- *Direct financial transfers:* grants to consumers, grants to producers, low-interest or preferential loans and government loan guarantees;
- *Preferential tax treatment:* tax credits, tax rebates, exemptions on royalties, duties or tariffs, reduced tax rates, deferred tax liabilities and accelerated depreciation on energy-supply equipment;
- *Trade restrictions:* tariffs, tariff-rate import quotas and non-tariff trade barriers;
- *Energy-related services provided directly by government at less than full cost:* government-provided energy infrastructure, public research and development of fossil fuels; and
- *Regulation of the energy sector:* demand guarantees, mandated deployment rates, price controls, environmental regulations and market-access restrictions.

Direct subsidies are usually referred to as direct financial transfer of subsidy (including tax rebates). While the other means of subsidies are referred to as indirect subsidies. Whether it is a direct subsidy or indirect subsidy, energy subsidy is common practice in many countries, particularly developing countries. Important elements of energy subsidies can be price controls, market access limits and trade restrictions.

In identifying subsidies, we can also learn from the differentiation in its status inside government budget. De Moor and Calamai (1997) have developed a categorization of subsidy and build a taxonomy as a practical tool in identifying subsidies (see **table 4**).

Table 4 A subsidy Taxonomy to Identify Public Support

Subsidy types	**Examples**
On-budget subsidies Budgetary subsidies	Direct subsidies, e.g., grants or payments to consumers or producers.
Off-budget subsidies Tax subsidies	Support through tax policies, e.g., tax credits, tax exemptions, tax deductions, rate relief, preferential tax treatment
Public provision below cost	Infrastructure provision and complementary services, public R&D expenditures
Capital cost subsidies	Preferential loans, liability guarantees, debt forgiveness
Subsidies through the market	a) Domestic-oriented, e.g., price regulation, quantity controls, procurement policies b) Trade-oriented, e.g., import and export tariffs, non-tariff barriers

Source: Based on de Moor and Calamai (1997)

IEA (2007) estimated that in 2005 world energy subsidies could be $250 billion per year. The number then further rose, reaching $544 billion in 2012 (IEA, 2013). One thing worth mentioning, there are quite distinguished forms of subsidies used in OECD and non-OECD countries. OECD countries tend to give subsidies to the producer side, while non-OECD generally provide energy subsidy to the consumer side. IISD (Ellis, 2010) mentioned that in developing countries, particularly with low GDP per capita, consumer fossil fuel subsidies were over 2 per cent of GDP for several years. Some examples can be seen in the case of Turkmenistan (15.2 per cent of GDP in 2008); Ecuador (8.7 percent); Egypt (8.4 per cent); Ukraine (3.3 percent); and Bangladesh (3.0 per cent) (Coady et al., 2006; World Bank, 2008). Indonesia is also one of the most heavily energy subsidized country with over $12.8 Million (2007 constant price) energy subsidies or 11% of total expenditure in 2007 (Agustina et al., 2008).

IEA (2011) estimated that without further reform, spending on fossil-fuel consumption subsidies, set to reach $660 billion in 2020, or 0.7% of global GDP. The phasing-out fossil fuel subsidies by 2020 would slash growth in energy demand by 4.1%, reducing growth in oil demand by 3.7 million barrels/day, and cutting growth in CO_2 emissions by 1.7 Gt. Many countries have started or planned reform since early 2010. The key driver has been fiscal pressure on government budgets. G20 & APEC commitments have also underpinned many reform efforts and tools. Much more still remains to be done to realize the full extent of benefits of phasing-out fossil fuel subsidies. Countries' developments on phasing-out fossil-fuel subsidies are summarized in **Table 5**.

The aims of subsidy from the government are usually motivated by economic and social purposes. The main objectives of implementing subsidies are to stimulate economic growth, enhancing or protecting employment and investments or providing infrastructure access (Van Beers and de Moor, 2001). In the case of Indonesia, it is also valid. In fuel subsidy practice, Pradiptyo and Sahadewo (2012) argue that the fuel subsidy policy is implemented because GOI wanted the people to receive an utmost benefit from the resources they got. The policy also intended to accelerate economic growth of the country. The high revenue from oil sector has made government of Indonesia (GOI) provided a fuel subsidy for its people.

Table 5 Summary of Countries' Development on Fossil-fuel Subsidy Reform

Country	Recent Development
Bolivia	In January 2012, the government raised the possibility of phasing-out subsidies for gas and diesel, after effort in 2011 failed of strong opposition.
China	Implemented a tiered electricity pricing system in July 2012 in which rates for the first-tier remain unchanged from current levels, but rates progressively increase for the second and third tiers. Each province will establish its own price brackets accordingly. Announced in March 2013 that prices of oil products would be adjusted every 10 working days to better reflect changes in the global oil market.
Chile	Raised natural gas prices by 3% in February 2011 for the Magallanes region in response to protests, rather than 16.8% as initially planned.
Egypt	Announced in August 2012 that energy subsidies to energy-intensive industries – including cement, iron and steel and chemicals – will be gradually phased out. Planning to implement a 'smart card' system to manage sales of subsidised gasoline: only small vehicles (1 600cc or below) will be eligible to purchase it and they will be restricted to 1 800 litres per year before having to pay the unsubsidised price.
Ghana	Cut fuel subsidies in February 2013 in response to larger than expected spending on subsidies. As a result, premium gasoline and diesel prices rose by 20%, kerosene and heavy fuel oil by 15%, and LPG by 50%.
India	In January 2013, allowed state fuel retailers to start raising the pump price of diesel on a monthly basis until it reaches market levels. A cap on subsidised LPG gas cylinders was raised from six to nine per year per household. The 2013-2014 budget for petroleum products subsidies has been cut by more than 32% compared to the previous year, from Rs 96,880 to Rs 65,000 crore (approximately $12 billion).
Iran	Significantly reduced energy subsidies in December 2010 as the start of a 5-year program to gradually increase the prices of oil products to at least 90% of Persian Gulf FOB prices, natural gas prices to 65% and 75% of the average gas export price for residential and industrial users respectively and electricity prices to full cost price. The 2nd phase of the fossil fuel subsidy reform has been put on hold due to increasing concerns about inflation. In January 2013, ended supplies of subsidised gasoline for cars with engines of 1 800cc and above and restricted sales of subsidised gasoline near border areas.
Jordan	Raised the price of premium gasoline by 20%, lower grade gasoline by 12.9% and electricity tariffs for selected industrial and service sectors in June 2012. Reduced subsidies in November 2012, leading to price increases of more than 50% for bottled gas, 33% for diesel and kerosene and 14% for lower grade petrol. Households that consist of six members or less, and whose income is less than $14 000 a year, are entitled to JD70 (approximately $100) annually in compensation. In March 2013, announced that prices of gas, diesel and kerosene would further increase.
Malaysia	In April 2012, announced that subsidies for gasoline, diesel and cooking gas would continue to be provided.
Mexico	Plans to raise fuel prices every month in 2013 to bring them closer to international levels.
Morocco	In June 2012, raised the price of gasoline by 20% and diesel by 10%.
Nigeria	Following implementation of a complete removal of gasoline subsidies in early January 2012 which doubled prices, a nation-wide strike ensued. Gasoline prices were then cut by a third, partially reinstituting the subsidy. Announced in March 2013 that there were no plans to reduce the subsidy on premium gasoline.
Pakistan	Although the government had planned to reduce subsidies for the power sector in the 2012/3 budget, the Senate Standing Committee on Finance subsequently recommended to raise the subsidies by 172% from the allocated amount.
Qatar	Increased gasoline, diesel and kerosene prices by 25% in January 2011.
South Africa	Energy Regulator granted power utility Eskom an 8% average electricity price increase per annum over the next five years, which will effectively reduce electricity subsidies.
Thailand	Plans to reduce subsidies for LPG for households and transport in April 2013, except for street vendors and low income earners. In early 2013, announced that LPG price would be gradually increased by 50 satang (approximately $0.02) per month each month for the next 12 months.

Source: International Energy Agency

At first glance, subsidy seems to be a safe haven that provides prosperity to the society especially those intended for people's basic needs such as food, energy, water, education, and shelters. In some way it is true. Subsidies may be applied to correct market failures. Subsidy policy usually intended for goods or services that has positive externalities with the objective to increase output, for example increasing education and technological advancement subsidy. These two sectors have positive externalities, so that, subsidy policy will give a greater good to the society.

The discussion of subsidy nowadays is much more than the debate over inefficient subsidies which occur when "price does not correspond to the overall cost to society of producing or consuming a little more or less of the good or service" (Fischer and Toman, 2000). Subsidies may result in an inefficient allocation of resources and fail to meet their intended objectives. World Energy Outlook 2012, IEA (2011) mentioned that energy subsidies can make markets more volatile by protecting the parts of the market. In addition, the prospect of higher international prices of fossil fuels will subsequently increase the state's burden. For net exporting countries, subsidies could restrict exports by increment of domestic demand that leads to lower export revenue in the long term. In the sustainable development point of views, fossil fuel subsidies in particular would provide wasteful consumption and thus subsequently increase greenhouse gas emissions. Inefficient subsidies are therefore an issue worth dealing with since their elimination can make society as a whole better off.

In summary, IEA, OECD, and World Bank (2010) summarized that there were several 'unintended' effects of subsidies that become the driver of subsidy reform:

- *Create fiscal burden on state budget*: The volatility of the international price of energy means subsidy which is coming from the state's budget would also be volatile. At the time of cheap energy, less subsidy will be required. It also applied vice versa, when global energy price is rising, higher expenses for the subsidy is the consequence the government has to take.
- *Encourage wasteful consumption*: Cheap energy price (provided by energy subsidy) would increase the consumption of energy. This can lead to fasten depletion of finite resources.

- *Exacerbate price-volatility*: The subsidies exacerbate price-volatility in global markets by dampening normal demand responses to changes in international prices.
- *Distort markets*: Subsidies for fossil-fuel production can hinder competition and create market distortions by propping up less efficient producers. For example, several countries still retain subsidies for hard coal mining. In some cases, a significant share of the subsidy is directed at covering the cost of closing down mines and compensating workers who had lost their jobs as a result of earlier rationalization of the industry, so is unlikely to alter demand and supply pattern.
- *Adverse impact on the environment*: Energy subsidies may give a harmful effect to the environment. Many poor households were using biomass as their source of energy. Introducing subsidy that promotes substitute of those biomass could positively impact the environment by reducing deforestation and cleaner air pollutions. However, most of the subsidies (for example, fuel subsidies) encourage wasteful consumption, thus increasing greenhouse gas emissions that harmed the environment.
- *Encourage fuel adulteration*: Smuggling may arise to another region when there is a significant price difference in the domestic market. This has been an issue for years in many countries, particularly in Southeast Asia, Africa, and the Middle East. This smuggling practice has a negative effect to the economy.
- *Disproportionately benefit the middle class and the rich*: Although energy subsidies are generally intended for the poor, the greatest benefit is typically received by middle to upper class of the society. It is simply because middle and upper class is the one who can afford to get the commodity.
- *Threaten investment in energy infrastructure*: Where fossil-fuel consumption is subsidized through consumer price control, the effect- in the absence of offsetting compensation payments to companies – is to reduce energy companies' revenues. This limits the availability of funds to be invested in infrastructures.
- *Hasten the decline of exports*: Some countries are thinking to phase out fossil-fuel subsidies not only by the high cost of subsidies but also the resulting low efficiency in domestic energy use. Over time, such subsidies may even threaten

to curtail the exports that earn vital state revenue streams, with implications of global energy security.

In calculating the amount of subsidy, one should be careful with the method and data used. Over or under estimation might arise when the data and the method used in the calculation are questionable. Below in **Table 6** several methods, in calculating the magnitude of subsidy together with its strengths and limitations, are summarized.

Table 6 Summary of Subsidy Measurement Approaches

Approach/Description	Strengths	Limitations
Programme-aggregation	Captures transfers whether or not they affect end-market prices. Can capture intermediate value (which is higher than the direct cost) of government lending and insurance	Does not address questions of ultimate incidence of pricing distortions. Sensitive to decisions regarding inclusion of programmes. Requires programme-level data.
Price-gap	Can be estimated with relatively little data. Useful for multi country studies. Good indicator of pricing and trade distortions.	Sensitive to assumptions regarding "free market" and transport prices. Understates full value of support by ignoring transfers that do not affect end-market prices.
Resource rent	Relevant for natural resources sectors such as forest and water.	Data intensive. Sensitive to assumptions.
Marginal social cost	Most comprehensive approach. Used for transport	Data intensive. Requires a significant amount of modeling. Sensitive to assumptions and has a wide range of uncertainty.
Producer/consumer support estimate	Integrates budgetary transfers with market price support into holistic measurement of support. Distinguishes between support to producers and consumers.	Data intensive. Currently calculated for agriculture and coal production, but not for other sectors.

Source: Based on Koplow and Dernbach (2001)

In estimating magnitude of fuel subsidies, the most common approach was the price gap approach due to its simplicity. That approach has been used in various works such as works by Larsen and Shah (1992) and Coady et al. (2010). Hereafter, the discussion will be focusing on fuel related subsidies instead of subsidies in general or energy subsidies.

2.2.2 Fuel Price History and Mechanisms

In the early periods of independence, subsidy, especially on rice and fuel, were used as a tool to protect people from the huge effects of inflation, which reached as much as 500 per cent (Beaton & Lontoh, 2010). Thus, subsidy has been a very common practice in Indonesia since the very early periods. The introduction of fuel subsidy in Indonesia dates back to 1967 by subsidizing the retail price of fuels to keep fuel products affordable for the poor and to raise income (IISD, 2012).

In order to understand the subsidy practice in Indonesia more, we have to look further back from the first period of government. **Table 7** gives a summary of Indonesia's development phases in fuel subsidy reform. Here we can divide it by 4 periods: Old Order period (1945-1965), New Order Period (1966-1997), Financial Crisis Period (1998-1999), and Recovery and Subsidy Period (2002-present). In the early time of independence, Indonesia is suffering a serious economic problem with a high inflation rate. During this period, the government makes significant interventions to the price.

After the fall of the Old Order, the Suharto regime started which is widely known as the 'New Order' (1966-1998). This period is notable with boosting development in economy and infrastructures. In the early period of the new order, economic recovery and stabilization is performed (1966-1973). During the time, partial liberalization exists in order to recover from an earlier state of economic crisis. The mid era of this period is distinguished by the 'oil bloom'. Economic growth took place simultaneously with government interventions in the market. The last period of the new order is happening with deregulation and renewed liberalization. Rapid export had improved economic growth, thus increasing the wealth of the country; consequently, high bureaucracy corruptions were very high during this period (Beaton and Lontoh, 2010). The Asian economic crisis in 1998 had forced Suharto to sign up an agreement with the IMF in order to get an emergency loan. The agreement included dismantling of state and private monopolies and also a reduction of subsidies in several commodities (Beaton & Lontoh, 2010). The government then announced a fuel price increase. However, even after new order had collapsed, the subsidy was hardly phased out, mainly due to economic (e.g., Inflation and hoarding), political, social, and behavioral reasons (Widodo et.al., 2012).

After Suharto regime fell in 1998, gradual reform took place to restructure electricity, petroleum, and fuel subsidy. The law no. 22/2001 on petroleum and gas was then passed. It is intended to reach a more liberalized market structure of petroleum and gas industry. Law no. 22/2001 mentioned that the price of fuel and gas are based on a fair market mechanism. However, the law also noted that the government should still take a social responsibility towards particular groups of society (the poor). So, the government can still intervene the market for a certain consumer group in a certain type of fuel.

The subsidy reform period (2000-present) was present due to rising international oil price that puts a heavy pressure on the fiscal balance. Also, in this period, for the first time Indonesia became an oil net importing country, which followed up by suspending membership from the OPEC. Due to this reason, GOI then corrected the fuel price several times. The gasoline price was corrected by IDR 1,150/l (February 2000), IDR 1,450/l (June 2001), IDR 1,810/l (March 2003), IDR 2,400/l (March 2005), IDR 4,500/l (October 2005), 6,000/l (June 2008), IDR 5,500/l (1 December 2008), IDR 5,000/l (15 December 2008), IDR 4,500/l (January 2009), and IDR 6,500/l (June 2013). The largest price adjustment was recorded during the 2005 period when it rose by 148% from IDR 1,810/l in January to IDR 4,500/l in October (Dartanto, 2013). It is also worth to note that during this subsidy reform period, the type of fuels being subsidized was also limited. Formerly, there were 5 types of fuels that were subsidized: Gasoline (premium/RON 88), Kerosene, Automotive Diesel Oil (ADO), Industrial Diesel Oil (IDO), and Fuel Oil. Then, in 2001, prices were adjusted to be 50% of the market prices. Finally, in 2005, IDO and fuel oil were excluded from the subsidy. Currently, the 3 types of fuels given a subsidy are: gasoline (premium/RON 88), kerosene, and ADO. The consumer type is also limited to general consumer with restriction for industry using subsidized fuel. However, this kind of price differentiation has made oil smuggling and hoarding more common (Widodo et.al., 2012).

Table 7 Summary of Indonesia's development phases

Period	Indonesia's Development Phases
Old Order	
1956−1965	The Sukarno regime. There is significant government intervention in markets, with Dutch enterprises being nationalized in 1957. Towards its final years, high levels of government spending that are politically determined contribute to serious problems with inflation.
New Order	
1966−1973	The Suharto regime. A period of stabilization, rehabilitation, partial liberalization and economic recovery.
1974−1982	The "Oil Boom." Rapid economic growth takes place and levels of government intervention increase.
1983−1997	Post-Oil Boom. A period of deregulation, renewed liberalization (in reaction to falling oil prices) and rapid export-led growth. During this last phase, commentators (including academic economists) were increasingly concerned about the level of corruption that thrived at all levels of government bureaucracy: KKN (korupsi, kolusi dan nepotisme) practices, as they later became known.
Financial Crisis Period	
1998-1999	Period of Asian financial crisis. Inflations level was very high. Indonesian currency was weaken and government was forced to cut spending which affected fuel subsidies cut. This period was the end of Suharto regime.
Recovery and Subsidy Reform Period	
2000-present	Recovery after Asian financial crisis. Government passed Oil and Gas Law which partly liberalized oil and gas market. Deregulation of fuel price takes place in this period. 5 fuel products were subsidized and then reduced to only 3 fuel products (up until now).

