BUILDING DEFENSE POWER THROUGH RENEWABLE ENERGY MANAGEMENT BASED ON LOCAL WISDOM

Khusnul Khotimah[1]

Department of Energy Security Studies, Indonesia Defense University
(khusnul486@gmail.com)

Abstract – Human Resources (HR) is one of the potential sources for building non-military defense forces for Indonesia. However, the condition of Indonesian human resources has many challenges amid the existing pluralistic conditions of society. One of them is by creating a community that is united in national pluralism. The research method used in this study is literature study and observation of previous research. The result is an analysis on the use of local wisdom in managing renewable energy towards energy independence to support national defense forces, through the application of the basic principles of community participation which include: (1) The community mobilizes and facilitates other communities to provide energy independently and contribute to the growth of people's economy in support of national defense; (2) Management of renewable energy through community participation is expected to not only be a normative suggestion, but must be strengthened with regulations that regulate the active involvement of the community in supporting the achievement of 23% renewable energy mix program by 2025.

Keywords: defense power, plural society, energy

Introduction

A strong country is a country fully supported by its people as the supporting component of national power. However, until today, the Human Resources (HR) development in Indonesia still faces various challenges amid the pluralistic society of a plural nation.

Indonesia is an archipelago stretched from Sabang to Merauke which is positioned in a strategic region that enable contact with other nations. The contact with immigrants resulted in assimilation process through marriage (amalgamation) which later created different race and ethnicity. The difference in climate and topography also created a mixture of cultures and society.[1] Therefore, Indonesia is known for its rich variety of tribes, races, ethnicities and religions.

Indonesia has at least 600 ethnic groups with unique identity and culture. Some of those ethnic groups are concentrated in certain region, while some live along with other groups due to migration or the fast mobilization of

[1] Tasya Azzahra, "Indonesia's Diversity", 8 December 2016, in https://www.kompasiana.com/tasyaazzahra/58458eccf87e612f184d3af6/kemajemukan-bangsa-indonesia, accessed on 9 October 2018.

people. The same is also applied for the many religions adopted by the people of Indonesia.[2]

The plurality of the Indonesians raises the importance of mutual respect despite the existing difference, in order to minimize the occurrence of social conflict and to promote social integration. This is also important to maintain unity within the nation of Indonesia and to support national defense.

National defense is the only key to establish a united nation capable of protecting its sovereignty, territory, and people from any threat. In principle, national defense system is a total defense system which involves every citizen, territory and other national resources. It must be prepared at earliest possible by the government and is implemented in a total, integrated, directed and sustainable manner to enforce state sovereignty, territorial integrity and the safety of every citizen from any kind of threat.[3]

Energy is the main needs of every state in the current age of globalization. Energy need in Indonesia mainly fulfilled by fossil energy, especially petroleum in energy mix in Indonesia. Meanwhile, Renewable Energy (RE) such as geothermal, sea, sun, wind, hydro (water) and other sources of energy are underused despite being part of Indonesia's natural resources. It is a shame because Indonesia's rich sources of renewable energy could be used by the people in supporting national defense.

Every source of energy has unique characteristic and cannot replace each other. RE does not have the same characteristic (be it physical, chemical, composition, function etc.) as fossil energy and vice versa. Each has their own advantage and weakness since each of them is made from different type of source.

RE is developed for the purpose of energy diversification so that consumer will not have to rely on one source of energy – RE is not developed to replace fossil energy. (for example: the equivalent fossil fuels, the type of coal, but if the available coal is different from the heat value needed by a steam power plant, then the coal cannot be used as fuel for the steam power plant, because it is not suitable with fuel specs needed by the steam power plant). However, RE should

[2] Farida Hanum, Multicultural Education in Nation's Pluralism - *(*Yogyakarta*:* Lemlit UNY, 2012), p. 1.

[3] Presiden RI, Law No 3 of 2002 on State Defense, (Jakarta: Sekretariat Negara, 2015), p. 1.

be applied in the development of new technology that can be managed in an integrated and sustainable manner to fulfill the national interest. This will obviously support the target of energy mix (figure 1) in 2030 where RE usage is projected to reach 25% and then 31% in 2050.[4]

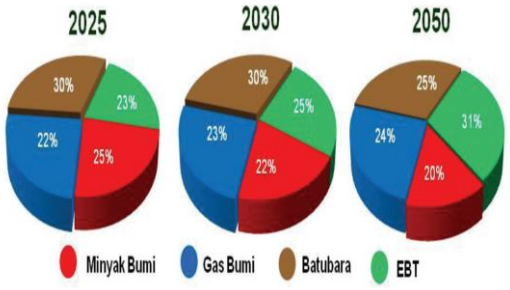

Figure 1. Energy Mix in National Energy Policy
Source: National Energy Council (DEN), *Indonesia's Energy Resilience, (*Jakarta*:* Sekjen DEN, 2015), p. 9.

The above problem can be resolved through energy management based on the local wisdom of a plural society. Development of renewable energy as part of natural resources can be realized by the plural society through the participation of human resources in supporting the national interest. Therefore, it is necessary to develop a concept to build a National Defense Power based on the plurality of its people through the local wisdom in renewable energy.

Research Methods

This research is categorized as literature review which is defined as a set of research related to the method of collecting literature data, or a research whose object of research is studied through observation on previous research. The data is collected through a variety of literatures (book, encyclopedia, scientific journal, newspaper, magazine and document) that studies or critically reviews knowledge, ideas or findings of academic-oriented literature. In addition, the literature also formulates theoretical and methodological contribution for certain topic hence it can be categorized as article review.

