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Assessment of Renewable Energy Impact to Community Resilience in Sumba Island*

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Abstract

Climate change-induced droughts, creeping food insecurity, and the poverty following is all too common in the Indonesian island of Sumba. From 1990-2014 Sumba lost 100-1000 tons (depending on the district) of rice due to droughts (Provincial Government, 2015), and agricultural land ownership dropped to under 0.3 ha per farm household in 2014 (BPS, 2014) which poses a challenge for maintaining food security on the island. This phenomenon threatens the livelihood and well-being of the Sumbanese people and chips away their resilience against future disasters making them more vulnerable. With the Sumba Iconic Island program already running and targeting for 100% renewable energy usage by 2025, this article aims to establish a relationship between renewable energy and resilience in communities. An exploration of the available renewable energy resources in Sumba provided information on the potential the island of Sumba has in the renewable energy sector. Vulnerabilities and the Sumbanese economy is also explored, giving an overview of the island and the problems it is facing.

We argue that the Sumba Iconic Island program can help contribute to community resilience by improving livelihoods of the inhabitants, thus increasing their well-being and ultimately their resilience against environmental shocks and disasters. This relationship is supported by the Millennium Ecosystem Assessment (2005) where energy is a service provided by the ecosystem which is linked to one or more constituents of well-being, including livelihood. The relationship with community resilience is then instituted by Miles (2015) by stating that well-being is a foundation of community disaster resilience; the three other foundations being identity, services, and capitals. While this connection may not have an immediate and significant impact, it can be argued that 100% renewable energy consumption will serve as a precedent for both rural and urban communities as a possible and sustainable alternatives than fossil fuel electric grids and also provide benefits for the coming generations. The renewable energy provided in Sumba will also generate more activities, such as new livelihood types that can ultimately help local people increase their capacity.

Keywords: *Community Resilience; Sustainable Energy; Sumba; Sustainability; Resilience; East Nusa Tenggara.*

1. Introduction

Sumba Island has been a subject of interest for many development agencies and national governments alike in recent times, mainly because of its humanitarian issues caused by climate change effects as well as the socio-economic repercussions caused by them, in the form of poverty, prolonged droughts, floods, and other disasters. In 2014, there was a recorded 111,779 "pre-prosperous" (a category defined by the Indonesian Government for people living in poverty, but not necessarily under the poverty line) families within Sumba, which makes 16.2% of the island population (BPS NTT, 2015). From 2010-2014, the number of people living under the poverty line in East Nusa Tenggara (NTT) stagnates around 900 thousand to 1 million people, hardly increasing nor decreasing.

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This is exacerbated by the effects of anthropogenic climate change and cyclical meteorological phenomena such as the warm phase of the El-Niño Southern Oscillation. Accounting for the fact that agriculture contributes to more than 30% of NTT's Gross Regional Domestic Product (GRDP), and that 778,854 households depend on agriculture as a source of income (BPS NTT, 2015), disruptive climate change has had a devastating effect on vulnerable groups across Sumba as well as NTT and will continue to threaten the livelihood and well-being of future families if not mitigated and assessed properly. In principle, poverty – which counts for less access to resources, goods, and services – has become vulnerability for the Sumbanese people, ultimately decreasing their resilience as a community against hazards such as droughts and other climate change phenomena, in turn feeding back to the poverty they are in; and so the cycle begins again.

A major project involving international organizations and governments that was recently started is the Sumba Iconic Island, a program aiming to make Sumba 100% renewable energy-dependent by 2025 with a 95% electrification rate. Centralized energy distribution are deemed to be expensive and somewhat inaccessible for rural communities in remote areas. Distributed energy systems on the other hand, while not a novel idea, is becoming a trend as an alternative to the traditional energy grid that is more reliable and environmentally friendly (Alanne & Saari, 2006). Distributed or decentralized energy systems may be the future for rural energy, hence the reason Sumba was considered for the Iconic Island project.

The objective of this piece is to show the relationship and linkages between renewable energy systems provided by Sumba Iconic Island and community resilience against climate change effects in Sumba. A literature review regarding both distributed renewable energy systems and resilience in rural communities will be discussed in the next section. The third section will give a general overview of Sumba along with its potentials and vulnerabilities to examine why Sumba was chosen as an Iconic Island.

