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# GAS RE-ALLOCATION POLICY ON ECONOMIC GROWTH IN INDONESIA

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***Abstract***

*In 2010 the Government of Indonesia has changed the purpose of utilization of natural gas, from export oriented in order to earn foreign exchange became sufficient gas for domestic oriented as to encourage national production growth and create a greater multiplier effect on the economy. This policy pored over regulation of the Minister of Energy and Mineral Resources No. 03 of 2010 on The Allocation and Utilization of Natural Gas for Domestic Needs. This condition brings dilemmatic to the Government. Therefore the purpose of this research is (1) analyzing the economic factors that affect the supply and demand as well as exports of gas Indonesia and (2) analyzing the reallocation policy on the development of gas industry and economic growth in Indonesia. In order to answer the research objectives is used econometrics approach with 2SLS methods and used time series data from 2000-2012. The results showed that the main factors that affect the behavior of the production of gas are the world gas price and Indonesian gas price. While export gas Indonesia's response to the gas production of elastic in the long run shows the development potential of resources in pushing gas export gas Indonesia. On the other hand the factors that affect the demand for gas by Indonesian electrical company and industrial fertilizers urea vary. However subsidies became influential real policies in boosting demand for gas by both industries. Based on simulation results in 2012-2018 showed that the reallocation policy gas Indonesia has not yet given the best solution for increasing domestic demand for gas Indonesia. The policy of future energy development by Goverment on gas would give relative positive impact to the economic growth and development of gas production .*

***Keywords**: Natural gas, economic growth, policy, reallocation, simultaneous, 2SLS*

## 1. INTRODUCTION

The growth of domestic demand on energy continues to increase each year, despite the decreasing capacity of national oil and gas production, which results in the necessity of the alternative energy for supplying the domestic needs. Currently, the largest energy demand is on the fuel and is mainly used for the transportation and power generation sectors. The increasing demand on fuel has caused the increasing need for fuel and electricity subsidy. In the end, this condition can suppress the domestic economy where in part, the fuel is imported. The high import value causes the deficit in the balance of payment due to the decreasing amount of export foreign exchange, that it puts a lot of pressure on the exchange rate of Indonesian Rupiah to the US Dollar. The dependency of fuel subsidy has been causing Indonesia to have difficulty in improving the national income per capita and be included in country with the middle-income trap category.

### 1.1. Background

Gas has various benefits than other sources of energy in Indonesia. This is due to its abundant resources, environmental friendly, and efficiency, especially if it is considered from the lower cost of capital to transform the energy into electricity. In the other hand, although coal, as one of the substitution energy, is cheaper but it is not environmental friendly; while other renewable sources of energy (wind, solar, and sea) is relatively expensive from the perspective of economy. Based on the above consideration, gas is very potential to be developed as one of the energy mix because it identifies the best

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energy mix to boost the economic growth (Elizabeth, 2011).

Therefore, the Government, by the Presidential Decree (Perpres) No. 5 Year 2006 regarding the National Energy Policy, has stipulated the target of energy mix year 2025 with the target consumption of gas of 30 percent, coal 33 percent, and fuel 20 percent, and the rest will be the other renewable sources of energy. The background of target was to reduce the dependency to the oil in supplying the domestic energy needs and optimize the development of renewable sources of energy.

In line with that, in 2010, the Government of Indonesia has changed the purpose of gas utilization, from the source of income which is export-oriented for the source of foreign exchange into the growth of economy by supplying the gas for domestic industries that it could boost the national production growth and create the larger multiplying effect to the economy. The policy was stipulated in the Regulation of Minister of Energy and Mineral Resources (Permen ESDM) No. 03 Year 2010 regarding the Allocation and Utilization of Gas for Domestic Needs. According to the Agency for the Assessment and Application of Technology (BPPT, 2010), if the export for gas is not reduced, in the long term, the domestic consumption of Indonesian gas will not be sufficed.

The utilization of gas for domestic needs has been increasing since 2003 to 2010. In 2003, the utilization of gas for domestic use was only more or less 1 500 *Billion British Thermal Unit per Day* (BBTUD) or 25 percent and the export for gas was more or less 4 500 BBTUD or 75 percent, however, in 2010, according to Legowo (2010) the utilization of gas for domestic use has reached 50.6 percent and 49.4 percent was used for export purpose. The milestone for accelerated increase of gas utilization was due to the policy for national energy by means of Presidential Regulation year 2006. Therefore, various preparations for gas infrastructures and investment allocation from the Government was driven to develop domestic gas industry, such as the utilization of new technology of Liquefied Natural Gas (LNG) receiving terminal, both the fix terminal or Floating Storage Receiving Unit (FSRU) technology.

The increasing role of Indonesian gas from year to year in the Indonesian economy has raised the urgency for various Government regulations and policies in utilizing gas effectively and efficiently. Therefore, a precise policy analysis on business strategy for gas is necessary to gain support from the Government. The role of gas is expected to be the potential energy foundation for the time being and in the near future for the development of domestic industries.

### 1.2. Problems

The research problem lies on the dilemma between the Government stand in prioritizing the gas allocation for the domestic economic activity despite the export foreign exchange revenue from gas that will be decreased dramatically although it is compensated by the higher domestic economic growth due to the increasing production. The changes will both directly and indirectly be responded by the economic variables, especially the demand, supply, price and economic growth. If the impact on gas policy changes can be identified well, the Government can anticipate the resulting changes from the gas reallocation policy. Additionally, in line with the increasing role of gas for Indonesia, the economic (fiscal and monetary) and non-economic (demography) policies need to be identified simultaneously that in the end they will give the largest benefit for the people of Indonesia. In the mid and long term, the economic impact to be considered is the change on people willingness to pay as the result of gas utilization and its infrastructures, while in the long term, the problem of national energy sustainability is also considered although Indonesia still has potential reserve of gas and coal to be developed.

### 1.3. Research Purpose

1. Analyzing the economic factors that influence the supply and demand as well as export for Indonesian gas.
2. Analyzing gas reallocation policy to the development of gas industry and economic growth in Indonesia.

## 2. LITERARY AND EMPIRICAL STUDIES

### 2.1. Literary Studies

### 2.1.1. Macroeconomic Theory

When trying to elaborate the role of gas to the economic growth, macroeconomic theory can explain the economic transmission from supply and demand of gas to the macro economy variables, including those being the focus of attention such as Gross Domestic Product (GDP), inflation, and Balance of Trade.

This economic theory was based on the idea of the British economist John Maynard Keynes (1936). Keynes theory analyzes how the economy works and criticize the classic economy which only focuses on the aggregate supply (capital and workforce) and availability of technology in determining the national income. According to this theory, the low aggregate demand is in fact responsible for the low income and high unemployment. Additionally, in this theory, the *Leissez Faire system* is purely unacceptable because at the macro level, the Government must be active and aware in controlling the economy to the full employment position due to the automatic mechanism that cannot be relied upon.

The macroeconomic situation is determined by the aggregate demand of the society; if it exceeds the aggregate supply within certain period, there will be a situation of production shortage. In the next period, the output will increase or the price will increase, or both can happen at the same time. If the aggregate demand is less than the aggregate supply, there will be a situation of surplus in production. In the next period, the output will decrease or the price will decrease, or both can happen at the same time.

The point of Keynes macroeconomic theory is that how the Government will intervene or influence the aggregate demand to be close to the full employment position. In closed economy, the aggregate demand consists of 3 elements: (1) consumption expenditure (C), (2) investment expenditure (I), and (3) Government expenditure (G). Whereas, in the open economy, there is balance of payment (BOT). Government can directly influence the aggregate demand by Government expenditure and indirectly to the consumption and investment expenditure.

Currently, the economists combine both views above using the aggregate supply (classic economic theory) and aggregate demand (Keynes economic theory) model. In the long term, the price will be flexible and aggregate supply will determine the income. In the short term, the price will be fixed so that the changes on aggregate demand will influence the national income.

### 2.1.2. Microeconomic Theory

On the other hand, according to Yusgiantoro (2000), the discussion on microeconomic theory can be applied to analyze the optimum allocation of energy resources among various alternatives of utilization. One of the microeconomic theories to be applied is the theory of company. This theory was started by a simple assumption that companies seek to optimize the profit. Using this assumption, the theory will explain how the company chooses the number of workforce, capital, and raw material for production. Additionally, the theory also explains how the choices depend on the input and output price (Pindyck and Rubinfeld, 2007).

Input demand is derived from the production function of each company, assuming that the producer will optimize the profit limited by technology and market (output and input price) (Varian, 2978 in Sinaga, 1989). While the other assumption stated that each company faces a perfect competition market, both at the input and output market. This has brought a consequence that each company becomes the price taker. The decrease on input demand and output supply requires First Order Necessary Condition (FONC) and Second Order Sufficient Condition (SOSC) in maximizing the profit.

The relationship between production input, process and the resulting product can be explained in the production function. A production function shows the highest output that can be made by the company for a certain combination of production input (Pindyck and Rubinfeld, 2007). Although in practice, the company uses many types of input for production, however in the next discussion, it is assumed that the production function of gas only uses gas as the input and other inputs as follows:

$$J_i = J_i(S, N)$$

Where,

$J_i$ : Number of output for gas type i.
S : Number of gas input.
N : Number of other input series.

International Journal of Information Technology and Business Management
29th April 2014. Vol.24 No.1


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And the price of each output and input is as follows:

$P_{ji}$ : Price of output for gas type i per unit.

$P_S$ : Gas price.

$P_N$ : Other inputs price.

The main function of gas business is to maximize the profit ($\pi_{ji}$). The profit is defined as total revenue minus the total cost. The mathematical equation will be as follows:

Maximize the profit $\pi_{ji} = P_{ji}.J_i(S, N) - (P_S.\ S + P_N.\ N)$ (2)

To maximize the profit for gas business, it can be obtained by decreasing the profit function partially to S and N and to equal with zero.

$P_{ji}.\ f_S - P_S = 0$ or $P_{ji}.\ f_S = P_S$ (3)

$P_{ji}.\ f_N - P_N = 0$ or $P_{ji}.\ f_N = P_N$ (4)

Where $f_S$ and $f_N$ is the partial derivative of production function to S and N. Therefore, $f_S$ and $f_N$ is the marginal product from input S and N. Equation 3 and 4 is a two-equation system with two endogenous variables (S, N) and three exogenous variables ($P_{ji}$, $P_S$, and $P_N$). This equation system is completed simultaneously to determine two endogenous variables related to three exogenous variables.

