
Investment Feasibility Analysis of LPG Bulk Filling Station (SPBE): Improving LPG Distribution in The City of Sorong

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Abstract

LPG Bulk Filling Station ("SPBE") is a facility for bottling LPG (Liquefied Petroleum Gas) gas into 3 Kg, 5 Kg, 12 Kg or 50 Kg cylinders with the LPG brand. SPBE is an important facility in the LPG distribution network in Indonesia. The purpose of this study is to identify the potential LPG market in Sorong and its surroundings and conduct a feasibility study on the construction of SPBE facilities in the Sorong SEZ. The methods used are quantitative and qualitative using secondary data using a market sizing approach to identify LPG market potential using data from the Directorate General of Oil and Gas of the Ministry of Energy and Mineral Resources and data from the Central Statistics Agency (BPS). Furthermore, a financial feasibility formulation was made to determine the business feasibility of SPBE infrastructure development and sensitivity analysis using the Monte Carlo approach for 10,501 iterations. And the study ended with a risk analysis using a risk register to map possible risks and how to deal with and handle them. The results of the study show that the development of SPBE infrastructure in the Sorong SEZ is feasible to be built with feasibility indicators in the form of IRR (Internal Rate of Return) of 12.79%; NPV (Net Present Value) of IDR 2,479,320,100; PI (Profitability Index) of 1.18; and DPP (Discounted Payback Period) for 12.34 years with a record average total LPG consumption of 9.81 tons/day in Sorong in a realistic scenario. Meanwhile, in an optimistic scenario with an average total LPG consumption of 11.07 tons/day, the feasibility indicator is an IRR of 14.995; NPV of IDR 4,726,461,323; PI from 1.34; and DPP for 10.48 years. The construction of SPBE infrastructure requires a cost of IDR 11,189,458,937 with a compact type of SPBE infrastructure with a land area of 60 m x 40 m or an area of 2,400 m².

Keywords: LPG Bulk Filling Station ("SPBE"); Feasibility study; Sorong Special Economic Zone ("SEZ") PT Equator Bumi Energi ("EBE"); PT Sorong Gas Nusantara ("SGN"); Market Size; Monte Carlo.

INTRODUCTION

As an important city in the Southwest Papua Province, Sorong has a significant energy demand, including the need for Liquefied Petroleum Gas (LPG), commonly known as Elpiji. However, despite the high demand for Elpiji in Sorong, there are still limitations in accessibility and the availability of Elpiji filling facilities. This condition has led to challenges for the community and businesses in Sorong in obtaining stable and affordable Elpiji supplies, thus affecting productivity and economic growth in the city (Setiyo et al., 2019, 2020; Thoday et al., 2018).

PT Equator Bumi Energi (EBE) collaborates with PT Sorong Gas Nusantara (SGN), a regional limited liability company engaged in Natural Gas Procurement, Wholesale Trade of Solid Fuels and Gas, as well as Power Generation and Distribution. EBE will

construct a Bulk LPG Filling Station (SPBE) in the Sorong Special Economic Zone (SZE) area in this business scheme (Alim, 2020; Nainggolan et al., 2024; Vikalista, 2016).

Through this business scheme, it is expected that the construction of the Bulk LPG Filling Station ("SPBE") infrastructure in the Sorong Special Economic Zone (SZE) area can address the issue of limited Elpiji supply and enhance the availability of energy supply in the city of Sorong (Rohman, 2021). As an initial step in the development of this SPBE infrastructure, EBE is undertaking preliminary planning, namely the preparation of the Feasibility Study for the Development of SPBE Infrastructure. However, due to global bond covenants preventing the establishment of the JVC by PLN and PERTAMINA at that time, subsidiaries of PLN and PERTAMINA, namely PT Indonesia Power ("IP") and PT Pertamina Gas ("Pertagas"). The ownership structure of the company is divided between the shareholders, with 65% (sixty-five percent) held by PT Pertamina Gas and 35% (thirty-five percent) held by PT Indonesia Power (NABIL, 2022).

According to Research conducted by Astuti et al., (2019) Fuel transition successful? Regulatory instruments, markets, and social acceptance in the adoption of modern LPG stoves in Indonesia. *Energy Research & Social Science*, 58, 101248. This article highlights the importance of regulatory and market instruments in the transition to LPG use. As a pivotal centre in West Papua Province, Sorong faces challenges in meeting its energy needs, particularly for Liquefied Petroleum Gas ("LPG") or Elpiji (Tayeh & Hashim, 2022). Despite the high demand for Elpiji in Sorong, limitations in accessibility and Elpiji filling facilities remain obstacles. The lingering use of kerosene for domestic needs by the community remains unresolved. Additionally, the difficulties encountered in the field while shifting public behaviour from kerosene to utilising LPG have also emerged as a distinct concern.

There is a significant difference when compared to the usage of LPG in other provinces. Based on the data, in these 10 provinces, more than 90% of households are using LPG. The most significant proportion of LPG consumer households in 2021 is in South Sumatra, with a percentage of 92.4%. Following closely is the second position held by Bangka Belitung Islands, reaching a percentage of 92.23%. In the third position is Bengkulu, with a percentage of 92.05%, followed by West Kalimantan, with 91.91%. Meanwhile, DKI Jakarta occupies the fifth position with a percentage of 91.78%. On the other hand, the lowest proportions are found in East Nusa Tenggara, North Maluku, Maluku, Papua, and West Papua. The percentage of LPG consumer households in these five provinces ranges only from 1% to 5%.

The low percentage of LPG gas users in the Papua region poses a distinct challenge for the government and all stakeholders interested in addressing this issue and encouraging increased LPG usage as a shift from kerosene to daily needs. As an initial move, EBE has developed preliminary plans through the preparation of the Feasibility Study for the Development of SPBE Infrastructure. Therefore, this business endeavour not only provides a solution to the energy availability issue in Sorong but also creates investment opportunities and economic growth in the region.

The research objectives in this study will focus on market analysis and assessing the feasibility of SPBE construction. As part of the overall feasibility study in this report, an evaluation of economic and risk aspects will be considered. The analysis will include addressing potential challenges and opportunities in implementing the infrastructure, contributing to a comprehensive understanding of the project's viability.

