International Journal of Multidisciplinary and Current Educational Research (IJMCER)
ISSN: 2581-7027 ||Volume|| 4 ||Issue|| 5 ||Pages 135-141 ||2022||

# SIMULATION OF THE IMPACTS OF LIQUIFIED PETROLEUM GAS POLICIES TOWARDS INFLATION IN INDONESIA

Pri Agung Rakhmanto, Ph.D.[1],Dr. Ir. Rini Setiati, M.T., IPM.[2]Dr. Dwi Atty Mardiana, S.T., M.T.[3]
*Faculty of Earth and Energy Technology, Department of Petroleum Engineering,*
*Graduate Studies Program on Petroleum Management, Universitas Trisakti, Jakarta, Indonesia*

**ABSTRACT:** This study was conducted to calculate the impacts of various policy options for determining the price of Liquified Petroleum Gas *(*LPG) on inflation in Indonesia. Calculations were carried out using the General Computable Equilibrium (CGE*)* model approach with the General Algebraic Modeling System (GAMS) software. Simulations were carried out using the CGE model to determine the impacts of LPG pricing policy options on inflation in Indonesia. This study utilizes the database from the Indonesian Socio-Economic Accounting Matrix (Sistem Neraca Sosial Ekonomi, SNSE) in 2015. The method used is the Static Computable General Equilibrium (Static CGE) model. Based on the simulation results, it was discovered that inflation in Indonesia is more greatly impacted by pricing policies on subsidized rather than non-subsidized LPG.

**KEYWORDS:** LPG Price, Inflation, Static CGE

## I. INTRODUCTION

The LPG pricing policy dilemma has emerged since the commencement of Indonesia's kerosene to LPG conversion program, which was effectively implemented since 2006. According to Yusgiantoro and Yusgiantoro (2018) and Rakhmanto (2017), in the long run, the most serious problems in LPG management in Indonesia primarily pertain to pricing policies. To be more specific, the main issue is to find a pricing policy towards economically viable prices, but with minimal impact on inflation.Since 2006, the Indonesian government decided to convert kerosene to LPG for household purposes. Since then, LPG products in Indonesia could be categorized into two major groups, which are subsidized LPG and non-subsidized LPG. Subsidized LPG is LPG packaged in 3 -kilogram cylinders sold at government-subsidized prices. Meanwhile, non-subsidized LPG come in other sized cylinders and are sold at prices unsubsidized by the government. Prices for the two types of LPG are both determined in reference to international LPG prices, but using different formulas. The subsidized LPG policy was conceived as one of the government's efforts to reduce fuel oil subsidies, most of which had been used to subsidize kerosene. In this regard, while budget is still allocated for LPG subsidies, the sum is not as large as the budgeted amount for kerosene subsidies. The policy caused a surge in LPG consumption in Indonesia from 1.28 million tons in 2007 to 7.19 million tons in 2017.

Indonesia's LPG consumption grew significantly during the first four-year period since the kerosene to LPG conversion policy was implemented. In 2008, exactly one year after the start of the conversion program, Indonesia's LPG consumption increased by about 43.94%. In 2009, Indonesia's LPG consumption growth reached an all-time high of 58.48%. Thereafter, LPG consumption growth slowed to 15.59% in 2011, to 15.71% in 2012, until it became 5.16% in 2018.

[1] pri.agung@trisakti.ac.id
[2] rini.setiati@trisakti.ac.id
[3] atty@trisakti.ac.id