The stages of literature review are as follows[5]:

1. *Organize*; i.e. organizing the literatures that will be reviewed. The literatures will be selected based on its relevance with the theme of the literature review. The stages in organizing literatures are identifying the ideas, general purpose, and conclusion of the literature by reading the abstract, some of the introductory paragraph, and its

[4] National Energy Council (DEN), *Indonesia's Energy Resilience, (*Jakarta*:* Sekjen DEN, 2015), p. 9.

[5] Nana Syaodih, *Research Methodology,* (Bandung*:* PT. Remaja Rosdakarya, 2009), p. 5.

conclusion, as well as grouping the literatures based on certain categories;

2. *Synthesize;* i.e. combining the result of literature organization into an integrated summary by looking at the intertextuality between the literatures;
3. *Identify*; i.e. identifying the controversial issues of the literature. Controversial issues are issues that are deemed important to be analyzed in order to produce an interesting article to read
4. *Formulate*; i.e. formulating the findings that require further research.

Discussion

Local Wisdom in a Pluralistic Nation

The creation of a plural society in Indonesia is part of the local wisdom that has been inherited from long time ago and is influenced by several factors, namely: (a) history of colonialism; (b) geographical structure and position of Indonesia; (c) inclusive culture, and (d) modernization (development)[6].

a) History of Colonialism

Historical factor will provide a picture of a certain area along with the life of its people. Jakarta is a good example. This city was built by the Netherland colonial government as the center of government, trade and military to control each of its colony in Dutch East Indies (Indonesia). As the consequence, Netherland needed skilled human resources to operate on their interest. The HR needs was fulfilled by recruiting people from other colony. The situation and condition of Jakarta (Batavia) at that time has shown a plurality of identity within the society. That background bolsters the creation of a plural identity. The historical contact between different people in a certain area will influence the creation of a plural society.

b) Geographical Position and Structure of Indonesia

Indonesia is an archipelago nation-state. The shape of each Island in Indonesia along with the contour and structure of its land is highly diverse. The difference in territorial layout allows the society to adapt by observing the diverse situation and condition of nature. This has influenced the society in living their life and fulfilling their needs. As such, every society will have a unique way to adapt

[6] Hasyim Djalal, *The Nation's Identity against the Threat of Globalization, (*Surabaya*:* Airlangga University Wordpress, 2007), p. 19.

to the diverse range of nature by adapting to the geographical situation and condition. The society's ability to adapt will create a mindset that will result in the diversity of traditional culture, language, livelihood, or lifestyle.

c) Inclusive culture

Globalization has affected the territorial integrity of nation-state. Through globalization, boundaries between state will eventually disappear. The growth and development of science and technology have paved the way for unlimited distribution of information across nations around the world. Events that occur in a country can be immediately accessed by other countries. Modernization paved the way for the growth and development of informational technology as well as a media to introduce culture. As a country become more modern in their mastery of technology and information, they will gain more opportunity to introduce and disseminate their culture to other countries. In that circumstances, when other country adopts the technology of other country indirectly, the dissemination and introduction of culture will immediately be in effect as it is embedded in that technology. As the consequence, a highly inclusive economic, social and political life or culture of local people provide more opportunity for them to be influenced by foreign culture.

Our people's inclusive culture makes them more vulnerable to be influenced by foreign culture. This can occur through social process such as acculturation or assimilation.

d) Development

When an area experienced economic growth and has more advanced facility as well as gaining more life opportunity, the individuals living in said area will be encouraged to stay. The ease in life will encourage individual or group to make an exodus – leaving behind their homeland. This event can be categorized as urbanization. In addition, transmigration can also be categorized as urbanization.

A highly developed area will gather individuals or groups from a variety of identities (races, ethnic groups, cultures, languages, sexes, religions, jobs) and interest. Many individual or group gathered in certain area for the sake of fulfilling their needs and interest. This factor became a magnet for the society to

enjoy the growth and prosperity of a region.

Local wisdom within a society is created out of race, religion and ethnic group.[7] Race is a group of people who has similarity in physical traits due to inheriting it from previous generations. Every human will obviously have different physical trait, such as their hair color, shape of nose and eyes. The difference in race will eventually create a 'stereotype', i.e. a presumption made based on the generalized view of the trait and character of certain race. The ancestors of Indonesia were also a mixture of native inhabitant and foreign people such as Malay Mongoloid, Papua Melanosoid and Vedoid.

In addition, there are ethnic groups who create local wisdom due to having the same homeland, ancestor and culture. Ethnic groups spread around Nusantara affects the diversity of Indonesian culture. For example, each of the ethnic group has a kinship system based on lineage, such as Batak clans which include Marpaung, Lubis, Sihotang. The same is also true for Minang people who has Cianogo, Koto, Tanjung; then Minahasa with Supit, Lasut, Mandagi; and Maluku with Manuhut, Guslaw, Pattinasarani.

On the other hand, some of the people of Indonesia also believe in the faith taught by the great ancestors, such as animism (faith in the spirit of ancestors and other spirit from other realms) and dynamism (faith in the sacredness of inanimate objects).

The concept of local wisdom in a pluralistic nation[8] can be implemented through: (a) the realization of national character based on Pancasila, 1945 Constitution, Unitary State of the Republic of Indonesia and Unity in Diversity (*Bhinneka Tunggal Ika*); (b) building a national character based on complex ethics that define the nation and has unique characteristic, such as: (1) mutual respect; (2) tolerance and helping each other; (3) unity as a nation; (4) empathy for fellow citizen; (5) morality and virtues based on religious value; (6) behaviors that entail mutual benefit for each other; (7) attitudes that reflect the value of religion, law and culture; and (8) behaviors that reflect the value of our nation.

