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The Impact of Using DME as A Substitute for LPG in Indonesian Economy

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Abstract
In order to reduce the import ratio and high budget needs for energy subsidies, the government of Indonesia is currently developing DME production to replace LPG as fuel in cooking activities. From various previous studies, the policy of using DME not only requires a relatively expensive cost but also has the potential to disrupt health and endanger environmental sustainability due to the use of large amounts of fossil energy from coal. This study aims to examine the impacts of DME policy on the Indonesian economy using the CGE method, 2019 SAM data and two forms of shocks: (i) Decreasing LPG imports and (ii) Reallocating the subsidies budget. DME will have a positive impact on the economy, trigger growth in the productivity of various sectors and encourage employment, but only in the short run. The results of the study in the long run show negative implications even though the percentages are relatively low and not significant.

Keywords: CGE, DME, Energy Subsidies, Import, LPG

Dampak Penggunaan DME Sebagai Pengganti LPG terhadap Perekonomian Indonesia

Abstrak
Dalam rangka menekan rasio impor dan tingginya kebutuhan anggaran subsidi energi, pemerintah Indonesia saat ini tengah mengembangkan produksi DME untuk menggantikan LPG sebagai bahan bakar dalam kegiatan memasak. Dari berbagai kajian sebelumnya, kebijakan penggunaan DME selain membutuhkan biaya yang relatif mahal, juga berpotensi mengganggu kesehatan dan membahayakan keberlanjutan lingkungan akibat penggunaan energi fosil dari batubara dalam jumlah besar. Kajian ini bertujuan untuk mengkaji dampak kebijakan DME terhadap perekonomian Indonesia dengan menggunakan metode CGE, data SAM 2019 dan 2 bentuk guncangan: (i) Penurunan impor LPG dan (ii) Realokasi anggaran subsidi. DME akan memberikan dampak positif terhadap perekonomian, memicu pertumbuhan produktivitas berbagai sektor dan mendorong penyerapan tenaga kerja, namun hanya dalam jangka pendek. Hasil kajian dalam jangka panjang menunjukkan implikasi negatif meskipun persentasenya relatif rendah dan tidak signifikan.

Kata Kunci: CGE, DME, Energy Subsidies, Import, LPG

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INTRODUCTION

Countries around the world, especially those with large populations and developing countries, are faced with the issue of high energy subsidies. Total energy subsidies

worldwide in 2021 have reached US$ 440 billion, increasing again after decreasing in 2019 and 2020 (IEA, 2021). Subsidies are an important policy, especially for poor households. Still, they also have the potential to burden public finances, taking away opportunistic spending in other more productive sectors of the economy and leading to deadweight loss or loss of efficiency (Bridle et al., 2019; IMF, 2015). In addition, energy subsidies also make energy commodities very cheap, leading to inefficient energy use and risking corruption and smuggling of subsidized goods (Sarrakh et al., 2020; Tumiwa et al., 2012).

With a growing economy, Indonesia still has to solve the problem of relatively large subsidies, especially the allocation for the Liquefied Petroleum Gas (LPG) sector, as shown in Table 1. From year to year, Indonesia's Gross Domestic Product (GDP) continues to rise and the government has successfully reduced the poverty rate to 9.71% in 2021 and 9,57% in 2022 (BPS, 2022). However, the amount of the LPG subsidy, which is mainly aimed at poor households and people with other social welfare problems, is projected to reach IDR 66.3 trillion or a 24.7% increase from the realization in 2021, and will be the largest allocation among other types of energy subsidies including for electricity (Kementerian Keuangan, 2021; TNP2K, 2021). The main causes of the high LPG subsidy budget include the large import ratio of 77.63%, expected to be even higher, reaching 83.55% in 2024 (PTBA, 2021; TNP2K, 2021). The fluctuating price of Contract Price Aramco (CPA) which tends to be more expensive, the weakening of the rupiah exchange rate and the increasing demand for LPG have resulted in high state expenditure to fulfill the 3 Kg LPG quota (Kajian & Keahlian, 2020).

Some of the government's strategies to overcome this problem are producing electric stoves and reducing the amount of LPG consumption to match the data of eligible subsidy recipients, namely the Integrated Social Welfare Data (DTKS). In addition, the government is also developing a coal processing/gasification industry with production output in the form of Dimethyl Ether (DME), which is projected to replace the use of imported LPG fuel because it has similar technical characteristics and specifications (Boedoyo, 2016; Larson & Yang, 2004; Murti et al., 2021). The government also designated the 6 million tons/year coal processing project as a National Strategic Project in 2020 and provided incentives for Coal Royalty payments up to a 0% rate. With this DME strategy, the government claims that it can reduce LPG imports by 1 million/ton and can save subsidies of at least IDR 7 trillion/year (BP Energy, 2021; Kementerian ESDM RI, 2021; PTBA 2021).

