Strengthening Planning Capacity for Low Carbon Growth in Indonesia: A CGE Country Analysis*

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1. Introduction
2. Motivations
3. Objectives
4. Methodology
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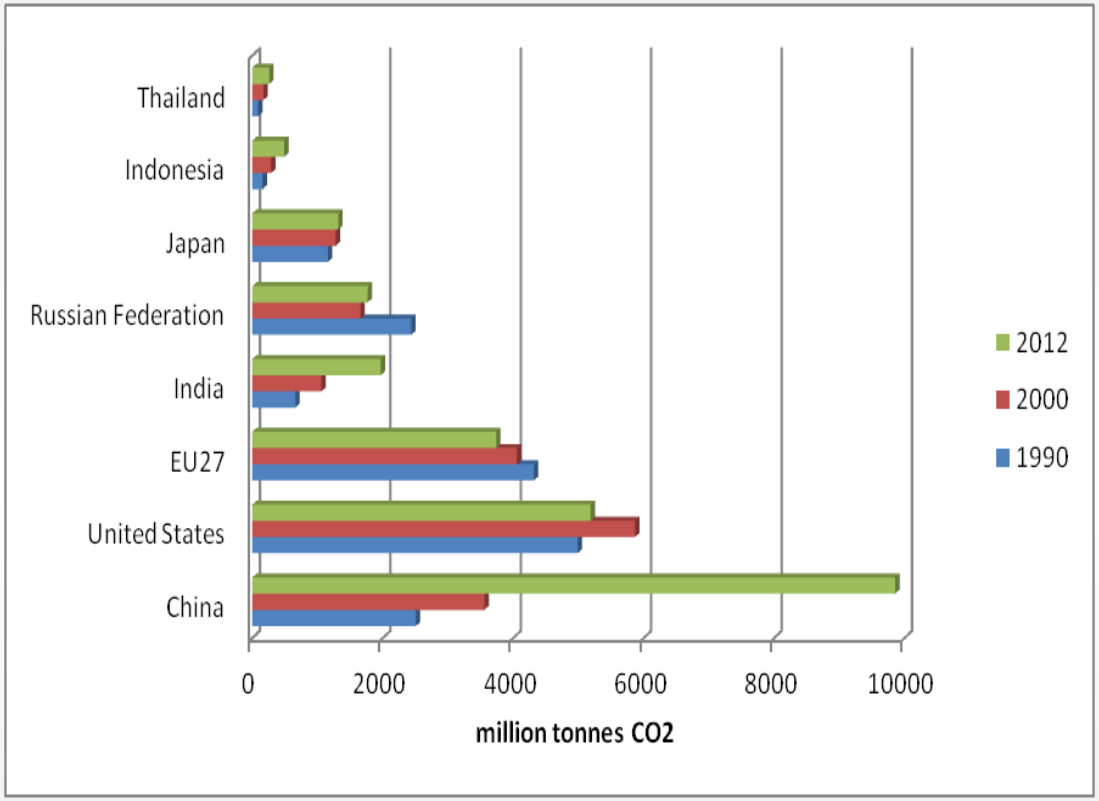
6. Conclusion

Introduction: Global CO2 Emissions



- Slower growth but still pretty high
- Indonesia is not one of the largest emitters but Indonesian CO2 emissions level is growing overtime

Introduction: Dealing with CO2 Emissions

- Australia introduced the Low Carbon Growth Plan (LCGP) in 2010
- Korea and its institutional approach
- However, single action will not have a significant impact on the environment → All countries should work together to reduce CO2 emissions

Introduction: Indonesia and CO2 Emissions

- The establishment of the Indonesia Climate Change Trust Fund (ICCTF) in 2009.
- Several initiatives on CO2 emissions reduction plan: 1. National Action Plan on Climate Change (RAN-PI) in 2007; 2. National Action Plan on GHG Emission Reduction (RAN-GRK) - Presidential Regulation No. 61 year 2011.
- Forestry & land use change is the biggest contributor of CO2 emission in Indonesia
- Energy sector is not the biggest contributors of CO2 emissions in Indonesia, but CO2 emissions that result from the energy sector are rapidly growing.
- Two economic tools that should be considered: energy subsidies and carbon tax
- In addition to the REDD implementation

Motivations: The Rationales Behind Energy Subsidies Reduction, Carbon Tax Policy, and REDD

- Energy subsidies
  - will distort price signal and
  - lead to misallocation of the natural resources.
- The implementation of carbon taxes
  - will raise energy prices and decrease the demand.
  - Consequently it will encourage economic agents to shift toward more energy efficient and more eco-friendly production.
- Removing energy subsidies and the implementation of carbon taxes
  - might have a negative effect on the economy (less competitive industry, lower household consumption, etc).
- Implementation of REDD
  - Might reduce CO_2 emission while raise the welfare
  - Have a negative impact on GDP
- Thus, a well-designed policy is necessary → Policy which considers the environmental, economy, and social aspects

Objectives

- This study aims to identify policies to assist the GoI to achieve low carbon growth:
  1). the removal of energy subsidy; and
  2). the implementation of a carbon tax policy.
  3). The implementation of REDD

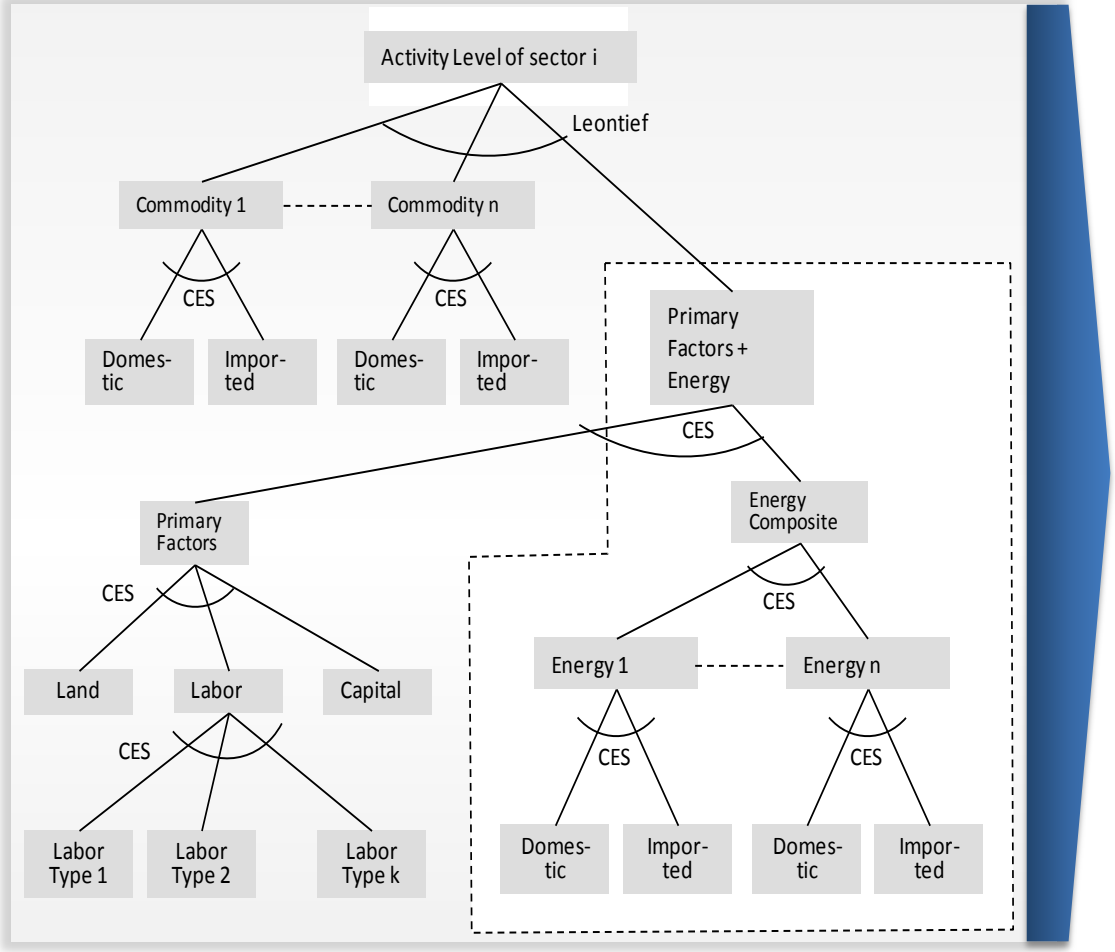
Methodology: Computable General Equilibrium Model

- A CGE model has the ability to describe the entire economy where all economic agents are taken into account using elaborated microeconomic foundation (Shoven and Whalley, 1992; Bergman, Karl-Göran et al. 2005).
- The CGE Model used is an extension of ORANIG-RD model developed by Horridge (2002). There were three modifications: energy possibilities, carbon emission accounting with carbon tax mechanism, and REDD mechanism
- The main database of Indonesian CGE model is the modified Social Accounting Matrix (SAM) Table.
- The 23 sector of standard SAM table is expanded into 47 sectors and commodities to get a more detailed energy and agriculture sectors.