**Table 1.**
**Growth in LPG Consumption in Indonesia in 2007-2018**

| Year | LPG Production (Tons) | LPG Consumption (Tons) | Growth Consumption | Surplus/Deficit (Tons) |
|---|---|---|---|---|
| 2007 | 1,409,430 | 1,281,000 | - | 128,430 |
| 2008 | 1,690,766 | 1,843,817 | 43.94% | -153,051 |
| 2009 | 2,125,218 | 2,922,080 | 58.48% | -796,862 |
| 2010 | 2,478,371 | 3,761,086 | 28.71% | -1,282,715 |
| 2011 | 2,285,439 | 4,347,465 | 15.59% | -2,062,026 |
| 2012 | 2,201,539 | 5,030,547 | 15.71% | -2,829,008 |
| 2013 | 2,010,990 | 5,607,430 | 11.47% | -3,596,440 |
| 2014 | 2,379,128 | 6,093,138 | 8.66% | -3,714,010 |
| 2015 | 2,307,407 | 6,376,990 | 4.66% | -4,069,583 |
| 2016 | 2,241,567 | 6,642,623 | 4.17% | -4,401,056 |
| 2017 | 2,027,941 | 7,190,871 | 8.25% | -5,162,930 |
| 2018 | 2,027,263 | 7,562,184 | 5.16% | -5,534,921 |

Source: Indonesian Ministry of Energy and Mineral Resources, 2019

The reason behind the government's policy to convert kerosene use to LPG is due to the potential savings in subsidy spending. The amount of budget allocation needed for subsidizing the LPG equivalent to one liter of kerosene was found to be cheaper. In its development, the sustainability of Indonesia's national LPG supply in fulfilling domestic demands has presented itself as a new problem for the country. Since 2008, Indonesia has been experiencing a deficit of 153 thousand tons in LPG supplies. Indonesia's LPG supply deficit has been recorded to continue rising each year, eventually reaching 5.53 million tons in 2018. In that year, the portion of domestic LPG consumption which had to be met by imports reached 71.79%.

Import making up the majority of LPG supplies has consequences affecting procurements costs and LPG prices, which are strongly influenced by fluctuations in the prices of LPG and its raw materials in the international market. In the context of national economy parameters, and inflation in particular, this situation calls for the formulation of an apt LPG pricing policy. LPG pricing policies have a wide range of impacts on the national economy, especially due its potential impacts on inflation. In view of this existent problem, it is relevant to conduct a study on the correlation between LPG pricing policies and inflation in Indonesia. It is expected that this study would serve as an additional reference for policy makers in managing the national energy sector, especially in LPG management.

## II. THEORETICAL FRAMEWORK

According to Parsons (2001), public policy is an action carried out by the government, political parties, and policy makers for the sake of society as a whole. In addition, Boston, et al., (2010) describes public policy as activities where government authorities determine what can and cannot be done by the society. Public policy in general encompasses several stages, including the formulation of problems, implementation and evaluation of policies. Public policy making is a complex process as it involves the study of processes as well as variables. The stages of public policy as a process start from the preparation of an agenda based on problems which have emerged, followed by the formulation of policies. After policy formulation, the next step is policy adoption, policy implementation, and the last stage is policy evaluation (Dunn, 2011).

The theory of government expenditure (public expenditure) pertains to the costs incurred by the government to provide goods and services through the public sector budget which has an impact on private sector spending (Ukwueze, 2015). Musgrave's theory of public spending discusses changes in the elasticity of demands for public services consisting of three ranges. Musgrave stated that, when per capita income is low, demand for public services tends to be similarly low. The reason is that, in this income range, people could only spend their income to meet their primary needs. When community income rises above the low-income bracket, demands for public service services such as health, education and transportation will increase, driving the government to increase public spending to meet the needs of the community.

Musgrave's research discovered that, when per capita income reaches a high level like in developed countries, the need for public services also tends to decrease because their basic needs have already been met (Chude & Chude, 2013).State finance could simply be defined as the study of the role of government in economic activities. In general, studies in state finance encompass: (i) when the government intervenes in economic activities; (ii) how the government intervenes in economic activities; (iii) what the impacts of the intervention are on economic outcomes; and (iv) why the government has decided to intervene the way it has. The reason that the government intervenes in economic affairs is due to the emergence of market failures which prevent economic activities from attaining maximum efficiency. Another reason that the government intervenes in economic affairs is to conduct redistribution activities that shift resources from one community group to another community group. There are a few alternatives that the government could resort to in order to intervene in economic activities, one of which is to provide subsidies as a price mechanism to respond to failures in the private sector. Subsidy is defined as public expenditure aimed at individuals or companies to lower the cost of consumption or production (Gruber, 2011). The governmental policy is intended to reduce the price of goods or services so that the people would have higher purchasing power.

