

THE ANALYSIS OF ENERGY OPTIONS FOR CENTRAL KALIMANTAN PROVINCE

ANALISIS PILIHAN ENERGI UNTUK PROVINSI KALIMANTAN TENGAH

Debora¹⁾, Vontas Alfenny Nahan²⁾

^{1), 2)}Program Studi Pendidikan Teknik Mesin, Fakultas Keguruan dan Ilmu Pendidikan
Universitas Palangka Raya, Kampus Unpar Tunjung Nyaho, Jl. H. Timang, 73111A

e-mail: dugau@yahoo.com

ABSTRACT

Kalimantan contributed 10.5% to the national GDP in 2008. Most of this contribution (7.5%) came from East Kalimantan, followed by West Kalimantan (1.2%), South Kalimantan (1.1%), and Central Kalimantan (0.8%). Even though Central Kalimantan's contribution is still relatively small in terms of national GDP, in the coming years it become bigger and bigger as the energy resources in the neighboring provinces is decreasing. It is estimated that energy demand in Central Kalimantan will more than treble by 2025 - as compared with 2010 consumption level. Clearly, effective policy measures will be required to overcome current energy problems and to plan for the future and this is the main objective of the research. Two scenarios are developed in this research to better understand the wider consequences of strategies to meet rising demand not only in Central Kalimantan, but also in Kalimantan region. The first scenario is called (in this research) Business-As-Usual (BAU) which corresponds with the national energy blueprint for 2025. The other scenario is Renewable (REN) with 15% more of renewable energy in the primary energy mix. First recommendation offered here is to suggest that the rate of utilization of renewable energy should be increased. Other option is to develop energy infrastructure, pipelines for gas distribution or gas stations for gas-fueled vehicles. Other strategies include promoting the environmental conservation, public-private partnership for infrastructure development, promotion of research and development on energy issues, design of appropriate financial and legal frameworks and emphasis on capacity building and technology transfer.

Keywords: *energy demand, options, challenges, scenarios, policy*

ABSTRAK

Kalimantan memberikan kontribusi sebesar 10.5% kepada PDB nasional pada tahun 2008. Kebanyakan kontribusi ini (7.5%) berasal dari Kalimantan Timur, diikuti Kalimantan Barat (1.2%), Kalimantan Selatan (1.2%), dan Kalimantan Tengah (0.8%). Walaupun kontribusi Kalimantan Tengah relative kecil kepada PDB nasional, dalam beberapa tahun ke depan kontribusi ini akan semakin besar seiring dengan berkurangnya sumber-sumber energy dari provinsi-provinsi tetangga. Diperkirakan permintaan energy Kalimantan Tengah akan lebih dari tiga kali lipat pada tahun 2025 – dibandingkan dengan tingkat konsumsi 2010. Sangat jelas, dibutuhkan langkah-langkah kebijakan yang efektif untuk mengatasi masalah energy saat ini dan untuk merencanakan pemenuhan kebutuhan pada masa datang dan inilah yang menjadi tujuan dari penelitian ini. Dua scenario dikembangkan dalam penelitian ini untuk dapat memahami konsekuensi dari penerapan strategi untuk memenuhi permintaan energy yang meningkat tidak hanya untuk Kalimantan Tengah tetapi juga wilayah Kalimantan seluruhnya. Scenario pertama adalah Business-As-Usual (BAU) yang mana sesuai dengan blueprint energy nasional 2025. Scenario lainnya adalah Renewable (REN) di mana 15% energy terbarukan ditambahkan pada energy mix dalam tahun 2025. Rekomendasi pertama yang ditawarkan dalam penelitian ini adalah menambahkan tingkat pemanfaatan energy terbarukan. Pilihan lainnya itu mengembangkan infrastruktur energy, pipa untuk distribusi gas, atau SPBU gas untuk mendukung kendaraan berbahan bakar gas. Strategi lain meliputi promosi pelestarian lingkungan, kerjasama pemerintah-swasta untuk pengembangan infrastruktur, promosi penelitian dan pengembangan energy, desain kerangka kerja keuangan dan legalitas dan penekanan pada pengembangan kapasitas dan transfer teknologi.

Kata Kunci: *permintaan energy, pilihan, tantangan, skenario, kebijakan*

INTRODUCTION

In order to support the economic development of a region in an efficient way, all resources of energy it has are needed to be optimized. Since the optimum exploitation of energy resources can damage environment, one need to decide the best energy policy that can be adopted to support the increasing demand of energy 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 should work together in order to produce Central Kalimantan energy policy since it is difficult for a regency to provide sufficient amount of energy for its people and its industries by relying only on its own energy 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 energy policy is needed.