Methodology: Indonesian SAM 2008: Sector Classification

Sector Classification	Sector Classification	Sector Classification
Paddy	Other Mining and Quarries	**Electricity non hydro**
Corn	Oil and Fat	**Electricity hydro**
Soya	Rice	**City Gas**
Other Food Crops	Sugar	Water
Rubber	Other Food	Construction
Coconut	Textiles	Trade
Palm Oil	Wood and Wood Products	Restaurant and Hotel
Other Crops	Paper and Machinery	Trains
Livestock	Chemical	Land Transportation
Forestry	Other Refinery	Air and Water Transportation
Fishery	**Gas Refinery (CNG)**	Supporting Transportation
Metal Mineral Mining	**LNG**	Bank and Insurance
Coal	**Gasoline**	Real Estate and Business
Oil	**Kerosene**	Public Services
Gas	**HSDO**	Other Services
Geothermal	**LPG**	

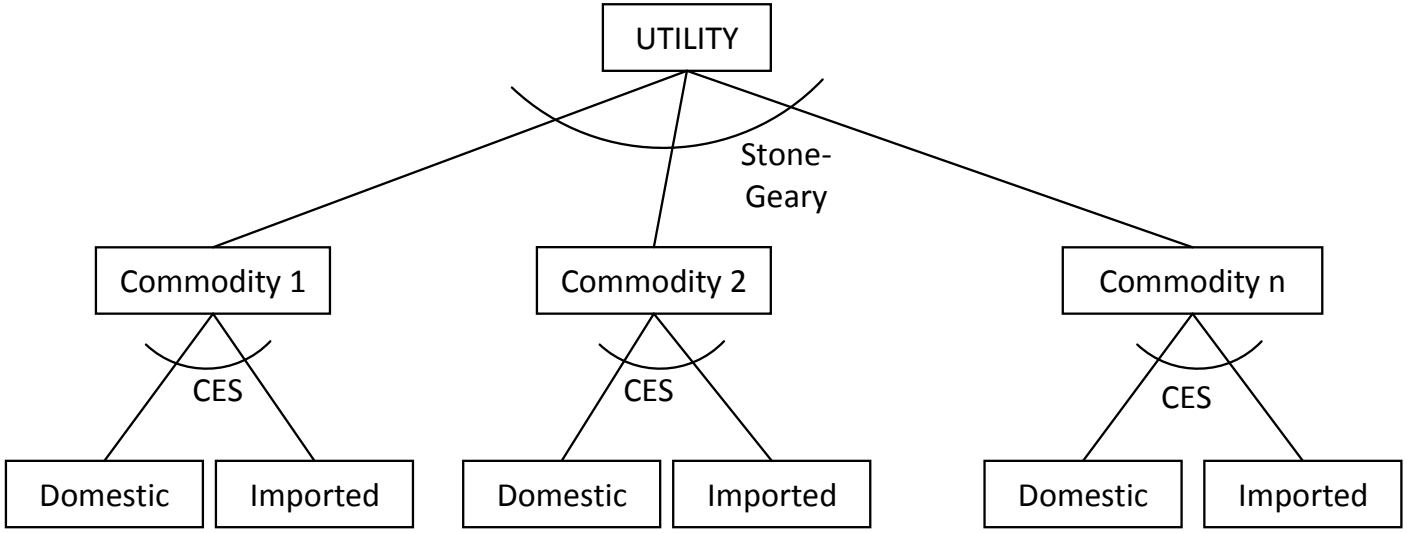
Methodology: Structure of Production



Nested production function

- Substitution between energy commodities
- Substitution between energy and primary factors

Methodology: Structure of Household Consumption



Nested consumption function

- Substitution between domestic & imported goods
- Substitution over commodities sourced-composite

Methodology: Sources of Data

- Input Output Table 2005 and 2008 obtained from BPS-Statistics Indonesia
- Indonesian SAM 2008, published by BPS-Statistics Indonesia.
- Carbon content coefficients for carbon emission calculation from energy use by users (industries and final demand) were taken from GTAP-7 dataset
- The substitution elasticity parameters values (expenditure, Armington, export and primary factor), and share of land in total capital in the model were obtained from GTAP-7 dataset
- Total carbon emission in 2008 was derived from World Bank country metadata, while the breakdown of emission emitted taken from the Indonesia Second National Communication Under The United Nations Framework Convention on Climate Change - UNFCCC (Ministry of Environment, 2010).

Methodology: Policy Simulation

- Two sets of simulation for energy Sector
  - Elimination of all subsidies on fossil fuels, such as gasoline, kerosene and high speed diesel oil in 2013.
  - Implementation of USD 10 per ton carbon tax in 2013
- These two policies were run under 6 different simulation scenarios
  - that differ on how the extra fund received from the implementation of the specified policy should be utilized by the government
- One set of simulation for forestry sector
  - The implementation of REDD in Indonesia from 2015 onward

Methodology: Policy and Simulation Scenarios #1

SIM 1	Keep the extra fund as saving
SIM 2	Allocate all the extra fund through proportional reduction of indirect taxes
SIM 3	Allocate the extra fund through 25% reduction of input taxes in the construction sector, while keeping the rest, if any, as saving
SIM 4	Allocate the extra fund through 50% reduction of input taxes in the renewable energy sectors (geothermal sector and hydropower sector) , while keeping the rest, if any, as saving
SIM 5	Allocate the extra fund through 25% reduction of input taxes in the transportation, and construction sectors, while redistributing the rest of the fund through proportional reduction of indirect taxes
SIM 6	Allocate the extra fund through 50% reduction of input taxes in the renewable energy sectors (geothermal sector and hydropower sector) , while redistributing the rest of the fund through proportional reduction of indirect taxes

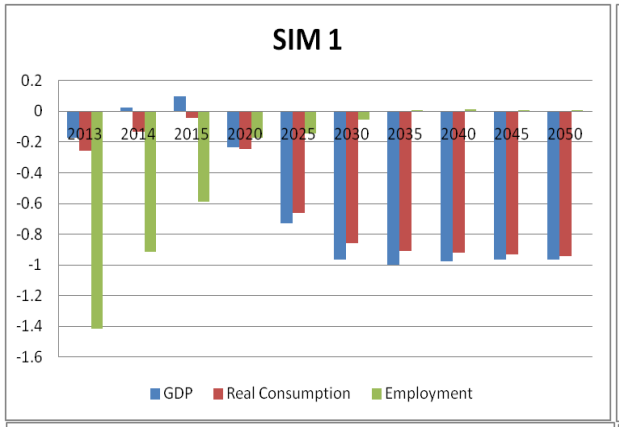
*) *government savings → comes from revenue generated by the removal of energy subsidies*

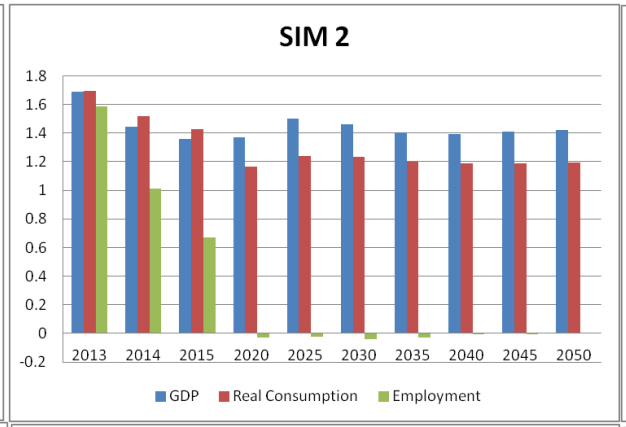
Methodology: Policy and Simulation Scenarios #2

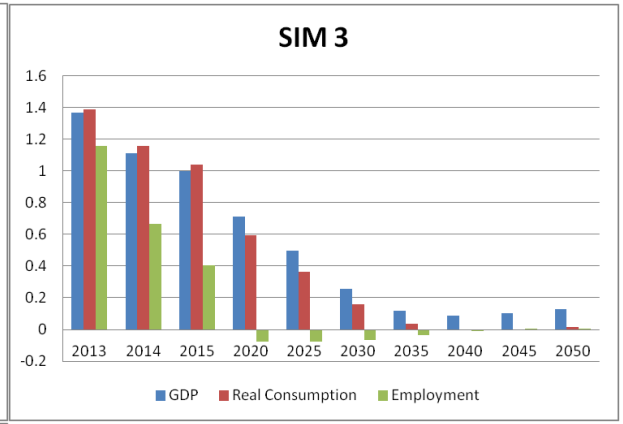
REDD simulation is focused on slowing down the land expansion in palm oil and industrial forest sectors while increase the natural forest cover.

