Summary: "Low Carbon Emission Development Strategy (LCEDS) in Indonesia Energy Sector", Scenario for 2020

by Retno Gumilang Dewi, Ucok Siagian, Rizaldi Boer

Background

This paper presents results of a study concerning Low Carbon Emission Development Strategy (LCEDS) in Indonesia Energy Development Scenario for 2020. In the same area, similar study has been carried out for 2050 [Dewi, et.al. 2010]. Although LCEDS is usually intended to assess long-term vision, this study is applied for short-term scenario because it is intended to address options for achieving reduction target in conjunction with National Action Plan for GHG Reduction (RAN GRK). The national action plan is to meet GOI non-binding commitment to reduce the emission 26% below the 2020 baseline projection of Indonesian Second National Communication (SNC).

Power sector is discussed in more detailed in this study, as it is one of major contributor of the GHG emission and there is a new plan that intends to revise power development plan, i.e. more coal compared to previous plan (RUPTL 2009-2018) in power sector will be deployed gradually by 2020. The baseline of power sector in the SNC is projected based on the RUPTL 2009-2018. The revision may alter the estimates of GHG emission level of the 2020 baseline of the SNC (Figure 1). It is therefore considered necessary to investigate the impact of this revised plan, if implemented, to the achievement of emission reduction target of energy sector set in RAN GRK and mitigation actions need to be undertaken to achieve the target. Policy gap analysis and recommendation relevant to the achievement of the RAN GRK target are also addressed in this study.

Objective

The objective of the study is to describe future visions of Indonesia in achieving the goals of RAN GRK as stated in the Presidential Regulation (PerPres) No. 61/2011. In addition, the document can also provide overview of the impact of newly proposed (2012) revision of power sector plan to the achievement of the RAN GRK goal. Therefore, the document is critical for Indonesia and can be used as reference for decision maker in formulating development plans and policies, particularly those that might affect to the achievement of GHG emission reduction target.

Approches and Methodology in Developing Scenario

The tool used in the development of LCEDS in this research is ExSS (Extended Snap Shot) using GAMS (General Algebraic Modeling System) 23.3 supported by various current technical, economic and social parameters. Three scenarios are developed to envision Indonesia energy development paths related to low carbon emission, namely business as usual (BAU) for 2020, two mitigation scenarios, i.e. M1 for end user energy efficiency measures and M2 for combination of end user efficiency measures and supply side efficiency measures (power generation and T&D network). Another three scenarios also have been developed to investigate the effect of PLN revised plan (higher coal share in PLN's supply mix) to the BAU 2020 GHG emission level and the strategies to address this effect, i.e. M1(R) consisting combination of end user efficiency measures and supply side efficiency measures (power generation and T&D network), M2(R) comprising the M1(R)+change of transportation mode. Figure 2 presents the 6 scenarios scheme.

Results of The Scenario Development

From the analysis of these results of the LCDS simulation (Table 1 and 2), it can be concluded that:

- During the period of 2005-2020, the energy demand will increase 2.7 times (Figure 3) in lined with the increasing of population (1.2 times) and GDP (2.6 times). The implication of increasing of the energy demand, CO2 emission will increase 3.3 times.
- The energy demand is projected to grow threefold from around 115 million toe in 2005 to around 307 million toe in 2020 (Figure 4). In 2005 the share residential demand is comparable with the share of demand from industry, transport and commercial. This situation is expected to change in 2020 where the demand from industry and commercial will be higher than the residential demand. As can be seen in Figure 4, the high energy demand is to be satisfied by different types of primary supply, i.e. oil fuels, coal, natural gas, hydropower, geothermal and biomass that highly dominated by oil in 2005. This situation is projected to change in 2020 where coal and natural gas would become comparable with oil share in energy mix. This occurs

because the growth of electricity demand (supplied by coal and gas power plants) is higher than transport sector (supplied by oil).

