

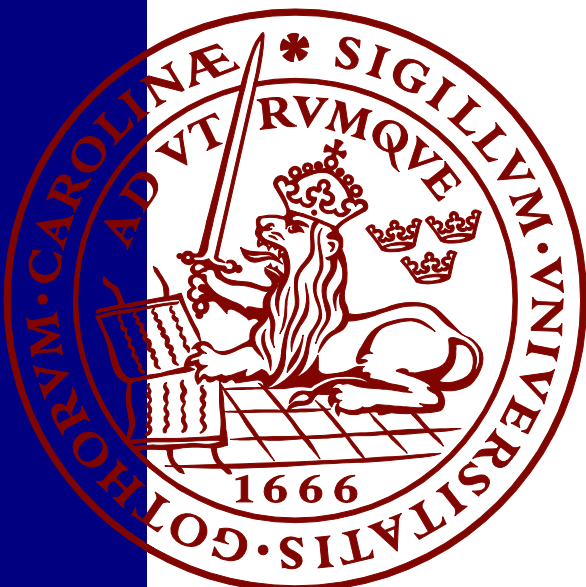
We own this power!

How a rural community in Indonesia uphold energy justice to harness a hybrid solar-wind energy plant and unlock capabilities

Sarah Aon Abdullah

Master Thesis Series in Environmental Studies and Sustainability Science,
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A thesis submitted in partial fulfillment of the requirements of Lund University
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(30hp/credits)



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Submitted May 12, 2020

Supervisor: Mine Islar, LUCSUS, Lund University

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Abstract

Indonesia, as per their stance on the Paris Agreement and social development goals (SDG), has been on a winding journey to meet their renewable energy targets. In providing the national electricity, the state electricity company (PLN) is still deriving more than 70% of its energy sources from coal and oil. As per 2018, only up to 8% of on-grid power is generated from renewable energy sources, and this percentage has decreased by half between 2010 and 2018. Conversely, while the nation succeeded in achieving a 98.2% electrification rate in 2017, the rest 1.8% implies that there are still more than five million people without access to electricity (World Bank, 2020). This dismissed population mostly lives in remote areas unreachable by the national grid. Indonesia's geographical contour renders the task of providing on-grid electricity in rural and remote areas daunting; one of the guidelines for advancing the implementation of SDG 7 is particularly useful in its recommendation to optimise the possibility for decentralised renewable energy solutions.

Using qualitative method, I conducted a field research to investigate the background of PLTH Pantai Baru's establishment—a renewable energy facility (REF)—in the Ngentak hamlet, Central Java, Indonesia, along with the relevant social processes that have happened in the community for almost a decade as the project beneficiary. Having shared control over PLTH planning with the project initiators from the early period, the community gained the ability to collectively arrange the utilisation of the PLTH according to community needs. This period has led the community to demonstrate recognition and procedural justice and has brought a fair distribution of benefits and responsibilities. Underpinned by the PLTH, tourism has become an effective alternative means of livelihood for the community, which has contributed to the establishment of capabilities. On the other hand, the PLTH has shaped the community members who run the facility into technical experts on their field. In Ngentak's case, these combined findings on energy justice and capabilities prove that the REF has successfully integrated into the Ngentak community.

Furthermore, future research comparing multiple case studies on existing community renewable energy in Indonesia can give more insight into patterns and suitable guides to build a sustainable and integrated community-based REF. In broader view, such future research may establish guidance or sustainable pathways for the national transition to renewable energy.

Keywords: community energy, renewable energy, energy justice, capabilities approach, energy transition, sustainability science

