



Contributing to poverty Alleviation through Regional Energy Planning in Indonesia

REGIONAL ENERGY

BASE LINE

CENTRAL JAVA PROVINCE

Final Draft

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Provinsi Jawa Tengah**

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1 General Condition of Central Java

1.1 Introduction

Central Java consists of 29 regions and 6 municipalities. The documentation in 2005 recorded that Central Java covered 3.25 million hectares or approximately 25.04% of the area of Java Island (1,07 percent of Indonesia). The area consists of 996 thousand hectares (30.60 %) of paddy field, 2,26 million hectares (69,40 %) of non – paddy field. Compared to previous year, the paddy field area decreased for about 0.02 % in 2005, on the contrary, the non – paddy field area increased for about 0.001%.

According to Class I of Climatology Station in Semarang, the average temperatures of Central Java in 2005 were about 24.80C to 31.80C. Places near the beach had relatively higher temperature. The humidity varied from 77% until 85%. The highest rainfall was recorded in Sempor, Kebumen for about 3,948 mm and Cilacap was recorded as the city with most days of rain, 277 days.

The population in Central Java Province reached 33 million people with 21% of the total population still under the poverty line. In 2005, the energy supply reached 2.9 million SBM which consisted of petroleum, hydro energy, and solar energy. The average ratio of electrification in Central Java in 2005 was still low, It was 66.69% and almost 60% of the population lived at the country side or in rural areas.

Based on the constant value of year 2000, in 2005 The Gross Regional Domestic Product (GRDP) was 133,631,137.52 million Rupiah. Manufacturing industry had the largest contribution toward the GRDP, about 27,45%. On the regional level, the region which has the highest income was Cilacap Region with about 12,309,252.20 million Rupiah and Semarang region with about 18,862,418.32 million Rupiah. The annual GRDP growth increased about 0.1%, from 4.9% in 2004 to 5% in 2005.

1.2 The Macro and Socio Economy in Central Java

1.2.1 Geographic Location

The Central Java Province is located between two big provinces, West and East Java Province. It lies between 5⁰40' and 8⁰30' South Latitude and between 108⁰30' and 111⁰30' East Longitude (including Karimunjawa Island). The furthest distance from west to east is 263 km and from north to south is 226 km (not including Karimunjawa Island).



Figure 1.1 Central Java Map

1.2.2 Governmental System and Administrative Structure

The Central Java Province is headed by a governor and a vice governor. Central Java comprises of 29 regions and 6 cities and consists of 566 sub district and 8.568 villages.

1.2.3 Demographic Condition

In 2005 the population of Central Java Province was estimated at about 32.91 million people. The amount of female citizens is greater than male citizens; this is shown by the gender ratio of 98.96. In 2005, the amount of households was 8,64 million families; with 3.8 people per family .

Table 1.1
The population based on the income

Area	Income Group	Population (people)		
		1999	2002	2005
Urban	Under Poverty Line	2.036.096	3.543.470	2.728.309
	Under 1.5 times Poverty Line	2.329.484	2.786.752	2.874.282
	Average	5.090.240	4.466.513	5.114.855
	20% highest	2.360.586	2.697.532	2.679.651
	Sub Total	11.816.406	13.494.267	13.397.097
Rural	Under Poverty Line	3.296.734	4.541.414	4.294.625
	Under 1.5 times Poverty Line	4.341.736	4.857.540	4.665.350
	Average	7.519.248	5.160.447	6.655.683
	20% highest	3.787.097	3.638.198	3.896.095
	Sub Total	18.944.815	18.197.599	19.511.753
Total		30.761.221	31.691.866	32.908.850

Sumber : Data Olahan BPS Jawa Tengah 2006

Based on the table above, the diagram can be drawn as in figure 1.2 and it shows there has been a change in terms of urban population in 1999 – 2005 period; in 2002 the population increased while in 2005 it decreased.

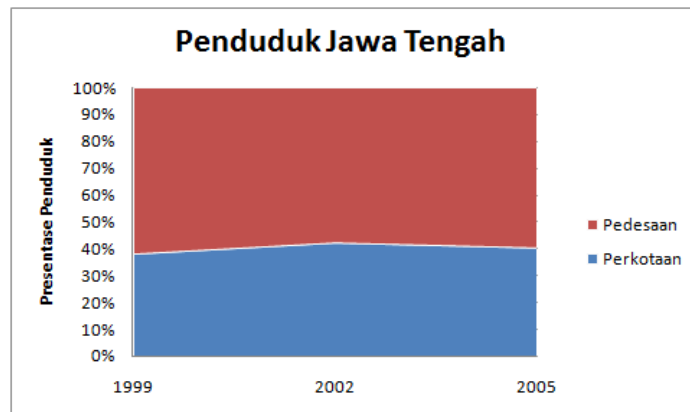


Figure 1.2 the graphic by percentage of Central Java Population

1.2.4 Economy

The growth of Gross Regional Domestic Product (GRDP) of Central Java Province in 2005, based on constant value of 2000, is higher than the previous year that is 5.35% (5.13% in 2004, see table 1.2). The inflation rate in Semarang in 2005 was 16.46% lower than the national inflation rate (17.11%). But, in 2004, the inflation increased 5.98%.

Tabel 1.2
The growth of GRDP and Inflation

No		2001	2002	2003	2004	2005
1	The growth of GRDP (%)	3,48	3,04	4,76	4,9	5
2	Inflation (%)	13,98	13,56	6,07	5,98	16,46

Sources; Jawa Tengah dalam Angka 2005

The real sector growth in 2005 experienced a fluctuation compared to the previous year. The highest growth reached by electricity and clean water sectors as much as 10.78%, although its contribution to the GRDP was only 0.82%. Agriculture sector contributes about 19.11% to GRDP. Manufacturer industrial sector contributed 33.71%, Commerce, hotel, and restaurant factors contributed at about 19.92%. The GRDP data for each sector from 2001 until 2005 can be seen in table 1.3 below.

Table 1.3
Central Java's Gross Regional Domestic Product
Based on each sector in 2001-2005

No	Sectors	GRDP (in Million Rupiah Constant 2005)				
		2001	2002	2003	2004	2005
1	Agriculture	26.417.424	27.725.086	27.157.596	28.606.237	29.924.643
2	Mining	1.190.372	1.227.652	1.295.356	1.330.760	1.454.231
3	Manufacturer Industry	30.737.651	31.957.829	33.496.797	35.464.673	36.685.630
4	Public services (Utilities)	872.604	975.869	980.307	1.065.115	1.179.892
5	Construction services	5.532.343	6.116.817	6.907.250	7.448.715	7.960.948
6	Commercial services	26.773.496	27.262.408	28.658.037	29.363.184	31.137.477
7	Transports	5.577.205	5.872.916	6.219.923	6.510.447	6.988.426
8	Financial services	4.420.388	4.524.128	4.650.802	4.826.241	5.067.666
9	Social services	10.868.007	10.140.012	11.949.959	12.643.261	13.232.226
	Total	112.389.490	115.802.718	121.316.027	127.258.633	133.631.138

Reference: Jawa Tengah dalam Angka 2006, BPS

1.3 Each Sector Explanation

1.3.1 Household Sector

Central Java Province consists of 29 regions and 6 municipalities, and the population of Central Java Province in 2005 was 32,908,850 people with a population density of 1,011.21 people/km. Table 1.4 below shows the population and population density in every region.

Tabel 1.4

The population condition in each region of Central Java

No	Regions/Cities	Population (People)	Family (Head of Family)	Regional area (km ²)	Population Density (people/km ²)
1	Reg. Cilacap	1.674.210	425.856	2.138,51	782,89
2	Reg. Banyumas	1.531.737	400.384	1.327,59	1.153,77
3	Reg. Purbalingga	863.478	222.640	777,65	1.110,37
4	Reg. Banjarnegara	903.919	225.153	1.069,74	844,99
5	Reg. Kebumen	1.208.486	311.488	1.282,74	942,11
6	Reg. Purworejo	712.003	201.312	1.034,82	688,05
7	Reg. Wonosobo	779.919	204.944	984,68	792,05
8	Reg. Magelang	1.169.638	203.369	1.085,73	1.077,28
9	Reg. Boyolali	941.624	255.488	1.015,07	927,64
10	Reg. Klaten	1.139.218	311.200	655,56	1.737,78
11	Reg. Sukoharjo	838.149	240.224	466,66	1.796,06
12	Reg. Wonogiri	1.010.456	277.312	1.822,37	554,47
13	Reg. Karanganyar	834.265	226.608	772,20	1.080,37
14	Reg. Sragen	868.036	248.400	946,49	917,11
15	Reg. Grobogan	1.334.380	381.056	1.975,85	675,34
16	Reg. Blora	840.729	242.727	1.794,40	468,53
17	Reg. Rembang	588.320	161.350	1.014,10	580,14
18	Reg. Pati	1.213.664	331.092	1.491,20	813,88
19	Reg. Kudus	759.267	181.511	425,17	1.785,80
20	Reg. Jepara	1.077.586	269.744	1.004,16	1.073,12
21	Reg. Demak	1.071.487	284.396	897,43	1.193,95
22	Reg. Semarang	894.018	238.510	946,86	944,19
23	Reg. Temanggung	717.486	178.326	870,23	824,48
24	Reg. Kendal	897.560	235.360	1.002,27	895,53
25	Reg. Batang	712.542	165.966	788,95	903,15
26	Reg. Pekalongan	858.650	190.060	836,13	1.026,93
27	Reg. Pemasang	1.371.943	352.595	1.011,90	1.355,81
28	Reg. Tegal	1.471.043	367.882	879,70	1.672,21
29	Reg. Brebes	1.814.274	460.648	1.657,73	1.094,43
30	City Magelang	130.732	36.420	18,12	7.214,79
31	City Surakarta	534.540	144.640	44,03	12.140,36
32	City Salatiga	175.967	48.736	52,96	3.322,64
33	City Semarang	1.435.800	384.225	373,67	3.842,43
34	City Pekalongan	284.112	67.976	44,96	6.319,22
35	City Tegal	249.612	61.710	34,49	7.237,23
Total		32.908.850	8.539.308	32.544,12	1.011,21

Sumber: BPS, Jawa tengah dalam angka 2005

1.3.2 Commercial Sector

Commercial Sector consists of tradings, hotels, restaurants, financial services, amusement services, and social services. The growth of commercial sectors can be seen in table 1.5 below:

Table 1.5
GRDP of Commercial Sector

No	Sub sector	GRDP (Million Rupiah, Constant Value in 2005)				
		2001	2002	2003	2004	2005
1	Trading	21.825.611	22.115.904	23.398.087	23.663.715	24.971.531
2	Hotels	443.517	465.075	483.284	514.205	541.222
3	Restaurants	3.544.215	3.708.764	3.785.101	4.165.125	4.544.209
4	Financial Services	4.420.388	4.524.128	4.650.862	4.826.541	5.067.666
5	Amusement Services	93.204	93.361	93.765	95.258	98.649
6	Social Services	866.949	879.305	897.800	924.882	981.865
	Total	31.193.885	31.786.537	33.308.899	34.189.726	36.205.143

Reference:; Jawa Tengah dalam Angka 2005

In 2005, trading sector dominates the commercial sector with 68.97%, the next is financial sector with 14%, restaurants 12.55%, Social Services 2.71%, Hotels 1.49%, Amusement services 0.27%. The figure 1.4 shows the comparison of each sector

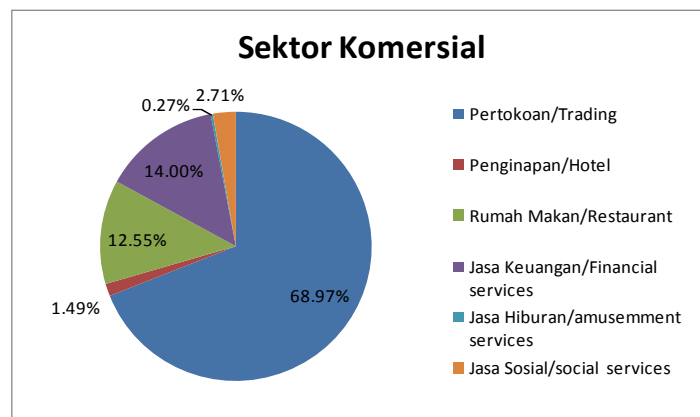


Figure 1.4 Commercial sector percentage

1.3.3 Industrial Sector

The Industrial sector consists of sub sectors as production and processing of food, textile, wood, paper, chemicals, non metal, metal, machinery, and others. The added value of industrial sectors can be seen in table 1.6 below.