$S = S(P_S, P_N, P_{ji})$ (5)

$N = N(P_S, P_N, P_{ji})$ (6)

Equation 5 and 6 is the function of input demand or the equation 5 is called gas derivative demand. The equation states the amount of gas demand which is the function of gas input price, other input price, and gas output price. Equation 5 and 6 is substituted to the equation for gas production function, the equation 1. The result of this substitution is the gas output supply:

$J_i = J_i(P_{ji}, P_S, P_N)$ (7)

While the gas industry demand is no longer derivative demand therefore the behavior is the same as consumption goods demand. According to Koutsoyiannis (1975), the factors in certain product market demand is the product price itself, the consumers income, other commodity price, consumers' taste, distribution, income, population, consumers' welfare, loan availability, government policy, and previous level of demand. The gas industry demand is written as follows:

$K_i = g(P_i, Z)$ (8)

Where,

$K_i$ : Gas industry demand type i.

$P_i$ : Gas price type i.

Z : Other factors of demand.

### 2.1.3. Gas Price

According to Yusgiantoro (2000), the energy price level, in this case gas, shall economically meet two main criteria from the perspective producers and consumers. Price for producers shall meet total cost of production for the energy resources. The simple criteria for producers is represented by the energy resource supply curve which consists of long run marginal cost (LRMC) component, depletion premium, and externalization cost. While for the consumers, the most important will be the consumer willingness to pay the highest minimal price up to the next best alternative price of energy. The criteria is depicted in the supply curve and showing the maximum price acceptable by consumers.

The concept of gas price fixing is basically the same as the other primary energy price which consider the producers and consumers perspective. The availability of producers is represented by LRMC and the availability of consumers is represented by netback value. The constraint in fixing the gas price is related to purification technique of gas and liquefaction process for LNG export. This constraint influences the economic scale which eventually makes the investment cost very high compared to oil.

In general, gas price depends on the cost function in the gas field therefore the price fixing does not have special formula. The price is the result of negotiation between producers (PSC) and the consumers of gas. The negotiated gas price is based on the cost of gas provision, level of return on revenue (ROR), and the constraints of markets purchasing the gas.

### 2.1.4. Economic Structure of Gas Industry

The economy of gas industry is unique compared to other industries. Among its uniqueness, it is the market structure that does not follow the perfect competition or monopoly (Yusgiantoro, 2000). The market structure for gas is categorized as regulated monopoly, although in fact it is not entirely true. The regulated monopoly market structure is characterized by sole seller, price discrimination, entry and exit barrier of the market which is relatively difficult, and types of good for sale (Sukirno, 1985).

According to Yusgiantoro (2000), Holland model explains energy industry in the

International Journal of Information Technology and Business Management
29th April 2014. Vol.24 No.1

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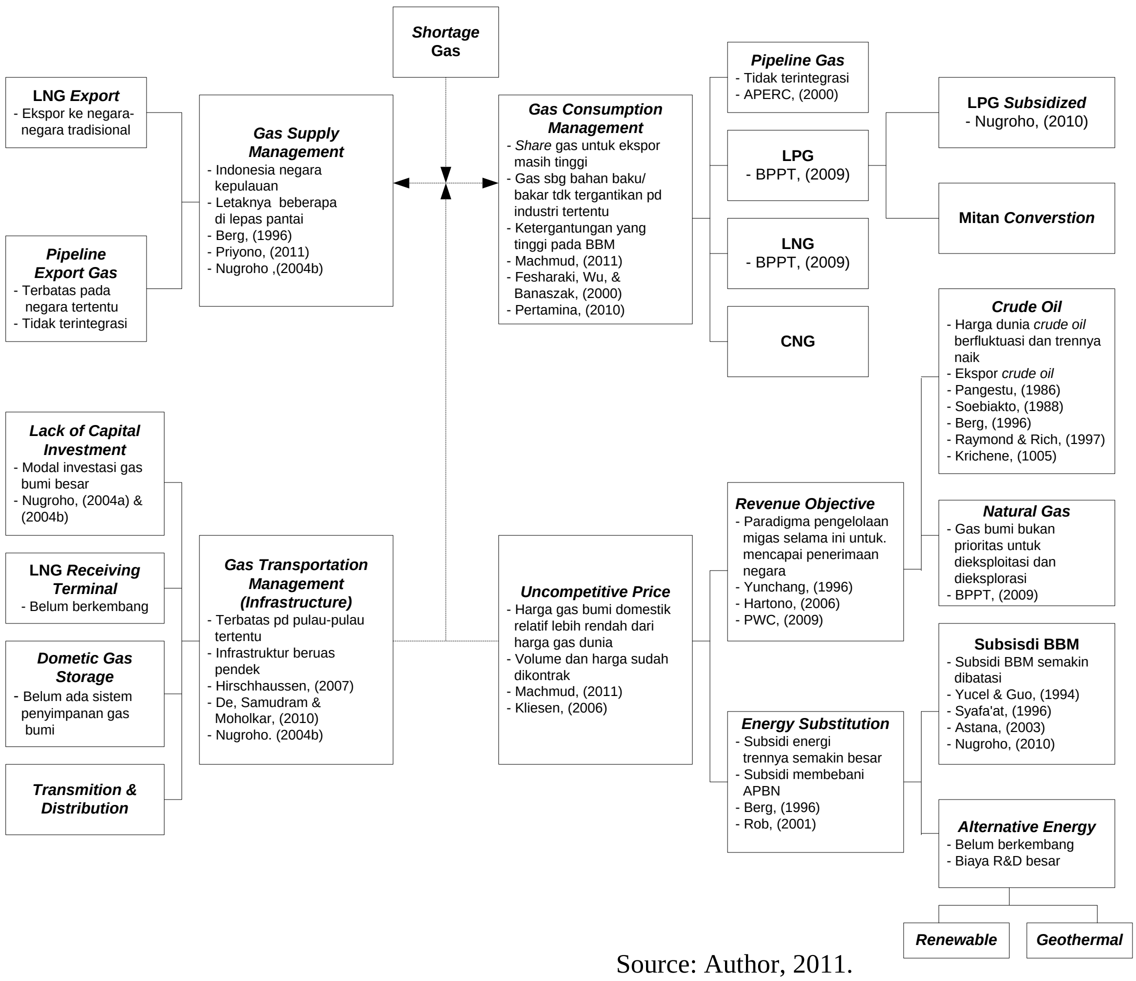
developing country which is in the initial stage. At initial stage, energy companies in the developing countries tend to be operated by state-owned enterprises which are the extension of Government reach. This position gives discretion to the Government to exercise protection for the gas industries, and the private participation is not limited but relatively small.

## 2.2. Empirical Study

Figure 1 presents all problems of Indonesian gas. The mapping functions to determine the research position to be chosen. The researches on economic analysis of domestic gas were still limited, so as the decision making process in gas business which is related to the sustainability problem of gas in the future. Therefore, this research is expected to complement the findings of the previous researches.

### 2.2.1. Research on Gas Worldwide

Yunchang (1996) researched the impact of energy policy, especially the changes of oil or gas price policy towards the Taiwan economy. The writer uses EGEM 1.1 (Computable Energy General Equilibrium Model) to answer the research purposes. The model explained the relationship between energy, production, consumption and international trade. For example, in the short term, Government should not only depend on the energy price policy to influence the economy, but there is no certain relationship and prediction between the economic performance and the price energy shock. Each industry has different response towards the changes on energy price due to economic competition, industry taking profit as well as suffering from losses.




Source: Author, 2011.

**Figure 1 Mapping of Gas Problems in Indonesia**

International Journal of Information Technology and Business Management
29th April 2014. Vol.24 No.1

ISSN 2304-0777 www.jitbm.com

Fluctuation in energy price usually affects the consumer price index. When energy price increase, the balance of trade will be deficit due to the harsh competition in the world market. There is no certain connection between price energy and Government tax revenue In general, increasing price of energy affects more on the economy than the price decrease. The increase of energy price will decrease GDP, workforce demand, trade surplus, other prices, and Government tax revenue. This is why Government tends to favor the price energy system that capable of stabilizing the energy price, especially during the surge increase in energy price.

According to Kliesen (2006), when Katrina and Rita storm hit, gas price in the United States rose significantly. Gas is the second most important source of energy in the economy, where its increase will have multiplier effect to the economic deceleration and industries' performance. However, based on the analysis, the changes in gas price didn't in fact influence the output of the two infrastructures that most intensively use energy: the basic metal and non-metal mineral. Additionally, the increase in gas price did not necessarily influence the PDG growth compared to the oil price.

According to Huang (2007), the increase of gas price in the United States has encouraged the decrease in ammonia production and increase the export quantity of ammonia in the United States. Ammonia is the primary source of nitrogen to produce chemical fertilizer. Gas as the important raw material where the production cost reached 72-83 percent of the total production cost for chemical fertilizer. Since 2000, the increasing volatility and price tendency for gas in the United Stated has caused a significant change in the supply of ammonia in the United States. The production capacity of ammonia decreased to 35 percent, the production decreased 44 percent, the number of ammonia factories decrease from 40 to 25 and the import of ammonia in the United States has in fact increased to 115 percent. The increase of ammonia import in the United States will make domestic aggregate supply to be vulnerable to the global competition, especially in relation with the nitrogen fertilizer trade. Moreover, the impact can be seen from the changes in the ammonia industries in the United States. Where the company will do more mergers to increase production and market efficiency than to cut the number of workers.

### 2.2.2. Gas Research in Indonesia

Afiatno (2006) researched the causality relationship between final energy consumption and the economy in Indonesia. Although the final commodity of energy was not mentioned specifically, the causality relationship towards the Indonesian economy was important related to this research. Using Vector Auto-regressions (VAR) method, it was concluded that there was two-way multivariate causality relationship, that the energy influencing economy and the economy influencing energy. Therefore, the Government must be careful in controlling energy consumption by means of price mechanism and tax because it has a broad impact, large cost, and decreases the economic growth. Controlling consumption shall also be done carefully because it can slowdown the economic growth considering the relationship of energy and economic growth is so strong. The condition is different in advanced countries such as Germany, which is generally having causality relationship between the economy and energy.