While there are already many efforts to alleviate poverty in Sumba and NTT and tackling the problems at the source, there are other indirect causes of low quality of life and well-being – one of them being renewable energy provision. This will be explained further in the fourth section where the relationship between renewable energy and well-being in Sumba is explained and how that ultimately can help increase resilience in Sumba communities.

2. Literature Review

2.1 Resilience and Community Resilience

Community disaster resilience and disaster risk reduction (DRR) are emerging fields within disaster research (Miles, 2015; Twigg, 2009) and thus a solid and unanimous definition of community resilience is still being formed. The UN body responsible for coordinating global disaster risk reduction efforts UNISDR (The United Nations Office for Disaster Risk Reduction) (2007) defines resilience as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions." Similarly, Twigg (2009) approached the definition of community resilience – through an operational and emergency response lens – as the "capacity to (1) anticipate, minimize and absorb potential stresses or destructive forces through adaptation or resistance; (2) manage or maintain certain basic functions and structures during disastrous events; (3) recover or 'bounce back' after an event."

Miles (2015), regretting the lack of theory-building efforts for community disaster resilience and in effort to bridge the gap between empirical research and theory, argued that the foundations of community disaster resilience comprise of four constructs: well-being, identity, services, and community. These constructs form the theoretical framework with which to close the gap between theory and methodological research.

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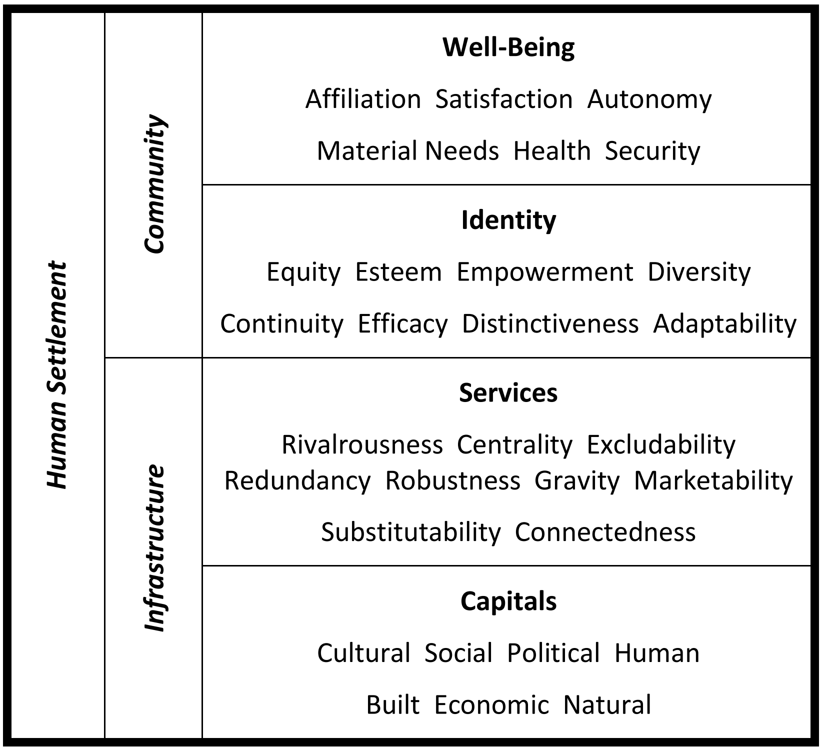

Figure 1. Conceptual model of community resilience for the theoretical framework WISC (Miles, 2015)

In this framework, "infrastructure supports and facilitates components of community within human settlements" – combinations of services and capitals represent infrastructure whereas connections of identity and well-being represent community. Adopting Costanza's (2000) ecological economic model, Miles argues that individual and community well-being ultimately depends on capitals accessible to them, and that they are indirectly connected by services and identity. He added that the goal of community resilience should be for the well-being of communities, not just its safety and functionality. This mirrors Norris et al.'s (2008) opinion that the outcome of resilience is "adaptation to an altered environment" manifested in wellness or, in this case, well-being of communities.

2.2 Renewable Energy in Rural Communities

According to Bassam & Maegaard (2004), the basic elements and energy needs of rural communities comprise of [energy for] heat, electric power, water, lighting, cooking, health and sanitation, communications, transportation, and agriculture. While in countries with smaller land mass a centralized energy system will have minor problems due to the lack of difficulty in maintenance, developing countries with sparse rural communities that make up of the majority of the population, distributed or decentralized energy systems will be much more reliable and cost-effective in both the short and long term. Despite the fact, countries such as Indonesia still endeavor in electrification of rural communities through national grids that are expensive, making it much longer for the girds to reach these communities and at a relatively higher price.