The government has various other alternative strategies to overcome the chronic issue of high LPG imports. In addition, the implementation of the DME policy not only requires high-value investments that can burden the state budget, but also raises health risks and environmental damage due to the use of large amounts of fossil energy, and reduces state revenue from the Coal non-tax revenue sector. Therefore, it is important to gain a comprehensive understanding of how much significance the policy of using DME as a substitute for LPG has on the Indonesian economy and whether the strategy of using DME can be a sustainable policy in the long-run? To answer these questions, it is necessary to conduct empirical research on the impact of using DME, which can be done through a

shock/change simulation mechanism on the structure of the economy in Indonesia. The shock scheme can be in the form of: (i) A decrease in the level of LPG imports and (ii) Reallocation of LPG subsidy spending to other productive government spending needs.

Table 1. *Growth of Subsidy Expenditure (2011-2022)*

Year	GDP (IDR Trillion)	GDP Growth	Poverty Level	Subsidy Expenditure (IDR Trillion)	Energy Subsidies (IDR Trillion)	LPG Subsidy (IDR Trillion)
2011	7,427	6.50%	12.36%	295.3	255.6	22.6
2012	8,242	6.23%	11.66%	346.4	306.5	32.8
2013	9,084	5.78%	11.37%	355.0	310.0	31.0
2014	10,543	5.02%	10.96%	391.9	341.8	49.0
2015	11,540	4.88%	11.22%	185.9	119.1	16.8
2016	12,407	5.02%	10.86%	174.2	102.8	24.9
2017	13,589	5.07%	10.12%	166.4	97.6	38.7
2018	14,837	5.17%	9.66%	216.9	153.5	58.1
2019	15,834	5.02%	9.22%	201.8	136.9	58.0
2020	15,434	-2.07%	10.19%	196.2	108.8	50.6
2021	16,970	3.69%	9.71%	248.6	128.5	49.9
2022	17,025	5.17%	9.57%	206.9	134.0	66.3

Various previous researches have produced studies related to the utilization of DME products as LPG substitutes, especially in terms of technology and other technical specifications such as Boedoyo (2016); Filippov & Keiko (2021); Larson & Yang (2004) and Murti et al. (2021). Many researchers have also examined the implications of import policies on the economy with various types of methodologies such as Astuti & Ayuningtyas (2018) using the Error Correction Model (ECM) method, which found a negative impact of imports on GDP in the short-run, but in the long-run the impact of imports on the economy is not significant. According to Winardi (2014) using the Computable General Equilibrium (CGE) method, the reduction in imports of horticultural products resulted in a decrease in the general welfare of the community, especially non-agricultural households in urban areas.

Various previous studies have also analyzed the impact of energy subsidy reform/reduction/removal policies that are diverted to government spending in other sectors outside the subsidy sector. The policy of reallocating fuel subsidies in South Africa for transportation development has been proven to provide cheap and accessible public transportation services, which have a positive effect on the economy and reduce unemployment (Henseler & Maisonnave, 2018). Simulation of the impact of fuel subsidy diversion on the transportation sector in Indonesia shows a positive contribution due to road construction. However, the mining and manufacturing sectors that require large

amounts of energy consumption have decreased due to the increase in oil prices (Kim & Samudro, 2021).

From these articles, research that specifically examines the implications of DME as an LPG substitute is mostly carried out on the technology side, safety level, and other technical characteristics. Studies of the impact of DME use on the economy are still not widely carried out, and generally use descriptive analysis as part of the technical research. For the study of import policy implications, research on the DME sector is also still limited, especially in Indonesia. In addition, the data used in CGE studies in Indonesia also still use the 2008 Social Accounting Matrix (SAM) data.

Therefore, the authors try to fill this gap by examining the impact of using DME as a substitute for LPG on the economy, analyzed from the variables of GDP, Production Output, and Labor. The research mechanism is to simulate a shock in the form of a decrease in subsidized LPG imports and reallocation of LPG subsidy savings to government spending in the productive sector. Furthermore, the author will use the CGE method and SAM 2019 data which are more relevant in explaining economic conditions in Indonesia and bring up the LPG sector to provide clarity on the significance of the implications of the DME use strategy on the Indonesian economy.