Hartono (2006) in his dissertation developed an Indonesian Energy Social Economy Balance System (SNSEE) and Computable General Equilibrium (CGE). The model would be used to analyze the impact of oil fuel, gas fuel, and electricity policies towards national economic performance. The findings of the dissertation stated that the reduction of subsidy in oil fuel, gas fuel, and electricity tariff had increased the GDB and the income was distributed evenly. The impact of GDP and income distribution was varied according to whether or not the subsidy reduction (i) is not followed by the increasing efficiency of the energy usage; (ii) is followed by the increasing efficiency of energy usage by group of industries; and (iii) is followed by the increasing efficiency of energy usage by group of industries and households.

Nugroho (2004b) conducted a research on the improvement of gas share to the national industry and consumption, especially from the perspective of infrastructure development. The elaboration of the research result shows that gas is one of the potential energies. The lack of infrastructure in energy distribution has been the significant obstacle in the development of industries which use gas as raw material. The development of gas infrastructure can be done

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by preparing national master plan to distribute the gas. Nugroho, (2004a) explained that Law No. 22 Year 2001 regarding the Oil and Gas has opened the opportunity of liberation in the downstream sector for gas.

## 3. RESEARCH METHODOLOGY

### 3.1. Sources and Types of Data

The types of data used in this research is periodic data from 2000-2011. Besides econometric reason to increase the number of samples, the period is expected to answer the problem related to the influence of various important changes in the Indonesian gas industries. The data was derived from various report and official publication from the related institution, the Statistics Indonesian, International Monetary Fund, BP Migas, Ministry of Agriculture, State Gas Company, Ministry of Energy and Mineral Resources, various local newspapers in Jakarta, and the Internet.

| No. | Objectives | Types of Data | Analysis Period | Source of Data | Method of Analysis |
|---|---|---|---|---|---|
| 1. | Analyzing the factors that influence the supply and demand as well as export for Indonesian gas. | a. Gas Production<br>b. Gas Reserve<br>c. Gas Demand<br>d. Gas Export<br>e. Gas Import<br>f. Gas Price<br>g. Substitute Price<br>h. Other Prices.<br>i. IDR/USD Exchange Rate<br>j. Gross Domestic Product<br>k. Number of Population<br>l. Consumer Price Index<br>m. Industry Production Index<br>n. Inflation<br>o. Other information | Year 2000-2011 | Statistics Indonesia, State Gas Company, BP Migas, Pertamina, Ministry of Energy and Mineral Resources, Ministry of Finance, Ministry of National Development Planning, IMF, OPEC. | Econometrics Syslin, 2SLS |
| 2. | Analyzing gas reallocation policy to the development of gas industry and in Indonesia. | | | | Econometrics Simlin, 2SLS |

**Table 1. Type, Source of Data, and Analysis Method Used in the Research.**

Source: Author, 2011.

### 3.2. Economic Analysis of Gas

Model is the real word representation and the model construction of gas operations will be formulated in this section. The economic relationship between variables in the model will be formulated in an econometrics model in order to find out the extent and direction by parameter estimator of each behavior equation. The dynamic nature of demand and export aspects of Indonesian gas was also accommodated by introducing the previous year's variables into the model (Figure 2).

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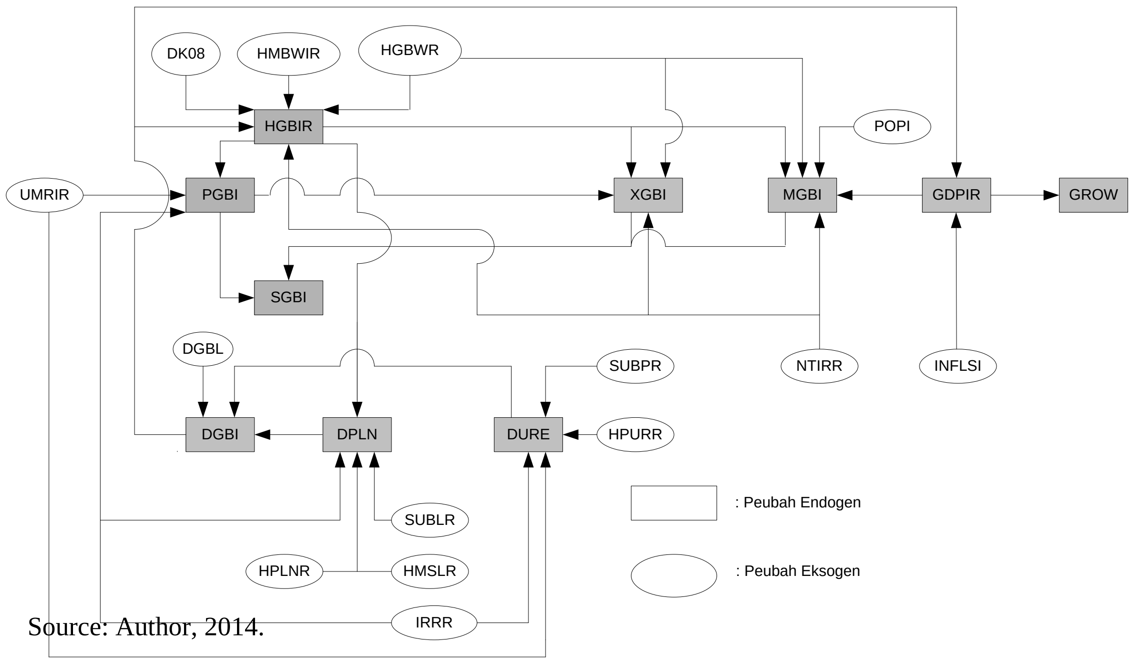

Source: Author, 2014.

**Figure 2. The Economic Model of Indonesian Gas**

The relationship between gas industry in domestic and world markets is the reason why the econometrics model was constructed using dynamic model in form of simultaneous equation. Additionally, the changes in the domestic gas market will directly and indirectly influence the macroeconomic indicators, including the economic growth. Each economic variable sometimes becomes the influencing factor to certain variables and sometimes is also influenced by other variables.

### 3.2.1. The Operational Model Structure of Indonesian Gas

**A. Market Blocks of Indonesian Gas**

a. Indonesian Gas Production

$$PGBI_t = a_0 + a_1(HGBIR_{t-1}/HGBWIR_t) + a_2(IRRR_t - IRRR_{t-1}) + a_3UMRIR_{t-1} + a_4T + a_5PGBI_{t-1} + u_1$$

The sign expected from the parameter expectation: $a_1 > 0$; $a_2$, $a_3 < 0$; and $0 < a_5 < 1$.

b. Indonesian Gas Supply

$$SGBI_t = PGBI_t - XGBI_t + STOK_{t-1}$$

c. Indonesian Gas Demand

c.1. Total Indonesian Gas Demand

$$DGBI_t = DPLN_t + DURE_t + DGBL_t$$

c.2. Gas Demand by State Electric Company

$$DPLN_t = b_0 + b_1(HPLNR_t - HPLNR_{t-1}) + b_2HGBIR_t + b_3(HMSLR_t/HMSLR_{t-1}) + b_4IRRR_t + b_5SUBLR_t + u_2$$

The sign expected from the parameter expectation: $b_2$, $b_3$, $b_4 < 0$ and $b_1$, $b_5 > 0$.

c.3. Gas Demand by Urea Fertilizer Industries

$$DURE_t = c_0 + c_1HPURR_t + c_2HGBIR_t + c_3IRRR_{t-1} + c_4(UMRIR_t/UMRIR_{t-1}) + c_5SUBPR_t + u_3$$

The sign expected from the parameter expectation: $c_2$, $c_3$, $c_4 < 0$ and $c_1$, $c_5 > 0$.

d. Indonesian Gas Price

$$HGBIR_t = d_0 + d_1DGBI_{t-1} + d_2SGBI_t + d_3HGBWIR_{t-1} + d_4(HMBWIR_t - HMBWIR_{t-1}) + d_5T + d_6DK08 + u_4$$

The sign expected from the parameter expectation: $d_2$, $d_5 < 0$ and $d_1$, $d_3$, $d_4$, $d_6 > 0$.

**B. Trade Blocks of Indonesian Gas**

a. Indonesian Gas Export (9)

$$XGBI_t = e_0 + e_1((HGBWR_t - HGBWR_{t-1})/HGBWR_{t-1}) + e_2HGBIR_t + e_3NTIRR_{t-1}\ e_4PGBI_t + e_5XGBI_{t-1} + u_5 \quad (10)$$

The sign expected from the parameter expectation: $e_1$, $e_3$, $e_4 > 0$; $e_2 < 0$; and $0 < e_5 < 1$.

b. Indonesian Gas Import (11)

$$MGBI_t = f_0 + f_1((HGBWR_t - HGBWR_{t-1})/HGBWR_{t-1}) + f_2HGBIR_{t-1} + f_3(NTIRR_t - NTIRR_{t-1}) + f_4(GDPIR_t/POPI_t) + f_5T + f_6MGBI_{t-1} + u_6 \quad (12)$$

International Journal of Information Technology and Business Management
29th April 2014. Vol.24 No.1

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The sign expected from the parameter expectation: $f_1$, $f_3$, $f_4 < 0$; $f_2$, $f_5 > 0$; and $0 < f_6 < 1$.

**C The Blocks of Indonesian Economic Growth**

a. Indonesian GDP

$$GDPIR_t = g_0 + g_1(DGBI_t/DGBI_{t-1}) + g_2(INFLSI_t - INFLSI_{t-1}) + g_3T + g_4GDPIR_{t-1} + u_7$$

The sign expected from the parameter expectation: $g_1$, $g_2$, $g_3 > 0$ and $0 < g_4 < 1$.

b. Indonesian Economic Growth

$$GROW_t = (GDPIR_t - GDPIR_{t-1})/GDPIR_{t-1} * 100$$

### 3.2.2. Procedure Analysis

**A. Model Identification**

Model identification aims to find out whether or not the model is foreseeable. The model formulated in this research is the simultaneous structural equation model. Using simultaneous model, identification shall be conducted before choosing the method of parameter estimation of a model equation. Identification can be done in two ways: using structural model (order condition) or reduced form model (rank condition).