Alanne & Saari (2006) argued that decentralization in energy systems goes beyond "just situating energy conversion units closes to energy consumers," rather, the political, administrative, fiscal, and market aspects of the system must also be decentralized, giving autonomy to the community that is benefitting from this system. This includes increasing local government responsibility, employing locals as operation staff for energy utilities, and utilizing local sources of fuel. Decentralized systems thus have a number of conclusions and consequences in which the more decentralized and energy system is in a region, the

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- smaller number of consumption nodes
- larger the number of units in that region
- smaller the unit size
- smaller the average distance between a unit and a consumption node
- slighter the interaction between units (and consumption nodes)
- more diverse the use of local resources
- greater the number of deliverers (and alternative fuels) on the market

Units being either technological, political, or economic (power plants, agencies, banks, etc.) while consumption nodes are represented as a single building or grid interface.

In Indonesia, one of few studies on renewable energy in rural areas can refer to studies by Sagala et al (2015), Hnyine et al (2015) in Boyolali District, Central Java. Sagala et al (2015) studied by how renewable energy can promote energy resilience village. In a village prone to Mt. Merapi volcano, access can be very limited. Therefore, an ability to provide energy resources from the neighboring environment is crucial. This study is strengthened by Hnyine et al (2015) that calculated the economic benefit of biogas project as renewable energy in the village. It is found that biogas is important not only for renewable energy but also providing other types of economic benefit, such as clean environment and organic fertilizer for the farmers.

2.3 *Renewable Energy and Community Resilience*

Miles (2015) argued that within community resilience, well-being is dependent on the capitals available but these constructs are mediated by identity and services. This is to mean that capital, particularly natural capital in this case, plays a significant role in establishing well-being within communities and ultimately community resilience.

To give an arbitrary example, a family that has access to solar energy (a natural capital) will be able to tend to their infant child at night properly, will allow their young daughter to study at any time of the day, and cut costs that were previously required for diesel generators. A more detailed connection between renewable energy and community resilience can be found in sub-chapter four.

2.4 An Overview of Sumba

Sumba Island, located in eastern Indonesia, within the province of Nusa Tenggara Timur (NTT). Wedged between Bali and Timor Leste with a land size twice that of Bali and a population of 686,000 residents in 2010 (Gokkon, 2015). One of the last tribal areas in Indonesia, Sumba is rich in culture. The culture has been safeguarded due to a low electrification rate on the island and the subsequent lack of tourism and a large proportion still attuned to the Marapu pagan religion and followers of the 'stone culture'; the peoples' roots are firmly embedded into their everyday lives.[1] Still at one with the land, much of their livelihood and survival relies on a healthy earth - there is limited western influence in Sumba. During the initial colonization period, Sumba was largely ignored as Sumba had little to offer the colonizers.[2]

Sumba is known as one of the most vulnerable areas in Indonesia, and arguably South East Asia. Sumba's biggest struggle right now concerns the low electrification ratio, with only 24.55% despite all the readily available renewable energy resources (Hivos, 2016).

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[1] The Sumba Foundation. 2016. 'The people and their culture'. *The Sumba Foundation.* http://sumbafoundation.org/index.php/sumba/the_people_and_their_culture/
[2] The Sumba Foundation. 2016. 'History and culture'. *The Sumba Foundation.* http://www.sumba-information.com/history-culture.html

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Since early 2015, El-Niño has resulted in yet another prolonged dry season for Sumba.[3] An already vulnerable Sumba struggles whilst the clear majority of Indonesia continues to prosper: higher than average water temperatures in the area has shifted the weather patterns dramatically. Many farmers delayed the planting of crops which reduced the amount of time for the secondary harvest and for those who followed traditional planting and harvest patterns saw their crops perish under the harsh sun and lack of rain or were not strong enough to survive a heavy downpour. In response to a general lack of food all over the region, pests like locusts have become a heightened issue (Hivos, 2016). Water is already scarce as drought threatens the island constantly, so as climate change continues to wreak havoc on this small community, families are pushed further into debt and starvation (Craine, 2013). With 23.5% of the NTT population now living under the poverty line, children have been forced to quit school to work or simply because school is no longer affordable. Food security is an issue and a startling 58.4% of children under 5-years-old are recorded as having stunted growth.[4]

Rugged and hilly terrain, with vast open savannah plains has aided in Sumba's emergence as potentially being the first 'iconic island'. Hivos International is working hard with the Indonesian government and various other international organizations to bring renewable energy to all of Sumba by 2020. Villages are sparsely located around the island, leaving plenty of space open to create wind and solar farms (Gokkon, 2015). The limited water sources can also be used to create small micro-hydro power plants. Biogas is easy to make due to the high population of livestock on the island. This has already been implemented into many of the wealthier households.