- Before plan revision, energy activities would generate 0.949 GTon of CO_2 (2020). The national GHG reduction target of energy sector is 0.038 Gton in 2020. The expected emission level after implementing GHG reduction actions is 0.911 Gton CO2 in 2020. Under M1 scenario the GHG would reach 0.914 Gton CO2 in 2020, which means this scenario could not meet the national action plan on GHG reduction target. The reduction target could be achieved by implementing M2 scenario. This scenario would result in emission level of 0.897 Gton in 2020 (see Figure 5). This reduction is much higher than that expected to meet national target. This is intensionally excercised to anticipate in case the efficiency measure at end-user side is not successfully materialized where effciency measures at supply side may be considered as the back up.
- If new plan is intended to increase more coal to replace oil power plant (higher coal power), the GHG in 2020 would become 0.975 Gton CO_2 (see Figure 6), which is 0.028 Gton higher than the BAU baseline in 2020. The increase of GHG due to new revised plan (see Figure 6) would be in opposite direction to the GOI commitment to reduce national GHG in 2020 by 0.038 Gton.
- Under "higher coal power" scenario, more reduction efforts have to be made to achieve the National GHG reduction target in 2020. Combination of efficiency measures in end-user and in supply side, designated as M1(R), would not be sufficient to meet the national target. M1(R) scenario would result in emission level 0f 0.914 GTon CO2 in 2020. To achieve the target, the efficiency measures has to be added with shift of transport mode, designated as M2(R). This M2(R) scenario would result in emission level of 0.906 Gton CO2. This level is lower than the national target (reduction of 0.038 GTon in 2020 from the baseline before PLN revision, which is equal to the level of 0.911Gton CO2 in 2020 if the new plan is implementd).

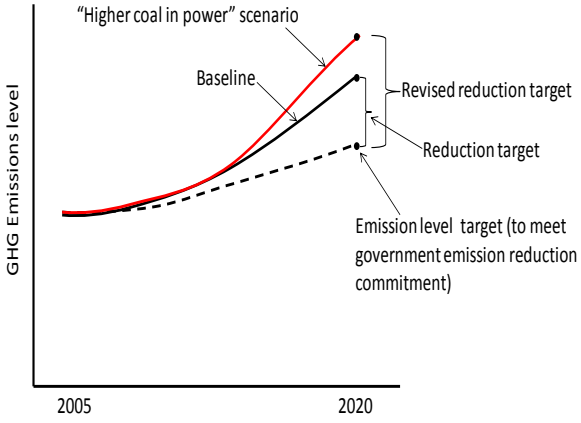

Figure 1 Effect of revised PLN plan to the GHG that have to be reduced from the "higher coal in power" scenario

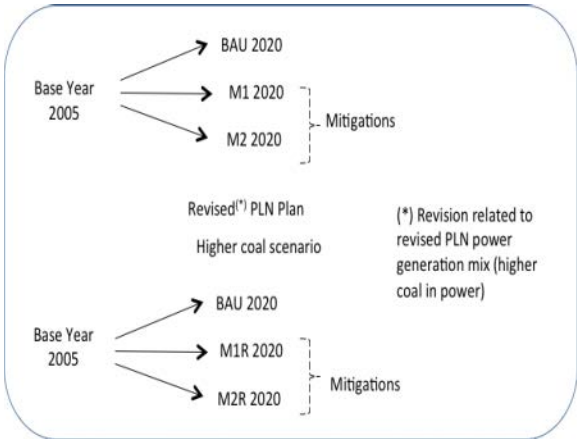

Figure 2. The schematic of the 6 scenarios of this Low Carbon Development Strategy

Table 1. Simulation results of the effect of 'higher coal power' to the SNC scenarios

Parameter	2005	2020 (SNC projection)			Effect of higher coal in 2020		
	Base Year	BaU	M1	M2	BaU	MR1	MR2
GDP (trillion IDR)	1,787	4,572	4,572	4,572	4,572	4,572	4,572
Population (million)	219	261	261	261	261	261	261
Energy demand (million toe)	115.3	307	299	299	307.3	298.7	298.7
Energy demand per capita (toe)	0.5	1.2	1.1	1.1	1.2	1.1	1.1
Energy intensity (toe/million IDR)	63.6	67.2	65.3	65.3	67.2	65.3	65.3
Energy Elasticity		1.06	1.03	1.03	1.06	1.03	1.03
CO_2 emission (million ton-CO_2)*	290	949	915	897	977	915	906
Carbon Intensity							
- Ton CO_2 per capita	3.6	3.6	3.5	3.4	3.7	3.5	3.5
- Ton CO_2 per million IDR	208	208	200	196	214	200	198

*It does not include CO_2 emission from fugitives

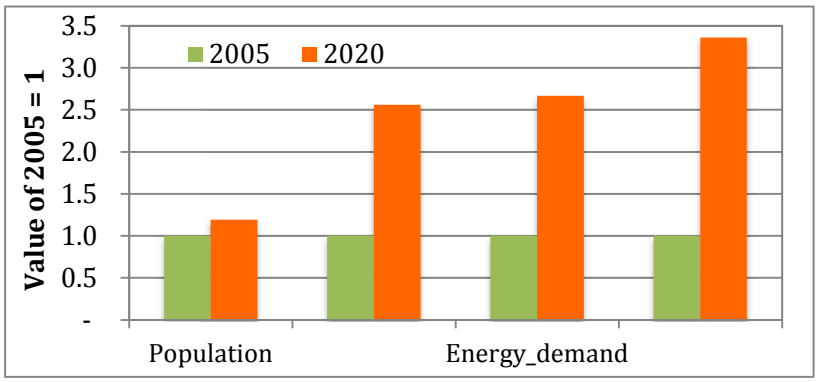

Figure 3 Snapshots of ratio of population, GDP, energy demand, and CO_2 emissions future value (2020) as compared to the base year