RESEARCH METHODS

The method used is quantitative and qualitative using secondary data using a market sizing approach to identify the potential of the LPG market using data from the Director General of Oil and Gas (Oil and Gas) of the Ministry of Energy and Mineral Resources and data from BPS (Central Statistics Agency). Furthermore, the formulation of financial feasibility was made to determine the business feasibility of the development of SPBE infrastructure and its sensitivity analysis using the Monte Carlo approach for 10,501 iterations. And this study ends with a risk analysis using a risk register to map the risks that may occur and how to deal with and handle them. Data collection methods used include:

Secondary Data:

Data was obtained from official documents such as annual reports, statistics, and relevant policy documents. The main sources were the Directorate General of Oil and Gas of the Ministry of Energy and Mineral Resources, the Central Statistics Agency (BPS), and reports from Pertamina related to LPG consumption. Additional literature was taken from scientific journals, books, and other publications relevant to the topic of energy conversion and SPBE infrastructure development.

Passive Observation

Observations were made of existing LPG filling facilities in other areas, especially regarding governance, operational capacity, and socio-economic impacts on the surrounding community.

Document Study and Historical Data

Planning documents such as previous feasibility studies, LPG market maps, and statistical data on energy consumption in Papua Barat Daya Province became the basis for the analysis. Historical data on LPG consumption, kerosene use, and consumption growth projections from BPS and the Ministry of Energy and Mineral Resources were also used.

Monte Carlo Simulation

Secondary data was used in the Monte Carlo simulation to emit the sensitivity of financial feasibility indicators, such as IRR, NPV, and PI.

Data analysis is carried out comprehensively with the following stages:

- a. Market Sizing Analysis (TAM-SAM-SOM): TAM (Total Available Market): Calculating the overall LPG market potential in Papua Barat Daya Province, based on the number of households, MSMEs, and the Horeka sector. SAM (Serviceable Available Market): Identifying areas that can be served by SPBE by taking into account existing LPG consumption and the potential for conversion from kerosene to LPG. SOM (Serviceable Obtained Market): Estimating the market share that can be achieved by SPBE after infrastructure development, assuming an increase in annual LPG consumption.
- b. Financial Feasibility Analysis: Calculating the economic added value of SPBE development based on cash flow projections during the project period.
- c. Internal Rate of Return (IRR): Measuring the rate of return on investment from SPBE development.
- d. Profitability Index (PI): Assessing investment efficiency compared to costs incurred.
- e. Discounted Payback Period (DPP): Analyzing the time required to return investment capital based on cash flow projections.

- f. Monte Carlo Simulation: Involves 10,501 iterations to evaluate the impact of variability on feasibility outcomes, such as LPG price fluctuations, operating costs, and consumption levels.
- g. Risk Analysis (Risk Register): Identifies potential risks that may affect the construction and operation of the SPBE, such as LPG price fluctuations, distribution constraints, and community resistance to LPG use.
- h. Sensitivity Analysis: Evaluates the impact of changes in assumptions (e.g., LPG price, daily consumption levels) on project feasibility. This analysis provides insight into the stability of the project under optimistic, realistic, and pessimistic scenarios.

RESULTS AND DISCUSSION

Market Aspects

Method 1: Based on Real Data from Directorate General of Oil and Gas of ESDM and Pertamina Sorong

The market analysis calculation in this first method uses data sourced from the Ministry of Energy and Mineral Resources and Pertamina Sorong (Purwosaputra et al., 2022; Wollff, 2023). In bringing up the market value of LPG filling capacity of SPBE per day that can be fulfilled, market sizing is carried out through three filtering steps using the TAM - SAM - SOM method.

TAM (Total Available Market)

The first method used to calculate the target market for LPG filling stations per day is done by calculating the Total Available Market (TAM). TAM, in this case, is defined as the total consumption of LPG, encompassing the regions of Southwest Papua and West Papua provinces. One approach used in calculating TAM is through LPG consumption at the household level and the number of Micro and Small Enterprises (UMK). The data used in this TAM calculation is based on actual consumption data from the Ministry of Energy and Mineral Resources (ESDM).

Assuming the above, the total consumption of kerosene equivalent mT LPG and LPG in Southwest Papua Province is 11,201 mT. Of the total consumption, around 85.54% was contributed by kerosene consumption or 9,581 mT. Meanwhile, the remaining 14.46% was contributed by households that consumed NPSO LPG or 1,620 mT. Then, if it is assumed based on daily consumption (mT/day), based on the calculation results, it is known that the average consumption of LPG and kerosene is 30.69 mT/day. With the results of the above calculations, it can be concluded that the potential conversion from kerosene to LPG has a considerable opportunity, considering the high level of kerosene use in Southwest Papua Province (Ananda, 2024).

In general, the value of LPG consumption in the main target market is still relatively low. However, if we see kerosene consumption as an opportunity as consumers who will switch to LPG assuming that NPSO LPG has a better advantage compared to kerosene (both in terms of price and use), then this is a great opportunity (Gusdianto & Rohman, 2017) (Lestari et al., 2023). However, of course, several efforts need to be made so that people can switch from kerosene to LPG, one of which is by increasing exposure to the benefits and counseling on the use of LPG.

SAM (Available Markets Servable)

The calculation of Serviceable Available Market (SAM) in this study is defined as total consumption which includes cities and regencies in Southwest Papua and West Papua Provinces, including Sorong City and Sorong Regency (Leftungan et al., 2022). Like the TAM calculation, the approach used in method 1 (one) uses data on the number of families and the number of MSEs to calculate the overall LPG consumption potential. The assumptions used in this calculation are the same as those used in the TAM calculations. Overall, this SAM calculation shows how the condition of kerosene consumption has been equated with the MT of LPG equivalent and the average consumption per day.

Based on the results of SAM calculations, it can be seen that Sorong City is the area with the highest consumption of kerosene and LPG fuel compared to other regions, which is 8,560 mT. Kerosene consumption in Sorong City in 2024 will reach 7,446 mT equivalent to LPG or 86.99% of total kerosene and LPG consumption. Meanwhile, the NPSO LPG consumption value is only 1,114 mT or 13.01% of the total kerosene and LPG consumption with an average daily consumption of kerosene and LPG of 23.45 mT. Meanwhile, the consumption value of kerosene and LPG in Sorong Regency is still relatively low. NPSO LPG consumption in Sorong Regency in 2024 will only be 506 mT while kerosene consumption will reach 2,135 mT LPG equivalent. The average consumption of LPG and kerosene in Sorong Regency is also still relatively small, which is only 7.24 mT/day.

Secara keseluruhan, kedua daerah di atas berpotensi menjadi target pasar utama sebagai lokasi penyaluran LPG jika diasumsikan rumah tangga yang mengonsumsi minyak tanah dikonversi ke LPG. Namun tentunya hal ini disesuaikan dengan kemampuan produksi LPG NPSO dari SPBE yang akan diadakan.