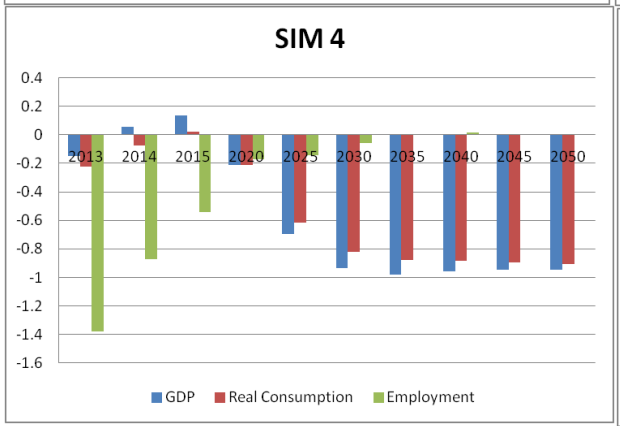
	Baseline	Simulation
Oil palm land expansion	6% per year	5% per year
Industrial forest land expansion	1% per year	0.8 per year
Compensation	USD 0 / tCo2	USD 10 / tCo2

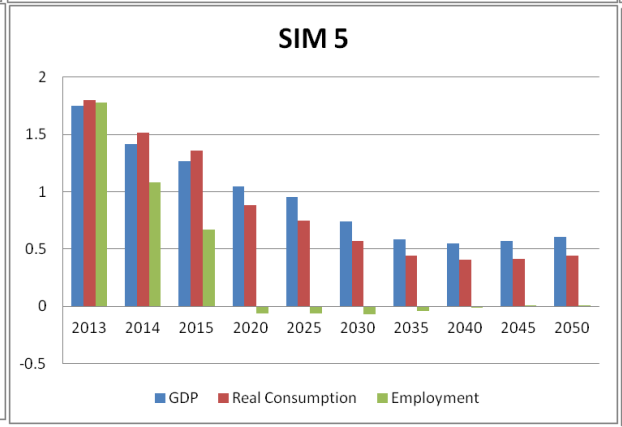
Findings: Impact of Phasing Out Fossil Fuel Subsidies on Macroeconomics Indicators

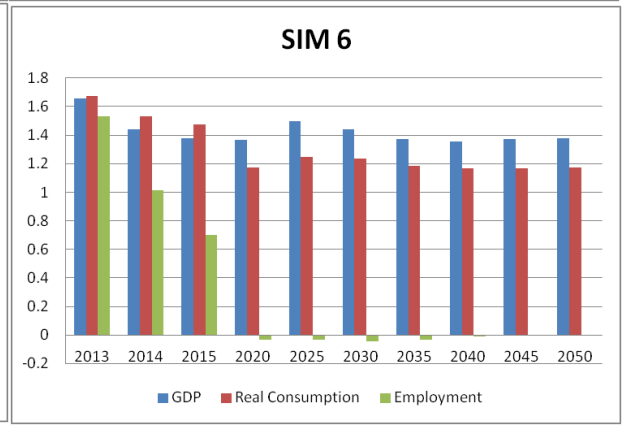




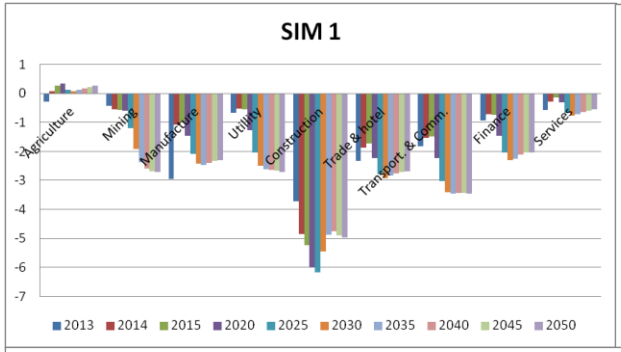


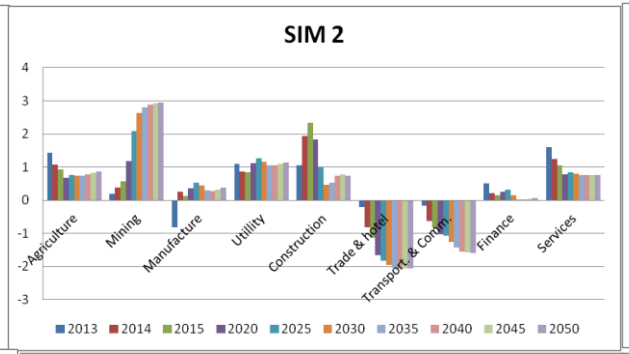


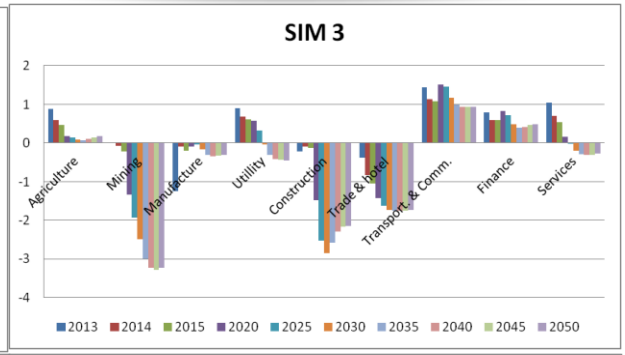


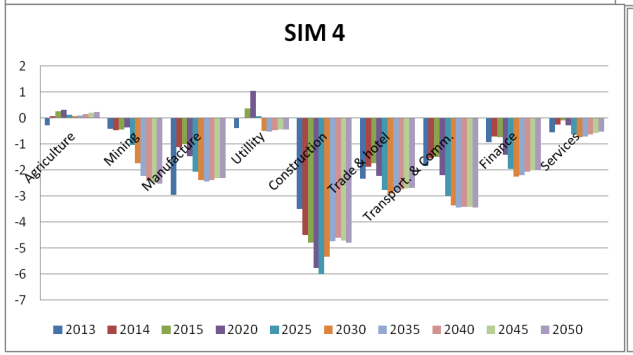


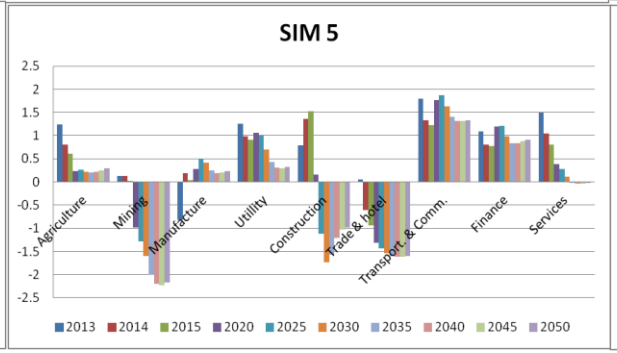
Findings: Sectoral Impacts of Fossil Fuel Subsidy Elimination