Source: Author's compilations adapted from Thee (2002) in Beaton and Lontoh (2010)

The trend administering subsidized fuels in Indonesia is presented in **figure 4**. Here we can see the fluctuation of prices resulted from government's price correction. The figure also shows Indonesian crude price (ICP) as a reference. Indonesia crude price (ICP) is the Indonesian crude oil price which is based on the moving average spot price of a basket of five internationally traded crudes. At the time of rising international market price, the government was forced to cut subsidies, which resulted in a rising fuel price. From the figure we can see that kerosene gets the biggest subsidy because the difference from its price relative to ICP is the highest. This is due to consumer profile of kerosene that is mainly from the poor household group of the society.

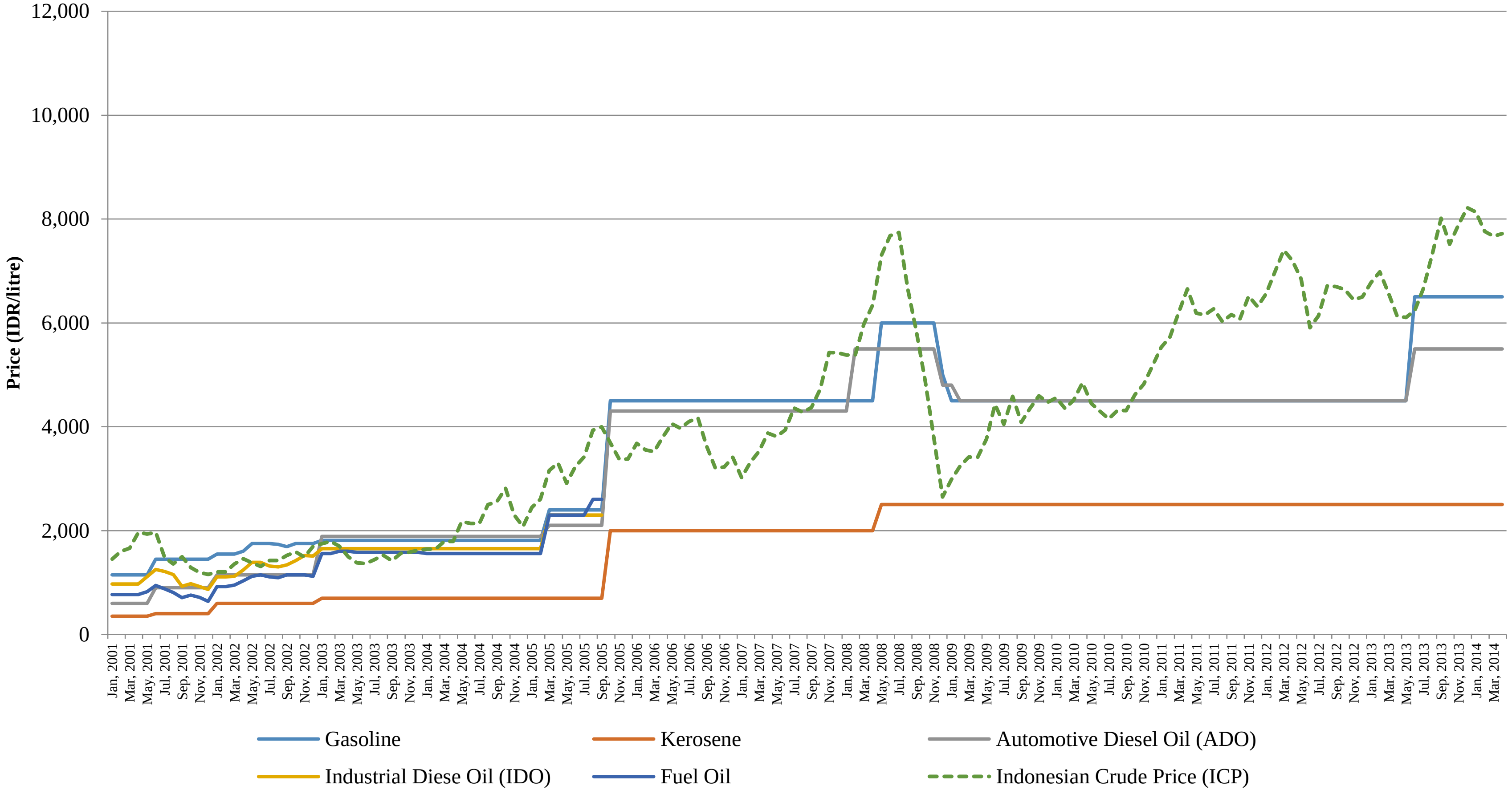


Figure 4 Retail Price of Subsidized Fuels and Indonesian Crude Price (ICP)

Source: Author compilation based on data from Ministry of Mineral Resources and CEIC

2.2.3 Fuel Consumptions Trend

The magnitude of the subsidy is depending on many factors such as Indonesian Crude Price (ICP), exchange rate, and amount of fuel consumptions. **Table 8** illustrates fuel consumption trend in 2003-2011 period. Gasoline and ADO are the most dominant fuels in Indonesia accounting for 51.9 mill m^3or 87% share of fuel consumption in 2011. However, while gasoline consumption was always rising every year, the ADO growth rate was relatively stable with -0.2% annual average growth in the 2006-2011 periods. The huge consumptions of those two petroleum products are determined by the lifestyle of the people. Gasoline is primarily consumed in transportation sectors either in private vehicles or for public transportations. Ministerial law no. 18/2013[4] stipulated that there are 5 sectors allowed to consume gasoline and ADO: micro sectors (small industry), small scale fishery, agriculture sectors, and transportation sectors (private vehicle, public transportation, social service transport), and public services. Because of its importance to the general public and many sectors dependent on those fuels, the magnitude of consumption is huge and has an increasing trend. That is why every time subsidy cut (price increase) was about to be adopted a lot of opposition arises. The derivative effect of cutting out subsidy also exists since those 5 sectors are linked directly with other sectors such as trade and business sectors. The fuel price increase usually followed up by inflation (increase of general price of commodities).

Table 8 Fuel Consumption Trend 2003-2011

Type of Fuel	Fuel Consumptions (million m^3)									Annual Average Growth Rate	
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003-2005	2006-2011
Gasoline	14.2	15.8	17.1	16.4	17.4	19.6	21.4	23.0	25.5	9.7%	7.0%
Kerosene	11.7	11.8	11.3	10.0	9.8	7.9	4.8	2.8	2.0	-1.7%	-23.8%
Automotive Diesel Oil (ADO)	24.0	26.5	27.0	25.0	24.7	27.0	26.7	27.7	26.4	6.2%	-0.2%
Industrial Diesel Oil (IDO)	1.1	1.0	0.9	0.5	0.3	0.1	0.2	0.2	0.1	-9.5%	-19.0%
Fuel Oil	6.2	5.7	4.8	4.8	5.1	4.9	4.5	4.3	3.9	-11.9%	-3.3%
Other	2.5	3.1	2.8	4.0	4.8	4.8	5.7	9.0	12.2	7.2%	29.2%
Total	59.7	64.0	63.9	60.0	61.6	63.7	63.4	66.8	69.6	3.5%	1.5%

Source: Author calculation based on data from Indonesia Energy Statistics 2012

[4] Ministry of Energy and Mineral Resources Law no.18/2013 on Retail Price of specific Fuels for specific use

The short run effect of fuel price increase to the fuel consumptions clearly can be observed from the fuel consumption trend (see **Table 8**). In the late 2005, where the subsidy cut was reaching its highest (148% rise) and by exclusion of 2 fuels (IDO and fuel oil) from subsidy, has made the drastic decrease of fuel consumptions. Total consumptions decreased from 63.9 mill m^3 in 2005 to 60 mill m^3 in 2006 (6.1%). Gasoline consumption declined from 17.1 mill m^3 in 2005 to 16.4 mill m^3 in 2006 (4.1%), kerosene declined from 11.3 mill m^3 to 10 mill m^3 (11.5%), ADO consumption decreased from 27 mill m^3 to 25 mill m^3 (7.4%), IDO decreased from 0.9 mill m^3 to 0.5 mill m^3 (44.4%), and fuel oil shows no significant change of 4.8 mill m^3 in both 2005 and 2006. The government's intention to control oil consumption was partly achieved through the subsidy cut program. Following 2005's price adjustment, 4 fuel products (kerosene, ADO, IDO, and Fuel Oil) show decreasing consumption trends. However, gasoline consumption is still showing a significant growth. This is due to price elasticity of demand of gasoline being the most inelastic among all other types of fuel. Price elasticity of demand of gasoline in the short period is indicating an elasticity level of -0.03 (very inelastic)[5]. It suggests that in the short run, a unit increase in gasoline price will decrease the gasoline demand by 0.03 units. The other fuels however, show higher elasticity value. Kerosene and ADO show elasticity values of -0.062 and -0.058 respectively. It suggests that a unit increase of price will decrease consumptions of kerosene and ADO as much as 0.062 and 0.058.

From all subsidized fuel, kerosene shows the most significant decrease with an annual growth rate of -23.8% for the period 2006-2011. This is achieved through kerosene to LPG program started in 2007. One year after the program (2008) kerosene consumption had decreased 19.4% to the level of 7.9 mill m^3(from 9.8 mill m^3in 2007). It further decreased by 39.2% in 2009 and reached 2 mill $m^3$of consumption in 2011. The program achieved a significant result in reducing kerosene dependency by decreasing its share in total fuel consumptions from 19% in 2005 to 4.7% in 2011. From this fact, we can roughly conclude that the government's fuel substitution program was successfully achieved. Although the policy seems to achieve its target,

[5] Elasticity calculation is for short period elasticity in the period 2005 and 2006

to the extent of our knowledge, the full economic, social, and environmental impacts have not been taken into consideration.

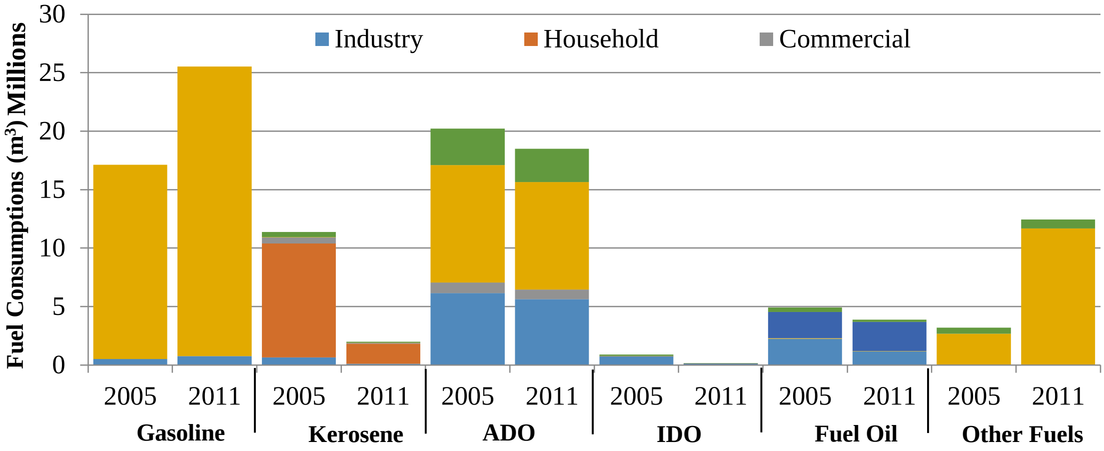


Figure 5 Fuel Consumptions by Sector 2005 and 2011

Source: Author calculations based on data from Indonesian Energy Statistics 2012

To get deeper into the fuel consumption trend related to fuel subsidies, sectoral fuel consumption profiles need to be taken into account. **Figure 5** above illustrates the comparison of sectoral fuel consumption trend of the year 2005 and 2011. The changes in consumption patterns (the magnitude and sectoral use) are easily observable. Gasoline is used mainly for transportation sector with only a small amount used in industry. The consumption of gasoline in 2011 has increased 50% from the year 2005. For kerosene, household sector was the main consumer of this type of fuel while small amounts are used by industry and commercial sectors. Due to kerosene to LPG program started in 2007, the consumption has decreased 82% from 2005's consumptions. ADO, which is the second most consumable fuel, is consumed diversely from all sectors. However, transportation consumption accounts for the highest portion of 50% consumption of ADO in 2011. The rest of consumptions are distributed to industry (30%), commercial (5%), and other sectors (15%). ADO consumptions also had been decrease 2% from the consumptions in 2005. Those three subsidized fuels above are the most important fuels that accounted for 77% of total fuel consumptions in 2011. For non-subsidized fuel, in 2011, other fuel usage was increased 6 times higher than it was in 2005. Most of the other fuel consumptions are through transportation sectors. This is happening through the increment of bio fuels productions and growth of aviation industry.

2.2.4 Magnitude of Subsidy

The magnitude of fuel subsidy is directly related with world crude oil price. Indonesia crude price (ICP) is the Indonesian crude oil price which is based on the moving average spot price of a basket of five internationally traded crudes. **Figure 6** illustrates budgetary expenditure for subsidy in 2005-2012 incorporated with the ICP level. Energy subsidies (electricity and fuel) were by far the largest subsidy allocation. To be specific, most of the subsidies were intended for fuel subsidy. That is why the allocation of subsidy is related with the ICP level. As shown in **Figure 6**, the rise of ICP, simultaneously increases the expenditure for subsidy. It is also true when the ICP drops, the subsidy level also decreases.

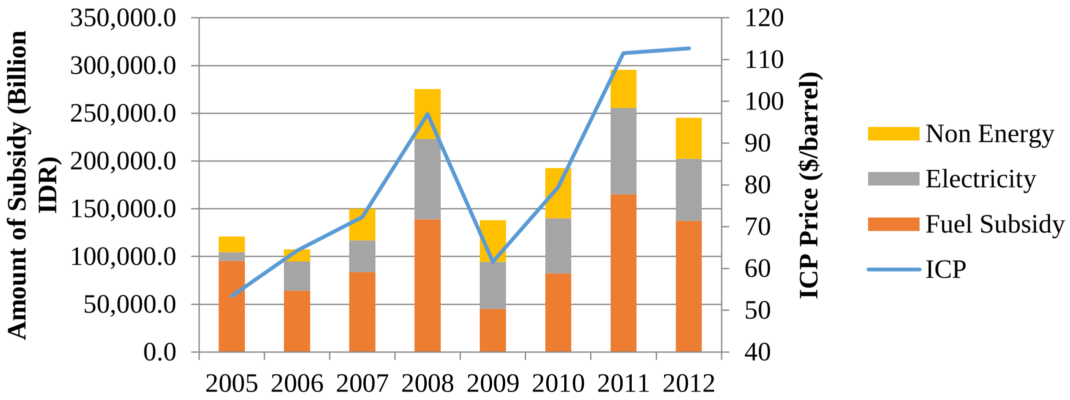


Figure 6 Indonesian Subsidy Expenditure 2005-2012 (ICP: Indonesian crude price)
Source: based on state budget statistics 2005-2011 and state budget statistics 2007-2013

To get a more comprehensive picture of the magnitude of fuel subsidies, the absolute value of fuel subsidy is presented in **Table 9**. During the period 2005-2012, the highest fuel subsidy expenditure was happening in 2011 reaching 165,161.3 billion IDR (real value), while the lowest occurred in 2009 reaching 45,039 billion IDR. However, in order to see its effect on the budget, the absolute value of the subsidy is not too much in use. We can see it by its share on the budget expenditure or its share of GDP. The highest burden of fuel subsidy on the budget is in 2005 when it reached 18.8% of total expenditure, while the lowest was in 2009 (4.8%). In 2012, the government of

Indonesia spent 137,379.8 billion IDR or 1.7% of GDP for fuel subsidy. That amount of subsidy is higher than government spending on education, health, and social security combined.

Table 9 Magnitude of Fuel Subsidy

Items	2005	2006	2007	2008	2009	2010	2011	2012
Fuel Subsidy (billions IDR)	95,598	64,212	83,792	139,106	45,039	82,351	165,161	137,379
Percent of GDP	3.4%	1.9%	2.1%	2.8%	0.8%	1.3%	2.2%	1.7%
Percent of budget expenditure	18.8%	9.6%	11.1%	14.1%	4.8%	7.9%	12.8%	8.9%
Parameter **Average ICP ($/barrel)**	53.4	64.3	72.3	97	61.6	79.4	111.5	112.7
Average Exchange Rate (IDR/$)	9,751	9,141	9,164	9,757	10,354	10,078	8,773	9,419

Source: based on state budget statistics 2005-2011 and state budget statistics 2007-2013

In the coming years, the challenge of the right fuel subsidy policy is more urgent. The high volatility of global crude oil price makes it hard for the government to set the level of fuel subsidies. The fuel subsidies will become more of a burden and will disturb fiscal sustainability that threatened the economic stability of the country.

2.2.5 The need to Deregulate Fuel Price: Wrongly Targeted Subsidy

Previously we have discussed the fuel subsidy development, its objective and its magnitude. The next question should be whether the fuel subsidy is needed by the society, are they beneficial or do they tend to harm the society? Should it be phased out? Should it be kept? This sub-chapter will give an analytical framework to make a decision whether the subsidy needs to be phased out or not. IEA on its Indonesian Energy Policy Review (2008) stated that "Subsidized pricing is a blunt instrument and imposes immense distortions on all of Indonesia's energy sectors: it inhibits and misallocates public and private sector investment, undermines diversification of energy sources and technologies, undermines energy efficiency, reduces enterprises' capacity for environmental compliance, and locks Indonesia into non-sustainable choices".

A subsidy is a government policy that targets social welfare and equality. Subsidies were supposed to target poor household group of the society as clearly stated in Law no. 30/2007[6]. It stipulated that energy subsidies are meant to help less wealthy community to be able to gain access to energy. In order to assess which target groups are most benefited from fuel subsidies, here we present household consumption of fuels divided into its consumption deciles (**Table 10)**. It is clearly seen from **Table 10**, fuel subsidy are mostly received by higher income groups of the society. The poorest 20% (consumption deciles 1 and 2) is a poor household with income less than 164,925 IDR/month, benefited from fuel subsidies as much as 27,197 IDR/month/capita. It is much lower than fuel subsidy benefited by the richest 20% (consumption decile 9 and 10) which benefited 183,564 IDR/month/capita. In other words, the richest income group received almost 7 times more benefits (in economic value) than it was received by the poorest groups in the society.

