DESIGNING STRATEGIES TOWARD LOW CARBON DEVELOPMENT: INDONESIA CASE

Rizaldi Boer[1], Retno Gumilang Dewi[2], Ucok Siagian[2], Toni Bakhtiar[1], Lukytawati Anggraeni[1], Gito Gintings[1], Iwan Hendrawan[2], Kei Gomi[3], Tomoko Hasegawa[4], and Yuzuru Matsuoka[3]

[1]Centre for Climate Risk and Opportunity Management in Southeast Asia and Pacific of Bogor Agriculture University, [2] Research Centre on Energy Policy of Bandung Institute of Technology, [3]Kyoto University-Japan, [4]National Institute for Environmental Studies-Japan.

Background

Managing land and forest resources in sustainable manner is responsibility of every nation to secure its long-term development. Improper management of these resources will lead to failure of the resources to provide sustainable goods and services for meeting our present and future needs. Indonesia as the second largest forested tropical country in the world has lost its forest cover at alarming rate. The largest lost occurred during the transition period (1996-2000), from new order era to reformation era with deforestation rate of about 3.5 million hectare per year. After this period, the rate of deforestation has decreased quite significant. Between 2000 and 2006, the annual rate of deforestation went down to only 0.606 million ha. However, this sector is still as a major source of GHG emission in Indonesia. Emission from peat land, forest and land use changes in the period 2000-2005 contributed to more than 60% of the national emissions. Projection of the emission from these sectors under the business as usual (BAU) scenario also indicated that this sector is still as a major GHGs sources.

After the COP13 in Bali, Government of Indonesia took more active actions to reduce its emission. In its submission to UNFCCC in the framework of the Copenhagen Accord, Indonesia stated that there are seven strategic actions to reduce its emission from the BAU emission, namely (i) sustainable peat land management, (ii) reduction in rate of deforestation and degradation, (iii) development of carbon sequestration projects in forestry and agriculture, (iv) promotion of energy efficiency, (v) development of alternative and renewable technology, (vi) reduction in soil and liquid waste and (vii) shifting to low emission transportation mode. It was announced that the GoI has set up targeted to reduce its emission by 26% below the BAU emission in 2020, and by 41% of the BAU depending on international support.

In 2011, the Government of Indonesia issued the Presidential Regulation Number 11/2011 on National Action Plan for GHG Mitigation (called **RAN GRK**). This regulation is one of key policies which mandate all sectors to reduce their emissions to achieve the 26% and 41% emission reduction target (ERT). The five sectors include (i) agriculture, (ii) peat land and forestry, (iii) energy and transportation, (iv) industry sector and (v) waste sector. In total there are 50 national mitigation actions (**RAN**) to be conducted to meet the 26% emission reduction target, which was equivalent to about 0.767 Gt CO_2e (Figure 1). Irrespective of the target, the

Government of Indonesia required inputs on how this emission reduction target can be achieved effectively and create many co-benefits for the future development of Indonesia.