Before making an energy policy, it is important to identify energy resources available not only benefit the 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 km² which 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 energy consumptions and future energy demand and analyze the options of energy of Central Kalimantan for meeting that energy 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.

Furthermore, it will develop some scenarios to set a light on how policy options can be formulated with the consequences they may bring. Finally, the paper will

formulate some energy policy options that may be suggested to energy policy makers in order to develop a reasonable energy policy.

LAND AND PEOPLE

Kalimantan, in English term, refers to the Indonesian portion of Borneo Island. It is about 73 % (540,000 sq km) of the total area of Borneo Island which is the third largest island in the world. It is surrounded by the South China, Sulu, Celebes, and Java seas and the Makassar and Karimata straits. In the northern part of the island are the states of Serawak and Sabah, which are part of Malaysia, and the British colony of Brunei.

Natural features. The coastal areas of Kalimantan are mostly low-lying, swampy, and weakly indented, with few good harbours. The sea is shallow along the western coast of the island; there is a barrier of coral reefs in places along the eastern coast. In the northwestern part of the island is the area of the ancient pre-Mesozoic Sunda platform, and in the southern and eastern parts of the island are regions of Mesozoic and alpine plicate formations. The central part of Kalimantan is composed of block mountains with elevations of 2, 000–3, 000 m that radiate from the centre to the outlying sections of the island. The highest point on Kalimantan is Mount Kinabalu (4, 101 m), in the northern part of the island. The mountains are composed mainly of granites, gneisses, and crystalline schists. Smoothed summits and steep slopes predominate. The mountains are surrounded by a zone of hilly plains that give way to flat marshy lowlands. The mineral resources of Kalimantan include petroleum and coal, as well as ores of iron, manganese, chrome, molybdenum, and copper.

Historical survey. Over a period of centuries the native population of Kalimantan—the numerous Ngadju, Ot-Danom, Ma'anyan and Klemantan tribes, which are frequently united under the name "Dayaks"—was driven back into the remote regions of the island and partially assimilated by newcomers (Malays, Javanese, and Buginese). Beginning in the 13th century, many feudal principalities that had arisen in the coastal regions of Kalimantan became dependent on various Javanese rulers. The largest principalities on Kalimantan in the 16th century were Bandjermasin and Kutei in the southeast; Sambas, Mampawa, Landak, and Sukadana in the west; and Brunei in the north.

According to Statistics Indonesia, total population of Kalimantan (4 provinces) based on 2010 census is 13,787,831. Compared to 11,331,558 in 2000, the growth of population is 2.17 % per annum. In terms of province, during this period, East Kalimantan has the biggest growth of population with 4.5%, followed by South Kalimantan, Central Kalimantan and West Kalimantan with 2.15%, 1.91% and 0.9% respectively. It was assumed that the high growth in East Kalimantan was caused by migration from other provinces especially Java provinces.

The population is unevenly spread over the island. Some areas are more densely populated than others. In term of population density, Kalimantan has only 20 people per sq km compared to Java which is about 951 people per sq km.

TRADITIONAL SOCIETY

On average, not more than half of population of Kalimantan still lived in rural area (41.95%) while by province, East Kalimantan is the only province which has population more than 50% live in urban area and West Kalimantan has the biggest population who still live in rural area.

The indigenous people of Kalimantan are usually called Dayak. In agriculture they have their own system which is called shifting cultivation. Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, then abandoned. This system often involves clearing of a piece of land followed by several years of wood harvesting or farming, until the soil loses fertility. They will shift from that depleted land and start to find a new fresh one to cultivate. After several years they will come back to that land when the condition has restored naturally. Recently many scientists appreciate this agricultural system as it does not destroy the surrounding environment.

When the forest fires happened in 1997 during dry season, resulting in the release of very thick smoke in the atmosphere that drifted north and west to affect Singapore and Malaysia, solar radiation in Central Kalimantan was reduced to only 40% of the normal level while visibility was reduced to 25 m. The GOI blamed on shifting cultivation from traditional people that caused the fire but the international community has recognized that it was because of Mega Rice Project that converted the peat land soil into rice fields.