Table 10 Amount of Fuel Subsidies Received by Household in 2008

Household Group by consumption deciles	**Household expenditure (IDR/Month/capita)**	**Fuel Subsidies received by households (IDR/month/capita)**
1	123,256	10,787
2	164,925	16,410
3	196,632	22,573
4	229,225	27,802
5	265,084	34,436
6	308,761	43,114
7	363,421	52,581
8	440,198	62,975
9	571,048	72,031
10	1,090,754	111,533

Source: Adaptod from Dartanto (2013)

Figure 7 illustrates allocation of fuel subsidy benefits to the society by fuel type. It shows that, in 2008 more than 41% of the gasoline subsidy benefitted the highest income groups. The top 20% of the richest received gasoline subsidies by almost 60%. In the other hand, the bottom 20% groups only received 1.8% of gasoline subsidies. Even if the poor household were counted as the bottom 40 % of the societies, they only received less than 8% of gasoline subsidies.

For the kerosene, the fuel subsidy shares were distributed more equally. Even though the top 20% richest group still gets the highest amount of 26% kerosene subsidies, the bottom 40% group gets only 24% of kerosene subsidies. This fact shows that richer groups tend to consume more gasoline, while poorer groups depend more on kerosene.

[6] Law no.30/2007 on Energy

This is because richer groups own motor vehicles which are very gasoline intensive, and poorer groups rarely own such vehicles. The poor on the other hand, use kerosene for their daily heating and cooking needs.

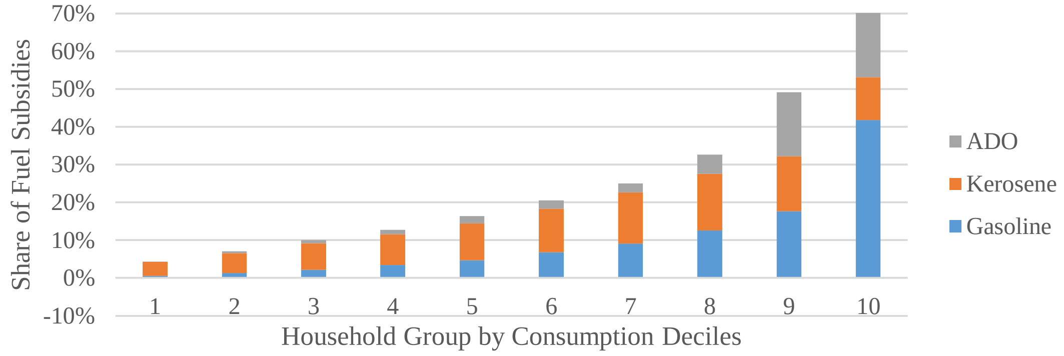


Figure 7 Share of Fuel Subsidies Received by Households in 2008

Source: Author compilation based on Dartanto (2013)

Those facts are similar to government findings. Based on National Social Economic Survey (SUSENAS 2008), 40% richer households get 70% of fuel subsidies while bottom 40% benefit from only 15% of those. However, while the government finds it useful to cut fuel subsidies, the policy itself had more damages to the poorer society. Even though they benefit less from fuel subsidies, they get a hard hit from fuel subsidy price through indirect effects of rising prices of other commodities. The effect of fuel increase in inflation was really clear as shown in **Figure 8**. The fuel price increases (through the reduction of subsidies) have affected the inflation rate. The 2005's drastic subsidy cut has raised inflation to almost 9%. While in contrast, the less drastic subsidies cut in 2008 only resulting in an inflation rate of about 2%. This inflation would affect household's decision on their consumptions. Dartanto (2013) mentioned that the fuel subsidies cut affected household welfare as well as poverty depending on the importance of energy and private transport cost in total household consumption and the fuel intensity on the production of goods and services. He further argues that the poor will then become poorer since they don't have enough savings for consumption smoothing to response the increase of price levels. In addition, Clements et al. (2007) found that, when fuel subsidies cut occurred in 2005, the short run effect was an increase in price levels and a reduced household consumption, particularly affecting the poor. However, in the long run, given the contribution of the subsidy reduction to fiscal sustainability, fuel subsidy reduction will be beneficial for the poor.

2.3 LITERATURE REVIEW

The literature on subsidies and energy subsidy in particular is mainly covering the following subjects: magnitude of subsidy, impact of subsidy to the economy, and impact of subsidy reform. Koplow and Dernbach (2001) summarized different approaches in measuring the magnitude of subsidies. The most common use approach for subsidy measurement is the price-gap approach. Larsen and Shah (1992) and Coady et al. (2010) has used price-gap approach in estimating the magnitude of subsidies. On the other hand, the discussion of energy subsidies impacts is much more on the debate over inefficient subsidies. Subsidy may result in inefficient allocation of resources and may fail to meet its intended objectives. An example of energy subsidies impact analysis is performed by Fattouh and El-Kattiri (2012).They studied the energy subsidies in the Middle East and North Africa region (MENA). The study suggested that, due to energy subsidies, price signals have been disturbed resulting in a misallocation of resources. Subsidies also become a burden to fiscal balance which lead to unsustainable fiscal balance. World Energy Outlook 2012, IEA (2011) mentioned that energy subsidies can make markets more volatile by protecting the parts of the market. In addition, the prospect of higher international prices of fossil fuels will subsequently increase the state budget. For net exporting countries, subsidies could restrict the export by increment of domestic demand that leads to lower export revenue in the long term. In the sustainable development point of views, fossil fuel subsidies in particular would provide wasteful consumption and thus subsequently increase greenhouse gas emissions. Inefficient subsidies are therefore an issue worth dealing with since their elimination can make society as a whole better off. IEA, OECD, and World Bank (2010) summarized several ‘unintended’ effects of subsidies that become the driver of subsidy reform: Create fiscal burden on the state budget, encourage wasteful consumption, exacerbate price-volatility, distort markets, the adverse impact on the environment, encourage fuel adulteration, disproportionately benefit the middle class and the rich, threaten investment in energy infrastructure, and hasten the decline of resources.

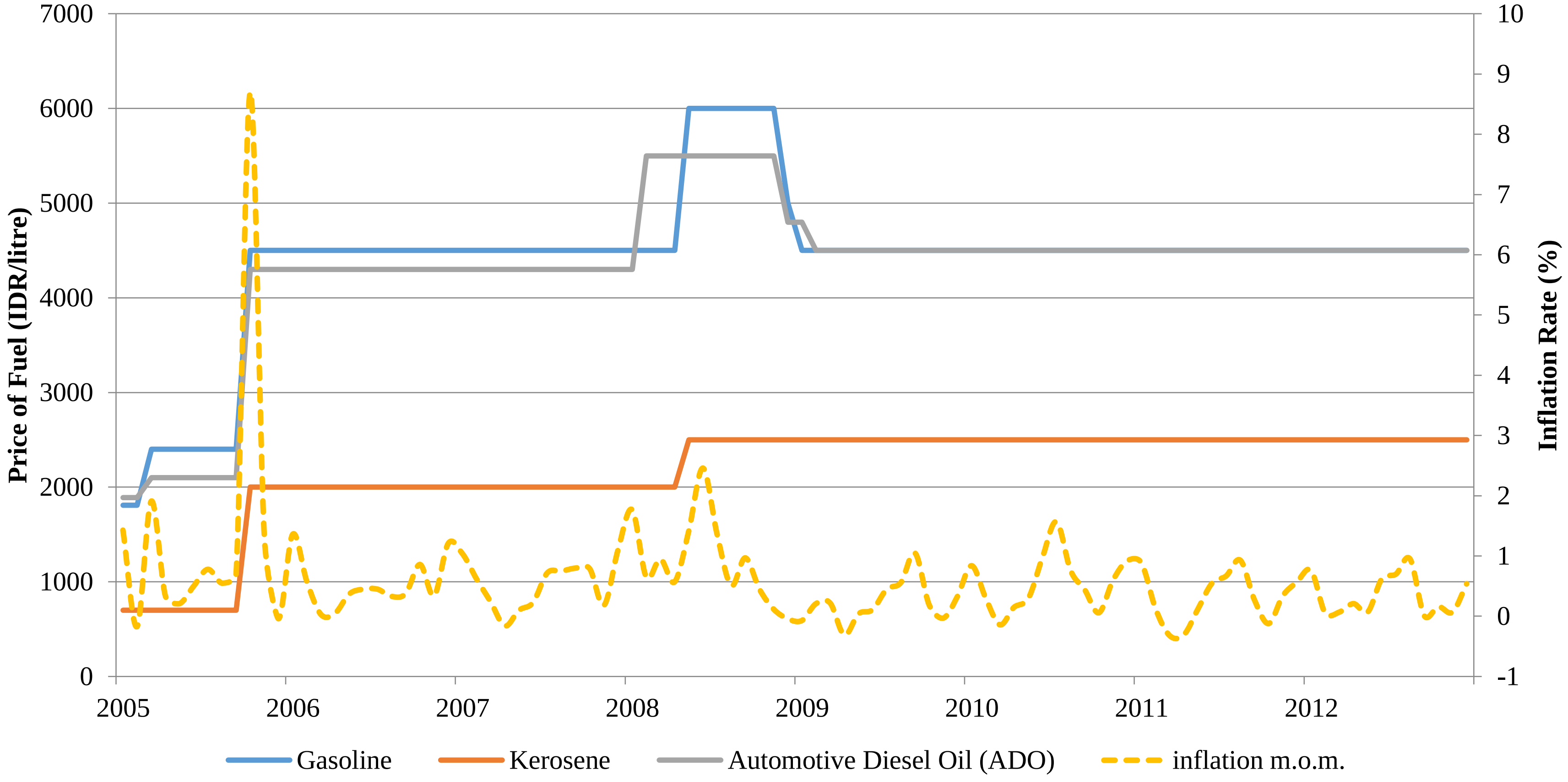


Figure 8 Subsidized Fuel Prices and Inflation 2005-2012

Source: Author calculation based on Indonesian National Statistics (BPS)

Looking at the significant negative effect to the economy, the subsidy reform has become an important agenda for policy makers. The implementation of energy subsidy reform has to be well planned due to its complex relation with various economic actors and the possibility of further harming the economy, welfare of society, and possible environmental impact. Some examples of study on energy subsidies reform impact can be seen in the case of China. Jiang and Tan (2013), Lin and Jiang (2010), and Lin and Li (2012) have estimated the impact of removal of various energy subsidies on the different indicators. Jiang and Tan (2013) found that removal of energy subsidies in China will have the greatest impact on the energy intensive industries that subsequently increase the general price level. Whichever energy subsidies removed, PPI will be mostly affected followed up by GDP deflator and CPI is the least affected. Lin and Jiang (2010) employed CGE model to simulate economic impacts of subsidy reform in China. They found that removing energy subsidies will result in a significant fall in energy demand and emissions, but negatively affect macroeconomic variables. They suggested that several offsetting policies should be pursued that would able to reduce energy intensity and benefiting the environment. Lin and Li (2012) suggested that removal of energy subsidies in China would affect competitiveness, output, welfare, and emissions to other world region in different weight. Subsidy removal would generate positive externalities to other world region without subsidy removal in terms of competitiveness. While for carbon, emissions subsidy removal could also providing a leakage, which other countries without subsidies would tend to consume more energy.

Other notable country examples of subsidy reform impact include are Ogarenko and Hubacek (2013), Birol et.al. (1995), and Siddig et.al. (2013). Ogarenko and Hubacek (2013) studied the impact of energy subsidy removal in Ukraina using IO model. They found that removing energy subsidies would lead a declining of 2.5% and 3.6% in energy consumption and GHG emissions respectively. Birol et. al. (1995) used econometric approach to find out the impact of subsidy removal on energy sectors and oil revenues in Algeria, Iran, and Nigeria. They found that the policy that favors more rational energy use would able to save guard oil to meet future increases in demand while maintaining stability in oil productions. In addition, such policy will further increase the oil revenue. Siddig et.al. (2013) studied the impact of subsidy reform policy on poverty in Nigeria. The results suggest that reduction subsidy will generally increase Nigerian GDP. However, it can have a negative impact on household income, which will hurt poor households the most. The phasing out of subsidy should be conducted along with other policies (e.g. Direct cash transfer, petroleum product stimulus) to alleviate the adverse impact on household income.

The assessment of the subsidy reform impact generally can be done in two ways (Ellis, 2010): (1) Empirical approach and (2) Economic modelling approach. The empirical approach examines countries in which fossil-fuel subsidy reform had already undertaken. While, the economic modelling approach tries to estimate what would happen if fossil-fuel subsidy is removed.

An example of empirical studies on subsidy reform is conducted by Hope and Sigh (1995). They estimate the impact of energy prices increase in six developing countries (Columbia, Ghana, Indonesia, Malaysia, Turkey, and Zimbabwe). The impact is analyzed towards household spending using survey data on household spending patterns. The results show that during the energy price increase, there were no large changes in the consumer index price. In addition, there was a fall in GDP growth rates during the period of subsidy reform, but recovered quickly in the year following reforms. The loss of income happened during the reform period ranging from 1% - 3% with urban poor being affected the most. However, the author noted that it is quite difficult to differentiate the effects of energy price increase from the effects of other policy changes.

For the modelling approach, Ellis (2010) suggests that there are mainly 2 modelling methods that can be used to calculate the impact of subsidy reform: i.e. Partial- and general-equilibrium modelling. For energy subsidy case, the partial-equilibrium model considers changes only in the energy market. It will consider price, demand, and production changes due to subsidy reform based on simple supply-demand curves and economic assumptions (Von Moltke, *et al.,* 2004). However, Widodo, et al. (2012) argues that in the case of Indonesia, the partial-equilibrium model is not suitable to be applied due to the price of fuel is set in some certain level, so the variation in price is not enough for the model to quantify any correlation with demand and production. Partial-equilibrium also does not answer macroeconomic questions and does not consider the relation between the commodities and other production sectors. The general-equilibrium models are required to address these questions.

The general-equilibrium has been used by many researchers to quantify impact of energy subsidy reform policy. Maipita et.al. (2011) for instance, studied the impact of diverting fuel subsidy to agriculture sector on income distribution and poverty using the computable general equilibrium (CGE) analysis. There were 3 different simulations based on different percentage of subsidy reductions. The simulation result shows that 43.2% redistribution of fuel subsidy to agriculture sector will lead to an increase in urban non-poor, rural poor, and rural non-poor. Also, the diverting subsidy will be able to reduce the headcount index of poor households. Dartanto (2013) applied CGE-micro simulation on evaluating the relationship between existing fuel subsidies and fiscal balance and also analyze the poverty impact of fuel subsidy removal. He emphasizes that reducing fuel subsidies and reallocation of it for government spending will able to decrease poverty incidence. Also, he illustrates that 25% fuel subsidy removal will increase poverty by 0.259%. However, if the money were reallocated to government spending, the poverty will decrease by 0.27%.

Another general-equilibrium that can be used for the impact analysis study is SAM model. SAM is an example of general equilibrium that can be further extended into CGE (Widodo et.al., 2012). SAM is also an extended version of IO, thus understanding IO, would make it easier to apply SAM. In this context, a textbook from Miller and Blair (2009) has become a very good reference for IO researchers. The textbook develops the framework set forth by Leontief and explores the many extensions that have been developed over the last nearly three quarters of a century. In addition, it explained about IO framework from its basic concept, application, and extension.

For the SAM analysis context, some notable basic references are found in Breisinger et.al. (2010), Hara (2008), and Parra and Wodon (2008). Those references have nicely explained SAM concept, especially the practical application of SAM model. Breisinger et. al. (2010) introduced a guide to SAM and multiplier analysis. It covers the basic concept of SAM, analysis, and practical example. Food sector in Ghana is used as an example to explain how the exogenous shock will impact the economy from SAM perspective. Hara (2008) similar with Breisinger et. al. (2010) explained SAM as one of the tools to analyze tourism industry by using IO and SAM models. Parra and Wodon (2008) explained the impact of changing food and energy price shock to Ghana economy.

On the subject of fuel subsidy reform, Clements et.al. (2007) used SAM for the impact analysis of higher fuel prices (caused by subsidy reduction) in Indonesia. The indicators were being used are the aggregate price level, real growth, and income distribution. They infer that the reductions of fuel subsidy raises the domestic fuel prices and production costs throughout the economy. Demand, production, income, and purchasing power will decrease as output prices increase. It also shows that the urban household groups will be the most significantly affected by the fuel subsidy reduction. Widodo et.al. (2013) applied SAM approach in analyzing the impacts of fuel subsidy removal on the Indonesian economy. The simulations applied to the model are the complete removal of subsidy and redistribution of fuel subsidy to 4 targeted sectors (i.e. Agriculture sector, trade sector, food, beverages, and tobacco sector, and education and health sector). The study emphasized 3 policy recommendations: first, fuel subsidy removal plan and schedule should be made by the government. Second, adjustable fuel subsidy with the increase of government fiscal policy should be pursued. Third, the targeted fuel subsidy should be considered by the government to overcome the problem of misallocation of subsidy.

In summary, the overall development of the fossil-fuel subsidy studies, mainly agreed to the idea of 'inefficient' fossil-fuel subsidies which then encourages governments to phase-out the subsidy. The studies then become more focused on the analysis of the impact on phasing-out fossil-fuel subsidies. There were abundant studies on the impact of removing subsidies on economic, social, and environmental aspects. However, as Ellis (2010) states, "few studies to date have effectively integrated the assessment of all economic, environmental and social impacts". In addition, the simulation was being performed by most of the studies were generally reallocation of fuel subsidy into non-energy sectors (e.g.Agriculture, food, beverages sector, social and educational sectors, etc.).This is becoming the significance of the study in approaching the issue. The study will fill the gap, where usually researchers only focused on either economic, or social, or environmental aspects of the impact. In addition, the employed methodology (i.e. SAM) will further add to the richness of the literature on this subject.

CHAPTER 3

METHODOLOGY AND DATA

The chapter serves as methodological framework of the study. The study uses Social Accounting Matrix (SAM hereafter) approach to find out the impacts of several fuel subsidy removal scenarios. The chapter will mainly cover the following issues:

1. Conceptual framework of the study, together with descriptions of selected scenarios.
2. Introduction of Social Accounting Matrix, its relation with Input-Output (IO) table, advantages and limitations.
3. Indonesian SAM description.

3.1 METHODOLOGICAL AND CONCEPTUAL FRAMEWORK

The previous chapter has discussed the fuel subsidy. It specifically tells us how fuel subsidy policy in Indonesia has become a burden to fiscal balance and also how it was miss targeted. Those facts were the main idea behind introduction of new fuel subsidy policy which should be more equitable to the society and provides positive benefits to the economy as a whole. In addition, the future policy needs also to account for its impact to the environment since deriving such energy policy would possibly give a huge impact to the environment.

