Assessing Industrial Customer's Willingness to Pay to Support Natural Gas Pricing Policy in Indonesia

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Abstract. The price of natural gas has always been controversial; there are always different points of view between producer and consumer because of its determination. However, in reality, it is not easy to reach prices in equilibrium conditions. On the others side, the Indonesian government has capped gas prices for some industries to increase the competitiveness of the industrial sectors. This study aims to assess the willingness to pay industrial gas users and to compare it with the current gas price policy. Willingness to pay off gas users is determined by netback value from the final product. The study shows that the willingness to pay is 11.41, 10.10, 9.13, and 3.78 $/MMBtu for ceramic, glass, cooking oil, and steel industries, respectively. The willingness to pay for ceramic, glass, and cooking-oil industries are higher than the current gas price (6 $/MMBtu), except the steel industry is lower. The current gas price includes a government subsidy by reducing the share of the government takes of the upstream sector. Therefore, the government needs to sort out which industries deserve the special gas price by considering willingness to pay in the future.

Keywords: Gas Price, Willingness to Pay, Industrial Sector, Netback, Indonesia

1 Introduction

The industrial sector is highly dependent on an energy supply in natural gas, which is used as raw material and energy sources in the production process. The most significant issues in the current industrial sector are that gas prices are still relatively high. Industrial gas price in Indonesia currently is as much as 8-10 $/MMBtu [1]. The critical issues of the price for those industries that use gas comprise approximately 15-30% of total production costs [2]. Therefore, an increase in gas price would cause the cost of production to balloon and reduce a company's overall performance. In addition, it will directly impact Indonesia's national industries concerning international markets by reducing competitiveness [3][4].

To solve the gas price problem, earlier this year, the government had implemented a Presidential Regulation (Perpres) No. 40 of 2016 as amended by Presidential Regulation No. 121 of 2020 to determine natural gas prices to cut domestic gas prices to help industry sectors spur economic growth and improve the competitiveness of the domestic industry. A presidential regulation set a price cap of 6 $/MMBtu below the market price average of 8-10 $/MMBtu. The gas price is intended for seven industries: fertilizer, petrochemical, oleochemical, steel, ceramics, glass, and rubber gloves, besides the seven industrial sectors using the market price. To adjust the price of 6 $/MMBtu, the gas price at the producer level reduced as well, taking into the cost of transportation and distribution costs reduced between 1-1.5 $/MMBtu.

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According to Ministry Energy decree No.8/2020, the cut in the gas price at the producer level not affects the revenue of gas production contractors in the upstream business due to it is compensated by government revenue under the production sharing contract scheme. The willingness to pay (WTP) denotes the maximum amount a consumer is willing to pay a given quantity of an item [5]. Measuring WTP is essential for price transparency between the customer and producer [6]. A few studies on energy policy have focused on the consumer's WTP. Many studies on WTP have used the contingent valuation (CV) method such as developed to measure WTP for solar energy development in Myanmar [7], energy reliability versus fuel type in Vietnam [8], renewable in electricity mix [9], improved of electricity supply in Nepal [10], measuring WTP for electricity generated from renewable energy sources [11] and reliable natural gas supply in Korea [12]. Some studies on WTP have also carried out with the other methods. For example, Bhandari (2020) assessed a WTP for rural electrification in Africa with a comparative analysis method [13], Hotaling (2021) had been developed measuring WTP for microgrid used mixed logit model [14]. The main methods found in the literature for analyzing preference and calculating WTP estimates are CV, comparative analysis (CA) and experimental auction [15].

This study aims to estimate the willingness to pay using netback value from the final product of industrial gas users and compare it with the current gas price policy.

2 Methodology

2.1 Willingness to Pay

There are two formula for calculating WTP for gas users [16]. First, using the opportunity cost approach where the WTP of gas used is compared with other alternative energy uses. Second,WTP calculation formula is based on the price of the final product. The price received by the gas supplier is a function of the WTP of the buyer (netback from final product) [17].