SOM (Available Market for Services)

For this reason, in this SOM market calculation, it is assumed that there will be an increase in NPSO LPG consumption by 30% in 2025 or a year after the operation of SPBE in the main target markets of Sorong City and Sorong Regency from the impact of SPBE infrastructure development, declining LPG prices, LPG energy consumption efficiency, and the affordability of the community to get LPG fuel.

In addition, there is also an assumption of a stable increase in NPSO LPG consumption in 2031-2039 due to the stabilization of the community shifting from the use of kerosene to the use of NPSO LPG. The justification for the increase in NPSO LPG consumption is based on data from the 2018-2022 National Socio-Economic Survey (Susenas) which shows that the highest per capita consumption in one month for non-food needs is in the top 20% of the population. Thus, the increase in consumption was driven by the population in the top 20% who immediately switched from kerosene to LPG use due to competitive prices and better availability of LPG compared to kerosene after the operation of SPBE. The graph below shows that monthly consumption expenditure for non-food products in Sorong City reached Rp 1,981,637 while in Sorong Regency it reached Rp 1,717,974.

In 2024, the plan to realize NPSO LPG consumption of 1,619.86 metric tons (mT) for the main target market, Sorong City is the largest with total NPSO LPG consumption in 2024 of 1,113.82 mT or 69% of the total consumption from the main target market. Meanwhile, Sorong Regency has an LPG NPSO consumption of 506.04 mT or 31% of the

total consumption of the main target market. In 2024, for the two main target market regions, based on the average daily consumption of NPSO LPG, the total LPG consumption for the main target market will be 4.53 mT/day. In that year, Sorong City had a daily consumption of 3.05 mT/day while Sorong Regency had a daily consumption of 1.48 mT/day. Furthermore, the average consumption after the operation of SPBE is estimated from 2025 to 2039 based on daily consumption (mT/day).

Assuming the increase in NPSO LPG consumption caused by changes in people's energy consumption patterns from kerosene to LPG, the average daily consumption of LPG fuel in the 2025-2039 projection is 15.00 mT/day with consumption in each main target market area of 10.10 mT/day for Sorong City and 4.90 mT/day for Sorong Regency. Meanwhile, in addition to assuming the percentage of consumption conversion from kerosene to LPG, there are several assumptions for increasing LPG consumption every year, including the following.

- a. In years 1 to 2, there was an increase in NPSO LPG consumption by 30.00%/year
- b. In years 3 to 6, there was an increase in LPG NPSO consumption by 20.00%/year
- c. From 7 to 15, there was an increase in NPSO LPG consumption by 2.50%/year

The assumption of initial growth in years 3 to 6 of 20.00%/year is based on the fact that many people are gradually switching from using kerosene to LPG whose availability in the market has begun to stabilize. Furthermore, the assumption of an increase in LPG NPSO consumption by 2.50% in years 7 to 15 refers to the fact that almost all people in the main target market have used LPG NPSO due to the assumption of the elimination of kerosene subsidies and the reduction/elimination of kerosene circulation in the community. Thus, NPSO LPG consumption every year from the 7th to the 15th year is driven by the increase in the number of people in the main target market and the increase in NPSO LPG consumption from people's consumption activities that are starting to stabilize using LPG energy for daily needs. The total LPG consumption in the main target market for each year is shown in the following table.

Table 1. LPG Consumption Estimation for Sorong City and Sorong Regency (Main Target Market) First Method

Year	Sorong City	Sorong District	Total
	Consumption (mT/Day)	Consumption (mT/Day)	Consumption (mT/Day)
2024	3,05	1,48	4,53
2025	3,97	1,93	5,89
2026	5,16	2,50	7,66
2027	6,19	3,00	9,19
2028	7,43	3,61	11,03
2029	8,91	4,33	13,24
2030	10,69	5,19	15,89
2031	10,96	5,32	16,28

2032	11,24	5,45	16,69
2033	11,52	5,59	17,11
2034	11,80	5,73	17,53
2035	12,10	5,87	17,97
2036	12,40	6,02	18,42
2037	12,71	6,17	18,88
2038	13,03	6,33	19,35
2039	13,36	6,48	19,84

TAM (Total Pasar yang Tersedia)

Total Available Market (TAM) in this study is defined as the calculation of potential LPG consumption in Southwest Papua Province using a household proxy or approach. The consumption assumptions used refer to the Indonesian Energy & Economic Statistics 2021 which explains that the average LPG consumption in Maluku-Papua per month is 7.6 Kg/family or 1.9 kg/person and 7.9 Kg/month for MSMEs.

Based on the results of household projections in Southwest Papua Province for 2006-2039, it shows that there is a steady increase in households. It is known based on the projection that the average number of family members in a family in Southwest Papua Province is 4.41 people. Using assumptions from Indonesian Energy & Economic Statistics, the average consumption of LPG in households in Maluku and Papua is 7.6 Kg/day or about 0.253 Kg/day. Based on the results of the TAM calculation, the average consumption of LPG in Southwest Papua Province is 36.31 mT/day with an average annual growth of 2.15% from 2025 to 2039.

Furthermore, in general, the projected number of MSEs shows a fairly steady increase from 2007 to 2039. Although there was a decrease in the number of MSEs in 2009, the following year experienced a significant increase. It is known that in 2010 the number of MSEs reached 758 business units, then in 2013 it decreased to 709 business units. From 2013 to 2039 the number of MSEs is projected to continue to increase, with the number of MSEs in 2039 reaching 1,165 business units. With the results of this projection calculation, it will certainly have an influence on the need and demand for LPG as a primary commodity in the implementation of business in Southwest Papua Province.

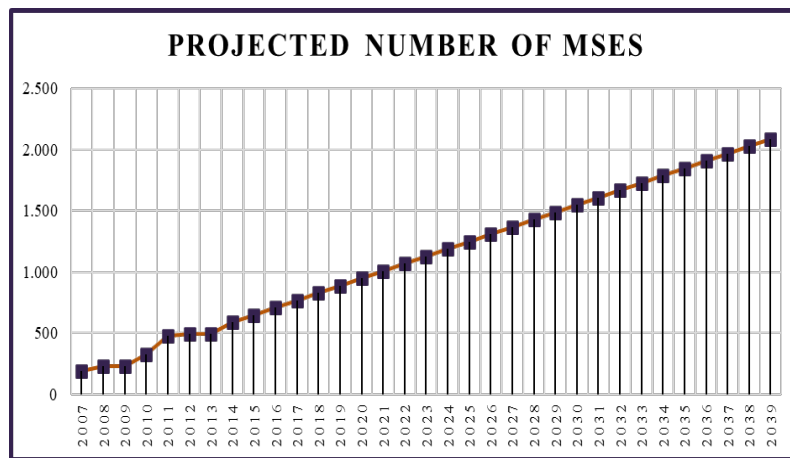


Figure 1. Projected Number Of MSEs

Meanwhile, based on the calculation of potential MSE consumption, the average daily consumption of LPG in Southwest Papua Province is 0.436 mT/day with an average annual growth of 4.18% from 2025 to 2039. The growth of LPG consumption illustrates that the demand for LPG in Southwest Papua Province is quite large in line with LPG consumption per year.