Table 1. Types of Renewable Energy in Sumba and Their Potential

Energy	Potential	Notes
Micro-hydro	10.2 MW	
Hydro storage	8.5 MW	Dams can be built on the Memboro and Kadahang rivers
Wind	10 MW	(1) 12 turbines with a capacity of 0.85 MW each, (2) Current demand is 10 MW and predicted demand in 2020 is 40 MW with 95% electrification rate
Solar	5 kWh/m^2/day, 10 MW	5 hours of sun 'emits' 1000 W/m^2

Source: SumbaIconicIsland.org

Sumba is currently dependent on fossil fuels, i.e. kerosene, diesel and petrol and the money that is to be saved from no longer having to purchase non-renewable resources for energy, will be invested back into the community. This fossil fuel energy is imported from other areas of Indonesia, mainly from Java. A constant source of reliable energy would prove invaluable for the agricultural industry. Water could be pumped from wells and other water sources to the farmers' crops and livestock where it is really needed; households and business could also have access to clean water, no longer deciding if it was worth using the expensive to run, diesel generator; and communities could now focus on improving healthcare, education, water for consumption and general living standards (Gokkon, 2015). It is hoped that through increased education infant mortality, literacy and malnutrition rates, especially in young children, will all improve over time.[5] The identification of natural resources as being the pinnacle of hope for this community has been embraced eagerly by this special population.[6]

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3 World Vision. 2016. 'World Vision's response to El Niño in Asia-Pacific'. http://www.wvi.org/sites/default/files/ElNino_AsiaPacific_April2016.pdf

4 World Food Program. 2013. 'East Nusa Tenggara (NTT) Profile'. https://www.wfp.org/sites/default/files/NTT%20factsheet%20Jan%202013.pdf

5 World Vision. 2016. 'World Vision's response to el Niño in Asia-Pacific'. http://www.wvi.org/sites/default/files/ElNino_AsiaPacific_April2016.pdf

6 World Vision. 2016. 'World Vision's response to el Niño in Asia-Pacific'.http://www.wvi.org/sites/default/files/ElNino_AsiaPacific_April2016.pdf

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3. Sumba Iconic Island as a Driver for Resilience

3.1 Sumba Iconic Island

The Sumba Iconic Island project was initiated in 2010 after numerous pre-feasibility studies and policy discussion by various international organizations and governments. The project will continue until 2025 with the aim of Sumba being 100% fossil fuel free with at least 95% electrification rate. Led by Hivos (Humanist Institute for Co-operation with Developing Countries) as the operating committee, the objective of this program is to "provide access to reliable renewable forms of energy to the population of a medium sized Indonesian island, and in doing so, ending their dependency on fossil fuels," (Hivos, 2012).

Sumba was chosen for this research due to a number of reasons:

- Sumba has very little access to modern energy (the electrification rate was only 24.5% in 2010) with electricity consumption per capita reaching only 42 kWh (the national average is 591 kWh per capita);
- Sumba has been, and still is, very much dependent on diesel-powered generators as sources of electricity which are scarce and unreliable due to the remoteness of Sumba;
- Fossil fuels contribute to 85% of power generation, despite the fact that a majority of them are imported from outside the island which, on average, cost more expensive than areas that are more connected;
- Sumba has a relatively large potential for renewable energy with 37 MW worth of water, biomass, wind, and solar energy; double the predicted energy need of the island in 2020.

Moreover, the Sumba Iconic Island is a form of decentralized energy system; it is separate from the national grid due to PLN being hesitant in fully connecting with Sumba (due to its poor economy, thus avoiding the risk of a bad investment) and is planned to still be disconnected. This makes Sumba independent from the national grid which not only is expensive to purchase, interruptions along the grid will disrupt electricity going in, should Sumba is fully connected. Due to its remoteness, one can hardly tell when PLN will be able to fix such an issue.