Table 1.6
GRDP of Industrial sectors

No	Sub sector	Value Added (Million Rupiah Constant 2005)				
		2001	2002	2003	2004	2005
1	Food	17.074.862	17.900.928	18.739.942	20.067.363	20.610.450
2	Textile	5.536.361	5.635.440	5.870.075	6.105.705	6.404.648
3	Wood	4.034.943	4.199.082	4.380.341	4.578.326	4.784.525
4	Paper	399.566	399.019	420.229	448.359	460.693
5	Chemicals	1.664.175	1.659.125	1.790.040	1.872.534	1.934.008
6	Non Metal	1.002.493	1.081.275	1.144.682	1.187.761	1.241.181
7	Metal	96.926	104.201	105.981	107.618	115.670
8	Machinery	799.181	841.111	895.639	940.595	973.141
9	Others	129.144	137.649	149.867	156.411	161.314
Total		30.737.651	31.957.829	33.496.797	35.464.673	36.685.630

Reference:; Jawa Tengah dalam Angka 2005

From the table above, it can be seen that Food industry dominates among other sub sectors from 2001 – 2005, in 2005, the percentage of food industry is 56.18%, 17.46% for textile, 13.04% for wood, 5.27% for chemicals, 3.38% for non metal, 2.65% for machinery, 1.26% for paper, 0.44% for others, and the least percentage was Metal Sector of 0.32%. The percentage comparison of those sectors can be seen in figure 1.5 below.

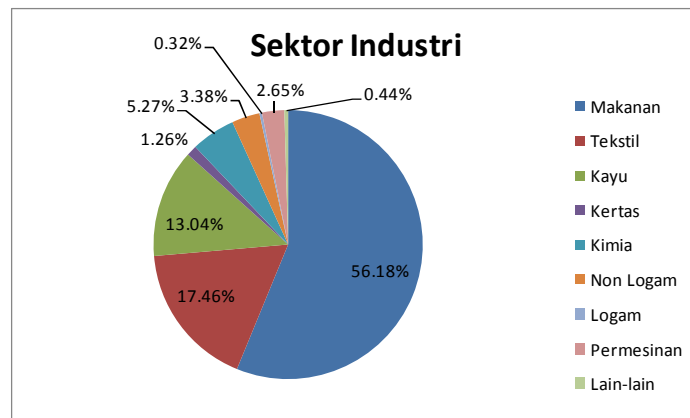


Figure 1.5 Industrial Sector Percentages

1.3.4 Transportation Sector

The transportation facilities in Central Java consist of Land, Sea and Air transportation. The land transportations are road transportation and trains, while sea transportation consists of crossing transportation by ferry and ships. The transportation facility data from 2001 – 2005 can be seen in table 1.7 below.

Table 1.7
Transportation Data

No	Kinds of Transportation	2001	2002	2003	2004	2005
1	Passenger cars (unit)	317.900	357.874	402.875	453.535	510.565
2	Motorcycle (unit)	2.593.327	2.840.443	3.005.861	3.889.864	4.392.651
3	Bus (unit)	33.883	35.611	38.719	38.158	41.530
4	Truck (unit)	75.091	84.533	95.163	107.129	110.882
5	Train (1000 km)	2.206	1.994	1.961	2.402	2.304
6	Ferry (hours)	4.346.420	4.816.540	4.273.420	3.979.960	3.952.220
7	Ships (hours)	7.355.480	7.938.020	7.635.800	7.957.000	8.262.140
8	Airplane (1000 km)	4.729	4.480	5.191	6.326	5.895

Reference: Jawa Tengah dalam Angka 2005, BPS

1.3.5 Other Sector

Others sector consists of agriculture, mining, and construction sectors. From year to year, the share of the agriculture sector decreased due to the increasing number of population and the swift from agriculture sector to industrial sector. The data of Gross Regional Income from 2001 to 2005 can be seen in table 1.8 below.

Table 1.8
GRDP of Others Sector

No	Subsektor	ValueAdded (Juta Rupiah Konstan 2005)				
		2001	2002	2003	2004	2005
1	Agriculture	26.417.424	27.725.086	27.157.596	28.606.237	29.924.643
2	Mining	1.190.372	1.227.652	1.295.356	1.330.760	1.454.231
3	Construction	5.532.343	6.116.817	6.907.250	7.448.715	7.960.948
	Total	33.140.139	35.069.555	35.360.203	37.385.712	39.339.822

Reference: Jawa Tengah dalam Angka 2005

In 2005, the agriculture sector had still the highest percentage compared to other sectors, the percentage is 76.07 %, the next is Construction sector with percentage of 20.24% and the smallest percentage (3.70%) is mining sector. See figure 1.6 below, for a clearer explanation.

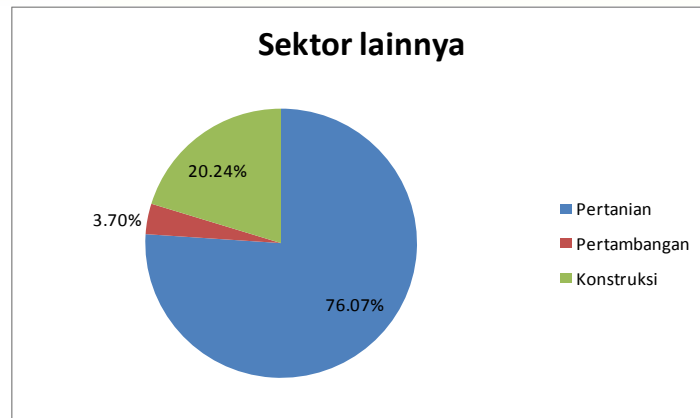


Figure 1.6 Percentage of Others Sector

2 PRIMARY ENERGY SUPPLY

2.1 Domestic Resources

2.1.1 Crude Oil

The Oil production in 2005 was still on a small scale, this is due to the production method that was still done by the citizen (people’s mining). The petroleum production in 2005 can be seen in table 2.1 below.

Table 2.1

Petroleum Production of Central Java in 2005

No	Company	Location	Production (Barrel/Year)
1	People’s mining	Cepu	829,53
Total			829,53

Reference:: Pertamina

2.1.2 Renewable Energy

The renewable energy sources in Central Java Province are hydro and solar energy. The use of hydro energy is divided into two uses; those are small scale and big scale usage. The big scale usage of hydro energy in Central Java is shown in the table 2.2 below.

Table 2.2

Big Scale of Hydro Energy usage

No	Name	Location	Discharged Capacity (MW)	Production (MWh/year)
1	PLTA Jelok	Jelok	20,48	125.583
2	PLTA Timo	Timo	12,00	73.584
3	PLTA Ketenger	Ketenger	8,04	49.301
4	PLTA Garung	Garung	26,40	115.632
5	PLTA Wadaslintang	Wadaslintang	16,80	73.584
6	PLTA Mrica	Mrica	180,90	380.000
7	PLTA Kedungombo	Kedungombo	22,50	70.746
Total				888,431

Reference:: RUPED Jateng 2005

Table 2.3 shows the small scale usage of water energy.

Table 2.3
The small scale hydro usage

No	Villages	District	Region	Discharged Capacity (kW)
1	Purbasari	Karangjambu	Purbalingga	40
2	Tripis	Watumalang	Wonosobo	50
3	Giyombong	Bruno	Purworejo	10
4	Kalissalak	Kd Banteng	Banyumas	10
5	Sidoarjo	Doro	Pekalongan	24
6	Mudal	Temanggung	Temanggung	20
7	Tanjung	Mlongo	Jepara	104
Total				258

Reference:: RUPED Jateng 2005

Central Java Province also has potential geothermal energy. This geothermal energy can be changed into electric energy which can be used to supply the electricity need in Central Java. In 2005, Central Java Province only had one geothermal energy generator that is in Dieng with 60 MW capacities. The potential of other districts can be seen in table 2.4.

Table 2.4
The potential of geothermal energy in Central Java

No	Location	Discharged Capacity (MW)	Reserves (MWe)			Resources (MWe)	
			Proven	Probable	Possible	Hypothesis	Speculative
1	Banyugaram, Cilacap	-	-	-	-	-	100
2	Bumiayu, Banyumas	-	-	-	-	-	25
3	Batu Raden, Banyumas	-	-	185	-	-	-
4	Guci, Tegal	-	-	100	-	-	-
5	Mangunan Wanayasa, Banjarnegara	-	-	92	-	-	-
6	Candradimuka, Wonosobo	-	-	-	-	-	25
7	Dieng, Wonosobo	60	280	185	115	200	-
8	Krakal, Kebumen	-	-	-	-	-	25
9	Panulisan, Cilacap	-	-	-	-	-	25
10	G.Ungaran, Semarang	-	-	52	-	50	-
11	G.Umbul Telomoyo, Semarang	-	-	-	-	92	-
12	Kuwuk, Grobogan	-	-	-	-	-	25
13	G.Lawu, Karanganyar	-	-	-	-	-	25
14	Klepu, Semarang	-	-	-	-	-	25
Total		60	280	614	115	342	275

Reference:: RUPED Jateng 2005

2.2. Import / Export Trading

2.2.1 Crude Oil

Most of the petroleum which is produced in the oil refineries in Central Java Province is not from Central Java, The amount of imported petroleum is 107,686.37 thousand Barrel which is produced in Cilacap oil refinery. In 2005, the Cepu block has not been operated, so the petroleum is still produced in small scale, consequently, there was no petroleum export.

2.2.2 Electricity

The electricity system in Central Java is a Java – Bali interconnection electricity system, thus, there will be electricity export and import from other areas. However, in 2005, electricity production was still too low to satisfy all demand in Central Java, so Central Java imported the electricity from other areas for as much as 4,194.91 GWh.

2.3. Sources Perspective

Central Java Province has petroleum reservation in Block Cepu that lies on the border of Central Java and East Java. The areas that are included in Central Java Province are Kedung Tuban, Alas Dara, dan Kemuning. The petroleum reserves in those areas can be seen in table 2.5 below.

Tabel 2.5
Petroleum Reserves

No	Location	Sources (MMSTB)	Reserves (MMSTB)	
			Proven	Perspective
1	Kedung Tuban	80	-	80
2	Alas Dara	12	-	12
3	Kemuning	70	-	70
Total		162	-	162

Reference:: www.balitbangjatim.com

The perspective of geothermal energy in Central Java is as much as 614 MWe which spreads out in Batu Raden Banyumas, Guci Tegal, Mangunan Wanayasa Banjarnegara, Dieng Wonosobo, dan G.Ungaran Semarang. The perspective can be seen in table 2.4.

