



# CONTROLLING POLICIES ON FOSSIL FUELS SUBSIDIES TO OVERCOME CLIMATE CHANGE



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## ABSTRACT

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The Indonesian government faces the challenge to provide energy at affordable prices and able to meet national energy needs. Government policies provide energy subsidies to reduce consumer expenses and ease production costs borne by energy producers. However, this adds to the burden of the state and also increases greenhouse gas emissions. Sometimes subsidies are often used as a powerful political program to gain support from the community. This study attempts to review the various literature on energy and environmental policies discussed which will be identified as 'opportunities' that may be adopted by Indonesia, especially from G20 members and others. The policy of controlling energy subsidies should continue to be enhanced and comprehensive, for example, limiting the use of subsidized fuel with direct and closed distribution (learning from India), adjusting subsidized retail prices, and in line with affordable public transport. The use of the degraded land would be more productive to absorb carbon from the atmosphere and generate biofuel energy than the transfer of forest. The government necessary provides substantial subsidies for the development of new energy sources (learning from Russia and the United States) and renewable energy programs, including the construction of pipelines for gas and other energy. The government invites the private and public sectors to engage in the development of renewable energy such as Europe.

**Contribution/Originality:** This documents contribution to provide recommendations on energy policy in Indonesia with several energy policy references in other countries. The recommendation is to limiting the use of subsidized fuel with direct and closed distribution (learning from India), adjusting subsidized retail prices, and in line with affordable public transportation.

## 1. INTRODUCTION

It is, of course, necessary to implement an environmental policy to save lives, but we need to look at this prospect from the perspective of the history of human civilization by using economic considerations. High-quality environmental demands are increasingly pushing the economy to play a role in policies on new standards, licensing, and taxation systems. Building arguments require coherent data and accurate information to predict the impact of an environmental policy. Thus, any environmental policy that has shown little tangible benefits will be increasingly difficult to replace (Hahn, 2000).

Developing a policy takes a long time because it involves the use of various instruments relating to the field of environment and a cost-effectiveness analysis or cost-benefit analysis (Morgenstern and Landy, 1997). Decision-

makers consider these factors before establishing or reforming a policy; they are expected to have a comprehensive picture of the climate policy to be determined. The use of such analysis and instruments has a constructive impact on political activity in terms of policy formulation (Portney, 1998). But there is always an opportunity to abuse this instrument or analysis to serve the interests of certain political groups—this will render the new climate policy ineffective (Hahn, 2000).

Every country faces the challenge of being able to provide energy at an affordable price and meeting national needs. The efforts to maintain energy security and supply chains in international trade require various considerations to develop energy subsidy policies. All subsidy policies should always be reviewed from time to time and reformed to eliminate inefficient energy subsidies and generate high emissions. In addition to evaluating an energy policy, it is necessary to consider the impact of reducing subsidies and fossil fuel supply chains to determine the efficiency of energy subsidy allocations. But every new policy and policy reform issue has consequences, which must be faced in future.

Although a reform will face a long battle, strong coordination and new ideas are incorporated in a new energy policy. The policies since the Kyoto Protocol (Protocol, 1997) and its failures were studied to create a new model with the addition of new information (Schmidt and Radaelli, 2004). Environmental policy failure often occurs due to budget-related and social problems (Petrenko *et al.*, 2016). Policy reforms require the adaptation of the actors involved in fossil fuel and renewable energy to changes in legislation, budgeting, and monitoring of implementation.

At the implementation stage, renewable energy developers and markets can adapt gradually to policy reform. Or is it possible to prevent a reform? Many argue that it is necessary to manipulate market prices through intervention for the success of CAP. Although a model of public goods has been adopted, it is often inconsistent with change agents and contradicts the WTO provisions. When an energy crisis occurs, it will affect other sectors such as agriculture, industry, and the environment. So, an energy policy requires cooperation and support across departments.

High-quality environmental demands are not in line with increasingly polluting by energy emission. Consumption of fossil fuels to generate electricity and fossil fuel production processes is a major cause of global emissions or pollution. Fossil fuel mining activities and electricity distribution systems also contribute substantial emissions. The energy subsidy adopted by many countries encourages the use of more energy sources and increases greenhouse gas emission (Stefanski, 2017). Sometimes energy sources (such as coal, petroleum, and natural gas) are located in forest sites, and exploiting them will invariably threaten the biodiversity and existence of natural forests. The wastes from mining and its energy production process further aggravate the pollution (Central Electricity Authority (CEA), 2015).

## 2. METHODOLOGY

This study uses a literature review method and descriptive qualitative analysis to provide a written description or an explanation of the findings or research results in the various literatures. The analytical process considers the various government policies implemented by several countries and the findings of previous studies relating to controlling policies on fossil fuels subsidies to overcome climate change. The data for the analysis used in this study is worked on with literature exploration techniques. The materials are collected and processed to be prepared following the flow of systematic discussion.

The author will study various literatures on environmental and energy policies related to energy subsidies, implementation, benefits, policy changes, innovation, emission from fossil fuel consumption, behaviour of users of fossil fuel subsidies, abolition of subsidies, impacts, fuel substitution, mitigation potential, renewable energy, international organizations report, and Nationally Determined Contribution. The environmental policies discussed

in the literature, we will identify 'opportunities' that may be adopted in environmental policy by the Indonesian government.