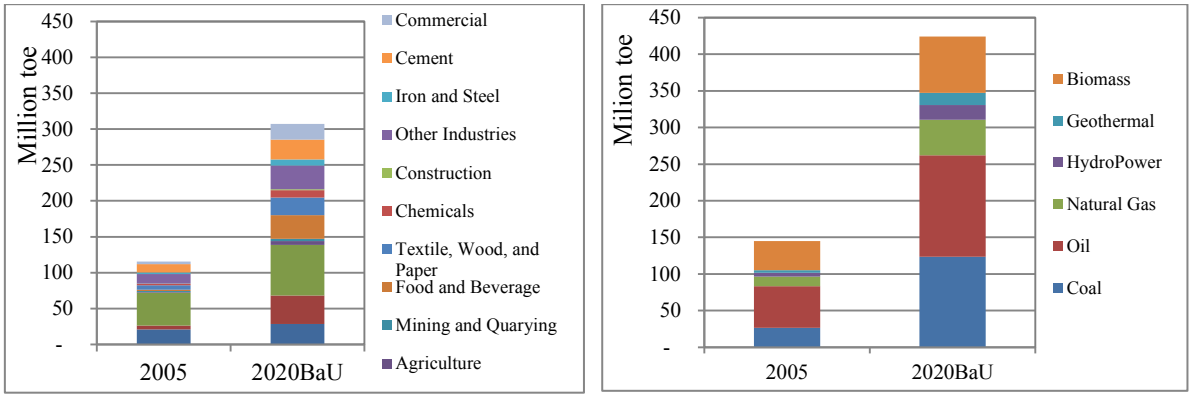

Figure 4 Final energy demand and primary energy supply projection for BAU scenario (2020)

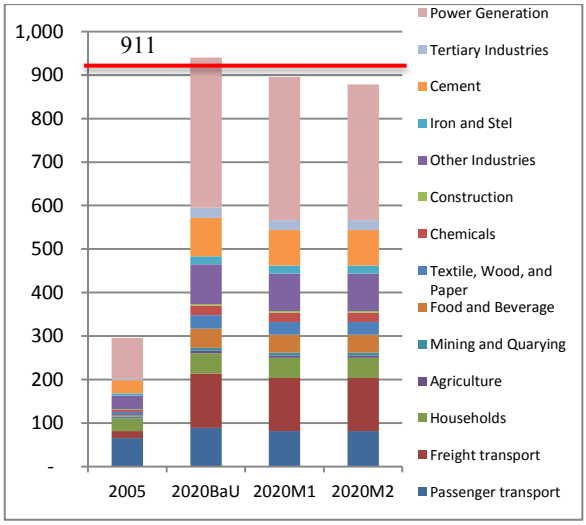

Figure 5 CO_2 (million ton) under Bau and mitigation scenarios (M1 and M2) in 2020

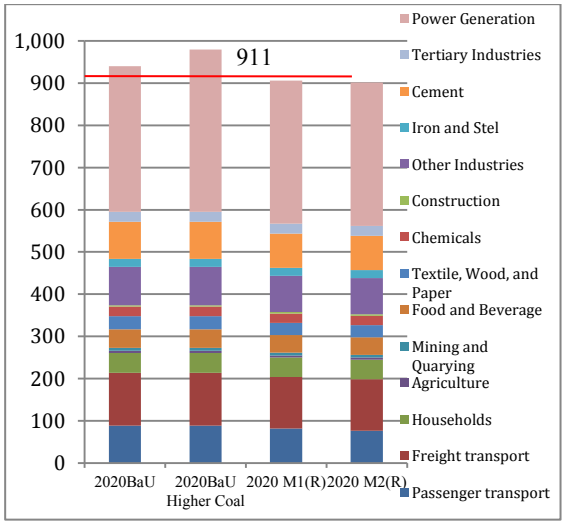

Figure 6 CO_2 (million ton) for BAU (SNC) and higher coal scenario: BaU, M1(R) , M2(R) in 2020