The other energy perspectives in Central Java Province are solar energy, biogas, and biomass. Central Java Province memiliki has potential of biomassa from Paddy at about 421,204.8 ton, 109,562.7 ton from corn, 9,309.7 ton from Coconut, 10,495.7 ton from sugar cane and 198.5 ton from waste. The areas which have good perspectives for Paddy is the regions of Cilacap, corn in Grobogan Region, Coconut in Kebumen region, sugar cane in Pati Region, and waste in Banjarnegara Province. The biomass perspective like bio fuel and biogas in other areas can be viewed in tables 2.6 – 2.8

Tabel 2.6
Biomass Perspective

No	Regions/City	Biomass Perspective (ton)				
		Paddy	Corn	Coconut	Sugar Cane	Waste
1	Reg. Cilacap	34.170,7	740,9	597,8	-	2.686,2
2	Reg. Banyumas	17.776,9	699,6	490,3	-	97,5
3	Reg. Purbalingga	7.471,7	1.299,7	621,1	38,6	22,2
4	Reg. Banjarnegara	6.500,8	4.450,7	504,1	-	2.808,3
5	Reg. Kebumen	18.623,6	854,2	1.503,7	11,7	65,9
6	Reg. Purworejo	13.459,0	701,5	1.172,4	140,2	29,3
7	Reg. Wonosobo	7.237,8	5.427,8	122,9	-	24,7
8	Reg. Magelang	12.920,4	2.807,0	287,6	111,1	45,0
9	Reg. Boyolali	11.215,0	5.589,3	107,7	57,0	9,8
10	Reg. Klaten	15.400,1	1.888,1	310,1	305,7	429,6
11	Reg. Sukoharjo	13.175,0	1.079,8	31,1	138,8	19,8
12	Reg. Wonogiri	12.326,2	14.106,6	548,7	137,9	59,9
13	Reg. Karanganyar	11.245,1	1.155,9	116,1	348,6	39,0
14	Reg. Sragen	22.863,5	1.430,3	244,3	994,1	30,3
15	Reg. Grobogan	25.990,3	21.808,3	54,9	76,6	113,8
16	Reg. Blora	14.561,2	10.685,3	178,3	88,2	38,3
17	Reg. Rembang	6.518,2	4.338,3	253,2	366,0	47,7
18	Reg. Pati	22.801,0	2.324,0	236,8	1.962,2	29,8
19	Reg. Kudus	6.899,1	167,7	20,8	1.068,8	75,0
20	Reg. Jepara	9.544,7	773,1	802,3	435,1	101,4
21	Reg. Demak	25.229,6	2.789,6	28,1	7,9	47,9
22	Reg. Semarang	8.486,4	2.494,1	203,2	53,9	-
23	Reg. Temanggung	7.557,4	7.326,9	46,9	19,8	94,5
24	Reg. Kendal	10.615,3	3.221,1	46,3	94,3	50,5
25	Reg. Batang	10.132,9	1.188,5	84,9	240,0	41,3
26	Reg. Pekalongan	11.032,2	777,9	113,7	605,0	34,1
27	Reg. Pemalang	18.522,5	3.020,9	181,6	1.082,0	32,0
28	Reg. Tegal	13.870,1	3.149,1	104,9	1.434,6	54,2
29	Reg. Brebes	22.260,3	3.040,7	242,5	677,6	42,6
30	City Magelang	114,2	0,2	-	-	54,0
31	City Surakarta	59,8	2,7	1,0	-	41,8
32	City Salatiga	338,4	126,2	-	-	57,0
33	City Semarang	1.324,0	96,8	52,6	-	641,1
34	City Pekalongan	570,6	-	-	-	121,8
35	City Tegal	391,8	0,7	-	-	112,5
	Total	421.204,8	109.562,7	9.309,7	10.495,7	8.198,5

Sumber : RUPED Jateng 2005

Central Java Province has prospective in the biomass in the form of cotton (2,048.6 ton), *Jarak* is 1.6 ton, coconut is 173,960.1 ton and sugar cane is 10,495.7 ton. Jepara and Grobogan has more perspective in cotton, *jarak* in Grobogan Region, coconut in Wonogiri Region and sugar cane in Pati Region, as shown in table 2.7 below.

Table 2.7
Bio fuel Prospective

No	Regions/City	Bio fuel Prospective (ton)			
		Cotton	<i>Jarak</i>	Coconut	Sugar Cane
1	Reg. Cilacap	0,7	-	7.275,1	-
2	Reg. Banyumas	0,2	-	8.038,4	-
3	Reg. Purbalingga	0,1	-	6.592,0	38.6
4	Reg. Banjarnegara	0,5	-	12.190,9	-
5	Reg. Kebumen	0,8	-	8.198,7	11.7
6	Reg. Purworejo	0,1	-	7.467,9	140.2
7	Reg. Wonosobo	0,1	-	4.727,3	-
8	Reg. Magelang	0,2	-	2.617,5	111.1
9	Reg. Boyolali	5,8	-	7.270,5	57.0
10	Reg. Klaten	2,6	-	1.144,9	305.7
11	Reg. Sukoharjo	5,5	-	4.638,2	138.8
12	Reg. Wonogiri	11,8	-	56.193,2	137.9
13	Reg. Karanganyar	0,2	-	5.086,1	348.6
14	Reg. Sragen	10,6	-	3.900,6	994.1
15	Reg. Grobogan	21,8	1,6	2.055,2	76.6
16	Reg. Blora	80,3	-	1.003,7	88.2
17	Reg. Rembang	16,0	-	1.569,6	366.0
18	Reg. Pati	417,2	-	9.813,6	1.962.2
19	Reg. Kudus	24,6	-	833,5	1.068.8
20	Reg. Jepara	1.372,1	-	6.233,4	435.1
21	Reg. Demak	5,2	-	739,4	7.9
22	Reg. Semarang	14,2	-	1.680,1	53.9
23	Reg. Temanggung	0,4	-	4.076,5	19.8
24	Reg. Kendal	13,6	-	2.274,3	94.3
25	Reg. Batang	9,7	-	1.889,6	240.0
26	Reg. Pekalongan	2,3	-	758,4	605.0
27	Reg. Pemalang	0,7	-	1.936,0	1.082.0
28	Reg. Tegal	27,3	-	936,0	1.434.6
29	Reg. Brebes	2,9	-	1.748,2	677.6
30	City Magelang	-	-	6,4	-
31	City Surakarta	-	-	11,6	-
32	City Salatiga	-	-	334,4	-
33	City Semarang	1,1	-	719,8	-
34	City Pekalongan	-	-	-	-
35	City Tegal	-	-	-	-
Total		2.048,6	1,6	173.960,1	10.495,7

Reference:: RUPED Jateng 2005

Central Java Province has good perspectives for biogas from cow farming, k as much as 3,224,383.20 ton, 5,803,320.60 ton from goats and 3,225,504.06 ton from chickens. Semarang has greater perspective for cows, Wonogiri Region for goats and Kebumen Region for chickens, as seen in table 2.8 below.

Table 2.8
Biogas Perspective

No	Regions/City	Biogas (ton)		
		Cows	Goats	Chickens
1	Reg. Cilacap	15.703,20	88.372,80	146.639,79
2	Reg. Banyumas	36.482,40	511.822,80	124.082,55
3	Reg. Purbalingga	31.557,60	288.154,80	98.681,13
4	Reg. Banjarnegara	66.879,00	256.374,00	103.450,32
5	Reg. Kebumen	59.155,20	326.113,20	216.604,80
6	Reg. Purworejo	23.797,80	244.409,40	104.170,05
7	Reg. Wonosobo	61.511,40	222.085,80	60.735,06
8	Reg. Magelang	129.256,20	124.261,20	92.325,51
9	Reg. Boyolali	265.174,20	200.215,80	104.584,14
10	Reg. Klaten	156.211,20	118.224,00	92.371,23
11	Reg. Sukoharjo	46.287,00	65.104,20	54.534,51
12	Reg. Wonogiri	259.191,00	1.018.350,00	186.584,85
13	Reg. Karanganyar	86.022,00	39.643,20	89.976,06
14	Reg. Sragen	139.039,20	125.654,40	63.474,93
15	Reg. Grobogan	191.824,20	181.017,00	108.725,13
16	Reg. Blora	391.546,80	176.227,20	179.276,40
17	Reg. Rembang	174.715,20	155.887,20	43.940,79
18	Reg. Pati	115.212,60	194.817,60	104.852,52
19	Reg. Kudus	14.104,80	52.763,40	42.698,61
20	Reg. Jepara	44.299,80	99.194,40	50.148,09
21	Reg. Demak	3.526,20	65.340,00	58.456,89
22	Reg. Semarang	691.509,60	251.762,40	113.344,20
23	Reg. Temanggung	63.268,20	96.237,00	147.750,48
24	Reg. Kendal	29.133,00	102.871,80	76.177,44
25	Reg. Batang	25.277,40	104.670,00	54.697,14
26	Reg. Pekalongan	20.340,00	87.148,80	76.181,67
27	Reg. Pemasang	9.779,40	175.411,80	114.092,55
28	Reg. Tegal	9.372,60	73.416,60	111.685,23
29	Reg. Brebes	36.428,40	317.050,20	311.984,46
30	City Magelang	415,80	432,00	8.817,39
31	City Surakarta	2.453,40	954,00	2.587,14
32	City Salatiga	16.718,40	9.360,00	9.675,90
33	City Semarang	6.987,60	24.705,00	43.740,00
34	City Pekalongan	1.006,20	3.492,00	17.186,31



35	City Tegal	196,20	1.776,60	11.270,79
	Total	3.224.383,20	5.803.320,60	3.225.504,06

Reference: : RUPED Jateng 2005

3. TRANSFORMATION

To process the primary energy in order to be able to be used by the user, the primary energy needs to be transformed into final energy. The energy transformation which Central Java had in 2005 are oil refineries and electric power stations.

The location of primary petroleum transformer is focused in Cepu and Cilacap. The capacity of Cepu oil refinery in Blora Region is 1.095,00 MBBL/year, while the capacity of Cilacap oil refinery is 125.000,00 MBBL/year. In the transformation, the amount of final energy produced depends on the efficiency of the transformation process. The efficiency of the oil refinery technically cannot reach 100%. Cepu and Cilacap oil refineries in Central Java are very efficient with about 75.76% efficiency for Cepu oil refinery and 86.65% for Cilacap oil refinery.

The electric energy transformation in Central Java in 2005 still depended mainly on refined fuel oil as the fuel, but in the early of 2006 the use of coal is a replacement of the refined fuel oil. This can be seen from the new power stations in 2006 – 2007, those are Coal Power Station (CPS) Cilacap dan CPS Tanjung Jati B. There will be new CPS in Rembang which will be operated in 2015. In its development, Central Java wants also use a nuclear power plant for electric energy because the increasing of electric load from year to year. The efficiency of the electric power station in Central Java is between 40 – 80%.

3.1 The Power plants

The production of electric energy in Central Java Province is done in PLTU Tambak Lorok, PLTU Cilacap, PLTU Tanjung Jati, PLTG Cilacap, PLTGU Tambak Lorok, PLTP Dieng, PLTA Area 3 (Jelok,dsb) and PLTA Jend.Sudirman. The State Electricity Enterprise in Central Java Province is a part of Central Java – DIY distribution area, with total electric production in 2005 of about 6.932 GWh. While the electric production for every power station can be seen in table 3.1 below.

Tabel 3.1
Total electric production in Central Java Province (GWh)

No	The power Plants	Electric Production (GWh)				
		2001	2002	2003	2004	2005
1	PLTA	1.103	745	787	814	890
2	PLTU	1.789	1.531	1.750	1.602	1.577
3	PLTGU	2.729	3.280	3.001	3.443	3.894
4	PLTG	21	30	35	41	72
5	PLTP		51	185	288	499
Total		5.642	5.637	5.758	6.188	6.932

Reference: PT.PLN

To supply the electric power, Central Java Province depends on the big scale power plants run by the PT.Indonesia Power, PT. Geodipa Energi, PT. Sumber Segara Rimadaya, PT. Central Java Power. Specification of each power station can be viewed in table 3.2 below.

