

A Short Review of the Energy Fulfillment Strategy in the Development of Nusantara's Capital City

Andre Sahat Tua Sirait[#]

[#] Doctoral Student, Civil Engineering,
Hasanuddin University, Makassar, 90245, Indonesia,

Abstract— The territory in East Kalimantan has been declared as the future State Capital (IKN) of the Indonesian Republic. Energy will be one of the greatest obstacles to the functioning of the new IKN. How will the IKN's energy demands be met in the future? How should energy be used there in line with the principles of efficient energy use? Kalimantan has vast deposits of nonrenewable (fossil) and renewable energy sources, but "energy availability" will not be a major concern for the future capital city. The infrastructure of the capital city must be maintained, as new cities (ports, airports, etc.) will expand swiftly. Energy connection between provinces, as well as intra-province connectivity, must be significantly expanded/improved. It is necessary to adhere to the requirements for developing and expanding energy use, for instance in accordance with policy directives regarding Low Carbon Development and Sustainable Development Goals. Kalimantan's role as Unitary State of the Republic of Indonesia means it must adhere to the following fundamental policies: Relying on local sources, including fossil fuels and non-fossil resources, wherever feasible. Avoiding imports from neighbouring islands, particularly lowering international crude oil shipments. Prioritizing the usage of renewable and clean energy sources, such as water (hydropower), PV (photovoltaic, solar power), and biomass, with priority. Develop/reinforce the connectivity of energy infrastructure throughout all of Kalimooantan, both for electricity and other energy infrastructure.

Keywords— Put your keywords here, keywords are separated by semi colon.

I. INTRODUCTION

The territory in East Kalimantan has been declared as the future State Capital (IKN) of the Indonesian Republic. As the new capital city (which will not only support its role as the government's administrative hub), the city's population will rise in the future. In and around the vicinity of the capital city, a variety of economic activity will continue to expand. All of these factors will raise the demand for energy and other resources [1].

Energy is the motor of activity; without energy, government administration, services, transportation, and industry in the city would not be feasible. If the availability and usage of energy systems are not dependable and sustainable, particularly in the new IKN in East Kalimantan in the future, a capital city will not be able to perform its tasks effectively. Energy will be one of the greatest obstacles to the functioning of the new IKN [2].

Kalimantan has substantial reserves of both fossil and renewable energy sources. Until now, Kalimantan has served as a producer of energy (petroleum, natural gas, and coal) as well as forest goods [3], the majority of which are shipped outside of the island, overseas, making Indonesia a world-class exporter of energy and Kalimantan its greatest contributor [4].

How will the IKN's energy demands be met in the future? How should energy be used there in line with the principles of efficient energy use?

Taking into consideration the existing energy system in Kalimantan as a whole, this article presents energy supply and

consumption principles for IKN in East Kalimantan. This article analyses the state of Kalimantan's energy reserves, the constructed energy infrastructure, and recommends a system of energy supply and energy usage for the future IKN in East Kalimantan.

II. LITERATURE REVIEW

Rich fossil fuel reserves exist in Kalimantan, including oil, natural gas, and coal, as well as unconventional fossil fuel deposits like as coal bed methane and oil-gas shale [5]. The reserves are dispersed irregularly, with the highest concentration in East Kalimantan. In contrast to other provinces, West Kalimantan has essentially little fossil fuel potential [6].

East Kalimantan started petroleum exploitation more than a century ago [7] (on the islands of Bunyu and Tarakan, now in North Kalimantan) [8]. In the early 1970s, East Kalimantan (Kutai Kartanegara) generated enormous quantities of natural gas [9], which was later converted to LNG (liquefied natural gas) in Bontang-Kaltim and exported to industrialised East Asian nations (Japan, Taiwan, and South Korea) [10]. This LNG output (together with Arun in Aceh) has become Indonesia the greatest LNG exporter in the world [11].

Indonesia is still ranked as one of the world's leading coal exporters, and East Kalimantan and South Kalimantan are coal-producing regions whose output is mostly exported [12]. Coal from Kalimantan is also transported to a number of Indonesian provinces [13], including the island of Java, where it is used as fuel for PLTU (Steam Power Plants) [14].

