

# Mapping the potential of green energy to border societies of Indonesia and Timor Leste (a preliminary study)

Frederikus Fios<sup>1</sup>

<sup>1</sup>Bina Nusantara University, Character Building Development Center, School of Computer Science, Jakarta, Indonesia, 11480

**Abstract.** The fulfillment of renewable energy supported by environmentally friendly technology is important for the Indonesian people especially in the border areas of Indonesia and Timor Leste today. This is a preliminary study that aims to map the possibility of wind energy in the border areas of Indonesia and Timor Leste, especially in North Central Timor District, East Nusa Tenggara Province, Indonesia. The method of research is the qualitative method with participatory observation approach. The results of the study found that the potential of wind energy in Mount Ainiut that can generate electricity of  $7 \times 3.5 = 24.5$  Megawatts can be consumed 20,000 homes and small industries scattered around the West Timor Region. Local people are also open to accept the construction of microgrid electric technology facilities based on wind energy that is environmentally friendly. The findings of potential wind and acceptance of local communities can be important information for the Indonesian government to adopt relevant policies to support development efforts to provide electricity for communities in Indonesia's border regions of Indonesia and Timor Leste where satisfactory electricity needs are not yet met. Collaboration of the private and government sectors, especially the ministries in charge of the mineral resources of the Republic of Indonesia is very important. This has a positive impact on the economic growth of societies in the border areas of Indonesia and Timor Leste.

## 1 Introduction

Energy crisis is a thing that hit many countries in the world. Many world countries are challenged to seek alternative energy to meet domestic needs, including Indonesia. Therefore, strategic and constructive efforts should be taken to address this issue with a primary focus on providing a source of energy for the society. A good source of energy can improve the welfare of society and increase the rate of economic growth of the society. Energy sources referred to in this paper is a source of renewable energy that is environmentally friendly.

The fulfillment of renewable energy supported by environmentally friendly technology is essential for Indonesian society today, especially in the border areas of Indonesia and Timor Leste. This observation is a preliminary study aimed at mapping the possibility of renewable energy in the border areas of Indonesia and Timor Leste, especially in North Timor Tengah District, East Nusa Tenggara Province, Indonesia. This paper reports a preliminary study to map the potential for environmentally friendly natural energy found in the border areas of Indonesia and Timor Leste conducted by the researchers. This preliminary study is important to validate the presence or absence of environmentally friendly natural energy potentials within the borders area of Indonesia and Timor Leste that can be explored for the welfare of local communities, particularly in the

aspect of meeting the basic needs of community electricity in the territory of Timor Island, especially in the border areas of Indonesia and Timor Leste. The existence of certainty of the potential of natural energy let alone renewable energy and environmentally friendly become important information to open application of environmentally friendly technology that is relevant to be able to overcome the problem of welfare of society in border area of Indonesia and Timor Leste especially in the case of fulfillment of electricity requirement and increase of economic growth.

The potential of natural energy is assumed as green energy potential. What is green energy? "Green energy (sometimes called renewable or sustainable energy) comes from natural sources like wind, water, and sunlight. Because green energy can be produced with little pollution, it's far more environmentally-friendly than other types of energy, and it does not contribute to climate change or global warming like traditional energy sources. Plus, unlike fossil fuels such as coal and oil, green energy sources are renewable, meaning they replenish naturally and are in continuous supply [1]".

Previous research related to environmentally friendly or renewable energy has been done by researchers of other countries. The future generation of the Philippines is currently enjoying renewable electricity [2]. Agaton and Karl's encourages important investment opportunities in the field of renewable energy in the Philippines [2]. The result presents a positive net present

\* Corresponding author: [fios@binus.ac.i](mailto:fios@binus.ac.i)

value for renewable energy investment [2]. A similar study was conducted by Kim, Park, and Kim entitled "Real options analysis for renewable energy investment decisions in developing countries" [3]. Wesseh and Lin examines under the title "Renewable energy technologies as a beacon of cleaner production: A real options valuation analysis for Liberia" [4]. Zhang, Zhou, and Zhou examine it with the title "A real option model for renewable energy investment with application to solar photovoltaic power generation in China" [5]. Kitzing, Juul, Drud and Boomsma examined "A real options approach to analyzing wind energy investments under different support schemes" [6]. Kim, Lee and Park made a study on "Evaluation of RandD investments in wind power in Korea using real options" [7]. Abadie and Chamorro Research on "Valuation of wind energy projects: A real options approach" [8]. Barrera, Ramírez and González examines the "Application of real options valuation for the analysis of public RandD financing on renewable energy projects: A company's perspective" [9]. Eryilmaz and Homans examines "How does uncertainty in renewable energy policy affect decisions to invest in wind energy?" [10]