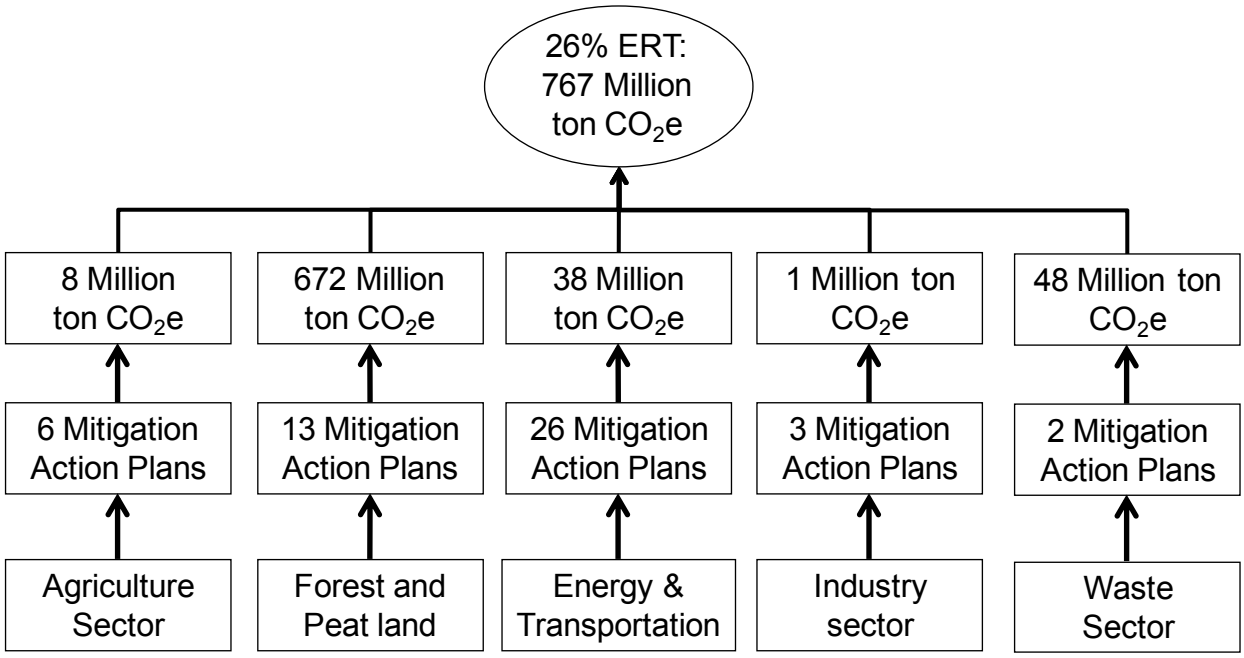


Figure 1. Number of national mitigation actions (RAN) and its emission reduction target

In Science-Policy Dialogue on Low Carbon Development Workshop held in 21 February 2013 at National Development and Planning Agency (BAPPENAS), the Deputy Minister for Natural Resources and Environment stated the important for policy makers to understand the causal effect of a sector's climate change policies/strategies with other sectors such as economic implications of the implementation of the mitigation actions, level of funding resources required for the implementation of the mitigation actions, options to increase the efficient use of available funding sources to reach maximum outcomes, effectiveness of policy measures for reducing emission such as carbon tax, subsidy, incentive policies, level of financial support required to achieve the ERT and for what options, etc.

In this regards, Indonesian Team supported by Japanese Scientists from NIES, Kyoto University, IGES and Mizuho is implementing modeling studies to assist the policy maker in formulating and better enabling the implementation of science-based low-carbon, green-growth policy in Indonesia. Set of research questions have been set up in consultation with the BAPPENAS, namely:

- How can the 26% emission reduction target be achieved with minimum cost?

- What are the energy type (energy mix) and land use scenarios to meet the emission reduction targets and at what cost?
- What will be the impact of reducing emission on Indonesia's GDP and on energy and food security?
- What co-benefits will be gained from the implementation of mitigation actions in the long term?

This report describes summary of the research progress made by the team which consists of two sectors (i) agriculture, forest and other land uses (AFOLU) sectors and (ii) energy and industrial sector (power, industry and transport, commercial and residential).

2. **AFOLU Sector**

Strategy for implementing low carbon development in the AFOLU sector was developed using two models namely AFOLU A and AFOLU B. AFOLU Activity model (AFOLU A) is a top-down model to estimate future agricultural and livestock production and land-use change based on population and socioeconomic indicators such as population and income. AFOLU Bottom-up model (AFOLU B) calculates mitigation countermeasures and cost under given reduction constraints. Carbon Development Scenarios being evaluated include:

1. **BAU scenario**: Land demand for food, livestock and settlement increase following the population growth taking into account level of food consumption, growth of agriculture/forest products export without consideration of LCS. Annual deforestation rate is given exogenously using historical rate of deforestation between 2000 and 2006.
2. **Mitigation Scenario**: Deforestation is reduced and forestation is increased against BaU (historical rate of 2000-2006) and set of mitigation measures for rice cultivation, managed soils and livestock are implemented to meet the 26% target with minimum cost