The conceptual framework of the study is illustrated in **Figure 9**. After the main causes of fuel subsidy ineffectiveness identified, the reform scenarios are then defined. In this study, based on the availability of alternative energy resources, economic structure, and government priorities, we identify 4 scenario options which are:

Scenario #1: 50% fuel subsidy removal, redistributed to gas sector

Scenario #2: 100% fuel subsidy removal, redistributed to gas sector

Scenario #3: 50% fuel subsidy removal, redirected to the poor

Scenario #4: 100% fuel subsidy removal, redirected to the poor

Scenario #1 and #2 serves as sectoral subsidy, by which the amount of fuel subsidy redirected to other potentially more beneficial sector. Gas sector is selected due to the fact that fuel subsidy mostly consumed for transportation sectors and gas subsidy is meant to reduce dependency to fuel with promoting gas as a substitute product. Although coal is also an abundant resource in Indonesia, we disregard it due to its adverse environmental effects. Both coal and renewable resources are not seen as close substitutes for oil. Furthermore, the share of renewables is not expected to increase significantly in the near future. Hence, we choose the gas sector as an alternative to which the subsidy may be redirected.

Scenarios #3 and #4 include a targeted subsidy. As previously discussed, subsidy is a government policy that targets social welfare and equality. It should benefit poorest groups in the society. The scenarios #3 and #4 try to achieve that goal by direct cash injection of subsidy to the poor.

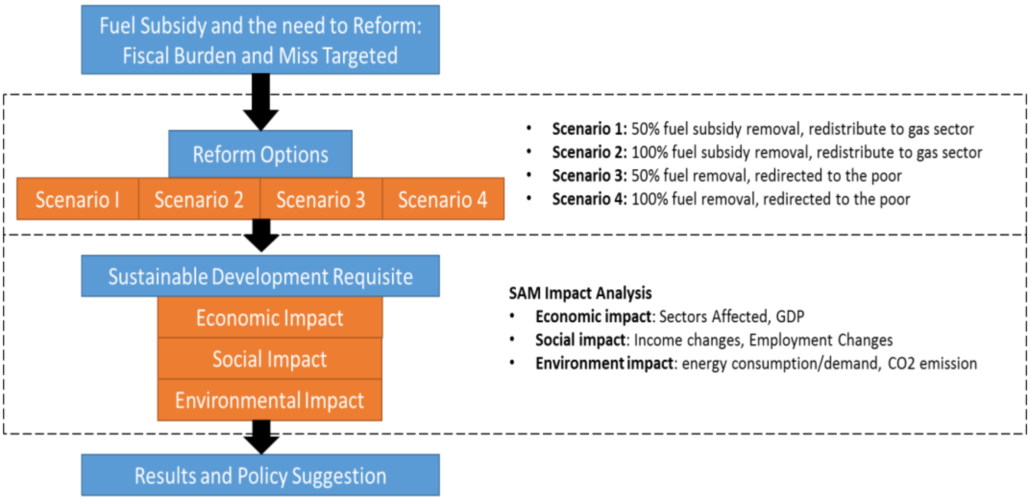


Figure 9 Conceptual Framework of the Study

It has been generally accepted that putting a sustainable development framework to the government policy is something that government should do in order to maintain well-being of its citizens. In order to picture the impacts of defined policies, sustainable development requisites will be given as indicators. The study will simulate the 4 scenarios and see their economic, social, and environmental impacts. For the **economic criterion**, 2 indicators are selected: sectors affected and GDP changes. The given scenarios will have an impact to sectoral output and then later to GDP. From the sectoral point of view, we will learn the impact in sectoral indicators (i.e. which sectors affected by the given scenario) as well as overall output changes. **The social criterion** will be analyzed based on impact to households and employment changes. This criterion is mainly to analyze effect of the policy to the households. Finally, **environmental impact** will be analyzed through 2 indicators: energy consumption/demand changes and CO_2 emission changes. Environmental impact is an important parameter for sustainable development criterion, thus the impact assessment deemed to be necessary. Furthermore, Indonesia will face increasing global pressure as an international agreement is sought to mitigate climate change. The fuel subsidy policy will have a huge impact on the environment, in terms of GHG emissions. The huge consumption of fuel has resulted in enormous GHG emissions that are viewed by many researchers as a main cause of global warming. Furthermore, a report by OECD (2007) described that subsidies have often resulted in vast depletion of natural resources, and more generally, the inefficient use of a scarce and critical resources.

SAM analysis will be utilized as a tool for the impact assessment measures. Based on the results of the analysis, we will compare each scenario to suggest a better fuel subsidy policy. In order to do the analysis, the study adopted methodological workflow from Hara (2008) as shown in **Figure 10**. **First**, Indonesia SAM 2008 data are being prepared by means of reconstruction and extension. The endogenous and exogenous accounts are defined. The oil refinery sector, that includes all sectors producing fuels, is not disaggregated in the 2008 Indonesian SAM. It is included in the Chemical and Cement account. So, Indonesia SAM 2008 is extended to take oil refinery sector out of chemical and cement sector by using data from Indonesia IO 2008. **Secondly**, after the extended SAM 2008 is ready, the standardization is applied. Standardization is calculation of coefficient matrix which is needed for model generation. **Third step**, the simulation is being run by giving an exogenous shock, i.e., changing subsidy policies (based on 4 scenarios that discussed earlier). **Finally**, the results of the simulations will be analyzed to see the subsidy reform policy impacts. The next following sub-chapter will discuss the analytical tool employed (i.e. SAM model), which is focused on SAM models theoretical framework.

Figure 10 Workflow of the Study

3.2 SAM MODELS: INTRODUCTION

The structure of a country's economy can be described by its production of goods and services, income distributions, consumption of commodities, savings and investments. A SAM has been able to illustrate how the flow of economic transactions occur between economic actors.

Social accounting matrix is a data framework arranged in a matrix form that summarizes several social and economic variables. The SAM is also able to give a representation of the economy of a country in a certain time period. It shows interdependent relationships between its social and economic variables. SAM analysis can also serve to analyze economic and social performance in a country or region, e.g., observing GDP performance. It is also able to picture social and economic indicators such as income distribution problems, household consumption structure, etc.

Thus, the main aim of SAM analysis is to see an area's social and economic performance which can be described as below:

1. Analyzing economic development of an area, such as national GDP value and sectoral contribution to it, sectoral economy analysis, its expenditure, income, and value added.
2. Factorial income distribution
3. Household income distribution
4. Sectoral employment distribution

Furthermore, De Anguita (1999) expressed that there are two principle objectives of SAM: first, the organization of information usually about the economic and social structure of a country or region in a specific period of time. When the data is introduced in SAM format, it describes a country's economic structure. Second, SAM is meant to provide statistical basis for employing a plausible model. The main principle of SAM is the same as an IO model. It is containing double entry bookkeeping in which input (income) and output (expenditure) must be balanced.

As a data framework that shows, social-economic condition, SAM has advantages due to its simplicity, compactness, and detailed data delivery within its accounts. In addition, Sudaryadi (2007) expressed that there are at least 3 advantages of SAM based on its model and development process:

1. SAM is a complete, compact, and consistent data system that can capture inter-actors economic dependency within a region.
2. SAM is able to assess government policy impact related to employment, poverty, and income distribution.
3. SAM is a relatively simple analysis tool that is easy to apply.

Due to its advantages, SAM has been used to analyze many government policy to see its impact to economic and society. It also used as a tool for development planning purpose.

3.2.1 Input-Output vs SAM Models

SAM is regarded as an extended version of IO table as noted by Hara (2008), de Anguita (1999), and Akkemik (2011). SAM uses a balanced matrix form, as it is also used in IO table. Nevertheless, SAM covers broader area than IO. IO table shows information on income distribution, household consumption, and labor in aggregate form. That is why the detailed information cannot be shown in IO. Income distribution in IO is displayed in the form of economic sector, not in labor/household form. Thus, the total employment only exists in economic sector without having to know what kind of positions/jobs the employees have. IO table is a statistical description in matrix form that shows transactional activity of goods and service and also explains interdependent relations between each sector in an economy. In short, an IO model focuses only on the production aspects, while a SAM able to model the links between productions, income distribution, and demand (de Anguita, 1999). Parra (2008) remarked that the advantage of SAMs over Input-output tables is that data from household surveys on incomes and consumption patterns can be incorporated into the analysis, so that economic-social relationship can easily be distinguished. Furthermore, de Anguito (1999) explained two basic accounting differences between SAM and IO:

1. In IO tables the expenditures of the intermediate factors of production and the receipts of the industries are accounted only once. The SAM uses a double accounting framework. Value added, institution demands, and import-exports (rest of the world) are accounted both as columns and rows.
2. The lower right quadrant of the expanded IO table should show the flow between primary inputs and final demand. SAM provides a framework to develop this flow as well as all other possible flows among all economic agents.

One of the most important characteristics of SAM is its ability to show complete and consistent information on economic linkage at the level of production and factors, as well as the government, and private sectors (Daryanto & Hafizrianda, 2010). Nevertheless, as an extended version of IO, it follows IO's limitation and assumptions. Those assumptions are homogeneity, no assumption on supply constraints, constant return to scale, and fixed commodity input structure (Hara, 2008).

Homogeneity limits the model such that each sector produces a sole output with the sole input structure. Also, there are no automatic substitutions of input from the different sectoral outputs. However, relatively small changes in the economy or changes in relatively larger economy would create lesser problems when using SAM as an impact analysis tool.

IO and SAM modeling also assumes that the required input is always available without constraints in supply. It means that, supply side will always be able to respond to the changes from demand side, regardless of the scale of the changes. Consequently, the price will be constant (fixed price) and exogenous.

Constant returns to scale assumption means that the link between input and output within sectors is linear. The total input consumed by a specific sector will increase or decrease according to its output increase or decrease value.

Finally, fixed commodity input structure assumption is similar to the constant returns to scale assumption. The ratio of inputs remains the same regardless of changes in price of some items. Suppose that under the simulation the price of domestic rice is increased significantly. The input structure will remain the same as it was in the base period. It disregards the possibility of changes in input structure (an increase in imports for example).

In addition to the limitations above, the study also possesses some constraints which are similar with the constraints in the study by Hartono and Resosudarmo (2007):

1. The method does not address the price issue, while price is an important variable in fuel issues in Indonesia;
2. The SAM model is static in nature, while in real world, the structure changes over time, so the model does not reliable in forecasting for a long-term period;
3. The SAM model assumes fixed Leontief Technology matrix, which shows that technologies are constant from the base year of the model until a new SAM is constructed (usually in 5 year period)

3.2.2 Conceptual Introduction of SAM Table

In order to fully understand SAM model, economic activities concept should be understood. **Figure 11** illustrates the circular flow diagram of the economy. The figure shows how economic activities happen which pictures all transfers and transactions between sectors and institutions. It also shows the key concepts of institutions, production activities, and factor of productions, which are the backbone of constructing SAM.

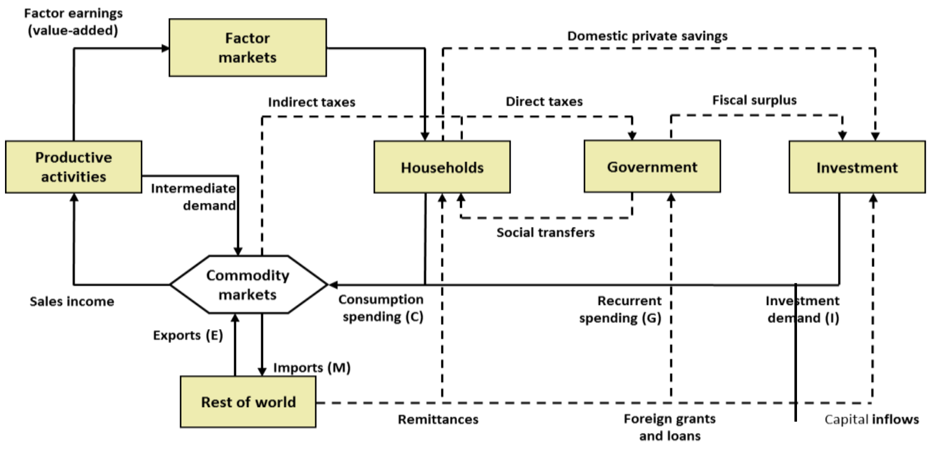


Figure 11 Circular Flow of Economy

Source: Adopted from Breisinger et.al. (2010)

First, let us focus on productive activities. It is where the goods and services are being produced by sectors. The pointing out arrow is a purchase while pointing in means an income. Here, the production activities purchase land, labor, and capital inputs from factor markets and also purchase commodity inputs (as a material for production) from commodity markets. The productive activities eventually will receive an income through the output product they sell in commodity markets.

The commodity markets get income through intermediate demand, consumption spending (C), recurrent spending (G), investment demand (I), and exports (E). While its expenses are through sales income, imports (M), and taxes. The factor market which is factor earnings from production activities is supplementing household to form a household income. Here, we can see that each institution's expenditure becomes other's income. Another example we can see from the government account. Government purchases commodities in the commodity market which accordingly provides an income for production activities to continue their production. Afterwards, Government will also generate income through taxes through buying-selling activities in the commodity markets, ensure that the circular flow of income is closed. In short, all income and expenditure flows are accounted for and there are no leakages (Breisinger et.al., 2010)

3.2.3 Basic Structure of SAM

Basic structure of SAM is 4x4 matrices which are based on consolidated balance sheets of economic actors. It describes monetary flows from variety of economic transactions. The most common basic structure of SAM can be seen in **Table 11**. We can see that the table shows in a very simple way to describe how the flow of economic transactions are working. As shown in the table, there are mainly 4 accounts, which are:

1. Production activities
2. Production factors
3. Institutions
4. Other accounts

In the production activities account, industries sell and purchase goods and services to form inter-industry transactions. The activities here are indeed the same as described in IO table. Here, industrial sectors received input from others to produce outputs, which then will be sold as intermediate or finished products for final demands.

The production factors are referred to as the exchange market for labor and capital. Just like any other market where there are buyers and sellers, here, the buyers and sellers in the market are labor and capital owners.

Institutions account can be described as several economic entities that are involved in economic activity. The institutions include households, enterprises, and governments. Furthermore, Households usually are classified into groups of mutually distinct socioeconomic levels.

The other accounts are balance sheets consisting of exogenous capital account and the rest of the World (ROW). It distinguishes major types of economic activity such as savings and investment, imports and exports, and indirect tax and subsidies.

Each account holds a column and a row which represent their economic transactions. The columns represent expenditures, while the rows describe income. Cell $T_{3,2}$ for example, is an income of institutions from production factors. Or, it is an expenditure of production factors to institutions. Furthermore, the total expenditures must equal total income, the row sum will equal column sum for the same account.

Table 11 Basic Structure of SAM

		Expenditure				Total
		Production Activities	**Production Factors**	**Institutions**	**Other Accounts**	
Income	**Production Activities**	$T_{1,1}$ Intermediate Demand	$T_{1,2}$	$T_{1,3}$ Final Demand	X_1 Export and Investment	Y_1 total output and demand
	Production Factors	$T_{2,1}$ Value Added to Production Sectors	$T_{2,2}$	$T_{2,3}$	X_2 Production Factor income from other accounts	Y_2 Factorial Income distribution
	Institutions	$T_{3,1}$	$T_{3,2}$ Income allocation to institutions	$T_{3,3}$ Institutional transfer	X_3 Foreign Transfer	Y_3 Institutional Income distribution
	Other Accounts	L_1 Import, Indirect tax	L_2 Income allocation of production factors to foreign	L_3 Saving	L_4 Transfer and other accounts	Y_4 Other Income
Total		Y_1' Total Input and Supply	Y_2' Production factors expenditure	Y_3' Institutions' expenditure	Y_4' Other expenditures	

Each cell in the matrix has its own meaning. As shown in the table, $T_{1,1}$ cell represent an intermediate demand of goods and services. It is an interaction between production activities. It is an economic activity where sectors receive an input from other sectors to produce intermediate goods or to satisfy final demands. $T_{1,3}$ is final demand of goods and services, where commodity from production activities is being purchased by institutions (e.g. households, government). There are also cells with zero value such as in $T_{1,2}$, $T_{2,2}$, $T_{2,3}$ and $T_{3,1}$. It means that no economic activity present at those cells.

3.2.4 SAM Analysis

The SAM analysis is mainly an impact analysis usually used to describe the impact of a given policy on the economy. In addition, analysis of SAM also enables us to examine an external shock's impact on household income distribution in rural and urban area (Iqbal & Siddiqui, 1999). To assess the impact of a shock, some accounts are set as exogenous and the remaining accounts are set as endogenous. The shock given to exogenous accounts result in changes in the incomes or production and consumption levels in the endogenous accounts through a multiplier process. (Akkemik, 2011)

There is no generic formula to define which accounts are set to endogenous and which to set exogenous. However, the endogenous accounts usually consist of production activities (production sectors and commodities), production factors, and institution accounts (usually only household while government account is set as exogenous). The rest of the accounts are set as exogenous accounts. Exogenous accounts usually are accounts which enable us to formulate a policy that gives a shock to the economy (e.g. government policy). Thus, government account is usually set to be exogenous. Other exogenous accounts are variables that we are unable to control (out of reach by the model) such as capital account, indirect tax and subsidies, and rest of the world accounts. An exogenous shock for example, can be an increase in commodity price or it can be in the form of changes in demand due to a given situation.