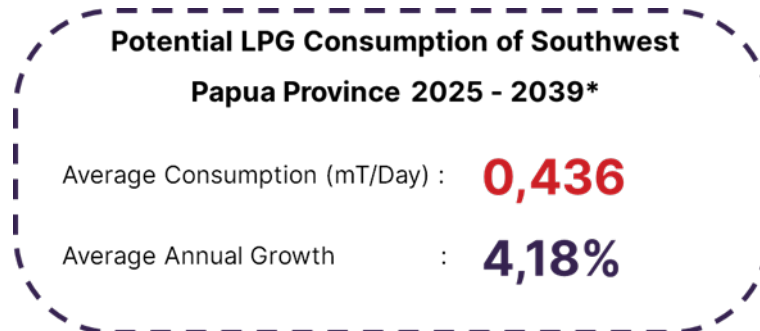


Figure 2. Potential LPG Consumption of MSEs in West Papua Province Data 2025-2039
*LPG and Kerosene Users Based on Energy Mix

At the last stage of the TAM calculation is to calculate how much potential LPG consumption in Horeka in Southwest Papua Province. Based on the results of the projection of the number of Horeka in Southwest Papua Province from 2005 to 2039, it shows quite fluctuating changes, especially during the Covid-19 pandemic. There was a significant decrease in 2022 in the number of horeka in Southwest Papua Province. Most likely this decline was caused by a government policy that imposed restrictions on community mobility to reduce the number of Covid-19. But on the other hand, this policy has a negative impact on the business continuity of the horeka.

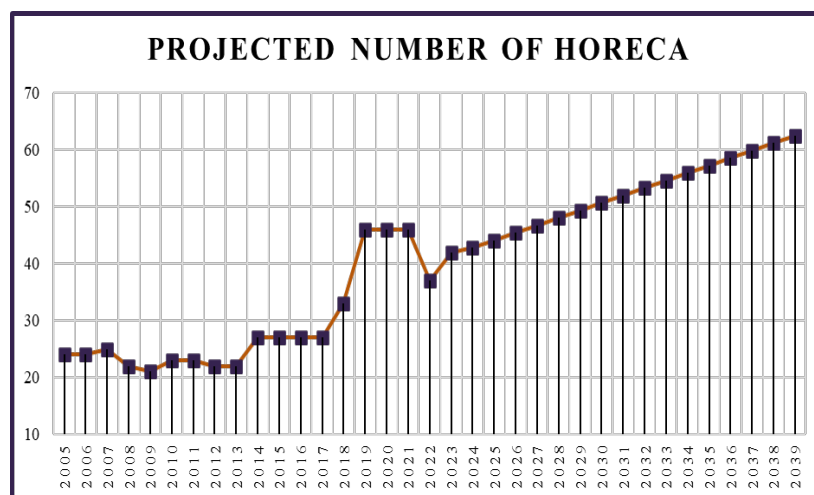


Figure 4. Projected Number of Horeca

Based on TAM calculations in the hospitality sector, it shows that the potential LPG consumption reaches 2,259 mT/day, which is greater than the MSE sector. In addition, the average annual growth of this sector is smaller when compared to the MSE sector which only reaches 2.46%. Overall, the consumption potential of this sector contributes

significantly more than the non-household sector. This indicates that the hospitality sector can be one of the driving forces in the sustainability of the SPBE supply chain in Southwest Papua Province.

SAM (Serviceable Available Market)

Similar to the TAM calculation, the SAM calculation method in this study uses the same approaches and assumptions. There are several steps to identify the main target markets. TAM in method 2 is defined as the calculation of market consumption potential in the main target market with a focus on the same district and city level. Some of the steps taken in the SAM calculation are more or less the same as those taken in the TAM calculation. Where, the three sectors namely households, MSEs and Horeka are the main target sectors used to see how much consumption potential they will provide to the overall market.

The first step to identify the potential consumption of NPSO LPG in the household sector in the main target market areas is to project the number of households. Household size projections were conducted in the two main target market areas of Sorong City and Sorong Regency. The projection results show that the number of households in Sorong City tends to experience stable growth from 2006 to 2039. Meanwhile, household growth in Sorong Regency before 2020 tends to undergo fluctuating changes, where a significant increase occurred in 2017 reaching 42,105 households. Furthermore, in 2020 and subsequent years, the number of households in Sorong Regency increased more than the number of households in Sorong City. It is known that in 2039 the number of Sorong City households reached 96,070 while in Sorong City it reached 69,161.

Then based on the calculation results, when viewed from the average daily consumption from 2025 to 2039, it is dominated by Sorong Regency, which reaches 20.52 mT/day. The average annual growth of LPG consumption in Sorong Regency reached 2.27%. Meanwhile, the average LPG consumption in Sorong City reached 15.79 mg/day with an average growth of 2.00%. When compared between the two regions the majority of the population using LPG comes from Sorong Regency, but the amount of LPG consumption in Sorong City also does not have a significant difference.

In line with the household sector, the MSE sector also tends to have increasing growth from year to year. Based on the forecasting results, the number of MSEs in Sorong City in 2010 experienced a very high increase, reaching 497 units. This number is the highest in the first 10 years of the 2007-2038 period. In general, the growth of the two main target market areas experienced stable growth from 2012 to 2039.

The high number of MSEs in Sorong Regency may be influenced by geographical factors that are larger than those in Sorong City. In addition, this reflects that a larger proportion of kerosene and LPG fuel users are used in Sorong Regency. However, despite these conditions, overall both regions have high potential in identifying fuel gas/LPG demand.

Furthermore, based on the results of the SAM calculation, shows that the average value of MSE sector LPG consumption from the two regions tends not to have a large difference. Where, the average LPG consumption in Sorong Regency reached 0.192 mT/day with an average annual growth of 3.94%. Meanwhile, the average LPG consumption in Sorong City reached 0.244 mT/day with an average growth of 4.38%. The

consumption values that are not much different reflect that the characteristics of LPG use in both Sorong City and Sorong Regency tend not to be much different.