METHOD

CGE Model

To measure the significance of government policy implications related to the use of DME as a substitute for LPG through a shock simulation in the form of a decrease in LPG imports and reallocation of LPG subsidy spending to other government spending needs, the author used a CGE model. CGE is a system of mathematical equations that represents all the activities of economic agents in an economy and can explain the economy's reaction in the presence of a shock or change in the level of prices, quantities, policies or other factors (Resosudarmo et al., 2011). The purpose of a CGE model is not to predict the exact outcome of a policy but to indicate the direction and size of the policy implications (Hartono & Resosudarmo, 2006; Lee et al., 2021; Resosudarmo et al., 2011).

The structure of the CGE model in this study is similar to the CGE Model initiated by Aissa & Hartono (2017), which was then adapted to the use of the 2019 Indonesian SAM database referring to the research Hartono et al. (2017) and Sobri et al. (2020). The equation system consists of 4 (four) blocks of equations, namely (i) The Production Block, (ii) The Consumption Block, (iii) The Export-Import Block, and (iv) The Market Clearing Block.

Data

The author used SAM data in 2019. SAM is a very useful data collection system because it summarizes all economic transactions of a country in a certain period and can explain its socioeconomic structure. In addition, SAM can show the impact of a government policy on household income as a reflection of poverty and income distribution issues in the region (Hartono & Resosudarmo, 2006; Hayati, 2013; Resosudarmo et al., 2011). The SAM in this study modifies the 2008 Indonesian SAM, which is then updated with 2016 IO data using

the RAS method as conducted by Aissa & Hartono (2017), Hartono et al. (2017), and Sobri et al. (2020), and there are 66 (sixty-six) sector groups as a CGE model database.

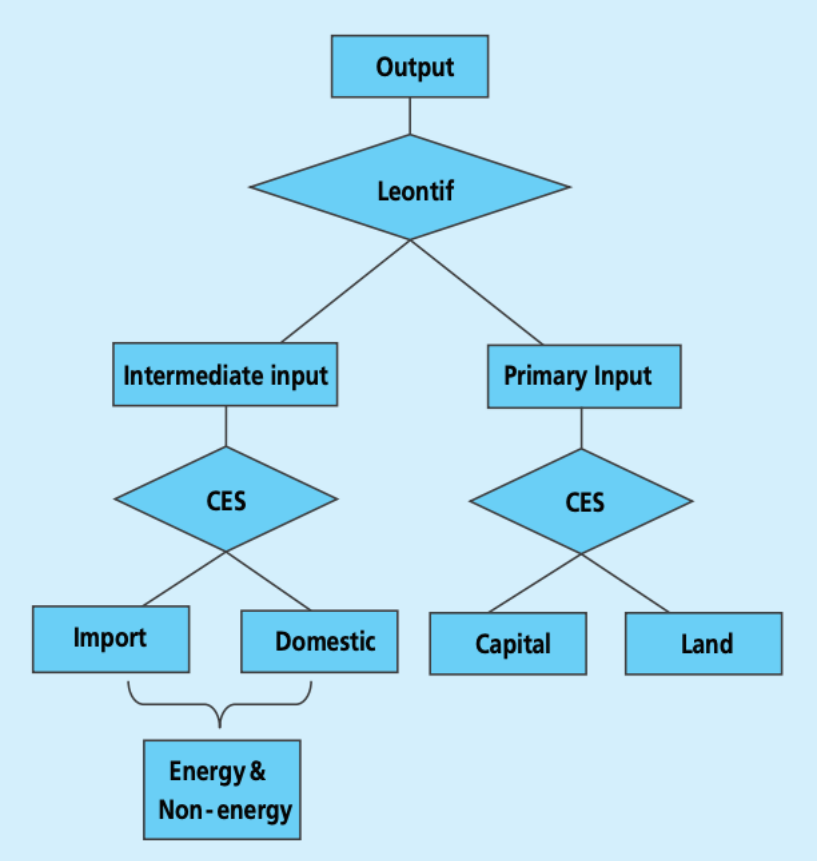

Figure 1. CGE Model Framework of the Impact of Import Reduction & LPG Subsidy Reallocation (Aissa & Hartono, 2017)

Policy Simulation Scenario

The study of the impact of using DME as an LPG substitute was carried out by analyzing the impact of the policies: (i) Decrease in imports of LPG products and (ii) Reallocation of LPG subsidies to government spending in other sectors. From the government release through the Ministry of Energy and Mineral Resources and PT Bukit Asam, DME can replace the use of LPG by 1 million tons or reduce imports by 15.75% per year. The government also claims that the DME policy scheme has the potential to save LPG subsidy expenditure of IDR 7 trillion/year (Kementerian ESDM RI, 2021; Kementerian Keuangan, 2021; PTBA, 2020).

