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ENERGY MODELLING AND FORECASTING OF DAERAH ISTIMEWA YOGYAKARTA 2025

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Abstract

Daerah Istimewa Yogyakarta (DIY) is one of the provinces in Indonesia which does not have a backup or potential sources of non-renewable primary energy. The non-renewable energy demand until this time, such as oil,coal and gas is supplied from the outside. DIY is in Java Madura Bali (JAMALI) interconnerction system and has not had a large-scale power systems. While DIY has renewable energy sources such as hydro, solar, wind, wave and biomass energy. These renewable energy sources are alternative energy that have not been optimally used. The lack of reserve energy resources that resulting dependence of energy supply from other areas should receive special attention from DIY government. To meet energy demand, the energy resources development is required. Due to the energy resources development requires a long time and high cost, it is necessary to be supported by good planning in energy policy.

The purpose of this study is to determine the balance of energy demand and supply of DIY until 2025. Furthermore, the purpose of this study is to find out a mix number of renewable energy. The Indonesian government has launched a vision of 25/25 which expection in 2025, the mix number of renewable energy will be 25%.

The results of this study indicate that in 2025, the Transportion Sector is the largest energy user sector in DIY at 52.37%, followed by Household Sector (32.70%), Commercial Sector (8.26%), Other Sector (4.64%), and Industrial Sector (2.04%). The high level of energy consumption in the Transportation Sector is caused by the increasing number of vehicles especially motorcycles and passenger cars considering DIY is a student and tourism city. In term of the type of energy used, in 2025, the gasoline is the greatest type of energy demand (41.8%), followed by LPG (23.97%), electricity (18.14%) and diesel oil (11, 74%). This indicates that the fuel oil is still the main energy source for the DIY community activities. When viewed from supply side, most of the energy needs in DIY are supplied from outside. If the development of enewable energy targets DIY reached, the renewable energy mix is obtained by 0.53 %.

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1. Introduction

Daerah Istimewa Yogyakarta (DIY) is one of the provinces in Indonesia that does not have a backup or potential sources of non-renewable primary energy. The non-renewable energy demand until now, such as oil, coal and gas is supplied from other regions such as West Java, Sumatra and Sulawesi. DIY is in the Java economic corridor because of the presence of iron sand mining and the determination of steel industry in Kulonprogo regency. The electrical of DIY is in Java Madura Bali (JAMALI) interconnection and has not had a large-scale power systems. DIY also has deposits of fossil energy resources of coal. While oil and gas are still in the exploratory stage. DIY electrification ratio in 2012 reached 76.21%.

The lack of reserve energy resources that resulting dependence of the energy supply from other areas should receive special attention DIY government. To meet energy demand, the development of energy resources is required. Since the development of energy resources requires a long time and high cost, it is necessary to make good planning supported by energy energy policy. Therefore, it is the required the energy planning studies that can provide the real picture of current conditions and future forecasts regarding how should potential energy resources are managed and utilized for the construction of DIY.

2. Research Methodology

This study was conducted by several stages as follows;

a. Study of Literatures

The study of literature is done by studying some literatures that have relevances to this research such as; basic theory, outlook, energy studies, journals or presentation slides from related agencies etc.

b. Data Collection

Data collected from various agencies and related institutions. The data is secondary data. The data includes the data of energy consumption, the potential of renewable energy, renewable energy infrastructure, and energy policies implemented in DIY.

c. Data processing

As data obtained has different time series, the non-renewable energy consumption data used is only the data that has the same time series. While the potential and infrastructure of renewable energy data used in this study is only data obtained at final year.

The data obtained are grouped into non-renewable energy data, renewable energy data, renewable energy potential data, renewable energy infrastructure data, social and economic data and the energy policies of DIY.

d. Forecasting Analysis 2012-2025

Based on historical data obtained, forecasting analysis is performed using the methods recommended in the basic theory. In this study, the tool used in forecasting analysis is Microsoft Excel 2010.

e. Energy Modelling 2012-2025

Data resulted from previous stage was entered in LEAP tool to look the forecast from 2012 to 2025.

f. Energy Balance Analysis

Energy balance analysis was performed by decomposing the demand side and the supply side. Energy balance is used to facilitate identifying between demand and supply. Overall study flow is shown in Figure 1.