Kalimantan has many rivers and all daily activities of the people related to it. All villages are at the river banks. Before the GOI start to construct Trans Kalimantan road, river is the only mean of transportation beside small airplane. It will take days for example, from Banjarmasin, capital of South Kalimantan, to Palangka Raya, capital of Central Kalimantan, by boat or nearly 20 hours by speedboat. By land, it only takes 4 -5 hours. As the GOI started the Trans Kalimantan projects, the use of river as transportation has reduced significantly and the people start to use cars or buses instead of boats. It resulted also in the significant increase in the use of gasoline and diesel oil.

Village people depend mostly on subsistence farming to make a living. Their main source of income is through their sales of cash crops genuinely from the

forest like rubber and rattan. Fishing is very rarely done for commercial activities and only those living on the coastal areas are involved. Since most of the people who lived in the rural area depend on subsistence farming, the need for electricity is narrowed towards just better lighting with no intention of commercialising the use of electricity to much superior use like food processing factories or clothing factories and so forth.

COLONIALISM

During colonial times, Kalimantan was divided into two regions: a) northern part (Sabah, Serawak and Brunei) which belong to British and b) south-eastern and western part which are belong to Dutch. The Dutch placed these regions under a strict control of the Dutch colonial administration which included Sambas (West Kalimantan), Bandjermasin (South Kalimantan), and Kutei (East Kalimantan).

Kalimantan was occupied by Japan in December 1941. After Japan's surrender in 1945, the Dutch colonizers, with the support of their protege, Sultan Abdul Hamid of Pontianak, created a puppet "state" on Kalimantan. After the Round Table Conference of 1949, the formerly Dutch part of Kalimantan became one of the United States of Indonesia and, in 1950, part of the Republic of Indonesia. In northern Kalimantan, Great Britain redeemed the "rights" to Sarawak from the Brooke dynasty in 1946. Sarawak then became a crown colony. Sabah was also made a crown colony in 1946. Sabah and Sarawak were included as states in the Malaysian Federation in 1963. During the preparation for the creation of Malaysia, an uprising broke out in Brunei in 1962 under the slogan of the independent unification of the territory of northern Kalimantan. The uprising was brutally suppressed.

POST INDEPENDENT PERIOD

With news of Japanese surrender came a strong Indonesian independence movement, and, though the Dutch at first attempted to retain control, Kalimantan became a part of the Republic of Indonesia in 1949–1950.

Under the GOI Kalimantan was divided into four provinces namely West Kalimantan, Central Kalimantan, East Kalimantan, and South Kalimantan. Each of the provinces has their own governor and representative. After Soeharto took the power in 1966 (New Order era) there are only three big political parties acknowledged by GOI which are Golkar (which accommodated military in the government), PDI (Democratic Party) and PPP (Islamic Party). The latter two were allowed for the formation but were kept weak during Soeharto regime.



Fig. 2 Division of Kalimantan Region

On economic matters, the New Order tended to rely on a group of American-educated economists, nicknamed the "Berkeley Mafia," to set policy. Soon after coming to power, Suharto implemented a number of reforms meant to establish Indonesia as a center of foreign investment.

Indonesia experienced tremendous growth, with Gross Domestic Product rising threefold between the mid 1960s and 1990. However, members of the military and Golkar Party acted without accountability. Key figures from the military and Golkar were heavily involved as intermediaries between the booming corporations (foreign and domestic) and the Indonesian government. This led to a great deal of corruption in the form of bribery, racketeering, and embezzlement. Funds from these practices often flowed to foundations (*yayasan*) controlled by the Suharto family.

Support for Suharto and his New Order government began to increasingly wane in the 1990s with more strident demands for democracy from within Indonesia's legal political parties. Criticism of the New Order's authoritarianism, human rights abuses, and situation of East Timor from Western NGOs and politicians began to isolate the regime diplomatically. The onset of the 1997 Asian financial crisis in Indonesia, and the stubbornness of Suharto in adopting reforms to address the crisis drew greater scrutiny from international lenders to the New Order corruption and lack of transparency. These factors culminated in the Indonesian Revolution of 1998 and the resignation of Suharto as president.

Following the downfall of Soeharto regime, the political system in Indonesia began to change dramatically as people demanded for democracy. All provinces demanded autonomy and the selection of a governor and representatives were directly by people (before it was done by representative in the parties in the House of

Representatives). Many political parties were founded during this era leading to frustrating and costly president election processes.