National value includes the values attached in Pancasila, 1945 Constitution,

[7] Tasya Azzahra, *op.cit.*

[8] Arkanudin, Character Building amidst the Diversity within the Four Pillar of State and Nation's Live, (Pontianak: University of Tanjung Pura, 2012), p. 34.

Unitary State of the Republic of Indonesia, Unity in Diversity as the main and fundamental foundation for the implementation of the Republic of Indonesia. Pancasila which is attached in the preamble of 1945 Constitution contained five (5) principles of fundamental value. The fundamental values of Pancasila are Belief in The One and Only God, A just and civilized humanity, A unified Indonesia, Democracy, led by the wisdom of the representatives of the People, Social justice for all Indonesians.

The 1945 Constitution constitutes the position and responsibility of the government, including their obligation, task and relation among them (legislative, executive and judicative).

The creation of Indonesia was a conscious choice of the whole people to realize a common future as well as an avenue to unite the territory of Nusantara which includes the thousands of Island from Sabang to Merauke. Indonesia is also an avenue to facilitate the diversity of value and tradition from different religions, ethnic groups, languages and cultures owned by the people of Indonesia.

Bhinneka Tunggal Ika or Unity in Diversity is the slogan of Indonesians. This slogan is written in the symbol of Indonesia, the mythical bird of Garuda Pancasila. Constitutionally, this is also regulated in article 36A of 1945 Constitution which reads: "The State Symbol is Garuda Pancasila with the slogan of Bhinneka Tunggal Ika." If we interpret it literally, Bhinneka Tunggal Ika means unity despite the diversity. It means that the nation of Indonesia might have different background due to differing ethnic group, religion and race but shall remain as one united nation.

National character building is a collective and systemic effort of a nation-state to realize a society in accordance to its national philosophy and ideology, constitution, regulations and collective potential. Especially in the context of civilized national, regional and global society to shape a nation that is tough, competitive, virtuous, morally good, tolerant, cooperative, patriotic, dynamic, cultured, and science-oriented based on Pancasila and bolstered by faith and belief on the One and Only God. This situation must also be strengthened by the ability of human resources to defend themselves from any threat, either that come from inside or outside.

National Defense

The management of national defense system as one of the functions of the government is made to protect national interest and support national policy in the field of defense. The national interest can be realized through national development in all fields, including the development of defense. Meanwhile, development in defense must be done as early as possible through the empowerment of defense area which is essentially part of the development system in the region that requires capacity building in national defense.[9]

National defense system involves every component of national defense, i.e. main component, reserve component and supporting component as depicted in Figure 2.[10]

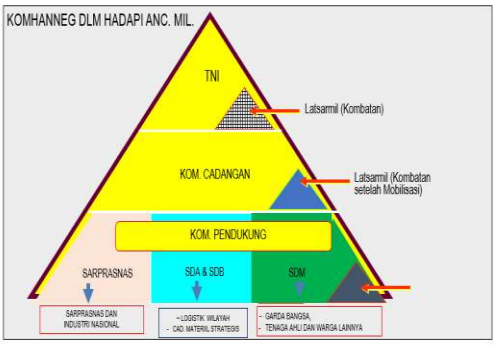

Figure 2. National Defense Component in the Face of Threat

Source: Sutrimo, *Implementation of Reserve and Supporting Component* (Bogor: Defense University, 2017), p. 16.

The main component is Indonesian National Army which is prepared to carry out defense-related task. Reserve component is national resources which is prepared through mobilization in order to expand and strengthen the power and ability of main component. Supporting component is national resources that may be utilized to increase the power and ability of main component and reserve component.[11]

Supporting component is an avenue for the people in utilizing natural resources, artificial resources and facilities that are prepared as early as possible to strengthen the main and reserve component of national defense.[12] Reserve component as part of national resources need to be build, maintained and developed so its preparedness can be realized and can be used to increase the power and ability of main component. In regard to the current condition and preparedness of reserve component, it has been faced by threat due to the development of strategic environment

[9] Sutrimo, Implementation of Reserve and Supporting Component, (Bogor: Defense University, 2017), p. 15

[10] President of RI, Law No 3 of 2002 on State Defense, (Jakarta: State Secretariat, 2015), p. 1.

[11] Sutrimo., *op.cit*, p. 19.

[12] *Ibid,* p. 17.

that constantly changes. Thus, the realization of reserve component which consists of human resources, natural resources, artificial resources and facilities is as follows[13]:

a) Human Resources

Human resources as the reserve component has the right to defend their state as well as obliged to love the nation, conscious of their obligation as a citizen as well as having unconditional faith to Pancasila as national philosophy. Hence there needs to be a directed and sustainable development so human resources can be mobilized as effective as possible, which includes:

1) Empowerment; Human resources empowerment includes empowerment of power and capacity. Empowerment of power expected of human resources is the one able to increase the ability of reserve component when it is being used to support the operation in rear area. Empowerment of power is expected to increase the quality of state defense consciousness with proportional number. While empowerment of capacity is expected to ensure that each human resource has a capacity in accordance to each of their profession in their area which is required in order to increase the ability of reserve component.
2) Development; Human resources development includes physical, mental and intellectual building. IN this development, materials on ethics and morality at school which is used as the basis of personality building must reflect on the national culture so that it will create a reliable personality capable of increasing the ability and power of reserve component.
3) Mobilization; Mobilization of human resources in the development of reserve component needs to be managed and regulated. Hence there needs to be a Law that regulates on the procedures for mobilizing human resources so that it would not disrupt other programs. The mobilization of human resources shall adjust with the need of each area.