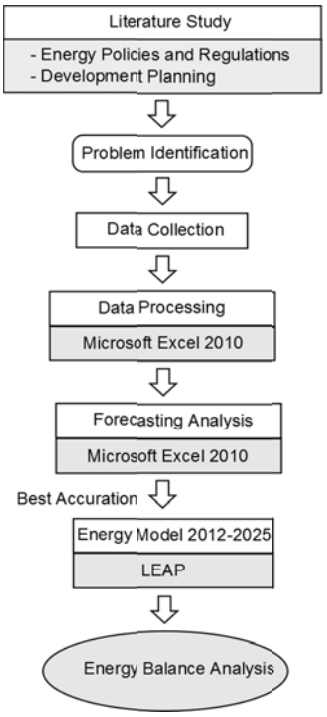

Figure 1. Research Methodology

3. Results

The amount of energy intensity in the Transportation Sector by vehicle type is assumed to be equal to the energy intensity of each vehicle type in Transportation Sector in 2007 that shown in detail in Table 1.

In this study, pertamax and pertamina plus is included in to gasoline oil type. While Pertamina dex is included in to diesel fuel. The number of diesel oil consumption in other sector is the total amount of diesel fuel that sold in general retail reduced by diesel oil consumption in the Transportation Sector and Industrial Sector.

Table 1. Intensity of Energy Consumption in Transportation Sector by Vehicle Type

No	Vehicle Type	Vehicles	Consumption 2007 (BOE)		Intensity (BOE/unit)	
		Amount (units)	Gasoline	Diesel	Gasoline	Diesel
1	Passengger Car	89.598	726.016,91	54.395,95	8,103048171	0,607111208
2	Motorcycle	1.012.319	1.015.229,49	-	1,002875072	-
3	Bus	21.232	-	184.879,16	-	8,70757159
4	Truck	38.537	289.707,28	253.314,81	7,517639671	6,573288268

Source: data processed from BPS and RUED DIY

3.1. Forecasting Analysis

In this research, the historical data are grouped according to the amount of time series data. The number of vehicles was obtained from years 2003-2012 (10 years). GDP data was obtained from the 2006-2012 years (7 years). While energy consumption data was obtained from the 2009-2012 DIY (4 years). Those time series data are devided model compiler and model examiner as shown in Table 2.

Table 2. Division Scenario of Data Model Compiler

Data	Historical Data	Model Compiler	Model Examiner
Number of Vehicles	2003-2012 (10)	2003-2008 (6)	2009-2012 (4)
GDRP	2006-2012 (7)	2006-2009 (4)	2010-2012 (3)
Energy Intensity	2009-2012 (4)	2009-2011 (3)	2012 (1)
Avtur Comsumption	2009-2012 (4)	2009-2011 (3)	2012 (1)

3.2. Selection of Forecasting Methods

The data used for forecasting were time series data on annual basis. If we look at the patterns of the four data groups, they have trend pattern that have a ascending or descending tendency. In this study, forecasting will be conducted until 2025 or 13 years to the future so that it includes long-term forecasting. According to Hanke and WICHERN (2005), for time series data that follows the long-term trends pattern, the recommended forecasting method is Exponential Trend Model, S-Curve Fitting, Gompertz Model or Growth Curve. S - Curve Fitting method and the Gompertz model is typically used to forecast new product that has the characteristics of slow growth at initial stage, rapid growth at growth stage, slow growth at maturity stage and the decline growth at final stage. To forecast energy demand, some kind of the energy consumption drivers are total population, number of vehicles and Gross Regional Domestic Product (GDRP) that always tend to increase over time. In this study, the forecasting method to be used is Trend Exponential Model and Growth Curve. For the Exponential Trend method, Linear Double Exponential Method with Brown's Single Parameter is choosen because when be seen from the plot history data, be obtained the data tend to linear trend rather than quadratic trend. Therefore, Linear Double Exponential Method with Brown's Single Parameter and Growth Curve Method will be compared.

3.3. Accuracy Testing Model

Forecasting results using Trend Exponential Model and Growth Curve Model were be tested for accuracy by Mean Squared Error (MSE). Guidelines used is a method that has a smaller MSE will be energy models used in the province of DIY. By comparing the calculation of the two methods of forecasting, MSE values are obtained respectively as shown in Table 3.

