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The Economic Implications of Natural Gas Infrastructure Investment

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Abstract

Since 2001, the Indonesian government has issued natural gas master plans annually holding the planned gas infrastructure developments in order to motivate private parties who are not motivated due to the lack of the gas infrastructure increase. Since 2002, there were only three segments of gas pipelines that have been tendered, Gresik-Semarang (2005), Cirebon-Semarang (2006), and Bontang-Semarang (2005, Kalimantan to Java pipeline) which have no supply anymore. The current transmission and distribution lines of 3,762.32 km and 4,554.54 km respectively are very small compared to developed countries in a similar gas resource position as Indonesia. The paper views the role of natural gas infrastructure for economic growth and energy security in Indonesia. The economic impacts of natural gas infrastructure are analyzed through the Computable General Equilibrium model. The results show that all financing scenarios have positive impacts on the various macro-economic indicators as well as on sectorial output and employment.

Keywords: CGE model; energy investment; Indonesia; natural gas; natural gas infrastructure

1. Introduction

Indonesia liberalized its natural gas market in 2001; to give private investors an incentive to invest in the bidding process for new gas infrastructure. The private willingness to invest was minimal and extending the national gas pipeline infrastructure remains far behind the planning. Since 2002, only three bids for gas pipeline segments have been tendered, Gresik-Semarang (2005), Cirebon-Semarang (2006), and Bontang-Semarang (2005, Kalimantan to Java pipeline). To date, none of these segments has gas supply certainty. Transmission lines

of 3,762.32 km and 4,554.54¹ km along the distribution network are relatively sparse when compared to similar facilities owned by developed nations (UK, 19,000 km; Netherlands, 11,600 km; and even Japan, 3,000 km) and are very small compared to the size of Indonesia (Nugroho, 2004).

This paper analyzes Indonesia's gas infrastructure needs to ascertain the requirements for continued economic development and growth. Indonesia's options for financing the needed gas infrastructure investments are also assessed. Three options are proposed for financing infrastructure investments: foreign loans, removal of the gasoline subsidy, and state revenues from the oil and gas sector. The analysis is guided by the idea that natural gas should contribute to the nation's economic development, increased employment, and energy security.

This paper therefore addresses the following research question: How significant is the role of gas infrastructure in supporting Indonesian economic growth and energy security, and what are the viable options for financing it? Section 2 briefly discusses the general outlook of Indonesian natural gas demand and infrastructure, section 3 discusses the methodology and simulation scenarios, section 4 discusses the results, and section 5 summarizes the major findings.

2. Indonesian Natural Gas Overview

2.1. The Role of Natural Gas

¹ The length of transmission is not a proper proxy for connectivity, but it can be used as a rough estimation of how mature a nation's network is. Here the proportion of the transmission length and distribution with the size of the country is relatively small if compared to smaller nations like the UK or the Netherlands, which have longer transmission lines.

The Indonesian government's 'Master Plan of Acceleration and Expansion of Indonesia's Economic Development 2011-2025' aims to accelerate development of various existing economic programs; to increase the value added from prime economic sectors, and in particular energy supply. The target is Indonesian GDP growth of 4.0-7.5% for the period 2011-2014, and 8-9% for the period 2015-2025 (Kementerian Koordinator Bidang Perekonomian/Coordinating Ministry for Economic Affairs, 2011). This can only be achieved with sufficient available energy resources, including natural gas. Natural gas plays a vital role in Indonesian economic development and in ensuring energy security.

2.2. Natural Gas Infrastructure

Figure 1 shows the existing and planned natural gas infrastructure. Northern Sumatra, western Java, and eastern and central Java are regions that need additional gas supply because local production is not sufficient. Gas supply is expected to come from the Natuna block, Senoro (Sulawesi), Masela (Maluku), and Tangguh/Wiriagar (Papua); these are remote areas in eastern Indonesia with no gas infrastructure. The Indonesian government prepares a natural gas master plan every year; despite lofty planning ambitions, actual infrastructure investments lag behind. Two problems have been identified related to the government master plan's failure. The first is a lack of coordination between government agencies, where Badan Pengatur Hilir² (BPH) tends to doubt the feasibility of government planning, including gas supply certainty. The second problem is that liberalization in the

² BPH is regulatory body who has the responsibility for regulating and supervising the business activities of fuel supply and natural gas transportation business through the pipeline (LNG and other type of gas transportation mode are not included).

downstream market increases potential investors' uncertainty, due a lack of long-term contracts for gas supply.

Previous literature on the impact of infrastructure can be found in Bohme et al. (2010), who argued that decisions about public investment are made on the basis of their growth and poverty effect. From that perspective, it is important to know in advance where to invest. There is broad agreement in the economic development literature that productivity-enhancing public investments to support the private sector are keys for growth and job creation (Syrquin and Chenery, 1989; World Bank, 1993; Collier, 2006; Breisinger et al., 2009). Agénor and Moreno-Dodson (2006) and Fourie (2006) argued that infrastructure can impact economic growth in some ways, lower the cost of input factors, improve worker productivity, and also creates job multipliers during the period of construction. Caloghirou et al. (1996) estimated the macroeconomic impact of investment in gas infrastructure using Input-Output Analysis; while Lu et al. (2010) analyzed the impact of energy investment on economic growth using a Computable General Equilibrium (CGE) Model.