## 2 Research methods

This research used qualitative method by field study and literature review approach. Library research using book references, journals and online resources and observation made by researchers in the field, especially in the border areas of Indonesia and Timor Leste. Analytical techniques using data reduction on findings of objective facts in the field are combined with hermeneutic interpretation process of the researcher. It is could produce the truth of science that implementing for the academic world, the government and the people of Indonesia.

## 3 Result and analysis

### 3.1 Challenging facts on electrical energy at the Indonesia-east Timor border

Communities in the border areas of Indonesia and Timor Leste belong to the category of people who are not yet prosperous. One indicator of this is indicated by the unmet demand for electricity in the border region. This assumption departs from some of the literary search facts that preceded it before this fieldwork was conducted by the researcher.

Indonesian newspaper reveal the facts of lack of fulfillment of electricity needs for people in the border zone of Indonesia and Timor Leste. Economy.okezone.com publishes entitled "... Electricity at the border of Indonesia is only active 12 hours per day" [11]. There are some people in the border area who enjoy electricity only at night, while in the day they do not enjoy electricity. This complicates their activities such as learning, reading, writing, and conducting economic and other social activities.

People in Belu District complain about the lack of electricity available in the border areas of Indonesia and Timor Leste. One of the citizens named W. Foni said that the people of Belu Regency, which amounted to about 50,000 heads of family or about 217,557 souls are in dire need of electricity to meet their industrial needs [12]. Creative economic activities and home industry can not run well, due to lack of electrical energy in Belu District and surrounding areas including in Malaka District.

In North Central Timor District, residents said that there are two main problems that are currently engulfing the district namely the problem of water and electricity. One resident named Kristo Haki said water and electricity were a very worrying problem in his area [13]. This condition is certainly very bad for the welfare of the local community in North Central Timor District.

The above facts are certainly not new. Because the State Electricity Company (PLN) of the Republic of Indonesia has acknowledged the fact that there are still many villages that have not received electricity service and East of Indonesia is the area most not served by electricity. Ekonomi.metrotv.com publishes a story entitled "PLN recognizes 2,500 villages not yet powered by electricity" [14]. What is the Indonesian government's response?

The Government of Indonesia responded positively to this statement of appreciative attitude to provide electricity needs in areas that have not received electricity. In connection with the above matter the Ministry of Mineral Resources of the Republic of Indonesia (ESDM) is committed to electrify villages that have not received electricity and still lag behind it. Economy.metrotv.com exposes a story entitled "Minister of Energy and Mineral Resources focusing on power to 2,500 villages" [15]. Ignatius Jonan Minister has promised and is committed to pay attention to areas that have not been powered by electricity, including of course in the border regions of Indonesia and Timor Leste are still short of electrical energy.

For the province of East Nusa Tenggara, Jonan said the area will be fully illuminated by electricians in 2019. "The electrification ratio in NTT, similar to West Papua, is well below the national average that is currently above 95%. Therefore, the electrification ratio in NTT which is still 65% will continue to be increased by 99.9% by the end of 2019. Nationally, the government is committed to fulfill the electrification ratio target of up to 99.9% in 2019", said Minister Jonan.

To support the government's commitment to overcome the electrical challenges (problems), it is necessary field studies that supporting the government's commitment to prosper the people of Indonesia, especially in the border region can run properly and correctly. This study is a consideration to the government in taking the relevant policy.

One of the thoughts that need to be considered by the government of Indonesia to run the electrification efforts of the village that is by considering the source of non-fossil energy or sources of renewable energy (green energy). We know that non-fossil energy is limited and non-renewable. Therefore, an alternative breakthrough is

needed to observe and apply non-fossil energy opportunities like as environmentally friendly energy derived from renewable energy whether it is hydropower, solar power or wind power.