Table 3.2
Electric generator based on the source of generator

No	Companies	Power Plant	Discharged Capacity	Power Capacity	Production Netto	Fuel
			kW	kW	GWh	
1	PT. Indoneisa Power	PLTGU T. Lorok Blok 1	516.950	466.615	1.947	HSD
		PLTGU T. Lorok Blok 2	516.950	466.615	1.947	HSD
		PLTU T. Lorok 1,2,3	300.000	273.630	1.577	MFO
		PLTG Cilacap 1-2	55.000	39.800	72	HSD
		PLTA PB Sudirman 1-3	180.900	179.400	380	Air
		PLTA Area 3 (Jelok, Timo, Ketenger, Garung, W. Lintang, Kd.Ombo)	107.420	106.050	508	Air
2	PT Geodipa energi	PLTP Dieng	60.000	60.000	499	Panas Bumi
3	PT. Sumber Segara Rimadaya	PLTU Cilacap	562.000	562.000	4.299	Batubara
4	PT. Central Java Power	PLTU T Jati	1.320.000	132.000	9.075	Batubara
Total			3.619.220	2.286.110	20.304	

Reference:PT.PLN

In 2005, the electrification ratio in Central Java Province is 66.69 % with total costumer of 5.529.960, and the connections of discharged capacity reach 5.297,7 MW. The ratio of electrified Village is 99.79%, the ratio of electrification and electrified villages in some regions/Cities in Central Java in 2005 can be seen in table 3.3 below.

Table 3.3
The ratio of electrification and electrified village

No	Region/City	Electrification Ratio	Electrified Villaged
1	City.Semarang	86,96%	100,00%
2	Reg.Semarang	78,17%	100,00%
3	Reg.Kendal	73,45%	100,00%
4	Reg.Demak	38,25%	100,00%
5	Reg.Grobogan	65,89%	100,00%
6	City.Salatiga	86,03%	100,00%
7	Reg.Kudus	94,08%	100,00%
8	Reg.Jepara	55,86%	100,00%
9	Reg.Pati	61,32%	100,00%
10	Reg.Rembang	55,68%	100,00%
11	Reg.Blora	60,94%	100,00%
12	City.Surakarta	93,32%	100,00%
13	Reg.Sukoharjo	67,66%	100,00%
14	Reg.Boyolali	57,97%	100,00%
15	Reg.Klaten	81,74%	100,00%
16	Reg.Karanganyar	56,57%	100,00%
17	Reg.Sragen	95,55%	100,00%
18	Reg.Wonogiri	73,19%	100,00%
19	City.Magelang	89,51%	100,00%
20	Reg.Purworejo	69,32%	100,00%
21	Reg.Magelang	64,14%	100,00%
22	Reg.Temanggung	69,27%	100,00%
23	Reg.Wonosobo	47,07%	100,00%
24	Reg.Kebumen	61,49%	100,00%
25	City.Tegal	94,91%	100,00%
26	Reg.Tegal	56,37%	100,00%
27	Reg.Brebes	47,71%	100,00%
28	Reg.Pemalang	56,22%	100,00%
29	Reg.Pekalongan	53,16%	94,70%
30	Reg.Batang	51,05%	100,00%
31	City.Pekalongan	83,91%	100,00%
32	Reg.Banyumas	59,46%	100,00%
33	Reg.Purbalingga	52,25%	99,60%
34	Reg.Banjarnegara	42,51%	100,00%
35	Reg.Cilacap	53,26%	98,50%
Rata –rata		66,69%	99,79%

Reference; Jateng Dalam Angka 2005

3.2 Electricity Distribution

The electricity distribution of PLN (state-owned company) in Central Java Province is handled by PLN Central Java and Yogyakarta Distribution. To support the transmission and distribution of electricity in the province, Central Java has several main vaults of 150 kV in Pekalongan, Bumiayu, Cilacap, Kebasen, and Blora and Extra High Voltage Vault of 500 kV in Ungaran and Pedan, Klaten as seen in table 3.4 below.

Table 3.4
Transmission Network and Electricity Distribution

No	Types of Network	Voltage	Distance (kms)
1	High Voltage	25 - 30 kV	33,64
		150 kV	3.564,8
		500 kV	836,52
2	Extra High		
3	Network of Middle Voltage	20 kV	37.006
4	Low Voltage	220 V	40.655

Sumber: PT.PLN

3.3 Oil Refinery

In 2005 Central Java Province had two oil refineries, they are PPT Migas Cepu and UP-IV Cilacap. The capacity of Cepu refinery is 1.095,00 MBBL/Year while Cilacap refinery produced much more capacity 125.000,00 MBBL/year as presented in table 3.5 below.

Table 3.5
The capacity of Central Java Province refineries in 2005

No	Names of Refinery	Company	Location	Capacity (MBBL/year)
1	Kilang PPT Migas Cepu	Pertamina	Reg. of Blora	1.095,00
2	Kilang Up-IV Cilacap	Pertamina	Reg. of Cilacap	125.000,00
Total				126.095,00

Sumber: Pertamina

In 2005, Blok Cepu still did some exploitations traditionally by the local people. The data of crude oil production in Central Java can be seen in the following table.

Table 3.6
Production of Crude oil in Central Java Province in 2005

No	Company	Location	Production (MBBL/Year)
			2005
1	People's mine	Cepu	829,53
Total			829,53

sumber : Pertamina

Based on the type of their productions, Cepu and Cilacap refineries’s production is presented in the table 3.7 below. The table shows that the production of Cilacap refinery is more varied than Cepu refinery. The total amount of production of the two refineries reached 109.006.839 Barrel/Year.

Based on 2005 data, PPT Migas Cepu refinery produced ADO as much as 221.005 barrel, Kerosene 187.063 barrel, and other products 421.458 barrel. UP-IV Cilacap refinery produced: Kerosene, ADO, IDO, FO, avtur, LPG and other products.

Tabel 3.7
Production of Central Java Province refinery in 2005

No	Refinery	Types of production	Production (Barrel/year)
1	PPT Migas Cepu refinery	Other products	421.458
		Kerosene	187.063
		ADO	221.005
2	Up-IV Cilacap refinery	Gasoline	20.164.933
		Kerosene	17.074.400
		ADO	22.759.712
		IDO	7.088.214
		FO	20.141.468
		Avtur	2.802.409
		LPG	1.287.283
Other products	16.858.894		
Total			109.006.839

Sumber : Pertamina

3.4 Other Transformasion

In addition to the power supplied from the larger power plants, Central Java also has small scale power plants. The micro hydro power plants like the ones in Purbalingga, Wonosobo, Purworejo, Banyumas, Pekalongan, Klaten, and Temanggung can own a capacity from 5-125 kVA. Solar power plants (*Serta Pembangkit Listrik Tenaga Surya* (PLTS) in Boyolali, Purworejo, Banyumas, Wonogiri, Karanganyar, Brebes supply 50-100 kVA power capacity.

The other transformation in Central Java is coal briquettes. The briquettes were produced by CV Sinar Teknik Utama yang which is located in Tegal and its production reached about 70.000 ton/year as seen in table 3.8.

Table 3.8
Production of Coal Briquettes

No	Company	Location	Production (Ton/Year)		
			2003	2004	2005
1	CV. Sinar Teknik Utama	Tegal	70.000	70.000	70.000
Total			70.000	70.000	70.000

Source: Coal Statistics

Furthermore, Central Java had potential oil resources of 3.368,66 which is located in Block Cepu Central Java, as displayed in the following table 3.9 below.

Table 3.9
Oil Potential Resources

No	Location	Resource (BSCF)	Reserve (BSCF)	
			Proven	Potential
1	Blok Cepu	3.368,66	1.812,27	1.556,39
Total		3.368,66	1.812,27	1.556,39

Sumber; www.balitbangjatim.com

The biomass energy forms which are commonly used by the village homes to cook are woods, charcoal and agricultural wastes. In some areas where cow farming is commonly found such as in Boyolali, the technology of biogas production from manure has been applied. The methane gas produced by the digesters is used for daily cooking activities.

4 FINAL ENERGY DEMAND

4.1 Fuel based final Energy

Energy demand in Central Java in 2005 reached 43.84 million Barrel of Oil Equivalent with the following distribution percentage for the demand of each energy: Coal (6.22%), Gasoline (25.21%), Kerosene (17.69%), Fuel Oil (3.17%), Automobile Diesel Oil (26.04%), Industrial Diesel Oil (0.74%), Electricity (14.78%), LPG (1.95%), Wood (3.46%), *Avtur* (0.53%) and coal briquettes (0.20%).

Demands of each type of energy in Central Java were :

<i>Avtur</i>	:	0,23 million Barrels of Oil Equivalent (BOE)
Kerosene	:	7,75 million Barrels of Oil Equivalent (BOE)
Gasoline	:	11,05 million Barrels Of Oil Equivalent (BOE)
Automobile Diesel Oil:		11,42 million Barrels Of Oil Equivalent (BOE)
Industrial Diesel Oil:		0,32 million Barrels Of Oil Equivalent (BOE)
FO	:	1,39 million Barrels Of Oil Equivalent (BOE)
Electricity	:	6,48 million Barrels Of Oil Equivalent (BOE)
LPG	:	0,85 million Barrels Of Oil Equivalent (BOE)
Coal Briquettes	:	0,09 million Barrels Of Oil Equivalent (BOE)
Woods	:	1,52 million Barrels Of Oil Equivalent (BOE)

4.2 Sector based energy demand

The distribution of energy demand over each sector is as follows: Household (23,10%), Industrial sector (20,73%), Commercial(11,92%), Transportation (39,92%), others (4,32%). The sector based energy demand is divided into:

House hold	:	10,13 Million Barrels Of Oil Equivalent (BOE)
Industrial Sector	:	9,09 Million Barrels Of Oil Equivalent (BOE)
Commercial	:	5,23 Million Barrels Of Oil Equivalent (BOE)
Transportation	:	17,50 Million Barrels Of Oil Equivalent (BOE)
Others	:	1,89 Million Barrels Of Oil Equivalent (BOE)

This can be seen in the figure 4.1

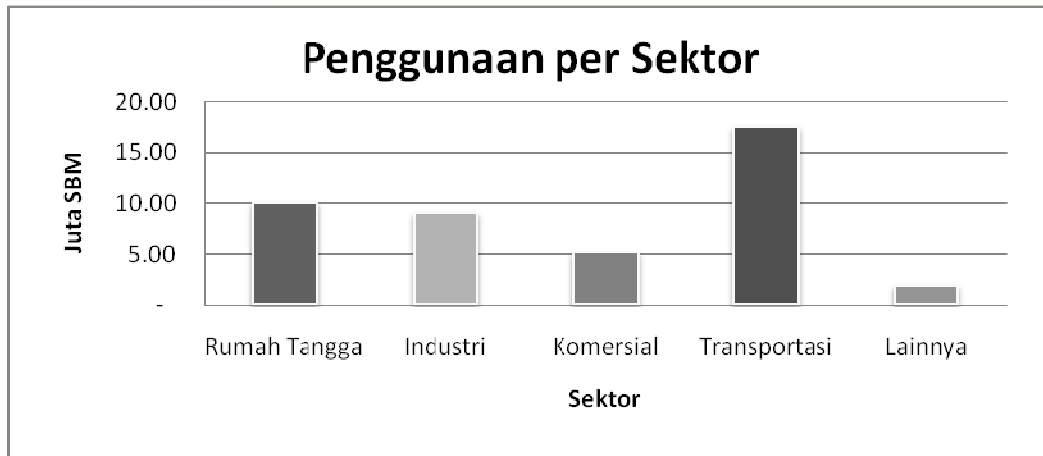


Figure 4.1 Sector based final energy demand

4.2.1 Industrial Sector

The energy in industrial sector is mainly used for manufacturing process, manufacture utility, lightning and material transportation. This part focuses on the types of energy used in the industrial sectors such electricity, automobil diesel oil and diesel oil and LPG.