Table 3. Accuracy Comparison between Exponential Method and Growth Curve Method

No	Forecasting	Eksponensial		Growth Curve		Choosen
		α	MSE	Growth	MSE	Method
1	Industrial GDRP	0,9	43.977.255.656	1,69%	42.860.268.988	Growth Curve
2	Commersial GDRP	0,9	10.759.590.826	5,11%	83.383.536.828	Eksponensial
3	Other sector GDRP	0,9	98.174.420.994	4,53%	81.141.335.990	Growth Curve
4	Passenger car	0,7	10.048.373	0,44%	709.588.090	Eksponensial
5	Bus	0,5	4.521.528	28,59%	140.640.975	Eksponensial
6	Truck	0,9	2.241.052	4,27%	1.177.162	Growth Curve
7	Motorcycle	0,3	24.200.113.338	13,77%	45.724.951.010	Eksponensial
8	Electricity Intensity of Household	0,9	4,74785E-05	5,26%	2,42479E-05	Growth Curve
9	LPG Intensity of Household	0,9	9,39389E-05	12,92%	1,59454E-05	Growth Curve
10	Electricity Intensity of Commercial	0,1	7,31091E-20	-1,08%	1,96122E-18	Eksponensial
11	LPG Intensity of Commercial	0,5	1,9851E-17	-3,33%	2,20687E-17	Eksponensial
12	FO Intensity of Industry	0,5	1,52276E-22	-25,37%	1,61328E-19	Eksponensial
13	IDO Intensity of Industry	0,4	4,76351E-21	-77,41%	3,06709E-22	Growth Curve
14	ADO Intensity of Industry	0,4	1,5978E-20	15,76%	1,58251E-17	Eksponensial
15	Kerosene Intensity of Industry	0,7	1,82622E-21	8,02%	2,161E-20	Eksponensial
16	Electrical Intensity of Industry	0,1	6,76997E-19	-5,27%	4,0855E-17	Eksponensial
17	ADO Intensity of other sector	0,1	1,03234E-17	-2,90%	3,68082E-17	Eksponensial
18	Avtur Comsumption	0,8	251.226.304	3,97%	149.169.321	Growth Curve

4. Discussion

4.1 Model Assumptions

There are two scenarios that are used in seeing the possibility of energy supply in DIY, namely Basic Scenario and Renewable Energy. In the Basic Scenario, energy supply conditions during the forecasting period considered does not change with the condition of the base year. This means that the entire energy demand can always be met on the supply side. While on the Renewable Energy Scenario, the supply of electricity partially is supplied by solar power, wind energy, biomass and hydro power according to the renewable energy development target of the department of PUP–ESDM DIY as shown in Table 4. While the supply of biodiesel as mentioned on the target is a 0.5% (2015), 1% (2020) and 1.5% (2025) of the diesel oil consumption in that year.

The number of electricity transmission and distribution losses is determined by the percentage of difference between electricity production and electricity sold to consumers. The number of electricity transmission and distribution losses in 2012 was 7.52%.

Table 4. Development of Renewable Energy Target

No	Type	Target			
		2010	2015	2020	2025
1	Solar Power Plant	25 KWp	250 KWp	2000 KWp	3000 KWp
2	Hidro Power Plant	8 units (25 KW)	15 units (50 KW)	20 unit (60 KW)	25 units (750 KW)
3	Wind Power	20 KW	40 KW	80 KW	160 KW
4	Biogas	300 unit	1000 unit	2500 unit	5000 unit
5	Biodiesel	0	0,5% diesel	1% diesel	1,5% diesel
6	Biomassa	0	100 KW	500 KW	2 MW
7	energy self-sufficient village	0	2	6	10

Source: Department of Energy and Mineral Resources DIY PSP-2012

4.2. Energy Demand Forecasting by Sector User

Energy demand trend by sector user from 2012 to 2025 is shown in Figure 2. The picture showed that the final energy demand in 2025 will be dominated by demand from the transportation sector, followed by the household sector and the commercial sector. In that period, the final energy demand will grow 5.41% per year. Annual demand growth by user sector will be; household (9.94%), transportation (4.03%), other sector (3.87%), commercial (3.5%) and industry (2.82%). With this growth, the share of final energy demand will be dominated by the transportation sector (52.37%), followed by household sector (32.70%), commercial sector (8.26%), other sector (4.64%) and industrial sector (2.04%) in 2025.

In accordance with the development of energy targets DIY in 2025, it was found that the renewable energy mix is only 0.52% of total final energy consumption of fuel and LPG. The low value of the energy mix encourages energy conservation efforts, especially in the transportation and household.

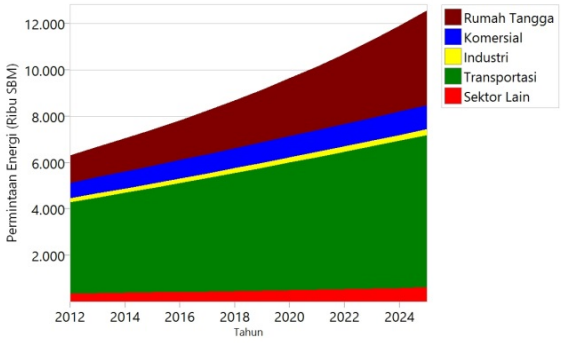

Figure 2. Demand forecasting by user sectors

4.2.1. Household Sector

The household sector is the second largest energy user sector after transportation sector. The share of this sector demand (except biomass) reached 18.92% in 2012. Energy utilization of household sector is associated with electrical power for lighting, air-conditioning, electronic equipment and thermal energy for cooking. Thermal energy need is met by the combustion of LPG and firewood for rural areas.