Furthermore, the projection of the number of horeka shows quite fluctuating changes, especially in Sorong City. Nevertheless, the number of convenience stores in Sorong City and Sorong Regency tends to have an increasing trend from 2005 to 2039. There is a considerable difference between the number of horeka in Sorong City and Sorong Regency. Where convenience stores in Sorong Regency began to exist from 2018. In general, the number of horeka in the main target market areas is dominated by Sorong City.

Furthermore, the calculation shows that the average consumption of horeka LPG from 2025-2039 for Sorong City reaches 2.03 mT/day with an average growth of 2.23%. While the average consumption in Sorong Regency is 0.23 mT/day, with an average growth of 4.64%. The high number of horeka in Sorong City causes the average consumption in Sorong City to be greater than that in Sorong Regency. Overall, the Serviceable Available Market in the main target market areas is greater than the average consumption value in the MSE sector.

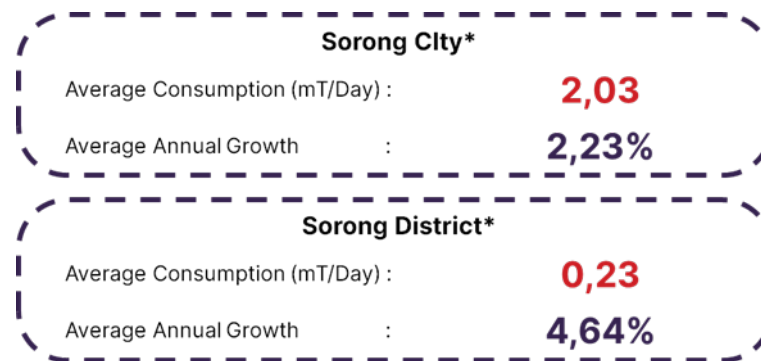


Figure 5. Average LPG Consumption of Key Target Market Areas 2025-2039
*LPG and Kerosene Users Based on Energy Mix

SOM (Serviceable Obtained Market)

In the calculation of SOM (Serviceable Obtained Market) or the amount of NPSO LPG market that can be achieved for the main target market after the development of SPBE infrastructure. At the SOM stage, the calculation focuses on the potential conversion of energy consumption from kerosene to LPG.

The last calculation step carried out is the SOM calculation stage. At this stage, the calculation focused on the potential shifting of energy consumption from other fuels to LPG and also the calculation of LPG market demand that will be absorbed by SPBE. The steps taken include. Total LPG demand from SPBE was calculated based on existing LPG consumption and potential shifting from other fuels.

It is known that the number of households in 2024 in Sorong City and Sorong Regency reached 68,011 or 54% of the total households in the main target market provinces and districts/cities. While the number of households in Southwest Papua Province reached 57,187 or 46% of the total households in the main target market.

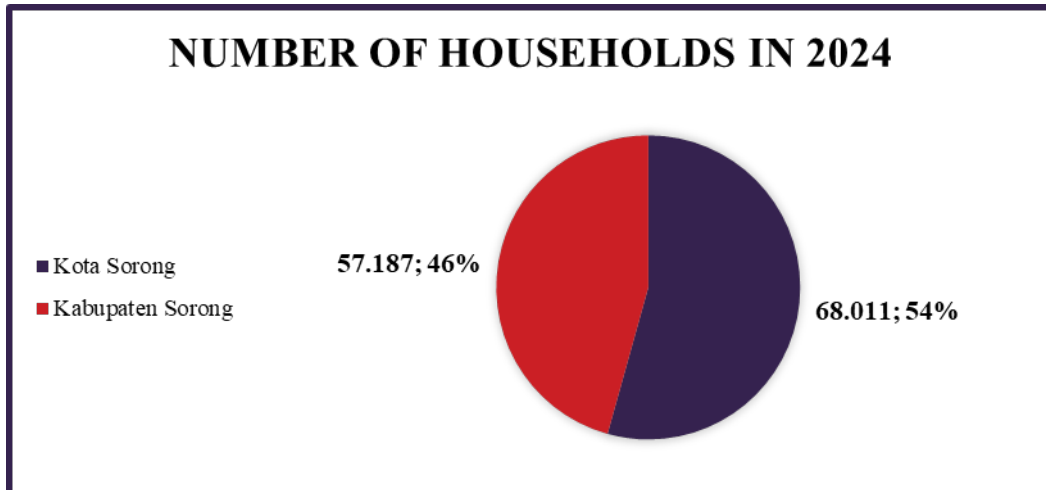


Figure 6. Number of Households in Key Target Market Areas in 2024

To identify the market size of NPSO LPG in Sorong City and Sorong Regency, this study assumes that there will be an increase in NPSO LPG consumption due to the shift in people's energy consumption patterns from kerosene to LPG. The change in fuel use to LPG is assumed to cause an increase in NPSO LPG consumption in year 1 (2025) or one year after the SPBE operates by 40%. The assumption is based on the price of LPG (new price) which is cheaper, more efficient, and more readily available than Kerosene.

The calculation shows that before the operation of SPBE, LPG consumption in Sorong City reached 2.06 mg/day. Meanwhile, the total consumption before the shifting in Sorong District was 0.93 mg/day. When aggregating the two main target market areas, the total consumption before the shifting was 2.99 mg/day.



Figure 7. Comparison of Daily Consumption of NPSO LPG in the Main Target Market Before the Operation of SPBE in 2024 and After the Operation of SPBE Projection 2025-2039 for Households Based on Proxy of Number of Households

Meanwhile, after the SPBE has been operating and causing an increase in NPSO LPG consumption due to changes in energy consumption patterns from kerosene to LPG. Causing the average consumption of NPSO LPG in Sorong City to be 8.87 mg/day. While in Sorong Regency the average consumption of NPSO LPG after the operation of SPBE is 4.02 mg/day. With the potential for conversion from kerosene to LPG, there will be an increase in household LPG consumption in the 2025-2039 projection.

As for MSEs (Micro and Small Enterprises), similar to the increase in LPG consumption in the household sector where there is an increase in NPSO LPG consumption in year 1 by 40% after SPBE operates with the justification that MSEs also need a stable energy supply for production needs where if they rely on energy supply with subsidized kerosene which is quite difficult to obtain because sales are not carried out every day and if buying kerosene from general retailers has a high selling price. So the development of

SPBE infrastructure that causes the supply of LPG to be stable and quite easy to obtain, will encourage MSEs to switch to LPG.