Human resources empowerment is oriented at the realization of human resources that

[13] Arief Wahyu, *Arrangement of Reserve Components in the National Defense System, Ministry of Defense Journal*, Vol. 70, No. 54, Edition of January - February 2018, p. 4.

can work optimally in accordance to their specialty. The quality of human resources is reflected in their productivity; hence it must always be increased. The productivity of human resources is influenced by social-demographic factor such as age, sex, education, work ethos, as well as societal habit.[14]

Human element and its social system play an important role in developing national power. In fact, development can only be success ful if the government able to develop developers. Developing developers also means developing high quality human resources. The development in question is the efforts to guide and empower the potential of its people so that its ability can be well directed in the form of strength, idea, and intellectuality in order to achieve a higher level of livelihood.[15]

b) Natural Resources

Indonesia has natural resources in its land, sea and air. These resources are national potential that can be used for the purpose of national development.

Renewable Energy (RE) utilization technology is still being dominated by foreign-made products. Almost all of the currently-used RE utilization technologies (except for civil construction) were imported. RE sources are available for free but we need to buy foreign products and technology to utilize it, meaning that our fund that was supposed to manage RE sources are channeled to foreign countries instead. That fund was supposed to be used as an investment for the development of domestic energy technology, not for foreign countries. It means that Indonesia with its wealth in RE was supposed to be a developer of energy technology through research and development, or other method, instead of becoming a market for the 'promotion' of imported technology.

If left unchecked, this condition will lead to conflict, either with neighboring countries or other countries and could result in the vulnerable state of national defense. The preparation of natural resources as the component of national defense is as follows:

1) Securitization; securitization is expected to increase the main and

[14] Sutarno, *Multicultural Education, (*Jakarta*:* Ditjen Dikti, 2007), p. 8.

[15] Soetrisno, Mary Johnston, *Community Development, (*Surakarta*:* YIS, 1982), p. 58.

reserve component by maintaining the confidentiality of Seabed Contour and Seawater Characteristic from foreign entities, and ensure that it can be useful for the economy and defense of Indonesia

2) Management; Management of natural resources so it can be used to increase the ability of main and reserve component in an integrated manner.

Focusing on the development of power through national resources in the form of human resources or natural resources capable of supporting the main and reserve component of national defense. Energy as part of natural resources with the potential contained within the earth, water and air in its natural form can be used for the purpose of national defense.

Energy Management System

Energy management system based on local wisdom can be initiated through the involvement and participation of the people as human resources component in managing natural resources in the form of energy potential owned by each area in an organized manner by using the principles of energy management (Figure 3).

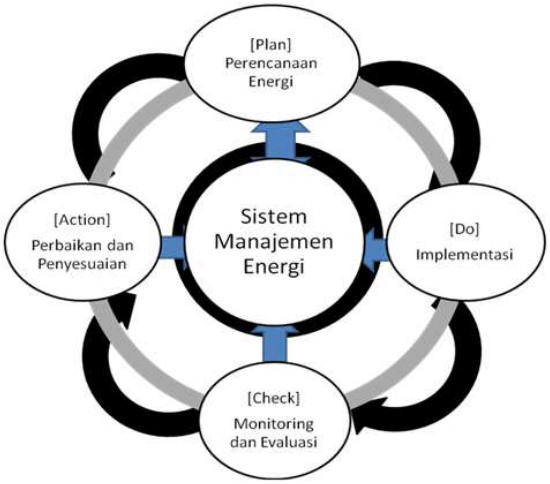

Figure 3. Energy Management System
Source: PT. Energy Management Indonesia (Persero), *Introduction to Energy Management*, (Jakarta: Ministry of Industry, 2011), p. 11.

The stages of energy management are as follows[16]:

1. Energy Planning (Plan), including:
   a. Determining the goal of energy plan
   b. Determining the strategy to achieve goals:
      1) Identifying energy use situation
      2) Energy planning commitment and consistency
      3) Required fund
      4) Required equipment
      5) Required organization
2. Implementation (Do), including
   a. Program creation which consists of:

[16] Parlindungan Marpaung, *Preparation for Energy Audit Process*, (Jakarta: Association of Energy Conservation Expert, 2014), p. 12.

1) Program goal
2) Strategy to be employed
3) Required staff and organizational structure

b. Program implementation which consists of:
1) Increasing the use of renewable energy in accordance with local wisdom
2) Conducting training and management through the participation of community as executive staff who will be directly involved in program implementation
3) Conducting pilot program activities
4) Directing, supervising and monitoring the pilot program in collaboration with related institution (Ministry of Village, Disadvantaged Regions and Transmigration, Ministry of Energy and Mineral Resources, Ministry of Defense.
5) Preparing and modifying the equipment that will sustain RE infrastructure

3. Monitoring and Evaluation (Check), including:
a. Effective and efficient energy management
b. Nurturing community participation culture in maintaining and managing renewable energy to every part of the community.