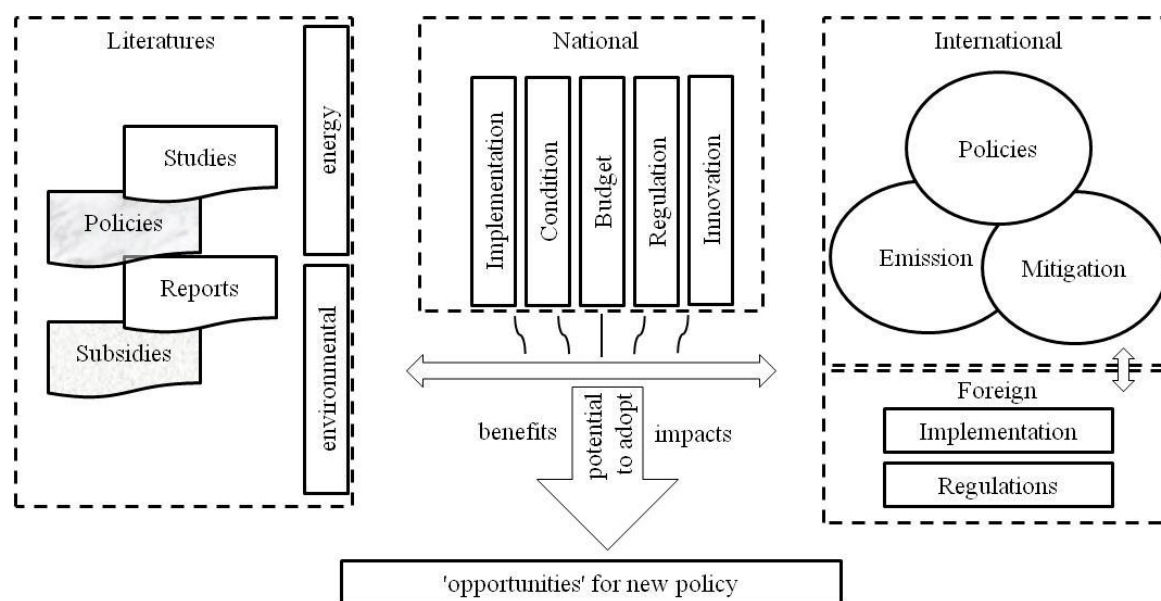


Figure-1. Review process of literature

### 3. A GRADUAL REDUCTION PROGRAMME OF FOSSIL FUEL SUBSIDIES

Every government has an obligation to look after the welfare of its people, including the availability of energy. People from all walks of life, even the poor, have equal rights to gain access to electricity and fuel. The government provides subsidies to reduce the burden on consumers to meet their demand for energy and to alleviate production costs borne by energy producers. The access to energy access is a vital daily need. The provision for subsidies is an attempt to equalize wealth and to maintain price stability against extreme fluctuations. Subsidies are often used as a powerful political programme to gain support from the community as well as an effort to help communities cope with the rising cost of living.

Based on IEA data, the value of subsidies increased 6.1% every year from 2008 to 2013—this means that the volume of consumption increased during that period (Energy Information Administration (EIA), 2014). Later on, the global subsidy for fossil fuels has declined from US\$310 billion in 2015 to US\$260 billion in 2016 due to the decline in world energy prices, especially oil and coal (International Energy Agency (IEA), 2017). So, it can be stated that the government's policy is still not effective in decreasing the volume of users of subsidized fuel because the volume of subsidized fossil fuels is not reduced from 2013–2015 (International Institute for Sustainable Development (IISD), 2015). All G20 members, including Indonesia, India, Russia and the US, committed at the G20 summit on 24–25 September 2009 in Pittsburgh, the US, to removing inefficient fossil fuel subsidies (G20, 2009). According to the Global Subsidies Initiative (GSI), if many countries abolish fossil fuel subsidies, it is estimated that CO<sub>2</sub> emissions reductions would be more than 4% by 2020 (Merrill *et al.*, 2015).

All energy policies, related institutions, and impacts of policy implementation are part of learning. A policy also often undergoes changes in accordance with socio-political conditions and bargaining between interests. Behind the climate policy scenario, decision-makers have different perspectives on economic instruments, social impacts, scientific and technological roles, and government roles. Such differences make it difficult to negotiate and reach a consensus (Leiserowitz *et al.*, 2005). Many countries often experience conflicts between their energy policies and environmental policies during formulation.

It has been found that rather than poor people, those who belong to the middle-income group mostly enjoy the benefits of government subsidies. Thus, more effective subsidies or targeted subsidies will reduce such subsidy in

terms of both volume and value. This will eventually reduce greenhouse gas emission and ensure availability of funds for renewable energy development.

### 3.1. Fossil Fuel and Electricity Subsidies

Many countries provide direct and indirect energy subsidies. Project funding support is a form of direct subsidy, while tax cuts, credit support, or special pricing is a type of indirect subsidy. Energy subsidies in India are budgeted by the central or local government through fiscal transfers or foregone revenue (Global Subsidies Initiative (GSI), 2017). The calculation of fossil fuel subsidies in many countries uses a top-down approach—a gap between the costs incurred to provide energy and the price to be paid by the end consumer. National policies (including taxes, duty exemptions, opportunity costs, etc.), and international policy (phasing out fossil fuel subsidies, emission reducing, etc.) are taken into consideration in shaping traditional incentive-based subsidies and reforming processes. In the following figure, we can see the estimated total subsidy for energy based on the share of GDP (%) by country in the 2016 (IEA, 2017).