The simulations in this study also considered scenarios in the short and long-run. In the short-run period, production factors are endogenous. Firms can change the number of inputs (capital and labor) to be used so that there may be unabsorbed labor and no movement of production factors to sectors outside the sectors in the simulation. While for the long-run setting, production factors are exogenous, it is assumed that full employment or all labor has been absorbed and it is possible to move production factors (capital & labor) between sectors (Aissa & Hartono, 2017; Hutagalung et al., 2020).

Table 2. *Policy Simulation Scenarios for Decreasing the Amount of LPG Imports*

No.	Description	Short-Run Simulation			Long-Run Simulation		
		SR-1	**SR-2**	**SR-3**	**LR-1**	**LR-2**	**LR-3**
1	Import Requirement/year	6.35 M tons	6.35 M tons	6.35 M tons	6.35 M tons	6.35 M tons	6.35 M tons
2	Decrease in LPG Imports/year from DME Production	1 M tons	1 M tons	1 M tons	1 M tons	1 M tons	1 M tons
3	% Decrease in Imports	15.75%	15.75%	15.75%	15.75%	15.75%	15.75%
4	Compensation from Subsidy Savings	100% *Savings*	50% *Expenditure*; 50% *Savings*	100% *Expenditure*	100% *Savings*	50% *Expenditure*; 50% *Savings*	100% *Expenditure*

FINDING AND DISCUSSION

Before entering the simulation stage, the author tested the validity and reliability of the CGE model that had been prepared. The test included looking at the number of iterations to produce SAM before and after the simulation, and the initial value must be equal to zero. Furthermore, after performing the simulation, a solution must also be found which is indicated by the appearance of "Exit - Solution Found". The model has also been tested for theoretical aspects to ensure the consistency of the CGE model structure through the nominal homogeneity test. In this test, economic sectors are assumed to produce only one kind of goods or services and there are no substitutes in the inputs and outputs of different sectors.

Furthermore, to analyze the impact of a shock in the form of a decrease in subsidized LPG imports and the diversion of subsidy spending to other productive government spending, the 66 sectors in the SAM were aggregated into a more compact number of 19 sectors. The author divided the manufacturing industry sector into refinery and other manufacturing industries and separated the LPG processing industry sector (PSOLPG and LPG) to display the impact on the sector more clearly.

Gross Domestic Product (GDP)

Table 3 shows the simulation results of reducing LPG imports by 15.75% per year on macroeconomic performance reflected through the GDP variable.

SR-1 simulation results show a potential growth of 0.096%. With a GDP of IDR 15,835 trillion in 2019, the GDP growth can generate additional economic productivity of around IDR 15.17 trillion/year. This economic growth is even more promising when the government utilizes the savings of IDR 7 trillion in LPG subsidy expenditure for productive spending in other sectors. In the SR-2 simulation, with expenditure of IDR 3.5 trillion or

50% of it, the economy would grow at 0.133% and 0.169% if the entire budget was fully spent or no longer allocated as savings. Through SR-3, the potential value added to the Indonesian economy from the DME project can reach around IDR 26.73 trillion/year.

Table 3. *Impact of Import Reduction and LPG Subsidy Reallocation on GDP*

No.	Simulation	GDP Growth
1	SR - 1	0.096%
2	SR - 2	0.133%
3	SR - 3	0.169%
4	LR - 1	-0.002%
5	LR - 2	-0.003%
6	LR - 3	-0.005%

Meanwhile, the simulation results for the long-run period are not as optimistic as the potential economic growth in the short-run. Of the 3 (three) simulations that have been carried out, none of them show positive economic growth. The first DME project carried out in Tanjung Enim actually risks reducing economic output to a level of -0.005%. With GDP in 2019 reaching IDR 15,835 trillion, the economy could suffer a loss of around IDR 727 billion/year.

The domestic energy industry can grow in the short-run to fulfil the LPG needs of the community due to the shock of reducing LPG imports from abroad. Significant growth in the energy industry will be followed by the need for production factors such as capital and labor provided by other sectors in the economy, thus in aggregate encouraging better economic performance. With a GDP value in 2019 of IDR 15,835 trillion, the potential value added to the Indonesian economy from the DME project could reach IDR 26.73 trillion/year. This positive result is in line with the results of previous studies such as Alam et al. (2009) and Hodijah et al. (2021)..