4. Improvement and Adjustment (Action), including:
a. Priority grade based on the result of monitoring and treatment
b. Focus energy monitoring and analysis to the potential for energy efficiency starting from the biggest one

Implementation of Energy Management based on Local Wisdom

Energy management based on local wisdom in Indonesia can be seen from the geographical terrain that shapes the behavior of its society, such as (1) Bajo sea tribe who lives in some coastal areas of Sulawesi and Lamarela in East Nusa Tenggara (NTT) who utilizes microalgae sea plants as biofuel; (2) people of Dusun III Kawerewere, Palolo Subdistrict, Sigi District, Central Sulawesi who utilizes water as energy; (3) people of Bangli who lives in Bali by building Biogas digester plant by utilizing livestock waste as its raw material; (4) People of Bangun Sari Village, Negeri Katon Subdistrict, Pesawaran District, Lampung Province also utilizes tapioca wastes as biogas.

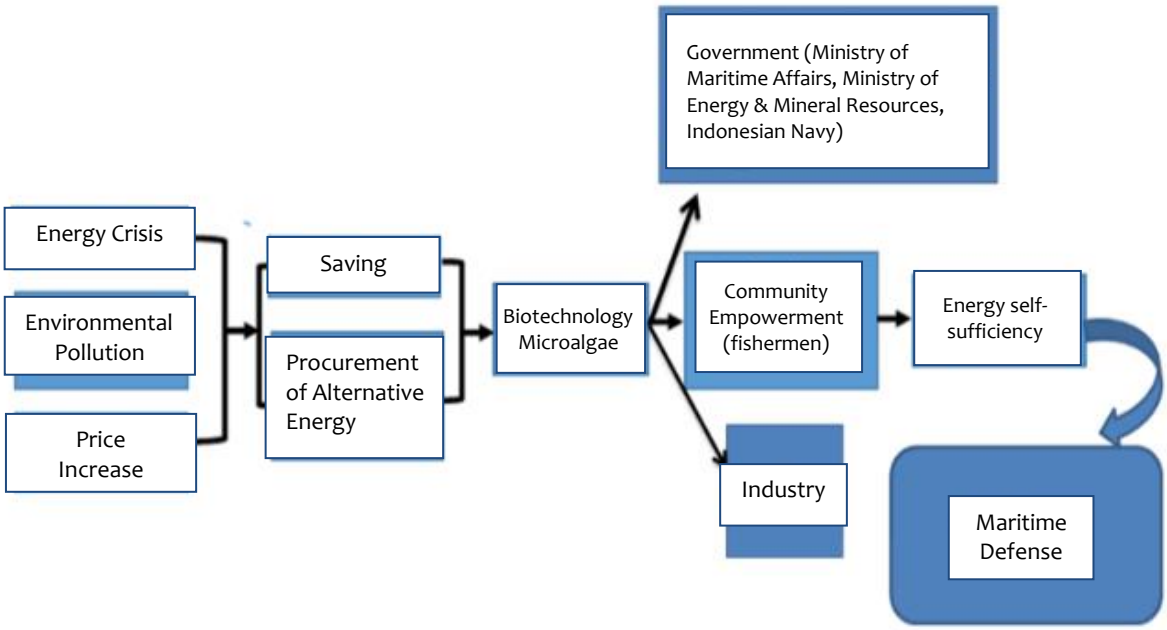

Figure 4. Roadmap for the Utilization of Microalgae in Support of Defense Power
Source: Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production,* (Bogor: IPB Press, 2010), p. 18.

Bajo Tribe understands sea as their culture, lifestyle and livelihood. When the Bajo Tribe decided to live and stay in boat house, they will produce and shape the ability to adapt with the sea. The contact and communication that was created among them turned into local language. Furthermore, the sea will produce a culture that become the unique characteristic of their tribe and this will then become the lifestyle of Bajo Tribe. Hence the geographical factor which includes the environmental condition will shape their livelihood.

Climate or weather will produce a lifestyle that will integrate with social life, including the utilization of biodiesel as a replacement of Solar fuel, which is made out of sea energy namely the microalgae sea plants.[17] The same is also true for the people of Lamarela in East Nusa Tenggara (NTT). People of Lamarela are fishermen known to hunt whales and stingrays. It is also their livelihood.[18]

[17] Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production,* (Bogor: IPB Press, 2010), p 16.

[18] *Ibid*, p 17.

Cooperation in the cultivation of microalgae as the raw material of biodiesel to replace Solar which is used to fuel the fishermen's boat has helped the local economy in the coastal area by turning it into the center integrated biodiesel production. Their model can then be imitated by other region in Indonesia and produce a positive social impact for defense power (Figure 4).

Economically, the cost of microalgae production is cheaper than other biomass sources such as palm oil, see Table 1.

Table 1. Economic Value Comparison between the Production of Microalgae and Palm Oil Biodiesel

Proses/bahan	Mikroalga		Kelapa sawit	
	Rp	Total Rp	Rp	Total
Budidaya		5.955 (62,30%)		4.680 (51,23%)
a. Persiapan lahan	1.367		3.032	
b. Pupuk	778		330	
c. Bahan lain	27		353	
d. panen	3.783		974	
Produksi minyak alga		1.683 (17,61%)		1.445 (15,82%)
a. Metanol	851		667	
b. Bahan lain	163		330	
c. Energi listrik	453		236	
d. Energi panas	217		212	
Produksi *biodiesel*		1.095 (11,46%)		997 (10,92%)
a. Metanol	480		393	
b. Bahan lain	63		188	
c. Energi listrik	416		283	
d. Energi panas	136		133	
Lain-lain		317 (3,31%)		730 (7,99%)
a. Pajak dan lain-lain	190		393	
b. Tenaga kerja	127		338	
Eksternalitas		508 (5,31%)		1.282 (14,04%)
a. Nilai lahan	309		961	
b. Biaya lingkungan	197		196	
c. Biaya sosial	2		125	