There is a linear relation between energy, such as in this case, oil and gas, and development The ongoing debate on this relation is on whether economic growth promotes energy consumption or, conversely, energy consumption promotes economic growth. Biophysicists argue that the only primary production factor is energy (Stern, 1999). Stern views that the more energy consumed, the less energy is available and the lower the quality. Some of the theories developed that explain the role of energy in the economy come from Stiglitz (1974) and Tahvonen and Salo (2001). Experts have developed economic models to explain how energy affects economic growth by simulating replaceable as well as irreplaceable energy needs. These experts divided economic development into three stages, including pre-industrial, industrial, and post-industrial. At the pre-industrial stage, energy prices started out low before eventually rising. The price of non-renewable fuel, such as LPG, which started out as law, would also increase in turn.

## III. RESEARCH METHODS

The data used from the Socio-Economic Accounting Matrix (SNSE) comes from the 2015 update of SNSE Indonesia, which is an update of the data from 2008. As for several other parameters such as constant elasticity of substitution (CES) and constant elasticity of transformation (CET), a few assumptions have been adopted. The CES and CET values are assumed to be 0.5 for twenty-three sectors, except for the food and beverage and tobacco industry sectors, where they are assumed to be 1.5. SNSE data is updated by inputting renewed data and adjusting data classification lines and columns used in the 2008 SNSE. To start with, the production sector block, domestic commodity block, and imported commodity blocks are merged into one new block. Second, the lines and columns for trade and transport margins (TTM) are deleted, followed by a move away from consumer price-based to producer price-based transactions between production sectors/production and commodity sectors. Third, disaggregation of lines and columns for indirect taxes to net indirect taxes and net import tariffs.

The comparative static CGE analysis tool is appropriate to be used for observing the impacts of policy implementation or the impacts of changes in external variables towards the economy, comparing conditions when a policy is implemented and when it is not. CGE is considered a deterministic model which prioritizes comparison of changes in variables focused upon in the study between the initial equilibrium conditions (base) and the new equilibrium (shock simulation results). Compared to other deterministic models such as the input-output (IO) table model or the SNSE model and its derivatives, the CGE model has incorporated several factors such as price and exchange rate variables and explains the cause for differences in consumption behavior among community groups as utility maximization. Utility maximizing behavior is considered to represent welfare, which is the goal of policy implementation (Hosoe et al, 2010:1-2). Static CGE is performed using the General Algebraic Modeling System (GAMS) software.

The Energy Economy CGE model is constructed using general equations (formulas) used in the typical (basic) CGE model. The model was developed by expanding the database using transactions from both the IO Table and the SNSE Table. In addition to database expansion using the IO and SNSE Tables, modifications were also made to the formulas/equations, which were adjusted to existing needs and expansion of the database. The formulas used in the CGE model are as follows:

In this study, the model used was adapted from the model constructed by Hosoe et al. (2010: 87-121), then adjusted to adapt to the economic characteristics, analysis needs, and availability of Indonesian SNSE data. The adjustments in question were made towards several aspects, which are:

1. Modification of Goods and Services Market Specifications for Several Sectors, from Perfect Competition to Monopoly;
2. Addition to the Number of Categories of Household Institutions from a Single Household to Several Household Categories;
3. Addition of Enterprise Institutions (Establishments) in the Model;
4. Addition of Service Compensation Transactions with Overseas Factor; and
5. Addition of Transfer Transactions within One Institution and Across Institutions (Households, Companies, Governments, and Overseas).