Table 4.1
Final Energy Demand of Industrial Sector in 2001-2005
Energy Demand in 2005 (BOE)

No	Types of Industry	Kerosene	Automobile Diesel Oil	Diesel Oil	FO	Electricity	Coals	LPG
1	Food	65.757	594.472	23.930	91.961	179.928	12.188	46.456
2	Textile	19.749	814.217	142.299	470.138	803.073	379.097	41.859
3	Wood	1.033	98.952	7.850	7.089	128.628	-	11.435
4	Paper	1.548	99.670	17.484	133.898	85.245	220.287	9.199
5	Chemical	4.824	318.812	15.040	112.820	527.685	62.447	23.520
6	Non Metal	974	87.095	69.646	457.493	192.752	2.042.650	10.923
7	Metal	5.877	122.654	8.166	36.105	168.141	5.552	2.189
8	Machinery	110	106.992	4.044	3.466	75.368	3.043	8.031
9	Others	4.645	40.173	439	585	55.762	2.542	1.612
	Total	104.517	2.283.038	288.898	1.313.554	2.216.581	2.727.806	155.224

Resource: Data Olahan Sensus Industri

Industrial sector based final energy demand is dominated by the use of coal which is 2.727.806 BOE or 30,01%. The second one is Automobile Diesel Oil (ADO) with 2.283.038 BOE (25,12%), electricity 2.216.581 BOE (24,39%), FO 1.313.554 BOE (14,45%), Industrial Diesel Oil 288.898 BOE (3,18%), LPG 155.224 BOE (1,71%), and Kerosene 104.517 BOE (1,15%), as shown in the figure 4.2 below.

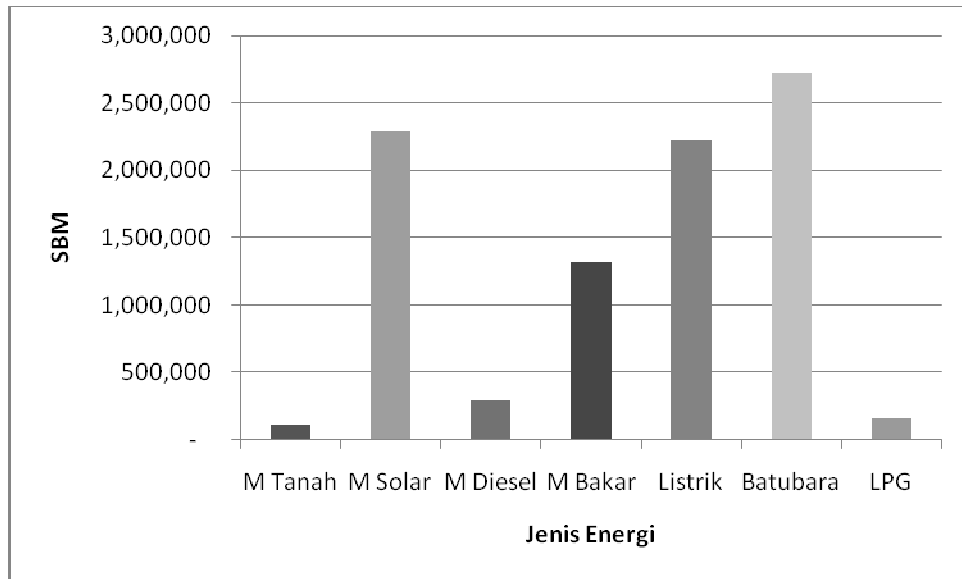


Figure 4.2 Industrial sector based final energy demand for each type of energy

4.2.2 Transportation sector

To support the economic activities, labours, raw materials and other goods needs to be transported. The higher the economic activities are in an area, the higher the need for transport will be and the more energy used for transportation will be. The estimated use of energy in the transportation sector presentend in this report is calculated based on the amount of fuel sold (*avtur*, *avgas*, petroleum and automobile diesel oil) in gas stations and DPPU.

Table 4.2
Transportation sector final energy demand in 2001 – 2005

No	Sub Sector	Energy Usage in 2005 (BOE)					
		Avtur	Gasoline	Kerosene	ADO	FO	IDO
1	Passanger cars (unit)	-	5.492.823	-	788.962	-	-
2	Motorcycle (unit)	-	4.879.213	-	-	-	-
3	Bus (unit)	-	-	-	1.340.199	-	-
4	Truck (unit)	-	-	-	3.680.469	-	-
5	Train(thousand Km)	-	-	-	14.946	-	-
6	Ferry (hour)	-	4.231	8.714	340.756	-	-
7	Ship (Hour)	-	-	-	683.781	19.235	11.349
8	Aeroplane (thousand km)	233.478	-	-	-	-	-
Total		233.478	10.376.267	8.714	6.849.113	19.235	11.349

The table shows that the demand of final energy in the transportation sector is mainly on gasoline 10.376.518 BOE (59,30%), ADO 6.849.113 BOE (39,14%), *Avtur* 233.478 BOE (1,33%), and FO 19.235 BOE (0,11%), IDO 11.349 BOE (0,06%), and kerosene 8.714 BOE (0,05%). The figure below shows the demand.

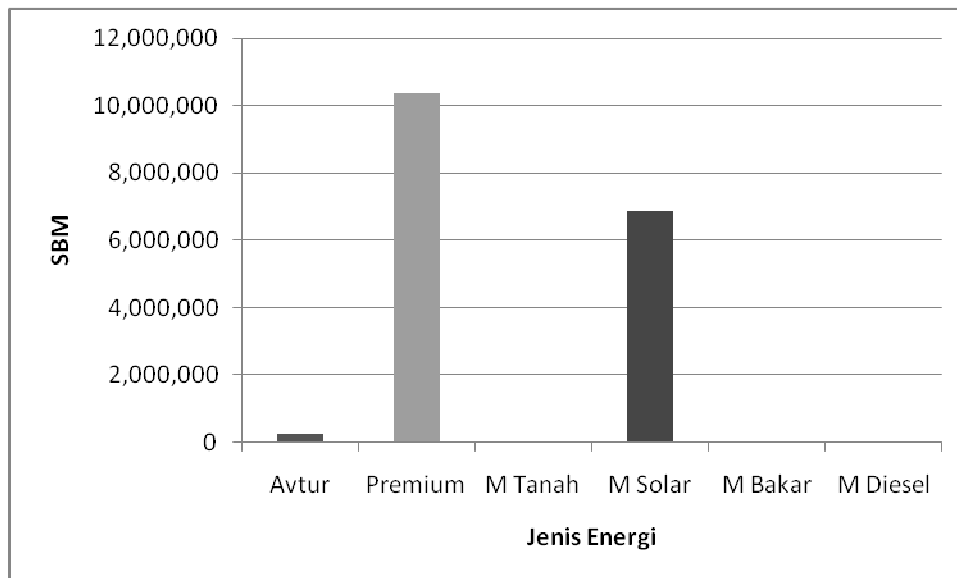


Figure 4.3 Transportation sector based final energy demand on each type of Energy

4.2.3 Household sector

The household sector is divided into two sub sectors, i.e., urban and rural. Furthermore, the sub sector is further classified based on the income. The energy demand of this sector is commonly used for daily lighting, electrical appliances and cooking activities. The types of energy used in this sector are electricity, kerosene, LPG and biomass (wood). The energy demand in 2005 in each subsector is reflected in the following table 4.3. below.

Table 4.3
Household sector final energy demand in 2001-2005

No	Income groups	Energy use in 2005 (BOE)				
		Kerosene	Electricity	LPG	Wood	Briquette
1	Urban					
a.	Under the poverty line	387.395	142.977	1.315	64.401	0
b.	Under 1,5X poverty line	538.228	220.593	7.373	65.218	0
c.	Middle	1.228.460	604.987	112.061	70.763	1.539
d.	Top 20%	530.712	703.175	408.331	11.133	121
2	Rural					
a.	Undert the poverty line	201.733	157.728	1.684	262.123	1.832
b.	Under 1,5X poverty line	377.935	237.392	2.719	300.272	2.930
c.	Middle	845.053	476.576	11.952	479.219	2.676
d.	Top 20%	786.888	499.798	114.651	262.936	3.197
	Total	4.896.404	3.043.224	660.086	1.516.065	12.294

Source: Data Olahan Susenas

The data shows that the biggest demand of energy used in household sector is kerosene with 4.896.404 BOE (48,34%), which is obviously used for cooking activities. Electricity is second at 3.043.224 BOE (30,05%) which showed that the most of the population in Central Java has obtained access to electricity. The next energy demand is wood 1.516.065 BOE (14,97%), LPG 660.086 BOE (6,52%), and the rest is briquette 12.294 BOE (0,12%) as shown in the following table.

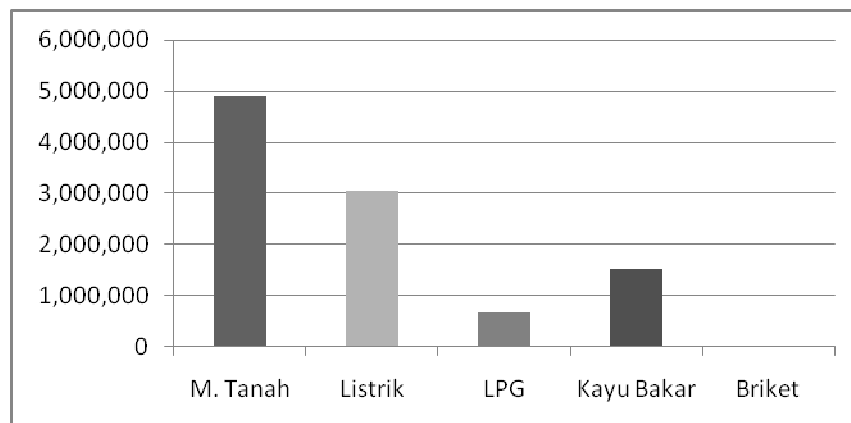


Figure 4.4. Final energy demand of house hold sector for each type of energy

4.2.4 Commercial Sector

This sector covers all activities which demand the energy such as trading stores, hotels, restaurants, financial services, amusement services, and social services. The data of final energy demand of each subsector is reflected in table 4.4 below.

Table 4.4

Final energy consumption of Commercial sector in 2001-2005

No	Sub Sector	Energy demand in 2005 (barrels of Oil Equivalent)				
		ADO	Kerosene	Electricity	LPG	Briquette
1	Trading	1.622.775	483.965	1.064.612	17.193	74.915
2	Hotels	2.979	2.195	2.162	10	-
3	Restaurants	55.686	1.502.649	61.387	19.282	1.818
4	Financial Services	1.785	1.523	5.079	15	-
5	Amusement services	27	36.593	3.984	3	-
6	Social Services	29.027	152.234	82.934	2.318	196
Total		1.712.278	2.179.159	1.220.158	38.821	76.929

Source: Data of Central Burrau Data Olahan BPS Jawa Tengah 2006

The energy demand from this sector is dominated by the kerosene which reached 2.179.159 barrels of oil equivalent (41,69%), ADO 1.712.278 (32,76%), electricity 1.220.158 barrels of oil equivalent (23,34%). Briquettes were used as much as 76.929 barrels of oil equivalent (1,47%) and LPG 38.821 barrels of oil equivalent (0,74%). As such, the energy demand of this sector is shown in figure 4.5. below.