Ideally, the growth of various sectors in the economy will maintain the stability of aggregate GDP growth in the long-run. While in the Solow Growth Model, in the long-run equilibrium condition there is no economic growth or a steady state condition where the amount of capital and output does not change. The model also allows for diminishing marginal returns, where the addition of capital will have a positive impact on economic output with increasingly smaller significance.

Such conditions also occur in the structure of the Indonesian economy in the long-run if there is a decrease in the amount of LPG commodities. The results of the simulation of a decrease in the ratio of LPG imports not only show 0% GDP growth, but even produce a negative number. The results of this study confirm the results of previous studies such as Torasa & Mekhum (2020), which state that import activity is an important and necessary factor because it has a positive impact on economic activity in ASEAN countries (Indonesia, Malaysia, Thailand, Singapore, Philippines, Vietnam, Cambodia and Laos). Energy is one of the fundamental needs, so import activities due to the high level of energy

consumption in these countries will also generate positive externalities in the form of technology transfer.

Slightly different from the study, the national LPG demand in this case will be met with DME from the domestic industry. Therefore, the negative impact of the decline in imports is not due to the reduced availability of commodities to meet public energy consumption and the loss of technological renewal. Energy supplies for the community will still be fulfilled and technology is also possible to continue to develop along with the growth of the domestic industry. The negative GDP growth is indicated to be due to the emergence of labor shifting phenomenon between sectors. As mentioned in the previous section, in the CGE model in the long run it is assumed to be in full employment conditions or all labor can be absorbed. So that when there is growth in certain sectors related to DME production, it will trigger the interest of labor from other sectors to move (labor shifting).

As stated by Permata & Prasmuko (2010), changes in output demand in a particular sector will trigger changes in the labor demand of that sector, thus requiring additional labor or can be fulfilled by labor shifting from other sectors. Labor shifting can be a positive indication of high labor absorption, but the negative result on GDP can also provide evidence that the labor shifting phenomenon in this study occurs from sectors with low productivity to sectors with higher production output.

Furthermore, the results of the shock simulation in the form of reallocation of LPG subsidies in the short-run are in line with the results of Barro (1990), Branson (1979), Levačić & Rebmann (1982) and Lucas (1988), where an increase in the ability of government spending for investment, education, infrastructure and debt repayment activities will have a positive impact on economic growth. However, the transfer of subsidy expenditure to other government expenditures in the long run in this study shows negative implications. This could be an early indication that the current structure of government spending is not productive so the greater the allocation of government spending triggers even greater negative implications.

In the GCC countries, government expenditures actually reduce the rate of economic growth, due to budget allocations to unproductive sectors (Ansari, 1993). In Tanzania, government spending on physical investment is not a productive expenditure because it has a negative impact on economic growth. However, government spending on income-generating and consumption-enhancing sectors shows a positive impact. While spending on health and education sectors requires a long period of time to show productivity gains and economic growth (Kweka & Morrissey, 2000).

Production Output for Each Sector

Table 4 shows the simulation results of the policy's impact on reducing imports and reallocating LPG subsidies on production output in the short and long run by sector. In the SR-1 simulation, there are 18 out of 19 sectors that experience output growth and only 1 sector that has a negative effect on the government's policy on imports. The sector that benefits the most is the LPG sector. With the government producing DME as a substitute for LPG by 15.75%, the processing industry grew aggressively by 7.18%. Furthermore, for

the shock simulation of reallocation of LPG subsidy spending to productive government spending, a total of 17 out of a total of 19 sectors experienced increasingly expansive production output growth. The growth of the LPG sector is higher in the SR-2 and SR-3 simulations to reach growth levels of 7.22% and 7.25%. The electricity and gas procurement sector also increased in SR-2 and SR-3, namely 0.139% and 0.179%. Meanwhile, education services grew more aggressively, reaching 0.472% and 0.716%. Likewise, health services and social activities can reach growth levels of 0.303% and 0.445%.