To better visualize this concept, it is described that the production sector in an economy only produces two outputs consisting of goods 1 (BRD) and goods 2 (MLK). To further simplify the illustration, the only process stage shown is the production of goods 1 (BRD), although the same process actually applies as well for the production of goods 2 (MLK). Based on the flowchart sequence of the CGE model, functions are then arranged in a way that represents the behavior of each element involved in the general equilibrium of the economy. These functions are grouped according to blocks which are similar to one another, namely the domestic production block, the export commodity and domestic commodity transformation block, the substitution between imported commodities and domestic commodities block (Armington composite), the government institutions block, the savings and investment block, the household institution block, the export and import commodity price balance of payment (BOP) block, and the market clearing conditions block. In addition to compiling functions into each block, during the preparation of this model, a calibration procedure is also needed for the parameters required. The calibrated parameters and functions used to obtain them are as follows:

1. Calibration towards the Leontief production function coefficients, as such:

$$ax_{ij} = \frac{X_{ij}^0}{Z_j^0} \qquad \forall i, j$$

$$ay_j = \frac{Y_j^0}{Z_j^0} \qquad \forall j$$

$ax_{ij}$: input coefficient (i-th good used to produce one good from the j-th sector)
$ay_j$ : input coefficient (i-th composite good used to produce one good from the j-th sector)
$X0_{ij}$ : intermediate input (amount of i-th goods used to produce goods in the j-th sector goods) under initial equilibrium conditions
$Z0_j$ : gross domestic output of the j-th sector under initial equilibrium conditions
$Y0_j$ : composite factor of the j-th sector under initial equilibrium conditions

2. Calibration towards coefficients of the CES function, as such:

$$\delta m_i = \frac{(1+\tau_i^m)p_i^{m0}M_i^{0(1-\eta_i)}}{(1+\tau_i^m)p_i^{m0}M_i^{0(1-\eta_i)} + p_i^{d0}D_i^{0(1-\eta_i)}} \qquad \forall i$$

$$\delta d_i = \frac{p_i^{d0}D_i^{0(1-\eta_i)}}{(1+\tau_i^m)p_i^{m0}M_i^{0(1-\eta_i)} + p_i^{d0}D_i^{0(1-\eta_i)}} \qquad \forall i$$

$$\eta_i = \frac{(\sigma_i - 1)}{\sigma_i} \qquad \forall i$$

where σi is obtained from the results of previous studies

$$\gamma_i = \frac{Arm_i^0}{\left(\delta m_i M_i^{0\eta_i} + \delta d_i D_i^{0\acute{\eta}_i}\right)^{1/\eta_i}}$$

3. Calibration towards coefficients of the CET function, as such:

$$\xi e_i = \frac{p_i^{e0} E_i^{0(1-\Phi_i)}}{p_i^{e0} E_i^{0(1-\Phi_i)} + p_i^{d0} D_i^{0(1-\Phi_i)}} \qquad \forall i$$

$$\xi d_i = \frac{p_i^{d0} D_i^{0(1-\Phi_i)}}{p_i^{e0} E_i^{0(1-\Phi_i)} + p_i^{d0} D_i^{0(1-\Phi_i)}} \qquad \forall i$$

$$\theta_i = \frac{Z_i^0}{(\xi e_i E_i^{0\Phi_i} + \xi d_i D_i^{0\Phi_i})^{1/\Phi_i}} \qquad \forall i$$

4. Estimation of savings rates and indirect tax rates:

$$S_r^p = \frac{S_r^{p0}}{(\sum_h p_h^f FF_{h,r} + trhhr(r) + trhohest(r) + trhohgov(r) + \varepsilon.trhohext(r))}$$

$$ss^g = \frac{S^{g0}}{\left(\sum_h p_h^{f0} FF_{gov} + \sum_q T_q^{d0} + \sum_j T_j^{z0} + \sum_j T_j^{m0} + T_{est}^{d0} - S^{g0}\right)}$$

$$\tau_r^d = \frac{T_r^{d0}}{(\sum_h p_h^{f0} FF_{est} + \sum_r tresthoh0(r) + trestest0 + trestgov0 + \varepsilon.trestext0)}$$

From these functions, endogenous variables contained in the model include

$Y_j$, $F_{h,j}$, $X_{ij}$, $Z_j$, $X_i^p$, $X_i^g$, $X_i^v$, $E_i$, $M_i$, $Arm_i$, $D_i$, $p_h^f$, $p_j^y$, $p_j^z$, $p_i^q$, $p_i^e$, $p_i^m$, $p_i^d$, $\varepsilon$, $S_r^p$, $S^g$, $T_r^d$, $T_j^z$, $T_i^m$