3.2.5 Mathematical Model of SAM

Let's recall again SAM structure from **Table 11**. Here let us assume that endogenous accounts are production activities, production factors, and institutions, while other accounts being exogenous. Income distributions of endogenous accounts can be mathematically described as below:

Total Output and Demand $Y_1 = T_{1,1} + T_{1,3} + X_1$ (3.1)

Factorial income $Y_2 = T_{2,1} + X_2$ (3.2)

Institutional Income $Y_3 = T_{3,2} + T_{3,3} + X_3$ (3.3)

Expenditure for endogenous accounts can be described as:

Total input and Supply $Y_1' = T_{1,1} + T_{2,1} + L_1$ (3.4)

Production factors' expenditure $Y_2' = T_{3,2} + L_2$ (3.5)

Institutions' Expenditure $Y_3' = T_{1,3} + T_{3,3} + L_3$ (3.6)

Matrix T as a transactional matrix between each endogenous account can be written as:

$$T = \begin{pmatrix} T_{1,1} & 0 & T_{1,3} \\ T_{2,1} & 0 & 0 \\ 0 & T_{3,2} & T_{3,3} \end{pmatrix} \qquad (3.7)$$

As one of sub-matrix in SAM, matrix T can also illustrate income and expenses transactions in the smaller scale (endogenous transactions). If we divided each cells in matrix T by its column total, we can see the share of each account's expenditure. It can be written as:

$$A_{ij} = T_{ij}\ Y_j^{-1} \qquad (3.8)$$

Or

$$T_{ij} = A_{ij}\ Y_j \qquad (3.9)$$

Where:

A_{ij} = ratio of expenditure in row-i , column-j / Coefficient Matrix

T_{ij} = Matrix T in row-i , column-j

Y_j = Total output of row-j

And so, we can translate SAM framework into matrix form as below:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} = \begin{bmatrix} A_{1,1} & 0 & A_{1,3} \\ A_{2,1} & 0 & 0 \\ 0 & A_{3,2} & A_{3,3} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} + \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \qquad (3.10)$$

$$Y \quad = \quad A \quad . \ Y \quad + \quad X \qquad (3.11)$$

The equation is then further simplified in matrix multiplication form:

$$Y = A\ Y + X \qquad (3.12)$$

$$Y – A\ Y = X \qquad (3.13)$$

$$(I - A)\, Y = X \qquad (3.14)$$

$$Y = (I - A)^{-1} X \qquad (3.15)$$

Or

$$Y = M_a X \qquad (3.16)$$

It further can be written as changes of output by the changes of exogenous account.

$$\Delta Y = M_a \Delta X \qquad (3.17)$$

Where:

Y = Total output

ΔY = Total output changes

X = Total exogenous

ΔX = Total exogenous changes

$M_a = (I - A)^{-1}$ = Multiplier Matrix/Total requirement Matrix/Leontieff Inverse Matrix

Multiplier matrix tells us a change of endogenous accounts as M_a which is due to exogenous shock of 1 unit. In other words, every 1 unit changes of exogenous account (X) will subsequently impact endogenous account (Y) as of M_a.

3.3 INDONESIAN SOCIAL ACCOUNTING MATRIX 2008

3.3.1 Basic Framework of Indonesia SAM 2008

The SAM framework offers a flexible tool which can be used in varying levels of analysis. Most of the countries have their own SAMs. However, the structure varies across countries. Husain (2006) expressed that the differences of the structure in each country are in the kinds of classifications applied, the type of sectors, groups and transactions distinguished, the degree of detail, etc. which is guided by the socio-economic structure of that particular country. The way SAM is constructed also depends on data availability and the motivation to construct it. In principle, there is no limit to the fineness of detail; and in practice, both the data and effort available for constructing the SAM impose limitations (King, 1981).

The main data used in the study is Indonesia SAM 2008 which is published by the Indonesian Central Agency of Statistics (BPS, 2011). Every 5 years since 1975, BPS publishes the Indonesian SAM. Many researchers have used these SAMs (e.g. Aziz and Mansury (2003), Bourguignon et al. (2003) and Clements et al.(2007), Hartono and Resosudarmo (2007), and Widodo et.al. (2013)). It indicates the validity and reliability of the SAMs published by BPS.

The basic framework of SAM Indonesia, in accordance with basic SAM's framework, includes 4 main accounts, namely: production activity accounts, production factors account, institution accounts, and exogenous accounts consisting capital and rest of the world (ROW). Those accounts bring together the structure of production, income generation by factors of production, distribution of income by institutions in return for factor services, consumption of wants (i.e. final consumption items) by households, savings and investment patterns. There are 48 sets of accounts in 5 broad groups: (1) 23 Production sectors, (2) 5 Production factors, (3) 8 Household groups, (4) 2 other institutions, (5) 5 other accounts. The main basis data for SAM 2008 construction are production balance, income and expenditure balance, Input-Output table, gross domestic product, and other secondary data (BPS, 2011).

The complete classification of Indonesia SAM 2008 is defined in **Table 12**. The production accounts composed of 23 sectors which are derived from IO table 2008. Agriculture sector is becoming a guide for production factors and household groups' classification. The high dependency of the sector especially in generating labor force is the reason. The production factors are composed of labor and non-labor (capital). The labor accounts are classified by its skill level whether the labor in working in agriculture or non-agriculture sector.

Table 12 Classification of the Accounts in Indonesia SAM 2008

SAM Accounts	Classifications/ Sub-Accounts
Production Sectors (23)	**Agriculture (5)**
	1) Crop farming, 2) other crop farming, 3) livestock and livestock products, 4) forestry, 5) fishery
	Industry (7)
	1) Coal, metal, and oil mining, 2) other mining industry, 3) food, beverages, and tobacco industry, 4) garment, textile, clothes, and leather industry, 5) wood and wood product industry, 6) paper, printing, transportation tools, metal products, and other, 7) chemical and cement industry
	Utility and Constructions (2)
	1) Electricity, gas, and drinking water , 2) constructions
	Service (9)

Table 12 (continued)

	1) Trade, transportation supporting services, and warehousing, 2) restaurant, 3) hotel, 4) land transport, 5) air, water transport, and communication, 6) bank and insurance, 7) real estate and services, 8) government, defense, education, health, film, and other social, 9) individual service, household, and others
Production Factors (5)	**Labor (4)**
	1) Agriculture, 2) Production, operators of transportation means, unskilled labors, 3) administration, sales, and services, 4) leaders, military, professionals, and technicians
	Capital (1)
Households (8)	**Agriculture (2)**
	1) Agriculture labor, 2) Agriculture entrepreneurs
	Non-Agriculture Rural (3)
	1) Low income 2) Non-Labor force, 3) High income
	Non-Agriculture Urban (3)
	1) Low income 2) Non-Labor force, 3) High income
Other Institutions (2)	**1) Corporations 2) Government**
Other Accounts (5)	**1) Trade margin, 2) Transport margin, 3) Capital Balance, 4) Indirect taxes (subsidies), 5) Rest of the world**

Households sector classification also based on agriculture sector. First, it is defined by which household group working in agriculture sector or non-agriculture sector. Households account is classified into 8 accounts which are defined as follows:

1) Agriculture labor: Agriculture workers who do not own land
2) Agriculture entrepreneur: Agricultural land owners
3) Low income (rural/urban): Rural/Urban non-agricultural households, consisting of small retail store owners, small entrepreneurs, small personal service providers, and clerical and manual workers.
4) Non-Labor Force (rural/urban): Rural/Urban non-agricultural households, consisting of non-labor force and unclassified households.
5) High Income (rural/urban): Rural/Urban non-agricultural households, consisting of managers, technicians, professionals, military officers, teachers, big entrepreneurs, big retail store owners, big personal service providers and skilled clerical workers

The other institutions account captures transactions from corporations and government. Finally, the other account consists of 5 accounts which include capital, indirect tax and subsidy, trade and transport margin, and rest of the world (ROW).

3.3.2 Employment Coefficient

SAM framework is basically using monetary values in its transactions matrix. However, as already discussed in the previous sub-chapter, employment changes will be analyzed for the study. In order to do that, the monetary value should be converted into employment value (physical terms) by using an employment coefficient.

To do this, let's assume "e" as an employment coefficient which is described as total manpower needed per billion IDR of sectoral output. In mathematical form it can be written as follows:

$$e_j = \text{Employment}_j / Y_j \tag{3.18}$$

Where:

Y_j = Total output of sector in row j

Employment_j = Total employment for sector in row-j

e_j= employment coefficient for sector in row-j

The employment coefficient used in the study can be seen in **Table 13**. Here, we assume those employment coefficients will remain constant regardless of changes in sectoral output. The employment impact (changes) then can be assessed by multiplying employment coefficient by each sector's output changes:

$$\Delta\varepsilon_j = \Delta Y_j e_j \tag{3.19}$$

Where:

$\Delta\varepsilon_j$ = Employment impact (changes) for sector in row-j

ΔY_j = Output changes for sector in row-j

Table 13 Employment Coefficient

Production Sectors	**Sector's Output (billion IDR)**	**Total Employment (thousand people)***	**Employment Coefficient (people/billion IDR)**
Agriculture, Hunting, Forestry And Fishing	1,170,309.57	8,726.75	7.46
Mining And Quarrying	692,160.58	625.94	0.90
Food , Beverages And Tobacco	952,513.77	1,180.66	1.24
Garment, Textile, Clothes, And Leather Industry	292,371.06	1,808.16	6.18
Wood And Wood Product Industry	173,145.44	1,538.97	8.89
Paper, Printing, Transportation Tools, Metal Products, And Other Industries	1,246,992.57	2,212.26	1.77
Oil Refinery	507529.0181	58.58991212	0.12
Chemical And Cement Industry	655,172.28	898.78	1.37
Electricity, Gas, And Drinking Water	206,047.02	153.48	0.74
Construction	1,219,988.91	4,450.42	3.65

Table 13 (continued)

Trade, Transportation Supporting Services, And Warehousing	1,013,876.82	3,545.86	3.50
Hotels And Restaurants	324,634.61	1,361.08	4.19
Land Transport	266,367.40	1,252.52	4.70
Air, Water Transport And Communication	326,708.70	835.78	2.56
Bank And Insurance	268,189.98	713.02	2.66
Real Estate And Services	286,491.48	708.93	2.47
Government, Defense, Education, Health, Film, And Other Social Services	493,328.10	8,674.09	17.58
Individual Service, Household, And Others	279,257.25	2,180.79	7.81

Note: * Data obtained from WIOD database (2012)

3.3.3 Environment and Energy Coefficient

In order to see the impact to environment, energy demand and CO_2emissions changes are given as an indicator. To assess those indicators, energy and environment coefficient are required. Calculation of energy and environment coefficients employs the same procedure as the employment coefficient. However, employment total is changed to energy demand and CO_2 emissions for calculating energy coefficient and environmental coefficient respectively. **Table 14 s**hows the coefficient to be used in this study.

Table 14 Energy and Environment Coefficient

Sectors	Sector's Output (billion IDR)	Energy Demand (tJ)*	Energy Coefficient (tJ/billion IDR)	CO_2 Emissions (kt CO_2)*	Environmental Coefficient (ton CO_2/billion IDR)
Agriculture, Hunting, Forestry And Fishing	1,170,309.57	224,662.9	0.19	16,157.38	13.81
Mining And Quarrying	692,160.58	486,923.3	0.70	39,565.92	57.16
Food , Beverages And Tobacco	952,513.77	351,451.2	0.37	7,989.18	8.39
Garment, Textile, Clothes, And Leather Industry	292,371.06	234,992.9	0.80	13,650.51	46.69
Wood And Wood Product Industry	173,145.44	61,425.30	0.35	2,351.33	13.58
Paper, Printing, Transportation Tools, Metal Products, And Other Industries	1,246,992.57	652,174.9	0.52	61,072.82	48.98
Oil Refinery	507,529.02	2,095,704	4.13	3,234.74	6.37
Chemical And Cement Industry	655,172.28	437,809.4	0.67	11,343.12	17.31
Electricity, Gas, And Drinking Water	206,047.02	2,142,594	10.40	103,492.5	502.28
Construction	1,219,988.91	177,698.6	0.15	10,087.56	8.27
Trade, Transportation Supporting Services, And Warehousing	1,013,876.82	122,521.0	0.12	5,565.32	5.49
Hotels And Restaurants	324,634.61	47,469.1	0.15	2,174.22	6.70

Table 14 (continued)

Land Transport	266,367.40	173,578.4	0.65	12,848.41	48.24
Air, Water Transport And Communication	326,708.70	124,074.0	0.38	8,787.93	26.90
Bank And Insurance	268,189.98	4,504.40	0.02	225.35	0.84
Real Estate And Services	286,491.48	26,899.12	0.09	1,013.48	3.54
Government, Defence, Education, Health, Film, And Other Social Services	493,328.10	46,465.54	0.09	2,604.68	5.28
Individual Service, Household, And Others	279,257.25	33,170.29	0.12	1,584.23	5.67
HOUSEHOLDS	3826444.53	2873133	0.75	58,181.45	15.21

Note: * Data obtained from WIOD database (2012)

3.3.4 Brief Analysis of Indonesia SAM 2008

This sub-chapter will discuss the analysis of Indonesia SAM 2008 in brief. Here, the basic economic data from SAM will be utilized and Indonesian economic structure will be depicted. There are 4 main things that will be discussed which notably are: Macro-economic structure of Indonesia, Production structure, household consumption structure, and factorial income structure. For the convenience of the reader, Indonesian SAM 2008 aggregate data is shown in **Table 15**.

Macro-Economic Analysis

SAM can be used as a table that shows several macro-economic indicators such as: GDP at factor cost, GDP at market price, and import-export values. In SAM, GDP at factor cost is shown as total value added to production sectors which is located in the intersection of production sectors column and production factors row. GDP at factor cost for Indonesia in 2008 is 5,156,936 Billion IDR which is composed of 2,692,618 billion IDR Labor value added and 2,464,317 Billion IDR capital value added.

GDP at market price is Institutions' (household, corporation, and government) commodity consumption plus capital and export minus total commodities import. It has resulted 6,473,152 Billion IDR of GDP. Indonesian recurrent fiscal balance for 2008 is 229,473 Billion IDR, which is government's saving (capital). It tells us that the government is running recurrent fiscal surplus since government savings is positive.

Import-export values are shown in commodities expenditure/income from rest of the world account. From the **Table 15** we can see that export earnings of Indonesia reach 1,487,238 Billion IDR, while the import payment was 1,347,756 Billion IDR. We can suggest that in 2008, Indonesia is running a trade surplus of 139,482 Billion IDR worth of commodities.

The information in the SAM has been able to show a number of country's economic indicators. It is also able to reveal country's economic characteristic. In a macro point of view, Indonesian economy is showing positive signs, with a surplus in trade and positive recurrent fiscal surplus.

Production Structure

The production activities are sectoral activities which produce goods and services (commodities) that are later consumed by institutions. The consumption share of commodities is illustrated in **Table 16**. Intermediate consumptions mostly include Paper, Printing, Transportation Tools, Metal Products, and Other Industries sectors which together accounted for 20.41% of total intermediate consumption. Other important sectors for intermediate consumptions are chemical and cement industry (19.77%) in the second place, and coal, metal, and oil mining (8.7%) in the third place. The rest of the sectors accounted for below 7% of total intermediate consumptions. The intermediate consumptions show how a given commodity is consumed by other sectors as intermediate products to create final goods or services.

The household consumption patterns show a different picture. Households mostly consumed products from food, beverages, and tobacco industry that accounts for 22.83% of total household consumptions. The second and third most important commodities for households are from Paper, Printing, Transportation Tools, Metal Products, and Other Industries (11.5%) and Chemical and Cement Industries (9.35%).

Table 15 2008 Indonesian SAM Aggregate (Billion IDR)

			EXPENDITURE												
			Commodities		Production Sectors	Production Factor		Households	Corporations	Government	Trade Transport Margin	Capital Balance	Indirect Taxes (Subsidies)	Rest of the World	TOTAL
			Domestic	Import		Labor	Non-Labor								
			1	2	3	4	5	6	7	8	9	10	11	12	
INCOME	Commodities	Domestic 1			4,190,140			2,973,367		277,090	1,170,980	1,314,139		1,487,238	11,412,955
		Import 2			1,028,009			344,737		17,477		194,691	41,190		1,626,103
	Production Sectors	3	10,175,382										199,702		10,375,084
	Production Factor	Labor 4			2,692,618									1,707	2,694,325
		Non-Labor 5			2,464,317									6,658	2,470,975
	Households	6				2,688,905	788,550	43,365	43,085	199,034				63,506	3,826,445
	Corporations	7					1,591,198	35,164	176,470	89,692				24,177	1,916,702
	Government	8						85,073	650,053	181,676			344,940	2,291	1,264,033
	Trade Transport Margin	9	1,000,473	170,506											1,170,980
	Capital Balance	10						325,444	990,597	229,473					1,545,515
	Indirect Taxes (Subsidies)	11	237,099	107,841						240,891					585,831
	Rest of the World	12		1,347,756		5,420	91,227	19,293	56,497	28,700		36,684			1,585,576
	TOTAL		11,412,954	1,626,103	10,375,084	2,694,325	2,470,975	3,826,445	1,916,702	1,264,033	1,170,980	1,545,515	585,831	1,585,576	

Descriptions:

Endogenous Accounts

Eksogenous Accounts

Source: Modified from BPS (2011)

For the government, 60.83% of government consumption is mostly formed of services sectors which are Government, Defense, Education, Health, Film, and other Social Services sectors. The positive capital balance is shown for construction sector (75.83%) and negative balance on chemical and cement industry (-3.2%). Finally, export products were mainly coming from chemical and cement industry (23.74%), Paper, Printing, Transportation Tools, Metal Products, and Other Industries (23.16%), and coal, metal, and oil mining (16.67%).

Table 16 Sectoral Consumption Shares

Commodities	**Intermediate Consumptions**	**Households Consumptions**	**Government**	**Capital Balance/Investment**	**Export**
Crop Farming	6.68%	8.48%	0.00%	-0.49%	0.06%
Other Crop Farming	3.77%	0.47%	0.02%	0.05%	1.55%
Livestock and Livestock Products	3.45%	5.62%	0.00%	-0.53%	0.04%
Forestry	1.05%	0.20%	0.00%	0.20%	0.03%
Fishery	1.79%	4.66%	0.00%	-0.34%	0.26%
Coal, Metal, and Oil Mining	8.70%	0.00%	0.00%	4.79%	16.67%
Other Mining Industry	2.03%	0.04%	0.00%	0.00%	0.08%
Food, Beverages, and Tobacco Industry	6.85%	22.83%	0.00%	-1.81%	13.82%
Garment, Textile, Clothes, and Leather Industry	2.17%	3.43%	0.51%	0.90%	8.07%
Wood and Wood Product Industry	2.31%	1.17%	0.03%	0.78%	3.14%
Paper, Printing, Transportation Tools, Metal Products, and Other Industries	20.41%	11.50%	6.17%	22.48%	23.16%
Chemical and Cement Industry	19.77%	9.35%	4.83%	-3.20%	23.74%
Electricity, Gas, and Drinking Water	1.58%	1.18%	0.97%	0.00%	0.00%
Construction	1.59%	0.00%	5.82%	75.83%	0.00%
Trade, Transportation Supporting Services, and Warehousing	0.64%	0.15%	0.53%	0.00%	0.36%
Restaurant	0.90%	6.91%	4.65%	0.00%	0.88%
Hotel	0.16%	0.63%	1.09%	0.00%	1.76%
Land Transport	1.62%	2.24%	1.85%	0.00%	0.08%
Air, Water Transport and Communication	2.67%	4.55%	4.23%	0.00%	3.59%
Bank and Insurance	4.11%	1.67%	2.24%	0.00%	0.25%
Real Estate and Services	4.30%	3.06%	1.40%	0.16%	0.94%
Government, Defense, Education, Health, Film, and other Social Services	0.66%	8.29%	60.38%	0.13%	1.45%
Individual Service, Household, and Others	2.78%	3.59%	5.31%	1.04%	0.07%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%

Household Consumption Structure

The household consumption structure shows which goods and services consumed by households. **Figure 12** illustrates the household consumption structure of Indonesia in 2008. In general, all households except agriculture labor (household number 1) spent most of their income for other manufacturing goods. The goods in this category are clothes, furniture, electronics, etc. The agriculture households in contrast, consumed more on food, beverages, and tobacco products that accounts for 30% of their total consumptions. This indicates that agriculture labors, which are the lowest income group from all households, spent their income for their basic needs (i.e. foods). The higher the income level, the lower the share of food, beverage, and tobacco industry output in their expenditures. As indicated in the figure the highest rural and urban income groups (number 5 and 8) only spent 18% and 17% of their income on these products respectively.