In this research, there are 10 equations consisting of 7 structural equation and 3 identity equation. Whereas the number of endogenous (G) is 10 and 19 variables predeterminant, which consists of 15 exogenous variables and 4 lagged endogenous variables. Therefore, total number of variables in the model (K) was 29 variables. While the most variables in the equation (M) was 6. Following the model identification formula using order condition criteria, each model equation was over identified.

**B. Model Estimation Method**

Based on the model identification, it was found that each equation in the model was over-identified. The said equation is usually estimated using various estimation methods such as Two Stage Least Squares (2SLS), Three Stage Least Squares (3SLS), Limited Information Maximum Likelihood (LIML) or Full Information Maximum Likelihood (FILML). The chosen method is adjusted according to the research purpose, which is to obtain the coefficient for simultaneous structural equation.

The 2SLS method was chosen because it is suitable in estimating the over identified model and describing the more general usage (Sinaga, 1989). Additionally, the implementation of 2SLS results in a more consistent, simpler, and easier estimation, while 3SLS and FIML method uses more information or data and tend to be more sensitive to the measurement error and model specification (Gujarati, 1999). Data processing uses computer (17) software of Statistical Analysis System (SAS) version 9.0

The model formulated in this research contains lagged endogenous variables, therefore the serial correlation test of Dw (Durbin Watson (18) Statistics) was not valid if used. Therefore, the test uses Dh (Durbin h statistic) (Pindyck and Rubinfield, 1991). Dh statistic test was not valid if the result of n x (Varβ) is larger than one. If the statistics h is larger than the critical value of normal distribution, the model will have a serial correlation.

To test whether or not the exogenous variables are all really influencing the endogenous variable on each equation, F statistic test was used. Then, to test whether or not each exogenous variable is really influencing the endogenous variable on each equation, t statistic test was used.

**C Model Validation**

Statistical criteria for the validation of estimation value for econometrics model used in this research was Root Mean Squares Error (RMSE), Root Mean Squares Percent Error (RMSPE), and Theil's Inequality Coefficient (U) (Pindyck and Rubinfield, 1991). U-Theil score is between 0 and 1. If U-Theil = 0 the model estimation is perfect and if U-Theil = 1 then the model estimation is naive. Essentially, the smaller RMSE, RMSPE and U-Theil then the better the model estimation. Other indicator is the determinant coefficient ($R^2$). The larger the $R^2$ value, the larger the variance of endogenous variable changes explained by the exogenous variable, thereby the model is better.

**D. Policy Simulation**

The simulated policies for the 2012-2018 forecast was divided into 3 aspects: (1) the simulation in relation with the aspect of industrial sector; (2) simulation in relation with the aspect of economic sector; and (3) simulation in relation with the aspect of price sector (international).

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## 4. RESULT AND DISCUSSION

### 4.1. General Performance of Gas in Indonesia

The parameter estimation result using 2SLS method showed good statistical indicators. In general, $R^2$ value varies from 0.62 to 0.99. It shows that in general, the exogenous variables in the behavior equation was able to explain the endogenous variables. In general, the statistical value of F-test is high, which ranges between 1.65 to 708.64, meaning that the variation of exogenous variables in each behavior equation was able to well explain the endogenous variables in the level of $\alpha = 0.0001$ to $\alpha = 0.2976$, while all estimation parameters is according to the expectation and is logical from the perspective of economic theory.

The Durbin Watson (DW) scores ranged from 1.76 to 2.52. The lowest DW score was in demand equation of gas by PLN. While the highest DW score was in the price equation of gas in Indonesia. The interrelationship between variables in the simultaneous equation frequently faces autocorrelation. Therefore, in this economic model, the author prioritizes the economic criteria over the statistical and econometrics criteria. Based on the estimation result, the economic model used in this research was relatively representative in explaining the impact of gas reallocation towards the development of domestic gas industries as well as economic growth.

Additionally, the model will be validated for the purpose of prediction (Table 2). There are 9 equations with the RMSPE value lower than 50 percent and 1 equation with the RMSPE higher than 50 percent. The high value of RMSPE is difficult to be avoided because the equations were the identity equation. Reviewed based on the U-theil criteria, there are 10 equations with U-theil score of less than 0.20. The highest U-theil score was 0.12, which is on the economic growth equation. Although having the highest U-theil score, the equation has relatively small the bias proportion (UM) of 0.00. It shows that the bias occurred in the model simulation was more because of non-systemic factors. In overall, the model is relatively good to be used as estimation model and thereby the structural model which has been formulated can also be used for forecasting simulation.

**Table 2. The Result of Validation Test for Economic Model of Gas in Indonesia, Year 2001-2011.**

| Variable | RMSE | RMSP | (R) | (UM) | (UR) | (UD) | (US) | (UC) | U-theil |
|---|---|---|---|---|---|---|---|---|---|
| PGBI | 177868.0 | 6.09 | 0.86 | 0.75 | 0.00 | 0.25 | 0.01 | 0.23 | 0.0286 |
| SGBI | 69929.30 | 5.75 | 0.91 | 0.11 | 0.06 | 0.83 | 0.18 | 0.71 | 0.0253 |
| DGBI | 8750.80 | 0.75 | 1.00 | 0.01 | 0.03 | 0.96 | 0.05 | 0.94 | 0.0036 |
| GDPIR | 25368.60 | 1.48 | 1.00 | 0.06 | 0.11 | 0.83 | 0.10 | 0.84 | 0.0059 |
| DPLN | 8055.60 | 10.25 | 0.78 | 0.00 | 0.01 | 0.98 | 0.05 | 0.94 | 0.0519 |
| DURE | 2385.00 | 2.54 | 0.93 | 0.01 | 0.00 | 0.99 | 0.03 | 0.96 | 0.0124 |
| HGBIR | 4371.80 | 19.47 | 0.84 | 0.02 | 0.07 | 0.92 | 0.00 | 0.98 | 0.0972 |
| XGBI | 138791.0 | 8.66 | 0.93 | 0.89 | 0.02 | 0.09 | 0.04 | 0.07 | 0.0399 |
| MGBI | 67583.50 | . | 1.00 | 0.18 | 0.01 | 0.81 | 0.02 | 0.80 | 0.0411 |
| GROW | 2.12 | 132.10 | 0.84 | 0.00 | 0.02 | 0.98 | 0.02 | 0.98 | 0.1245 |

Source: data processing result using SAS 9.0 software.

### 4.2. Performance Factors of Gas Market

#### A. Market Blocks of Indonesian Gas

##### a. Indonesian Gas Production

Result of parameter estimation for gas production in Indonesia is shown in Table 2. The parameter estimation result for gas production in Indonesia has the high $R^2$ score of 0.62. It shows the relatively high ability of price variable of Indonesian gas towards the gas price worldwide, the interest rate, and labor wage of the previous year, time trends, and production of Indonesian gas of the previous year in explaining the gas production behavior in Indonesia. Additionally, the parameter estimation mark has been consistent with the expectation and exogenous variables has significant influence, in terms of price ratio of Indonesian gas to the gas worldwide.

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Table 3. The Result of Parameter Estimation for Gas Production in Indonesia, Year 2000-2011.

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short Term | Long Term | |
| Intercept | 1639562.00 | 1.48 | | | Intercept |
| RHGB | 534589.30 | 1.74^C | 0.0884 | 0.1256 | Ratio of domestic gas price to the gas price worldwide |
| DIRRR | -4220.17 | -0.46 | -0.0008 | -0.0011 | Changes on bank interest rate |
| LUMRIR | -688.54 | -0.16 | -0.0680 | -0.0966 | Indonesian labor wage t-1 (IDR/Year) |
| T | 70615.05 | 0.90 | | | Time Trend |
| LPGBI | 0.30 | 0.86 | | | Indonesian gas production t-1 (mmscf) |
| $R^2$ = 0.62, F-count= 1.65, DW = 2.15 | | | | | |

Source: data processing result using SAS 9.0 software.

The price is a signal of the producer to enter the market and produce gas. The parameter estimation for ratio of Indonesian gas price to the gas price worldwide was 534 589.30 and is negatively correlated. Meaning that there is an increase of Indonesian gas price to the gas price worldwide in amount of IDR 1 per mmbtu, then it will increase the gas production in Indonesia for 534 589.30 mmscf, ceteris paribus. However, the response of Indonesian gas to the ratio of Indonesian gas price to the gas price worldwide was not elastic in short term and long term.

**b. Indonesian Gas Supply**

The Indonesian gas supply is the identity equation which includes the following:

$$SGBI_t = PGBI_t + MGBI_t - XGBI_t$$

From the identity equation, it is shown that each time there is a change in gas supply with relatively large in number and proportion in total gas supply, then it will influence the balance of domestic gas market.

**c. Indonesian Gas Demand**

Total gas demand is the identity equation obtained from the summation of gas demand by PLN, gas demand by fertilizer industries, and other gas demands. The equation is shown as follows:

$$DGBI_t = DPLN_t + DURE_t + DGBL_t$$

From the above identity equation, in case tehre is a change in gas demand in various sectors, it will influence the domestic gas market and economic condition.

**c.1. Gas Demand by PLN**

The parameter estimation result for gas demand by PLN shown in the Table 4 Indonesia has the high $R^2$ score of 0.74. It shows the relatively high ability of exogenous variables in explaining the behavior of demand variable for gas by PLN. Or in other words, all exogenous variables have been able to explain the endogenous variable of 74 percent, while the rest 26 percent was explained by other factors in the equation. Additionally, the parameter estimation mark of the variables has been consistent with the expectation.

Table 4. The Result of Parameter Estimation for Gas Demand by PLN, Year 2001-2011.