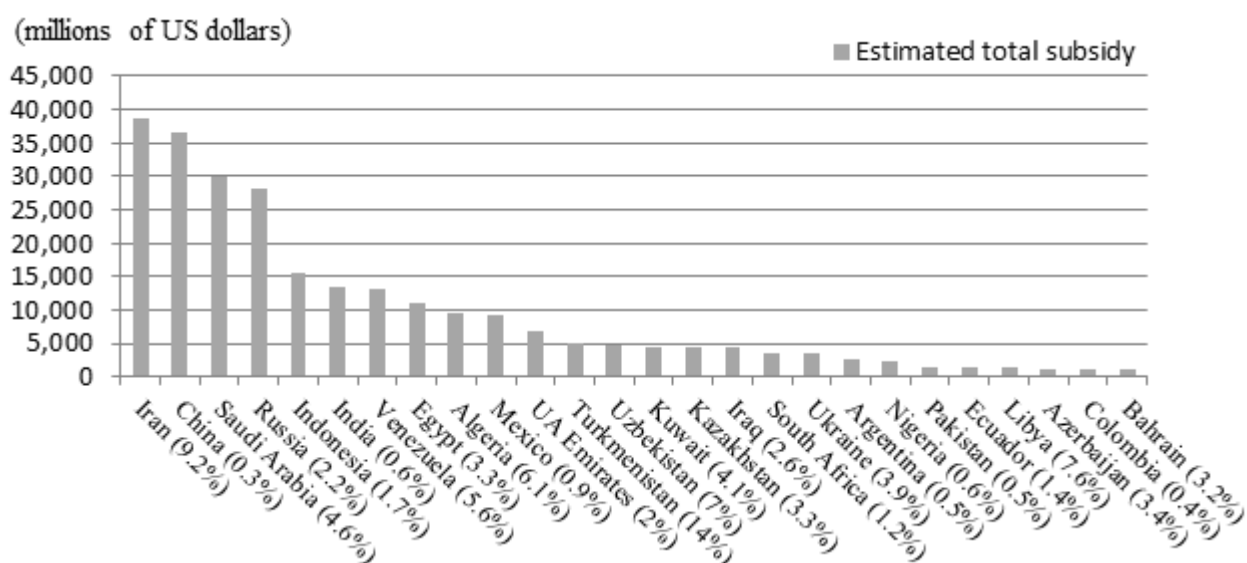


Figure-2. Estimated total subsidies for energy by country

Source: worldbank.org and IEA (2017) reprocessed

Each country's budget allocation for direct and indirect energy subsidy funding is less transparent and estimated to be larger than the data in the table. And the energy sector is often affected by global price fluctuations and slowly follows changes to control the impact of such price increases (Asian Development Bank (ADB), 2016). Based on IEA energy subsidy statistics data in 2016, we can see that the magnitude of each country's energy subsidy for each type of use with the approach of the difference in user price and reference standard price (www.iea.org/statistics/resources/energysubsidies/). However, the data given in the table above does not include the subsidy value of coal, as applied in India. Based on author's literature, describe the implementation of several energy subsidy policies from several countries namely India, Indonesia, Russia, and United State.

#### Case of Subsidy in India

India, which is the seventh largest economy in the world (www.weforum.org) and the second most populous country (worldpopulationreview.com), still subsidizes fossil fuels. The magnitude of energy needs is substantial so as to drive economic growth and improve living standards. And India's government programmes expand access to electricity for 240 million people (IEA, 2015). By 2015, 92% of the national primary energy supply is still sourced

from fossil fuels (BP, 2017). India has some similar conditions with the Indonesian such as high poverty rates, large population, and allocation concentration of government budget for infrastructure and transportation.

The need to import petroleum products and natural gas increases, while domestic production can only meet 20% of the total demand for petroleum and 40% for natural gas. The Indian government provides subsidies for electricity, diesel, kerosene, LPG, Light Speed Diesel (LSD), and natural gas to the community. The gasoline price policy has followed international market prices and every two weeks domestic price adjustment is controlled by the Oil Marketing Company (OMC). And the government only give subsidy very little as the cost of adjusting the price. Based on an Energy and Resources Institute study, 40% of LPG subsidies are enjoyed by rich people. And 60% of diesel subsidies are enjoyed by private vehicle owners. Subsidized kerosene is used for lighting and cooking.

The Indian government determines energy prices and provides energy subsidies in the form of fiscal incentives. Under the type of subsidy, the Indian government subsidized by 2016 customs duty prices for coal production through tax breaks, subsidies for domestic LPG users through direct transfers, electricity subsidies for poor households and agriculture through income allowances and affordable prices, and subsidies for generation of renewable energy through revenue foregone (GSI, 2017). In addition to subsidies for fossil fuels, hydropower and nuclear power are also subsidized. Coal dominates power plants in India, while oil and gas are used for transportation, industrial, household, and power generation purposes. Coal subsidies account for only 9% of the total national subsidies. Government policies remove the inefficient use of energy through budget cuts for petroleum product purchases and petroleum exploration and production (GSI, 2017).

India's energy subsidy trend declined from 2014 (about US\$ 35.8 billion) to 2016 (US\$ 20.4 billion). The largest energy subsidy was allocated to petroleum and gas by about US\$ 26 billion in 2014 and then it declined to US\$ 6.8 billion in 2016. It is predicted that subsidies will continue to fall to US\$ 4.6 billion by 2018. While subsidies for transmission and distribution electricity costs have increased from US\$ 6.7 billion in 2014 to US\$ 9.9 billion in 2016 with the addition of new networks and for the electricity programme in villages for the village electricity programme. Coal subsidies also decreased from US\$ 2.6 billion in 2014 to US\$ 2.3 billion in 2016. However, the trend of subsidized fossil fuel, especially the oil and gas decline, is identified by the decline in global crude oil prices (GSI, 2017). By 2014, India had cut their energy subsidy budget by US\$ 15 billion (IEA, 2015).

#### *Case of Subsidy in Indonesia*

The National Energy Council states that the national oil production is only 50% of the total consumption (1.6 million barrels per day for 2016). And crude oil has not been entirely processed by domestic refineries and thus the dependence on imported products and foreign refineries is still very large. So, fluctuations in global fossil fuel prices often affect the national economy, e.g. in 2013-2015, it has drained the state savings funds of US\$ 57.7 billion (IISD, 2015). But the government continues to slowly reduce fuel and electricity subsidies and monitor the development of community behaviour.