The higher income group also tends to save more of their income which is indicated by a higher level of capital spending. Household group number 5 and 8 were able to save 12% and 13% of their income respectively, while the lowest group (number 1) only able to save 5% of their income.

For the sake of the study, here we defined households that will get a direct redistribution of fuel subsidy as household group numbers 1, 3, 4, 6, and 7. The amounts of subsidy to be distributed are equal to their share of income which are 23.6%, 18%, 23%, 13.9%, and 21.6% reallocation of fuel subsidy for household number 1, 3, 4, 6, and 7 respectively.

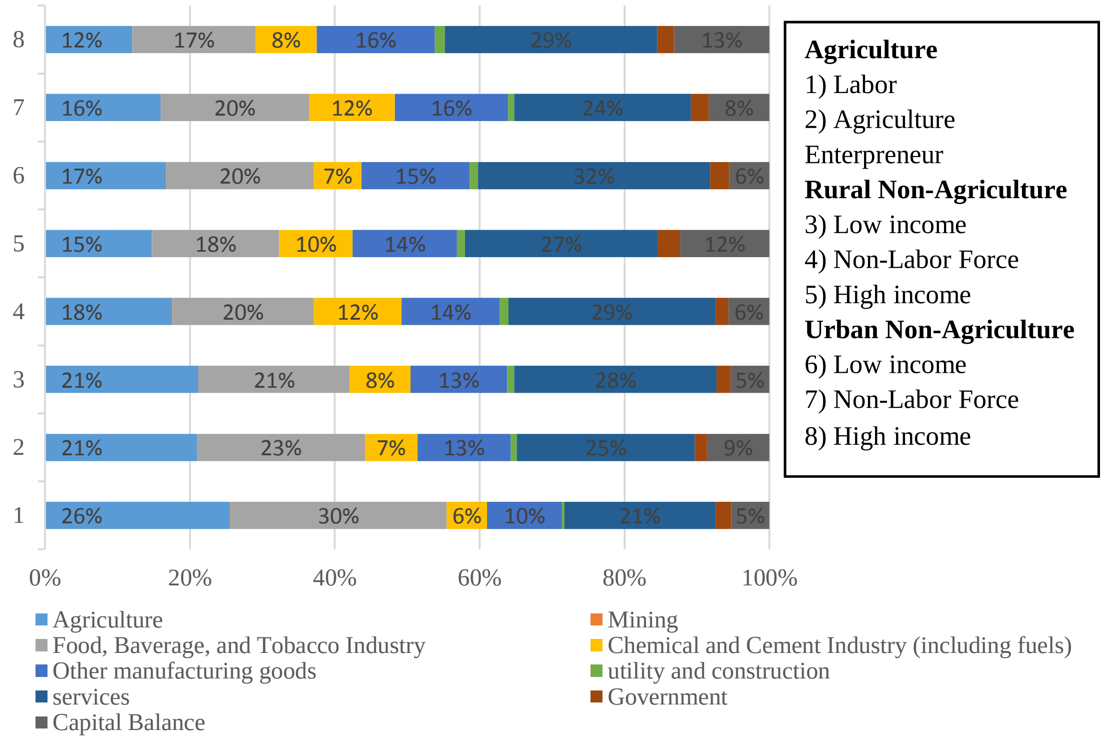


Figure 12 Households Consumption Pattern

Source: Own calculation based on Indonesia SAM 2008

Factorial Income Structure

Factorial income structure of Indonesia for the year 2008 is shown in **Table 17** and **Table 18**. **Table 17** described factorial payment by sectors, while **Table 18** shows factorial payment by factors. In total, as shown in aggregate SAM 2008 (see **Table 15**), labor received 2,692,618 Billion IDR or 52.21% of income received from sectors, while capital received 2,464,317.45 Billion IDR or 47.79%. Labor still receives most of the value added from the sectors, even it is not really much different than capital one. We generally can infer that, Indonesian economy is neither labor intensive, nor capital intensive, or it is in balance state.

Table 17 Factor Payment Structure by Sectors

Sectors	Sectoral Factor Payment (trillion IDR)	Labor				Non-Labor (Capital)
		Agriculture	Production, Operators of Transportation means, Unskilled Labors	Administration, Sales, and Services	Leaders, Military, Professional, and Technicians	
Crop Farming	377.5	93.45%	0.34%	0.28%	0.35%	5.58%
Other Crop Farming	128.8	78.07%	2.17%	1.68%	0.65%	17.45%
Livestock and Livestock Products	129.7	63.94%	2.73%	2.41%	1.43%	29.49%
Forestry	40	29.49%	4.08%	3.25%	1.30%	61.88%
Fishery	134	34.60%	0.97%	1.02%	0.30%	63.11%
Coal, Metal, and Oil Mining	485.9	0.00%	6.02%	4.07%	2.27%	87.64%
Other Mining Industry	63.1	0.00%	64.38%	4.79%	4.88%	25.96%
Food, Beverages, and Tobacco Industry	286.7	0.00%	34.04%	5.86%	2.04%	58.06%
Garment, Textile, Clothes, and Leather Industry	108.7	0.00%	35.64%	5.14%	1.38%	57.84%
Wood and Wood Product Industry	72.1	0.00%	45.85%	2.26%	1.62%	50.27%
Paper, Printing, Transportation Tools, Metal Products, and Other Industries	430.9	0.00%	31.00%	7.31%	3.27%	58.42%
Chemical and Cement Industry	541.3	0.00%	21.96%	5.59%	3.22%	69.23%
Electricity, Gas, and Drinking Water	127.5	0.00%	5.04%	4.73%	3.06%	87.17%
Construction	427.6	0.00%	39.75%	3.55%	3.67%	53.02%
Trade, Transportation Supporting Services, and Warehousing	526.3	0.00%	8.31%	76.66%	2.78%	12.25%
Restaurant	116.1	0.00%	3.65%	84.14%	1.95%	10.25%
Hotel	23.4	0.00%	3.37%	31.97%	4.23%	60.43%
Land Transport	105.9	0.00%	67.05%	13.41%	1.92%	17.62%
Air, Water Transport and Communication	184.9	0.00%	15.12%	18.34%	3.38%	63.17%
Bank and Insurance	174.9	0.00%	1.17%	23.26%	5.95%	69.62%
Real Estate and Services	198.0	0.00%	3.33%	13.20%	6.46%	77.01%
Government, Defense, Education, Health, Film, and other Social Services	330.6	0.00%	6.87%	28.44%	51.25%	13.44%
Individual Service, Household, and Others	141.9	0.00%	19.95%	33.19%	7.51%	39.35%

For sectoral point of view (**Table 17**), crop farming and restaurant sectors are the most labor intensive sectors with more than 90% value-added is allocated to labor. In contrast, coal, metal, and oil mining sectors are the most capital-intensive sectors with 87.64% sectoral payment to capital. This fact is important for government to choose which sectors to develop. For opening more jobs, for example, the wise policy to pursue will be to further develop sectors that can absorb many labor (labor-intensive sectors), rather than the one that needs more capital.

If we look from factors side (**Table 18**), we can learn how important each sector is in generating income for each production factors. For labor factors, Administration, Sales, and services employees received most of the income accounting for 903,717.95 Billion IDR. Most of their income is received from Supporting Services, and Warehousing sector. Agriculture labor on the other hand, only received income from agriculture-related sectors which is crop farming, other crop farming, livestock and livestock products, forestry, and fishery. For Production, Operators of Transportation means, and Unskilled Labors, the distribution are more differs. Most of the income received from construction sector (19.18%). While for Leaders, Military, Professional, and Technicians, they received 55% of their income from Government, Defense, Education, Health, Film, and other Social Services sectors. As for capital formation income, mining and chemical and cement sectors had become the most important sectors accounting for 17.28% and 15.21% of total income received by capital.

Table 18 Factorial Income Shares

Sectors	**Labor**				**Non-Labor (Capital)**
	Agriculture	**Production, Operators of Transportation means, Unskilled Labors**	**Administration, Sales, and Services**	**Leaders, Military, Professional, and Technicians**	
Crop Farming	59.34%	0.15%	0.12%	0.43%	0.85%
Other Crop Farming	16.91%	0.31%	0.24%	0.27%	0.91%
Livestock and Livestock Products	13.96%	0.40%	0.35%	0.60%	1.55%
Forestry	1.99%	0.18%	0.14%	0.17%	1.01%
Fishery	7.80%	0.15%	0.15%	0.13%	3.43%
Coal, Metal, and Oil Mining	0.00%	3.30%	2.19%	3.58%	17.28%
Other Mining Industry	0.00%	4.59%	0.33%	1.00%	0.67%
Food, Beverages, and Tobacco Industry	0.00%	11.01%	1.86%	1.90%	6.76%
Garment, Textile, Clothes, and Leather Industry	0.00%	4.37%	0.62%	0.49%	2.55%
Wood and Wood Product Industry	0.00%	3.73%	0.18%	0.38%	1.47%
Paper, Printing, Transportation Tools, Metal Products, and Other Industries	0.00%	15.08%	3.49%	4.57%	10.22%
Chemical and Cement Industry	0.00%	13.42%	3.35%	5.65%	15.21%
Electricity, Gas, and Drinking Water	0.00%	0.73%	0.67%	1.27%	4.51%
Construction	0.00%	19.18%	1.68%	5.09%	9.20%
Trade, Transportation Supporting Services, and Warehousing	0.00%	4.94%	44.65%	4.75%	2.62%
Restaurant	0.00%	0.48%	10.81%	0.74%	0.48%
Hotel	0.00%	0.09%	0.83%	0.32%	0.58%
Land Transport	0.00%	8.01%	1.57%	0.66%	0.76%

Table 18 (continued)

Air, Water Transport and Communication	0.00%	3.15%	3.75%	2.03%	4.74%
Bank and Insurance	0.00%	0.23%	4.50%	3.38%	4.94%
Real Estate and Services	0.00%	0.74%	2.89%	4.15%	6.19%
Government, Defense, Education, Health, Film, and other Social Services	0.00%	2.56%	10.41%	54.99%	1.80%
Individual Service, Household, and Others	0.00%	3.20%	5.21%	3.46%	2.27%
Total Factor Income (Triillion IDR)	**594.5**	**886.2**	**903.7**	**308. 1**	**2,464.3**

CHAPTER 4

FUEL SUBSIDY REFORM SIMULATION

In this chapter, the results of the simulation will be presented and analyzed. As a review, from previous chapter we have explained the methodology to be used in the study. The methodology included 4 sets of scenario to be run as simulations. Those scenarios are:

Scenario #1: 50% fuel subsidy removal, redistributed to gas sector
Scenario #2: 100% fuel subsidy removal, redistributed to gas sector
Scenario #3: 50% fuel subsidy removal, redirected to the poor
Scenario #4: 100% fuel subsidy removal, redirected to the poor

Here we defined, simulation 1 (Sim 1 hereafter) is a simulation on scenario #1. Sim 2 for simulation on scenario #2, and so on.

Impacts of the scenarios will be analyzed via three main indicators. Those indicators are economic, social, and environmental variables which conform to sustainable development criteria. Each of those indicators have two sub indicators:

- Economic: sectoral output and GDP;
- Social: Income and Employment;
- Environmental: Energy demand and CO_2 emission.

In order to read the Sim 1 & 2 results, one should be careful to interpret. The unsegregated utility sector (electricity, gas, and water sector) might produce over-estimated results. However, the results show good indices on how the reallocation of fuel subsidy to other sectors will affect economy, social, and environmental as a whole.

4.1 ECONOMIC IMPACT

4.1.1 Sectoral Output

Changes in the output in each production sector due to four given scenarios are shown in **Table 19**. The results of simulations as shown in **Table 19** represent the deviations from the base year values. The changes are illustrated both in absolute and percentage changes. The degree of deviations vary among sectors due to different multipliers for each sector. When there is an exogenous shock to the economy, it will result a direct and indirect effect to the whole economy. The multipliers assure, "how much a direct effect is amplified or multiplied by indirect linkage effects" (Breisinger et. al., 2010). The range of impact (i.e. changes of output) for Sim 1 is between -54,492.80 bill IDR (oil refinery sector) to 74,075.51 bill IDR (electricity, gas, and drinking water). For Sim 2 the range is between -108,985.61 bill IDR (oil refinery sector) to 148,151.02 bill IDR (electricity, gas, and drinking water). For Sim 3 -59,508.06 bill IDR (oil refinery sector) to 16,430.65 bill IDR (food, beverages, and tobacco industries). For Sim 4 -119,016.12 bill IDR (oil refinery sector) to 32,861.31 bill IDR (food, beverages, and tobacco industries). The linearity nature of SAM analysis had given doubling impact differences between the 50% subsidy removal (Sim 1 & 3) with 100% subsidy removal (Sim 2 & 4). For example, the output changes of oil refinery from Sim 2 is -108,985.61 bill IDR which is twice as much amount as Sim 1's impact to the same sector (-54,492.80 bill IDR).

From all simulations, oil refinery will encounter the biggest loss of output. It is quite obvious, since the subsidy is intended to benefit oil refinery sector and cutting subsidy will subsequently decrease demand that results in a loss of output. We called such changes as a 'direct impact'. If we compare the sectoral subsidy (Sim 1 & 2) with targeted subsidy (Sim 3 & 4) on their impact to the oil refinery sector, we can infer that sectoral subsidy will have smaller impact on oil refinery sector than those targeted subsidy. In Sim 1 & 2, 10 sectors (out of 24) will encounter a decrease on their output. In contrast, Sim 3 & 4 will decrease 2 sectors only The top 5 sectors that encounter the biggest output loss (in absolute terms) for Sim 1 & 2 is oil refinery, "coal, metal, and oil mining", "food, beverages, and tobacco", crop farming, and Government, Defense, Education, Health, Film, and other Social Services. In the other hand, Sim 3 & 4 will decreases output of oil refinery and "coal, metal, and oil mining". The increase of income for the households will increase their spending on other goods that subsequently increases their output. However, coal, metal, and oil mining were the sectors ‘less’ consumed by households. The sector also has a high degree of dependency to the oil refinery sector. Thus, the sector will have a loss to their output.

From the sectoral beneficiary point of view, Sim 3 & 4 will give a positive output change to more sectors than by Sim 1 & 2. Only 14 sectors will be positively affected in Sim 1 & 2, while in Sim 3 & 4, 22 sectors will be positively affected. In relative terms, Sim 1 & 2 will give a boost to output mostly in “electricity, gas, and drinking water” sector with 36% and 72% output increase respectively. The increases are due to redistribution of subsidy to that particular sector. This is also regarded as a direct impact of reallocation of fuel subsidy to that sector. On the other hand, crop farming will be the sector getting the most output increase by 2% for Sim 3 and by 4% for Sim 4. The other sector that got the most benefit is “food, beverages, and tobacco” sectors that got 1.9% and 3.9% output increase for Sim 3 and Sim 4 respectively.

From earlier analysis, we can draw that Sim 3 & 4 will have a better impact on the sectors in the sense that more sectors positively affected and lesser sectors negatively affected from the removal of fuel subsidy. However, if we look at the overall sectors, the aggregate value of output changes is shown negative for Sim 3 & 4, while Sim 1 & 2 surprisingly showing a positive output changes. In aggregate, Sim 1 & 2 will give an increase of output as 13,657.04 (0.13% output increase) and 27,314.08 bill IDR (0.26% output increase) respectively. Sim 3 & 4 in contrast, will give an overall output decrease of 708.16 (0.007% output decrease) and 1,416.31 bill IDR (0.014% output decrease) respectively. The overall increase that happens in Sim 1 & 2 is due to the fact that Sim 1 & 2 are a sectoral subsidy by which fuel subsidy is being reallocated to another sector (gas sector). The boost increase in gas sector will compensate the loss in many other sectors that results in aggregate increases of sectoral output. On the other hand, sectors’ output increase in Sim 3 & 4 is not able to compensate the huge loss of output in oil refinery and mining sectors.