Currently domestic energy demand (except biomass) is dominated by electricity and LPG. With the kerosen to LPG conversion programme, the energy demand of household sector will not be met by kerosene as a source of thermal energy and lighting. In the 2012-2025 period, the household sector demand will grow 9.94% per year (Figure 3). Factors driving growth in the household sector energy demand is population growth and purchasing power (GDP per capita). Household sector energy demand will increase in line with growth in GDP per capita and access to energy.

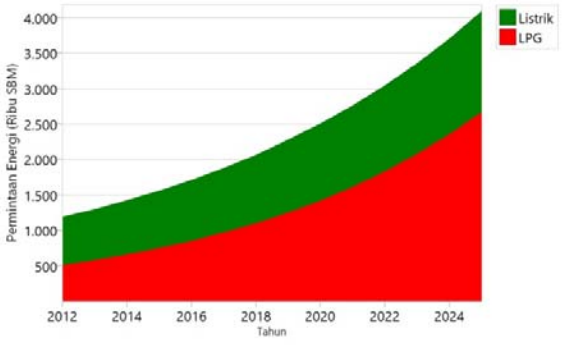

Figure 3. Demand forecasting of household sector

Increasing of purchasing power will also affect the type of energy used. The more capable of a family, the type of energy used will shift to the more modern types of energy. The prominent increasing in 2012-2025 is LPG demand that will be an average of 13.55% per year in line with the increase in population, purchasing power and access to energy.

4.2.2. Commercial Sector

Commercial sector includes shops, hotels, restaurants, office buildings and hospitals. Many types of energy used in this sector is electric power for conditionning room temperature, lighting and supplying other electrical equipment. Energy demand of commercial sector will grow 3.5% per year. Energy demand in this sector will grow in line with the development of the commercial sector in DIY in the future. Energy demand trend of commercial sector is shown in Figure 4. The dominant type of energy used is electrical. In 2025 the share of this sector demand will decrease to 8.26%.

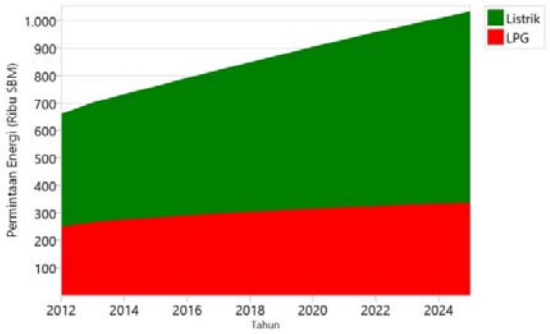

Figure 4. Demand forecasting of commercial sector

4.2.3. Industrial Sector

The Industrial Sector is the smallest energy user sector. Industrial energy demand is associated with the use of energy for production purposes include propulsion equipment, material removal, heating, drying and conditioning room. Type of energy source used for mechanical and room conditioning is generally electrical power. Demand of electrical energy is met by the state power company and the captive power.

Final energy demand trend of industrial sector by type is shown in Figure 5. Figure 5 shows that the energy consumption of the industrial sector will be dominated by electric and diesel oil. Meanwhile, fuel oil, kerosene and diesel oil tend to have negative growth so that the consumption of those energy types are zero in 2025. The share of energy types in the Industrial Sector in 2025 is very different from the share in 2012. In 2025, the share of electricity consumption will be 56.92% and diesel oil will be 43.08%. Increasing of diesel oil and decreasing of electricity share are expected due each industries want to increase the electricity supply reliability to minimize the effect of power outages on production. That encourage the industries to have their own generator operated by diesel fuel.

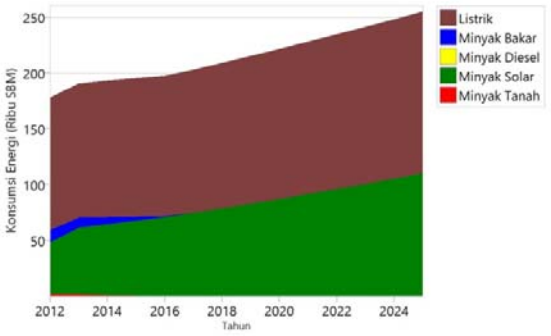

Figure 5. Demand Forecasting of Industrial Sector

4.2.4. Transportation Sector

The Transportation Sector is the largest sector of energy demand. Driver factor of energy demand growth in this sector is economic growth (GDP) and population growth. The increasing of GDP and population growth determine the transportation growth and vehicle purchasing power which will affect the level of energy demand.