While the exogenous variables include:

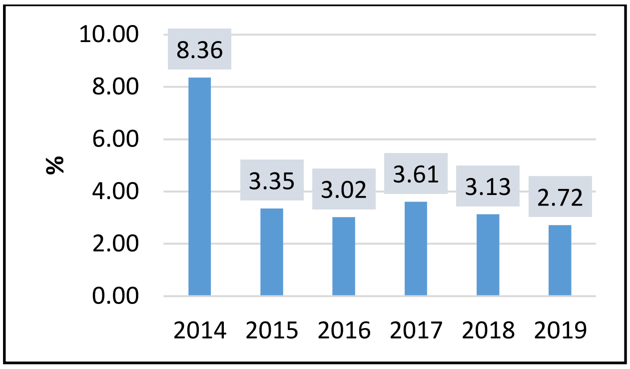
$FF_{rh}$, $FFest$, $FFgov$, $FFext$, $NL^f$, $p_i^{We}$, $p_i^{Wm}$, $\tau_r^d$, $\tau_j^z$, $\tau_i^m$, $trhohhoh_{qr}$, $trhohext$, $trestext$, $trgovext$

In this model, price variables are expressed as numeraires and expressed in units of one (unity), while other variables are expressed in certain amounts. The consequence of expressing all prices in unity units is that price changes caused by a policy (shock) become relative. The numeraire process is implemented in reference to Walras's law, which states that if there are n markets in the economy and n-1 of them are in equilibrium, then the one remaining market (n-th market) is also in equilibrium The application of Walras's law is helpful to solutions of CGE model developments As in the model used in this study, the solution to an optimization model aims to obtain *feasible* and unique results mandates that the number of variables be equal to the number of functions. With the price variable transformed into *a* numeraire, this means that one endogenous variable is missing from the model and thus the number of variables is no longer equal to the number of functions as it originally was. The advantage of using Walras's law is that if there is an n number of markets, only n-1 markets need to reach equilibrium, as the nth market would then automatically reach equilibrium. The nth market is therefore not actually independent but reliant on the equilibrium of n-1 markets Dependency of the nth market is the same as having one redundant function in the model, which must consequentially be removed from the model. This eventually makes the number of variables equal once more to the number of functions (Burfisher, 2011:38).

## IV. RESULTS AND DISCUSSION

Over the period of 2015-2019, inflation growth rate has been relatively kept stable in the range of 3%. Existing data show that inflation in 2015 was 3.5%, a significant decrease from the previous year's rate reported at 8.36%. The declining inflation rate was influenced by the government's policy to reduce fuel subsidies at the end of 2014 following a downward trend in global crude oil prices. In 2016, inflation decreased once more to 3.02% as one of the impacts of an energy price management policy reform by the Indonesian government implemented as oil prices were in decline at the time.

**Figure 1**
**Indonesia's Inflation Rate in 2010 – 2019**




Source: Statistics Indonesia (2020)

In 2017, the inflation rate was again recorded to be increasing, but still remained in stable condition within the range of 3%. Inflationary stability is driven by commodity price stability, especially of food commodities, as well as the enactment of electricity tariff adjustments for consumers with 900 VA power capacities as a derivation of targeted subsidy policies. A positive trend also occurred in 2018 with inflation recorded at 3.13%, lower than the previous year. Similarly, in 2019, with the consistent implementation of the government's price management policy, inflation rate remained a positive value even as it was recorded as the lowest rate over the past five years.

The simulation results show that the impacts of raising subsidized LPG prices towards inflation growth is much greater compared to the impacts of raising non-subsidized LPG prices (Table 2). Furthermore, the simulation results show the same pattern across different price hike scenarios. The impacts on inflation remain consistent, in that raising subsidized LPG prices produced greater impacts on inflation growth compared to the impacts of raising non-subsidized LPG prices.

