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# A REVIEW ON THE ELECTRICITY SUPPLY POLICYON THE PROVINCE OF CENTRAL KALIMANTAN, INDONESIA

## SEBUAH TINJAUAN ULANG PADA PENYEDIAAN LISTRIK UNTUK PROVINSI KALIMANTAN TENGAH, INDONESIA

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**ABSTRACT**
Recently, blackouts in Palangka Raya, capital city of Central Kalimantan became more and more often. PT. PLN Palangka Raya branch was always put the blame on the dry season that caused the dam in RiamKanan to have dried resulting in the shutdown of their power engine thus to turn off the electricity supply to every area including Palangka Raya. Endowed with rich natural resources including energy resources such as oil and coal, it is unlikely to see that this region was suffered from lack of power. There must be something wrong in the electricity supply policy from central government in the arrangement of energy. This is one of the reasons why this topic is deemed important as the background of the research. This research aims to find electricity supply policy for Central Kalimantan Province by reviewing the current and future electricity supply policy in order to meet the future electricity demand up to 2025. The current electricity consumptions are calculated based on the historical data and future electricity demand for Central Kalimantan. The methodology used in this research is historical analysis to get the trend of the supply and demand and the review of electricity planning of PT. PLN 2006-2025 in order to meet the future electricity demand. The review on the effect of the coal-fired power plant is also discussed to give readers a clear understanding on the effect of coal-fired power plant on human health in long term. Finally, the objective of this research beside to find electricity supply policy for the Central Kalimantan province, is also to give a clear understanding of the consequences our next generation will face by choosing a certain electricity supply policy reflected in the RUPTL made by PT. PLN. Still this research has many limitations which open further research to give more comprehensive electricity supply for Central Kalimantan such as the more accurate data collecting, method used and time constraint.
***Keywords*** **:** *electricity supply, coal, health, policy*

**ABSTRAKSI**
Akhir-akhir ini, pemadaman listrik di Palangka Raya, ibukota Kalimantan Tengah semakin sering terjadi. PLN cabang Palangka Raya selalu menyalahkan musim kemarau yang menyebabkan bendungan di Riam Kanan menjadi kering yang menyebabkan dimatikannya mesin pembangkit listrik sehingga memutus penyediaan listrik ke setiap daerah termasuk Palangka Raya. Diberkati dengan sumber daya alam yang melimpah seperti sumber daya energi misalnya minyak dan batubara, sangat tidak mungkin melihat daerah ini menderita kekurangan listrik. Pasti ada sesuatu yang salah pada kebijakan penyediaan listrik dari pemerintah pusat dalam pengaturan energi. Hal ini menjadi salah satu alasan mengapa topik ini dianggap penting sebagai latar belakang penelitian. Penelitian ini bertujuan untuk mendapatkan kebijakanpenyediaan listrik untuk Provinsi Kalimantan Tengah dengan cara meninjau ulang kebijakan sekarang dan yang akan datang untuk memenuhi permintaan listrik di masa yang akan datang sampai tahun 2025. Konsumsi listrik saat ini dihitung berdasarkan analisis historikal untuk mendapatkan tren penyediaan dan permintaan listrik dan tinjauan ulang perencanaan listrik PT. PLN 2006-2025 untuk memenuhi permintaan listrik masa depan. Tinjauan ulang pada efek penggunaan pembangkit listrik tenaga batu bara juga dibahas untuk memberikan pembaca pengertian yang jelas pada efek pembangkit listrik tenaga batubara pada kesehatan manusia pada jangka panjang. Akhirnya, penelitian ini bertujuan selain mendapatkan kebijakan penyediaan listrik untuk Provinsi Kalimantan Tengah, juga untuk memberikan gambaran yang jelas pada konsekuensi yang akan dihadapi generasi kita yang akan datang dengan memilih kebijakan penyediaan listrik tertentu tercermin dalam RUPTL yang dibuat oleh PLN. Penelitian ini tentu masih memiliki beberapa keterbatasan yang membuka peluang untuk penelitian berikutnya untuk memberikan pengertian penyediaan listrik yang menyeluruh untuk Kalimantan Tengah seperti cara mendapatkan data yang lebih akurat, metode yang digunakan dan keterbatasan waktu.
***Kata Kunci*** **:** penyediaan listrik, batubara, kesehatan, kebijakan

**Introduction**

In this modern life, all human activities are related to electronics devices. These devices need electricity in order to be functional. Since the optimum exploitation of energy resources to produce electricity can damage environment, one need to decide the best electricity supply policy that can be adopted to support the increasing demand of electricity as the result of higher quality of life for people and development of its industries.