Currently, type of energy used by this sector is almost fuel oil. The use of electricity and gas as a transportation energy source is still very small. To reduce dependence of fuel oil that is increasingly expensive, some effort will be made by using biodiesel and increasing the efficiency of the Transportation Sector through the improvement of transportation infrastructures and traffic management.

The growth of energy demand in the Transportation Sector 2012-2025 will be approximately 4.03%. Energy demand trend in transportation sector is shown in Figure 6. Energy demand by type will not shift from the current state in which the whole is fuel.

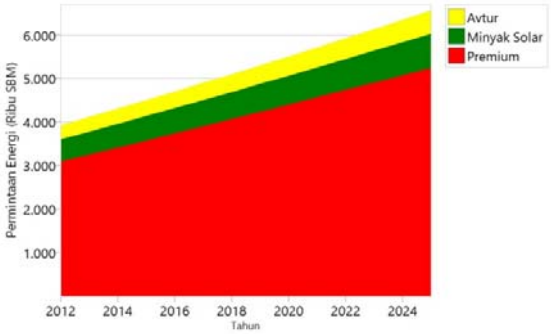

Figure 6. Demand Forecasting by Energy Type

4.2.5. Other Sector

Energy demand of agriculture, construction and mining sector in 2012-2025 will grow by an average 3.87% per year (Figure 7). Type of energy used in this sector is the fuel for the propulsion of agricultural equipment such as tractors, water pumps, boats, and other mining equipment.

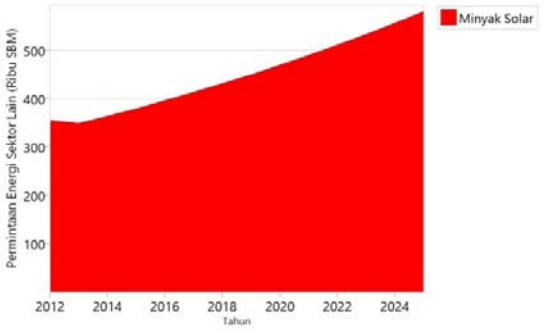

Figure 7. Demand forecasting of other sector

4.3. Energy Demand by Type

According to the type of energy, energy demand in 2012 was dominated by fuel oil (68.72%) followed by electricity (19.24%) and LPG (12.04%). In 2025, the type of energy demand that will rapidly growing is LPG. Energy demand trend by type in 2012-2025 is shown in Figure 8. The average growth of final energy demand by type as follows; fuel oil (3.94%), LPG (11.20%) and electricity (4.89%). By that growth in 2025, the share of energy demand (except household biomass) will be; fuel (57.89%), LPG (23.97%) and electricity (18.14%).

Some things that can be explained from the forecasting of final energy share by type in 2012 compared to the condition in 2012 are; the fuel oil share will decrease from 68.72% to 57.89% while LPG will increase from 12.04% to 23.97%. The decreasing of fuel oil demand share mainly is caused by kerosene to LPG conversion programme.

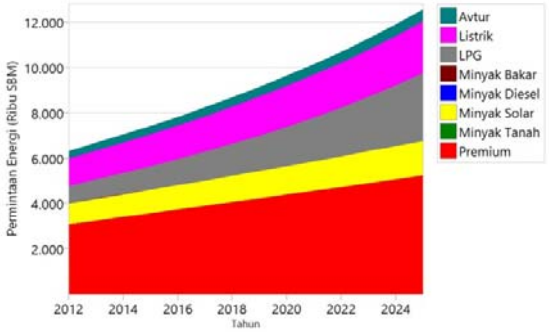

Figure 8. Demand Forecasting by Type

4.3.1. Fuel Oil Energy Demand by Type

Fuel oil is the dominant type of final energy in Indonesia. This energy type is used in transportation, industrial and other sector. In 2012, the largest consumer of fuel oil was the transport sector (90.45%), followed by other sector (8.19%) and industrial sector (1.36%). In 2012-2025, fuel demand grow by an average 4.03% per year (Figure 4.9). Growth in fuel demand by sector in the period are as follows; industrial sector (4.96%), transportation sector (4.03%) and other sector (3.87%). By that growth number, share of each sectors in 2025 will be; transportation sector (90.47%), industrial sector (1.52%) and other sector (8.02%). The usage share when compared to previous years tend not to change much. The high share of fuel in the transportation sector occurs due to the positive energy demand growth in transportation sector while the penetration of alternative fuels is still relatively low.