The analysis suggested that the rate of deforestation should be reduced and reforestation should be increased from the BAU and mitigation measures should be implemented in rice cultivation, managed soils and livestock to meet emission reduction target. Total emission reduction from agriculture sector in 10 year (2011-2020) could reach 75 MtonCO_2e or about 16 Mt CO_2e in 2020. This is about two time of emission reduction target of the RAN (see Figure 1). The total cost in 10 year will be about 4.8 billion USD or about 895 millions USD per year in 2020. The highest potential emission reduction is from application of high efficiency fertilizers, intermittent irrigation, and incorporating rice straw to soils, and replacement of urea with ammonium sulphate (Figure 2). Meanwhile, the highest cost derived from the biogas plant, daily spread of manure, and replacement of roughage with concentrates. By taking out these high cost mitigation measures, this sector still can reduce the emission more than 67 Mt CO_2e in 10 years or about 14 MT CO_2e in 2020. The total cost in 10 years will reduce significantly to 336 million USD or to 62 million USD per year in 2020.

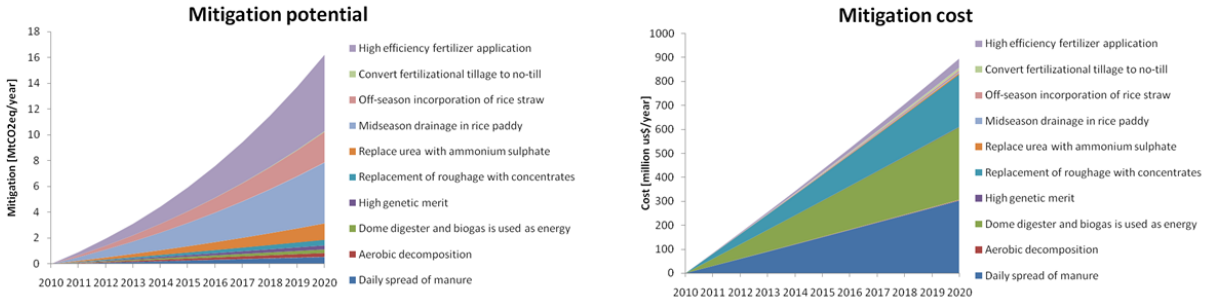


Figure 2. Mitigation potential and cost for agriculture sector

The mitigation potential in forest and other land use is much higher than agricultural sector 672 MtonCO_2 e per year in 2020) with cost of about 202 million USD/year in 2020. The highest potential emission reduction are obtained from the improvement of water management in peat lands, forest protection, reduced impact logging and enhanced natural regeneration (Figure 2).

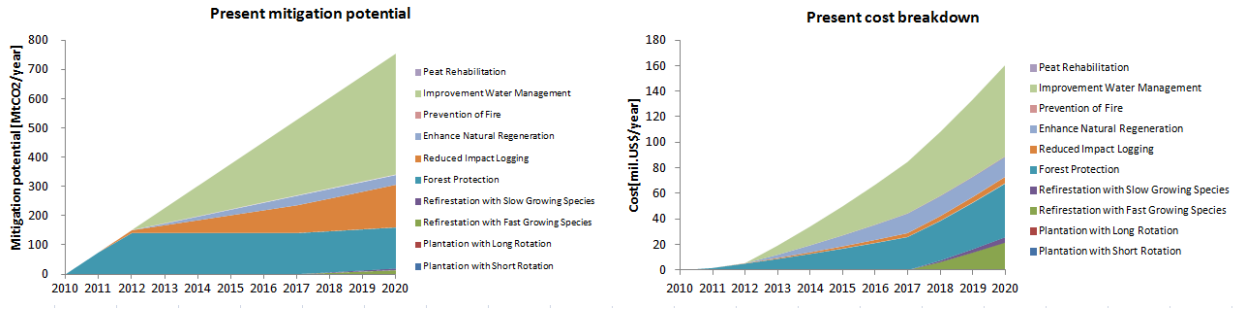


Figure 2. Mitigation potential and cost for LUCF sector

Further refinement of the analysis are updating the mitigation cost data, inclusion of transaction costs in calculating mitigation cost of key CMs and refining assumptions (e.g. yield, yield growth, population growth, allocation of CMs in each RAN categories). In addition, this study will explore more low carbon development scenarios by taking into account possible changes in development policies (e.g. energy mix policies, production target on palm oil, increasing rice production through extensification and intensification etc).