It is known that the total consumption of LPG in the main target markets before the operation of SPBE reached 0.028 mg/day. In detail, the largest consumption in the MSE sector was contributed by Sorong City at 0.016 mg/day, while Sorong Regency had an LPG consumption of 0.012 mg/day. Furthermore, after assuming that after the SPBE operates, MSE customers make the switch from using kerosene to LPG as the main fuel, the average LPG consumption for 2025-2039 reaches 0.070 mg/day for Sorong City and 0.050 mg/day for Sorong Regency. In aggregate from the two regions, the average LPG consumption will be 0.120 mT/day.



Figure 8. Comparison of NPSO LPG Daily Consumption of Main Markets Before the Operation of SPBE in 2024 and After the Operation of SPBE Projection 2025-2039 for MSEs (Micro and Small Enterprises) Based on the Number of Households Proxy

Furthermore, for the convenience store sector, it is assumed that there is an increase in NPSO LPG consumption from the change in kerosene consumption to LPG with the justification that convenience stores will use LPG because it is more affordable compared to kerosene. This will have an impact on the cost factor owned by each convenience store unit so that they get higher profits and increase cost efficiency. Overall, the amount of LPG consumption in the convenience store sector can be said to have a higher potential demand for LPG compared to the MSE sector. The total LPG consumption before the operation of the SPBE in 2024 reached 0.217 mT/day with a total consumption of 0.205 mT/day for Sorong City and 0.011 mT/day for Sorong Regency. While the average consumption after the operation of SPBE in 2025 - 2039 totaled 0.935 mT/day. The average LPG consumption after the operation of SPBE in Sorong City reached 0.886 mT/day, while in Sorong Regency it reached 0.049 mT/day.



Figure 9. Comparison of Daily Consumption of NPSO LPG in Main Target Markets Before the Operation of SPBE in 2024 and After the Operation of SPBE Projection 2025-2039 for Hotels, Restaurants, and Cafes Based on Proxy of Number of Households

In aggregate, the average consumption in the main target markets for 2025-2039 reached 13.95 mT/day, with a breakdown of 9.83 mT/day contributed by the household, MSE, and convenience store sectors in Sorong City. Meanwhile, Sorong Regency has a total consumption of 4.12 mT/day from the total sum of the household, MSE, and Horeka sectors. The detailed consumption estimates in the main target market areas can be seen in the table below.

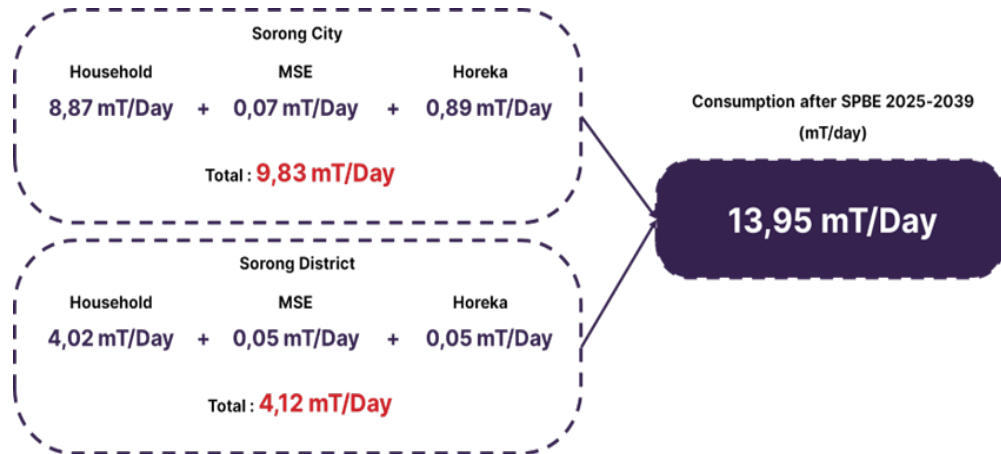


Figure 10. Average Consumption Forecast in Major Target Markets 2025 – 2039

Table 2. LPG Method Consumption Estimation for Sorong City and Sorong Regency (Main Target Market) Second

Year	Sorong City	Sorong District	Total
	Consumption (mT/Day)	Consumption (mT/Day)	Consumption (mT/Day)
2024	2,28	0,95	3,23
2025	3,19	1,34	4,52
2026	4,14	1,74	5,88
2027	5,39	2,26	7,64
2028	6,46	2,71	9,17
2029	7,76	3,25	11,01
2030	9,31	3,90	13,21
2031	11,17	4,68	15,85
2032	11,45	4,80	16,25
2033	11,74	4,92	16,65
2034	12,03	5,04	17,07
2035	12,33	5,17	17,50
2036	12,64	5,30	17,93
2037	12,95	5,43	18,38
2038	13,28	5,56	18,84
2039	13,61	5,70	19,31

Consumption of NPSO LPG in Papua Province Market

The first step in benchmarking the main market areas in Papua Province is to forecast the number of households from 2012 to 2038.

Based on the projection results, there was an increase in the number of households in Papua Province from 2012 to 2038. Overall, the number of households in Papua Province experienced a positive increase from year to year. The increase in the number of households in Papua Province is fairly stable, where in 2023 the total number of households was 204,481 and reached 287,595 in 2038.

TAM (Total Available Market)

Papua Province has 8 regencies including Jayapura, Yapen Islands, Bak Numfor, Sarmi, Keerom, Waropen, Supiori, and Mamberamo Raya and has 1 city, namely Jayapura City. Jayapura City has the largest population, reaching 398,478 million people or contributing 39.53% of the population of Papua Province in 2020. Then the area with the least population is Supiori Regency, reaching 22,547 million people or contributing around 2.23% of the total population in Papua Province in 2020.

Table 3. Potential LPG Consumption by Papua Province 2012-2038

	Papua Province
Average Family Member	4.94
Average Consumption (mT/Day)	47.10
CAGR (%)	5.28

Source: Data processed

As in the previous calculation, the first step is to calculate the Total Available Market ("TAM"). By using assumptions as in the previous calculation, the calculation results show that the average consumption of LPG in Papua Province is 47.10 mT/day with an average growth of 5.28%. It can be concluded that the average potential of households consuming LPG from 2012 to 2038 in Papua Province is 1,002,937 people. It can be concluded that the TAM value or the number of consumers expected to be reached by the product is 47.10 mT/day.

SAM (Serviceable Available Market)

The second stage is to see how much market potential can be covered by the company, in this case how much LPG can be distributed to the main target market, especially in Jayapura City and Jayapura Regency. To do this calculation, first the number of households in Jayapura City and Jayapura Regency was calculated. The results show that the number of households in Jayapura City and Jayapura Regency has increased from year to year. However, the figure below shows that the number of households in Jayapura Regency is not growing as fast as Jayapura City.