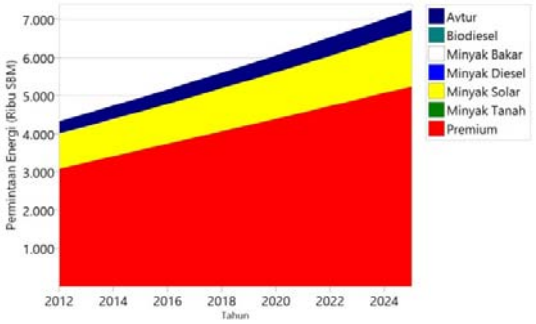

Figure 9. Demand forecasting of fuel oil

4.3.2. LPG

LPG is used in household and commercial sectors. The dominant sectors in the use of LPG is the household sector (67.30%) followed by the commercial sector (11.18%). During 2012-2025, demand for LPG will increase quite rapidly by an average 11.15% per year (Figure 10). This will happen due to mainly the implementation of the kerosene to LPG conversion programme. By such growth, in 2025 the share of LPG demand by user sectors will be; household (88,82%) and commercial (11,18%).

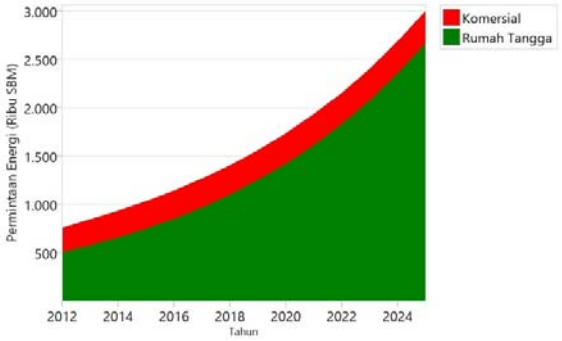

Figure 10. Forecasting of LPG demand

4.3.3. Electricity

Electrical energy is used only in the household sector, the commercial sector and industrial sector. While other sector and the transportation sector do not use electricity. In 2012, the largest consumer of electricity was the household sector (56.22%), followed by the commercial sector (34%) and industrial sector (9.78%). That share is just the electricity purchased from the PLN. The average of electricity demand growth (2012-2025) will be 4.94% per year (Figure 11). By that growth, the share of electricity demand in 2025 is; household sector (62.87%), commercial sector (30.74%) and industrial sector (6.39%). Electricity demand in future will grow in line with economic and population growth.

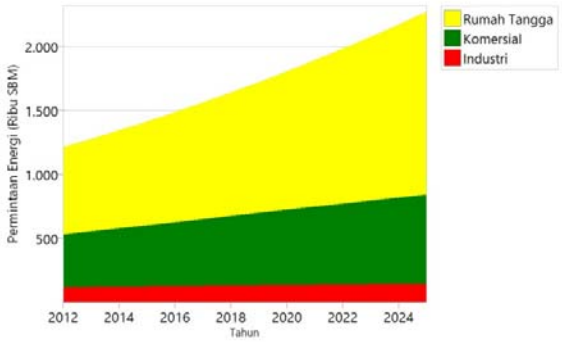

Figure 11. Forecasting of Electricity Demand

4.4. Energy Supply

4.4.1. Supply of Fuel Oil and Gas

Fuel and gas distribution channels in DIY are supplied directly from the fuel processing unit at Cilacap using pipelines to the Depot Marketing Rewulu. Fuel supplied is in the form of gasoline, diesel, kerosene, oil and gas. From depot Rewulu, gasoline and diesel oil are directly distributed to the General Fuel Filling Station (Gas Station). Then from gas stations and oil dealer, the fuel is distributed to consumers. Especially for kerosene, it is only intended for industries and not sold in the retailers.

In 2012, the department of PUP-ESDM DIY noted that the number of retail outlets in DIY was 89 units spread in each regencies and municipality. The spread of gas stations in the province of DIY was as follows ; 16 of Yogyakarta municipality, 30 units of Sleman, 20 units of Bantul, 10 units of Kulonprogro and 12 units of Gunungkidul. Gas is supplied directly from UP IV Cilacap than distributed to dealers, retailers and consumers. In 2012, the number of gas station in DIY was 41 units and spread as follows; 16 units of Sleman, 12 units of Yogyakarta municipality, 8 units of Bantul, 4 units of Kulonprogro and 1 unit of Gunungkidul.