Indonesia's undeniable need of energy will result in unreasonable claim that it could move immediately to a fully sustainable energy system (Brooks and Indonesia 1992). However, it is possible to attain such system in the future with important steps to be taken. One of these steps is to realize that someday the reserves of nonrenewable energy will be gone and therefore it is important to decide what policy to be adopted by Government of Indonesia (GOI), especially the Ministry of Energy and Mineral Resources (MEMR) to overcome this problem.

Central Kalimantan which consists of fourteen regencies ideally work together in order to produce Central Kalimantan electricity supply policy since it is difficult for a regency to provide sufficient amount of electricity for its people and its industries by relying only on its own electricity resources. Today, nearly all regions in Kalimantan are suffering from lack of energy (Kurtubi 2012)due to lack of investment in electricity infrastructure as well as low exploration in new resources of energy(IEA 2008). It seems unlikely to see these problems are occurring in the energy-rich island of Kalimantan since it is long time known to export energy abroad. There should be some mistakes had happened in the energy management run by central government. This is one of several reasons why a comprehensive electricity supply policy is needed.

Before making an electricity supply policy, it is important to identify energy resources available not only benefitthe region in particular but also the whole country in general. Central Kalimantan, as the main topic in this research, has an area of about 153,800 km2which is the second largest area after East Kalimantan with many energy resources available waiting to be utilized. Besides East Kalimantan, Central Kalimantan, has a lot of energy resources from nonrenewable such as oil, coal, and natural gas, and renewable ones such as hydro, wind, solar, biogas, and biomass which are left untouched (RUEDCK 2011).

This paper will first describe the current electricity consumptions and future electricity demand and analyze the options of electricity supply policy of Central Kalimantan for meeting that electricity demand to support not only the economic growth and population development of the province but also the economic growth and society development of the country as well.

Finally, the paper will formulate some electricity supply policy options that may be suggested to energy policy makers in order to develop a reasonable electricity supply policy.

**Current electricity development in Central Kalimantan**

In terms of energy development, Kalimantan is still left behind compared to Java-Bali region and Sumatra region especially in electricity sector. It can be seen from the PLN planning 2010-2019 that they plan to build some 100 - 300 MW power plants for Sumatra system and 400 - 1,000 MW power plants for Java-Bali system and only 25-100 MW for Kalimantan system (PLN 2010).The electricity for Central Kalimantan province is supplied from neighboring province namely South Kalimantan province by an isolated system called Barito System. Even though Central Kalimantan has the highest growth rate in electricity consumption, it actually has the smallest in terms of quantity. As economic factors play an important role in energy sector development, it is important for Central Kalimantan to increase the economic activities in the area.

**Current Electricity Supply in Central Kalimantan**

As mentioned in the previous section, electricity system of Central Kalimantan is combined with South Kalimantan namely Barito Electricity System. The regions connected to this system are Palangka Raya, Kapuas, PulangPisau, Katingandan Barito Timur. Isolated systems are Sampit, Pangkalan Bun, Buntok, MuaraTeweh, Kuala Pembuang and Kasongan (Table 1 and Fig. 2).

Peak load in Central Kalimantan during 2009 was 117 MW but rated capacity was just 108.5 MW which means there was a deficit in Barito System resulting in scheduled power off and no new connection for new customers until new addition of capacity.As the consequences of additional 8 new regencies in Central Kalimantan, more power is required by the new regencies to add more loads for PLN to supply power. The central government has issued a "power crisis status" region to overcome such problem.