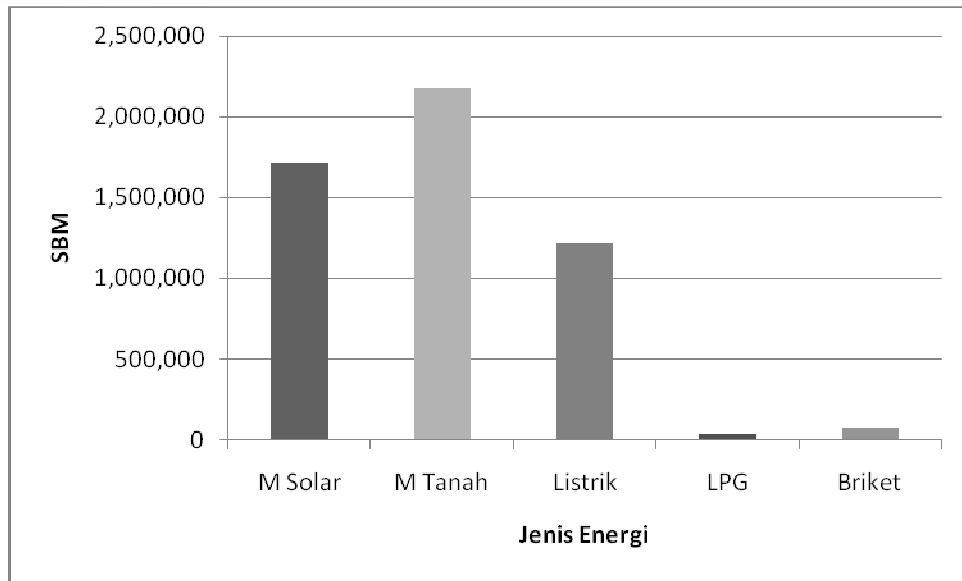


Figure 4.5 demand of final energy in commercial sector of each type of energy

4.2.4 Others

The energy demand for construction, agriculture and mining is classified into several groups as displayed in the table below.

Table 4.5

Final energy demands of other sectors in 2001-2005

No	Sub Sector	Energy demand in 2005(barrels of oil equivalent)				
		gasoline	Kerosene	ADO	IDO	FO
1	Construction	507.350	424.660	428.586	17.669	44.347
2	Agriculture	124.470	104.186	105.149	4.335	10.879
3	Mining	43.830	36.680	37.024	1.527	3.830
Total		675.650	565.526	570.759	23.530	59.056

Source: Data Olahan BPS Jawa Tengah 2006

The data displays that most energy demanded by these sectors is gasoline (*pertamax* and *premix*) with 675.650 barrel of oil equivalent (35,66%), ADO 570.759 barrel of oil equivalent 30,13%, kerosene 565.526 barrel of oil equivalent (29,85%). The energy which were demanded the least were FO 59.056 barrel of oil equivalent (3,12%) and IDO 23.530 barrels 1,24% as shown in the figure 4.6.

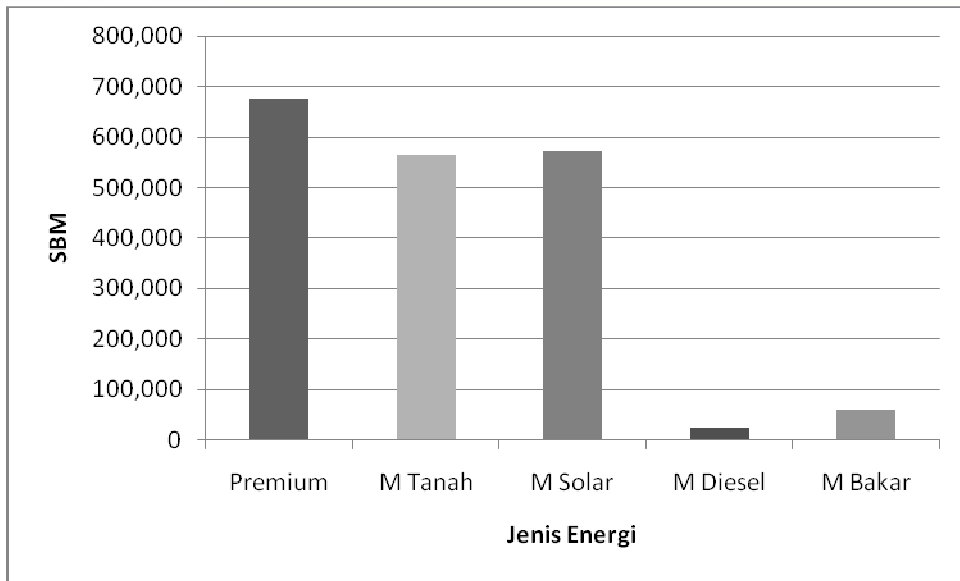


Figure 4.6 Final energy demand of other sector for each type of energy

5 ENERGY POLICIES DEVELOPMENT USING BAU (BUSINESS AS USUAL) IN 2025

Central Java Province uses several assumptions for BAU (Base As Usual) to develop its energy from 2005 to 2025. The assumptions are among others economic macro assumption and other assumptions of energy demand in different sectors and each type of the energy used.

5.1 Macro Economy Assumption

In line with the energy development projected for 2025, the growth of energy use is based on the growth of population and Gross Regional Domestic Products (GRDP). The population growth is used to create a scenario of household energy demand, and the GRDP is used to make a scenario of industrial, commercial, transportation, and other relevant sectors. In BAU scenario, the population and GRDP growth to 2025 are assumed to have the same rate as that of baseyear (2005) which is 1.45% for the population growth and 5% for GRDP growth.

The elasticity of energy demand is obtained from the average growth of activity level over 2001-2005 divided by the total growth of GRDP in the same period. The elasticity of demand growth of each sector in 2005 is shown in table 5.1 below.

Table 5.1
Elasticity of energy demand in 2005

No	Sectors	Elasticity
1	Commercial	0.863
2	Industry	1.022
3	Transportation	
	Trucks	1.304
	Passanger cars	2.129
	Motorcycle	3.259
	Ship	1.110
	Aeroplane	1.449
	Train	0.404
	Ferry	4.890
	Bus	1.199
4	Others	0.995

The elasticity of demand in 2025 in the BAU scenario for transportation sector will be reduced to less than 1 and for other sectors will depend on the regional policies . In BAU scenario, the elasticity of commercial, industry and other sectors is used to create the

activity projections in each sector by multiplying them with the GRDP growth. The intensity of energy demand in 2025 is basically considered the same as that of in 2005.

5.2 Business As Usual (BAU) Assumption

In BAU (Business as Usual) scenario, it is considered that the tendency of energy use pattern projected in 2025 is equal to the baseyear 2005. To analyze the energy needed in 2025, the LEAP (Long-range Energy Alternatives Planning System) software is used. The projections are presented in table 5.2. The LEAP software has 4 main branches in doing the calculation. The main branches are *Key assumption*, *Demand*, *Transformation*, and *Resources*. *Key assumption* is the basic branch to create the policy scenario assumptions, while *Demand* is the branch in which the final use of energy is defined. *Transformation* is the branch which contains the processes that transform energy so that it is ready to be used by *Demand*, and *Resources* is the resource branch in which the fuel possessed by the region and to be included in the scenario are listed. For the four branches the assumption are elaborated as follows:

A. Key Assumption

1. Growth of GRDP and population use the data obtained in 2005 which are 5% of GRDP and 1.45% of the population growth rate.
2. The growth of GRDP is used as the reference for the growth of industrial, commercial and other sector.
3. The elasticity of the subsectors in transportation sector uses the data calculation obtained in 2005 and the years prior to 2005 as seen in table 5.1.
4. The elasticity in 2025 for the transportation sector will reduce to less than 1 because it is expected that there will be a saturation of activity demand in transportation sector.

B. Demand

1. The dynamic activities of household, commercial, industrial, transportation and other sectors in 2025 are calculated using the trend line of activities in 2001 – 2005.
2. There is no change in the intensity in 2025 because there has been no certainty in the energy demand.



3. The calculation of elasticity of commercial, industrial and other sectors uses the equation of activity changes of energy demand in 2001 – 2005 divided by the growth of GRDP in 2001 – 2005.

Tablee 5.2
Scenarios used by each sector

Sector	Scenario
1. Household	Growth as (population growth)
2. Commercial	Growth as (Elasticity of GDRP*)
3. Industry	Growth as (Elasticity of GDRP*)
4. Transportation	
a. Motorcycle	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Motorcycle[Per Year])$
b. Passenger car	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Passenger car[Per Year])$
c. Bus	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Bus[Per year])$
d. Truck	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Truck[Per Year])$
e. Ferry	Growth as (GDRP * 1)
f. Train	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Train[Per Year])$
g. Ship	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Ship[Per Year])$
h. Aeroplane	$PrevYearValue * (1 + Key \setminus GrowthGDRP[PerTahun] * Key \setminus Growth of Aeroplane[Per year])$
5. others	Growth as (GDRP* elastisitas)

C. Transformation

1. Transformation of transmission and distribution branches will be set so that the loss will reduce from 5% to 4.5% by 2025
2. The curve of electrical energy load duration will be kept at the same position to 2025. In 2005, Central Java Province imported electricity. However, since the new power plants (PLTUB Tanjung Jati B and Cilacap) were built in 2006 and 2007, the power supply in Central Java has been covered by these power plants. With further capacity addition, Central Java will export electricity to the Java Bali grid. In the BAU it is assumed that this export will amount to ... in
3. The data of the Nuclear Power Plants Muria has not yet been filled in because it has not been decided when it will be operating.
4. Dispatch rules of the power plants can be seen in table 5.3

Table 5.3
Dispatch rules of eacy type of power plants

Power Plants	Dispatch rules
PLTA (all)	Run to full capacity
PLTUB	In ascending merit order
PLTU	In ascending merit order
PLTGU	In ascending merit order
PLTP	Run to full capacity
PLTS	Run to full capacity

Run-to-full capacity means that the power plant will be operated to its maximum capacity and not based on the order of the load. Ascending merit order means that the power plants will be operated based on the merit order of the basic dispatch rules.

5. There are two oil refineries in Central Java Province, they are in Cepu and Cilacap, and they are considered to have their operational ability and capacity.
6. There is only one oil field in Central Java Province and that is located in BLOK Cepu, and in 2025, it is considered not to change because it is considered that the other oil fields are not to be found.
7. The other transformation is the factories of wood, biodiesel and biofuel in which the input data was obtained from the energy profile.

D. Resources

The reserves and potential of the primary resources, both the renewable and unrenueable ones, are documented, and the secondary branch with the derived fuels will be automatically filled.