### **3.2 Wind potential and opportunity of green technology development**

The island of Timor as a whole has several wind points where the evidence suggests good and precise wind quality for developing environmentally friendly wind energy-based on technologies to generate electricity. The point of concern for this research is in the border areas of North Central Timor District, Belu District, and Malaka District.

North Central Timor District has several wind points scattered among others around the Mutis Mountain (Bikomi Region), Femnasi Mount (Region of East Miomaffo), Mount Ainiut and surrounding areas (Biboki Area). Belu Regency has a good wind point in Tukuneno and Laktutus (Tasifeto Barat Region) and Lamaknen (Tasifeto Timur Region). This study focuses on the point of wind in Mount Ainiut located in the area of Biboki, North Central Timor District.

On March 2-8, 2018, researchers conducted a preliminary study at a research site in the border area of Indonesia and Timor Leste, precisely in Mount Ainiut, Insana Region, North Central Timor District, East Nusa Tenggara Province. Researchers along with elements of government, religious figures, community leaders and local youth leaders climbed Mount Ainiut for 4 hours gon on foot. Mount Ainiut is considered sacred by the local people because on this mountain there is a place of traditional rituals as a form of homage to their ancestors.

It is not easy to reach the peak of Mount Ainiut due to difficult road access coupled with heavy terrain and mileage about 3 kilometers journey from residents domicile in Loeram village. Many green trees grow in the forest of Ainiut mountain. Local people appreciate a harmonious life with the natural environment.

Mount Ainiut (Oelolok) has a height of 600 meters above the beach surface that has the best wind quality among all other points spread across the island of Timor. Wind speed in Mount Ainiut is an average of 8.5 meters per second and can be said the best one in Indonesia. Therefore, the potential of developing a power plant project (wind power center) is estimated at 7x3.5 megawatts. In addition to the existing natural potential, there is tremendous social support from the government, religious leaders, community leaders and the entire community in Loeram Village.

Potential development of this power plant has great benefits for people in the border region. Theoretically, if built a wind power center in Bukit Ainiut, it is very positive impact to help the people of the border region of Indonesia and Timor Leste in fulfilling the need of electricity. The potential of Ainiut project development is very prospective to be developed because the electricity generated can be consumed by 20,000 houses and small industries in West Timor and surrounding areas (border of Indonesia and Timor Leste).

This openness and attitudes of local communities are a sign that the local community is technically and sociologically open to accept the construction of micro grid-based electric energy technology facilities that are environmentally friendly.

The findings of potential wind and acceptance of local communities can be important information for the Indonesian government to take the relevant policy to support the development effort to provide electricity for the people in the border areas of Indonesia and Timor Leste which are still not satisfied with the needs of electricity satisfactorily. Collaboration of the private and government sectors, especially the ministries in charge of the mineral resources (ESDM) of the Republic of Indonesia.

The fulfillment of electricity in these border areas would improve the economy of local communities. This has a positive impact on the economic growth of communities in the border areas of Indonesia and Timor Leste in the struggle for the welfare of their lives. Therefore, an ideal synergy between government, religious leaders, private entrepreneurs, community leaders and all stakeholders is needed to support the development of environmentally friendly technologies based on wind energy in Timor island.

## **4 Conclusions**

The earth is currently filled with environmental crises as a result of the implementation of development that is not environmentally friendly. Therefore the implementation of development for improving the welfare of the community needs to pay attention to the environmentally friendly aspects. The direction of technological development today is shifting to the development of environmentally friendly industrial projects. Creation of new energy sources to meet human energy needs, it is important to note the potential of environmentally friendly energy.

The fulfillment of renewable energy is supported by environmentally friendly technology is important for the people of Indonesia, especially in the border areas of Indonesia and Timor Leste are still short of electrical energy. The results of a preliminary study of mapping of wind energy potential in Mount Ainiut, North Central Timor District is important as a recommendation for the government in taking into account the implementation of environmentally friendly development for communities in the border areas of Indonesia and Timor Leste.