Fig. 1 Division of Central Kalimantan region

Table 1. Load composition in Central Kalimantan in 2009

| System | Installed Cap. (MW) | Rated Cap. (MW) | Peak Load (MW) | Remark |
|---|---|---|---|---|
| Barito System*) | 16.30 | 12.40 | 36.50 | 17.13 MW was release as per contract |
| Isolated Systems | | | | |
| Sampit | 38.08 | 18.70 | 18 | |
| Pangkalan Bun | 23.65 | 15.95 | 14.76 | |
| Buntok | 8.38 | 4.35 | 3.71 | |
| MuaraTeweh | 10.47 | 3.55 | 3.30 | |
| Kuala Pembuang | 3.32 | 2.47 | 1.98 | |
| Nanga Bulik | 1.89 | 1.12 | 1.09 | |
| Kuala Kurun | 3.14 | 0.80 | 0.65 | |
| PurukCahu | 3.87 | 1.56 | 1.45 | |
| Sukamara | 1.78 | 1.28 | 1.05 | |
| Others | 26.57 | 20.54 | 12.33 | |
| TOTAL | 175.83 | 108.52 | 117.16 | |

Kalselteng/Barito Systems:
Central Kalimantan: Palangka Raya, Kapuas, PulangPisau, Kasongan, and Barito Timur
Source: PLN Electricity Planning for 2010-2019

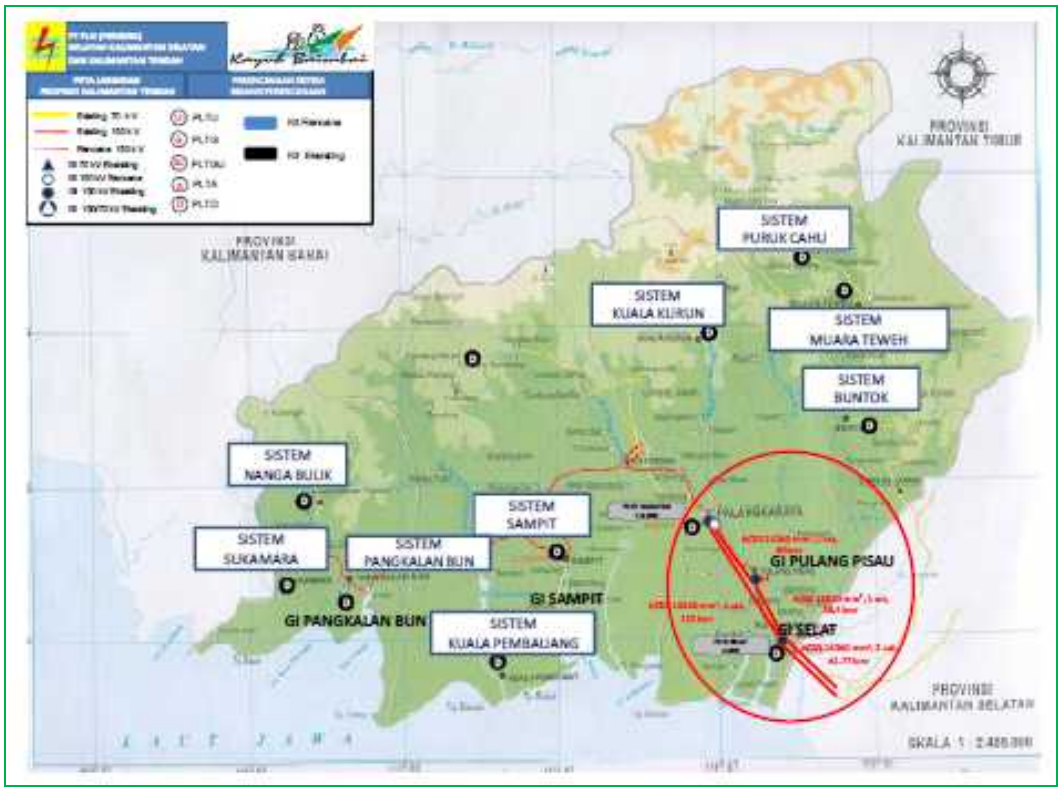


Fig. 2 Electricity system in Central Kalimantan
Source: PLN Electricity Planning for 2010-2019

**Electricity Consumption and Possible Future Demand for Central Kalimantan Province**

Based on 2010 census (Table 2), the population of Central Kalimantan is 2,202,599 compare to 1,801,965 in 2000 (bpskalteng 2010). It means that there were an additional 400,634 people within 10 years and a growth rate of 2.01% per annum. From that 2,202,599 people who live in urban area are 33.46% and 66.54% in rural area.

The economy of Central Kalimantan from 2004 to 2010 has relatively increased. In 2006, 2007 and 2008 it increased 5.84%, 6.06% and 6.2% respectively. There was slight decrease to 5.48% in 2009 as a result of global crisis but it is still above national growth which is 4.5%. In 2010, based on national census, the growth rate is 6.47 which was higher than national 6.1% as shown on Fig. 3.