3. Methodologies

3.1. Computable General Equilibrium

A static CGE model is applied to simulate the impact of natural gas infrastructure financing. Before setting the scenarios, the needs for gas infrastructure are examined. Tjandranegara (2012) identified and mapped the infrastructure needed to improve domestic consumption of natural gas in Indonesia. He developed an infrastructure plan drawing on the previous study of Zawier (2010), who estimated the investment costs of gas pipelines and LNG terminals (Gary and Handwerk, 2001; Perry et al., 1997). Two important

infrastructure projects are taken from Tjandranegara's infrastructure planning as the reference points: two new LNG receiving terminals in Java that will add additional capacity for 750 (250+500) MMSCFD from domestic production or imports, and the pipeline network for Natuna-West Java, which connects the giant gas fields of Natuna to West Java. CGE is an attempt to utilize general equilibrium theory as a tool to perform an empirical analysis of allocation of resources in a market economy (Bergman, 2005). The forerunner of CGE models used in this study is based on the CGE models of economic equilibrium used in Australia Orani-G models.

Structure of CGE Model

This structure of CGE model consists of several blocks of equations: (i) Production block: reflecting the structure of production and producer behavior; (ii) Institution block: reflecting the behavior of households and other institutions³; (iii) Block of Market Clearing and other equations: determining the market clearing conditions for labor, goods and services in the economy.

Database of CGE-Social Accounting Matrix

Table 1 show the classification of Indonesia's economic sectors which have been used as database of the Indonesian SAM in the model. The original SAM is modified; the modification is the disaggregation of the energy sectors - coal, natural gas, crude oil, geothermal, and mining, the separation of the petrochemical sector from refinery in general and the distinction between electricity, urban gas, and water. The analysis covers 44

³ Institution refers to economic actors in the SAM database, which consist of household, firm (private sector) and government.

economic sectors; another modification is household type which is aggregated in one type of household.

Simulation Scenario

The CGE model is used for empirical analysis to change the properties of endogenous and exogenous variables to simulate certain policies under certain conditions. Endogenous variables are explained by the model, whereas exogenous variables are set or are assumed to be fixed; the policy shocks for simulation will be set on exogenous variable. Before the scenarios are set, the needs of gas infrastructure are mapped.

3.2. Possible Infrastructure Projects as Reference of the Analysis

Two important infrastructure projects are taken from Tjandranegara's infrastructure planning as the reference points; as mentioned in 3.1 above. Three different financing scenarios for the infrastructure investments are distinguished and analyzed. In the first scenario, it is assumed that the investment will be financed by a foreign loan and therefore the financing will not affect the government budget for other sectors, other than in the form of interest payments. In the second scenario, the investment is financed from a reallocation of the gasoline subsidy budget. This scenario is based on the assumption that the economic impact of the gasoline subsidy can be improved by using the money on energy infrastructure instead of gasoline consumption. In the third scenario, financing comes from a reallocation of government revenues from oil and gas production. This scenario draws on recent debates in Indonesia about spending part of those revenues on oil and gas sector development, instead of using all revenues for the general economy. The proposed percentage for petroleum is 5% of state revenue from oil and gas which is considered to be a reasonable source of funds for natural gas infrastructure.

4. Result

4.1. Influences on Macro Indicators

The long-term effects of gas infrastructure investment are summarized in Table 2. Almost all macro indicators show positive impacts in every scenario. GDP increases gradually; this is caused by expansion of gas-intensive user sectors – industry and electricity, and is followed by increase in investment. Household consumption shows overall increase in all gas price increase scenarios. Scenario B, reallocation of the gasoline subsidy shows the highest increments in macro indicators. This supports the argument that this subsidy is a fiscal burden and would be better spent on infrastructure. Scenarios A and C show almost similar positive trends, although somewhat smaller than in Scenario B. It is no surprise that reallocation of state revenue from oil and gas reduces the government's spending capacity.

4.2. Influences on Sectoral Output and Employment

The output of the gas-intensive sector, electricity, petrochemical, paper increases slightly with an average of 0.25% for all scenarios. However, food processing and textile production decreases. Some non-gas-intensive sectors also show positive change as a result of an indirect impact from gas-intensive industry. Land transportation decreases almost 0.4% in Scenario B, which is explained by the impact of gasoline subsidy removal (see Figure 2). Figure 3 show that employment has the opposite trend with sectoral output. Employment levels decrease in all scenarios, except C. In Scenario B, the gas-intensive sectors like electricity, petrochemical, and paper also show decline in employment. This might be due to change in production costs in the industrial sectors, where subsidy removal will increase costs that lead to labor adjustments.

4.3. Influences on Energy Consumption

In long-term energy consumption changes in utilization pattern (see Figure 4); gas shows a significant increment, with an average 1% to 2% increase in utilization, while coal consumption decreases slightly because of shifts from industry or electricity to natural gas. The same condition applies for HSDO consumption. Gasoline decreases tremendously in Scenario B, particularly B3, as an impact of subsidy removal. Renewables increase slightly, particularly in the subsidy removal scenario, which supports the proposition that gasoline subsidy hinders renewable energy development. In general, all scenarios have the same trend in energy utilization pattern.

5. Conclusion

The simulation shows that public financing of gas infrastructure investment will stimulate economic growth. It is worth noting that all financing scenarios have a positive impact on the various macroeconomic indicators, as well as on sectoral output and employment. It also shows that gas consumption will increase. It confirms the initial assumption that gas infrastructure investment is productive for economic growth and energy security.

Scenario B, subsidy removal, shows the most positive impact on macro indicators; followed by Scenarios A and C with somewhat similar results. This finding supports opinions in Indonesia suggesting a reallocation of fuel subsidies in favor of more economically productive spending. However, Scenario C, reallocating government revenue from oil and gas in favor of natural gas infrastructure investment, has the largest positive economic impact on sectoral performance (output and employment), followed by Scenario A, foreign aid. Financing the investments through foreign loans is actually not a viable option, because the loan is outside control of the Indonesian government. The findings of the research are encouraging for private investment in Indonesian natural gas infrastructure.

The results show that significant economic gains are associated with such investments. This might help to improve the investment climate in the gas sector.

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