Kalimantan has enormous supplies of both fossil fuels and renewable energy sources [15]. Indonesia is the greatest

producer of CPO (crude palm oil) in the world [16], and Kalimantan is the largest site alongside Sumatra for the largest palm oil plantations in the world, which are also situated in Indonesia [17]. West Kalimantan, on the other hand, has uranium deposits (nuclear fuel) that have not yet been explored, as well as non-energy natural resources, particularly bauxite in extremely high amounts [18], which are nearly never possessed by other Kalimantan provinces [19].

Biomass derived from palm oil, including POME (palm oil mill effluent), may be utilised as an energy source [20], either as oil or gas that can be burnt directly or as a fuel for the production of power [21]. Biodiesel produced from crude palm oil (CPO) derived from oil palm farms in Kalimantan and Sumatra is currently the world's biggest producer [22].

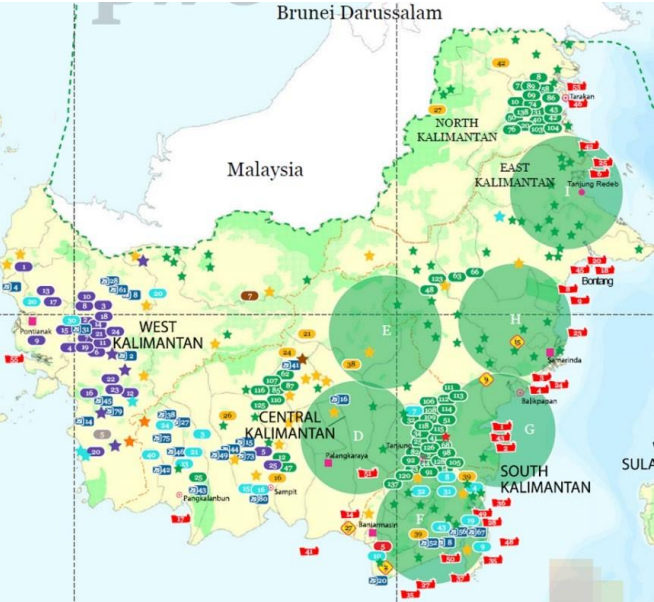


Fig. 1 Kalimantan coal and mineral concessions

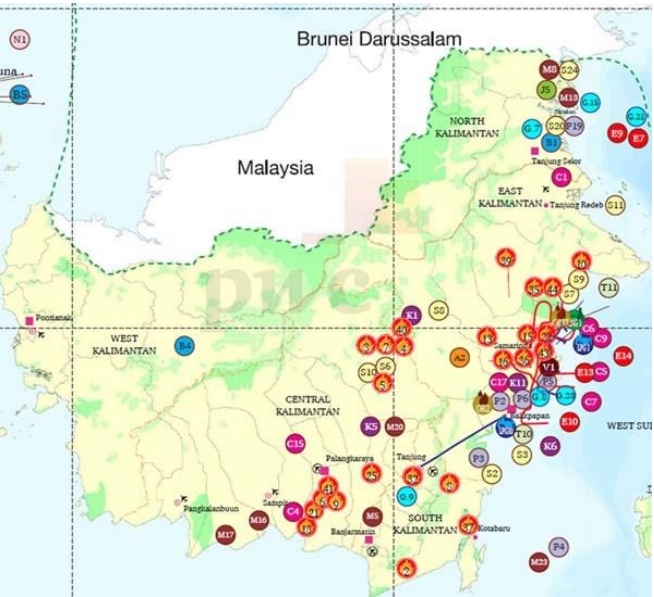


Fig. 2 Oil and gas concessions in Kalimantan

Numerous energy infrastructures have been constructed in Kalimantan to take use of its abundant energy supplies [23]. After the Cilacap refinery in Central Java, the Balikpapan oil refinery (260,000 barrels per day processing capacity) [24] is the second biggest oil refinery in Indonesia [25]. Originally, this oil refinery was intended to utilise crude oil produced by oil fields in eastern Kalimantan [26]. However, with the rising demand for oil products and the declining local production of Kalimantan crude oil, the refinery's input has been augmented by storing crude oil from multiple fields, such as imports [27].



Fig. 3 Kalimantan's electricity infrastructure

The Badak LNG Plant in Bontang-Kaltim has the biggest capacity in the world [28](8 trains, processing capacity of 22.5 MTPA - million tonnes per annum) [29]. The Bintulu LNG Plant (Sarawak Malaysia) and the Lumut LNG Plant (Brunei Darussalam) are both located on the island of Kalimantan, making Kalimantan the biggest LNG exporting island in the world with 3 exporting nations on the same island [30]. East Asia is the biggest LNG trading region in the world due to the exports of these three nations on the same island to industrialised East Asian countries [22].