3. **Energy Sector**

Strategy for implementing low carbon development in energy sector was developed using ExSS (extended snapshot) tool for period up to 2020. Although LCDS is usually intended to assess long-term vision, particular emphasis in the short-term is to address options for achieving GHG reduction target (National Action Plan) in 2020. Low Carbon Development Scenarios of this sector being evaluated include Business as Usual scenario (BAU) and Counter Measure 1 (CM1) and Counter Measure 2 (CM2). The CM1 and CM2 is to address options for achieving GHG reduction target (National Action Plan) up to 26% below the baseline with domestic budget and further up to 41% with international support

respectively. This analysis seeks for alternatives mitigation action to achieve the national emission targets. The BAU projected GHG emission under expected socio-economic development in Indonesia without additional countermeasures to reduce GHG emission from energy (by 2020, the population will be about 1.19 of that of 2005; and GDP will be 2.31 of that of 2005). The BaU development scenario is presented in Figure 3. From the analysis of the simulation results of the GHG emission of energy sector, it can be concluded that during the period of 2005-2020, final energy demand will increase from 115 MToe (2005) to (a) 251 MToe or 2.19 times (2020), such as presented in Figure 4. This would generate 1.009 Gt CO_2 increased 2.9 times from 0.35 Gt CO_2 (2005). Under CM1 and CM2, the final energy demand will be 239 and 237 MToe respectively. Under these scenarios, transport demand and power supply mix are presented in Figure 5 and 6.

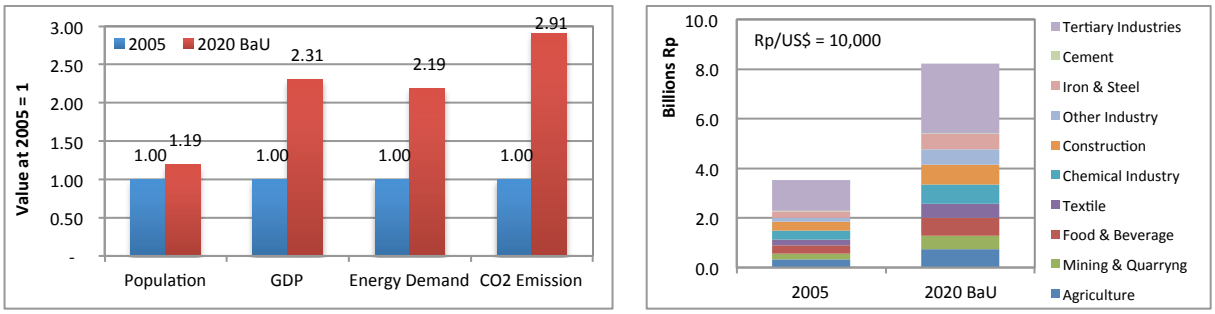


Figure 3 Socio economic development, gross output and BaU scenario

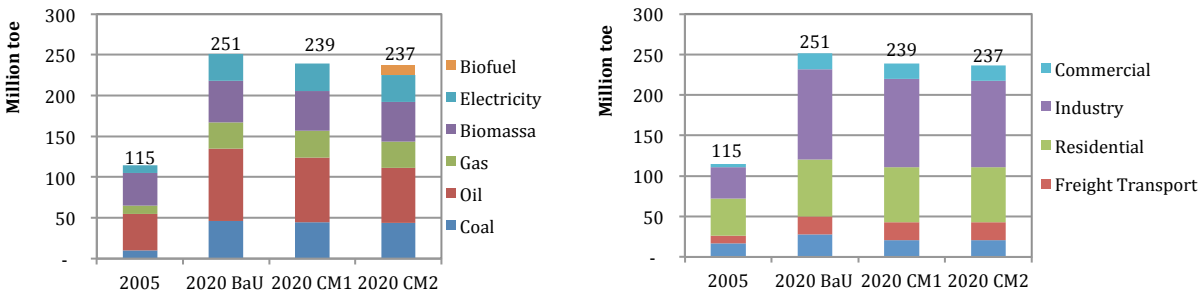


Figure 4 Final Energy Demand Projections (2020)