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | 124155.90 | 4.36 | | | Intercept |
| DHPLNR | 0.40 | 2.77^A | 0.1965 | - | Changes in electricity price |
| HGBIR | -0.61 | -1.13 | -0.1759 | - | Indonesian gas price (IDR/mmbtu) |
| RHMSLR | -26634.40 | -1.96^C | -0.3836 | - | Diesel fuel price ratio |
| IRRR | -2178.83 | -1.96^C | -0.1769 | - | Bank interest rate (%/year) |
| SUBLR | 0.66 | 2.28^A | 0.1331 | - | Electricity subsidy (IDR Billion) |
| $R^2$ = 0.74, F-count = 2.81, DW = 1.76 | | | | | |

Source: data processing result using SAS 9.0 software.

The gas demand by PLN is influenced by the change in electricity price, diesel fuel ratio, interest rate, and the electricity subsidy. where the parameter estimation of electricity price has

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a positive correlation. It means that if there is an increase in the electricity price by-1 percent then it will increase the gas demand by PLN by 0.2 percent, ceteris paribus. However, the response on gas demand by PLN towards the change in electricity price is inelastic in the short term.

One of the inputs to be used in generating electricity is diesel fuel which is exchanged by the diesel fuel ratio. In this case, the parameter estimation of diesel fuel ratio has a negative mark. Meaning that if the diesel fuel ratio increases 1 percent then it will decrease the gas demand by PLN by 0.38 percent, ceteris paribus. However, the response on gas demand by PLN towards the ratio in diesel fuel price is inelastic in the short term.

Other inputs in improving or even decreasing the gas demand by PLN is exchanged in the bank interest rate for investment activity. The bank interest rate has significant influence to the gas demand by PLN. If the bank interest rate increases 1 percent, the gas demand by PLN will decrease 0.18 percent, ceteris paribus. Besides, the response of gas demand by PLN to the bank interest rate will be inelastic in the short term.

In order to improve the access of poor people to the electricity, the government has taken intervention measures by providing subsidy. If the subsidy increases 1 percent,–the gas demand by PLN will increase 0.13 percent, ceteris paribus. The response on gas demand by PLN towards the electricity subsidy is inelastic in the short term.

### c.2. Gas Demand by Urea Fertilizer Industries

Result of parameter estimation for gas production by urea fertilizer industries is shown in Table 5. The parameter estimation result for gas demand by urea fertilizer industries has the high $R^2$ score of 0.90. It shows the relatively high ability of exogenous variables in explaining the behavior of demand variable for gas by urea fertilizer industries. Additionally, the parameter estimation mark of the variable has been consistent with the expectation and exogenous variables has significant influence, in terms of Indonesian gas price and fertilizer subsidy.

**Table 5. The Result of Parameter Estimation for Gas Demand by Urea Fertilizer Industries , Year 2001-2011.**

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | 139704.30 | 5.24 | | | Intercept |
| HPURR | 8.13 | 0.37 | 0.0670 | - | Urea price (IDR/kg) |
| HGBIR | -0.43 | $-2.41^B$ | -0.1008 | - | Indonesian gas price (IDR/mmbtu) |
| LIRRR | -418.83 | -1.13 | -0.0251 | - | Bank interest rate t-1 (%/year) |
| RUMRIR | -39318.70 | -1.12 | -0.4635 | - | Indonesian labor wage ratio |
| SUBPR | 0.98 | $1.72^C$ | 0.0342 | - | Fertilizer subsidy (IDR Billion) |
| $R^2$ = 0.90, F-count = 8.95, DW = 1.85 | | | | | |

Source: data processing result using SAS 9.0 software.

The parameter estimation of Indonesian gas price has negative correlation. It means that if there is an increase in the Indonesian gas price by–1 percent then it will decrease the gas demand by urea fertilizer industries by 0.10 percent, ceteris paribus. It is because gas is one of the important inputs in producing urea fertilizer. Response to the gas demand by urea fertilizer industries to the Indonesian gas price is inelastic in the short term.

The sufficient accessibility and availability of urea fertilizer is the important factors in supporting the improvement of farmers' welfare and food security. Based on the data processing result, the parameter estimation of fertilizer subsidy has a positive mark. It means that if there is an increase in the fertilizer subsidy by–10 percent then it will decrease the gas demand by urea fertilizer industries by 0.34 percent, ceteris paribus. Response to the gas demand by urea fertilizer industries to the fertilizer subsidy is inelastic in the short term.

### d. Indonesian Gas Price

Result of parameter estimation for Indonesian gas price is shown in Table 6. The parameter estimation result for Indonesia gas price has the high R2 score of 0.81. It shows the relatively high ability of exogenous variables in explaining the behavior of demand variable for Indonesian gas price. Additionally, the

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parameter estimation mark of the variable has been consistent with the expectation and exogenous variables has significant influence, in terms of gas price worldwide of the previous year and time trend.

**Table 6. The Result of Parameter Estimation for Indonesian Gas Price, Year 2001-2011.**

| Variable | Parameter Estimatio | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | -83674.80 | -1.63 | | | Intercept |
| LDGBI | 0.08 | 1.44 | 3,842 | - | Total gas demand in Indonesia t-1 |
| SGBI | -0.03 | -1.01 | -1,948 | - | Indonesian gas supply |
| LHGBWIR | 2.01 | 2.46[B] | 0,003 | - | Gas price worldwide t-1 (IDR/Thousands |
| DHMBWI | 0.07 | 1.12 | 0,954 | - | Changes in gas price worldwide |
| T | -2796.52 | -2.48[B] | | | Time Trend |
| DK08 | 12364.01 | 1.09 | | | World economy crisis dummy, 2008 |
| $R^2$ = 0.81, F-count = 2.92, DW = 2.52 | | | | | |

Source: data processing result using SAS 9.0 software.

Gas price worldwide of the previous year has real influence to the Indonesian gas price. If the gas price worldwide of the previous year increased 0 percent, then the Indonesian gas price will also increase -0.03 percent in the short term, ceteris paribus. Besides, the response of Indonesian gas price to the gas price worldwide will be inelastic in the short term. Additionally, with time, the Indonesian gas price tends to decrease in amount of IDR 2 796,52 per mmbtu, ceteris paribus.

## B. Trade Blocks of Indonesian Gas

### a. Indonesian Gas Export

The parameter estimation result for Indonesian gas export shown in the Table 7 has high $R^2$ score of 0.79. It shows the relatively high ability of exogenous variables in explaining the behavior of export variable for Indonesian gas. Besides, the parameter estimation mark of the variable has been consistent with the expectation and the exogenous variable has a significant influence, in terms of IDR exchange rate to the USD of the previous year, the Indonesian gas production, and Indonesian gas export of the previous year.

The IDR exchange rate to the USD of the previous year has real influence to the Indonesian gas export. If the IDR exchange rate to the USD is depreciated by IDR 1 per USD, then the Indonesian gas export will increase 61.72 mmscf, ceteris paribus. Additionally, the response of Indonesian gas export to the IDR exchange rate to the USD of the previous year is inelastic, both in the short and long terms.

Indonesian gas production has real influence to the Indonesian gas export. If the Indonesian gas production increases 1 mmscf, the Indonesian gas export will increase 0.48 mmscf, ceteris paribus. Additionally, the response of Indonesian gas export to the Indonesian gas production will be inelastic in the short term and elastic in the long term.

**Table 7. The Result of Parameter Estimation for Indonesian Gas Export, Year 2001-2011.**

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | -840881.00 | -1.25 | | | Intercept |
| GHGBWR | 4294.17 | 0.03 | 0.0004 | 0.0008 | The growth of gas price worldwide |
| HGBIR | -4.82 | -0.87 | -0.0640 | -0.1202 | Indonesian gas price (IDR/mmbtu) |
| LNTIRR | 61.72 | 2.26[B] | 0.0002 | 0.0005 | IDR exchange rate t-1 (IDR.USD) |
| PGBI | 0.48 | 3.37[A] | 0.8720 | 1.6371 | Indonesian gas production t-1 |
| LXGBI | 0.47 | 1.84[C] | | | Indonesian gas export t-1 (mmscf) |
| $R^2$ = 0.79, F-count = 3.75, DW = 2.09 | | | | | |

Source: data processing result using SAS 9.0 software.

The IDR exchange rate to the USD of the previous year has real influence to the Indonesian gas export. If the IDR exchange rate to the USD is depreciated by 10 percent then the Indonesian gas export will increase 0.002 percent in the short term and will increase 0.005 in the long term, ceteris paribus. Additionally, the response of Indonesian gas export to the IDR exchange rate to the USD of the previous year is inelastic, both in the short and long terms.

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Indonesian gas production has real influence to the Indonesian gas export. If the Indonesian gas production increases 1 percent then the Indonesian gas export will increase 0.87 percent in the short term and will increase 1.64 percent in the long term, ceteris paribus. Therefore, in general, the response of Indonesian gas export to the Indonesian gas production will be inelastic in the short term and elastic in the long term.

The Indonesian gas export is influenced in real by the lagged endogenous variables. Meaning that if the Indonesian gas export of the previous year increased 1 mmscf, then the Indonesian gas export for the current year will increase 0.47 mmscf. Or, there is a relatively slow deadline for the Indonesian gas export in readjusting the equilibrium in responding the changes in economic situation.

**b. Indonesian Gas Import**

Whereas, the result of parameter estimation for Indonesian gas import is shown in Table 8. The parameter estimation result for Indonesia gas import has the high $R^2$ score of 0.99. It shows the relatively high ability of exogenous variables in explaining the behavior of import variable for Indonesian gas. Besides, the parameter estimation mark of the variable has been consistent with the expectation and the exogenous variable has a significant influence, among others, in Indonesian per capita income and the Indonesian gas import of the previous year.

**Table 8. The Result of Parameter Estimation for Indonesian Gas Import, Year 2001-2011.**

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | -1957604.00 | -2.85 | | | Intercept |
| GHGBWR | -175389.00 | -0.77 | -0.0673 | -0.2917 | The growth of gas price worldwide |
| LHGBIR | 9.62 | 1.28 | 0.4437 | 1.9228 | Indonesian gas price t-1 (IDR/mmbtu) |
| DNTIRR | -62.31 | -0.87 | -0.8353 | -3.6196 | The change of IDR/USD exchange rate |
| GDPIR1 | 256.93 | $2.15^B$ | 5.2404 | 22.7077 | Per capita income of Indonesian people |
| T | -53326.80 | -0.80 | | | Time Trend |
| LMGBI | 0.77 | $4.18^A$ | | | Indonesian gas import t-1 (ton) |
| $R^2$ = 0.99, F-count = 49.06, DW = 2.26 | | | | | |

Source: data processing result using SAS 9.0 software.