One of the effects of democracy is the energy policy which were backed by Article 18 of the new Energy Law No. 30/2007, which was enacted by the House of Representatives in August 2007, requires that local governments formulate their own regional energy master plan (based on the National Energy Master Plan) aimed at securing sustainable energy supplies and promoting energy conservation and the use of RE. Every province in the name of autonomy has the right to decide where they would like to go. They are racing to increase their local income by exploiting their natural resources, including energy resources, even though the central government still has some rules to obey. Actually, the autonomy given by central government was not a true autonomy. The matters which are deemed important for the country (according to central government) are still in the hand of central government such as military and defense, fiscal and monetary, religion, judicial system, foreign affairs plus standardization and macro-economic planning (Brodjonegoro, 2001). Other than those, all are given to province.

CURRENT ENERGY CONSUMPTIONS AND POSSIBLE FUTURE DEMAND

In order to have a better understanding on the trend of current energy consumption in the Central Kalimantan, it is needed to get all required data of energy 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 1. Energy consumption growth rate in Central Kalimantan during 2005-2010

Province	Growth Rate % per annum				
	Electricity	Premium	Kerosene	Diesel	LPG
Central Kalimantan	10.02	8.55	-37	6	1.95

Source: Ministry of Energy and Mineral Resources and BPH MIGAS, 2010

From the table above it can be seen that in terms of fuel consumption, in the province, these three types of fuels premium, diesel and kerosene has similar rate of growth during 2005 to 2010 which are 8.55%, -37% and 6% respectively. The significant drop in kerosene growth rate most likely due to conversion program from kerosene to gas applied by the central government.

In terms of electricity consumption, during 2005-2010 Central Kalimantan has the highest growth rate with 10.05%, followed by West Kalimantan, East Kalimantan, and South Kalimantan with 9.25%, 8.20% and 6.02% respectively (MEMR 2010). 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.

For four provinces in Kalimantan, 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 concluded the industry in 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 energy in 2010 between provinces, a table created as follows (Table 2).

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 3. From the table above it can be concluded that in 2025 the demand of energy, except for kerosene, would increase more than triple of the 2010 consumptions. Hence, comprehensive energy planning and policy should be designed carefully in order to meet those demands

Option for Meeting Future Energy Demand

In order to meet the future energy demand in the Kalimantan region it is decided to examine the current energy system within the region and the energy options available in this region. The data gathered from various

Table 2. Total energy consumption between provinces in Kalimantan in 2010

No.	Province	Type of energy				
		Electricity (GWh)	Premium (KL)	Kerosene (KL)	Diesel (KL)	LPG (kg)
1	West Kalimantan	1,178.78	327,147.76	43,903.00	311,901.62	37,657,176
2	South Kalimantan	1,211.00	358,658.79	42,191.73	432,428.41	11,325,682
3	Central Kalimantan	515.04	179,537.66	27,981.40	170,032.03	4,183,189
4	East Kalimantan	1,750.58	521,653.99	46,124.53	857,435.98	70,342,807
TOTAL		4,655.40	1,386,998.20	160,200.66	1,771,798.04	70,342,807
NATIONAL		147,297.00	22,934,500.00	2,349,510.00	12,944,076.00	3,751,000,000

Source: Ministry of Energy and Mineral Resources, 2010

Table 3. Future demand of energy in Central Kalimantan in 2025

No	Province	Electricity (GWh)	Premium (KL)	Kerosene (KL)	Diesel (KL)	LPG (kg)
1.	Central Kalimantan	2,151.45	614,614.75	27.35	408,646.46	5,591,177.73

Source: This research

resources such as national and regional office of energy and mineral resources in each province, PLN (PLN 2010) and National Energy Blueprint 2025 (MEMR 2006).

Current Energy Development in 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).

In terms of energy supply for Kalimantan region, East Kalimantan currently supplies all kinds of fuels to South and Central Kalimantan. Especially for West Kalimantan, all kind of fuels is coming from South Sumatra most likely due to cheaper costs compared to fuels coming from East Kalimantan. For electricity there are three isolated system which are Khatulistiwa System to supply West Kalimantan, Barito System for South and Central Kalimantan and Mahakam System for East Kalimantan and several isolated systems across these four provinces (PLN 2012). In the future, PLN plans to connect all these three systems to increase the electricity reliability of Kalimantan region (PLN 2010).

Furthermore, East Kalimantan is actually not only supplied its neighboring provinces but also Java-Bali and all eastern part of Indonesia as we can see in Fig. 1.