Source: Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production* (Bogor: IPB Press, 2010), p. 20

The externality cost of microalgae biodiesel production is smaller than that of palm oil (5% to 14%). This information can be used as the consideration of decision makers in Indonesia. If CPO is selected as the material of biodiesel, the consequence is that every liter of its production will impact the environment by creating 14% pollution. The biodiesel production using microalgae uses a lot of chemical substance, namely methanol for the process of esterification – trans-esterification, chemical substance for sterilization and several inorganic fertilizers. The use of chemical substance needs to be watched out for due to its potential of polluting the environment. Thus, there needs to be efforts to neutralize those substances before being dumped into the environment or reused in production cycle.[19]

The comparison of total production and externality cost of diesel, microalgae biodiesel and CPO biodiesel, as illustrated in Figure 5, shows that if the production cost of fuel is calculated without taking into account externality cost, then the production of diesel, microalgae biodiesel and CPO biodiesel amount to,

[19] *Ibid*, pg 58.

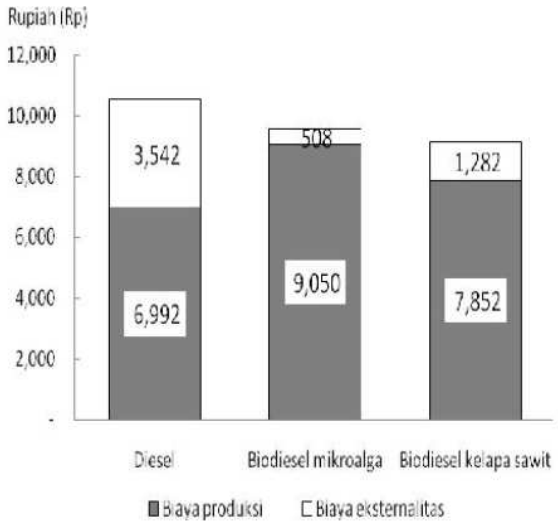

FIgure 5. Comparison of Production and Externality Cost between Microalgae Biodiesel, CPO and Diesel

Source: Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production,* (Bogor: IPB Press, 2010), p. 58.

respectively: Rp 6,992, Rp 9,050 and Rp. 7,852. Based on the three production cost, biodiesel algae's price is not competitive because its production cost is way above the market price for diesel, namely RP 8,500.

However, the production of algae biomass has great potential to be further developed. The production algae biomass which is sourced from the sea means there is no potential of social conflict due to the use of land. The conversion value of algae biomass into algae oil can still be increased by limiting certain nutrient and modifying the penetration of light to the media, as well as its important role in GHG (Greenhouse Gas) mitigation, where the media for algae cultivation can absorb GHG emission more effectively.[20]

Such condition can become an opportunity to utilize microalgae as a biodiesel managed by the people in coastal area as the technical manager and producer of the development of raw materials for the stage of microalgae cultivation (Figure 6) as well as the user of the end-product, which is supported by training from the government (Miistry of Energy, Ministry of Marine Affairs and Fisheries) and relevant research and academic institution (Indonesian Institute of Science/LIPI and Agency for the Assessment and Application of Technology/BPPT).[21]

Figure 6. Microalgae Cultivation as the Raw Material of Biodiesel

Source: Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production,* (Bogor: IPB Press, 2010), p. 16.

[20] *Ibid*, p 60.

[21] *Ibid*, p 17.

Central government can plays its role as regulator in pushing fuel oil conversion to biodiesel, such as making the price of biomass more competitive by reducing the production cost of biomass and utilizing the sampling product resulted from that process. A 1 ton production of algae biodiesel will usually produce waste in the form 3.12 ton fiber and side product in the form of glycerol amounting to 240 kg. If the price of algae biomass fiber is Rp 500/kg and glycerol is 1.28 US$/kg, then the utilization of those wastes and side products will save production cost for about Rp 2,856/kg biodiesel.[22]

The central and local government can support the utilization of microalgae as biodiesel by creating incentive-based policy to promote renewable energy among people living in coastal area. Blended finance is one of the methods for financing infrastructure that utilizes the collective fund of philanthropist and private sector as one of the financial instruments to propel sustainable economic growth, closing the gap in fiscal space limitation, attracting foreign investments into Indonesia as well as contributing to the stability of state financial system. The waste can also be utilized by recycling the chemical waste into the production system for the sake of making the production cost of algae biodiesel more efficient.

The role of private sector in the management of microalgae as biodiesel can be carried out through investment for the utilization of microalgae with technological and infrastructure development to optimize the usage of those maritime resources. This can help to support local income and also propel other sectors including housing, transportation, commercial, trade and others.

Through the help of pro-environment regulation from the government, people of Bajo and people living in coastal areas of Indonesia can independently produce biodiesel energy as the main fuel for the transportation needs of their fishermen as well as increasing energy security which also covers availability (availability of microalgae raw materials in coastal areas), accessibility (people can easily access microalgae raw materials in coastal areas), and acceptability (people accepting the idea of managing microalgae raw

[22] *Ibid*, p 18.

materials and turning it into biodiesel). Such condition can also support the realization of non-military defense through the participation of people as the manager of microalgae as biodiesel product (Figure 7)[23] from the early to the final stage.