Hermawan [18], in his study of netback value price in the fertilizer industry. The netback is calculated based on the revenue minus processing cost. The annual processing cost is expressed in equation (1):

$$PC_{tc} = (I \times CRF)_{tc} + OM_{tc} + FS_{tc} + LC_{tc} \tag{1}$$

PC_{tc} represents annual processing without utility cost in year *i* for industry *c* ($/year). I_{tc} is the annual investment cost ($/year), *CRF* is the capital recovery factor, OM_{tc} is the fixed operations and maintenance (OM) ($/year). FS_{tc} is annual feedstock cost ($/year). LC_{tc} is annual the logistic cost ($/year). Total revenue for each industry is represented by the equation (2).

$$RV_{tc} = PP_{tc} \times PT_{tc} \tag{2}$$

RV_{tc} denotes the total revenue in year *t* for industry *c* ($/year), PP_{tc} is the final product price in year *t* for industry *c* ($/unit of product), and PT_{tc} is production capacity in year *t* for industry *c* (unit of product/year).

The annual gas consumption is expressed by equation (3):

$$QC_{tc} = PT_{tc} \times RG_{tc} \quad (3)$$

RG_{tc} is the gas fuel to product ratio in year t for industry c (MMBtu/unit of product).

The total cost of gas is obtained by equation (4):

$$GC_{tc} = (RV_{tc} - PC_{tc}) \times GR_{tc} \quad (4)$$

GC_{tc} is the gas cost in year t for industry c ($/year), GR_{tc} is the ratio of gas to utility cost in year t for industry c.

Thus, the netback value of gas is calculated by equation (5):

$$NBG_{tc} = \frac{GC_{tc}}{QC_{tc}} \quad (5)$$

NBG_{tc} is the netback value of gas representing WTP in year t for industry c in $/MMBtu.

2.2 Data Input

The input data of four industrial sectors can be seen in **Table 1.** The fixed costs and variable costs are obtained from literatures [19-24].

Table 1. Production Capacity, Investment cost and Gas Consumption

Sector	Capacity	Fuel Gas Ratio
Ceramic	61,370,000 m^2/year	0.0584 MMBtu/m^2 [2][19][25]
Glass	854,730 Ton/year	8.4 MMBtu/Ton [26][27]
Steel	3,150,000 Ton/year	22.75 MMBtu/Ton [28][29]
Cooking-oil	1,700,000 Ton/year	7.78 MMBtu/Ton [30][31]

Fixed cost consist of investment and fixed *OM*, and the variable costs are raw materials and utilities including gas. In the metal industry, the raw materials used are iron ore in pellets, and scrabs, for ceramic industry uses feldspar, ball clay, quartz sand, and silica sand, soda ash, and iron oxide for the glass industry. Meanwhile, crude palm oil (CPO) is the primary raw material for the cooking-oil industry. The other cost classified as variable cost are logistics cost. One ton of crude palm oil can produce 73% cooking-oil (olein), 21% stearin, 5% PFAD (Palm Fatty Acid Distillate), and 0.5% waste.

2.3 Product Demand Projection

The projection of product demand for the ceramic, glass, cooking oil, and steel industries are calculated using the econometric method [32][33]. The data used in the projection is GDP growth of -2.19% in 2020 due to Covid-19 and the average GDP growth from 2020 to 2030 is 4.94% [34][35] and an elasticity of industrial growth to GDP is 0.91. Figure 1 shows that production in 2030 is increased with an average growth rate of 5,19% per year for each sector.

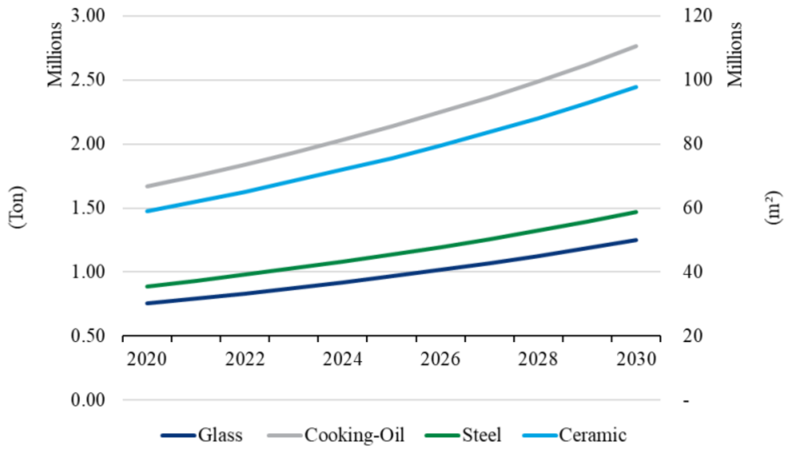

Fig. 1. Product Projection for Ceramic, Glass, Cooking-oil and Steel Industries.