The per capita income of Indonesian people has real influence to the Indonesian gas import. If the per capita income of Indonesian people increases -1 percent, then the Indonesian gas import will increase 5.24 percent in the short term and 22.71 in the long term, ceteris paribus. In general, the response of Indonesian gas import to the per capita income of Indonesian people is very elastic, both in short and long terms.

Additionally, the Indonesian gas import is influenced in real by the lagged endogenous variables. Meaning that if the Indonesian gas import of the previous year increased 1 mmscf, the Indonesian gas import in the current year will increase 0.77 mmscf. Or, there is a relatively slow deadline for the Indonesian gas import in readjusting the equilibrium in responding the changes in economic situation.

**C The Blocks of Indonesian Economic Growth**

**a. Indonesian GDP**

Whereas, the result of parameter estimation for Indonesian GDP is shown in Table 9. The parameter estimation of Indonesian GDP has the R2 score of 0.99. It shows the relatively high ability of exogenous variables in explaining the behavior of variable for Indonesian GDP. Additionally, the parameter estimation mark of the variable has been consistent with the expectation and exogenous variables which has significant influence was the ratio of Indonesian gas demand, Indonesia inflation, time trends, and Indonesian GDP lagged endogenous variables.

The ratio of Indonesian gas demand has real influence to the Indonesian GDP. It is based on the calculation of GDP from the production approach which involves the labor factors, modal, as well as energy. If the ratio of Indonesian gas demand increases 1 percent then the Indonesian GDP will increase 0.99 percent in the short term and will increase 7.52 percent in the long term, ceteris paribus. Therefore, it can be said that the response of Indonesian GDP to the ratio of Indonesian gas demand is inelastic in the short term and elastic in the long term.

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**Table 9. The Result of Parameter Estimation for Indonesian GDP, Year 2001-2011.**

| Variable | Parameter Estimation | t-count | Elasticity | | Label |
|---|---|---|---|---|---|
| | | | Short | Long | |
| Intercept | -170741.00 | -1.34 | | | Intercept |
| RDGBI | 1814104.00 | 1.98[B] | 0.9890 | 7.5229 | Ratio of Indonesian gas demand |
| DINFLSI | 4167.86 | 2.27[B] | 0.0007 | 0.0050 | Changes in inflation |
| T | 45376.15 | 3.60[A] | | | Time Trend |
| LGDPIR | 0.87 | 10.42[A] | | | Indonesian GDP t-1 (IDR. Billion) |
| $R^2$ = 0.99, F-count = 708.64, DW = 2.25 | | | | | |

Source: data processing result using SAS 9.0 software.

Changes in Indonesian inflation has real influence to the Indonesian GDP. It is because the increase in goods price in general will increase the GDP value. If the changes in Indonesian inflation increases 10 percent then the Indonesian GDP will increase 0.007 percent in the short term and will increase 0.05 percent in the long term, ceteris paribus. Or, the response of Indonesian GDP to the changes in Indonesian inflation will be inelastic, both in the short and long terms. Additionally, with time, the Indonesian GDP tends to decrease in amount of IDR 45 376.15 millions.

The Indonesian GDP is influenced in real by the lagged endogenous variables. Meaning that if the Indonesian GDP of the previous year increased IDR 1 million, then Indonesian GDP in the current year will increase IDR 0.87 million, or there is a relatively slow deadline for the Indonesian GDP in readjusting the equilibrium.

**b. Indonesian Economic Growth**

The growth of Indonesian economy is the identity equation which is formulated as follows:

$GROW_t = (GDPIR_t - GDPIR_{t-1}) / GDPIR_t \times 100$

If there is a change in Indonesian GDP, which in fact, is caused by the changes in behavior in the Indonesian gas market, then the growth of Indonesian economy will also change.

### 4.3. The Simulation Scenario Result of Policy and Non-Policy, Year 2012-2018 (Ex-Ante)

#### 4.3.1. The increase of Electricity and Fertilizer Subsidy by 10 Percent Each.

The increase in electricity subsidy by 10 percent will directly affect the increase in gas demand by PLN by 2.24 percent. So as the increase in fertilizer subsidy by 10 percent will increase the gas demand by urea fertilizer industries by 0.73 percent. The increase of gas demand by PLN and urea fertilizer industries will contribute to the increase of total Indonesian gas demand by 0.22 percent. Next, the Indonesian gas demand will propagate the increase of Indonesian gas price by 2.28 percent.

The increase in Indonesian gas price will stimulate the increase of Indonesian gas production by 0.07 percent. On the other hand, the Indonesian gas production will contribute to the increase in gas export by 0.03 percent and increase the gas import by 0.59 percent. While the increase in gas import is much driven by the increase in Indonesian GDP by 0.25 percent as the result of total Indonesian gas demand. Eventually, the economic growth will increase 0.64 percent. Simultaneously, the accumulation of production, export, and import of Indonesian gas will increase the Indonesian gas supply by 0.11 percent.

**Table 10. : Simulation of the Impact of Policy in Indonesian Gas, Year 2012-2018 (SIM-01 to SIM-04)**

| Variable | Baseline Value | Sim-01 | Sim-02 | Sim-03 | Sim-04 |
|---|---|---|---|---|---|
| | | Percent | | | |
| $PGBI_t$ | 3 678 288.00 | 0.0655 | -8.3992 | -8.4608 | -4.2304 |
| $SGBI_t$ | 1 678 923.00 | 0.1082 | 41.1416 | 41.0068 | 20.5034 |
| $DGBI_t$ | 1 427 389.00 | 0.2173 | 1.5822 | 1.3640 | 0.6820 |
| $GDPIR_t$ | 4 301 183.00 | 0.2542 | 1.8954 | 1.6455 | 0.8264 |
| $DPLN_t$ | 103 260.00 | 2.2409 | 13.3052 | 11.0566 | 5.5278 |
| $DURE_t$ | 107 578.00 | 0.7325 | 8.2219 | 7.4857 | 3.7433 |

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| | | | | | |
|---|---|---|---|---|---|
| $HGBIR_t$ | 6 685.80 | 2.2780 | -276.5668 | -278.6607 | -139.3296 |
| $XGBI_t$ | 1 999 365.00 | 0.0296 | -50.0000 | -50.0000 | -75.0000 |
| $MGBI_t$ | 4 738 907.00 | 0.5886 | -3.8541 | -4.4318 | -2.2089 |
| $GROW_t$ | 7.67 | 0.6415 | 4.5086 | 3.8867 | 1.9596 |

Source: data processing result using SAS 9.0 software.

**4.3.2. Increase in Electricity Subsidy and Fertilizer of 10 Percent Each and Reallocation of Gas to the Domestic Market of 50 Percent.**

The increase in electricity subsidy by 10 percent will directly affect the increase in gas demand by PLN by 13.31 percent. The increase in fertilizer subsidy by 10 percent will increase the gas demand by urea fertilizer industries by 8.22 percent. Next, the Indonesian gas demand will drive the increase in total Indonesian gas demand by 1.58 percent.

The reallocation policy of Indonesian gas by 50 percent will increase the Indonesian gas supply by 41.14 percent. The increase in supply which is larger than demand has stimulated the gas price by 276.57 percent.

The decrease in Indonesian gas price will decrease the Indonesian gas production by 8.40 percent. On the other hand, the increase in gas import is due to the driven by the increase in Indonesian GDP by 1.90 percent as the result of total Indonesian gas demand. Eventually, the economic growth will increase 4.51 percent.

**4.3.3. Reallocation of Gas into Domestic Market by 50 Percent**

The reallocation policy of Indonesian gas by 50 percent will increase the Indonesian gas supply by 41 percent. The condition will then stimulate the decrease in gas price by 278.66 percent.

The decrease in Indonesian gas price will decrease the Indonesian gas production by 8.46 percent. Additionally, the Indonesian gas price will influence the increase in gas demand by PLN by 11.06 percent and the increase of gas demand for urea fertilizer industries by 7.49 percent. In total, the Indonesian gas demand will increase 1.36 percent and drive the Indonesian GDP by 1.65 percent so that the Indonesian economic growth will also increase 3.89 percent. On the other hand, the gas import will decrease 4.43 percent due to the decrease in Indonesian gas price.

**4.3.4. Reallocation of Gas into Domestic Market by 75 Percent**

The reallocation policy of Indonesian gas by 75 percent will increase the Indonesian gas supply by 20.50 percent. The condition will then stimulate the decrease in gas price by 139.33 percent.

The decrease in Indonesian gas price will decrease the Indonesian gas production by 4.23 percent. Additionally, the Indonesian gas price will influence the increase in gas demand by PLN by 5.53 percent and the increase of gas demand for urea fertilizer industries by 3.74 percent. In total, the Indonesian gas demand will increase 0.68 percent and drive the Indonesian GDP by 0.83 percent so that the Indonesian economic growth will also increase 1.96 percent. On the other hand, the gas import will decrease 2.21 percent due to the decrease in Indonesian gas price.

**Table 11. Simulation of the Impact of Policy in Indonesian Gas, Year 2001-2011 (SIM-05 to SIM-09)**

| Variable | Baseline Value | Sim-05 | Sim-06 | Sim-07 | Sim-08 |
|---|---|---|---|---|---|
| | | Percent | | | |
| $PGBI_t$ | 3 678 288.00 | -0.0149 | 2.9798 | 0.7759 | 0.5852 |
| $SGBI_t$ | 1 678 923.00 | -0.0256 | 2.8353 | 1.2768 | 0.9578 |
| $DGBI_t$ | 1 427 389.00 | -0.0511 | -0.6680 | 2.5500 | 1.9019 |
| $GDPIR_t$ | 4 301 183.00 | -0.0624 | -0.8232 | 2.9487 | 2.2328 |
| $DPLN_t$ | 103 260.00 | -0.6004 | -5.4151 | 36.0000 | -0.7980 |
| $DURE_t$ | 107 578.00 | -0.1032 | -3.6652 | -0.7204 | 26.0000 |
| $HGBIR_t$ | 6 685.80 | -0.5504 | 136.4758 | 26.8195 | 20.1068 |
| $XGBI_t$ | 1 999 365.00 | -0.0059 | 3.1012 | 0.3554 | 0.2723 |
| $MGBI_t$ | 4 738 907.00 | -0.1479 | 2.2359 | 6.8667 | 5.2294 |

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| | | | | | |
|---|---|---|---|---|---|
| $GROW_t$ | 7.67 | -0.1473 | -1.9401 | 7.2544 | 5.4265 |

Source: data processing result using SAS 9.0 software.