The electricity price is raised gradually so that subsidies can be reduced. Such subsidy reductions are aimed at lower-middle-income or 900 Volt Ampere (4 million household customers) or 450 Volt Ampere (19.1 million household customers). Currently, the government provides subsidies to about 51.2% of the 45.1 million electricity customers in Indonesia. Almost all vehicle users choose subsidized fuel rather than quality fuel at a more expensive price. If subsidies to fuel are reduced, it will raise fuel prices and demand falls, but depending on fuel imports will remain because the national oil refinery will not be able to meet the national minimum requirement of about 72 million kiloliters per year (www.gaikindo.or.id). The stability of the national economy can be undermined if there is a disruption of the supply of fuel for transportation and the industry. Based on the events of 2013, rising gasoline and diesel prices have disrupted the energy supply chain and demonstrations in some areas, although one of the reasons is the weakening of the rupiah.

Learning from experience, the Indonesian government is implementing subsidy reforms with two schemes: setting maximum limits on subsidies and increasing substitution fuel like biofuel, LPG, and CNG. In most fixed subsidy schemes, subsidized fuel prices follow fluctuations in global oil and gas prices. The government is also trying to evaluate several fuel subsidy reduction schemes including the determination of who is eligible for receiving subsidies and their quantities. Several programs are attempted—these include restrictions to the access to fuel based on vehicle classification and vehicle type—that consider the substantial difference between subsidized and non-subsidized fuel prices as well as the planned installation of Radio Frequency Identification (RFID) in vehicles.

This situation is exacerbated by deviations from the use of subsidized fuel for transportation as it is sold illegally to the industry. The government's program replacing gasoline and diesel by gas faces many obstacles—for instance, the supporting infrastructure proves to be inadequate in all regions. And sometimes the decision of the executive is still aligned with direct subsidies rather than renewable energy. As in 2016, the House of Representatives approved a fund of US\$ 1.5 billion for 3 kg of LPG subsidy, while the proposed budget of US\$ 80 million for renewable energy development was rejected.

#### *Case of Subsidy in Russia*

Russia is a developed country, which is the provider of the fourth largest energy subsidy (IEA, 2017). In 2016, the subsidy for fossil fuels reached US\$ 28.2 billion. The world fossil fuel subsidy in 2009 amounted to US\$ 312 billion, while Russian subsidy had a share of 10.9% at the same time. This includes oil and gas subsidies for fossil fuel production companies on the Arctic Sea that have been provided to generate a large number of jobs and make available sufficient electrical energy to meet national needs.

For example, a subsidy of US\$5.75 billion is given to LNG producer Yamal Liquefied Natural Gas, but the company only generates 75.65% return against the subsidy. The government provides credit subsidies to fossil fuel producers—especially thermal, oil, and gas producers—that need loans from US\$ 3 billion to US\$ 8 billion for each project. The energy policy aims to prevent the project from being taken over by foreign parties. In addition, the Russian government also provides subsidies in the form of property tax exemptions and pipelines that are very important for oil and gas.

#### *Case of Subsidy in the United States*

After the Pittsburgh meeting, the US government issued a policy to abolish the preferential tax for oil and gas production in 2010. This policy change affects US producers, consumer prices, and oil and gas securities. The total fuel subsidy reached US\$ 5.5 billion, especially for energy producers in the form of tax breaks (IEA, 2007). The value of US oil and gas subsidies is relatively small compared to some G-20 member countries, while domestic oil and gas producers generate revenues of US\$ 3.4 trillion (EIA, 2008).

### *3.2. The Impact of Subsidies on Fossil Fuels and Electricity*

Based on the knowledge of the impact and trends of subsidies, we know that energy subsidies affect the economy, social welfare, and the environment. Coal subsidies aim to conserve coal mine sites and incentives for power generation in the form of income tax and land acquisition at special rates. And subsidies in the states are aimed at lowering the value added tax (GSI, 2017). Any increase in global fossil fuel prices increases the burden of subsidies borne by the government and the environmental impact becomes negative in terms of government commitments to international agreements to reduce emissions. But the reform of the fuel subsidy that occurred in Thailand and India has become a stimulus of mobile economic activities (ADB, 2016).

The negative impact of fuel subsidies leads to wasteful, rise power needs, inhibits the development of cheaper energy, no funds to develop electricity infrastructure, etc. And the positive impact is the people's purchasing power increase, the growth of small-micro business actors, the growing desire to invest, etc. So if the energy subsidy is

removed then the impact becomes the opposite of the impact when the subsidy is given, such as the increase in freight rates and the price of basic necessities, turns to public transport, fall in real incomes, and society becomes more innovative and pro-environment (IISD, 2015).

Subsidies provided by the government not only affect the state budget, but also the markets and society on a global basis. Providing subsidies will cause distortions in trade and subsidizing fossil fuels will lower prices hence unfavorable for renewable energy development. It is also not fair for people in areas or locations that do not receive subsidies. Inappropriate subsidies actually increase poverty and increase pollutants due to inefficient use of fossil fuels (GSI, 2017).

### *Economic Impact*

Based on economic theory, subsidies can generally reduce the productivity in the long term of each resource and accordingly hamper economic growth (Steenblik, 2005). This will change the investment value down and short and further intensify consumption of energy (Beattie, 2015). By aiding to farmers and small households in the form of electricity subsidies, the Indian government aims to restore utilities with guaranteed energy needs. This also increases the demand. On the other hand, subsidies to electricity producers will decrease energy production costs (GSI, 2017).