Furthermore, in the SAM calculation assumptions are used that refer to the Indonesian Energy & Economic Statistics 2021, namely the average consumption of Household LPG in Maluku-Papua is 7.6 Kg / Month or 0.253 Kg / Day. In calculating the potential market in Jayapura City and Jayapura Regency, this study uses the population using LPG and kerosene based on the energy mix. The calculation shows that the potential consumption of LPG in Jayapura City has an average consumption from 2012-2038 of

20.86 MT/day with a growth of 1.59%. When compared to the provincial level, the average growth in Jayapura City is not too high.

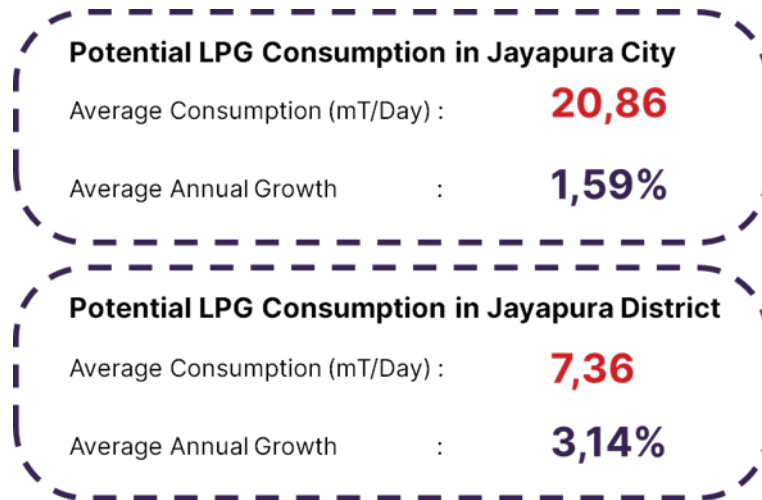


Figure 11. Potential LPG Consumption in Key Target Markets: Jayapura Regency and Jayapura City

Meanwhile, potential LPG consumption in Jayapura Regency shows that the average daily consumption of LPG reaches 7.36 mT. The average growth of LPG consumption in Jayapura Regency from 2012 to 2038 is 3.14% higher than that of Jayapura City. This indicates that the potential for conversion from kerosene to LPG is higher in Jayapura Regency.

SOM (Serviceable Obtained Market)

Dalam analisis tahap terakhir dilakukan perhitungan SOM yang bertujuan untuk melihat seberapa besar potensi shifting dari bahan bakar lain ke LPG. Selain itu, dalam analisis SOM ini akan difokuskan kepada kebutuhan pasar LPG yang akan diserap oleh SPBE. Beberapa langkah yang dilakukan dalam analisis perhitungan SOM ini diantaranya adalah melakukan perhitungan demand LPG total dari SPBE berdasarkan konsumsi eksisting LPG dan potensi shifting dari bahan bakar lainnya. Adapun target pasar dalam perhitungan ini tidak hanya menggunakan pendekatan rumah tangga tetapi juga menggunakan pendekatan UMK. Hal ini dilakukan untuk menangkap perubahan atau shifting dari setiap elemen yang berpotensi menggunakan LPG.

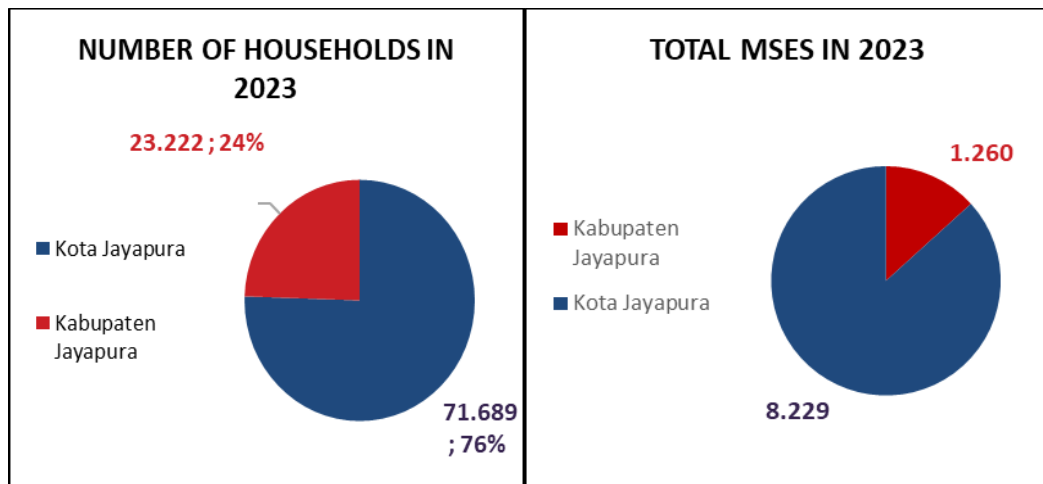


Figure 12. Number of Households and Micro & Small Enterprises (MSEs) in Jayapura City and Regency by 2023

When viewed based on the number of households and MSEs in the main target market areas, the differences are quite large. Of the two regions, the number of households is dominated by Jayapura City with the number of households in 2023 reaching 71,689 or 76% of the total households in the main target market. Meanwhile, the number of households in Jayapura Regency in 2023 only reached 24% of the total or 23,222 households. Meanwhile, in terms of micro and small enterprises (MSEs), it shows that Jayapura City has more MSEs than Jayapura Regency at 8,229. Meanwhile, Jayapura Regency only has 1,260 MSEs.

The first thing to note is the assumptions used in calculating the potential shifting from kerosene to LPG. The assumption used in looking at the shifting potential is that there is a 10% shift in consumption from households from kerosene to LPG in 2024. This assumption is made based on the price of LPG (new price) being cheaper, more efficient, and more readily available than the price of kerosene.

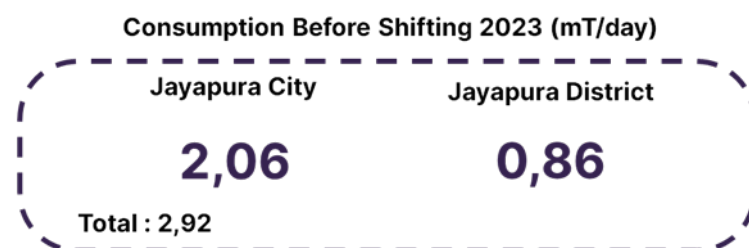


Figure 13. LPG Consumption Before Shifting Year 2023 (mT/day)

Based on the calculation, the consumption before the transfer of kerosene to LPG in 2023 reached 2.06 mT/day in Jayapura City and 0.86 mT/day in Jayapura Regency. Therefore, when viewed in total, it shows that the contribution of LPG consumption tends to be dominated by Jayapura City. Assuming that there is a 10% shift in kerosene fuel use from households to LPG, the total average consumption from 2024 to 2038 is 7.18 mT/day. Looking in detail at the two main target market areas, it is known that the average consumption after shifting is 5.30 mT/day for Jayapura City and 1.88 mT/day for Jayapura Regency.