Table 19 Sectoral Output Changes

Production Sector	Initial Value (billion IDR)	Sim 1		Sim 2		Sim 3		Sim 4	
		Changes	**%**	**Changes**	**%**	**Changes**	**%**	**Changes**	**%**
Crop Farming	468,256.54	-90.86	-0.019%	-181.73	-0.039%	9,379.96	2.003%	18,759.92	4.006%
Other Crop Farming	202,251.11	13.73	0.007%	27.46	0.014%	2,676.83	1.324%	5,353.65	2.647%
Livestock and Livestock Products	265,105.49	-48.48	-0.018%	-96.95	-0.037%	5,075.46	1.915%	10,150.93	3.829%
Forestry	52,221.85	8.59	0.016%	17.18	0.033%	213.52	0.409%	427.03	0.818%
Fishery	182,474.58	-30.40	-0.017%	-60.81	-0.033%	3,563.71	1.953%	7,127.42	3.906%
Coal, Metal, and Oil Mining	610,107.14	-8,085.09	-1.325%	-16,170.18	-2.650%	-15,272.21	-2.503%	-30,544.42	-5.006%
Other Mining Industry	82,053.44	26.56	0.032%	53.13	0.065%	128.49	0.157%	256.99	0.313%
Food, Beverages, and Tobacco Industry	952,513.77	-141.60	-0.015%	-283.20	-0.030%	16,430.65	1.725%	32,861.31	3.450%
Garment, Textile, Clothes, and Leather Industry	292,371.06	-13.25	-0.005%	-26.51	-0.009%	2,686.40	0.919%	5,372.79	1.838%
Wood and Wood Product Industry	173,145.44	17.37	0.010%	34.73	0.020%	683.10	0.395%	1,366.19	0.789%
Paper, Printing, Transportation Tools, Metal Products, and Other Industries	1,246,992.57	677.38	0.054%	1,354.75	0.109%	6,076.36	0.487%	12,152.72	0.975%
Oil Refinery	507,529.02	-54,492.80	-10.737%	-108,985.61	-21.474%	-59,508.06	-11.725%	-119,016.12	-23.450%
Chemical and Cement Industry	655,172.28	531.75	0.081%	1,063.50	0.162%	5,348.12	0.816%	10,696.23	1.633%
Electricity, Gas, and Drinking Water	206,047.02	74,075.51	35.951%	148,151.02	71.902%	988.74	0.480%	1,977.47	0.960%
Construction	1,219,988.91	332.93	0.027%	665.86	0.055%	254.52	0.021%	509.03	0.042%
Trade, Transportation Supporting Services, and Warehousing	1,013,876.82	4.26	0.000%	8.53	0.001%	270.05	0.027%	540.10	0.053%
Restaurant	285,031.99	-28.01	-0.010%	-56.02	-0.020%	3,970.57	1.393%	7,941.14	2.786%
Hotel	39,602.62	6.79	0.017%	13.58	0.034%	299.15	0.755%	598.29	1.511%
Land Transport	266,367.40	22.52	0.008%	45.03	0.017%	1,850.75	0.695%	3,701.51	1.390%
Air, Water Transport and Communication	326,708.70	31.80	0.010%	63.59	0.019%	2,153.91	0.659%	4,307.82	1.319%
Bank and Insurance	268,189.98	347.69	0.130%	695.38	0.259%	1,440.28	0.537%	2,880.57	1.074%
Real Estate and Services	286,491.48	547.55	0.191%	1,095.09	0.382%	1,906.88	0.666%	3,813.77	1.331%
Government, Defense, Education, Health, Film, and other Social Services	493,328.10	-49.10	-0.010%	-98.21	-0.020%	6,235.85	1.264%	12,471.69	2.528%
Individual Service, Household, and Others	279,257.25	-7.78	-0.003%	-15.56	-0.006%	2,438.83	0.873%	4,877.65	1.747%
Total	**10,375,084.56**	**13,657.04**	**0.132%**	**27,314.08**	**0.263%**	**-708.16**	**-0.007%**	**-1,416.31**	**-0.014%**

4.1.2 Value Added/GDP Impact

As discussed in the previous chapter, the total income of factors of production (i.e. labor and capital) can be interpreted as a value added income or GDP at factor cost. The changes in value added/GDP at factor cost owing to 4 subsidy removal simulations are shown in **Table 20**. The results of the simulations shows that in aggregate, Sim 1 & 2 will increase GDP by 0.08% (4,217 bill IDR) and 0.16% (8,435 bill IDR) respectively. Sim 3 & 4 in contrast, will encounter a decrease of GDP as much as 0.29% (14,794 bill IDR) and 0.57% (29,589 bill IDR). The reason for the results are related to sectoral changes. The overall increase of output from Sim 1 & 2 has caused the value added to rise. Simultaneously, the output decrease from Sim 3 & 4 has resulted in a decrease of value added as well. A value added which is income received by factors of production will increase when output had increased. It is also valid vice versa.

From the labor point of view, for the Sim 1 & 2, the most positive affect will be to "Leaders, Military, Professional, and Technicians". They will receive 0.14% and 0.29% increase of income for Sim 1 & 2 respectively. For the Sim 3 & 4, due to huge boost of sector output from agriculture sectors, the agriculture labors will get the most increase of income by 1.84% (Sim 3) and 3.68% (Sim 4). Labor groups those affected at most from the removal of subsidy is "Production, Operators of Transportation means, and Unskilled Workers". They will have a decrease in their factors income from all simulations. The reason for this is because this particular group is the one related most to oil refinery sector which got the direct effects of subsidy removal.

For the capital formation, Sim 1 & 2 showing positive impacts while Sim 3 & 4 show negative impacts. Sim 1 & 2 will increase capital formation as of 0.28% and 0.57%. In contrast, Sim 3 & 4 will have a negative capital formation of 1.12% and 2.25%.

Table 20 Value Added Changes

Production Factor		Initial Value (triillion IDR)	Sim 1		Sim 2		Sim 3		Sim 4	
			Changes (trillion IDR)	%	Changes (trillion IDR)	%	Changes (trillion IDR)	%	Changes (trillion IDR)	%
Labor	Agriculture	594.5	-0.08	-0.01%	-0.17	-0.03%	10.94	1.84%	21.88	3.68%
	Production, Operators of Transportation means, Unskilled Labors	886.6	-3.72	-0.42%	-7.45	-0.84%	-2.12	-0.24%	-4.24	-0.48%
	Administration, Sales, and Services	904.4	0.55	0.06%	1.09	0.12%	2.53	0.28%	5.07	0.56%
	Leaders, Military, Professional, and Technicians	308.8	0.44	0.14%	0.88	0.29%	1.63	0.53%	3.27	1.06%
Non-Labor (Capital)		2,471.0	7.04	0.28%	14.07	0.57%	-27.79	-1.12%	-55.57	-2.25%
Total		**5,165.3**	**4.22**	**0.08%**	**8.44**	**0.16%**	**-14.79**	**-0.29%**	**-29.59**	**-0.57%**

4.2 SOCIAL IMPACT

4.2.1 Income Impact

Household income is derived from factors of production, which then transferred its income to the households. **Table 21** displayed the results of simulations to the household income. It is found that the impact of fuel removal simulations on household income varies. Sim 1 & 2 generally resulted in a reduction in household income levels for all groups except high income households (both in rural and urban). The reduction of income is due to the fact that many sectors perform negative sectoral output resulting in a decrease in income received by households. Agriculture households (labor and land owner) get a decrease of income through the agriculture sectors' negative output. The low income and non-labor households are affected by any other negative output sectors which dependent on their income generation. We can also incorporate this argument by looking at the value added changes results. Low income households are generally the ones who work as "Production, Operators of Transportation means, Unskilled Workers". Thus, the negative value for "Production, Operators of Transportation means, Unskilled Labors" can be incorporated with the negative value of household income for low income households. The same evident also applied for agriculture workers.

On the other hand, high income households get the most benefit from the reallocation of fuel subsidy to gas subsidy that increases their household income level. The fact that high income households control more resources in the “electricity, gas, and water distribution” sector is the cause of their income increase. In addition, high income households generally work as “Administration, Sales, and Services and/or Leaders, Military, Professional, and Technicians”. Those workers are showing positive impact from Sim 1 & 2.

The targeted subsidy simulations as depicted by Sim 3 & 4 show a contrasting picture. All household groups experience increased level of income. Only urban high income households show negative income level changes. The households enjoyed most from this subsidy simulations is agriculture labor and non-labor force (both in rural and urban). Agriculture employees get multiple benefits via increases of agricultural output as well as redistribution of fuel subsidy directly to their pocket. The non-labor force are not affected from the sectoral output rises but they get benefit from the direct subsidy reallocation (direct impact). However, low income labor group is only showing a small increase compared with two other recipients of subsidy (agriculture labors and non-labor households) probably because of a decrease in value added they received. The fact that most of them are working as “Production, Operators of Transportation means, Unskilled Labors” which shows negative impact in the simulation is affecting their income. However, the direct cash injection received by them is able to compensate the loss as shown as increase in their income level. If we see the high income households in urban area, their loss of income is probably due to higher budget they need to spend for gasoline. Most of these household are the one who owns vehicles. Thus, the reductions of fuel subsidy will result in a decrease in their income level.

Table 21 Household Income Changes

Households			**Initial Value (trillion IDR)**	**Sim 1**		**Sim 2**		**Sim 3**		**Sim 4**	
				Changes (trillion IDR)	**%**	**Changes** (trillion IDR)	**%**	**Changes** (trillion IDR)	**%**	**Changes** (trillion IDR)	**%**
Agriculture	Labor		176.8	-0.04	-0.022%	-0.08	-0.045%	17.47	9.886%	34.95	19.772%
	Agriculture Entrepreneurs		731.6	-0.11	-0.016%	-0.23	-0.031%	4.40	0.602%	8.81	1.205%
Non-Agriculture	Rural	Low income	494.2	-0.20	-0.041%	-0.41	-0.082%	12.28	2.486%	24.57	4.971%
		Non Labor Force	173.2	-0.14	-0.080%	-0.28	-0.160%	16.43	9.491%	32.87	18.982%
		High income	468.5	0.14	0.029%	0.27	0.059%	0.90	0.193%	1.81	0.386%
	Urban	Low income	710.5	-0.91	-0.128%	-1.82	-0.256%	8.09	1.139%	16.19	2.279%
		Non Labor Force	243.9	-0.09	-0.039%	-0.19	-0.078%	14.60	5.989%	29.22	11.978%
		High income	827.9	0.80	0.096%	1.59	0.192%	-0.16	-0.019%	-0.31	-0.038%
Total			**3,826.4**	**-0.57**	**-0.015%**	**-1.14**	**-0.030%**	**74.05**	**1.935%**	**148.10**	**3.870%**

Overall, Sim 1 & 2 will result in a decrease of household income level. The aggregate results in Sim 1 shows that households will lose 568 bill IDR of their income or experience a 0.015% income decrease. While for Sim 2 the decrease will be doubled to the level of 1,137 bill IDR or by 0.03%. Sim 3 & 4 on the other hand, show positive income increases. For Sim 3, household income level will increase by 74,050 bill IDR (1.9%) and for Sim 2 the increase will be by 148,101 bill IDR (3.8%).

4.2.2 Employment Impact

The employment impact indicator can show the impact of varying simulations to the availability of jobs. The most important parameters that account for employment impact are sectoral output and employment intensity (employment coefficient). So, the negative changes of output will also result in a decrease in employment. The employment intensity then, will be the important factor to determine the magnitude of employment changes.

Table 22 shows the results of four fuel subsidy removal scenarios to the availability of employment. We can see that the negative employment availability is happening in the sectors that perform a negative output. It is also valid vice versa, with the increase of employment availability occurring in the sectors that show positive output results. The results show that all scenarios will result in a positive employment effect. In aggregate, Sim 1 & 2 will be able to employ further 45,011 people (0.11% increase) and 90,023 people (0.22% increase) respectively. Sim 3 & 4 however will produce more employment. Sim 3 will need 368,482 people (0.9% increase) and Sim 4 will employ 736,963 people (1.8% increase). From here we can draw that targeted subsidy is more effective in generating employment than it is by sectoral subsidy. To analyse the reason behind this, we have to look closer to the sectoral employment results.

From sectoral employment view, the removal of subsidy will hit employment in oil refinery sector badly. The sector obviously will need to lay off their workers as their output also decreases. The sectors that will make the jobs available vary across simulations. Sim 1 & 2 for instance, provide a huge employment availability through the “electricity, gas, and water distribution” sector, which account for 55,178 and 110,356 employment for Sim 1 & 2 respectively. The redistribution of subsidy to the sector has simultaneously increased its output and made the jobs available. Sim 3 & 4 on the other hand, are able to open most jobs in Agriculture, Hunting, Forestry and Fishing sectors. The sectors contributed to 155,918 and 311,835 new jobs for Sim 3 & 4 respectively.

One interesting fact in the employment impact is, sectoral increase of output does not necessarily mean more increase in employment availability. If we see the sectoral output results, Sim 1 & 2 shows positive while Sim 3 & 4 shows negative output changes. However, for the employment impact, Sim 3 & 4 proved to be more beneficial for creating new jobs. The reason behind this is employment intensity. Sim 1 & 2 which gets most of their output increase from "electricity, gas, and water distribution" sector, apparently has relatively small employment intensity. Sim 3 & 4 in comparison, could open more jobs through Agriculture, Hunting, Forestry and Fishing sectors. The sector obviously has high employment intensity properties. The "electricity, gas, and water" distribution sectors' employment intensity is 0.76 people/billion IDR, while "Agriculture, Hunting, Forestry and Fishing" sectors' employment intensity is 7.46 people/billion IDR.

4.3 ENVIRONMENTAL IMPACT

4.3.1 Energy Demand

The changes in energy demand are influenced by sectoral output changes and energy intensity. The additional output will need to be fulfilled sufficiently by additional energy input. Thus, the increase of output will also increase the energy demand. And it is also valid vice versa. **Table 23** shows the energy demand impact from varying simulations. Simulation results are able to show quite distinguished pictures on how energy demand responds to different allocations of subsidy. For sectoral reallocation of subsidy to the gas sector (Sim 1 & 2), it is found that energy demand will increase 5.23% for Sim 1 and 10.47% for Sim 2. The significant increase in the energy demand is due to reallocation of subsidy to the energy intensive sectors. "Electricity, Gas, and water distribution" sectors is the most energy intensive sector with the level of energy intensity of 10.4 tJ/billion IDR. In the first glance, the removal of subsidy will make the energy demand drop due to decrease in the demand for fuels. However, "electricity, gas, and water distribution" sectors' energy demand rise is able to offset the decrease.

Table 22 Employment Changes

Production Sectors	Total Employment (thousand people)	Sim 1		Sim 2		Sim 3		Sim 4	
		Changes (people)	**%**	**Changes (people)**	**%**	**Changes (people)**	**%**	**Changes (people)**	**%**
Agriculture, Hunting, Forestry And Fishing	8,727	-1,099	-0.01%	-2,199	-0.03%	155,918	1.79%	311,835	3.57%
Mining And Quarrying	626	-7,288	-1.16%	-14,575	-2.33%	-13,695	-2.1%	-27,390	-4.3%
Food , Beverages And Tobacco	1,181	-176	-0.01%	-351	-0.03%	20,366	1.72%	40,732	3.45%
Garment, Textile, Clothes, And Leather Industry	1,808	-82	0.00%	-164	-0.01%	16,614	0.92%	33,228	1.84%
Wood And Wood Product Industry	1,539	154	0.01%	309	0.02%	6,072	0.39%	12,143	0.79%
Paper, Printing, Transportation Tools, Metal Products, And Other Industries	2,212	1,202	0.05%	2,403	0.11%	10,780	0.49%	21,560	0.97%
Oil Refinery	59	-6,291	-10.74%	-12,581	-21.47%	-6,870	-11%	-13,739	-23%
Chemical And Cement Industry	899	729	0.08%	1,459	0.16%	7,337	0.82%	14,673	1.63%
Electricity, Gas, And Drinking Water	153	55,178	35.95%	110,356	71.90%	737	0.48%	1,473	0.96%
Construction	4,450	1,215	0.03%	2,429	0.05%	928	0.02%	1,857	0.04%
Trade, Transportation Supporting Services, And Warehousing	3,546	15	0.00%	30	0.00%	944	0.03%	1,889	0.05%
Hotels And Restaurants	1,361	-89	-0.01%	-178	-0.01%	17,901	1.32%	35,803	2.63%
Land Transport	1,253	106	0.01%	212	0.02%	8,703	0.69%	17,405	1.39%
Air, Water Transport And Communication	836	81	0.01%	163	0.02%	5,510	0.66%	11,020	1.32%
Bank And Insurance	713	924	0.13%	1,849	0.26%	3,829	0.54%	7,658	1.07%
Real Estate And Services	709	1,355	0.19%	2,710	0.38%	4,719	0.67%	9,437	1.33%
Government, Defense, Education, Health, Film, And Other Social Services	8,674	-863	-0.01%	-1,727	-0.02%	109,644	1.26%	219,287	2.53%
Individual Service, Household, And Others	2,181	-61	0.00%	-122	-0.01%	19,045	0.87%	38,091	1.75%
Total	**40,926**	**45,011**	**0.11%**	**90,023**	**0.22%**	**368,482**	**0.90%**	**736,963**	**1.8%**

A contrasting picture is found on the results of targeted subsidy (Sim 3 & 4). The reallocation of fuel subsidy to the poor households will decrease overall energy demand. Sim 3 will gives a decrease as of 1.62% (167,464 tJ) while Sim 4 will able to decrease energy demand by 3.25% (334,928 tJ).In these types of policy scenarios, the decrease of energy demand, via direct impact of fuel removal, has able to offset the increase of energy demand from other sectors. As discussed in the earlier sub-chapter, the scenarios will enable many sectors to increase their output. However, the overall output level is negative.

4.3.2 CO_2 Emissions

The CO_2 Emissions changes is shown in **Table 24**. The changes of CO_2 emission is working in the same fashion as it is in energy demand changes. It is influenced by sectoral output changes and sectoral CO_2 emissions intensity. The sector might have an increase for its energy demand but not much increase in CO_2 emissions when the sector has small CO_2 emission intensity value. On the other hand, small increase in output might result a huge increase in CO_2 emissions if its CO_2 emissions intensity is high. The highest CO_2 emission intensity is observed in the energy sectors. Electricity, gas, and water distribution is the most energy intensive sector which emits 502.28 tons of CO_2 emissions/billion IDR. Now, it is become more reasonable when we see the results of the simulations. Sim 1 & 2 which redirecting subsidy to electricity, gas, and water distribution sector will boost overall CO_2 emissions by 10.07% (Sim 1) and 20.13% (Sim 2) from the base value. The significant increase in output (due to subsidy reallocation) and a high CO_2 emission intensity they produce is contributing to the significant increase of the overall CO_2 emissions. The high increase of CO_2 emissions is due to unsegregated gas sector from utility sector (electricity, gas, and water sector). In another picture, the redirecting of fuel subsidy to poor households, as it is performed by Sim 3 & 4, will relatively result in fewer amounts of CO_2 emissions. The reason behind this can be elaborated into 3 factors: (1) the overall sectoral output from the simulation showing negative value, which means a decrease in overall sector output. We would hoping from this decrease will simultaneously decrease CO_2 emissions generated. However, the increase of output in many sectors has resulted in a slight increase in CO_2 emissions. (2) The energy demand value from these 2 simulations shows a negative. (3) Due to increase in their income, the household is showing the most significant increase of their emissions. In these simulations, households have become the determinant factor accounting for overall increase in CO_2 emissions. The households' CO_2 emissions are able to off-set the decrease that is happening in oil refinery sector.