The electricity sales in Central Kalimantan in 2010 is 515.04 GWh compared to 319.35 GWh in 2005. It means that there is an increase of sales about 195.69 GWh during the period with the growth rate 10.05% per annum. From the Table 3 it can be concluded also that the residential sector really plays an important role as it takes 74% of the total electricity sales compared to industrial (5%) and commercial (21%).According to data from state-owned electricity company (PLN) the electrification ratio in this region in 2008 is 61.2% compared to 44.5% in 2003. It means that the electrification growth rate is 3.34% per annum. The PLN predicted that in 2013 the ratio will be 71% (PLN 2004).

**Potential Energy Resources in Central Kalimantan**

Just like its neighbor province, Central Kalimantan is also endowed with abundant energy resources such as oil, gas, coal, hydro, solar, biofuel and biomass. Below are the potential resources of energy found within the area of Central Kalimantan (Table 4).

**Oil and Gas Potentia**l

Oil and gas resources are assets for Central Kalimantan and need to be utilized. Oil and Coal Bed Methane (CBM) gas are located in Block Kapuas which is already offered to investors, Block Bangkanai in Barito Utara had been explored for gas-powered power plant plan to operate in 2013 which has reserve about 30 MMSCF, with assumption that the plant will consume 9800 btu/kWh, thus the capacity is 127.5 MW. Meanwhile Block PulangPisau, Block Pembuang and Block Damar are in offer stage to investors (see Fig. 3).

**Biomass Potential**

Palm oil plantation in Central Kalimantan covered the area about 1,306,016 Ha with total production 2,203,352 tons in 2011. Of this production about 132,201 tons are the shell from the waste (158-184

GWh), 264,402 tons of fibers (202-349 GWh) and 506,770 tons of dried brunches (660 GWh). The liquid waste produced is about 1,322 – 1,542 tons which can produce biogas about 0.67 $m^3$/kg liquid waste.

**Option for meeting future electricity demand for Central Kalimantan**

After examining the current electricity supplies and potential energy resources in Central Kalimantan region, this section discusses the option for meeting the future electricity demand that has been discussed in previous section based on the current and potential energy in the province in order to have optimum utilization of the energy for, not only for Central Kalimantan, but also for whole area of Kalimantan.

After examining the current electricity supplies and potential energy resources in Central Kalimantan region, this section discusses the option for meeting the future electricity demand that has been discussed in previous section based on the current and potential energy in the province in order to have optimum utilization of the energy for, not only for Central Kalimantan, but also for whole area of Kalimantan. Since it is difficult for a province to rely only on its own energy resources, firstly, let us see the overall potential energy resources in Kalimantan in the table below (Table 5)

Table 2. Central Kalimantan population in 2000 and 2010

| Regency/City | 2000 | 2010 |
|---|---|---|
| Kota Waringin Barat | 168.472 | 235,274 |
| Kota WaringinTimur | 308.765 | 373,842 |
| Sukamara | 29.561 | 44,838 |
| Seruyan | 92.037 | 139,443 |
| Katingan | 121.047 | 141,350 |
| Lamandau | 47.969 | 62,776 |
| Kapuas | 325.243 | 329,406 |
| PulangPisau | 111.488 | 119,630 |
| Gunung Mas | 74.823 | 96,838 |
| Barito Selatan | 108.560 | 123,991 |
| Barito Timur | 71.907 | 97,080 |
| Barito Utara | 109.273 | 120,879 |
| Murung Raya | 74.050 | 97,029 |
| Palangka Raya (Cap) | 158.770 | 220,223 |
| **Central Kalimantan** | **1,801,965** | **2,202,599** |