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

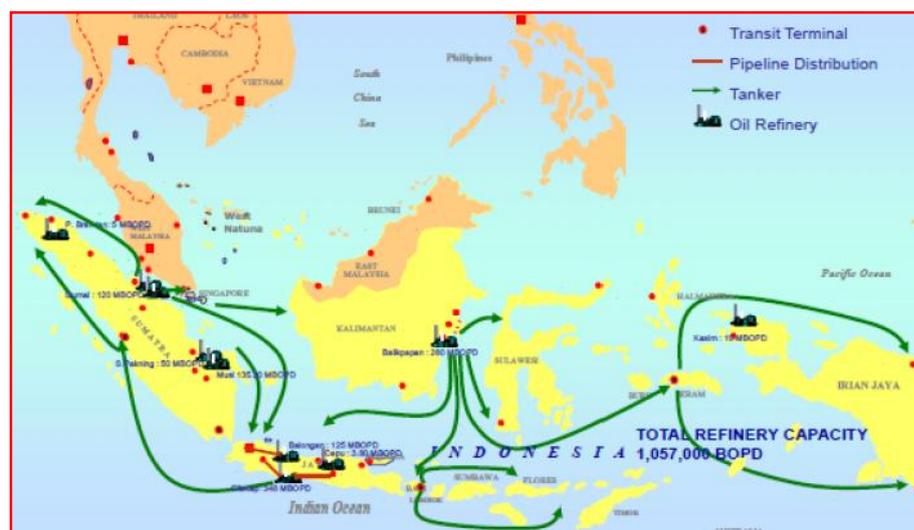
in this area is better compare to other areas in Kalimantan. It is not surprising since East Kalimantan endowed with a lot of natural resources such as oil, gas and coal and attracts a lot of foreign investment thus resulting in people coming from all over Indonesia to look for a better job or business.

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 4.

Considering the current energy systems and potential energy resources in the Kalimantan region, these are the options to meet future energy demand.

OPTIONS FOR MEETING ENERGY 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 CO₂ 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.
- **Gas demand for household:** gas for Kalimantan can be supplied not only from East Kalimantan but also from CBM reserves in Central Kalimantan (RUEDCK 2011) in order to supply for South Kalimantan as well. The local government involvement is needed to ensure the utilization of these energy resources.
- **Fuel demand for transportation:** gas is one option to reduce the dependence on fossil fuels and all provinces in Kalimantan has potential reserves of it. Another option is to develop biofuel as many non-productive lands available across Kalimantan region to make it relatively easy to find the area to develop it.



Source: National Energy Blueprint 2025

Fig. 1 Kiln and Fuel Transportation Mode, 2007

Table 4. 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 x 10 ⁶	1,002.94	4.5	-
TOTAL		120,160.19	1,731.01	918.53 x 10⁶	3,587.59		33.10

Source: This research

CHALLENGES FOR MEETING FUTURE ENERGY DEMAND AND STRATEGIES TO OVERCOME

This section discusses the possibility of challenges not only in terms of technical and geographical constraints such as cost, carbon emission and sparse population, but also from institution barriers which actually will hamper the development of renewable energy technology start from industry structure until financing matter and how to handle them. The strategies on how to handle such challenges are also presented.

- **Industry structure:** the monopoly of PLN as the single authorized buyer of electricity in Indonesia is seen a major problem to renewable energy development in Indonesia (IEA, 2008).

Strategies to overcome: market reform should be introduced in order to allow the country to better harness the power of market forces and private capital within the energy sector (IEA, 2008).

- **Price Issues:** exclusion of externalities in energy price, subsidies, incentive are the issues that also hinder the development of renewable energy hence making it difficult for meeting energy demand (Pétursson 2011).

Strategies to overcome: inclusion of externalities in energy price, to give subsidies to renewable energy development (Beck and Martinot 2004), to give incentives to private investors, to share the risk.

- **Regulatory Environment:** lack of clarity and transparency due to inconsistency and insufficient details of legislation and poor coordination, Petursson (2011) said, had hindered investment in energy sector especially in renewable energy.

Strategies to overcome: serious implementation of the regulation of related renewable energy by government institutions, to form a transparent and independent regulator which is able to operate separately from government.

- **Government and Public Institutions:** severe corruption, low effectiveness of government and security issues such as terrorism and mass violence.

Strategies to overcome: law enforcement should be upheld by the authority in order to minimize corruption not only in energy sector but also in every aspect of Indonesia, to give information on renewable energy project to local people by socializing it and to

involve local people as many as possible into the project to avoid misunderstanding between local people and private investors.