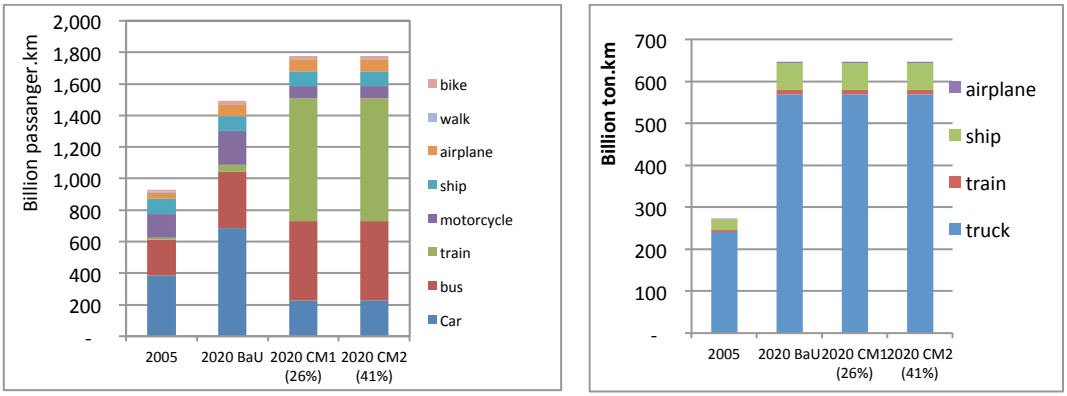


Figure 5 Transport demand scenarios under BaU and CM2 and CM2

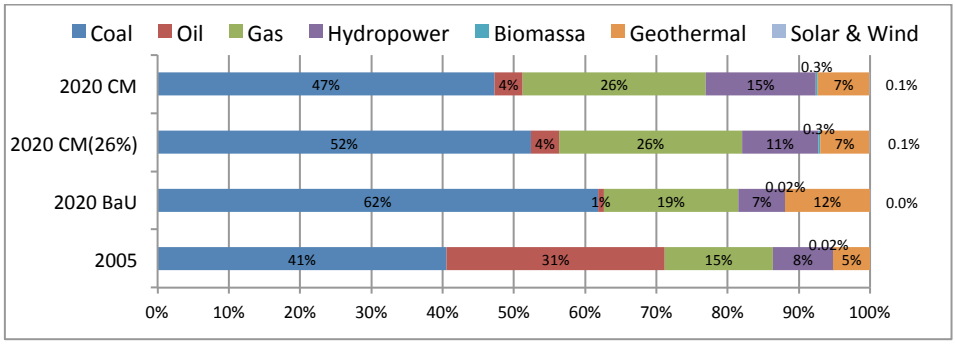
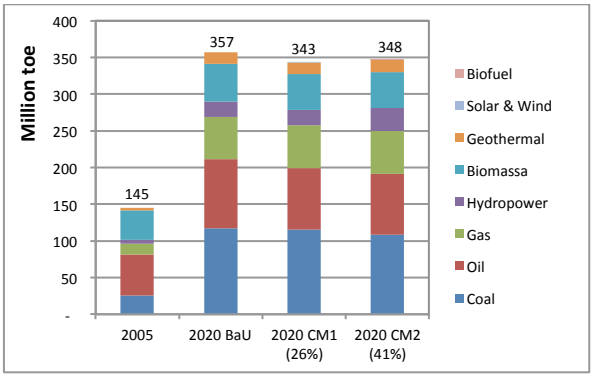


Figure 6 Power supply mix scenario under BaU and CM 1 and CM2

The reduction target of CO_2 emission as outlined in RAN GRK is 0.038 Gt for 26% reduction target and 0.056 Gt for 41% reduction target in 2020. This means that expected emission level after implementing mitigation actions is 1.0052 Gt for 26% reduction and 0.953 Gt for 41% reduction in 2020. By implementing mitigation CM1 scenario, CO_2 emission level would reach 0.965 Gton in 2020, which means this scenario could meet the RAN GRK 26% reduction target. By implementing mitigation CM2 scenario, CO_2 emission level would reach 0.947 Gton in 2020, which means this scenario could meet the RAN GRK 41% reduction target. Figure 7 presents primary energy supply and CO_2 emission scenario under BaU and mitigation (CM1 and CM2) for 26% & 41%. Figure 8 presents CO_2 emission reduction resulted from mitigation actions listed in RAN GRK for both mitigation scenarios (CM1 + CM2). Further analysis will be focused on the analysis of mitigation cost of each action for meeting the emission reduction target under CM1 and CM2