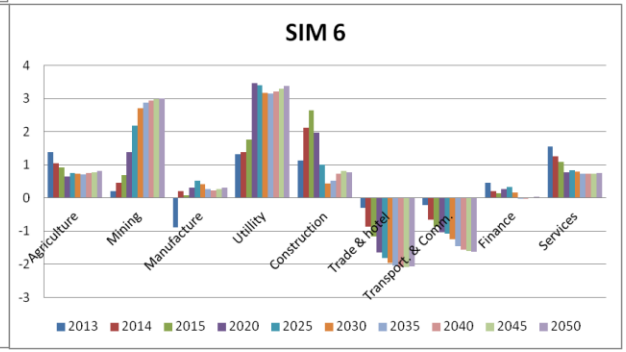




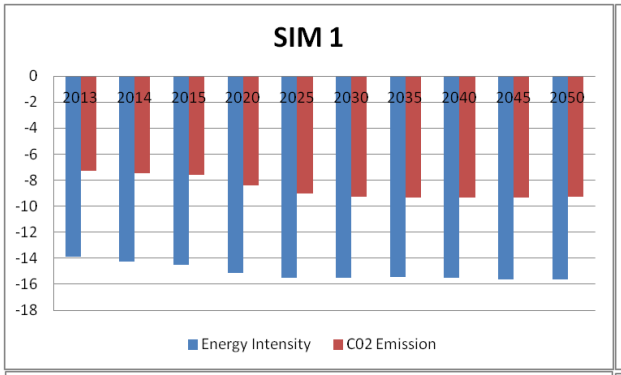


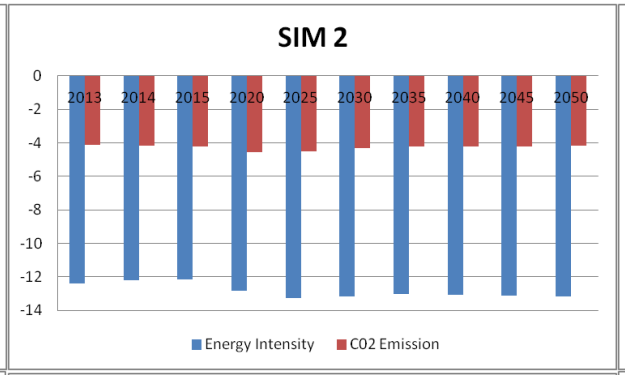


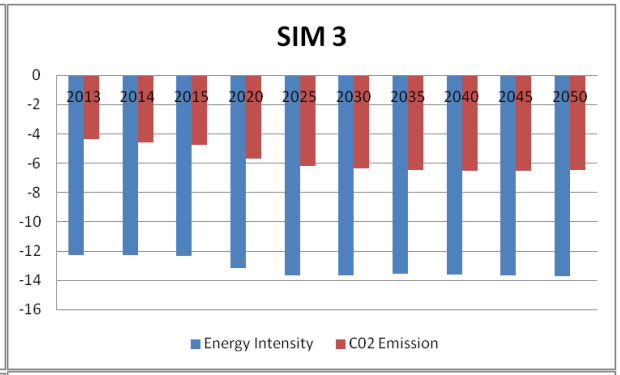


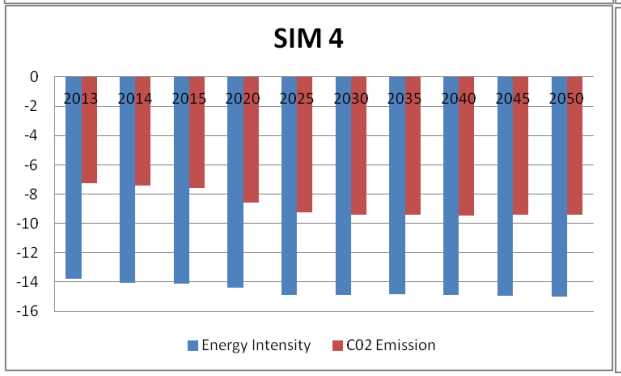


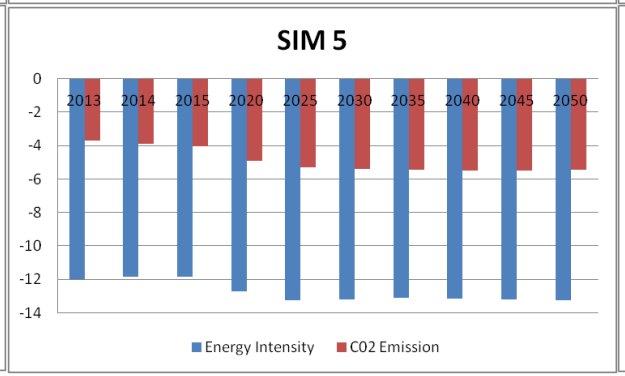
Findings: Impact of Phasing Out Fossil Fuel Subsidies on Environmental Indicators

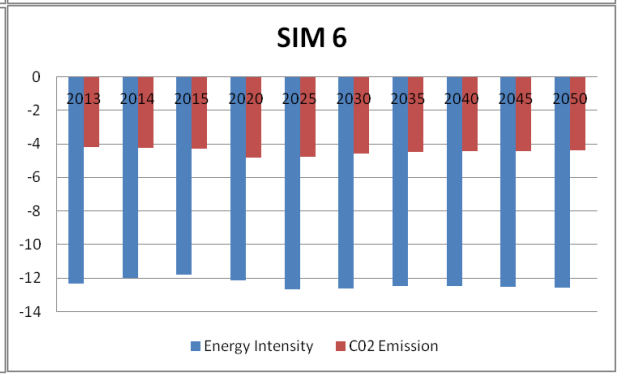






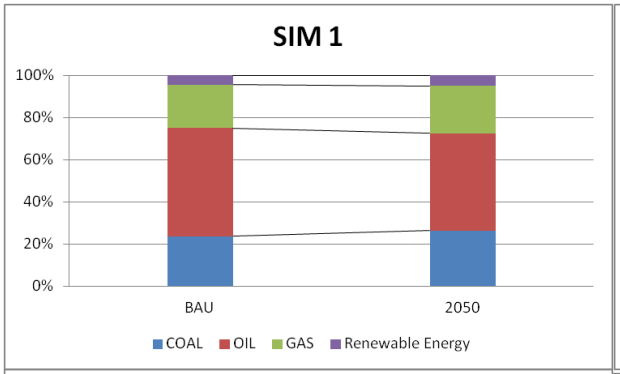


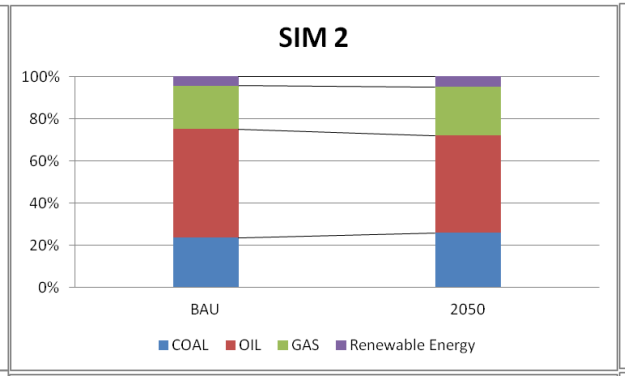


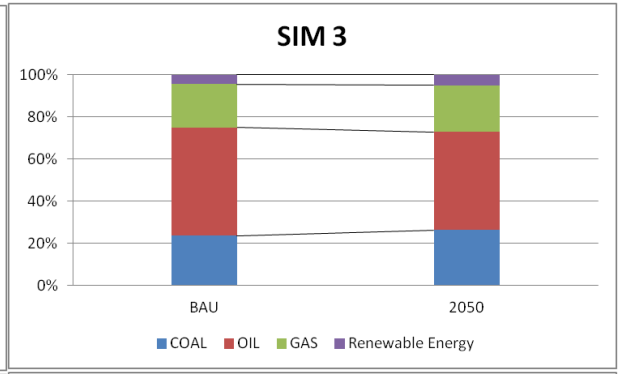


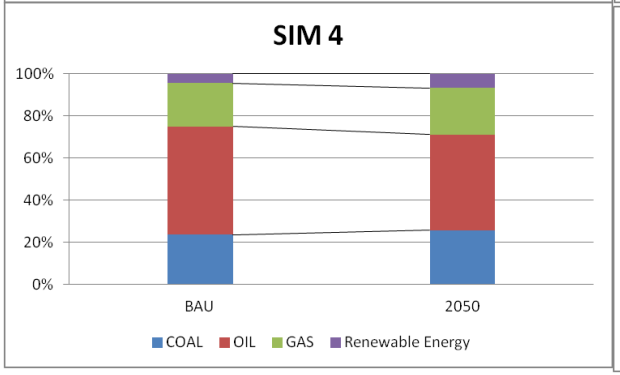
Findings:

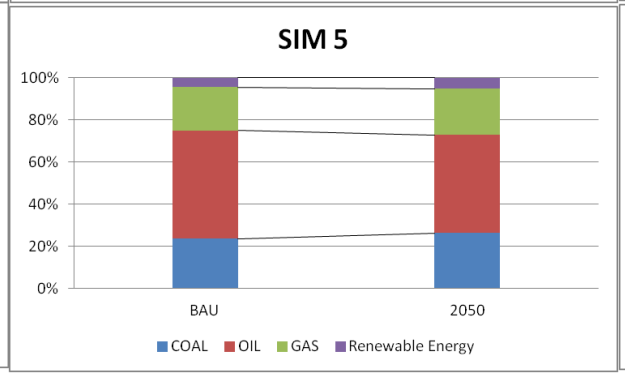
Impact of Phasing Out Fossil Fuel Subsidies on Indonesian Energy Mix