In IMF analysis, it has found that fossil fuel subsidies strengthen market externalities associated with climate change (Coady *et al.*, 2015). The estimated removal of post-tax fossil fuel subsidies will increase 2.2% of the global GDP (Cusick, 2015). Thus, subsidies can be likened to a coin with two faces that help as well as harm. Energy subsidies help people have purchasing power and increase productivity in the presence of energy for the short term. In addition, the IMF estimates that for every 25 cent increase in the power price will lower the purchasing power of a weak economy by 5%. Real income can increase by 4.1% for those poor who receive energy subsidies (Anand *et al.*, 2013). Subsidies also cause losses because they will slow economic growth. The condition of high fuel price pressure due to the abolition of subsidies could encourage companies to go for innovation.

### *Social Impact*

In many countries that subsidize consumers, subsidies are more beneficial to the upper middle class than to the poor—this is the case for 87% of electricity subsidies in India. Most poor people use timber or other biomass and thus do not feel the benefits of this energy subsidy (GSI, 2017). However, some experts argue that fossil fuel subsidies lead low energy prices and consumption extravagance so that under these conditions there is almost no chance to invest in renewable energy and undermine efforts to tackle climate change. But energy subsidies can also be used to suppress the rising prices of products. The increase in production costs will cause many businesses to go bankrupt, impacting increasing unemployment and poverty. And this causes social problems in a country.

### *Health Impact*

In the Landrigan's paper found that coal as the largest contributor to air pollution (Landrigan *et al.*, 2018). Air pollution from overall fossil fuels has resulted in the deaths of about 6.5 million people every year it causes illness and directly results in declining productivity and premature death. According to Zulqarnain (2016) health costs of air pollution reach about 3% of India's GDP (Yuliarmi *et al.*, 2015). This value increased considerably compared to that in the year 2011 (around 1.02% of GDP). It is also caused by poor air quality due to sulphur oxide and nitrogen oxide emissions, suspended particulate matter, mercury, soot, and fly ash (Shearer *et al.*, 2017). According to IMF analysis, the total cost of environmental impacts of global energy production and consumption exceeded US\$ 4 trillion by 2015 (Coady *et al.*, 2015).

The use of conventional cooking stoves in India creates a lot of smoke that causes other health problems, especially mothers and children. And by 2015 it is estimated that smoke from the cooking process is the leading

cause of death to reach 50% in India (Landrigan *et al.*, 2018). Thus, LPG subsidies in India have an impact on health through clean cooking processes (GSI, 2017). So, it can be said that energy subsidies, especially LPG, also have a positive impact on future health and disaster costs of climate change. But the poor need more subsidies for education, health, and food. Therefore, it is expected that inefficient energy subsidies can be transferred to these three sectors, as in the case of India and Indonesia.

### 3.3. Reform of Subsidized Oil and Gas Subsidy Policy

Any subsidy reform should follow the key principles of stipulating and depoliticizing the pricing mechanism to gradually apply market prices. In addition, the government should ensure that the impact of reforms is not bad for the community, especially for vulnerable groups, and can be managed with targeted policies. Ideally, oil and electricity materials should be sold at market prices. But in most countries, it cannot be done directly and in no time. In the process, many countries apply the transition into market prices by gradually increasing prices based on the pricing formula. Even after the formula raises the price to the level of market prices, the formula must remain within the dominant price-fixing corridor until the political decision-maker agrees that the market price is acceptable—there is already enough investment to stimulate a competitive market and to properly enforce it.

Many policy reforms are carried out by the government with various considerations—for instance, the Indian government ushers in reforms, such as the policy of reducing the cost of distribution of kerosene and domestic LPG by regulation of Ministry of Petroleum and Natural Gas No. P-20029/18/2001-PP dated 28 January 2003, reduce the volume of coal transported long distances and reduce environmental pollution by Ministry of Environment, Forest and Climate Change No. G.S.R. O2 (E) dated 2 January 2014, etc. In this case, energy policy reforms have led to spiralling inflation, but they also helped to overcome the budget deficit. Owing to high premium prices, the government provides an alternative to the policy of converting premium fuel to gas by using a catalytic converter kit. So, the vehicle can choose the cheaper fuel that will be used. To support this reform, national car manufacturers are also involved in build technology for gas and simultaneously for renewable energy.

The same is also developed in Indonesia with electric cars, but the supporting infrastructure for this programme is minimal and thus the progress of development is rather slow. In addition, fossil fuel subsidies can be diverted for the construction of public and mass transportation infrastructure. Therefore the use of private vehicles can be suppressed, and this may decrease the amount of fuel consumption. It can also be an alternative to a reform programme to lower and slowly remove fuel subsidies for the Indonesian case.

Alternatively, fuel subsidies can be reduced by lowering the oil consumption. For example, the production of automotive industry causes the number of motorcycles and cars to increase rapidly in Indonesia; it is a major factor in overcoming the problem of increasing the realization of fuel subsidies. Governments may adopt policies to impose high progressive taxes on private vehicle ownership in the hope that the number of owned vehicles would be more than necessary. The government also needs to commit to providing adequate, cheap, and convenient public transportation facilities to divert private vehicle use and promote alternative energy (Yuliarmi *et al.*, 2015).

Energy subsidy policy reforms were undertaken to reorganize subsidies to target and determine subsidy recipients, calculate subsidy with accurate data, channel subsidy distribution systems, and identifying the proportion of subsidies for certain types of energy. The Indonesian government can learn from the experiences of other countries such as energy policy is not only normative in the framework of implementation (from India), subsidization for energy production development in order to create employment and provide energy (from Russia), subsidy to energy producers in order to reduce production costs (from the United States), policy to guarantee the purchase of renewable energy prices in order to grow investment and diversify energy sources (from Denmark, Spain and Germany), etc. A consumer energy subsidy is a burden for the state. However, if given to the producers, this subsidy will have an increased potential for state revenue.