2.4 Final Product Price

The final product price is assumed depend on the projection of oil and gas prices [36][37]. The correlation between oil and gas prices and final product prices each industrial sector are based on industries product price historical data and author's calculation [19][22][23][24][36][37][38]. The whole final products prices are illustrated in Figure 2. The ceramic prices in Indonesia tends to stagnate for the last five years. The final product price of ceramics was 2.58 $\$/m^2$ in 2020, it will grow by 4.12% in 2030 became 2.68 $\$/m^2$, with an average annual growth rate (CAGR) of 0.40%. The selling price of glass products in 2020 is 364 $/ton and it will increase slightly to 377 $/ton in 2030 with a CAGR of 0.32%. The cooking oil price in 2020 is 775 $/ton and the projection price in 2030 is 944 $/ton with a CAGR of 1.99%. The steel price in 2020 is 464 $/ton and it will increase to 608 $/ton in 2030 with a CAGR of 2.74%.

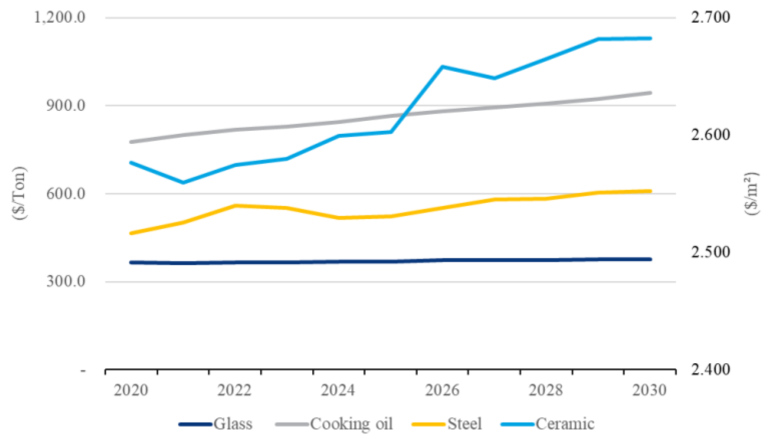

Fig. 2. Final Product Price Projection for Ceramic, Glass, Cooking-oil, and Steel.

3 Result and Discussion

3.1 Processing Cost

The projected processing costs are shown in Figure 3. It shows that the processing cost of ceramic, glass, cooking oil, and steel are increased with a CAGR of 2.79%, 3.28%, 7.03%, and 2.70%, respectively.

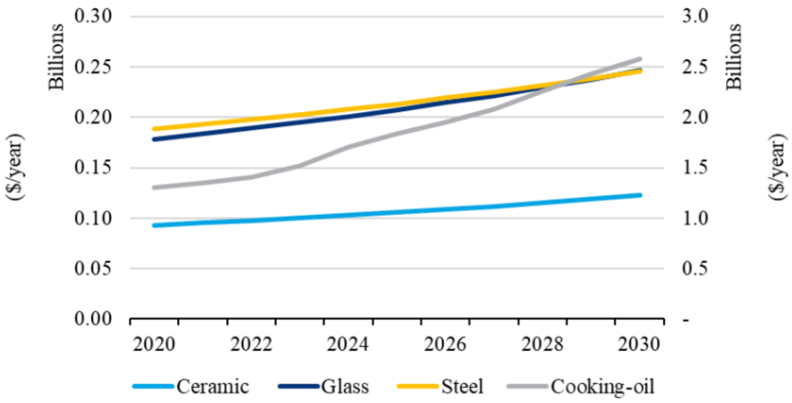

Fig. 3. Processing Cost Projection for Ceramic, Glass, Cooking-oil and Steel Industries

3.2 Revenue

Figure 4 shows the revenue projections for ceramic, glass, cooking-oil, and steel industries. The revenue increase with the increasing the final price of products. The income of ceramic industry in 2020 is $152 million and increases to $263 million in 2030 with a CAGR of 5.7%. Similar trends of revenue with ceramic industry are observed for glass and steel industries. Higher growth of revenue in cooking oil industry compared to the other industrial sectors with a CAGR of 7.4%.