As of recently, the Sumba Iconic Island project have installed numerous power generators that collectively produces 4.87 MW of energy and in 2016 half of Sumba inhabitants enjoy consistent lighting in which 40% of those are produced from renewable energy sources, although only 9.8% of the 37.4% electrification rate in Sumba are renewable energy. Around 464 solar power plants have been distributed across the island and 6 main plants in three of the districts.

Support from the government have been positive with Rp131 billion of the budget going into electricity investments which includes 14,868 solar panels, 100 wind turbines, 1,173 household biogas reactors, and 12 micro-hydro installations (PLTMH Berdiri di Sumba, 2016). Plans have also been made (as of 2015) for a biomass power plant with a capacity of 1 MW in West Sumba, revitalizing 85 biodigesters in South-West Sumba, an electric car project in East Sumba, micro-hydro installations with a capacity of 23 kW in East Sumba, wind turbines in West Sumba, and functioning street lamps across Sumba Island (Dewi, 2015). Below is a table highlighting activities done by the Ministry of Energy and Mineral Resources (ESDM) supporting the Sumba Iconic Island Program as of 2014.

The State Electricity Company (PLN) have also developed a micro-hydro installation in Lokomboro village, South-West Sumba and as of 2016 it is able to produce up to 4,934,252 kWh of energy every year. This allowed PLN to save up to 1,356,919 liters worth of diesel fuel or Rp10 billion in 2015 (PLN Kembangkan Energi, 2016). Their SEHEN project, which stands for *Super Ekstra Hemat Energi* (Super Extra Energy Saving), aimed to provide clients living in remote areas such as the Sumbanese with affordable solar energy. The installations include one solar panel, cables, and three lamps which includes a storage and remote to turn them on and off. Reportedly the project garnered close to 10,000 customers in Sumba and PLN’s target for 2015 was to add to that 37,000 more. [7]

Table 2. ESDM Activities Supporting Sumba Iconic Island in 2014

<table>
<tr><th>District</th><th>2011</th><th>2012</th><th>2013</th><th>2014 (plan)</th></tr>
<tr><td>West Sumba</td><td>• Special Allocation Fund (SAF) for Village Electrification Rp2.2 trillion</td><td>• SAF for Village Electrification with Renewable Energy Rp1.2 trillion
• 400 units of energy saving stoves</td><td>• SAF for Village Electrification with Renewable Energy Rp4.9 trillion
• 125 units of energy saving stoves</td><td rowspan="4">• SAF for Village Electrification with Renewable Energy Rp4.9 trillion (West Sumba)
• SAF for Village Electrification with Renewable Energy Rp5.2 trillion (South-West Sumba)
• SAF for Village Electrification with Renewable Energy Rp5.1 trillion (Central Sumba)
• SAF for Village Electrification with Renewable Energy Rp5 trillion (East Sumba)
• 300 units of energy saving stoves
• 50 biodigesters ($6m^3$/unit)</td></tr>
<tr><td>South-West Sumba</td><td>• 25 household biodigesters
• SAF for Village Electrification with Renewable Energy Rp2.2 trillion</td><td>• SAF for Village Electrification with Renewable Energy Rp1.4 trillion
• 400 units of energy saving stoves</td><td>• SAF for Village Electrification with Renewable Energy Rp5.2 trillion
• 125 units of energy saving stoves
• 85 biodigesters ($6m^3$/unit)</td></tr>
<tr><td>East Sumba</td><td>• SAF for Village Electrification with Renewable Energy Rp2.2 trillion</td><td>• SAF for Village Electrification with Renewable Energy Rp0.9 trillion
• 400 units of energy saving stoves
• Hybrid power plants 30 kW
• 50 biodigesters ($5m^3$/unit)</td><td>• SAF for Village Electrification with Renewable Energy Rp0.5 trillion
• 125 units of energy saving stoves
• Biomass Gasifier 30 kW</td></tr>
<tr><td>Central Sumba</td><td>• SAF for Village Electrification with Renewable Energy Rp2.2 trillion</td><td>• SAF for Village Electrification with Renewable Energy Rp1.2 trillion
• 400 units of energy saving stoves</td><td>• SAF for Village Electrification with Renewable Energy Rp5.1 trillion
• 125 units of energy saving stoves</td></tr>
</table>