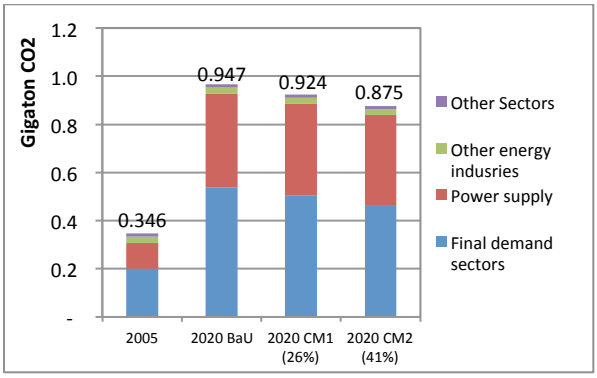


Figure 7. Primary energy supply and CO_2 emission scenario under BaU and Mitigation for 26% & 41%

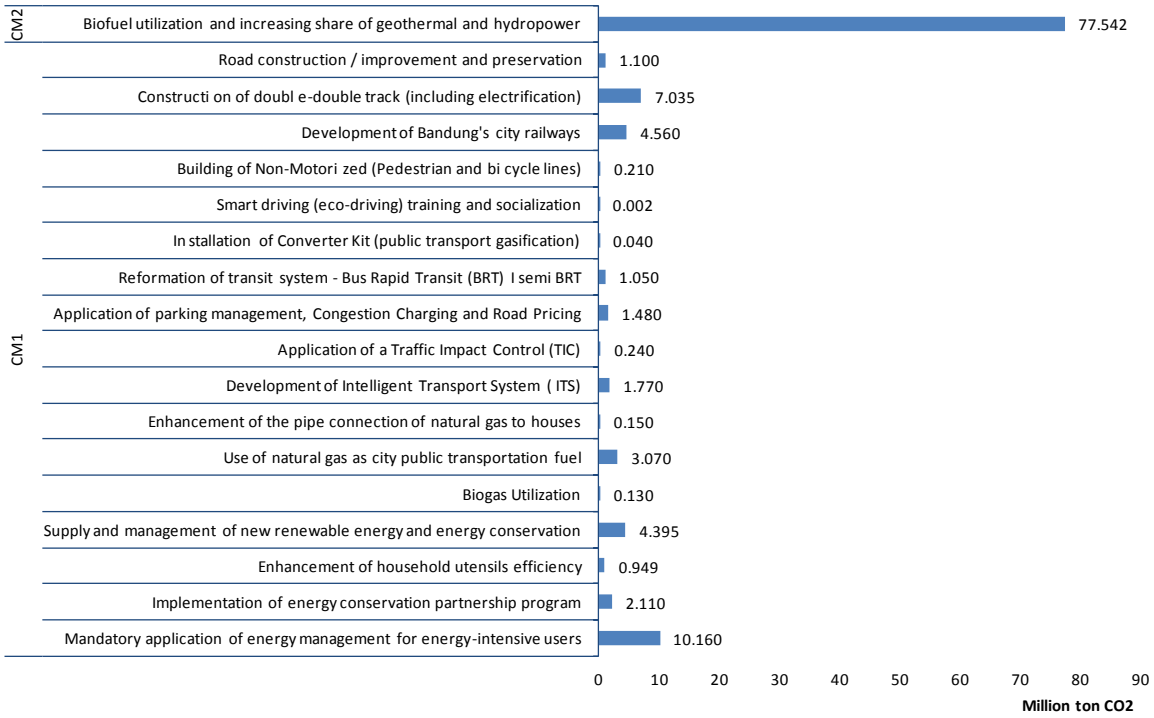


Figure 8. CO_2 emission reduction resulted from mitigation actions listed in RAN GRK to achieve 26% and 41% targets in 2020