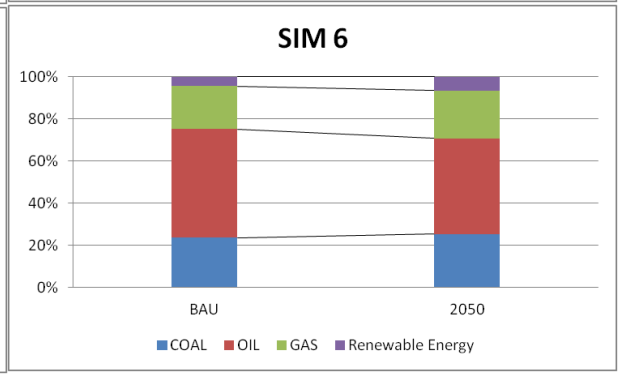








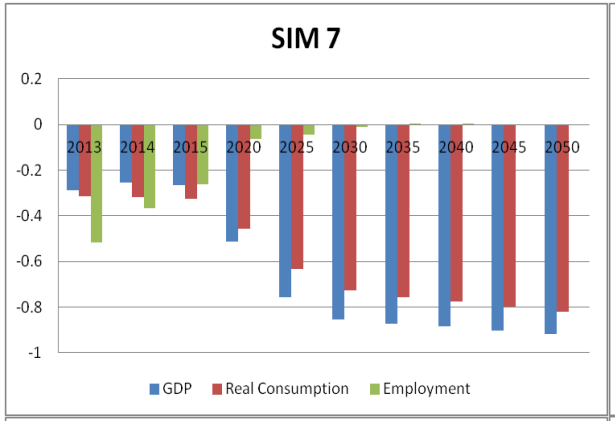


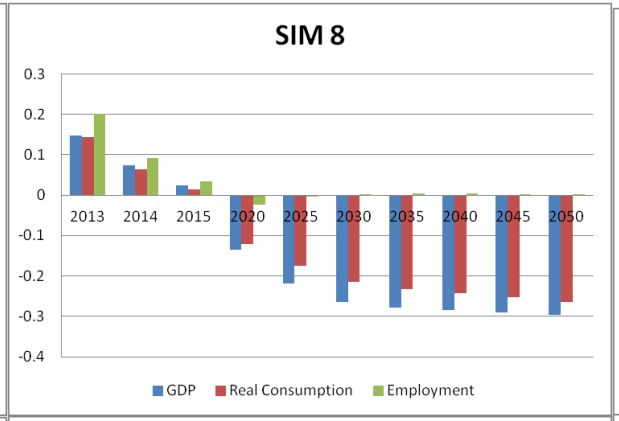


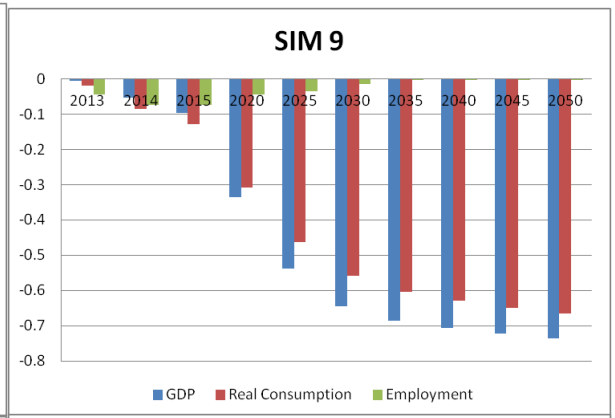
Findings Summary: Impacts of Phasing Out Fossil Fuel Subsidies

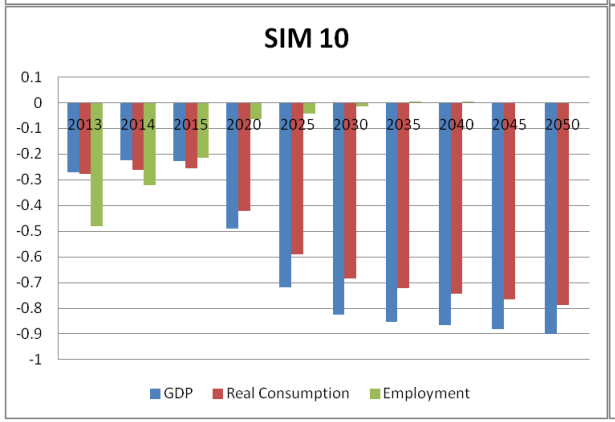
- In general, the elimination of fossil fuel subsidies that is not followed by significant compensation program
  - might have a negative impact on the economy as a whole.
  - will negatively impact almost all sectors, except the agriculture sector.
- Removing fossil fuel subsidies have a negative impact on CO2 emission and energy intensity which imply less pressure on the environment.
- The share of oil in Indonesian energy mix is expected to decrease.
  - Oppositely, other types of energy such as gas, coal and renewable energy will have a higher share in Indonesian energy mix.

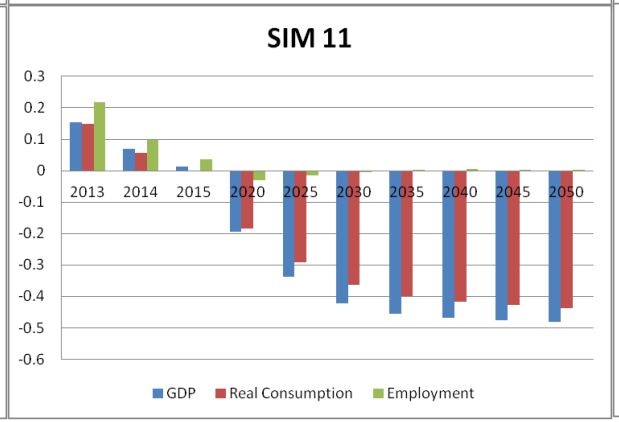
Findings: Impact of Phasing Carbon Taxes Implementation on Macroeconomics Indicators

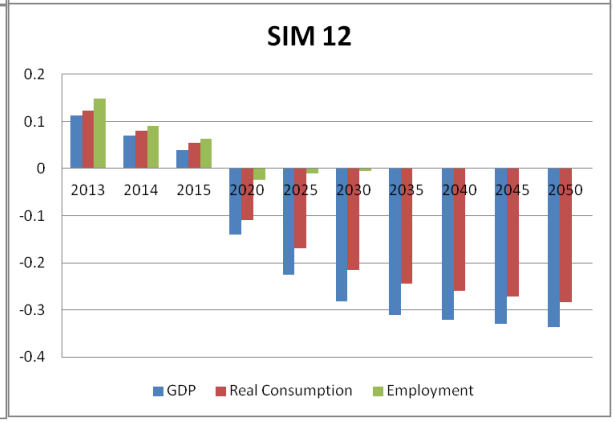




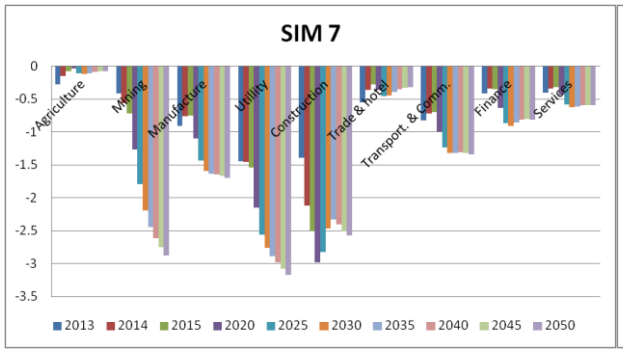


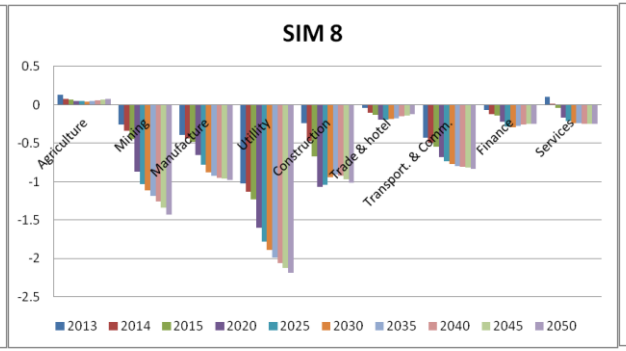


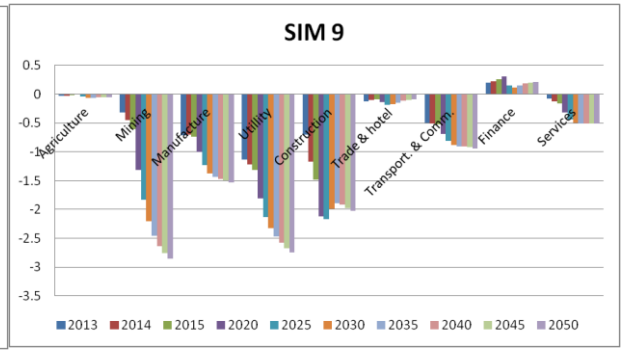


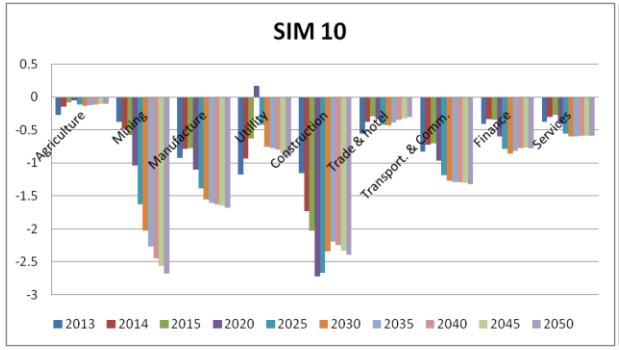


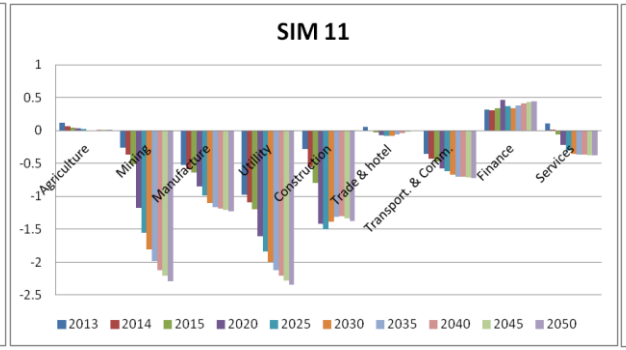
Findings: Sectoral Impact of Carbon Tax Simulation