The support and openness of local people to accept the construction of micro grid-based on wind energy technology facilities needs to be followed up with a concrete program that is essential to advance the community by paying attention to local wisdom and the goodness of nature to support sustainable development. This study offers important information for the Indonesian government to take the relevant policy to support the efforts to build the electricity supply needs for the people of the border regions of Indonesia and Timor Leste that are still not fulfilled their electricity needs satisfactory.

## 5 Suggestion

This research proposes some concrete suggestions :

- The study of the potential of environmentally friendly energy needs to be developed in Indonesia carefully, effectively, appropriately and wisely.
- Further studies are needed to strengthen the results of this preliminary study
- It is necessary to support the Ministry of Environment and the Ministry of Energy of Mineral Resources (ESDM) of the Republic of Indonesia to support the realization of the follow-up study of these preliminary studies
- Public and government sector collaboration is needed in continuing the planning and application of environmentally friendly technology development in the border areas of Indonesia and Timor Leste
- Intensive research and study is needed to initiate every application of technology
- Application of environmentally friendly technologies needs to be continuously improved and developed in a planned and sustainable manner in the future
- It takes an open mind and cooperation of all parties in an effort to improve the welfare of the community by taking into account the dimensions of the application of environmentally friendly technologies.

## References

1. Retrieved <https://www.igsenergy.com/your-energy-choices/green-energy/types-of-green/> 2 April 2018
2. C.B Agaton; H. Karl “A real option approach to renewable electricity generation in the Philippines” *Energy, Sustainability and Society* **8** (1): 1 (2018)
3. K. Kim; H. Park, H. Kim “Real options analysis for renewable energy investment decisions in developing countries” *Renewable and Sustainable Energy Reviews* (75) pp. 918-926 (2017)
4. P.K. Wesseh; B. Lin “Renewable energy technologies as beacon of cleaner production: A real options valuation analysis for Liberia” *Journal of Cleaner Production* (90) pp. 300-310 (2015)
5. M.M Zhang; P. Zhou, D. Q. Zhou “A real options model for renewable energy investment with application to solar photovoltaic power generation in China” *Energy Economics* (59) pp. 213-226 (2016)
6. L. Kitzing; N. Juul; M. Drud; T.K. Boomsma “A real options approach to analyse wind energy investments under different support schemes” *Applied Energy* (188) pp. 83-96 (2017)
7. K.T. Kim; D.J Lee; S.J. Park “Evaluation of RandD investments in wind power in Korea using real option” *Renewable and Sustainable Energy Reviews* (40) pp. 335-347 (2014)
8. L.M. Abadie; J.M. Chamorro “Valuation of wind energy projects: A real options approach” *Energies*, **7** (5), pp. 3218-3255 (2014)
9. Barrera Martín; Zamora. G; C. Ramíre; J.M. González “Application of real options valuation for analysing the impact of public RandD financing on renewable energy projects: A company’s perspective” *Renewable and Sustainable Energy Reviews* (63) pp. 292-301 (2016).
10. D. Eryilmaz; F.R. Homans , F.R. “How does uncertainty in renewable energy policy affect decisions to invest in wind energy?” *Electricity J* **29** (3), pp. 64-71 (2015)
11. Dedi Afrianto (Online) available at: <https://economy.okezone.com/read/2017/08/08/320/1751766/walau-gratis-listrik-di-perbatasan-indonesia-timor-leste-hanya-aktif-12-jam-hari> 2 April (2018)
12. Dana Aditiasari (Online) available at: <https://finance.detik.com/berita-ekonomi-bisnis/d-3062014/industri-di-perbatasan-ri-timor-leste-kekurangan-listrik> 2 April (2018)
13. Admin BTNews (Online) available at: <http://www.bintangtimur.news/info-perbatasan/energi/warga-perbatasan-belum-merdeka-dari-air-dan-listrik.html> 2 April (2018)
14. Husen Miftahudin (Online) available at: <http://ekonomi.metrotvnews.com/read/2016/12/20/630539/pln-akui-2-500-desa-belum-teraliri-listrik> 2 April (2018)
15. Dian I. Siregar (Online) available at: <http://ekonomi.metrotvnews.com/read/2016/12/08/625528/menteri-esdm-fokus-mengaliri-listrik-ke-2-500-desa> 2 April (2018)