Note: Special Allocation Fund = Dana Alokasi Khusus
Source: Blueprint dan Roadmap Program Pengembangan Pulau Sumba sebagai Pulau Ikonik Energi Terbarukan 2012-2025

3.2 The Connection

The question still remains: how does renewable energy exactly build resilience in communities such as Sumba? Biological energy or any energy provided by nature can be categorized as a service that the ecosystem provides to its inhabitants. The Millennium Ecosystem Assessment (MEA) states that these services comprises of supporting, provisioning, regulating, and cultural services. These services are then linked with constituents of well-being which are security, basic material for good life, health,

[7] http://www.pln.co.id/2012/04/100-persen-energi-terbarukan-untuk-pulau-sumba/

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good social relations, and freedom of choice and action. The diagram below shows the complete connection between ecosystem services and well-being.

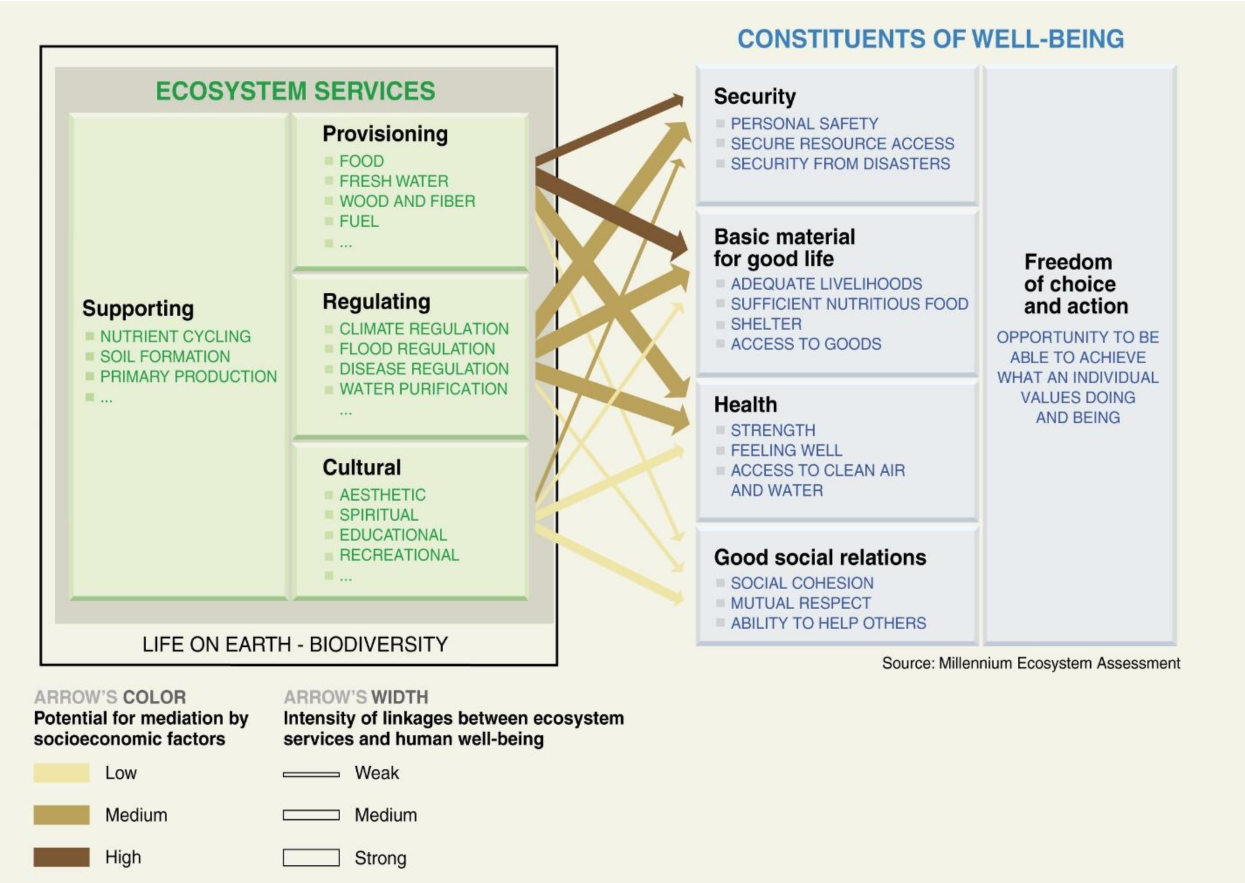

Figure 2. Linkages between Ecosystem Services and Human Well-Being (Millennium Ecosystem Assessment, 2005)