5.3 Result of Running LEAP BAU Scenario

5.3.1 Primary Resources

Central Java Province only has two primary energy resources, i.e. oil and wood, and in the projection using LEAP (Long-range Alternatives Planning System) it is presented as follows:

a. Crude Oil

Tabel 5.4

Figure 5.1 The oil projection for 2025 using BAU scenario

b. Wood

Tabel 5.5
Transformation Results: Outputs
Scenario: BAU, Fuel: All Fuels
Branch: Transformation\Wood Factory\Processes
Units: Barrel of Oil Equivalent

	2005	2010	2015	2020	2025
Wood	121,852	121,8	121,75	121,7	121,65

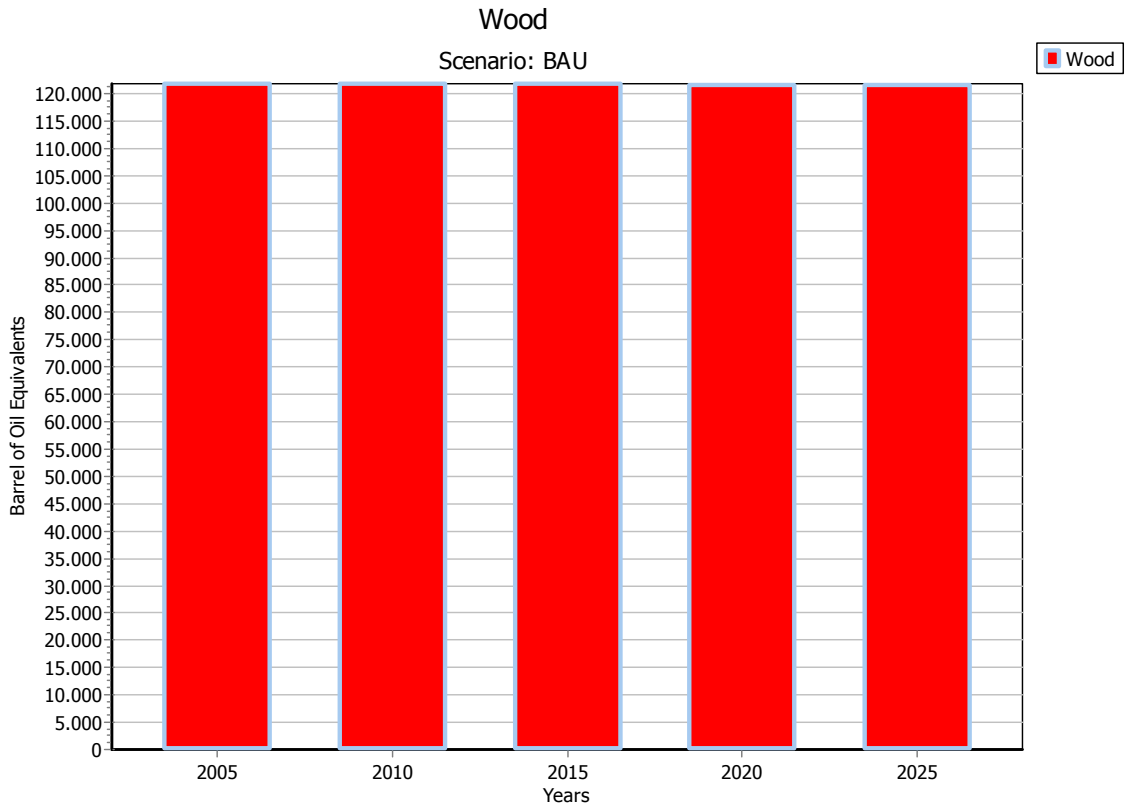


Figure 5.2 The Projection of Wood for 2025 using BAU Scenario

5.3.2 Transformation

a. Power Plants

Table 5.6
Transformation Results: Outputs
Scenario: BAU, Fuel: All Fuels
Branch: Transformation\Power Plant\Processes
Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
PLTA Area 3	314,761	320,366	320,366	320,366	320,366
PLTG Cilacap	44,577	0	33,687	65,476	97,135
PLTA Jendral Soedirman	235,266	235,466	235,466	235,466	235,466
PLTU Tambak Lorok	976,353	742,016	593,612	593,612	593,612
PLTP Dieng	308,941	309,139	309,139	309,139	309,139
PLTGU Tambak Lorok	2.410.855	2.984.261	3.328.918	3.505.995	3.539.807
PLTUB Cilacap	0	2.263.298	2.524.690	2.658.987	2.684.630
PLTUB Rembang	0	2.263.298	2.524.690	2.658.987	2.684.630
PLTUB Tanjung Jati B	0	4.526.595	5.049.380	5.317.973	5.369.261
PLTMH OFF GRID	731	732	732	732	732
PLTS OFF GRID	1	2	2	2	2
PLTN Muria	0	0	0	0	0
PLTU Tambahan	0	0	0	0	0
Total	4.291.485	13.645.172	14.920.683	15.666.736	15.834.781

Electricity Generation

Scenario: BAU

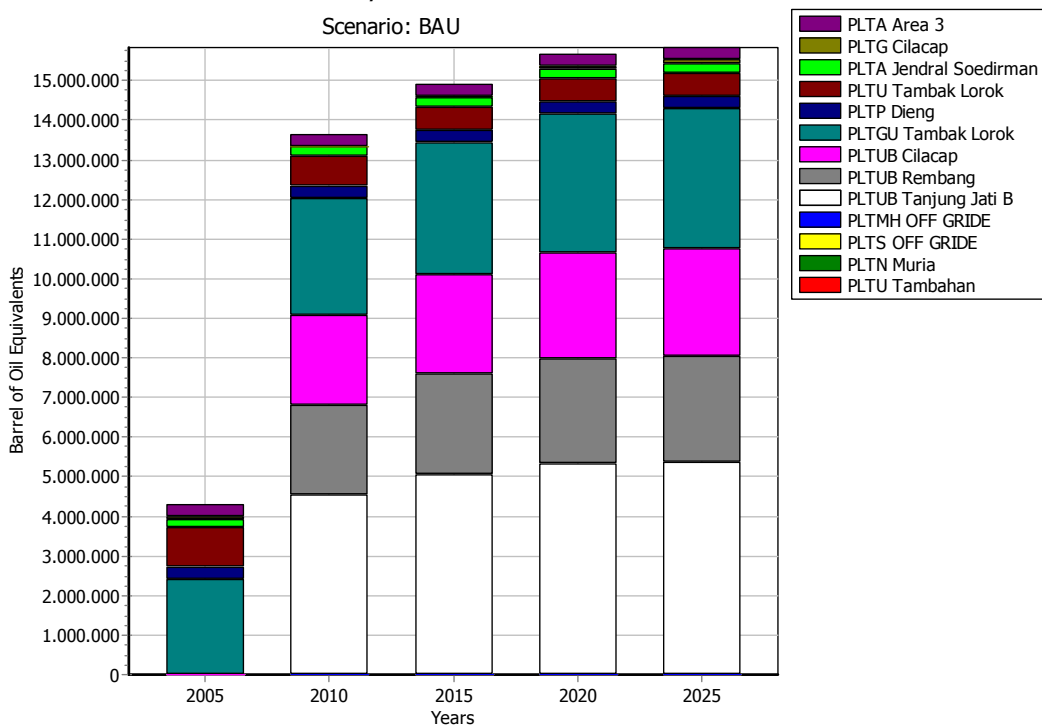


Figure 5.3 the projection of power plants for 2025 using BAU scenario

b. Export of Electrical Energy

Table 5.7 Export of Electrical Power for Central Java

Transformation Results: Exports from module

Scenario: BAU, Fuel: All Fuels

Branch: Transformation\Transmission Distribution

Units: Thousand Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
Transmission Distribution	0	5,263	5,263	5,263	5,263

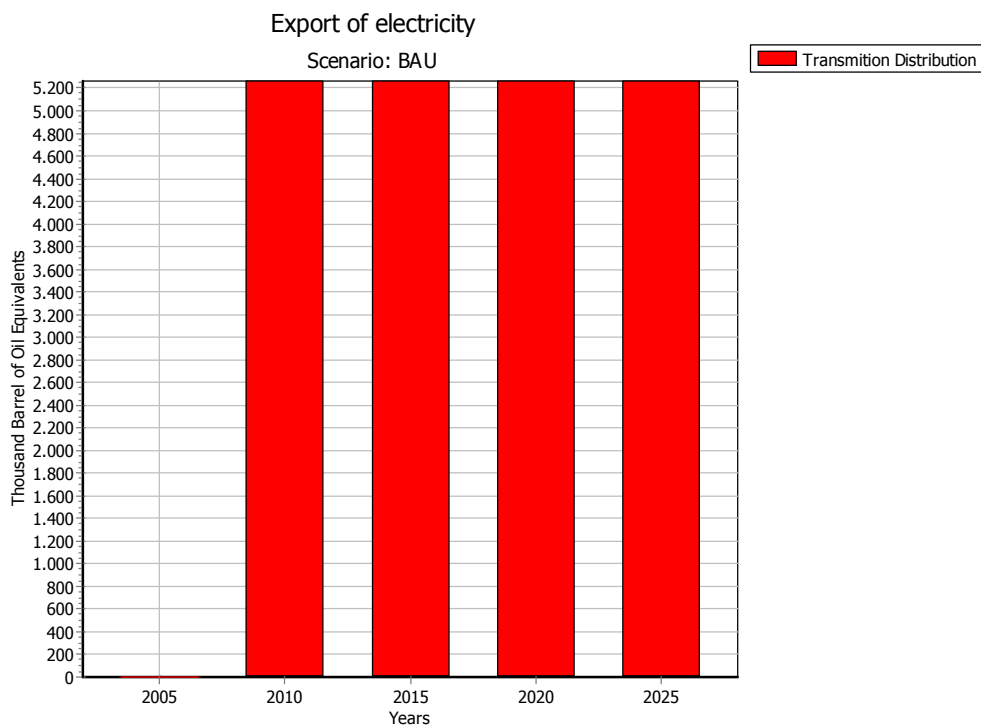


Figure 5.4 Projection of Export of Electrical Energy until 2025 as related with BAU scenario

c. Import of Electrical Power

Table 5.8 Import of Electrical Power for Central Java

Transformation Results: Imports into module

Scenario: BAU, Fuel: All Fuels

Branch: Transformation\PowerPlant

Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
Power Plant	2,571,478	0	263,233	1,365,370	3,422,675

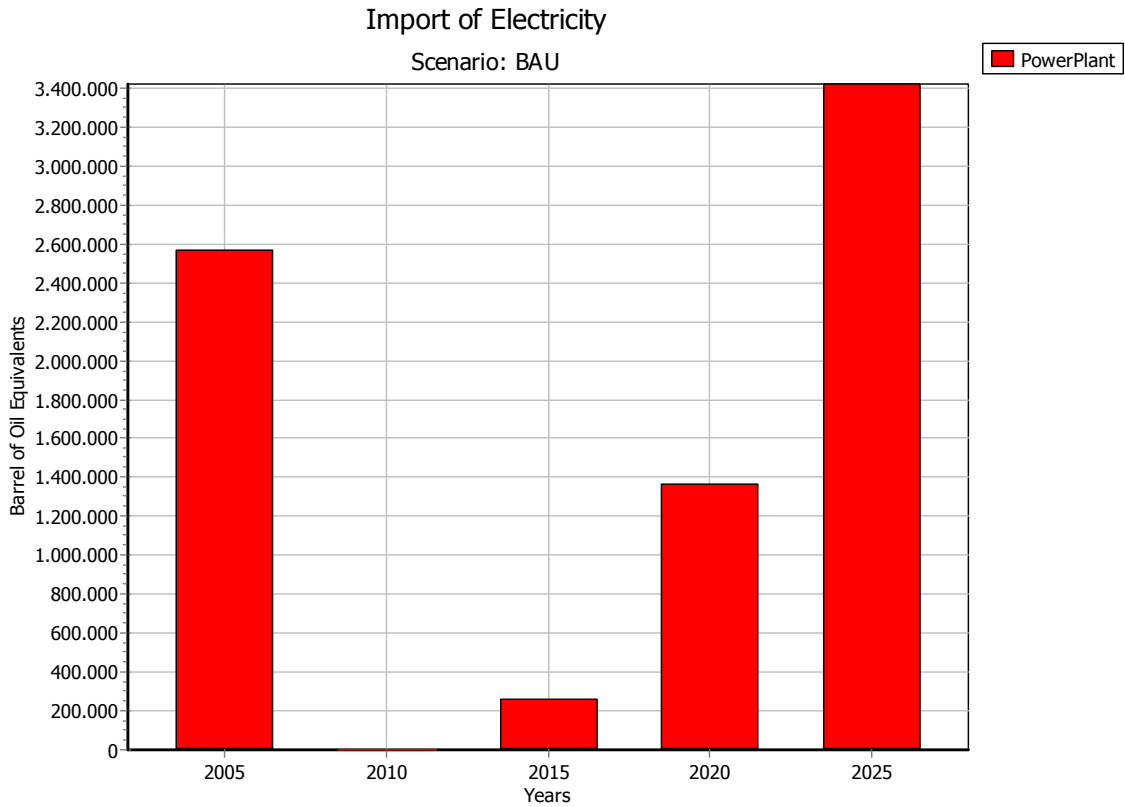


Figure 5.5 Projection of Import of Electrical Energy until 2025 as related with BAU scenario

d. Oil Refinery

- **Cepu Oil Refinery**

Table 5.7
Transformation Results: Outputs
Scenario: BAU, Fuel: All Fuels
Branch: Transformation\Refinery Oil Cepu
Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
Processes	829.523,0	1.095.000,0	1.095.000,0	1.095.000,0	1.095.000,0