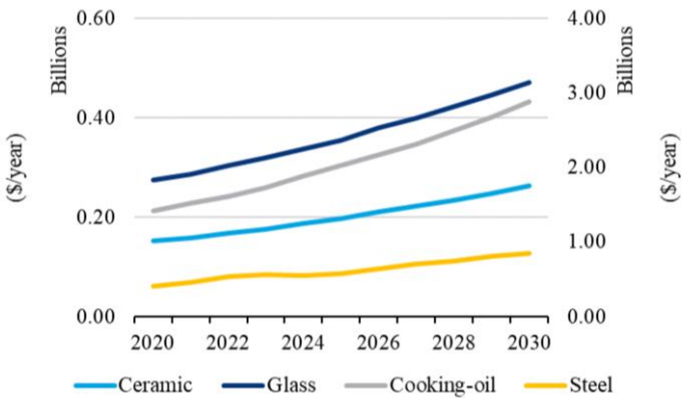

Fig. 4. Revenue Projection for Ceramic, Glass, Cooking-oil and Steel Industries.

3.3 Netback Value Gas

The netback gas prices of ceramic, glass, cooking oil and steel industries compared to regulated gas price are illustrated in Figure 5. The willingness to pay for ceramic, glass, and cooking-oil industries are higher than the current gas price (6 $/MMBtu), except the steel industry below than. It can be seen that WTP of ceramics is higher than glass, both of them increase linearly from 2020 to 2030. The ceramic industry gives higher WTP than the glass industry due to the different of revenue and processing cost values and trends. The WTP fluctuations in cooking oil industry is influenced by volatility of CPO price, Higher WTP since CPO prices is lower, and vice versa. In steel industry, lower values of WTP in 2020 to 2026 are caused by lower utilization capacity of the plant of 28%. It increases to 40% in 2027 giving impact on increasing WTP to higher than 6 $/MMBtu in 2027 to 2030.

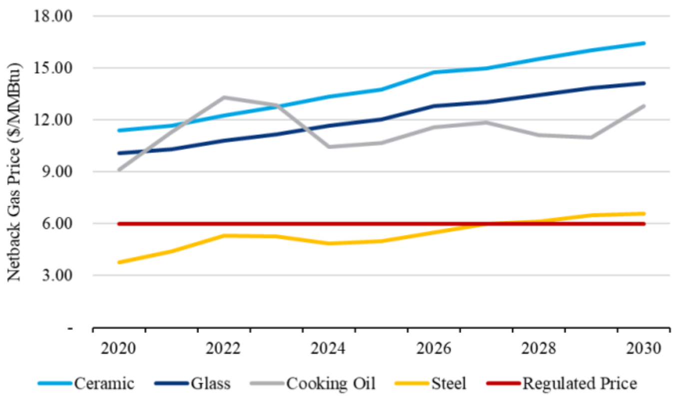

Fig. 5. Comparison of Netback Gas Price for Ceramic, Glass, Cooking-oil, and Steel Industries.

The ceramic industry has WTP of 11.41 $/MMBtu in 2020 that above regulated gas price. It increases by 3.41 % per year in 2030 to 16.44 $/MMBtu. Previously, the gas price in the ceramic sector was 9.16 $/MMBtu [39], which means capping gas price at 6 $/MMBtu, the government provided a subsidy of 3.16 $/MMBtu and 5.41 $/MMBtu for WTP of 11.41 $/MMbtu. However, gas cost only contributes 24% of the total production cost in the ceramic industry and the largest portion, 32%, is raw materials [39]. Therefore, gas cost is not the dominant driver of whole cost structure in the ceramic industry.

In the glass industry, WTP values ranging from 10.10 to 14.10 $/MMBtu with an annual growth rate is 2.71% from 2020 to 2030. Previously the gas price in the glass industry is 9.16 $/MMBtu [39]. This study shows that WTP in 2020 is 10.10 $/MMBtu, compared to regulated prices, the government provides indirectly subsidized by 5.10 $/MMBtu. The share of gas costs in the glass industry's cost structure is only of 16%, lower than the raw material cost of 27% [39]. The increasing of glass production costs per year has an impact on the lowering of the amount of domestic production then reduces exports. Nevertheless, the Central Statistics Agency (BPS) recorded that the export performance of flat glass in 2020 was still - 8.84 % on an annual basis. Furthermore, amid the issue of imported glass products, the utilization factor of the glass industry in 2020 was 57.5%, lower than in 2019, which reached 69% [35].

WTP of cooking oil industry is 9.31 $/MMBtu with a CAGR of 3.44%, and reaches 12.8 $/MMBtu in 2030. It is caused by the increasing of revenue and processing cost per year are

7.2% and 7.0%, respectively. The netback value is still higher due to higher final product prices and load factor. The cost structure of cooking oil production comprises 57% raw materials and 5% gas cost [39].