Source: Central Kalimantan Statistics, 2010

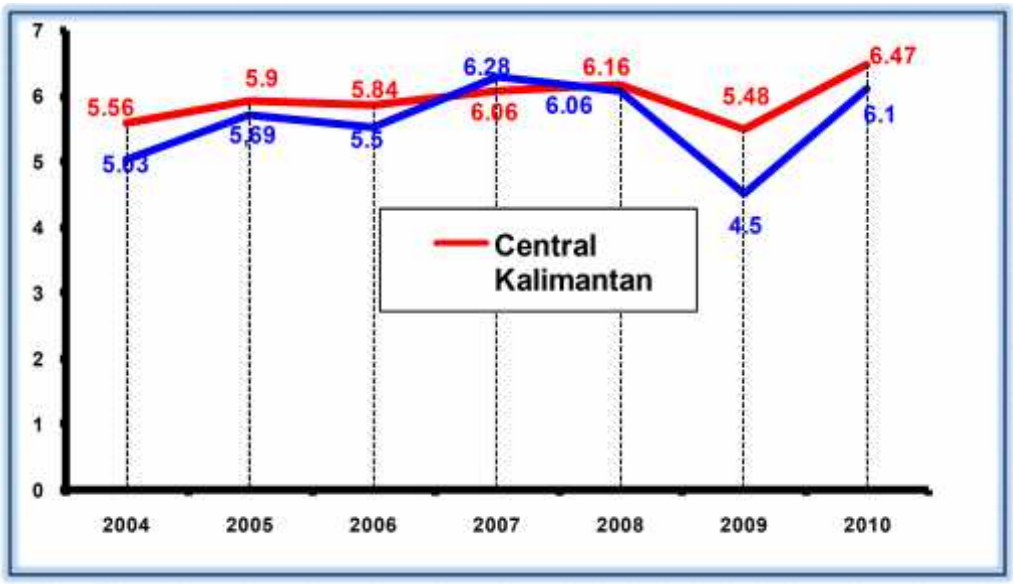


Fig. 3 Economic Growth of Central Kalimantan in 2004 – 2010 (Source: RUEDCK 2011)

Table 3. Electricity sales in Central Kalimantan based on the type of customers (GWh)

| Year | Type of customers | | | Total |
|---|---|---|---|---|
| | Residential | Industrial | Commercial | |
| 2005 | 239.63 | 21.05 | 58.67 | 319.35 |
| 2006 | 257.49 | 20.58 | 66.99 | 345.06 |
| 2007 | 284.19 | 24.96 | 79.86 | 389.01 |
| 2008 | 307.73 | 20.61 | 91.47 | 419.81 |
| 2009 | 346.9 | 18.45 | 104.05 | 469.40 |
| 2010 | 380.46 | 19.28 | 115.3 | 515.04 |

Source: Ministry of Energy and Mineral Resources, 2010

Table 4. Potential energy resources of Central Kalimantan

| No. | Type of energy resources | Potential | Installed/Taped |
|---|---|---|---|
| 1. | Oil/Gas and CBM | 30 MMSCF | - |
| 2. | Coal | 1.612 bill tones | - |
| 3. | Hydro | 484.3 MW | 30 kW |
| 4. | Peat | 1,914 mill $m^3$ | - |
| 5. | Biogas | 1,557,064.84 LOE | - |
| 6. | Biomass | 621,847,879.89 LOE | - |
| 7. | Solar | 4.5 kWh/$m^2$ | 887,400 Wp |
| 8 | Wind | 2 - 6.9 m/sec | - |