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Abstrak

Indonesia, sebagaimana komitmennya terhadap Perjanjian Paris dan tujuan pembangunan berkelanjutan (SDG), sedang menempuh perjalanan yang berliku untuk memenuhi target energi terbarukan mereka. Dalam menyediakan listrik nasional, perusahaan listrik negara (PLN) masih memperoleh lebih dari 70% sumber energinya dari batubara dan minyak. Per 2018, hanya hingga 8% daya jaringan listrik nasional yang dihasilkan dari sumber energi terbarukan, dan persentase ini telah menurun setengahnya antara tahun 2010 dan 2018. Di sisi lain, meskipun Indonesia telah berhasil mencapai tingkat elektrifikasi 98,2% pada tahun 2017, sisa 1,8% menyiratkan lebih dari lima juta orang tanpa akses ke listrik (Bank Dunia, 2020). Sisa populasi ini umumnya tinggal di daerah terpencil yang tidak terjangkau oleh layanan jaringan nasional. Kontur geografis Indonesia membuat tugas penyediaan listrik *on-grid* di daerah pedesaan dan terpencil sulit untuk dilaksanakan. Oleh karenanya, salah satu pedoman untuk memajukan penerapan SDG 7 sangat berguna dalam rekomendasinya untuk mengoptimalkan kemungkinan solusi energi terbarukan yang terdesentralisasi.

Dengan menggunakan metode kualitatif, saya melakukan penelitian lapangan untuk menyelidiki latar belakang pendirian PLTH Pantai Baru—fasilitas energi terbarukan (REF)—di dusun Ngentak, Jawa Tengah, Indonesia, berikut dengan proses sosial terkait yang telah terjadi di masyarakat selama hampir satu dekade sebagai penerima manfaat proyek. Setelah berbagi kendali atas perencanaan PLTH dengan pemrakarsa proyek sejak periode awal, masyarakat memperoleh kemampuan untuk secara kolektif mengatur pemanfaatan PLTH sesuai dengan kebutuhan masyarakat. Periode ini telah mengarahkan masyarakat untuk menunjukkan pengakuan dan keadilan prosedural dan telah membawa distribusi manfaat dan tanggung jawab yang adil. Didukung oleh PLTH, pariwisata telah menjadi sarana alternatif mata pencaharian yang efektif bagi masyarakat, yang telah berkontribusi pada pembentukan kemampuan. Di sisi lain, PLTH telah membentuk anggota masyarakat yang menjalankan fasilitas menjadi ahli teknis di bidangnya. Dalam kasus Ngentak, temuan gabungan ini tentang keadilan dan kemampuan energi membuktikan bahwa REF telah berhasil diintegrasikan kedalam komunitas Ngentak.

Lebih lanjut, penelitian di masa depan yang membandingkan berbagai studi kasus tentang energi terbarukan masyarakat yang ada di Indonesia dapat memberikan lebih banyak wawasan tentang pola dan panduan yang sesuai untuk membangun REF berbasis masyarakat yang berkelanjutan dan terintegrasi. Dalam pandangan yang lebih luas, penelitian masa depan tersebut dapat membangun pedoman atau jalur berkelanjutan untuk transisi nasional ke energi terbarukan.

Kata kunci: energi masyarakat, energi terbarukan, keadilan energi, pendekatan kapabilitas, transisi energi, ilmu keberlanjutan

Jumlah kata: 11651

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List of Abbreviations

AC / DC	Alternating Current / Direct Current
DEPKOP	Ministry of Cooperatives and Small and Medium Businesses
UGM	Gajah Mada University
ISWR	Integrated Solar Wind Regulator
KKP	Marine and Fisheries Ministry
LAPAN	National Institute of Aeronautics and Space
Pokdarwis	Tourism Activist Group
Pokgiat LPMD	Village Community Empowerment Institution activities group
PLTH	Solar-Wind Hybrid Power Plant
RE	Renewable Energy
REF	Renewable Energy Facility
RISTEK	The Ministry of Research and Technology
RPJMN	Rencana Pembangunan Jangka Menengah Nasional
SDG	Sustainable Development Goals
SIDa	The Regional Innovation System

“to ask whether a society is just is to ask how it distributes the things we prize. ... A just society distributes these goods in the right way; it gives each person his or her due”

- Michael J. Sandel

1 Introduction

This thesis links renewable energy and energy justice. As a necessary resource for modern economies and societies, providing carbon neutral energy sources has been the flagship of sustainable development. Therefore, renewable energy (RE) is considered an effective solution to reducing carbon emissions and is a central point on the United Nation's agenda of Sustainable Development Goals (SDG) 2030 and the Paris Agreement. Both courses of action aim to ensure that affordable, reliable and sustainable modern energy is accessible for all by 2030 (UN, 2018). Accessible clean energy is believed to lead to a better world that enjoys economic improvements, women's empowerment, improved health and education, and just and inclusive communities, all of which will create greater resilience to climate change. Yet almost half of the global population remains far from fulfilling basic energy needs due to inability to afford electricity from private companies, or worse, inaccessibility to national electricity grids (Sovacool & Drupadi, 2012). Thus, in this research, I aim to examine if renewable energy can be implemented in a just manner, focusing especially on the Global South where already existing inequalities in land-use and access to livelihoods are in place.