**Table 2**
**Simulation Results of the Impact of Raising LPG Prices on Indonesia's Inflation**

| Price Hike Policy Simulation | Impact on Inflation |
|---|---|
| Subsidized LPG Increased By 2% | 0.0212% |
| Subsidized LPG Increased By 5% | 0.0528% |
| Subsidized LPG Increased By 10% | 0.1052% |
| Subsidized LPG Increased By 20% | 0.2089% |
| Subsidized LPG Increased By 30% | 0.3112% |
| Non-Subsidized LPG Increased By 2% | 0.0208% |
| Non-Subsidized LPG Increased By 5% | 0.0519% |
| Non-Subsidized LPG Increased By 10% | 0.1033% |
| Non-Subsidized LPG Increased By 20% | 0.2051% |
| Non-Subsidized LPG Increased By 30% | 0.3056% |
| Subsidized LPG by 20%, Non-Subsidized LPG by 10% | 0.3292% |

Source: Results of CGE model simulation (2020)

Based on the results in Table 2, the impacts of price hike policies for both types of LPG on Indonesia's inflation rate show a relatively similar pattern which apply towards price hike scenarios above 10% and below 10%. Raising the price of subsidized LPG by more than 10% and less than 10% would both result in an increased inflation rate. The impact of raising non-subsidized LPG price on inflation is also relatively identical the impact caused by raising subsidized LPG price. Increasing non-subsidized fuel price by less than 10% and more than 10% would also both result in increased inflation rates in Indonesia. The simulation results show that the policy of raising subsidized LPG and non-subsidized LPG prices at the same time has a greater impact on inflation compared to raising the price of only one type.

## V. CONCLUSIONS AND RECOMMENDATIONS

1. Based on the simulation results, explanation and discussion of the analysis of the impacts of LPG pricing policies on inflation, it was found that LPG prices are directly correlated to inflation level.
2. Pricing policies on subsidized LPG have a relatively greater impact on inflation than those concerning non-subsidized LPG.
3. The simulation results show that policies that increase the prices of subsidized and non-subsidized LPG at the same time have a greater impact on inflation than policies that only increase the price of one type.
4. The simulation results show that there are several possible combination which could be taken for raising the prices of subsidized and non-subsidized LPG, with various consequences towards inflation.

## REFERENCES


1. Boston, Jonathan, Bradstock, Andrew & Eng, David. (2010). Public Policy: Why Ethics Matters. Australia: ANU Press.
2. Chude, N. P., and Chude D. I. (2013). Impact of Government Expenditure on Economic Growth in Nigeria International Journal of Business and Management Review, Vol.1, No.4, pp. 64-71.
3. Dunn, W.N. (2011). Public Policy Analysis, 5th Edition. New Jersey: Pearson Education.
4. Gruber, J. (2011). Public Finance and Public Policy. New York: Worth Publishers.
5. Hosoe, N., Gasawa, K., and Hashimoto, H. (2010). *Textbook of Computable General Equilibrium Modelling: Programming and Simulations*. Palgrave Macmillan. New York.
6. Central Government Financial Reports (LKPP). (2010). Penerimaan Migas Terhadap APBN. Jakarta: Government of Indonesia.
7. Parsons, Wayne. (2001). Public Policy: Pengantar Teori dan Praktik Analisis Kebijakan. Jakarta: Kencana.
8. Rakhmanto, P.A. (2017). Ekonomi Energi I: Teori Dasar. Jakarta: ReforMiner Institute.
9. Stern, D. I. (1993). Energy and Economic Growth in The USA: A Multivariate Approach. Energy Economics. Vol. 15, Issue 2, pp. 137-150.
10. Stiglitz, J.E. (1974). Bagi Resiko dan Insentif dalam Panen Bersama, *Review of Economic Studies*.
11. Tahvonen, Olli and Salo, Seppo. (2001). Economic growth and transitions between renewable and nonrenewable energy resources. *European Economic Review*, vol. 45, issue 8, 1379-1398.
12. Ukwueze, R Ezebuilo. (2015). “Determinants of the Size of Public Expenditure in Nigeria”, SAGE. http://us.sagepub.com/en-us/nam/open-access-at-sage (accessed on 21 August 2017).
13. Yusgiantoro, P and Yusgiantoro, L. (2018). Ekonomi Energi: Teori dan Aplikasi. Jakarta: Yayasan Purnomo Yusgiantoro