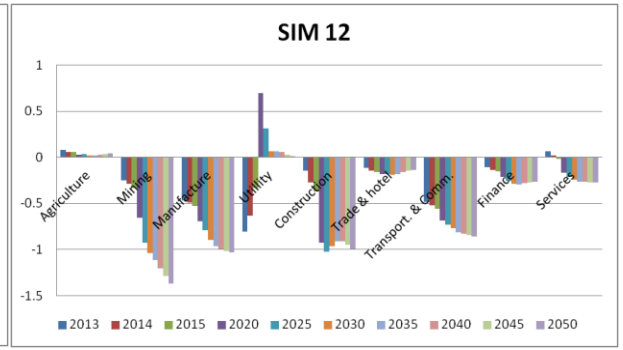




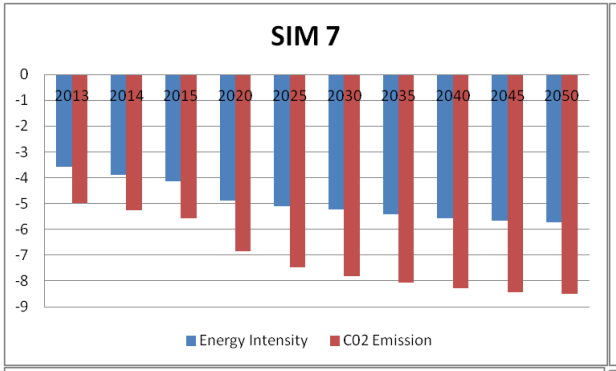


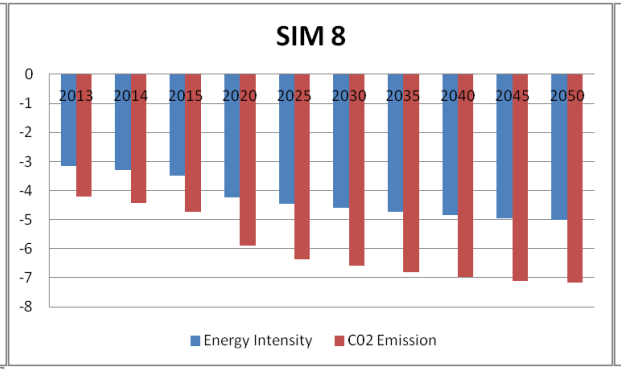


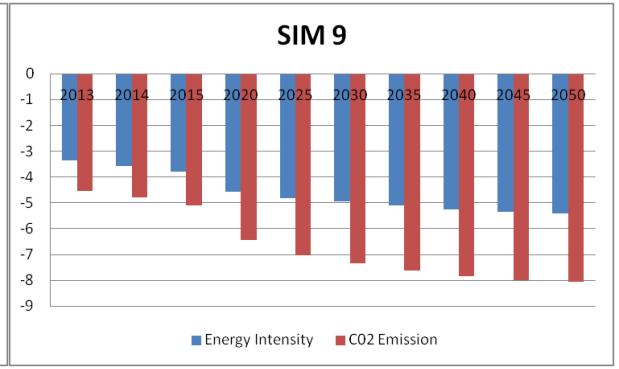


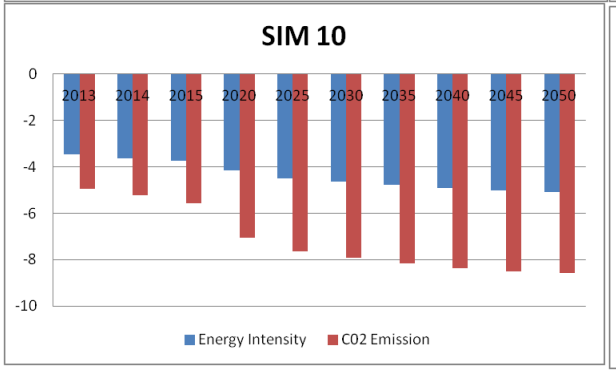


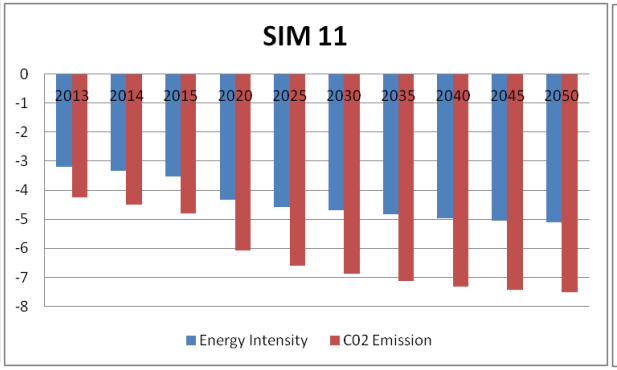
Findings: Impact of Carbon Taxes Implementation on Environmental Indicators

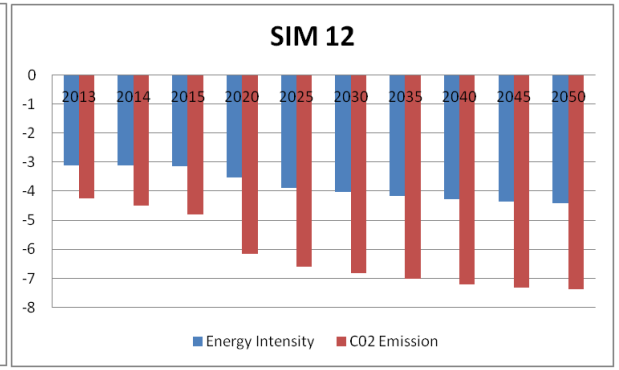




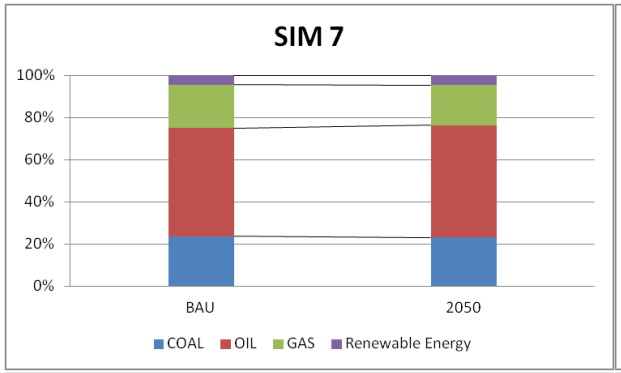


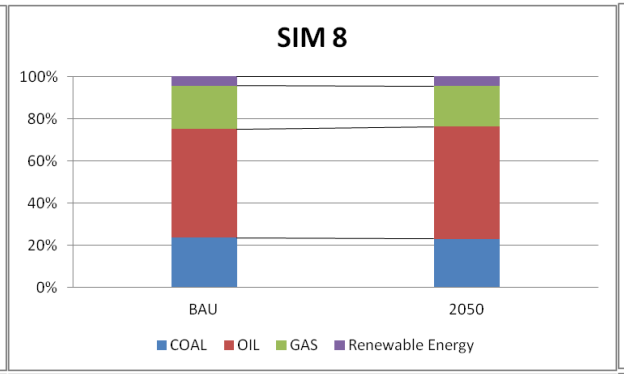


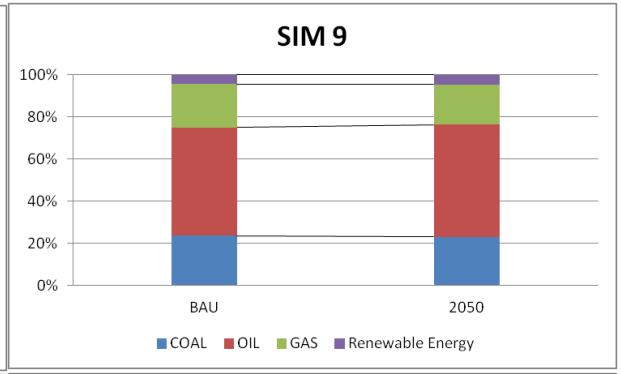


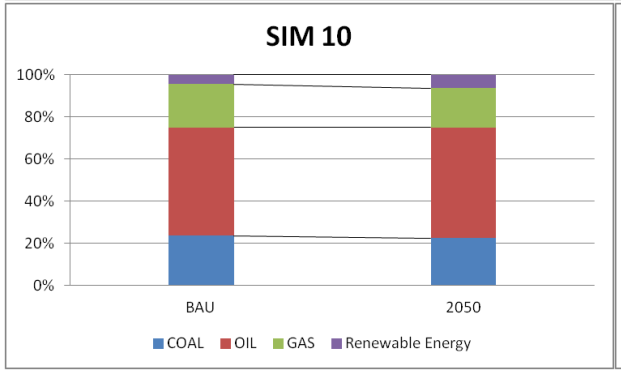


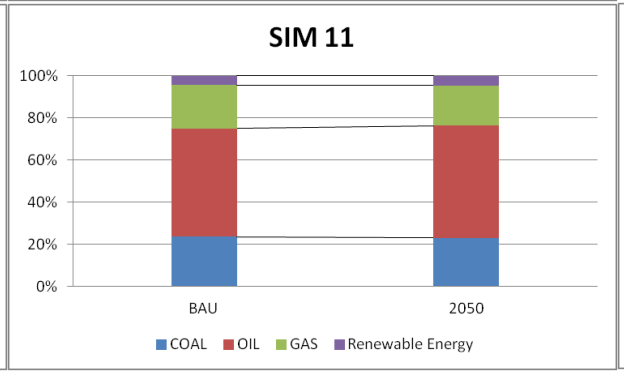
Findings: Impact of Carbon Taxes Implementation on Indonesian Energy Mix