Source: PLN Electricity Planning for 2010-2019

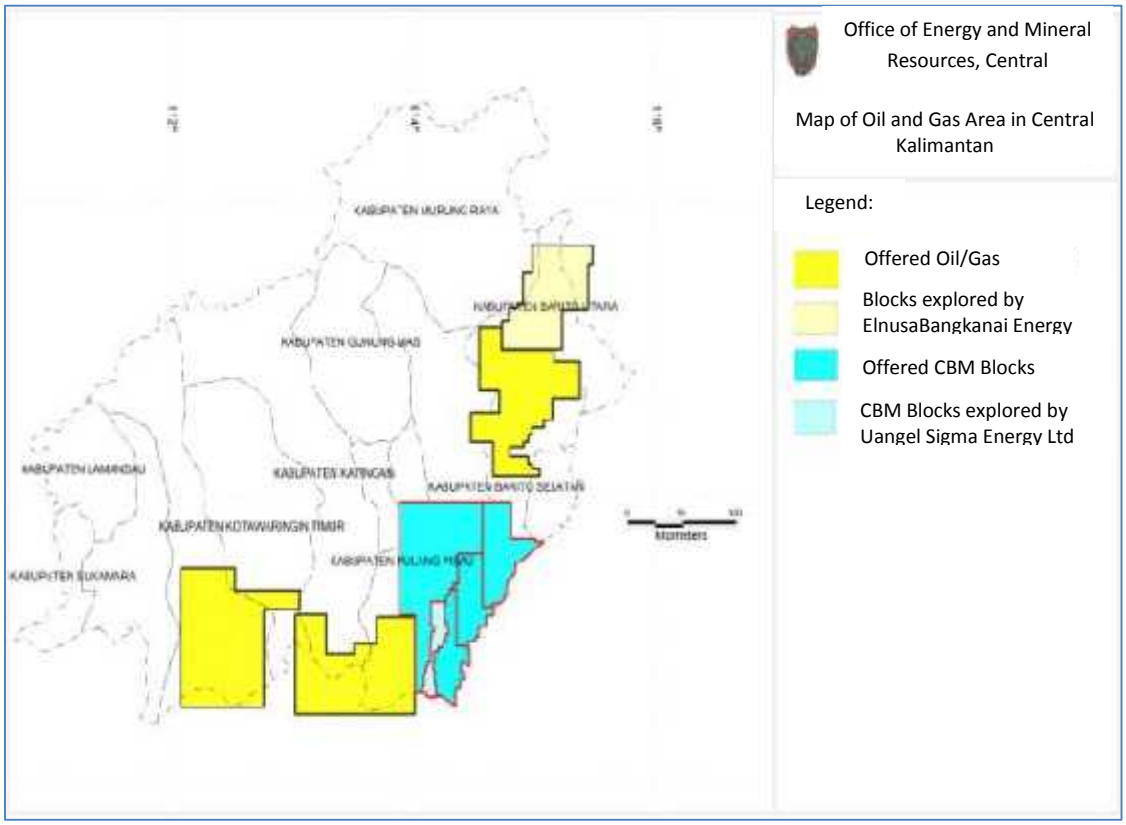


Fig. 3 Map of oil and gas area in Central Kalimantan

Table 5. Summary of Potential energy resources in Kalimantan

| No. | Region | Coal (MBOE) | Oil (MBOE) | Gas (MBOE) | Hydro (MBOE) | Solar ($kWh/m^2/day$) | Biomass (MBOE) |
|---|---|---|---|---|---|---|---|
| 1. | West Kalimantan | 782.02 | 125.41 | - | 2,241.18 | 8-9 | 11.22 |
| 2. | South Kalimantan | 7,563.03 | 620.60 | - | 58.59 | 4.5 | 0.74 |
| 3. | Central Kalimantan | 6,773.12 | - | 176.47 | 284.88 | 4.5 | 21.14 |
| 4. | East Kalimantan | 105,042.02 | 985.00 | $918.53 \times 10^6$ | 1,002.94 | 4.5 | - |
| | TOTAL | 120,160.19 | 1,731.01 | $918.53 \times 10^6$ | 3,587.59 | | 33.10 |

Conversion unit (World Bank, 1981):

1 tons of coal = 4.20 BOE
1 MMSCF = 5.88 BOE
1 MWh = 0.59 BO

**Current Electricity Consumptions and Possible Future Demand**

In order to have a better understanding on the trend of current electricity consumption in the Central Kalimantan, it is needed to get all required data of electricity consumptions within the province of Central Kalimantan during 2005-2010. The data is gathered mostly from Ministry of Energy and Mineral Resources (MEMR) and BPH Migas. The results are as follows Table 6.

From the table 6, in terms of electricity consumption, during 2005-2010 Central Kalimantan has a high growth rate with 10.05%. In terms of total rated capacity, Kalimantan region was still considered very low which only 4.9% from total national rated capacity (BAPPENAS 2009). This is surely hinders the economic development in the region.

During 2005-2010 households consumed most of the electricity energy compared to industry and commercial with more than 60% while industry consumed the least electricity with 9.75%(MEMR 2010). Compared to national consumption, the pattern was quite different. Even though households consumed most of the electricity (39%), industry was consumed slightly less about 37% during the period(MEMR 2010). It can be concludedthe industry in Kalimantan, especially Central Kalimantan, region needs to be developed more to level the industry development in other areas in Indonesia especially Java-Bali region and Sumatra region.

To compare the consumption of electricity in 2010 between provinces, a table created as follows Table 7.