While there are many elements that contribute well-being, it can be seen that renewable natural energy provides a number of services not excluding provisioning (reliable fuel, pumping fresh water) and cultural (educational advantages through lighting and electricity) services. The constituents these services contribute to this can be seen clearly; continuous energy supply will ultimately help increase well-being through – and not limited to – basic materials for good life (adequate livelihoods working in energy plants), health (access to clean water via electric pumps), and freedom of choice and action (educational and familial activities at night due to reliable lighting). The example of this concept is happening in Selo community who used biogas digester, which contributes around 20,000 IDR per month, from additional energy as much as 490 kWh per month (Hnyine et al., 2015).

After we have established the relationship between renewable energy and well-being, it is perhaps relevant to remember that well-being is an essential part of resilience. Miles (2015) argued that well-being is part of community resilience as much as the goal of community resilience is overall well-being. Resilience is, after all, the "capability to bounce back and to use physical and economic resources effectively to aid recovery following exposure to hazards" (Paton, 2000 in Norris et al., 2007), and MEA's constituents of well-being overlap with said definition (and others as well) of community resilience, particularly on livelihood as the driver to utilize resources for recovery. As UNDP put it, "sustainable energy, therefore, can be an engine for poverty reduction, social progress, equity, enhanced resilience, economic growth, and environmental sustainability."

As a key part in both well-being and community resilience, livelihood has thus took center stage as the enabler between renewable energy and the latter two elements. Increased livelihood would also

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increase community resilience due to its ability to provide the community with the capabilities it needs to bounce back.

In the case of Sumba, no known documentation of this phenomenon have been published, and to do so is beyond the scope of this article. However anecdotal evidence and news reports may shed some light into this matter, and despite the limitation of these we can already see how the Sumba Iconic Island has started to increase livelihood of the Sumbanese people.

An elderly Sumbanese by the name Pajaru Ngara feels that the project allowed the islanders to save a lot of time not having to walk into the city for fuel. Instead of spending half a day to get fuel for lamps, wind turbines and solar panels provide consistent electricity all day long. His grandson operates the wind turbine installed on the roof of their wooden house. He is proud of his family for knowing this new source of energy as they now can study and do other activities during night time.[8]

Up until 2013 the villagers of Kamanggih in East Sumba was reluctant in transitioning to renewable energy, despite the fact that they have to spend Rp 40,000 for 2 hours' worth of lighting produced by the diesel generators. The installation of wind turbines was through a donation of Rp2 billion, which paved the way for more renewable energy plants to be built. After the installation the villagers only had to pay a monthly Rp 89 thousand to their local cooperative for maintaining the turbines. Petrus Lamba Awang, the villager responsible for his village using more renewable energy, said that 20 wind turbines are able to generate electricity for three days, which is then stored in a battery; this is advantageous for the villagers when there is no wind to draw electricity from. He looks to be able to sell any excess electricity produced by the turbines to PLN, something that is not possible at the time since their village is still too remote for PLN to connect their grid to. But this did not discourage him from advocating renewable energy since he feels that in the next 10 years wind energy will be much cheaper than diesel, and it is the initial investment that is expensive (Ridha, 2016).

As of 2016, Kamanggih village are able to sell their excess electricity to PLN for the price of Rp475 per 1 kWh. Micro-hydro installations are able to sell up to Rp50 million worth of energy every year, around Rp4 million from micro wind turbines, and Rp12 million from fresh water. Collectively, the Kamanggih cooperative's assets are worth Rp8 billion which will be used contribute back to the local Kamanggih economy and perhaps the surrounding communities as well (Farida, 2016).

We can start to see signs of increased livelihood from cases such as Pajaru and the village of Kamanggih in which the renewable energy program, while still in its early stages, have a positive impact on the economy as well as the people, albeit in a small way. This paves a path for future contributions of Sumba Iconic Island towards the Sumbanese people as more power plants will be built which will create jobs for the locals, more excess electricity to be sold to PLN which cooperatives such as the Kamanggih cooperative benefit a lot from, and more investments as the Sumba economy continue to flourish from the latter two.