Table 4. *Impact of Import Reduction and LPG Subsidy Reallocation on Production Output*

No	Sector	Short-run Simulation			Long-run Simulation		
		SR-1	**SR-2**	**SR-3**	**LR-1**	**LR-2**	**LR-3**
1.	Agriculture, Forestry and Fisheries	0.045%	0.052%	0.058%	-0.003%	-0.010%	-0.017%
2.	Mining and Quarrying	0.020%	0.018%	0.017%	-0.089%	-0.161%	-0.234%
3.	Refinery Processing Industry	0.039%	0.053%	0.067%	-0.091%	-0.117%	-0.143%
4.	LPG Processing Industry (PSOLPG and LPG)	7.18%	7.22%	7.25%	15.86%	15.88%	15.90%
5.	Other Processing Industry	0.053%	0.062%	0.072%	-0.070%	-0.100%	-0.129%
6.	Electricity and Gas Provision	0.099%	0.139%	0.179%	0.001%	0.011%	0.021%
7.	Water Supply, Waste Management, Waste & Recycling	-0.178%	0.037%	0.251%	-0.468%	-0.147%	0.173%
8.	Construction	0.216%	0.205%	0.193%	0.140%	0.083%	0.026%
9.	Wholesale and Retail Trade; Repair of Cars and Motorcycles	0.068%	0.081%	0.095%	-0.033%	-0.059%	-0.085%
10.	Transportation and Warehousing	0.101%	0.134%	0.167%	-0.011%	-0.015%	-0.019%
11.	Provision of Accommodation & Meals	0.093%	0.140%	0.187%	-0.036%	-0.026%	-0.017%
12.	Information and Communication	0.089%	0.130%	0.172%	-0.021%	-0.002%	0.017%
13.	Financial and Insurance Services	0.094%	0.128%	0.163%	-0.010%	-0.014%	-0.018%
14.	Real Estate	0.038%	0.048%	0.058%	-0.061%	-0.087%	-0.113%
15.	Services Company	0.103%	0.173%	0.243%	-0.008%	0.034%	0.076%
16.	Government Administration, Defense & Compulsory Social Security.	0.277%	0.650%	1.022%	0.114%	0.469%	0.824%
17.	Education Services	0.228%	0.472%	0.716%	0.059%	0.249%	0.439%
18.	Health and Social Services	0.161%	0.303%	0.445%	0.030%	0.143%	0.256%
19.	Other Services	0.141%	0.192%	0.242%	-0.001%	0.003%	0.006%

In the long-run period, the simulation results show the opposite. The import reduction policy actually results in negative growth in 11 out of 19 sectors in the model. The LPG, electricity and gas procurement, construction, corporate services, government administration, education services, health services and other sectors still show positive implications but at a much lower percentage than the short-run results.

Labor for Each Sector

Table 5 shows the simulation results of the impact of import reduction and LPG subsidy budget diversion on labor variables. Similar to the effect on the production output variable,

there are 18 sectors that show positive implications and only 1 sector that shows a negative impact in the short-run simulation at SR-1. The sector with the largest increase in labor absorption is the LPG Processing Industry sector, which is 25.45% in SR-1 and 25.64% and 25.82% in SR-2 and SR-3 simulations. Sectors with relatively high absorption compared to other sectors also occur in sectors that show growth in production output such as construction, electricity and gas procurement, transportation and warehousing, education services and health services and social activities. Labor absorption in the electricity and gas procurement sector even reaches the level of 0.445% in SR-1, and continues to increase to 0.620% in SR-2 and 0.759% in SR-3. The water supply, waste management, waste and recycling sector even reached 0.219% in the SR-2 simulation from -1.061% and increased again in SR-3 at 1.506%.

Table 5. *Impact of Import Reduction and LPG Subsidy Reallocation on Labor*

No.	Sector	Short-run Simulation			Long-run Simulation		
		SR-1	SR-2	SR-3	LR-1	LR-2	LR-3
1.	Agriculture, Forestry and Fisheries	0.096%	0.108%	0.121%	0.001%	-0.001%	-0.003%
2.	Mining and Quarrying	0.068%	0.064%	0.060%	-0.065%	-0.140%	-0.214%
3.	Refinery Processing Industry	0.219%	0.294%	0.370%	-0.100%	-0.132%	-0.165%
4.	LPG Processing Industry (PSOLPG and LPG)	25.45%	25.64%	25.82%	14.46%	14.46%	14.47%
5.	Other Processing Industry	0.140%	0.166%	0.191%	-0.083%	-0.116%	-0.149%
6.	Electricity and Gas Provision	0.445%	0.620%	0.795%	-0.015%	-0.045%	-0.074%
7.	Water Supply, Waste Management, Waste & Recycling	-1.061%	0.219%	1.506%	-0.486%	-0.207%	0.071%
8.	Construction	0.440%	0.416%	0.392%	0.121%	0.071%	0.021%
9.	Wholesale and Retail Trade; Repair of Cars and Motorcycles	0.121%	0.145%	0.168%	-0.032%	-0.080%	-0.129%
10.	Transportation and Warehousing	0.256%	0.336%	0.416%	-0.021%	-0.042%	-0.063%
11.	Provision of Accommodation & Meals	0.148%	0.224%	0.301%	-0.032%	-0.044%	-0.056%
12.	Information and Communication	0.259%	0.380%	0.501%	-0.027%	-0.039%	-0.051%
13.	Financial and Insurance Services	0.202%	0.275%	0.348%	-0.013%	-0.048%	-0.082%
14.	Real Estate	0.151%	0.190%	0.230%	-0.070%	-0.139%	-0.208%
15.	Services Company	0.282%	0.475%	0.668%	-0.015%	-0.010%	-0.004%
16.	Government Administration, Defense & Compulsory Social Security.	0.390%	0.916%	1.441%	0.103%	0.417%	0.730%
17.	Education Services	0.309%	0.640%	0.971%	0.050%	0.207%	0.364%
18.	Health and Social Services	0.275%	0.516%	0.758%	0.017%	0.081%	0.144%
19.	Other Services	0.196%	0.267%	0.337%	-0.003%	-0.009%	-0.015%

