

EFFECTIVE INDONESIA'S GOVERNMENT POLICY TO REACH NET ZERO CARBON IN YEAR 2060

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Overview

Setting the right policy in the energy sector to meet an ambitious target of net zero carbon in 2060 in Indonesia is not an easy task for its government. With its GDP per capita at \$3870 in 2020, Indonesia's economy still needs to grow to significantly reduce its poverty. Currently, about 88% of final energy consumption in Indonesia still comes from fossil fuel. Despite the availability of domestic supply from oil and gas production, Indonesia still needs to import oil (crude and product oil) and gas (in form of LPG). Indonesia remains to significantly use coal for power generation. As a result, energy sector in Indonesia essentially contributes about 64% of GHG in 2020. In pushing the agenda to achieve net zero carbon in 2060, through its Nationally Determined Contribution, Indonesia is committed to reduce GHG by 29% by its own effort or 41% by the assistance of overseas financing in 2030. The road to net zero carbon in energy sector formulated by the government includes the phasing down of coal power plant and the usage of CCS/CCUS. Therefore, designing the right government policy to strike a balance between the need of energy sources and GHG reduction is an ultimate challenge. Furthermore, Indonesia is also aggressive in aligning itself with the global initiative in reducing CO₂ emission in mitigating climate change, along with 197 countries, Indonesia signed the Paris agreement with its intention to limit the emission below 2 degree Celsius above pre-industrial levels in 2030 by stimulating the development of renewable energy and reducing its reliance on fossil fuel. In this policy study, we use the data of energy balance, emission trends and economic conditions in Indonesia.

Keyword: *System Dynamic, Energy, Modelling, Policy*

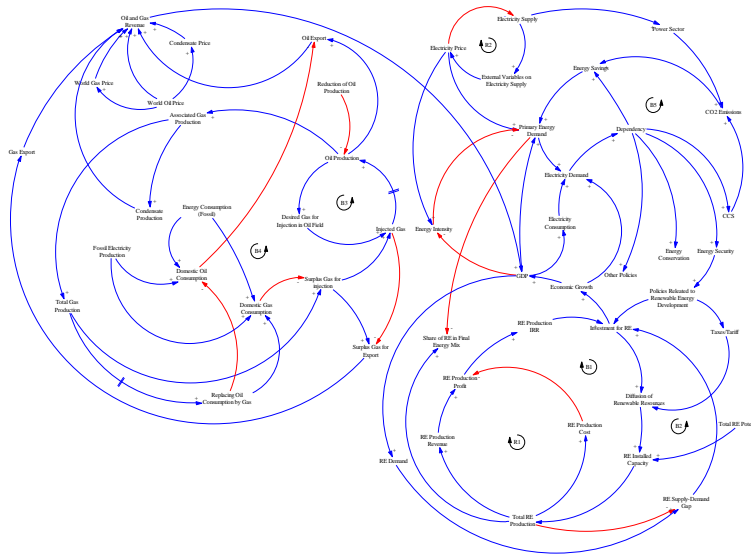
Methods

System dynamic (SD) has been used as a tool to design a government policy in Indonesia. However, we have not seen a system dynamic model used to specifically study on the topic of energy and environment in Indonesia. SD can be used as the foundation in setting an effective government policy and the model can be transferred to any other period or region. Many studies have been conducted to study the relation between economy and environment. Globally, a complex system of SD has been used to conduct studies on energy and environmental policy. Some of the studies are notable, such as (Feng et al., 2013) studies the impact of emission in Beijing for 2005-2030 caused by urban development by studying the energy consumption impacted by the urban transformation from industrial to service sector. (Robalino-López et al., 2014) uses SD to study government policies on the effort of Ecuador's government to reduce GHG in respect to the economic growth and energy consumption. Developing SD for the energy sector must be different from one to another country because of different energy and economic policy and characteristics. Developing SD for Indonesia to suit factors on energy, economy and environment are different because SD that has been developed for the energy system in Indonesia has not incorporated the latest development of Indonesia's target in achieving net zero carbon in 2060. In addition, the model incorporates the latest economic growth and LTP long term policy in energy and economics. Many SD models in Indonesia are based on sectoral, such as CCS or oil and gas sector. Using data range for 2010-2020 reference data such as energy policies in Indonesia such as emission targets, domestic fossil energy availability. Therefore, comprehensive energy, environment and economic sectors to study Government policy is needed. This model can be used as an instrument to set the right policy to balance the economic growth, hence energy demand and emission in Indonesia.

Results

Based on our preliminary result, our model shows that to meet Indonesia's economic growth of 7%, the use of oil and gas to meet the energy demand leads to the decreasing of the domestic production. The demand for electricity in Indonesia is significantly impacted by the economics of renewable energy. In 2020, the demand for electricity in Indonesia is relatively low, therefore the need for additional fossil fuel to generate electricity was not too significant. Our model shows, that between year 2030-2035, energy supply, particularly from domestic fossil fuel production, in

Indonesia is at its plateau. With the declining of domestic production of fossil energy, therefore in approximately after 2035, there will be a shortage of electricity to meet the demand for energy per capita. Between 2050-2055, with the increasing population, and declining of domestic fossil fuel production, additional source coming from renewable energy can not still satisfy the demand of energy. With the production decline of fossil energy, state revenues in the energy sector will have a direct impact to the Indonesia's economy. On the other hand, state revenue coming renewable energy does not impact on the compensation loss of state revenue coming from fossil fuel production. Renewable energy, therefore, will be intended solely to reduce emission and only limited to meet the demand of electricity. Diffusion of technologies such as CCS/CCUS may impact in providing energy that comes from fossil fuel need to meet the economic growth and to help reduce emissions in the energy sector and industrial sector. Between 2035-2045, there will be a dependence on renewable energy technology to stimulate energy saving, such as energy storage,



energy conservation, to strengthen energy security in Indonesia.

Causal Loop diagram of the dynamic behavior of the energy system of Indonesia

Conclusions

Energy is a sector that stimulates the economy and is a long-term business. Any decision on government policy in the energy sector may impact the economy, therefore having an effective long-term energy policy is imperative. Based on the model's preliminary results, Indonesia must have a balance between economic growth and its effort to reduce carbon emission. To fuel economic growth the government must set a policy that will not be too aggressive in intervening clean energy. Fossil fuel still dominates in final energy consumption in the coming years. With the current policy, we discover that the development of renewable energy in Indonesia does not significantly contribute to the economy. Therefore, Indonesia needs an aggressive policy in promoting renewable energy if Indonesia wants to reach net zero emission by 2060.

References

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