For steel industry, WTP in 2020 is 3.75 $/MMBtu, it increases to 6.59 $/MMBtu in 2030 with a CAGR of 5.79%. In 2020, WTP steel industry is 3.75 $/MMBtu thus the steel industry can't able to pay gas at 6 $/MMBtu. . The lower WTP due to the lower load factor of plant and higher share gas cost component (23%), so the government needs to support the steel industry.

3.4 Policy Analysis

The industries complaint about domestic gas price due to it is higher compared to other countries (Malaysia and Thailand) and it has been responded by the government by implementation of regulated gas price of 6 $/MMBtu. Based on the netback value asessment of industrial sector, it showed that some industries have WTP higher than regulated price, those no need to subsidize if they cannot produce more added values. Current gas price policy is an ad hoc basis and heavy regulated with limited transparancy of price signal. The transparency of price signal is very role in gas price policy to keep a balance between WTP of users and minimum value of gas for producers. In addition, an inefficiency of industries is not only caused by gas price as fuel gas or feedstock but also by low load factor, inefficiency of equipment. Therefore, the government needs to look at more detail on specific energy consumption of each industrial sector compares to other countries and by estimating the WTP so it can be seen whether the complaints from the industry are caused by gas prices or other factor.

4 Conclusion

This study aims to assess the willingness to pay of various industrial gas users which consist of: ceramic, glass, cooking-oil and steel, and to compare their WTP with the current gas price policy. Based on the calculation, the WTP value of gas users which depends on netback value of the final product for the ceramic, glass and cooking-oil and steel sectors are 11.41, 10.10, 9.13, and 3.78 $/MMBtu, respectively. In addition, the WTP value for ceramic, glass, and cooking-oil industries are higher than the current gas price (6 $/MMBtu), except the steel industry. The current gas price is imposed by government subsidy due to the reduction of the share of the government in the upstream sector. Therefore, the government should have to arrange willingness to pay which can be earned by each of industrial gas users in the future.

References

[1] PGN, "Annual Report PT Perusahaan Gas Negara, Tbk 2019," 2020.

[2] CEPS, "Composition and Drivers of Energy Prices and Costs in Energy Intensive Industries: The Case of Ceramics, Flat Glass dan Chemical Industries," 2014.

[3] T. Wang and B. Lin, "China's natural gas consumption and subsidies—From a sector perspective," *Energy Policy,* vol. 65, pp. 541-551, 2014.

[4] A. M. Hutagalung, D. Hartono, M. J. Arentsen, and J. C. Lovett, "The Economic Implications of Natural Gas Pricing Adjustment in Indonesia," *International Energy Journal,* vol. 20, no. 2, 2020.

[5] S. Kalish and P. Nelson, "A comparison of ranking, rating and reservation price measurement in conjoint analysis," *Marketing Letters,* vol. 2, no. 4, pp. 327-335, 1991.