#### 4. REALLOCATE SUBSIDIES TO CREATE CLEAN ENERGY

In making environmental or climate policy decisions, the focus is not on economic efficiency and even the economic impact of the policy is rarely considered. Energy policy decision-makers use subsidy mechanisms for improving welfare and as a replacement for emission allowances (Hahn, 2000). There are various mechanisms that aim to achieve the lowest level of emissions at the lowest cost and thus each application needs to be evaluated. Although every policy or regulation issued has regulatory impact analysis (RIA) (Hahn, 2000) there are many obstacles in reality to evaluating the cost benefits and actual cost-effectiveness such as institutional constraints, political barriers, and constraints on their implementation. Bargaining in decision-making for policy reforms is often politicized and sometimes the outcome differs from the original draft.

However, most of the applied carbon taxes are intended to increase revenue rather than limiting emissions (Hahn, 2000). The economic analysis of a climate policy provides is aimed to improve regulatory reforms, although it is not known for its effectiveness. Thus, incorporating economic analysis in a climate policy debate poses a challenge to researchers/consultants and policy-making concepts. Pigou can be applied to calculate the externality costs of the incentives on environmental policies (Pigou, 2013) and to calculate the cost benefits can use Page's theory (Page, 2013). Policy mechanisms using incentives are supported by environmental advocacy. So, the previous understanding of the cost of emissions as 'air pollution licenses' has changed. The energy standards for new resources will be structured more strictly by considering the aspects of environmental pollution in a more emphasized way. Thus, the learning process needs to influence the understanding of environmental and energy policymakers on the importance of economic analysis so those latter policies can be implemented.

In case of Indonesia, the use of fossil fuels (gasoline or diesel) and traditional fuels (firewood, rice pulp) is converted to alternative fuels, such as LPG or CNG, due to the increasing price. However, the increasing demand for alternative fuels cannot be met quickly as the infrastructure and distribution networks are not evenly distributed in all regions. This requires investment for the construction of alternative energy infrastructure. Consumer support modifies their vehicles to fit the more environment-friendly alternative fuel. The subsidy reform programme is implemented and works with the downstream industry to achieve such success. The government actually wants to divert subsidy funds to improve human capital and infrastructure development along with other more productive programmes.

As another option for Indonesia, the cost of building new refineries and exploring fossil fuel sources could be diverted for the development of new and renewable energy. For example, the government tries to control the burden of subsidies with the programme of transferring kerosene users to 3 kg LPG, energy diversification and alternative energy use, limiting subsidized fuel use, use of closed distribution system, and adjusting subsidized retail prices. Cost savings are derived from the flexibility of utility reductions and not from direct trade transactions; they are expected to improve the transaction system to be more efficient and effective (Burtraw, 1996). The savings from subsidy reductions will be diverted by the government to renewable energy or infrastructure development to boost national economic growth.

##### 4.1. Greenhouse Gas Emission

In many countries, energy policy models are often in conflict with environmental policies. However, the development of policies and institutions in these two sectors is very different. Each ministry establishes policies in its field and executes it using an operational budget. While the policy cannot be directly examined or judged through an ongoing decision (Bennett and Howlett, 1992) it can see evaluated from the outcome of the policy and the underlying reasons. In some cases, energy-related policy decisions are at the highest political level and therefore it is not easy to negotiate and provide a sufficiently sound argument. The implementation of the emissions tax on production is also narrow, but it is in use in the electricity sector and fuel oil. At a higher level, the decision-makers understanding is more partial and politicization is a problem.

Based on CEA calculation for India in 2016, coal-fired power plants produce 0.98 kg of CO<sub>2</sub> per kWh, gas power plants produce 0.3 kg of CO<sub>2</sub> per kWh, and there is no wind and solar power generation (GSI, 2017). Among all installed plants, the average yield is 0.732 kg of CO<sub>2</sub> per kWh. Based on an IMF study in 2011, 0.9% of government revenues of all countries (US\$480 billion) had been used as fuel subsidies and became smoke causing air pollution and global warming (Parry *et al.*, 2014).

Fossil fuel subsidies have the negative effect on various sectors. Non-renewable natural resources (petroleum and gas) inventories are reduced and produce a pollution from transportation, floods, congestion, and other negative effects. Many countries subsidize fossil fuel to make their price affordable to consumers and to earn income from taxes.

In case of India, although coal subsidies are few, they contribute 29% to the total national emissions. Power plants in India account for 54% of energy emissions. India's main emissions come from burning biomass with traditional stoves, transportation, and coal-fired power plants. If all the subsidies in India are removed, this will reduce about 105 Mt CO<sub>2</sub> emissions (United Nations Environment Programme (UNEP), 2003). According to Olivier, India's greenhouse gas emissions contribute only 7% of the total global emissions (GSI, 2017).

In case of Indonesia, the provision for alternative fuels is to meet fuel oil needs with the biofuels programme and the use of cellulosic raw materials. Increased fuel requirements to 15% have been replaced by biofuels made from oil palm residues; this does not negatively impact sustainable plantation practices (Petrenko *et al.*, 2016). In general, biofuels from cellulose residues greatly save carbon compared to palm oil biodiesel or fossil fuels (Baral and Malins, 2014).

Plantations using degraded land or reed fields can absorb carbon from the atmosphere (about 0.135 g CO<sub>2</sub> per hectare), store carbon, and neutralize air emissions (Germer and Sauerborn, 2008). Based on data from the Directorate General of Plantations, the area of oil palm plantations in Indonesia was estimated to reach 12 million hectares in 2016, but the area of degraded land is limited, approximately 0.3 million hectares (Caroko *et al.*, 2011). So, the expansion programme of oil palm plantations should avoid deforestation or the transfer of protected forest and secondary forest (Koh and Wilcove, 2008). In many studies, there have been problems relating to regulations and legal enforcement for forest conversion and illegal logging for small plantations. In addition to existing plantation efforts, an approach to safeguard the high conservation value (HCV) by planting oil palms together with some native plant species is likely to protect the area from biological interests (Yaap *et al.*, 2010) this will have no effect on crop yields (Prescott *et al.*, 2015).