Consistent with the response of production output, labor conditions in the long-run show the opposite result. Out of 19 sectors, only 6 sectors show positive growth and 13 other

sectors produce negative growth. In the LR-1 simulation, the LPG sector still shows positive and significant growth but much lower than the short-run condition, at 14.46%. The electricity and gas procurement sector, which previously showed the largest numbers outside of the LPG sector, was negatively affected to the level of -0.074%. In the long-run, water supply, waste management, waste and recycling were also affected relatively heavily as its labor growth fell to -0.486%.

In general, the simulation results of the government policy to reduce LPG imports also have a positive impact on the level of labor. With the growth of various sectors in the economic structure in Indonesia, there will be a need for production factors, including labor. An increase in the productivity of sectors in the economy in Indonesia will trigger higher labor absorption. In sectors with positive development of production output, the percentage of labor will also be positive. Meanwhile, for sectors that do not experience development or even show a negative response, it will lead to a decrease in labor growth.

Furthermore, the expansive growth in the LPG processing industry is expected to trigger the labor shifting phenomenon in the long run. The need for a large number of workers in this sector encourages displacement from other sectors, especially since the energy sector is known to require a lot of high skill workers and offers relatively high income. This phenomenon causes a decrease in the number of high-skilled workers in other sectors, which results in a decrease in sectoral production output and causes negative growth in national GDP. As the results of the study by GGGI (2020), the processing industry of fossil energy sources relatively requires more high-skilled labor compared to the Renewable Energy industry which can absorb low-skilled labor, especially in the installation and construction process.

The percentage of employment rate in the LPG processing industry is also far behind that of other sectors. However, the value of this industry in the structure of the Indonesian economy is not very large, at around 2.12%, so its impact on the economy is also not very large. The decline in the labour market in various sectors outside the LPG Processing Industry and the low productivity in the sector in aggregate result in a decline in the level of national GDP in the long run, but the value is not too significant. The development of the LPG Processing Industry, which is expansive and can lead to labour shifting, has proven to be unable to encourage stable and sustainable growth in the long- run.

Cost and Benefit Analysis of DME Projects in Indonesia

Furthermore, in order to provide a comprehensive study of whether the policy to substitute LPG with DME products is the right strategy, the authors have conducted a cost and benefit analysis as shown in Table 6. This calculation is based on the projection of coal processing/gasification and DME distribution costs which reach US$617/ton for the production of 1.4 million tons of DME. Meanwhile, the potential loss of Coal PNBP assumes a coal price per ton of US$19.8/ton and a 3% tariff as stipulated in Government Regulation No. 81/2019. The cost of carbon emission mitigation is at the lowest price based on the cost estimate in the research by Ackerman & Stanton (2012). Furthermore, the authors compiled the ratio between the estimated total cost and the potential benefits of the

DME use policy that has been simulated using the CGE method in the previous explanation.