[6] F. Voelckner, "An empirical comparison of methods for measuring consumers' willingness to pay," *Marketing Letters,* vol. 17, no. 2, pp. 137-149, 2006.
[7] M. S. Han, Y. Biying, D. Cudjoe, and Q. Yuan, "Investigating willingness-to-pay to support solar energy research and development in Myanmar," *Energy Policy,* vol. 146, p. 111820, 2020.
[8] L. Bakkensen and P. Schuler, "A preference for power: Willingness to pay for energy reliability versus fuel type in Vietnam," *Energy Policy,* vol. 144, p. 111696, 2020.
[9] T. Balezentis, D. Streimikiene, I. Mikalauskas, and Z. Shen, "Towards carbon free economy and electricity: The puzzle of energy costs, sustainability and security based on willingness to pay," *Energy,* vol. 214, p. 119081, 2021.
[10] N. Niroomand and G. P. Jenkins, "Estimation of households' and businesses' willingness to pay for improved reliability of electricity supply in Nepal," *Energy for Sustainable Development,* vol. 55, pp. 201-209, 2020.
[11] L. A. Oerlemans, K.-Y. Chan, and J. Volschenk, "Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error," *Renewable and Sustainable Energy Reviews,* vol. 66, pp. 875-885, 2016.
[12] J. Jang, J. Lee, and S.-H. Yoo, "The public′ s willingness to pay for securing a reliable natural gas supply in Korea," *Energy Policy,* vol. 69, pp. 3-13, 2014.
[13] R. Bhandari, V. Sessa, and R. Adamou, "Rural electrification in Africa–A willingness to pay assessment in Niger," *Renewable Energy,* vol. 161, pp. 20-29, 2020.
[14] C. Hotaling, S. Bird, and M. D. Heintzelman, "Willingness to pay for microgrids to enhance community resilience," *Energy Policy,* vol. 154, p. 112248, 2021.
[15] A. A. Cerda, L. Y. García, S. Ortega-Farías, and Á. M. Ubilla, "Consumer preferences and willingness to pay for organic apples," *International Journal of Agriculture and Natural Resources,* vol. 39, no. 1, pp. 47-59, 2012.
[16] P. Yusgiantoro, "Ekonomi Energi - Teori dan Aplikasi," vol. 1, no. Yayasan Purnomo Yusgiantoro, pp. 518-523, 2018.
[17] IGU, "Wholesale Gas Price Survey," no. June 2020, 2020.
[18] E. Hermawan and W. W. Purwanto, "Gas Price Policy Analysis for Fertilizer Industries in Indonesia Based on Netback from Final Product," *JURNAL SOSIAL HUMANIORA (JSH),* vol. 13, no. 2, pp. 190-202, 2020.
[19] ARNA, "Annual Report PT Arwana Keramik, Tbk Tahun 2019," 2020.
[20] I. Agri, "Sustainability Report 2019," 2019.
[21] AGF, "Annual Report PT Asahi Flat Glass, Tbk Tahun 2019," 2020.
[22] KS, "Annual Report PT Krakatau Steel, Tbk Tahun 2019," 2020.
[23] M. Mas, "Sustainability Report 2019," 2020.
[24] MLA, "Annual Report PT Mulia Industrindo, Tbk Tahun 2018," 2019.
[25] CEPS, "Cumulative Cost Assessment (CCA) of the EU Ceramics Industry," 2017.
[26] CEPS, "Final Report for Study on Composition and Drivers of Energy Prices and Cost in Energy Insentive Industries: Tha Case of The Flat Glass Industry " 2014.
[27] A. Schmitz, J. Kamiński, B. M. Scalet, and A. Soria, "Energy consumption and CO2 emissions of the European glass industry," *Energy policy,* vol. 39, no. 1, pp. 142-155, 2011.
[28] J. A. Moya and A. Boulamanti, "Production costs from energy-intensive industries in the EU and third countries," *Publications Office of the European Union: Luxembourg,* 2016.
[29] W. Sun, Q. Wang, Y. Zhou, and J. Wu, "Material and energy flows of the iron and steel industry: Status quo, challenges and perspectives," *Applied Energy,* vol. 268, p. 114946, 2020.
[30] AGRI, "Annual Report Indofood Agri Resorces, Ltd Tahun 2019," 2020.
[31] K. Sommart and S. Pipatmanomai, "Assessment and improvement of energy utilization in crude palm oil mill," in *2011 International Conference on Chemistry and Chemical Process; IPCBEE; IACSIT Press: Singapore*, 2011, vol. 10, pp. 161-166.
[32] W. W. Purwanto, Y. Muharam, Y. W. Pratama, D. Hartono, H. Soedirman, and R. Anindhito, "Status and outlook of natural gas industry development in Indonesia," *Journal of Natural Gas Science and Engineering,* vol. 29, pp. 55-65, 2016.

[33] Kemenperin, "Laporan Kinerja Pembangunan Industri Tahun 2020 Kementerian Perindustrian," 2020.
[34] Bappenas, "Low Carbon Development: A Paradigm Shift Towards a Green Economi in Indonesia," 2019.
[35] BPS, "Berita Resmi Statistik," 2021.
[36] EIA, "International Energy Outlook 2020," 2020.
[37] W. Bank, "The World Bank. Commodity Market.Data Online Available at: https://www.worldbank.org/en/research/commodity-markets," 2020.
[38] O. FAO, "OECD-FAO Agricultural Outlook 2020-2029.World Oilseed Projection.Data Online Available at: https://www.oecd-ilibrary.org/agriculture-and-food/world-oilseed-projections_9502660d-en," 2020.
[39] K. Perekonomian, "Bahan Rakor Harga Gas Industri - Kementerian Koordinator Bidang Perekonomian Republik Indonesia," 2017.