On the supply side (Figure 12), it is assumed that the condition of the fuel and gas supply over the forecast period is equal to the condition of the fuel and gas demand in the base year which is supplied directly from the processing unit at the Cilacap oil and gas using pipelines towards Depo Marketing Rewulu then distributed to gas stations agencies in DIY.

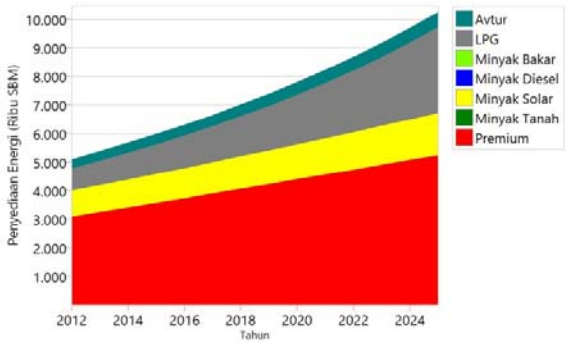

Figure 12. Forecasting of fuel and LPG supply

4.4.2 Electricity Supply

DIY electricity system is in Java, Madura, Bali interconnection system (JAMALI) that covering seven provinces in Java and Bali. This system is an interconnected system with a network of 500 kV extra high voltage that runs throughout Java and Bali. This system is interconnected system in Indonesia.

PT. PLN (Persero) APJ Yogyakarta duty is to serve the electricity needs of the DIY community. In 2012, electricity production of DIY was 2,210 GWh. The electricity sold was 2,044 GWh. So, the total losses was 7.52%. Electrical production capability of DIY was 516.8 MW (Table 5). In 2025 electricity production needed will be 2,243,572 BOE (Figure 13), thus it will requiring a substation with a total capacity of 418 MW. Practically, the transformer should not be operated more than 80% of its capacity. So that in 2025 it will be required at least 522 MW capacity. To meet the increasing demand of electricity production, it will need to increase PLN substation capacity.

Table 5. Substation capacity of DIY

No	Substation	Address	Capacity
1	KENTUNGAN	JL.Kaliurang Kentungan Sleman	120 MVA
2	BANTUL	JL.Parangtritis Druwo Sewon Bantul	120 MVA
3	GEJAYAN	JL. Afandi Gejayan Yogyakarta	120 MVA
4	GODEAN	Sidomoyo Godean Sleman	60 MVA
5	WIROBRAJAN	JL. RE Martadinata Wirobrajan Yogyakarta	60 MVA
6	MEDARI	Malang Caturharjo Sleman	60 MVA
7	WATES	JL Raya Pantai Glagah Wates	46 MVA
8	SEMANU	Mijahan Semanu Gunungkidul	60 MVA

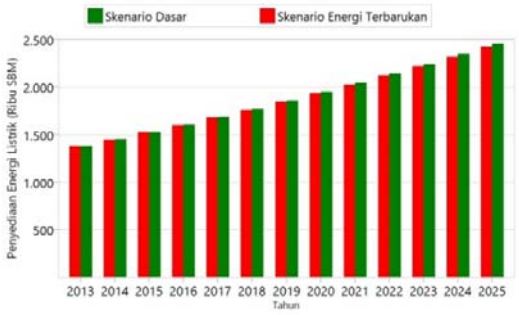

Figure 13. Forecasting of Electricity Supply

In the Renewable Energy Scenario, electricity production is partly derived from renewable energy infrastructure in accordance with the development plan of renewable energy targets established in 2025. So the amount of the supply of electrical energy on Renewable Energy Scenario will be smaller than the Base Scenario. The contribution of electricity generation from wind power, solar, micro-hydro and biomass is 32,051 BOE.

4.5. Energy Balance of DIY in 2025

In 2025, the total demand will be 12,565.93 thousand BOE. It's amount is twice the energy demand in 2012. Energy demand in 2025 include household sector (4101.57 thousand BOE), commercial sector (1035.76 thousand BOE), industrial sector (255.54 thousand BOE), transportation sector (6568.92 thousand BOE) and other sector (582.05 thousand BOE).