Table 23 Energy Demand Changes

Sectors	Energy Demand (tJ)	Sim 1		Sim 2		Sim 3		Sim 4	
		Demand Changes (tJ)	**%**	**Demand Changes (tJ)**	**%**	**Demand Changes (tJ)**	**%**	**Demand Changes (tJ)**	**%**
Agriculture, Hunting, Forestry And Fishing	224,662.94	-28.30	-0.01%	-56.60	-0.03%	4,013.97	1.79%	8,027.94	3.57%
Mining And Quarrying	486,923.34	-5,669.04	-1.16%	-11,338.07	-2.33%	-10,653.35	-2.19%	-21,306.70	-4.38%
Food , Beverages And Tobacco	351,451.25	-52.25	-0.01%	-104.49	-0.03%	6,062.46	1.72%	12,124.91	3.45%
Garment, Textile, Clothes, And Leather Industry	234,992.91	-10.65	0.00%	-21.31	-0.01%	2,159.19	0.92%	4,318.38	1.84%
Wood And Wood Product Industry	61,425.30	6.16	0.01%	12.32	0.02%	242.34	0.39%	484.67	0.79%
Paper, Printing, Transportation Tools, Metal Products, And Other Industries	652,174.98	354.27	0.05%	708.53	0.11%	3,177.93	0.49%	6,355.85	0.97%
Oil Refinery	2,095,704.64	-225,013.39	-10.74%	-450,026.78	-21.47%	-245,722.53	-11.73%	-491,445.07	-23.45%
Chemical And Cement Industry	437,809.47	355.34	0.08%	710.67	0.16%	3,573.80	0.82%	7,147.60	1.63%
Electricity, Gas, And Drinking Water	2,142,594.54	770,279.45	35.95%	1,540,558.90	71.90%	10,281.44	0.48%	20,562.89	0.96%
Construction	177,698.60	48.49	0.03%	96.99	0.05%	37.07	0.02%	74.14	0.04%
Trade, Transportation Supporting Services, And Warehousing	122,521.03	0.52	0.00%	1.03	0.00%	32.63	0.03%	65.27	0.05%
Hotels And Restaurants	47,469.11	-3.10	-0.01%	-6.21	-0.01%	624.33	1.32%	1,248.66	2.63%
Land Transport	173,578.48	14.67	0.01%	29.35	0.02%	1,206.04	0.69%	2,412.09	1.39%
Air, Water Transport And Communication	124,074.05	12.08	0.01%	24.15	0.02%	817.99	0.66%	1,635.98	1.32%
Bank And Insurance	4,504.40	5.84	0.13%	11.68	0.26%	24.19	0.54%	48.38	1.07%
Real Estate And Services	26,899.12	51.41	0.19%	102.82	0.38%	179.04	0.67%	358.08	1.33%
Government, Defense, Education, Health, Film, And Other Social Services	46,465.54	-4.62	-0.01%	-9.25	-0.02%	587.34	1.26%	1,174.68	2.53%
Individual Service, Household, And Others	33,170.29	-0.92	0.00%	-1.85	-0.01%	289.68	0.87%	579.37	1.75%
HOUSEHOLDS	2,873,132.91	-427.05	-0.01%	-854.09	-0.03%	55,602.04	1.94%	111,204.08	3.87%
TOTAL	**10,317,252.92**	**539,918.90**	**5.23%**	**1,079,837.8**	**10.47%**	**-167,464.39**	**-1.62%**	**-334,928.79**	**-3.25%**

Table 24 CO_2 Emission Changes

Sectors	CO_2 Emissions (kt CO_2)	Sim 1		Sim 2		Sim 3		Sim 4	
		Changes (tonn CO_2)	%	Changes (tonn CO_2)	%	Changes (tonn CO_2)	%	Changes (tonn CO_2)	%
Agriculture, Hunting, Forestry And Fishing	16,157.38	-2,035.31	-0.01%	-4,070.63	-0.03%	288,677.77	1.79%	577,355.55	3.57%
Mining And Quarrying	39,565.92	-460,648.71	-1.16%	-921,297.42	-2.33%	-865,658.86	-2.19%	-1,731,317.73	-4.38%
Food , Beverages And Tobacco	7,989.18	-1,187.69	-0.01%	-2,375.37	-0.03%	137,811.68	1.72%	275,623.35	3.45%
Garment, Textile, Clothes, And Leather Industry	13,650.51	-618.83	0.00%	-1,237.65	-0.01%	125,425.14	0.92%	250,850.28	1.84%
Wood And Wood Product Industry	2,351.33	235.85	0.01%	471.70	0.02%	9,276.51	0.39%	18,553.03	0.79%
Paper, Printing, Transportation Tools, Metal Products, And Other Industries	61,072.82	33,175.29	0.05%	66,350.58	0.11%	297,596.27	0.49%	595,192.53	0.97%
Oil Refinery	3,234.74	-347,309.85	-10.74%	-694,619.71	-21.47%	-379,274.57	-11.73%	-758,549.15	-23.45%
Chemical And Cement Industry	11,343.12	9,206.31	0.08%	18,412.62	0.16%	92,592.94	0.82%	185,185.88	1.63%
Electricity, Gas, And Drinking Water	103,492.51	37,206,364.01	35.95%	74,412,728.03	71.90%	496,618.63	0.48%	993,237.27	0.96%
Construction	10,087.56	2,752.86	0.03%	5,505.72	0.05%	2,104.49	0.02%	4,208.98	0.04%
Trade, Transportation Supporting Services, And Warehousing	5,565.32	23.41	0.00%	46.82	0.00%	1,482.34	0.03%	2,964.68	0.05%
Hotels And Restaurants	2,174.22	-142.12	-0.01%	-284.24	-0.01%	28,596.15	1.32%	57,192.29	2.63%
Land Transport	12,848.41	1,086.15	0.01%	2,172.29	0.02%	89,272.37	0.69%	178,544.74	1.39%
Air, Water Transport And Communication	8,787.93	855.28	0.01%	1,710.57	0.02%	57,936.60	0.66%	115,873.20	1.32%
Bank And Insurance	225.35	292.14	0.13%	584.29	0.26%	1,210.19	0.54%	2,420.38	1.07%
Real Estate And Services	1,013.48	1,936.98	0.19%	3,873.96	0.38%	6,745.72	0.67%	13,491.44	1.33%
Government, Defense, Education, Health, Film, And Other Social Services	2,604.68	-259.26	-0.01%	-518.52	-0.02%	32,924.07	1.26%	65,848.15	2.53%
Individual Service, Household, And Others	1,584.23	-44.14	0.00%	-88.28	-0.01%	13,835.46	0.87%	27,670.92	1.75%
HOUSEHOLDS	58,181.45	-8,647.76	-0.01%	-17,295.52	-0.03%	1,125,951.26	1.94%	2,251,902.52	3.87%
TOTAL	**361,930**	**36,435,034.62**	**10.07%**	**72,870,069.23**	**20.13%**	**1,563,124.15**	**0.43%**	**3,126,248.31**	**0.86%**

CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 SUMMARY

In summary, the study has been able to simulate different fuel subsidy removal scenario and see their impact on economic, social, and environment. There are four scenarios being simulated which are:

Scenario #1: 50% fuel subsidy removal, redistributed to gas sector

Scenario #2: 100% fuel subsidy removal, redistributed to gas sector

Scenario #3: 50% fuel subsidy removal, redirected to the poor

Scenario #4: 100% fuel subsidy removal, redirected to the poor

The scenario #1 and #2 are regarded as sectoral subsidy reallocation, by-which the fuel subsidy is reallocate to other energy sector (i.e. gas sector). The scenario #3 and #4 in contrast, are a targeted subsidy, which is reallocation of fuel subsidy to the poor households.

The simulations show varying results as shown in **Table 25**. In addition, **Figure 13** illustrates the simulation results in the diagram. For economic indicators, we can infer that either sectoral or targeted reallocation of subsidy will give no significant changes to the economy. Sectoral reallocation of subsidy can slightly improve sectoral output as of 0.13% and 0.26% for Sim 1 and 2 respectively. The value added also increases by 0.08% (Sim 1) and 0.16% (Sim 2). Targeted subsidy in contrast, will result in a slight decrease in both sectoral output and GDP. From these scenarios, sectoral output will decrease 0.0068% (Sim 3) and 0.0137% (Sim 4). In addition, GDP will get a 0.29% and 0.57% decrease for Sim 3 and 4 respectively.

For the social impact perspective, two indicators have been analyzed. The first one, employment,increasein all the simulations. While the other indicator, household income, shows a decrease for sectoral subsidy (Sim 1 & 2) and positive in targeted subsidy (Sim 3 & 4).

The increase in employment is 0.11%, 0.22%, 0.9%, and 1.8% for Sim 1, SIm 2, Sim 3, and Sim 4 respectively. For the income effect, sectoral subsidy will slightly decrease household income by 0.01% (Sim 1) and 0.03% (Sim 2). In contrast, targeted subsidy will provide increase in income by 1.94% and 3.87% for Sim 3 and 4 respectively.

Environmental indicators also have shown diverse results in all simulations. The sectoral subsidy will increase energy demand and CO_2 emission quite significant. Energy demand shows a 5.23% and 10.47% increase for Sim 1 and 2. While CO_2 emission is estimated to increase by 10.07% (Sim 1) and 20.13% (Sim 3). The targeted subsidy in comparison shows a decrease in energy demand and slight increase in CO_2 emission. During the simulations, energy demand decreases 1.62% (Sim 3) and 3.25% (Sim 4), while CO_2 emissions increase 0.43% (Sim 3) and 0.86& (Sim 4).

The simulation has been able to show various impact from both sectoral and targeted fuel subsidy reallocation. The linear nature of SAM model has made the doubling effect on reallocation of 50% and 100% of fuel subsidy. So, it is obvious that the results of Sim 2 and 4 is twice amount of Sim 1 and 3. Sectoral subsidy (Sim 1 and 2) which are a reallocation of 50% and 100% fuel subsidy to gas sector shows a positive improvement in terms of economic indicators (sectoral output and GDP) and employment increase. However, this type of policy would negatively impact households' income and also significant increase in energy demand and CO_2 emissions. This is because, the targeted sectors for reallocation (i.e. gas sector) is an energy and emission intensive sector.

Table 25 Summary of Simulation Results

Indicators	Initial Value	Unit	Sim 1		Sim 2		Sim 3		Sim 4	
			Changes	**%**	**Changes**	**%**	**Changes**	**%**	**Changes**	**%**
Economic Indicators:										
1. Sectoral Output	10,375,084.56	Billion IDR	13,657.04	0.13%	27,314.08	0.26%	-708.16	-0.0068%	-1,416.31	-0.0137%
2. Value Added/ GDP	5,165,300.93	Billion IDR	4,217.56	0.08%	8,435.12	0.16%	-14,794.73	-0.29%	-29,589.45	-0.57%
Social Indicators:										
1. Income Effect	3,826,444.53	Billion IDR	-568.74	-0.01%	-1,137.48	-0.03%	74,050.92	1.94%	148,101.84	3.87%
2. Employment Effect	40,926,077	People	45,011	0.11%	90,023	0.22%	368,482	0.90%	736,963	1.80%
Environmental Indicators:										
1. Energy Demand	10,317,252.92	TJ	539,918.90	5.23%	1,079,837.79	10.47%	-167,464.39	-1.62%	-334,928.79	-3.25%
2. CO2 Emissions	361,930,139.10	Tonn of CO2	36,435,034.62	10.07%	72,870,069.23	20.13%	1,563,124.15	0.43%	3,126,248.31	0.86%

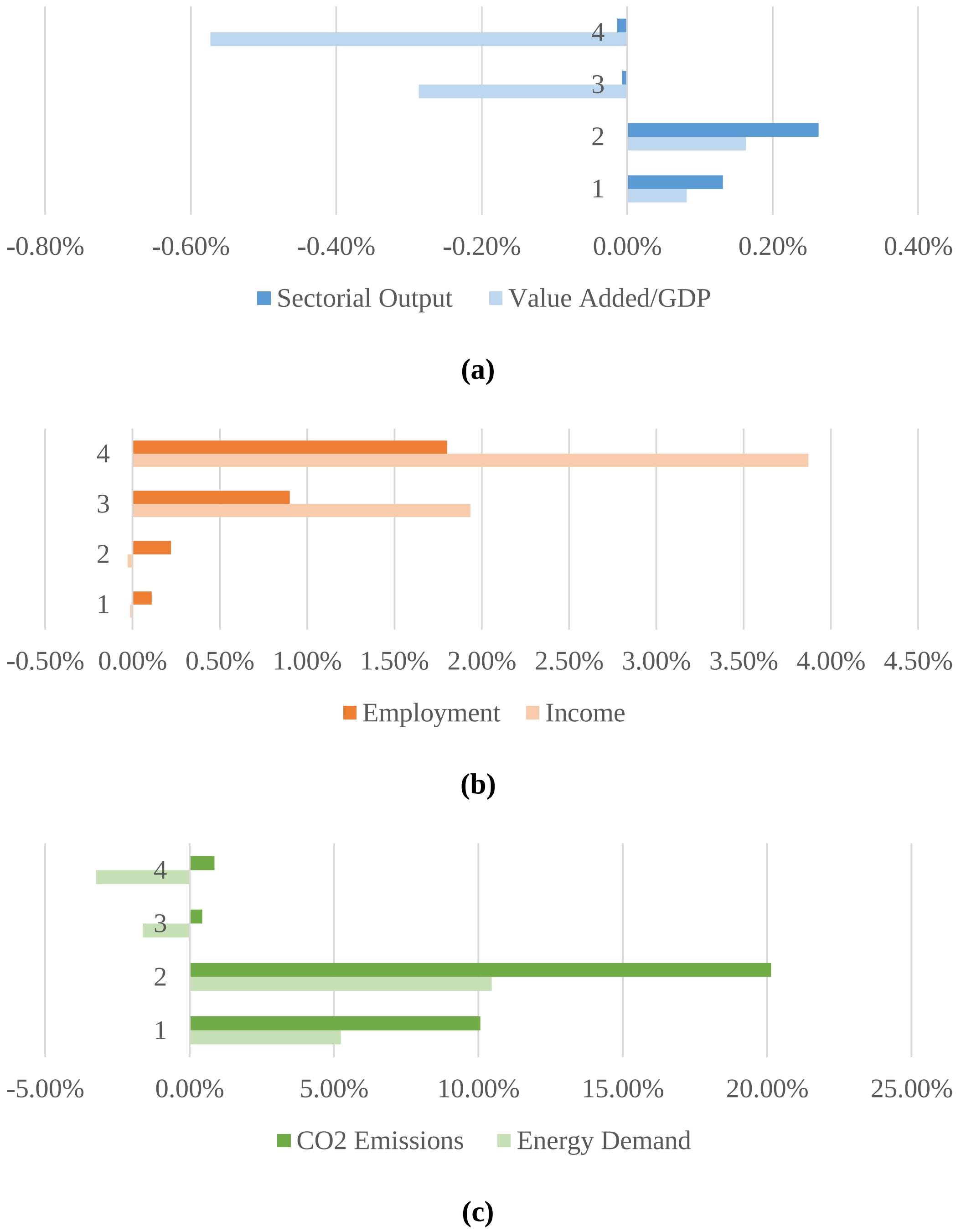


Figure 13 Fuel subsidy reallocation results **(a)** Economic Impact **(b)** Social Impact **(c)** Environmental Impact

5.2 Conclusions

The declining of domestic oil productions and increasing consumptions has made oil become a threat in Indonesian national energy security. Crude petroleum output has fallen by approximately 3% per year, while overall fuel use has increased by almost 4% per year during the last 15 years (OPEC, 2012). Furthermore, oil is ranked first as the primary energy driving the country that accounted for 34% of Indonesian primary energy supply. However, oil is the only energy source that could not be met by domestic production. Oil has also become the only fossil-fuel resource that is subsidized by the government. It is clear that oil has become the main challenge of Indonesian energy security.

Energy subsidies (electricity and fuel) were by far the largest subsidy allocation among all types of subsidies. To be specific, most of the subsidies were intended for fuel subsidy. During the period 2005-2012, the highest fuel subsidy expenditure was happening in 2011 reaching 165,161.3 billion IDR (real value), while the lowest occurred in 2009 reaching 45,039 billion IDR. The highest burden of fuel subsidy on the budget is in 2005 when it reached 3.4% of GDP, while the lowest was in 2009 (0.4% of GDP). In 2012, government of Indonesia spent 137,379.8 billion IDR or 1.7% of GDP for fuel subsidy. That amount of subsidy is higher than government spending on education, health, and social security combined.

The fuel subsidy has not only create a pressure to government budget, but also it is enjoyed mostly by richest group in the society. Based on National Social Economic Survey (SUSENAS 2008), the richest 40% household group gets 70% of fuel subsidies while the poorest 40% benefitted only from 15%.So, it is clear that fuel subsidy needs to be phased out. However, phasing out the fuel subsidy could potentially result in adverse effects in the economy and social development. Thus needs to be carefully planned.

Simulation results

The study estimates the impacts of fuel subsidy in terms of sustainable development indicators from the economic, social, and environmental perspective using Social Accounting Matrix (SAM) model. . The following observations based on simulation results are noteworthy:

1. By using SAM model, the impact of removal fuel subsidy will be linear for the same type of reallocation scenario. The 100% reallocation of fuel subsidy will result a doubling amount of impact that is happening in 50% reallocation.
2. In terms of sectoral subsidy, the reallocation of subsidy to energy sectors (i.e. gas sector) will result in the following observations:
    - economic parameters: sectoral output and GDP increase
    - social parameters: household income decrease, employment increase
    - environmental parameters: energy demand and CO_2 increase
3. In terms of targeted subsidy, the reallocation of subsidy as direct cash transfer to poor households will result in the following observations:
    - economic parameters: sectoral output and GDP decrease
    - social parameters: household income and employment increase
    - environmental parameters: energy demand decrease and CO_2 increase
4. Both sectoral and targeted subsidy will result employment and CO_2 increase. However, the magnitude of the changes is diverse. Sectoral reallocation of fuel subsidies will generate less employment and higher CO_2 emissions than targeted one.

Policy recommendations and Further Studies

Due to the varying results on impact of subsidy removal, it is suggested that government to consider a reallocation scheme of the fuel subsidy by taking economic, social, and environmental impacts into account. Furthermore, the reallocation of subsidy to other energy sectors will positively impact the economy as a whole while deteriorating environment by pushing energy demand and rising CO_2 emissions. The direct reallocation to the poor household in the other hand, will harm the economy but giving boost to social development and less harming the environment. If the government would like to pursue economic development boost, it is suggested that sectoral reallocation of subsidy to be pursued. But, if environment and social benefit is considered most, the targeted subsidy to the poor households is the better policy option.

The study however, lack of information on how the impact of mix reallocation scheme (to sectors and to households). Thus, the simulations taking consideration of mix reallocation schemes could be employed to address further policy options. In addition, due to limitation of available data, gas sector could not be segregated from utility sector. So, the results of reallocation to gas sector might be over-estimated. For further studies, the more detail segregation of sectors is highly advised to achieve more robust results.

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