Indonesia, as per their stance on the Paris Agreement and SDG, has been on a winding journey to meet their renewable energy targets. The country has committed to reaching the goal of 23% renewable energy use by 2025 and 31% by 2050 (IRENA, 2017). However, according to SDG 7 renewable indicator, Indonesia experienced a decrease in renewable energy shares in energy consumption from 2010 to 2016 (IEA et al., 2019). In providing the national electricity, the state electricity company (PLN) is still deriving more than 70% of its energy sources from coal and oil (PLN, 2019). As per 2018, only up to 8% of on-grid power is generated from renewable energy sources (PLN, 2019), and this percentage has decreased by half between 2010 and 2018 (IRENA, 2017). Conversely, while the nation succeeded in achieving a 98.2% electrification rate in 2017, the rest 1.8% implies that there are still more than five million people without access to electricity (World Bank, 2019). This dismissed population mostly lives in remote areas unreachable by the national grid. Thus, the government's efforts in distributing electricity to the whole country remain contestable in relation to SDG 7, which requires substantial renewable energy shares in nations' energy mix in order to provide clean and affordable energy for all (UN, 2020). Moreover, given the country's commitment to contributing to reducing global emissions, it is crucial for Indonesia to concretely strive for renewable energy transmission as well as provide energy access to its people.

Noting the above context, the national indicator of electrification supposedly lies in improving energy sovereignty by harnessing the country's abundant potential of renewable energy resources in rural

areas (IESR, 2019). Indonesia's geographical contour renders the task of providing on-grid electricity in rural and remote areas daunting; one of the guidelines for advancing the implementation of SDG 7 is particularly useful in its recommendation to optimise the possibility for decentralised renewable energy solutions. The guideline specifically clarifies the necessity of renewable energy access as a means to empower people, companies and communities (UN, 2018). Additionally, to provide energy access for rural areas, off-grid energy solutions are identified as an 'important driver', while affordability is also a crucial consideration (UN, 2018).

Therefore, in this thesis, I focus on off-grid renewable energy facilities (REF) run by the community—in other words, community energy. One form of community energy can be defined as a renewable energy project that is owned and controlled by the community and which collectively benefits from the outcomes (Seyfang et al., 2013). Some scholars argue that community energy should be beneficial for the communities where the project is seated, adding economic value and helping these areas to develop (Hoffmann, 2009; van Veelen, 2016). In light of the idea of community energy, in 2010, the Ministry of Research and Technology (RISTEK) initiated an establishment of a solar-wind hybrid power plant (PLTH) as a research implementation in Pantai Pandansimo Baru, the southernmost part of the special region of Yogyakarta, Central Java, Indonesia. RISTEK considered Pantai Pandansimo Baru to be a suitable area for the hybrid facility due to its wind and sun exposure. In addition, the specific area did not have any electricity because it was not covered by the national grid. In RISTEK's 2013 project report, they emphasised that the project was established to be a community-owned facility, which they believed would drive and improve the local economy.

While there are several cases being studied on bottom-up renewable energy initiatives in the Global North, there is only a limited number of similar research projects focused on the Global South. Moreover, generally, the rural societies being studied are often framed in a technologically driven top-down arrangement that limits their ability to independently overcome sustainability problems such as energy poverty and struggling economy (Cloke, Mohr & Brown, 2017). Hence, this research study introduces additional variation to the Global South studies regarding energy transitions which involve bottom-up renewable energy initiatives through analysis of the Ngentak community.

Through this research study, I aim to analyse and understand the phenomenon of how the community in the Ngentak hamlet has embraced a renewable energy transition, and how this transition has affected their community and their livelihoods for the past decade. First, I investigate all the related processes that have happened in the community. Then, I orient the results towards energy justice theory and capabilities perspective in relation to the operation of the PLTH to answer my research question:

How does community-based management of renewable energy contribute to a just renewable energy transition in Indonesia?