Fossil fuel combustion in Indonesia also contributed greatly to global warming. Greenhouse gas emission in Indonesia was estimated at 1,800 Mt CO<sub>2</sub>-eq in 2005, an increase of 400 Mt CO<sub>2</sub>-eq from 2000. Of the total greenhouse gas emission in 2005, land-use change (including related to fossil fuel resource extraction) and peat and deforestation accounted for an estimated 63%, while another 19% was directly related to fossil fuel combustion. Also in 2015, deforestation from land clearing (as discussed in Section 2.3) accounts for more than 850 Mt CO<sub>2</sub> emissions, with daily emissions exceeding the total daily emissions in 28 EU countries (Huijnen *et al.*, 2016). Carbon dioxide emission from fossil fuel combustion was estimated to be 322 Mt CO<sub>2</sub> in 2005 and further increased to 425 Mt CO<sub>2</sub> by 2013 (IEA, 2015b). Nearly 40% of emissions in 2013 were related to power generation, with another one-third caused by transport. Indonesia's Nationally Determined Contribution (NDC) sets an unconditional target for greenhouse gas emission reduction by 2030—about 29% below the normal level of emission, as well as a conditional 41% reduction, subject to the provision of international support (Government of Indonesia (GOI), 2016).

#### 4.2. Development of Renewable Energy

Renewable energy is a natural resource that can be used for the welfare of living things. The joint property regime is considered to be the best regime available for renewable energy management. Collective ownership is

possible along with and participation in the clean energy decision-making process, as adopted by some developed countries.

Renewable energy development needs to consider three factors: energy security, supply stability, and emission reduction. The development of a renewable energy policy should consider opportunities for capacity expansion, institutional development, climate change, and interacting community involvement for implementation. In addition, this activity is a promotional event for technological advancement and socialization for the community. To increase the capacity of renewable energy requires the support of innovation, research, inter-agency cooperation, and community involvement. As the experience of actors on wind power plant integrate economy, environment, and society in accordance with sustainable development (Szarka, 2006).

The R & D results in technology development will invite investors to develop the renewable energy market. Subsequently, the preparation of components and supply chain-related policies for product and socialization of products provide benefits to the community (Bergek and Jacobsson, 2003). Environmental policies must still take into consideration economic and social interests to work in balance for the parties involved (Szarka, 2006). Economic analysis and benefit analysis can be used as an analytical tool for a defined environmental policy to be more efficient.

In case of India, energy policy refers to 'all-of-the-above'—this means the development and use of a combination of resources to meet energy needs. NDC India is targeting 35% emissions reductions and increasing energy use from low carbon sources by 40% (175Gw) by 2022. Energy subsidies that occur in many countries have locked in the choice of how pollution or emissions mitigate the impact of climate change. Transparency and dialogue on energy options in many countries help to detect changes in government policies from fossil fuels to renewable energy in accordance with international agreements on low-carbon and energy-efficient services.

Within five years, the Indian government has encouraged the growth of renewable energy capacity to double by the year 2017 (57.13 MW) with supporting of energy subsidies. But this number is only 0.57% of India's total energy consumption. Subsidies increased from US\$ 431 million in 2014 to US\$ 1.4 billion in 2016. In recent years, there has been a four-fold increase in renewable energy budget transfers in on-going programmes. In states such as Tamil Nadu, renewable energy subsidies cover the obligation of promoting solar power and awarding of long-term contracts with generators (GSI, 2017).

India's renewable energy capacity increased from 24.9 GW in March 2012 to 57.1 GW in March 2017), with a target capacity of 175 GW in 2022 covering 60 GW of wind power, 100 GW of solar power, 10 GW of biomass power, and 5 GW of India's Intended Nationally Determined Contributions (INDC) to reduce emissions by 35%. But taxes for key equipment related to renewable energy, such as transformers, cables, and structures, increased from 15% to 18%. Tax rates for input services used by project developers also increased from 15% to 18%. Besides, the tax obscurity for primary and secondary batteries also adversely affects the development of clean energy (GSI, 2017).

The growth of renewable energy is very rapid but far less than the development of fossil fuel energy to meet national energy demand. It is estimated that if the proportion of renewable energy is higher than fossil energy it will cost savings several times, the cost of air pollution as an energy externality. Energy development needs to consider water scarcity and food security. Utilization of water as a heat transfer medium reduces the energy consumption and agricultural land use development of renewable energy. Basically, all three depend on each other. And long-term oriented renewable energy policies and product purchasing obligations from power plants. If India's renewable energy development is in line with the REmap program, then the country will have the fourth largest generating capacity after China, Germany or the United States. The prospect of developing renewable energy such as solar energy in India creates huge jobs and sources of energy supply become diverse.

Electricity tariffs, fuel prices, and renewable energy prices are set out in government regulations. The long-term purchase of energy or energy feed-in tariffs (REFIT) encourages the growth of renewable energy development

implemented by European countries like Denmark, Spain, and Germany. Many households are interested in investing and owning shares in wind power, for example, Denmark has 150,000 households in 2001 (Lauber, 2002) and Germany has 200,000 in 2002 (Rickerson, 2002). However, the quota-based scheme is still not flexible for renewable energy developers and its development pricing continues to strive for a 'fair and efficient' tariff (Chabot, 2001).

And based on the experience in France, where local people suffered losses due to turbine noise and received no compensation from owners who earned hefty profits, some owners do not want to share their income with locals where energy land is located. This has led to local social and political injustice (ADEME, 2002).