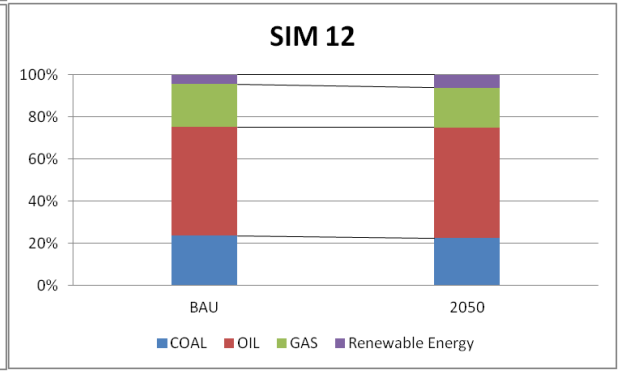








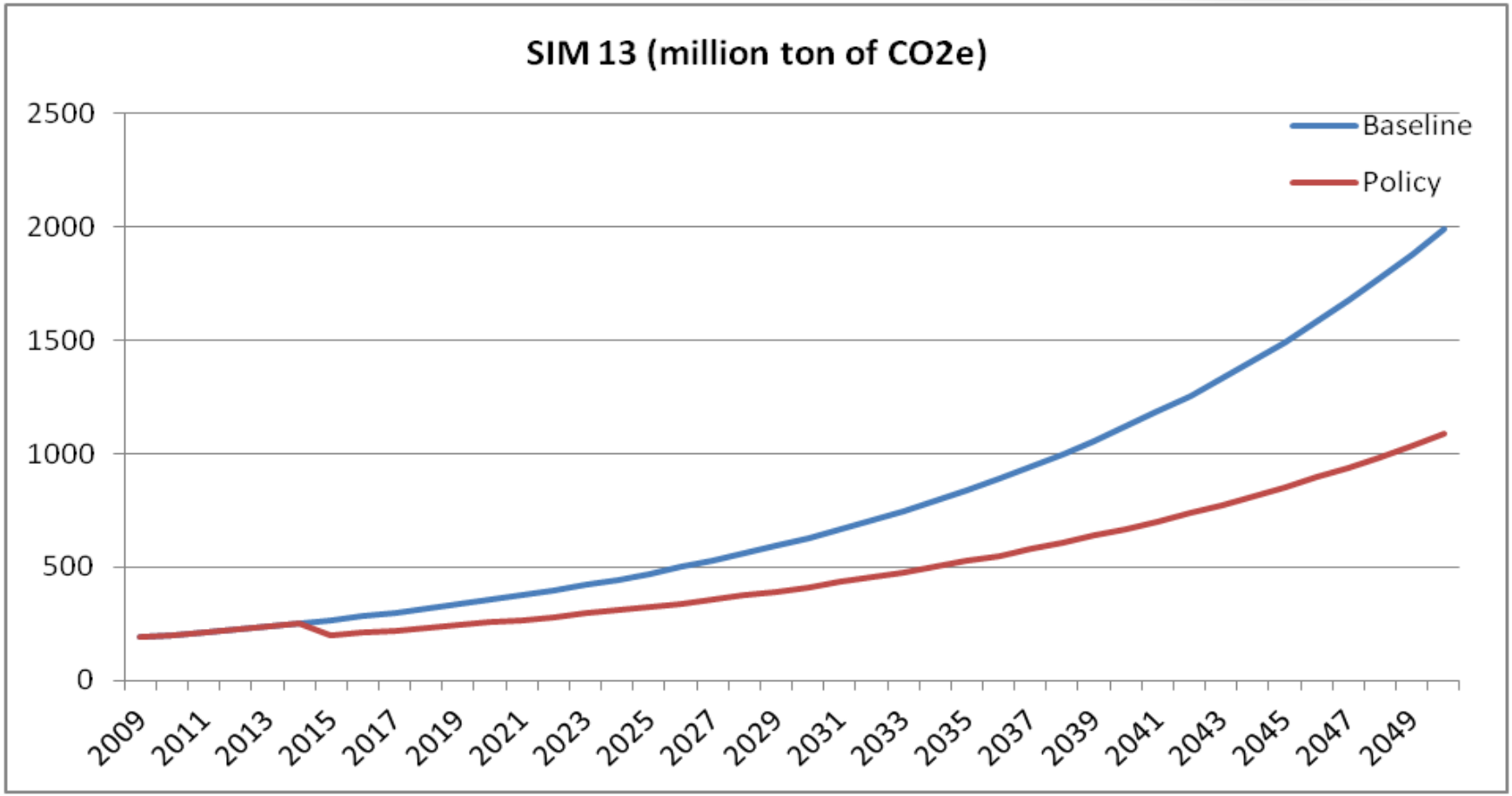




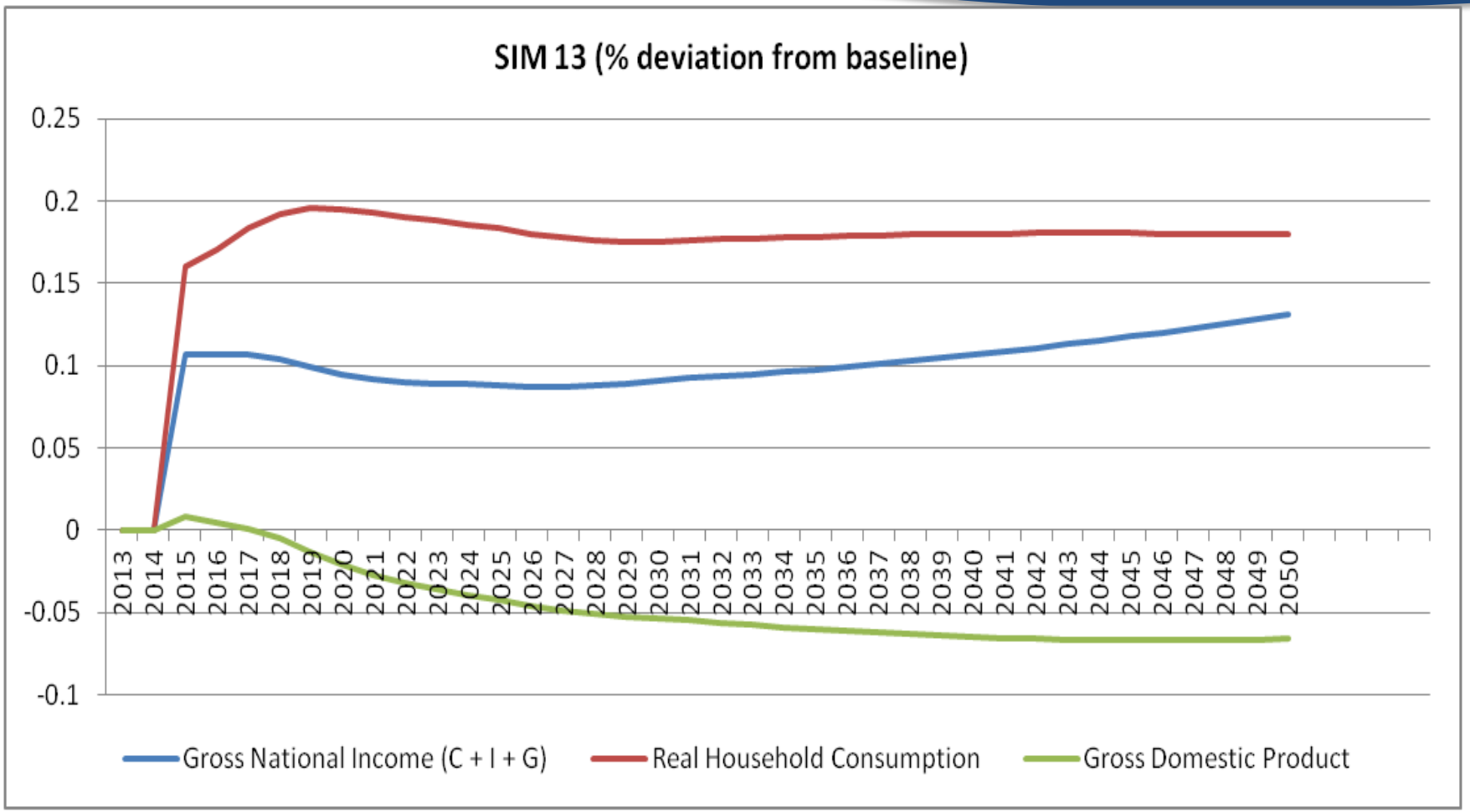
Findings Summary: Impacts of Carbon Tax Implementation

- Implementation of the carbon tax, which is followed by the reduction of indirect taxes, is expected to have a positive impact on GDP, real consumption, and employment relative to the BAU condition in the short run.
- Almost all sectors are expected to receive a negative impact due to carbon tax policy, except for some sectors, such as the utilities sector, the agriculture sector, and the finance sector.
- The implementation of carbon taxes will have a positive impact on environmental indicator, the CO2 emission as well as energy intensity.
- The scenario might bring Indonesia further away from its optimal energy mix which is stated in Indonesian Energy Blueprint.
  - Oil share in the Indonesian energy mix increases in all six scenarios.