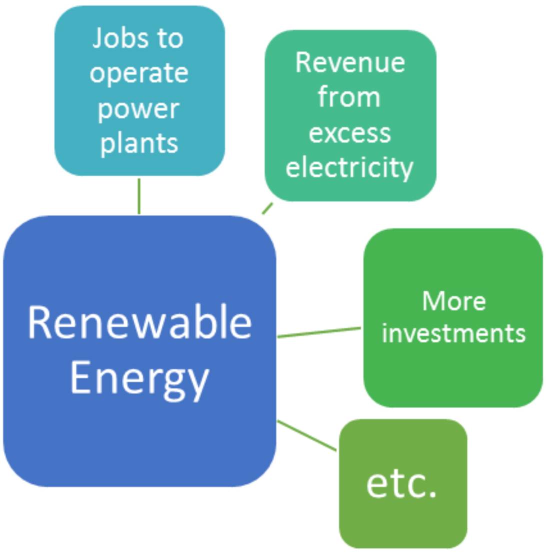

Figure 3. Livelihoods Provided by Renewable Energy

3.3 Challenges

The Sumba Iconic Island project still faces numerous and yearly obstacles. Sumba has a very dry climate all year round; only 3-4 months are monsoon season and effects of climate change exacerbate

[8] http://www.bbc.com/indonesia/berita_indonesia/2015/12/151126_sumba_energi_baru

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this phenomenon. This hinders power generation such as the micro-hydro installations since water volume from rivers and waterfalls decrease drastically when the dry season hit. Micro-hydro installations in Kamanggih village, for example, experienced a drop in electricity production from 30 kW to 15 kW during dry months (Kompas, 2016).

South-east Asia Hivos Green Energy Project Manager Sandra Winarsa stated that in 2015 the 5.7 MW that have been produced only represent 17.5% of the targeted 32.57 MW by the 2014 road map. This is due to a number of challenges including negotiations between PLN and ESDM, the lack of firm national policies on wind energy, lack of investor interest, and other geological and geographic obstacles preventing the full potential of renewable energy to be realized in Sumba. Global Coordinator for the Hivos Energy Program Eco Matser also adds that the low number of human resources and academicians involved in the renewable energy field hinders the progress of technical, social, and policy innovations for renewable energy.[9]

The 2014 road map for the Sumba Iconic Island shares the challenges it faced:

- The public still has a lack of understanding of renewable energy
- Energy consumer centers are disconnected and requires a transmission and distribution system from existing grids
- The plan for an integrated renewable energy system is still underdeveloped
- Lack of data and information on potential renewable energy
- Uncertainty of external factors that can have a negative impact on the renewable energy economy
- Geographic factors makes accessibility a problem
- Not prioritizing renewable energy enough in budget allocation
- The strong level of patriarchal culture hinders women from participating in the economy

Challenges are merely stepping stones for the Sumba Iconic Island project to progress to. This project has shown promising results and with continued support from both the government and international organizations, we can perhaps take a look at a society virtually free from fossil fuels to what extent that society can flourish using alternative energy.

4. Conclusion

This article has highlighted the inherent connection community resilience has with renewable energy through well-being and livelihood. Increasing livelihood through renewable energy will increase a community's well-being and ultimately their resilience against disasters and catastrophes. Although community resilience consist of many factors and are determined by both internal and external forces, reliable sources of livelihood form the basis of infrastructure that communities depend on (Miles, 2015). Renewable energy, thus, is an integral part of community resilience in the sense that it strengthens a community against disruptions and disasters.

In the case of Sumba, renewable energy continue to help communities gain a foothold in their own economy by selling excess electricity to state-owned PLN and investing the revenue back into the community. More and more energy plants also mean jobs to operate them and this will benefit particularly young people who are looking for jobs. A flourishing local economy and higher employment rates will attract more investors into the renewable energy sector thus propelling Sumba into a more dependent society. Not to mention, independence from the national grid is also a major advantage from which Sumba's remoteness is used as strength rather than a weakness. The absence of the national grid going into every household in Sumba will help boost the appeal of renewable energy which has so far been more reliable than PLN's grid. And should the grid fail, the wind, the sun, and the rivers will not stop providing the people with clean and consistent energy.

[9] http://www.undana.ac.id/index.php/en/news/718-sumbaikonik

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The Sumba Iconic Island project is still in its early stages and it is still too early to tell how it will significantly impact the Sumbanese people. However current reports are already showing that indeed it provides many with clean, cheap, and reliable energy and along with it better livelihood with which to strengthen themselves with and be a more resilience society.

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