End-Use Model for Indonesia Low-Carbon Development Pathways in Energy Sector

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Abstract

The paper presents results of an academic study on the development of End-Use Model for Indonesia Low-Carbon Development Pathways in Energy Sector. The study is carried out to identify the GHG reduction potential and costs of mitigation actions to reduce GHG emission in energy sector for 2020 and 2050. Short term analysis (2020) is to be used for assessing the achievement of mitigation actions to meet national target of GHG reduction in energy sector as stated in RAN GRK (National GHG Mitigation Action Plan) while long term analysis (2050) is to be used for assessing the development paths of energy sector toward 'Low Carbon Development'. The paper also presents the assessment results of the role of research community in implementing Low Carbon Concepts for National Energy Development.

Modelling tool used in this research is End Use Model - GAMS (General Algebraic Modelling System) supported by various current technical, economic and social parameters. Two scenarios are developed to envision 'Indonesia Low Carbon Development Paths of Energy Sector', i.e. business as usual (BAU) and mitigation scenarios. BaU scenario envisions the development paths of energy sector and the associated GHG without considering mitigation efforts while mitigation scenario is developed to envision the development paths by including mitigation efforts to reduce GHG emissions. The base year for projection scenarios is 2005 and the target year is 2020 (short term analysis) and 2050 (long term analysis).

The result of this study shows that under the BaU, final energy consumption in Indonesia is estimated to increase 2.91 times from 145 mtoe (2005) to 357 mtoe (2020) or 8.55 times to 983 mtoe (2050). Under the same scenario, primary energy supply will increase 2.46 times from 145 mtoe (2005) to 357 mtoe (2020) or 9.65 times to 1,399 mtoe (2050). The GHG emission associated with this energy consumption is estimated to increase 2.91 times from 0.346 GTon CO_2e (2005) to 1.009 GTon CO_2e (2020) or 8.55 times to 2.96 GTon CO_2e (2050). The study identifies and assess mitigation options selected from the optimization process using end use model, and the associated GHG emission reduction potential and estimates the cost of each of these options as cost (USD) per ton carbon reduced. The highest increase in energy consumption are majorly projected from industrial sector and freight transportation. There is a significant decrease in power sector GHG emission which is mainly contributed by the introduction of Nuclear (16%) and Coal-CCS (42%). While in the transportation sector the introduction and development of Biofuel and passenger railway transport has cut a third and half the GHG emission of transportation sector in 2020 and 2050 respectively.

Closing remarks; In order to achieve best concluding result, in this research it is required to accumulate more credible and market-integrated data and information regarding supply, demand, and technologies. There will be further development of the model to provide best recommendation for Government of Indonesia in setting and reinforcing energy sector development policies and pathways.

Keywords: energy development path, cost of mitigation, End-Use GAMS, energy technology mitigations, Low carbon development, low cost optimization, RAN-GRK