From the table above, it can be concluded that even though Central Kalimantan has the highest growth rate in electricity consumption, it actually has the smallest in terms of quantity. As economic factors play an important role in energy sector development, it is important for Central Kalimantan to increase the economic activities in the area. East Kalimantan represents the highest consumption of all type of energy which means the economic activities in this area is better compare to other areas in Kalimantan. It is not surprising since East Kalimantan endowed with a lot of natural resources such as oil, gas and coal and attracts a lot of foreign investment thus resulting in people coming from all over Indonesia to look for a better job or business.

**Future Demand**

After examining the current energy consumption, it is decided to use *Business-As-Usual*scenario which will use historical data to forecast the future demand of energy for Kalimantan. The results are presented in the Table 8.

From the table 8 it can be concluded that in 2025 the demand of electricity would increase more than triple of the 2010 consumptions. Hence, comprehensive energy planning and policy should be designed carefully in order to meet that demand.

Even though Central Kalimantan has the highest growth rate in electricity consumption, it actually has the smallest in terms of quantity amongst other provinces in Kalimantan. As economic factors play an important role in energy sector development, it is important for Central Kalimantan to increase the economic activities in the area. East Kalimantan represents the highest consumption of all type of energy which means the economic activities in this area is better compare to other areas in Kalimantan. It is not surprising since East Kalimantan endowed with a lot of natural resources such as oil, gas and coal and attracts a lot of foreign investment thus resulting in people coming from all over Indonesia to look for a better job or business.

To give a better option for a decision maker to plan an energy policy, it is decided to have a good knowledge on the potential of energy resources in the Kalimantan region. The results are presented in the table 9. Considering the current energy systems and potential energy resources in the Kalimantan region, these are the options to meet future energy demand.

Table 6. Energy consumption growth rate in Central Kalimantan during 2005-2010

| Province | Growth Rate % per annum |
|---|---|
| Central Kalimantan | 10.02 |

Table 7. Total electricity consumption between provinces in Kalimantan in 2010

| No. | Province | Type of energy |
|---|---|---|
| | | Electricity (GWh) |
| 1 | West Kalimantan | 1,178.78 |
| 2 | South Kalimantan | 1,211.00 |
| 3 | Central Kalimantan | 515.04 |
| 4 | East Kalimantan | 1,750.58 |
| | TOTAL | 4,655.40 |
| | NATIONAL | 147,297.00 |

Source: Ministry of Energy and Mineral Resources, 2010

Table 8. Future demand of electricity in Central Kalimantan in 2025

| No | Province | Electricity (GWh) |
|---|---|---|
| 1. | Central Kalimantan | 2,151.45 |

Table 9. Potential energy resources in Kalimantan

| No. | Region | Coal (MBOE) | Oil (MBOE) | Gas (MBOE) | Hydro (MBOE) | Solar (kWh/m$^2$/day) | Biomass (MBOE) |
|---|---|---|---|---|---|---|---|
| 1 | West Kalimantan | 782.02 | 125.41 | - | 2,241.18 | 9 | 11.22 |
| 2 | South Kalimantan | 7,563.03 | 620.6 | - | 58.59 | 4.5 | 0.74 |
| 3 | Central Kalimantan | 6,773.12 | - | 176.47 | 284.88 | 4.5 | 21.14 |
| 4 | East Kalimantan | 105,042.02 | 985 | 918.53 x $10^6$ | 1,002.94 | 4.5 | - |
| | TOTAL | 120,160.19 | 1,731.01 | 918.53 x $10^6$ | 3,587.59 | | 33.1 |

Source: This research

**Options for meeting electricity demand:**

**the electricity demand:** coal is the most advantageous option among other energy resources in Kalimantan since all provinces has it. In terms of cost is also the least cost, however, the backdrop of coal is the emission of $CO_2$ is also the biggest compared to any other energy resources(Tarjanne and Kivistö 2008). Another challenge is the dispute between central government and local government on the railway built for coal transportation.

**the implications of choosing coal-fired power plants**: Since the GOI have decided to build almost all new power plants with coal as its fuel, it is important as well to know the implications using coal-fired power plant to supply the electricity demand. Let us learn from the U.S., a country that since early 1800 had most its power plant using coal as the fuel. According to a 2010 study by Clean Air Task Force it is estimated that air pollution from coal-fired power plants accounts for more than 13,000 premature deaths, 20,000 heart attacks, and 1.6 millions lost workdays in the US each year. The total monetary cost of these health impacts is over $100billion annually (Schneider, 2010). From the lesson learnt in the U.S., the GOI suppose to know the risk especially health risk in using the coal-fired power plants in meeting the electricity demand in the future. They should not only consider only the cheap price of the coal and the abundant deposit of it in Central Kalimantan but also the health risk in a long term.