Table 6. Energy balance of DIY in 2025

	LPG	Wind	Solar	Hydro	Biomass	Premium	M. Solar	M.Diesel	Listrik	Avtur	Biodiesel	Total
Production	-	0,87	16,27	4,07	10,85	-	-	-	-	-	-	32,05
Imports	3.007,12	-	-	-	-	5.249,43	1.472,79	-	2.428,64	538,85	22,09	12.718,92
Exports	-	-	-	-	-	-	-	-	-	-	-	-
Total Primary Supply	**3.007,12**	**0,87**	**16,27**	**4,07**	**10,85**	**5.249,43**	**1.472,79**	**-**	**2.428,64**	**538,85**	**22,09**	**12.750,97**
Pembangkit Listrik	-	-0,87	-16,27	-4,07	-10,85	-	-	-	32,05	-	-	-
Transmisi dan Distribusi	-	-	-	-	-	-	-	-	-185,04	-	-	-185,04
Total Transformation	**-**	**-0,87**	**-16,27**	**-4,07**	**-10,85**	**-**	**-**	**-**	**-152,99**	**-**	**-**	**-185,04**
Energi Fosil	3.007,12	-	-	-	-	5.249,43	1.472,79	-	2.275,65	538,85	-	12.543,84
Rumah Tangga	2.670,80	-	-	-	-	-	-	-	1.430,78	-	-	4.101,57
Komersial	336,33	-	-	-	-	-	-	-	699,43	-	-	1.035,76
Industri	-	-	-	-	-	-	110,09	-	145,45	-	-	255,54
Transportasi	-	-	-	-	-	5.249,43	780,65	-	-	538,85	-	6.568,92
Sektor Lain	-	-	-	-	-	-	582,05	-	-	-	-	582,05
Energi Terbarukan	-	-	-	-	-	-	-	-	-	-	22,09	22,09
Biodiesel	-	-	-	-	-	-	-	-	-	-	22,09	22,09
Total Demand	**3.007,12**	**-**	**-**	**-**	**-**	**5.249,43**	**1.472,79**	**-**	**2.275,65**	**538,85**	**22,09**	**12.565,93**
Unmet Requirements	0,00	-	-	-	-	0,00	0,00	-	0,00	-	-	0,00

The user sector that has the greatest demand growth is household sector (9.94%), followed by the transportation sector (4.03%), other sector (3.87%), commercial sector (3.5%), and the industrial sector (2.82%). In the column of energy demand, the fuel most widely used is gasoline or premium (5249.435 thousand BOE), followed by LPG (3007.12 thousand BOE), electricity (2275.65 thousand BOE) and diesel oil (908.49 thousand BOE).

On the transformation side, there are two main parts: the Power Plant and Transmission and Distribution. At the power plant, all of the renewable energy infrastructure is assumed to work properly and able to generate electrical energy in accordance with their capacity. Energy sources here include wind, solar, hydro and biomass power plants. All the renewable energy sources was produced alone because there is the potential that exceeds the capacity of the installed infrastructure. The energy produced from electricity generation is used to meet electricity demand. In 2025, production of the Power Plant will be 32.05 thousand BOE.

On the Transmission and Distribution side, losses value is included based on annual kWh production and kWh sold from PT. PLN APJ Yogyakarta. For forecasting until 2025, losses number used in 2012 was 7.52%. In 2025, Transmission and Distribution will be 185.04 thousand BOE. The existence of transmission losses make the electricity import greater than the demand to compensate these losses.

On the Primary Supply, due to the production is smaller than the demand, the majority of energy is supplied from outside DIY. On the Production side, only renewable energy sources are there because most energy sources are imported from outside DIY. The energy imported from outside will be 12718.92 thousands of DIY, while the energy produced only by 32.05 thousand BOE.

4.6. Energy Mix 2025

The final energy consumption in DIY for the type of fuel and LPG in 2025 will be 10,268.1 thousand BOE. In addition, if the renewable energy development targets of DIY are achieved so as to produce 32.1 thousand BOE of energy for the year, the number of the energy mix in 2025 will be 0.53%.

5. Conclusion

Based on the analysis done, several conclusions can be drawn as follows :

a. The forecasting of energy demand by sector users shows that in 2025, transportation sector is the largest energy user sector share in DIY in the amount of 52.37% followed household sector (32.70%), commercial sector (8.26%), other sector (4.64%) and the Manufacturing Sector (2.04%).
b. The forecasting of energy demand by type shows that in 2025, the premium is the greatest type of energy demand (41.8%), followed by LPG (23.97%), electricity (18.14%) and diesel (11, 74%).
c. The high level of energy consumption of the transportation sector is caused by increasing number of vehicles particularly motorcycles and passenger cars considering DIY is a student and tourism city. In addition, it also shows that the fuel oil is still the main source of energy for the DIY community activities. From the supply side, most of the energy needs in the province of DIY are supplied from outside region.
d. If the renewable energy development targets of DIY are achieved, the number of renewable energy mix will be 0.53% in 2025.

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