East and South Kalimantan rivers (Mahakam, Barito, etc.) supplied the first infrastructure for the transoceanic transport of Kalimantan's coal (China, India, Japan, etc.) [31]. This coal fleet originating in the eastern portion of Kalimantan is the largest/largest of its sort in the world [32], carrying around one-third of the world's seaborne coal [33]. In a number of locations in Kalimantan, coal ports have been constructed not just to carry coal to export destinations across the globe, but also to other regions in Indonesia [34], particularly the island of Java, which uses a great deal of coal as power plant fuel [35]. Coal is used as fuel for the expansion of power production capacity in several parts of Indonesia [36], such as the 35,000 MW project in the 2015-2019 National Medium-Term Development Plan (RPJMN) [27].

III. METHODOLOGY

This study examines prior research on the strategic development of power-related infrastructure to sustain the development of the new Indonesia’s capital (IKN) through a

literature review. The methods used in this study are Observation, Literature Study, Focused Group Discussion and In-Depth Interview with the community and stakeholders.

IV. RESULT AND DISCUSSION

A. Fundamental principles of energy supply and consumption

As soon as the status of the Kalimantan area as the new IKN of the Republic of Indonesia is determined, energy requirements in Kalimantan will grow. As a result of the implementation of a new capital city development project, energy demands started to arise and grew with the expansion of urban activities, industrial development, etc., including in the surrounding regions. The electrical requirements of the newly constructed government city will stem from office operations, government employee housing, and the development of services (education, hospitals, malls, etc.).

Before the manufacturing industry will increase and be closer to Kalimantan, not only because of its function as the capital city, but also because of its strategic geographical location (closer to East Asian industrial countries than Java to these countries), the infrastructure of the capital city must be maintained. Additionally, new cities (ports, airports, etc.) will expand swiftly.

Considering the vast deposits of nonrenewable (fossil) and renewable energy sources in Kalimantan, "energy availability" will not be a major concern for the future capital city in Kalimantan. However, the future supply of energy in Kalimantan must take into account a variety of other factors, since IKN's presence generates a substantial demand. Additionally, the quality (reliability) of the energy supply system in Kalimantan must be improved (to satisfy the requirements of an IKN), which would increase energy consumption. Energy connection between provinces, as well as intra-province connectivity in Kalimantan, must be significantly expanded/improved, maybe even to the level of what has been created to service markets outside of Kalimantan.

As the capital of the Republic of Indonesia, Kalimantan will generate a substantial demand for (different types of) energy. In addition to addressing the challenge of meeting Kalimantan's energy needs, it is necessary to adhere to the requirements for developing and expanding energy use, for instance in accordance with policy directives regarding Low Carbon Development, Sustainable Development Goals, a greener Kalimantan, etc. Not only must these rules be applied to the "energy supply side" (particularly energy production and transformation), but also to its usage by other sectors (transportation, industry, households, offices, etc.).

B. Relying on Kalimantan-based Resources

To support Kalimantan's function as the Unitary State of the Republic of Indonesia, we suggest the following energy plans or fundamental policies:

1. In addition to concentrating on supplying energy for IKN, the relocation of IKN to East Kalimantan serves as a catalyst for expanding the island of Kalimantan's energy supply system.
2. Relying on local sources in Kalimantan to satisfy energy requirements. Use Kalimantan-based energy sources, including fossil fuels and non-fossil resources, wherever feasible. Avoiding imports from neighbouring islands, particularly lowering international crude oil shipments.
3. Putting Kalimantan's energy sources foremost for Kalimantan. Energy sources found in Kalimantan, especially those that are transportable/exportable, are prioritised to fulfil Kalimantan's demands first, then those of other islands in Indonesia and beyond. Such like this situation for coal.
4. Prioritizing the usage of renewable and clean energy. Utilize renewable energy sources, such as water (hydropower), PV (photovoltaic, solar power), and biomass, with priority. Prioritize the use of "cleaner" energy options among the fossil fuels present in Kalimantan, such as natural gas above coal.
5. Develop/reinforce the connectivity of energy infrastructure throughout all of Kalimantan. The connectivity of energy infrastructure across the Indonesian province of Kalimantan is built through linking the provinces of Kalimantan, both for electricity and other energy infrastructure. For the IKN region, energy infrastructure development is first emphasised.
6. Utilize energy effectively. The development of Kalimantan's transportation system, industry, and other economic activities must adhere to the principles of energy efficiency.