**4.3.5. Increase in Bank Interest Rate by 5 Percent**

The increase of bank interest rate for investment activity by 5 percent will result in the decrease of gas demand by PLN by 0.06 percent and the decrease in gas demand by urea fertilizer industry by 0.01 percent. Next, both gas demands will drive the decrease in total Indonesian gas demand by 0.05 percent. Eventually, the total decrease in Indonesian gas demand will decrease the Indonesian gas price by 0.55 percent.

Additionally, the bank interest rate will also decrease the gas production by 0.01 percent. It is because the bank interest rate is included into the input costs necessary for production. The decrease in Indonesian gas demand will eventually result in the decrease of Indonesian gas export by 0.01 percent. While the gas import also decreased because of the decrease in Indonesian GDP by 0.06 percent as the result of decrease in total Indonesian gas demand. Simultaneously, the total Indonesian gas supply will increase 0.03 percent. In general, the policy will decrease the economic growth by 0.15 percent.

**4.3.6. Depreciation of IDR Exchange Rate to the USD by 15 Percent**

Although Indonesia follows floating exchange rate regime, however Bank Indonesia still has the opportunity to intervene the market to protect the conducive IDR to USD exchange rate for the export and import activities. Depreciation of IDR to USD exchange rate of 15 percent will stimulate the increase in Indonesian gas export by 5.92 percent. Eventually, the Indonesian gas supply will increase 2.84 percent because the import increases 2.24 percent and it is smaller than the increase in gas export of 3.10 percent. Eventually, the condition will stimulate the Indonesian gas price by 136.48 percent.

The price increase will stimulate the increase of gas production by 2.98 percent. On the other hand instead, it decreases the gas demand by PLN and urea fertilizer industries by 5.42 percent and 3.67 percent respectively, so the total Indonesian gas demand decreases 0.67 percent. The decrease in total gas supply also affects the decrease in Indonesian GDP by 0.82 percent so that the economic growth also decreases 1.94 percent.

**4.3.7. Increase in Gas Demand by PLN by 36 Percent.**

The increase of gas demand by PLN by 36 percent will contribute to the increase of total Indonesian gas demand by 2.55 percent. The increase in total gas demand affects the increase in Indonesian GDP by 2.95 percent and the economic growth by 7.25 percent.

Additionally, the total increase in gas demand will also stimulate the increase in Indonesian gas price by 26.82 percent. Moreover, the increase of Indonesian gas price will contribute to the increase in gas production by 0.78 percent and increase the gas import by 6.87 percent. The increasing gas production will increase the Indonesian gas export by 0.36 percent. Simultaneously, increase in production, increase in export, and increase in import of Indonesian gas will drive the increase in Indonesian gas supply by 1.28 percent.

**4.3.8. Increase in Gas Demand by Urea Fertilizer Industries by 26 Percent.**

The increase of gas demand by urea fertilizer industries by 26 percent will contribute to the increase of total Indonesian gas demand by 1.90 percent. The increase in total gas demand affects the increase in Indonesian GDP by 2.23 percent and the economic growth by 5.43 percent.

Additionally, the total increase in gas demand will also stimulate the increase in Indonesian gas price by 20.11 percent. Moreover, the increase of Indonesian gas price will contribute to the increase in gas production by 0.59 percent and increase the gas import by 5.23 percent. The increasing gas production will increase the Indonesian gas export by 0.27 percent. Simultaneously, increase in production, decrease in export, and increase in import of gas will drive the increase in Indonesian gas supply by 0.96 percent.

**4.3.9. Increase in Gas Demand by PLN by 36 Percent and Urea Fertilizer Industries by 26 Percent.**

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The increase of gas demand by PLN by 36 percent urea fertilizer industries by 26 percent will contribute to the increase of total Indonesian gas demand by 4.56 percent. The increase in total gas demand affects the increase in Indonesian GDP by 5.21 percent and the economic growth by 12.62 percent.

**Table 12. Simulation of the Impact of Policy in Indonesian Gas, Year 2012-2018 (SIM-09 to SIM-12)**

| Variable | Baseline Value | Sim-09 | Sim-10 | Sim-11 | Sim-12 |
|---|---|---|---|---|---|
| | | Percent | | | |
| $PGBI_t$ | 3 678 288.00 | 1.3928 | 1.7834 | -1.1137 | -1.1149 |
| $SGBI_t$ | 1 678 923.00 | 2.2893 | 3.5232 | -2.2760 | -2.2765 |
| $DGBI_t$ | 1 427 389.00 | 4.5639 | -0.3929 | 0.2402 | 0.2941 |
| $GDPIR_t$ | 4 301 183.00 | 5.2131 | -0.4869 | 0.3436 | 0.4087 |
| $DPLN_t$ | 103 260.00 | 36.0000 | -3.1850 | 1.9475 | 2.5692 |
| $DURE_t$ | 107 578.00 | 26.0000 | -2.1556 | 1.3190 | 1.4371 |
| $HGBIR_t$ | 6 685.80 | 48.0735 | 80.2701 | 40.0000 | 40.0000 |
| $XGBI_t$ | 1 999 365.00 | 0.6399 | 0.3226 | -0.1376 | -0.1395 |
| $MGBI_t$ | 4 738 907.00 | 12.1872 | 1.2910 | -0.1377 | 0.0012 |
| $GROW_t$ | 7.67 | 12.6157 | -1.1317 | 0.6063 | 0.7601 |

Source: data processing result using SAS 9.0 software.

Additionally, the total increase in gas demand will also stimulate the increase in Indonesian gas price by 48.07 percent. Moreover, the increase of Indonesian gas price will contribute to the increase in gas production by 1.39 percent and increase the gas import by 12.19 percent. The increasing gas production will increase the Indonesian gas export by 0.64 percent. Simultaneously, increase in production, increase in export, and increase in import of gas will drive the increase in the Indonesian gas supply by 2.29 percent.

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**4.3.10. Increase in Gas Price Worldwide by 10 Percent.**

Indonesia is a small open country, where the external factor will influence the behavior of domestic gas market. When the gas price worldwide increases 10 percent, the Indonesian gas price will increase 80.27 percent. The increasing gas price will become the signal for the domestic producers to reduce the export gas by 0.32 percent.

The price increase will also increase gas production by 1.78 percent, however on the other hand it decreases the gas demand by PLN and urea fertilizer industries by 3.19 percent and 2.16 percent respectively, so the total Indonesian gas demand decreases 0.39 percent. The decrease in total gas demand also affects the decrease in Indonesian GDP by 0.49 percent and the decrease in economic growth by 1.13 percent. The Indonesian gas import will increase 1.29 percent as a result of increasing domestic gas price. Simultaneously, increase in production, decrease in export, and increase in import of gas will drive the increase in Indonesian gas supply by 3.52 percent.

**4.3.11. Increase in Indonesian Gas Price by 40 Percent.**

The price policy in form of Indonesian gas price increase by 40 percent has not yet capable of stimulating the increase in Indonesian gas production where the value is in fact decreasing 1.11 percent which in turns decreasing the Indonesian gas export by 0.14 percent. Unless the gas price increase can be implemented at least more or less 80 percent, the condition will contribute to the domestic gas production. On the other hand, the increase in gas price will not influence the decrease in gas demand. The gas demand by PLN and urea fertilizer industries increases 1.95 percent and 1.32 percent respectively, so the total Indonesian gas demand increases 0.24 percent. The gas import is also much influenced by the Indonesian gas price, where the import decreases 0.14 percent.

Additionally, total Indonesian gas demand will influence the price, however it also affects the increase in Indonesian GDP by 0.34 percent. Eventually, the Indonesian economic growth will increase 0.61 percent.

**4.3.12. Increase in Indonesian Gas Price by 40 Percent and Decrease of Interest Rate by 5 Percent.**

The increase in Indonesian gas by 40 percent and the decrease of interest rate by 5 percent has not yet capable to stimulate the increase in Indonesian gas production. The gas production decreases 1.11 percent, which in turns decreasing Indonesian gas export by 0.14 percent. On the other hand, the policy of gas price increase and at the same time the decrease of interest rate still increases gas demand by PLN and urea fertilizer industries by 2.57 percent and 1.44 percent respectively, so the total Indonesian gas demand decreases 0.29 percent. The gas import activities is also much influenced by the Indonesian gas price, where the import increases 0.001 percent as a result of the increase in Indonesian gas price.

Additionally, total Indonesian gas demand will influence the price, however it also affects the increase in Indonesian GDP by 0.41 percent. Eventually, the Indonesian economic growth will increase 0.76 percent.

**4.3.13. Discussion of the Simulation Result of Policy and Non-Policy, 2012-2018**

The development of domestic industries that demand gas has been the important agent in capturing the changes in gas reallocation policy. Based on the simulation result of the policy, it is clear that the policy in form of gas reallocation can provide significant increase to the gas demand by PLN and fertilizer industries. For example, the gas reallocation of 50 percent combined with the policy of fertilizer and electricity subsidy by 10 percent each can increase Indonesian gas demand relatively significant, where the gas demand by PLN reaches 13.31 percent and b fertilizer industries by 8.22 percent. However, the condition will become the disincentive for the Indonesian gas production because it triggers the decrease of domestic gas price. The condition will render the domestic gas production unattractive. On the other hand, the government policy to increase the gas usage in the near future, especially PLN and fertilizer industries, has in fact provided positive impact. It is also caused by the impact of relatively small increase in Indonesian gas price. Moreover, the policy will support the positive economic growth and the largest compared to the other policies in the year 2018. It shows that if the Government stand to

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facilitate the infrastructure and supra structure for the gas development in the future is very crucial matter.