**Policy Options for Meeting Future Electricity Demand**

The policy options for meeting future electricity demand in Central Kalimantan will be based on real situation in the region such as the availability of indigenous energy resources i.e. renewable and non-renewable, the existing infrastructures of energy and its system, supporting regulatory framework, financial

conditions, technology capacity and pricing policy. Here are some policies options can be adopted for Central Kalimantan region:

- to increase the utilization of renewable energy resources as well as to reduce GHG emission
- to ensure the utility of indigenous energy resources, renewable and non-renewable, for meeting future electricity demand of Central Kalimantan.
- to ensure the development of electricity infrastructure in Central Kalimantan region in order to boost the electricity consumption of Central Kalimantan region.
- to ensure energy diversification and efficient energy utilization
- to ensure the environmental conservation by adopting sustainable development
- to form partnership of government and private investors
- to encourage research and development in energy sector by government institutions
- to improve the financial and legal framework for private investors in renewable energy
- to increase capacity building and technology transfer

**Conclusions**

It is concluded that based on the findings in this research, Central Kalimantan is suppose to be able to meet its current and future electricity demand if the indigenous potential energy resources can be utilized in a proper way. The current lack of electricity in Central Kalimantan region indicates that there is something wrong in the energy policy in Indonesia in general. That is why it is deemed important to examine thoroughly the real electricity consumption and the current electricity systems within the region, continued by acknowledging the potential energy resources, renewable and nonrenewable, and also to identify the challenges for meeting electricity demand, technically as well as institutionally, altogether with the strategy on how to handle such challenges in order to have a comprehensive electricity planning and policy to ensure that we can manage our resources in a proper and sustainable way. It is identified also that the current policy from central government, reflected in the National Energy Blueprint 2025, to rely heavily on coal is just to repeat the mistakes done in the past on oil. Furthermore, not only is able to supply energy for the region, Kalimantan particularly East Kalimantan also is able to supply other parts of the country such as Java, Sulawesi, and eastern Indonesia. Even though endowed with abundant energy resources, it is realized that to rely fully on the non-renewable energy is considered unwise. Therefore it is deemed important to encourage as well the development of indigenous renewable energy to make sure that in the future when all nonrenewable energies have gone, we have already prepared our self with all needed means.

**References**


ASME (2009). *Technology and Policy Recommendations and Goals for Reducing Carbon Dioxide Emissions in the Energy Sector.* Washington, DC, American Society of Mechanical Engineers.

BAPPENAS (2009). *BUKU III PEMBANGUNAN RPJMN TAHUN 2010-2014.* BAPPENAS. Jakarta.

Beck, F. and E. Martinot (2004). "*Renewable energy policies and barriers.*" Encyclopedia of Energy**5**: 365-383.

Brooks, D. B. and E. M. D. i. Indonesia (1992). *Sustainable Energy: an Initial Policy Assessment for Indonesia*, The Project.

IEA (2008). *Energy Policy Review of Indonesia*. France, International Energy Agency.

Kurtubi (2012). *Kuota BBM dan Kalimantan*. Kompas. Jakarta.

MEMR (2006). *Blueprint Pengelolaan Energi Nasional 2006-2025*. Jakarta, Ministry of Energy and Mineral Resources.

MEMR (2010). "*Statistik Listrik Indonesia 2004-2011*." from http://www.esdm.go.id/publikasi/statistik.html.

Pétursson, H. (2011). "*Geothermal development in Indonesia*."

PLN (2010). *RENCANA USAHA PENYEDIAAN LISTRIK PT PLN (PERSERO) 2010-2019*. PLN. Jakarta.

PLN (2012). "*PT PLN (PERSERO)*." Retrieved March 15, 2012, 2012, from http://www.pln.co.id/.

RUEDCK (2011). *Rencana Umum Energi Daerah Provinsi Kalimantan Tengah*. Palangka Raya, Central Kalimantan Office of Energy and Mineral Resources.

Tarjanne, R. and A. Kivistö (2008). "*Comparison of electricity generation costs*." Research report/Faculty of Technology. Department of Energy and Environmental Technology.

USAID (2008). *Indonesia Energy Assessment.* Washington, DC, US Agency for International Development.