Figure 7. Microalgae Biodiesel Product
Source: Kawaroe et.al, *Microalgae Potential and Utilization for Bio Fuel Production,* (Bogor: IPB Press, 2010), p. 17.

Another example is the development of cacao farm lighting wheel in Dusun III Kawerewere, Palolo Sub-district, Sigi District, Central Sulawesi Province. Dusun III Kawerewere has 17 households and is located inside Rejeki Village. This village is 25km away from the capital of Palolo Sub-district of Sigi District, Central Sulawesi Province. When Mr. Sudirman first settled in the village, the area was a jungle engulfed with darkness at night – no electricity at all. For night lighting, villagers used kerosene-fueled lamps.

Figure 8. Construction of MHPP in Dusun III Kawerewere
Source: Balitbang ESDM, *Moving Toward Renewable Energy,* (Jakarta: Balitbang ESDM, 2014), p. 27.

In one month each family can spend 15 liters of kerosene worth IDR 7,000/l to light a lamp. For kerosene needs alone, the villagers will need IDR 105,000 each month. The amount was very burdensome for most residents of Kawerewere village.[24]

Such condition drove Sudirman to develop a water wheel by measuring, designing and excavating a tub shelter. He measured and designed the water wheel then he cut iron plate and welded it part by part. He then prepared a wood for the runway or holder of the mill and the dynamo and he channeled the water into the tub shelter. Finally, he managed to build a power plant which has only 3

[23] *Ibid*, p 18.

[24] Badan Litbang ESDM, *Moving Toward Renewable Energy*, (Jakarta: Badan Litbang ESDM, 2014), p 28.

kilowatt capacity in the beginning (Figure 7).[25]

The MHPP designed by Sudirman has now developed into 5 units with 56 kWh capacity (Figure 9).

Figure 9. MHPP in Dusun III Kawerewere
Source: Balitbang ESDM, *Moving Toward Renewable Energy,* (Jakarta: Balitbang ESDM, 2014), p. 29.

Each unit has a capacity of 15 kWh and can provide power for 350 households. Power users who even reach neighboring villages were charged with IDR 65,000 per month for power plant maintenance and other technical needs.[26]

If previously villagers can only stay at their house during the night, now they can visit each other and improve their social relations. The same is also true in economic aspect. Thanks to power availability, people are not afraid to open up new businesses, such as workshop, furnishing or coconut grater.[27]

Another renewable energy management that utilizes the available energy source has been carried out by the people of Bangli, Bali Province. I Wayan Nyarke of Dusun Delod Umah, Pengotan Village of Bangli Sub-district, Bangli District, Bali Province, was the initiator of Biogas development. His work as farmer and cattleman had always resulted in livestock waste problems that pollute the environment.[28]

Figure 10. Biogas Construction with Community Participation
Source: Balitbang ESDM, *Moving Toward Renewable Energy,* (Jakarta: Balitbang ESDM, 2014), p. 17.

Through a technical training provided by the government, he found a method to process livestock waste and he received local government fund to develop fiberglass digester with 4 meter cubic capacity (figure 10). [29]

[25] *Ibid*, p. 27
[26] *Ibid*, p. 28
[27] *Ibid*, p. 29
[28] *Ibid*, p. 18
[29] *Ibid*, p. 120

The employed technology was quite simple, i.e. excavating hole in the soil according to the volume requirements and connecting biogas installation pipes. If the soil texture is good then it can be directly plastered. However, if the soil texture is loose, then it will be walled with unused building materials. The making of the dome also employs used feed bags and sawdust with special blend.[30]

Materials to construct digester is sand, cement, waste rock, brick waste, sawdust, used feed bags, pipes, bamboo, planks and wooden rafters. A farm with 200 livestock will require 10 x 30m^2 land area, while a farm with 4 cows will require 9 x 6m^2 land area.

Ever since being proposed in 2008, the making of cheap digester with huge volume has experienced sharp growth and spread to nearby villages. Mr. Nyarke has built 15 digesters in Delod Umah Village, Ujung Desa (1 digester), Jebeh (2) and Dangin Desa (20), all of which is located in Bangli District. As for Tabanan and Gianyar District, each has 3 units of digester (figure 11). [31]

Figure 11. Livestock Waste being Channeled into Tub Shelter
Source: Balitbang ESDM, *Moving Toward Renewable Energy,* (Jakarta: Balitbang ESDM, 2014), p. 18.

Furthermore, Mr. Nyarke has been invited to provide training and make three units of digester in Manado, North Sulawesi. He also built one unit of digester for farmers in Palangkaraya, Lampung, Sorong and Bontang.

For those who want to build digester themselves, Mr. Nyarke will train and teach them without charge, except for transportation and accommodation cost during the training and construction of digester.

The most important thing that makes Mr. Nyarke happy and proud is the fact that up to 2013 there has been no complaint or information on failed digester from users in Bali and outside of Bali.

[30] *Ibid*, p. 21

[31] *Ibid*, p. 22

Figure 11. Utilization of Livestock Waste for Organic Fertilizer

Source: Balitbang ESDM, *Moving Toward Renewable Energy,* (Jakarta: Balitbang ESDM, 2014), p. 20.