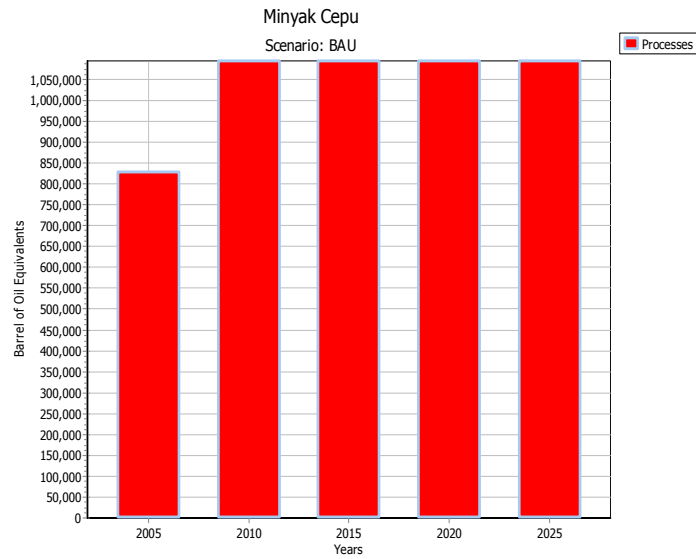


Figure 5.6 Projection of Cepu Oil Refinery for 2025 using BAU scenario

- Cilacap Oil Refinery**

Table 5.8
Transformation Results: Outputs
Scenario: BAU, Fuel: All Fuels
Branch: Transformation\Refinery Oil Cilacap\Processes
Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
Cilacap Refinery	108.177.313	99.435.970	110.053.188	125.000.000	125.000.000

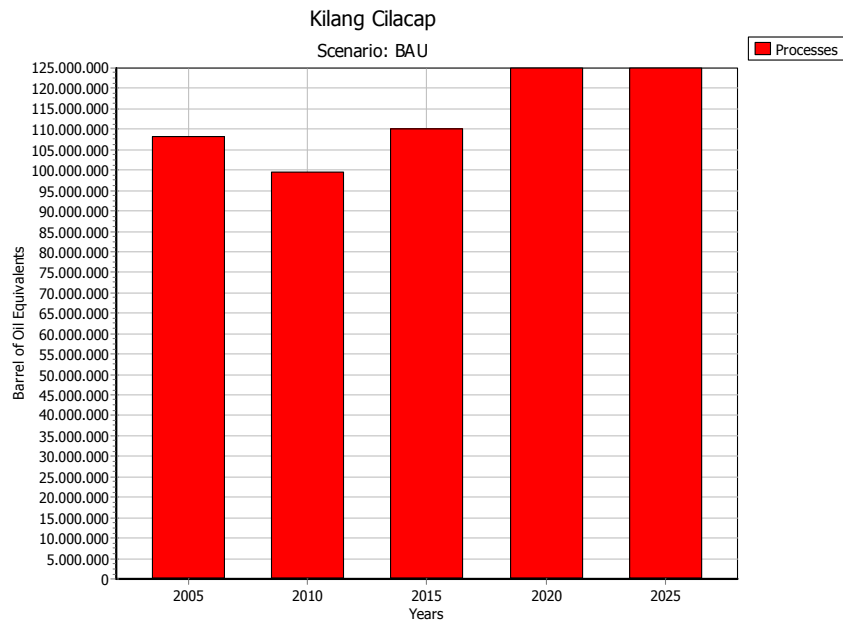


Figure 5.7 Projection of Cilacap Refinery for 2025 using BAU scenario

5.3.3 Energy demand of each energy type and each sector energy demand

a. Each sector

Table 5.11
Demand Results: Energy demand final units
Scenario: BAU, Fuel: All Fuels
Branch: Demand
Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
Household	10.128.017	11.118.825	12.200.841	13.382.495	14.673.019
Commercial	5.227.518	6.590.175	8.304.157	10.459.231	13.167.933
Industry	9.089.436	11.584.054	14.762.735	18.812.887	23.973.210
Transportation	17.498.173	25.419.056	32.054.952	38.523.160	45.608.852
Others	1.894.252	2.344.909	2.900.425	3.584.459	4.425.774
Total	43.837.396	57.057.019	70.223.109	84.762.233	101.848.788

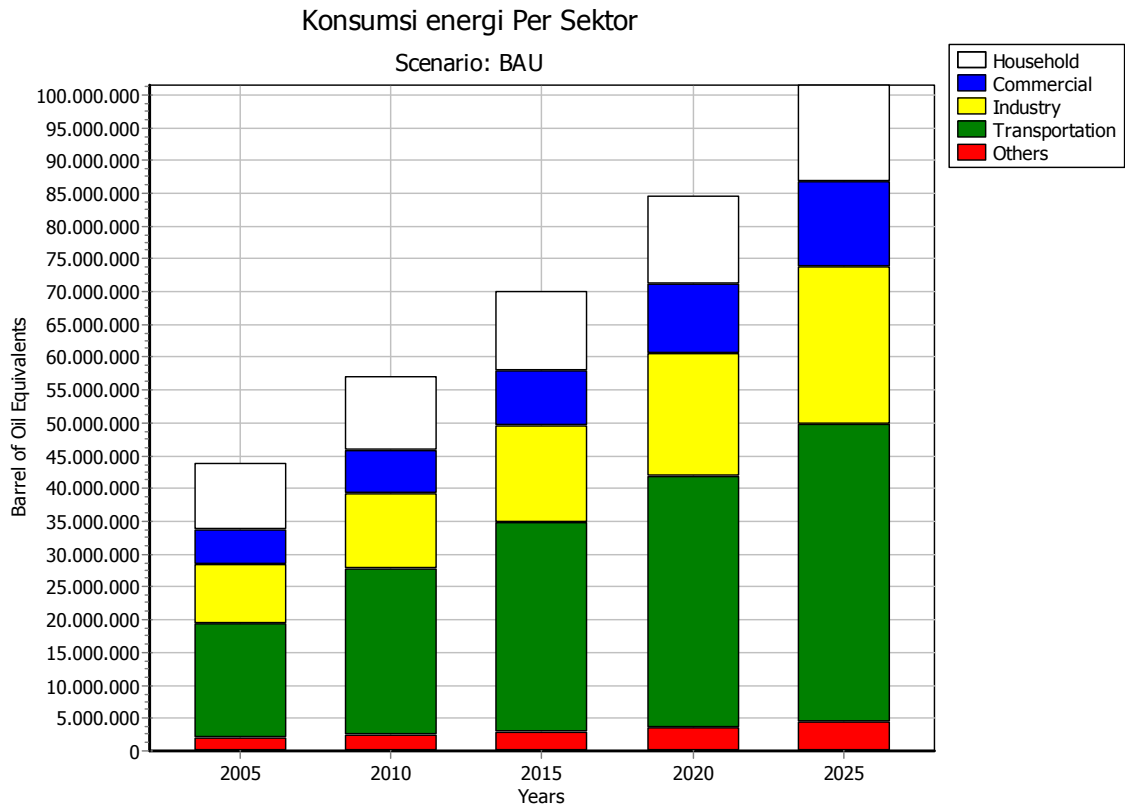


Figure 5.8 Projection of energy demand of each sector from 2005 to 2025 using BAU scenario

b. Each type of Energy

Table 5.10
Demand Results: Energy demand final units
Scenario: BAU
Branch: Demand
Units: Barrel of Oil Equivalents

	2005	2010	2015	2020	2025
kerosene	7.754.197	9.040.894	10.603.840	12.515.767	14.865.370
Wood	1.516.027	1.588.881	1.664.114	1.741.671	1.821.476
LPG	854,104	1.003.944	1.181.429	1.392.069	1.642.599
IDO	323,744	407,469	512,079	642,853	806,375
Gasoline	11.051.823	16.488.706	20.513.914	24.122.146	27.902.054
FO	1.391.740	1.765.209	2.237.643	2.835.431	3.591.952
Electricity	6.480.160	7.717.446	9.200.156	10.981.846	13.128.347
Coal {bituminous}	2.727.783	3.550.396	4.620.096	6.010.834	7.818.632
Coal briquete	89,213	106,514	127,415	152,68	183,237
Bioetanol	0	0	0	0	0
Biodiesel	0	0	0	0	0
Avtur	233,493	313,517	398,076	481,804	564,59
ADO	11.415.113	15.074.043	19.164.348	23.885.131	29.524.158
Total	43.837.396	57.057.019	70.223.109	84.762.233	101.848.788

Pemakaian Energi per Jenis Energi

Scenario: BAU

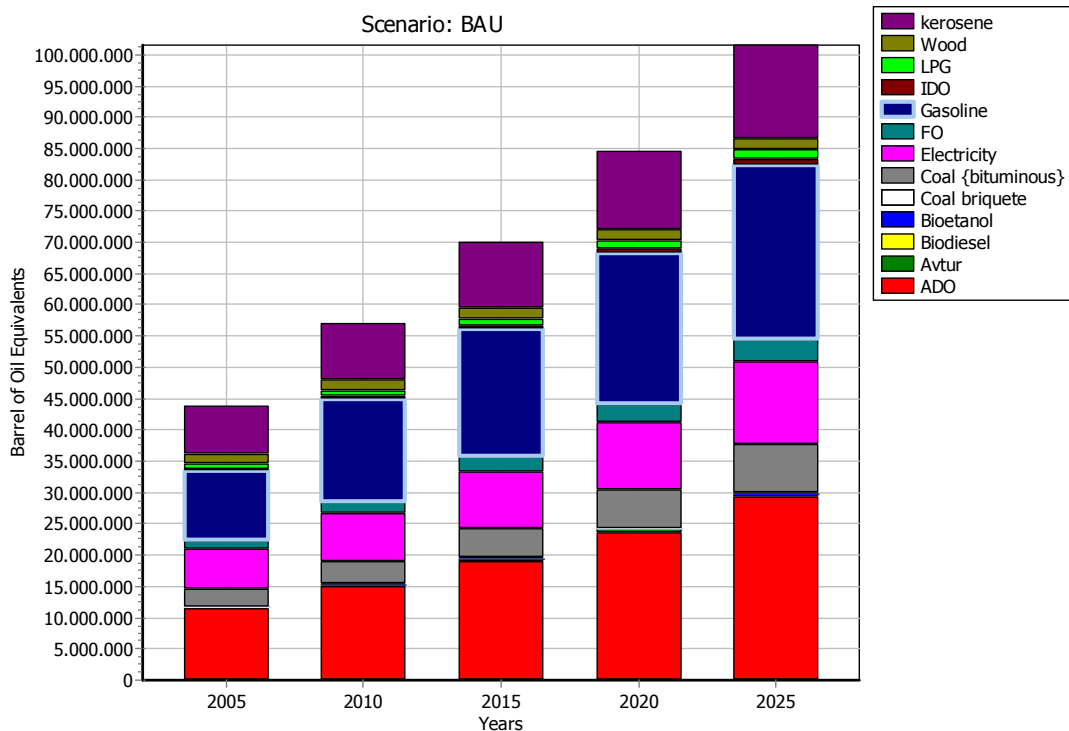




Figure 5.9 Projection of Energy demand of each type of energy for 2025 using BAU scenario