- **Technological capacity:** availability of qualified personnel and organizations, lack of technological resources, very limited state-owned company in research and development in energy sector.

Strategies to overcome: to form a National System of Innovation (Pétursson 2011) which is capable of fostering low carbon innovation and attracting foreign direct investment (FDI) and technology transfer (TT).

- **Financing:** limitation of government budget and limited knowledge of capital market on renewable technology make it difficult for the private company to develop renewable energy technology (USAID 2008).

Strategies to overcome: from domestic utilities, from direct private sector who seek an economic return, or from budget financing supplied either directly or through subsidies provided by government.

SCENARIOS FOR MEETING FUTURE ENERGY DEMAND AND ITS IMPLICATIONS

After the discussion on the possibilities of energy options for meeting future energy demand in Kalimantan, its challenges and the strategies to overcome them, it is decided to create scenarios for meeting those energy demands. The importance of these scenarios is to give some information on what implications actually we will face should we choose certain policy in order to meet our energy demand. Due to data and time constraint, it is decided to examine the general information of implications of the scenarios mainly on the supply of primary energy between two scenarios and environmental effect it creates i.e. GHG emission in the Kalimantan region based on the data gathered from previous discussion.

It is decided to develop two scenarios for meeting the future energy demand. First scenario is called **Business-As-Usual (BAU) scenario** with the assumptions based on the continuation of current trend in the Kalimantan's energy sector with energy mix in accordance with national energy policy 2006-2025. Second scenario

will be based on renewable energy and is called **Renewable (REN) scenario** with the same amount of future energy demand as in the first scenario but different pattern use of primary energy sources in the future with the share of oil and coal will be reduced and the share of renewable energy such as biodiesel will be increased hence energy mix will be different from first scenario.

These are the results of the scenarios:

- BAU scenario:
After the calculation, in this scenario the need of coal to fuel power plants in the Kalimantan region in 2025 is about 593,861 tons/year, oil needed for power plant and transportation will be 10,422,341.35 KL, natural gas will be 4,710,013.97 KL, biodiesel will be 1,005,688.48 KL, and LPG will be 239,248,282 kg.
- REN scenario
After the calculation, in this scenario the need of coal to fuel power plants in the Kalimantan region in 2025 is about 358,768 tons/year, oil needed for power plant and transportation will be 7,886,925.16 KL, natural gas will be 4,710,013.97 KL and biodiesel will be 4,025,654.59 KL, and LPG needs will be 239,248,282 kg.
- The comparison of both scenarios in Table 5.
- Implications of scenarios
BAU scenario:
 - Compare to 2010, it can be concluded that as all the power plants in Kalimantan region are mostly oil-fired ones, the need of oil is unavoidably increasing hence burdening the government with heavier subsidies.
 - The national energy policy 2006-2025 set by government actually reflects the commitment to the energy diversification and the utilization of renewable energy but since the main fuel to replace oil is coal which actually
 - dirtier than oil despite its cheaper price and abundant reserves in the region, it will only
 - lead to more GHG emission hence affecting the human health in long term.
 - One way to overcome this emission problem is to use advance technology in coal-fired power plants called IGCC (Integrated Gasification Combined Cycle), a relatively new option for power generation, have efficiencies of 38 to 42%. Another way is by using carbon capture and storage (CCS) which captures CO₂ in power plants and injecting them into deep geologic formations for permanent storage (ASME 2009). For transportation, biodiesel

can be used to also reduce the reliance on fossil fuel. Another option is to use solar-powered vehicles which will suit the climate in Kalimantan perfectly. Solar-powered equipments for households and small industries will be helping people in the rural area of Kalimantan.

- 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 supposed to be able to meet its current and future energy demand if the indigenous potential energy resources can be utilized in a proper way. The current lack of energy in 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 energy consumption and the current energy systems within the region, continued by acknowledging the potential energy resources, renewable and nonrenewable, and also to identify the challenges for meeting energy demand, technically as well as institutionally, altogether with the strategy on how to handle such challenges in order to have a comprehensive energy 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.

Table 5. The Comparison of BAU Scenario and REN Scenario

Scenario	Primary Energy requirement in 2025				
	Oil(KL)	Coal(Ton)	Natural gas (KL)	Biodiesel(KL)	LPG(kg)
BAU	10,422,341.35	593,861	4,710,013.97	1,005,688.48	239,248,282
REN	7,886,925.16	358,768	4,710,013.97	4,025,654.59	239,248,282

Source: This research

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.