His other innovation is processing solid livestock manure combined with deciduous leaves into organic fertilizer (dry compost). The solid organic fertilizer produced from 10-12 m^3 volume digester is amounted to one truck per week, and sold for IDR 100,000 per truck. Within a month, he can earn an extra IDR 400,000.[32]

Meanwhile, liquid waste or bio slurry generated by 10-12 m^3 volume digester is about 1,500 liter per week valued at IDR 150,000/tank. This liquid waste can be turned into liquid fertilizer to be directly splashed or injected around the base area. The added value of bioslurry is about IDR 600,000/month.[33]

In addition to improving land fertility, crops yields grown with organic or liquid fertilizer from livestock waste tend to be valued higher than one grown with inorganic fertilizer.[34]

Other area such as Bangun Sari Village, Negeri Katon Sub-district, Pesawaran District, Lampung Province also utilizes tapioca waste into biogas. People of Bangun Sari lives as farmer. The farming commodity of this area are, among others, rice, cassava and corn.[35]

There is also a factory that processes the semi-finished food such as tapioca flour processing. One of the owners and managers of this flour processing factory is H. Supar. The man who has lived for half a century has built his business from scratch and now his factory, PD Semangat Jaya, able to export tapioca flour every day to Java Island. Behind his success, there is indeed some problem in managing the waste of tapioca. Cassava processing into tapioca flour produces a significant amount of waste water every day, 4 to 5 meter cubic per ton cassava and it also produces bad smell (Figure 13).

[32] *Ibid*, p. 24
[33] *Ibid*, p. 25
[34] *Ibid*, p. 20
[35] *Ibid,* p. 34.

Figure 13. Waste of Tapioca Flour Mill
Source: Badan Litbang ESDM, *Moving Toward Renewable Energy*, (Jakarta: Badan Litbang ESDM, 2014), p. 34.

In 2008, the Ministry of Energy and Mineral Resources (ESDM) and Lampung State University (Unila) conducted research to transform tapioca waste into biogas. The biogas resulting from this research was originally only used to supply the biogas of people around the factory for the purpose of cooking.

The process to make biogas in H. Supar's factory is adopting the Cover Lagoon Anaerobic Reactor (CoLAR) system introduced by the researchers of ESDM and Unila. Generally speaking, the CoLAR System modifies Mr. Supar's waste water processing installation into a biogas producer. The biogas is then used by the people around the PD Semangat Jaya for cooking purpose (Figure 14).

Figure 14. Biogas Utilization as Corn Heater
Source: Badan Litbang ESDM, *Moving Toward Renewable Energy* (Jakarta: Badan Litbang ESDM, 2014), p. 35.

Conclusion

Energy management based on local wisdom can support national defense as follows: (1) The community mobilizes and facilitates other communities to provide energy independently and contribute to the growth of people's economy in support of national defense; (2) Management of renewable energy through community participation is expected to not only be a normative suggestion, but must be strengthened with regulations that regulate the active involvement of the community in supporting the achievement of 23% renewable energy mix program by 2025.

Recommendation

Things that should be noted: (a) The community as part of human resources must be aware that they are the supporting and reserve component who are obliged to support defense power; (b) There needs to be a synergic cooperation

between human resources (the people) and natural resources (energy) to support defense power in a sustainable manner and in accordance with the different potential of natural resources in each area due to geographical difference. This can be utilized through local wisdom in managing those energy for the purpose of supporting national defense.

References

Books

Arkanudin. 2012. *Pembangunan Karakter Ditengah Kemajemukan Dalam Bingkai Empat Pilar Kehidupan Berbangsa dan Bernegara*. Pontianak: Universitas Tanjung Pura

Badan Litbang ESDM. 2014. *Bergerak dengan Energi Terbarukan.* Jakarta: Badan Litbang ESDM

Dewan Energi Nasional (DEN). 2015. *Ketahanan Energi Indonesia*. Jakarta: Sekjen DEN

Hanum, Farida. 2012. *Pendidikan Multikultural dalam Pluraisme Bangsa*. Yogyakarta: Lemlit UNY.

Hasyim, Djalal. 2007. *Jati Diri Bangsa dalam Ancaman Globalisasi*. Surabaya: Airlangga University Wordpress.

Kawaroe et.al. 2010. *Mikroalga Potensi dan Pemanfaatannya untuk Produksi Bio Bahan Bakar*. Bogor: IPB Press.

Parlindungan Marpaung. 2014. *Persiapan Proses Audit Energi*. Jakarta: Himpunan Ahli Konservasi Energi.

PT. Energy Management Indonesia (Persero). 2011. *Pengantar Manajemen Energi*. Jakarta: Kementerian Perindustrian.

Soetrisno dan Mary Johnston. 1982. *Pengembangan Masyarakat*. Surakarta: YIS.

Sutrimo. 2017. *Implementasi Peran Komponen Cadangan dan Kompoenen Pendukung*. Bogor: Universitas Pertahanan.

Sutarno. 2007. *Pendidikan Multikultural,* Jakarta*:* Ditjen Dikti.

Syaodih, Nana. 2009. *Metode Penelitian Pendidikan*. Bandung: PT. Remaja Rosdakarya

Journals

Wahyu, Arief. 2018. "Penataan Komponen Cadangan Dalam Sistem Pertahanan Negara"*. Jurnal Kementerian Pertahanan.* Vol. 70. No. 54. Edisi Januari-Februari.

Law

Presiden RI. 2015. *UU No 3 Tahun 2002 Tentang Pertahanan Negara*. Jakarta: Sekretariat Negara.

Website

Azzahra, Tasya, "Kemajemukan Bangsa Indonesia", 8 December 2016, dalam https://www.kompasiana.com/tasyaazzahra/58458eccf87e612f184d3af6/kemajemukan-bangsa-indonesia, accessed on 9 October 2018.