Table 6. *Potential Cost and Benefit of DME Use Policy*

1. Potential Cost of DME Use Policy

No	Subject	Remarks	Total (Trillion IDR)
1	Production & distribution cost of 1.4 million tons of DME	US$617/ton	12,093
2	Potential loss of coal non-tax revenue	3% rate	0,499
3	Potential cost of environmental damage from carbon emissions	US$150/ton	8,95
	Total Cost		**21,542**

2. Potential Benefits of DME Use Policy (2019 GDP Value: IDR15,835 trillion)

No.	Subject	SR-1	SR-2	SR-3	LR-1	LR-2	LR-3
1	GDP Growth	0.096%	0.133%	0.169%	-0.002%	-0.003%	-0.005%
2	Potential Benefit (Economic Growth Value) (IDR)	15,20	21,06	26,76	-0,32	-0,48	-0,79

3. Cost and Benefit Ratio

	SR-1	SR-2	SR-3	LR-1	LR-2	LR-3
Cost and Benefit Ratio of DME Usage Policy	0,71	0,98	1,24	-0,01	-0,02	-0,04

Based on the simulation results, the author considers that the DME use policy can be an appropriate strategy in SR-3, namely as a policy instrument in the short-run by reducing LPG imports by 1 million tons per year and diverting the full subsidy savings budget as productive spending. However, in the long-run, the simulation results show that the government's policy to bring in a new energy source risks reducing economic performance. At this point, the DME project, which is one of the 2020 Strategic Projects, risks becoming an inefficient strategy. With the risk of weakening the pace of the Indonesian economy, in the long-run the DME project can potentially increase the fiscal burden on the state budget.

CONCLUSION

The study aims to examine the policy of using DME as an LPG substitute in the economy through a shock simulation of a decrease in LPG imports and a policy of reallocating LPG subsidies. The simulation results show that the strategy of using DME to reduce subsidized LPG imports can encourage GDP growth, production output and sectoral employment only in the short-run. By providing energy from the domestic industry, it can trigger output growth in other sectors so that in aggregate it will improve the national economy. Meanwhile, the impact in the long-run shows the opposite result, namely the emergence of negative implications on economic growth, although the percentage is relatively

insignificant. This negative impact is thought to be due to the phenomenon of labor shifting to growing sectors. In the long-run, this can trigger a reduction in high-skilled labor in the abandoned sectors, thus reducing productivity in these sectors and having a negative impact on the economy.

Meanwhile, the simulation results of fiscal stimulus from the reallocation of subsidies are proven to provide a multiplier effect by producing more expansive economic conditions, although it is not evenly distributed in each sector because the sectors that are prioritized by the government have relatively greater implications. Furthermore, the cost and benefit estimation also strengthen the conclusion that the DME policy can be an appropriate strategy only in the short-run, while in the long-run, it risks creating additional burdens on state finances.

Policy Implications

The DME use policy, which will begin to be implemented in 2024, cannot be a strategy that is in line with national development goals, namely the accelerated recovery of economic conditions after the Covid-19 pandemic and strengthening the foundation for sustainable development. Therefore, the government is expected to reconsider the implementation of the DME use policy in 2024 as well as the option of not continuing the coal gasification project. Current LPG import activities can still be an alternative solution in an effort to meet national energy needs. Furthermore, what needs to be done is to control the total demand for LPG itself, because 70% of subsidized LPG is actually enjoyed by well-off households (TNP2K, 2021). Therefore, the government needs to accelerate regulations related to the distribution of subsidized LPG which will be adjusted to the Integrated Social Welfare Data.

The Coal Royalty incentive policy up to 0% risks increasing the cost of DME policy because it has the potential to reduce total state revenue from the non-tax revenue sector. In the event that the government does not completely stop the activities of the DME project and the coal downstream industry, the government needs to set the amount of non-tax revenue rates above 0% on these activities.

If it is assumed that the government continues with the DME strategy and can obtain savings in LPG subsidies, then the budget can be utilized to finance DME infrastructure and production processes so as to compensate for the high investment needs of the project. However, with the risk of labor shifting due to the implementation of the DME policy, the author recommends the government to divert the budget to sectors that have experienced a decline in productivity such as agriculture, where this sector was able to grow positively by 3.8% during the Covid-19 pandemic and contributed around 12.6% to the economy. The government can also allocate the budget to the water supply, waste management, waste and recycling sectors which show positive conditions only when they get support from the government.

Research Limitations

In Indonesia's state budget system, reallocating expenditure specifically for subsidy expenditure cannot be done in the current fiscal year. Therefore, the LPG subsidy transfer policy is assumed to be implemented in the budget planning stage. In addition, the use of

SAM data in 2019 assumes that current economic conditions are the same as economic conditions in 2019, where there is no Covid-19 pandemic and war events between Russia and Ukraine which have implications for various economic sectors in Indonesia. Future research can be carried out using data on economic conditions in Indonesia after the Covid-19 Pandemic and after the war between Russia and Ukraine. Research can also simulate specific types of government spending so that it can be an input for the government in determining more efficient state spending policies.

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