In case of Indonesia, renewable energy targets are listed in the draft General Plan of Electricity Country (RUKN) 2015–2034, prepared by the Ministry of Energy and Mineral Resources (ESDM), including specific targets for various renewable energy technologies by 2025. In total, the renewable energy capacity installed for 2025 targets to produce 45 GW, up from the 8.7 GW targeted for 2015 (ESDM, 2016). Hydropower represents the largest share with 21 GW (of which 3 GW is expected to be a small hydropower plant, which has a capacity of less than 10 MW per plant), followed by geothermal power (target 7.1 GW by 2025), solar PV 6.4 GW), bioenergy power (5.5 GW), oceans power (3.1 GW), and wind power (1.8 GW). Based on economic calculations, it is estimated that saving energy costs and reducing carbon dioxide emission will save up to US\$53 billion annually or about 1.7% of Indonesia's GDP by 2030. Renewable energy programmes can take advantage of this potential with the investment support of about US\$16 billion every year until 2030 (International Renewable Energy Agency (IRENA), 2017).

#### 4.3. Renewable Energy Pricing Policy

Each government has its own policy for determining the price of each energy generator as a producer and each user as a consumer. For example, India sets the price of the plant based on additional cost rules and market prices through a tender. The calculation of electricity rates is based on fixed costs and variable costs. Fixed costs of return on equity, interest on capital loans, taxes and duties, depreciation, interest on capital loans, interest on working capital, administrative costs, and variable costs can be specific oil consumption and additional energy consumption. The calculation of consumer prices involves the price of electricity tariffs from generators, transmission costs, distribution costs, network-loss costs, and return on equity (about 14%–16%). Special rates are given to poor communities or farmers after the government provides direct subsidies and before the retail price is published (GSI, 2017).

For renewable energy generation, there is no choice of price or in accordance with the price applicable through the tender. The purchase price can be negotiated with the electricity distribution in an open energy market. Opportunities for renewable energy developers to earn additional profits can come through the selling of renewable energy certificate claims and obtaining a reduction of duty and taxes on spare parts purchase. There is also the opportunity to get soft loans for renewable energy development projects. For solar power plants, in particular, asset depreciation and claims for income tax reduction can be proposed at the beginning of the project (about 40% regulations in India have come into force since April 2017). These incentives and conveniences encourage the growth of renewable energy, especially wind and solar power. The private sector dominates investment in the renewable energy field (GSI, 2017).

Development of renewable energy is one of the best options that can be chosen by the government, must be integrated with the energy market as part of the supply chain. And environmental handling, production, and energy consumption are major problems in global warming (Szarka, 2006). But in the development of renewable energy requires subsidies to enter the market and the development of low-carbon energy. This energy subsidy becomes an investment stimulus for renewable energy and introduced to achieved environmental goals.

## 5. CONCLUSION

Based on the above references, we can state that energy subsidy policies should consider the budget, on-the-ground implementation, and implementation impacts on a national basis. In fact, renewable energy policies should be more environmentally inclined. Fossil fuel subsidies are still a priority rather than the development of renewable energy; they act as a barrier to the latter because of budget allocations, but the author believes this is only a matter of time. All governments seek to take direct and immediate action rather than waiting for development with existing limitations including infrastructure, regulations, and supply-distribution networks for renewable energy. Thus, energy subsidies are introduced and applied to protect the poor and needy communities (GSI, 2017).

Some research references have found the amount of fossil fuel subsidies and therefore it is necessary to study the mechanism of the distribution of such subsidies to make them effective and to reduce the energy subsidy so that the national economy can still grow. As long as energy subsidies are needed to be evaluated, they cannot be replaced by renewable energy—the policy of energy subsidy will continue to run. The utilization of more advanced technology of fossil fuels is expected to reduce greenhouse gas emission.

It is necessary to evaluate each energy subsidy policy, including renewable energy policy, in terms of achieving long-term development plans in the energy sector. Many countries voluntarily self-assess fossil fuel subsidies and slowly remove inefficient fossil fuel subsidies to allow energy subsidies only for people below the poverty line. This approach supports the UN Sustainable Development Goals programme that enables national policies to change from the best experiences of other countries (G20, 2009). However, every country seeks to meet the energy needs of its population and simultaneously strives to meet the international commitments for emission reduction (NDC) to the Paris Treaty. To meet the national need for energy, the choice of using fossil fuels has become dominant and the related technology has been mastered, despite its use leading to the emission of different particles into the atmosphere.

The energy each country expects is safe, affordable, and environmentally friendly. Renewable energy requires transmission networks with flexible capacity, energy storage innovations, and renewable energy standards associated with new building codes. Many governments, both central and local, are very cautious in adopting energy-related policies for these are considered a highly sensitive political issue. For instance, the subsidy given to the poor so that they can access energy products for daily needs will delay low carbon energy implementation targets for some time. Thus, the budget for renewable energy subsidy increases, even though it is very small compared to the fossil fuel subsidy.

The learning process to achieve the long-term goal is the greatest opportunity for renewable energy. Many studies have identified problematic trade-off in the past. There has been much controversy with respect to the use of various energy sources for electricity production and the problems arising from the development of renewable energy. The development of technical and economic innovations continues to expand production capacity to stabilize supply and promote institutional development. Besides, widespread public involvement should be taken seriously. Future energy policies will use a policy model approach by considering all environmental cost factors, such as greenhouse gas emission, and following internationally sustainable development aspirations. The success of renewable energy development policies can be shared as valuable lessons.

There is much debate on the determination and socialization of energy policies, especially energy subsidies. The paradigm of a new policy without considering economic issues will be a fierce battle. A capacity-building effort must embrace institutional innovation and broaden community involvement through on-the-ground implementation. In the social science community, it is believed that renewable energy demand encourages community involvement (Ruggiero *et al.*, 2014). This transition process must continue to achieve clean energy goals to mark the ideal aspirations of a prosperous society. If it stops, the result will be top-down coercion and market dependence. In addition, any renewable energy development programme requires supporting the integration of large-scale and connected networks.

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