In order to answer the overarching question, the following sub-questions structure this thesis:

1. How does the community distribute benefits and responsibilities?
2. How does community-level decision-making operate?
3. What are the capabilities of the people that this project underpins?

To contextualise these questions, I narrate the brief history of Pantai Pandansimo up to the establishment of the PLTH (Chapter 2). The research methodology is described in Chapter 3. Energy justice theory and the capabilities perspective, the base theories which are employed in this study, are elaborated in Chapter 4. Chapter 5 addresses findings from my fieldwork, and Chapter 6 provides analysis and discussion of how the results reflect energy justice and the capabilities perspective. Lastly, the conclusion and recommendation for future research are given in Chapter 7.

2 Case Study Background

To further illustrate the state of the community, information from interviewees is used to develop this chapter, particularly in subchapters 2.2 and 2.3. A complete list of the interviewees can be seen in Table 2.

2.1 RISTEK's Regional Innovation System (SIDa)

The Regional Innovation System (SIDa) is a whole process encompassed in one system to foster innovation carried out between Indonesian government institutions, regional governments, research and development institutions, educational institutions, supporting institutions of innovation, the business community and local communities (RISTEK regulation no. 3/2012). Based on this framework, RISTEK and other institutions initiated the development of SIDa in the Special Region of Yogyakarta in 2010 (see Table 1). Their focus was to work on the potential of renewable wind and solar energy in the Bantul area. One of the factors considered for site selection is that there are still many residents who works in coastal areas which are not reached by electricity from the national grid, especially in the Ngentak hamlet. As such, RISTEK collaborates with other government institutions (Marine and Fisheries Ministry (KKP)), the ministry of cooperatives and small and medium businesses (DEPKOP), the Ministry of Environment, Bantul district government, related industries (E-wind Energy Pte), National Institute of Aeronautics and Space (LAPAN) and Gajah Mada University (UGM) (Table 1). Hereafter, these parties will be represented collectively as project initiators. This joint coordination summed up a total fund of 5 billion Rupiah (equal to USD 300.000, -).

Table 1. Duties and functions of each institution in their collaboration with PLTH Pantai Baru development. (RISTEK, 2013)

No.	Institutions	Role and activities
1	Minister of Research and Technology (RISTEK)	<ul style="list-style-type: none"> Actors on the macro side (policy makers related to the application of hybrid energy science and technology). Conduct training for the community so that SMEs (small and medium industries) in the wind turbine sector can emerge. Providing assistance in management in the Pandansimo area and Srandakan workshop, so that the vision "of Bantul illuminating Indonesia can be realized. Encourage reverse engineering of windmills with a capacity of 1 KW.
2	Marine and Fisheries Ministry (KKP)	<ul style="list-style-type: none"> In 2011 allocated the construction of 26 freshwater fish and shrimp ponds. Allocate 2 hectares of land to cultivate sandy land. Build tsunami-resistant fish auction sites.
3	Gadjah Mada University (UGM)	<p>Referring to the Tri Darma of Higher Education:</p> <ul style="list-style-type: none"> Teaching: provide training for the mastery of technology in making wind turbines in Srandakan workshop. Research: in collaboration with the Ministry of National Education and the Government of Austria in conducting research on storage batteries for hybrid energy. Community service: supporting the sustainability of hybrid energy management through the "thematic real work lecture" program from students on a sustainable basis.
4	National Institute of Aeronautics and Space (LAPAN)	<ul style="list-style-type: none"> Supports the mastery of wind turbine technology. Integrating, operating, maintaining, monitoring, and researching on hybrid power plants.
5	Bantul regency government	<ul style="list-style-type: none"> Supports the program in its capacity as a local government. Ensuring the community as the subject in the management of the area and the existence of technology in Pandansimo Integrated managerial management. Ensuring PLTH can be sustainable in the Bantul area. Serving as a companion in technology transfer. Structuring of the Pandansimo area, Ngentak Hamlet, Srandakan District, Bantul Regency, Yogyakarta.
6	Ngentak community	Agree to support the energy independent region and tourism in science and technology with community economic empowerment programs.