Findings: Impact of REDD on CO2 emission



Findings: Impact of REDD on Welfare & GDP



Findings Summary: Impacts of REDD Implementation

- In general, the implementation of REDD will have a positive and persistent impact on Indonesian welfare
- On the other hand, it will have a negative impact on Indonesian GDP
- It will reduce the CO2 emissions nearly 50 percent compare to the baseline

Conclusion: Overall Impacts

1) There are several findings:

a. Stronger macroeconomic impact can be achieved by the phasing out fossil fuel subsidies policy;

b. The combination of the phasing out of fossil fuel subsidies policy and increase the government saving will result the most preferable impact on environment;

c. The impacts of the implementation of carbon taxes on both macroeconomic indicators and environment indicators are generally weaker than the phasing out of fossil fuel subsidies policy;

d. In terms of the impacts on the National Energy mix, the phasing out of fossil fuel subsidies policy is expected to have opposite results than the carbon tax policy.

e. The implementation of REDD in Indonesia has a big impact in halting the CO_2 emission and beneficial for welfare in general, however a contraction in palm oil and industrial forest resulting in a lower GDP.

Conclusion: Policy Implications and Further Study

2) Carbon taxes policy kept away the Indonesian energy mix target based on Indonesian Energy Blueprint where removal of fossil fuel subsidies is expected to lower the share of oil and increase the share of gas, and coal. Oppositely, carbon taxes will increase the share of oil and reduce the share of gas and coal.

3) GoI should consider combining several policies in order to achieve its target on low carbon growth, such as the development of renewable energy.

4) The study does not cover this political aspect, a further study on this issue is needed.

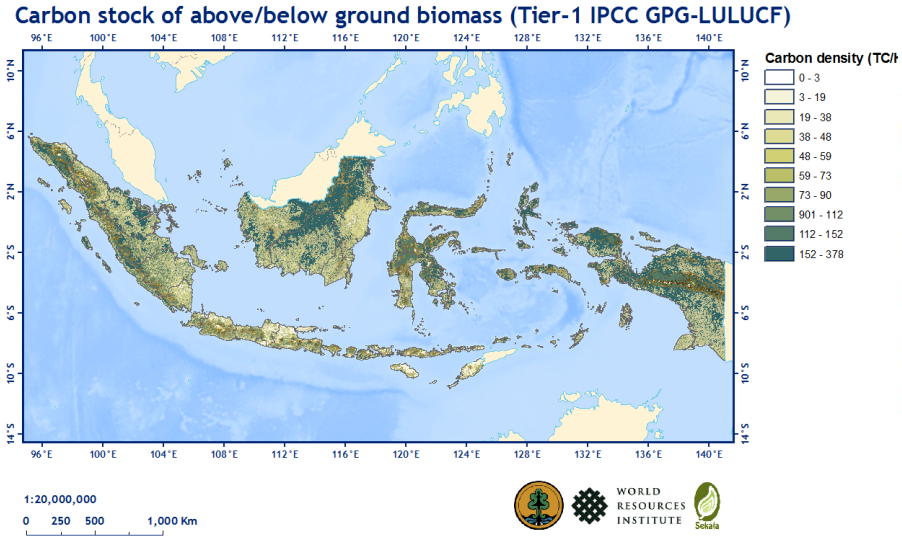
Thank You

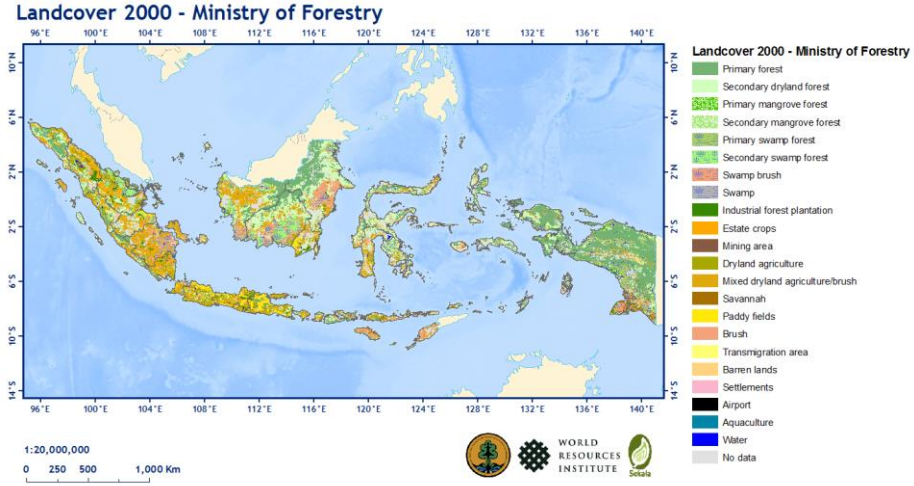
Incorporating carbon-dioxide emissions from land-use change in Indonesian CGE model

In order to incorporate carbon dioxide emissions from land-use change, we use the following data:

Carbon stock map (Figure 1)

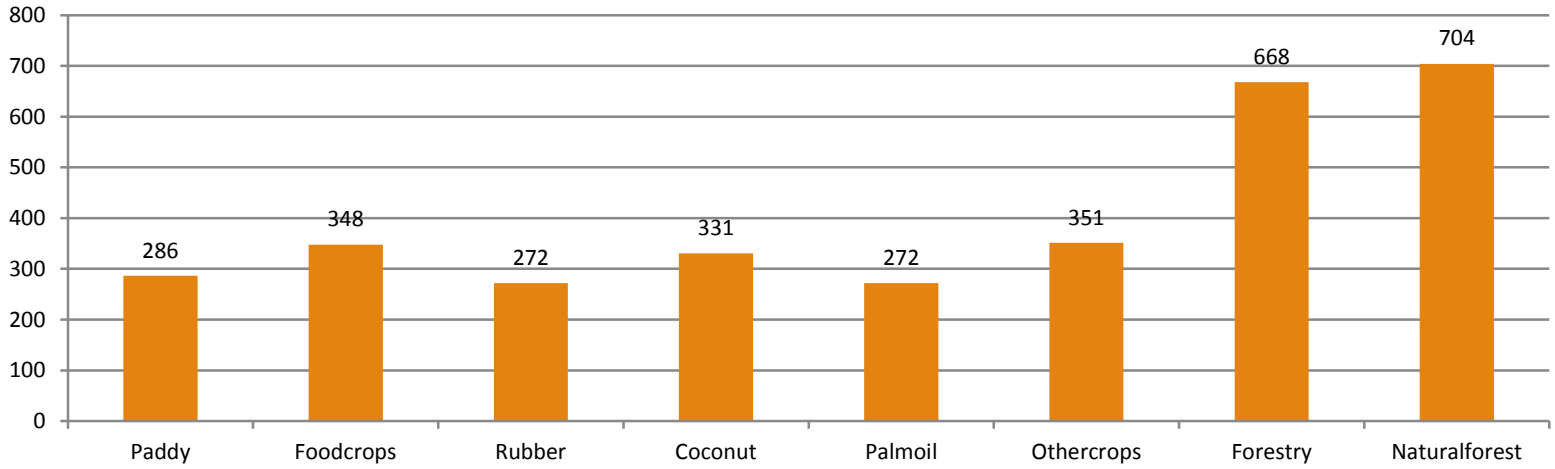
Land use map (Figure 2)





carbon-intensity

Figure 3. Carbon intensity (CO2/ha)



Note: using Geographic Information System (GIS) software we overlay the two map and calculate the average of carbon intensity. Here, we don't distinguish between peat or other type of land, as whether the land is peat or not-peat has implicitly been accounted for in the carbon stock map