If the development of Indonesian gas production is the main priority the depreciation policy of IDR to USD exchange rate can be the choice to support it. The depreciation policy of IDR to USD exchange rate by 15 percent is in fact capable of increasing directly Indonesian gas price as the transmission from the gas price worldwide in USD unit. The increasing Indonesian gas price will then drive the improvement of domestic gas production. It indicates that the monetary policy also has positive contribution on the exploration and exploitation of Indonesian gas in the future.

## CONCLUSION

The main factor that influences gas production behavior is the Indonesian gas price and gas price worldwide. While the Indonesian gas export is influenced by the Indonesian gas production, IDR to USD exchange rate, and lagged endogenous variables of Indonesian gas export. Response to the Indonesian gas export to the elastic gas production in the long term shows the potential of gas resource development in driving the Indonesian gas export. Additionally, gas import is much influenced by the Indonesian per capita income and lagged endogenous variables of gas import. Response of Indonesian gas import to the elastic per capita income of Indonesian people, both in the short and long term, shows that the increase in number of the middle-class people currently contributes to the gas consumption.

While the factors that influence gas demand by PLN and urea fertilizer industries are varied. However, the subsidy becomes the important policy in increasing the gas demand by both industries. The output factors of electricity price and input factor of diesel fuel price and other costs influence gas demand by PLN. While for the gas demand by urea fertilizer industries, the input factor relatively influences in a greater degree.

The gas price becomes the signal for the producer to produce the gas and for the consumers to decide the amount of consumption. Indonesian gas price is influenced in real by the gas price worldwide. The elasticity of Indonesian gas price to the gas price worldwide will be inelastic in the short term. The condition shows that Indonesia is a small open country where the gas price worldwide will influence the domestic prices.

Indonesian GDP is the most important part in the effort of observing the domestic gas reallocation policy. The Indonesian gas demand contributes the changes in Indonesian GDP, besides the general price increase factors. Moreover, in the long term, the response of Indonesian GDP to the Indonesian gas demand is elastic.

Based on the simulation result, the gas reallocation policy has not yet capable in providing massive and broad impact to the economic growth and industrial development. The government commitment which prioritizes the gas as the energy in the future has in fact showed the positive impact to the economic growth and development of electricity and fertilizer industries.

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**Appendix 1. Simulation Result of Policy and Non-Policy of Gas, Year 2012-2018.**

| Variable | Baseline Value | Sim-01 | Sim-02 | Sim-03 | Sim-04 | Sim-05 | Sim-06 |
|---|---|---|---|---|---|---|---|
| | | Percent | | | | | |
| $PGBI_t$ | 3 678 288.00 | 0.0655 | -8.3992 | -8.4608 | -4.2304 | -0.0149 | 2.9798 |
| $SGBI_t$ | 1 678 923.00 | 0.1082 | 41.1416 | 41.0068 | 20.5034 | -0.0256 | 2.8353 |
| $DGBI_t$ | 1 427 389.00 | 0.2173 | 1.5822 | 1.3640 | 0.6820 | -0.0511 | -0.6680 |
| $GDPIR_t$ | 4 301 183.00 | 0.2542 | 1.8954 | 1.6455 | 0.8264 | -0.0624 | -0.8232 |
| $DPLN_t$ | 103 260.00 | 2.2409 | 13.3052 | 11.0566 | 5.5278 | -0.6004 | -5.4151 |
| $DURE_t$ | 107 578.00 | 0.7325 | 8.2219 | 7.4857 | 3.7433 | -0.1032 | -3.6652 |
| $HGBIR_t$ | 6 685.80 | 2.2780 | -276.5668 | -278.6607 | -139.3296 | -0.5504 | 136.4758 |
| $XGBI_t$ | 1 999 365.00 | 0.0296 | -50.0000 | -50.0000 | -75.0000 | -0.0059 | 3.1012 |
| $MGBI_t$ | 4 738 907.00 | 0.5886 | -3.8541 | -4.4318 | -2.2089 | -0.1479 | 2.2359 |
| $GROW_t$ | 7.67 | 0.6415 | 4.5086 | 3.8867 | 1.9596 | -0.1473 | -1.9401 |

| Variable | Baseline Value | Sim-07 | Sim-08 | Sim-09 | Sim-10 | Sim-11 | Sim-12 |
|---|---|---|---|---|---|---|---|
| | | Percent | | | | | |
| $PGBI_t$ | 3 678 288.00 | 0.7759 | 0.5852 | 1.3928 | 1.7834 | -1.1137 | -1.1149 |
| $SGBI_t$ | 1 678 923.00 | 1.2768 | 0.9578 | 2.2893 | 3.5232 | -2.2760 | -2.2765 |
| $DGBI_t$ | 1 427 389.00 | 2.5500 | 1.9019 | 4.5639 | -0.3929 | 0.2402 | 0.2941 |
| $GDPIR_t$ | 4 301 183.00 | 2.9487 | 2.2328 | 5.2131 | -0.4869 | 0.3436 | 0.4087 |
| $DPLN_t$ | 103 260.00 | 36.0000 | -0.7980 | 36.0000 | -3.1850 | 1.9475 | 2.5692 |
| $DURE_t$ | 107 578.00 | -0.7204 | 26.0000 | 26.0000 | -2.1556 | 1.3190 | 1.4371 |
| $HGBIR_t$ | 6 685.80 | 26.8195 | 20.1068 | 48.0735 | 80.2701 | 40.0000 | 40.0000 |
| $XGBI_t$ | 1 999 365.00 | 0.3554 | 0.2723 | 0.6399 | 0.3226 | -0.1376 | -0.1395 |
| $MGBI_t$ | 4 738 907.00 | 6.8667 | 5.2294 | 12.1872 | 1.2910 | -0.1377 | 0.0012 |
| $GROW_t$ | 7.67 | 7.2544 | 5.4265 | 12.6157 | -1.1317 | 0.6063 | 0.7601 |

Notes:
Sim-01: Electricity and Fertilizer Subsidy Increases 10%
Sim-02: Reallocation of Gas by 50% and Electricity and Fertilizer Subsidy Increases 10%
Sim-03: Gas Reallocation by 50%.
Sim-04: Gas Reallocation by 75%.
Sim-05: Interest Rate Increases 5%.
Sim-06: Depreciation of Exchange Rate by 15%,
Sim-07: Gas Demand by PLN Increases 36%.
Sim-08: Gas Demand by Urea Fertilizer Increases 26%.
Sim-09: Gas Demand by PLN Increases 36% and the Urea Fertilizer 26%.
Sim-10: Gas Price Worldwide Increases 10%.
Sim-11: Domestic Gas Price Increases 40%.
Sim-12: Domestic Gas Price Increases 40% and the Interest Rate Decrease 5%,

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**Appendix 2. Definition of Operational Variable in the Economic Model of Gas**

| No. | Symbol | Variable | Unit | Source |
|---|---|---|---|---|
| 1. | $CPIN_t$ | Indonesian Consumer Price Index, Year t | Index | Statistics |
| 2. | $DGBI_t$ | Total Domestic Gas Demand, Year t | scf | KESDM |
| 3. | $DGBI_{t-1}$ | Total Domestic Gas Demand, Year t - 1 | scf | KESDM |
| 4. | $DPLN_t$ | Gas Demand by PLN, Year t | scf | PLN |
| 5. | $DGBL_t$ | Other Gas Demands, Year t | scf | KESDM |
| 6. | $DURE_t$ | Total Demand Gas by Urea Fertilizer Industry, Year t | scf | PUSRI |
| 7. | DK98 | Domestic Economy Crisis Dummy, year 1998. | - | - |
| 8. | $GDPIR_t$ | Indonesian GDP, Year t | IDR billion | Statistics |
| 9. | $GDPIR_{t-1}$ | Indonesian GDP, Year t - 1 | IDR billion | Statistics |
| 10. | $GROW_t$ | Indonesian Economic Growth, Year t | %Year | Statistics |
| 11. | $HPLNR_t$ | PLN electricity price on Year t | IDR/Kwh | KESDM |
| 12. | $HMSLR_t$ | Diesel Fuel Price on Year t | IDR/litre | KESDM |
| 13. | $HGBIR_t$ | Domestic Gas Price on Year t | IDR/scf | KESDM |
| 14. | $HMBIR_t$ | Oil Price on Year t | USD/*barrel* | KESDM |
| 15. | $HPURR_t$ | Urea Fertilizer Price on Year t | IDR/Kg | PUSRI |
| 16. | HGBWI | Gas Price Worldwide on Year t | USD/scf | Bloomberg |
| 17. | $IRRR_t$ | Bank Interest Rate on Year t | %/year | BI |
| 18. | $IRRR_{t-1}$ | Interest Rate, Year t - 1 | %Year | BI |
| 19. | $INFLSI_t$ | Indonesian Inflation, Year t | %Year | BI |
| 20. | $MGBI_t$ | Total Indonesian Import, Year t | IDR billion | Statistics |
| 21. | $MGBI_{t1}$ | Total Indonesian Import, Year t - 1 | IDR billion | Statistics |
| 22. | $NTIR_t$ | IDR/USD Exchange Rate, Year t | IDR/USD | BI |
| 23. | $NTIR_{t-1}$ | IDR/USD Exchange Rate, Year t - 1 | IDR/USD | BI |
| 24. | $PGBI_t$ | Indonesian Gas Production on Year t | scf | Statistics |
| 25. | $POPI_t$ | Total Indonesian Population, Year t | People | Statistics |
| 26. | $SGBI_t$ | Domestic Gas Supply on Year t | scf | KESDM |
| 27. | T | Time Trend | - | - |
| 28. | $UMRI_t$ | Labor Wage, Year t | IDR | Statistics |
| 29. | $UMRI_{t-1}$ | Labor Wage, Year t - 1 | IDR | Statistics |
| 30. | $XGBI_t$ | Indonesian Gas Export on Year t | scf | KESDM |
| 31. | $XGBI_{t-1}$ | Indonesian Gas Export on Year t - 1 | scf | KESDM |
| 32. | $u_1$-$u_7$ | *Error Term* | - | - |

Notes: All variables with domestic scale uses the deflated unit of money with Indonesian Consumer Price Index (2000-100). Whereas all variables with international scale uses the deflated unit of money with United States Consumer Price Index (2000-100).