C. Power-related Infrastructure Projects

In addition to executing the above-mentioned fundamental policies, we suggest the implementation of the following strategic energy development projects:

1. Construction of a natural gas transmission network from the site of natural gas (or LNG) availability in East Kalimantan to IKN Unity of the Republic of Indonesia cities in Kalimantan. This development is accompanied by the building of a natural gas distribution network at IKN and the construction of natural gas distribution networks in cities covered by the natural gas transmission network. The building of the Trans Kalimantan natural gas transmission network is the next step, followed by the establishment of distribution zones.
2. Strengthening Kalimantan's transmission network of electrical interconnections. The already integrated Central Kalimantan and East Kalimantan

transmission networks must be quickly connected to the West Kalimantan network so that a statewide power interconnection network may be established. The enhanced connectivity of the Kalimantan system would prevent energy imports from Sarawak (which have been carried out through the "Equatorial System" of West Kalimantan) from being replaced by electricity produced by various other power plants in Kalimantan. Similarly, the Trans Kalimantan highway and shipping network may serve as infrastructure for the transfer of energy, particularly in bulk or liquid forms like as coal and oil.

3. The development of large-scale hydropower facilities makes use of the potential of Kalimantan's huge rivers. With the usage of the Kayan river hydropower in North Kalimantan, the development of a long-distance transmission network connecting it to the Kalimantan linked transmission system may commence. Utilizing the potential of huge rivers like as the Kapuas in West Kalimantan, the Mahakam in East Kalimantan, and the Barito in South Kalimantan, similar improvements were implemented. Not only will the development support energy in IKN, but it will also be used for the future growth of industrial locations in Kalimantan.
4. Construction of facilities and use of renewable energy Kalimantan must construct a large number of power plants and other fuels from "clean" energy sources, particularly renewable energy sources. Extensive forests may generate vast quantities of biomass that can be employed as a source of clean energy. The plentiful solar energy in Kalimantan, which is situated near the equator, is a source of energy that may be efficiently utilised there. There are certain fossil fuels that are "cleaner" than others. Natural gas is a "clean" energy resource that is abundant in Kalimantan, and the sector has been expanding for decades (though initially it was to serve exports). Natural gas is the most environmentally friendly fossil fuel compared to other energy sources (coal and oil). Natural gas must be exploited vigorously in Kalimantan for both direct combustion (in houses, factories, etc.) and power production. Coal (called "dirty") must still be exploited (given the availability of extremely huge reserves) but by using "super critical" technology, which is very efficient and burns cleaner than the technology that is currently commonly employed in Indonesia.
5. Construction of an ecologically responsible and energy-efficient transportation system. The new capital city must be equipped with an ecologically friendly and energy-efficient transportation system, such as light rail-based urban public transit, the widespread usage of bicycles by city residents, and the use of electric automobiles as opposed to gas-powered cars. The city is also meant to be "compact" in order to reduce people's needless mobility. IKN's government and private offices are intended to be "energy efficient buildings" by maximising the

amount of natural light and green space. In further Kalimantan cities, an energy-efficient and ecologically friendly transportation and office system will be established. The same principles apply to the growth of industrial zones, etc.

V. CONCLUSIONS

Taking into mind Kalimantan's history as an island with abundant energy resources and the selection of a city in Kalimantan as the capital of the Republic of Indonesia, the following suggestions are made for energy development in Kalimantan:

1. Key elements of energy policy or strategy, such as relying on local sources to satisfy energy demands; Kalimantan Prioritizing the usage of clean and renewable energy; giving priority to Kalimantan's energy sources. Develop/reinforce the interconnectivity of Kalimantan's energy infrastructure; and Use energy effectively.
2. Construction of a natural gas transmission network from the location of natural gas (or LNG) availability in East Kalimantan to IKN; Strengthening the transmission network of electricity interconnections throughout Kalimantan; The construction of large-scale hydropower plants that utilise the potential of large rivers in Kalimantan; Construction of installations and use of clean energy; and The creation of an ecologically friendly and energy-efficient transportation system.

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