Figure 14. LPG Consumption After Shifting Year 2023 (mT/day)

In addition to calculating the average consumption after the assumed conversion from kerosene to LPG at the household level, this study also calculates the average consumption of Micro and Small Enterprises (MSEs) after shifting. It is known that the average consumption before the shifting of MSEs in 2023 tends to be dominated by Jayapura City with a total consumption of 2.05 mT/day. Meanwhile, the total consumption of Jayapura Regency is only 0.33 mT/day or 13% of the total consumption of the two regions. The total consumption of LPG for MSEs is indeed strongly influenced by the number of MSEs in the two regions. Nevertheless, the existing total consumption illustrates how small-scale industries use LPG as both primary and secondary fuel. The total LPG consumption before the shifting of the accumulation of the two regions was 2.38 MT/day.



Figure 15. MSE LPG Consumption Before Shifting in 2023 (mT/day)

Assuming that there is a 50% shifting of total MSEs using kerosene to LPG, the average consumption from Jayapura City from 2024 to 2038 is 1.47 mT/day. Meanwhile, the average LPG consumption from 2024 to 2038 is 0.20 for Jayapura Regency. The average consumption in these two regions shows a significant increase in line with the increase in the number of MSEs. The need for LPG is the main source for MSEs both in the production process and in other processes as a supporting process.

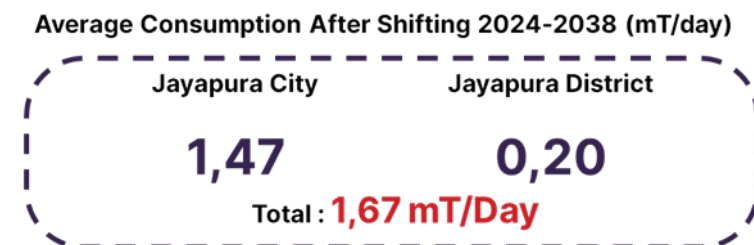


Figure 16. MSE LPG Consumption after Shifting in 2023 (mT/day)

Overall, in the benchmarking section in the first province, namely Papua Province, it can be accumulated from both proxies between households and MSEs. Based on the

calculation results, the estimated consumption of LPG in Papua Province, especially in Jayapura City, is 6.77 mT/day and 2.08 mT/day in Jayapura Regency. Therefore, the total average estimated consumption in the two regions used as the main target market in 2024-2038 is 8.85 mT/day. Details of LPG consumption after shifting in 2024-2038 can be seen in the table below.

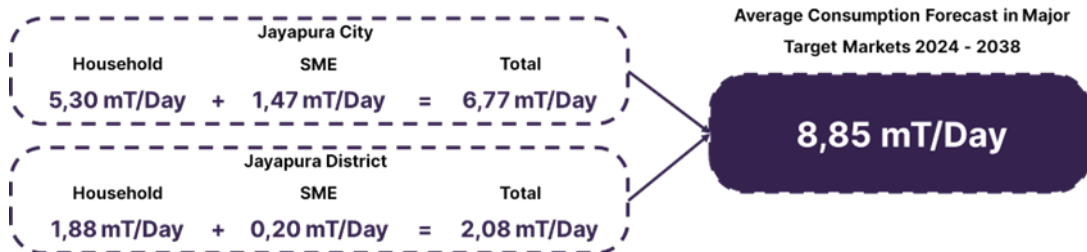


Figure 17. Perkiraan Konsumsi Untuk Pasar Target Utama Tahun 2024-2038

Table 4. Potential LPG Consumption by Papua Province 2024-2038

Year	Jayapura City		Jayapura District		Total	
	Consumption (mT)	Consumption (mT/Day)	Consumption (mT)	Consumption (mT/Day)	Consumption (mT)	Consumption (mT/Day)
2024	1,101	3.02	391	1.07	1,492	4.09
2025	1,211	3.32	430	1.18	1,641	4.50
2026	1,332	3.65	473	1.30	1,805	4.95
2027	1,465	4.01	520	1.43	1,986	5.44
2028	1,612	4.42	573	1.57	2,184	5.98
2029	1,773	4.86	630	1.73	2,403	6.58
2030	1,862	5.10	661	1.81	2,523	6.91
2031	1,955	5.36	694	1.90	2,649	7.26
2032	2,053	5.62	729	2.00	2,782	7.62
2033	2,155	5.90	765	2.10	2,921	8.00
2034	2,263	6.20	804	2.20	3,067	8.40
2035	2,376	6.51	844	2.31	3,220	8.82
2036	2,495	6.84	886	2.43	3,381	9.26
2037	2,620	7.18	930	2.55	3,550	9.73
2038	2,751	7.54	977	2.68	3,728	10.21

CONCLUSION

The feasibility study for developing SPBE (LPG Bulk Filling Station) infrastructure in the Sorong Special Economic Zone (SEZ) confirms its viability using two alternative data approaches. The first approach, based on Non-PSO LPG consumption data from the Directorate General of Oil and Gas ESDM and Pertamina, shows the project is "FEASIBLE" with an NPV of Rp 5.77 billion, an IRR of 14.74%, a PI of 1.27, and a DPP of 10.7 years. The second approach, relying on proxy data from household growth, MSEs, and Horeka businesses, also deems the project "FEASIBLE" with an NPV of Rp 3.24 billion, an IRR of 13.05%, a PI of 1.15, and a DPP of 12.3 years. Non-PSO LPG users in Sorong City and Sorong Regency include the top 20% of households, MSEs, and Horeka businesses, with projected consumption of up to 15.00 tons/day (Method 1) and 13.95 tons/day (Method 2). Annual consumption growth rates are projected to range from 30-40% initially, tapering to 2.5% after seven years.

The proposed SPBE will cover 3,626 m² with a compact design meeting Pertamina standards and includes a 50-ton storage tank and two box culvert bridges for LPG cylinder transport vehicles. Development costs are estimated at Rp 21.10 billion, excluding pipeline construction costs. Operational resources include a team of operators, logistics personnel, and administrative staff, led by an operations manager with HSE expertise. The LPG supply will rely on a pipeline system from the Petrogas storage field. This project demonstrates strong feasibility and potential to meet increasing LPG demand in the Sorong SEZ.

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