2.2 Ngentak hamlet

Located in the southernmost part of the Special Region of Yogyakarta, the Ngentak hamlet covers an area of less than five hectares (RISTEK, 2013) inhabited by 241 families for a total of 1,160 people (Village archive, 2018) (Figure 1). Administratively, it is the 22nd of 24 hamlets under Poncosari village's administration. The demographics of Poncosari village are largely homogenous; almost all residents adhere to the same religion (Islam) and ethnicity (Javanese) (Village archive, 2019).



Figure 1. Map of the Ngentak hamlet, Poncosari Village, Bantul, Yogyakarta, Indonesia (defined by the red line). The mark A is the location of the new beach, Pantai Baru. B is the location of the PLTH control house and office. C is a plot of sandy soil where the wind turbines stand. D is a collective plot of land where animals are kept (animal husbandry) (Own modifications based on Google Maps, 2020).

The Ngentak community organise themselves through a formal community group called Pokgiat LPMD (Village Community Empowerment Institution Activities Group, hereinafter will be written short as Pokgiat). According to the community group’s documentation, as per 2014 almost half of Ngentak residents were farmers and fishermen, others owned small commercial enterprises, and a few worked in public and private institutions. Within this Pokgiat, other forms of community groups are supervised, such as groups for farmers, livestock farmers, fishermen and tourism activists (Pokdarwis - Kelompok Sadar Wisata, translated in English as ‘tourism activist group’). Although each group has their own agenda and monthly meetings, they meet as one hamlet each year to consolidate their activities before the village government (Informant G31, L11, L12). Informant L31 explained that “Pokgiat’s work is more about planning for the continuation of Pantai Baru. Governing matters. For example, to pay for janitors and rubbish, the source of funds used for this activity comes from the results of the Pantai Baru tourism activities. Meanwhile, Pokdarwis focuses more on developing strategies so that Pantai Baru attracts more tourists”.

2.3 Project history and the beneficiary

Since 1963, Pantai Pandansimo Baru has been the location where Indonesian scientists test their research and launch rocket trials (RISTEK, 2013). In 2008, a group of researchers built a single wind turbine in the area that later became the origin of RISTEK’s collaborative project for a hybrid power

plant in Pantai Baru Pandansimo (Informant G11). These research activities subsequently sparked residents' interest in the possibility of having electricity in the coastal area, realising that it would help them in reviving their tourism activities (Informant L11, L12).

Administratively located in Pantai Baru Pandansimo, Ngentak hamlet, Poncosari village, Bantul, Yogyakarta, Central Java, Indonesia (mark A on Figure 1), the PLTH Pantai Baru was expected to be the force that would develop the local economy (RISTEK, 2013). Before the PLTH was built, residents in Ngentak experienced difficulties in starting small commercial enterprises in the coastal area to support their livelihood because the area was not covered by the national grid. Their low earnings prompted the Ngentak hamlet to be categorised as the least developed village in Indonesia (RISTEK, 2013). Therefore, the PLTH was built with the intention to boost economic activities such as tourism, agriculture, fisheries and so on. Furthermore, the PLTH was also expected to be an inspiration for other regions with similar potential for renewable energy (RISTEK, 2013).

In its early phase, collaboration between institutions allowed the project execution to take only three months to build 33 wind turbine towers with electric power of 56 KW and 218 solar panels with a capacity of 27 KW. In January, this hybrid power plant had its first examination. Having a maximum total power of 83 KW, PLTH Pantai Baru is also equipped with control terminals, inverters and energy storage batteries of 268 units with a capacity of 4,045 Ampere hours (Ah). Given this capacity, project initiators claim that PLTH Pantai Baru is the largest hybrid energy facility in Indonesia.

Power generation starts from the solar cells and wind turbines that produce electric currents that are then channelled to the control house. From there, the electric currents are then synchronised by an integrated solar wind regulator (ISWR) to charge electric current to the battery. In the battery, the direct current (DC) is stored and then flowed to the inverter to be converted into alternating current (AC). Following this process, the produced power can be used as electricity for various kinds of machinery and equipment nearby, such as ice machines, water pumps and public street lighting. Based on the results of commissioning, the efficiency of electric current fluctuations is around 20-60% of the installed capacity (RISTEK, 2013).

3 Methodology

3.1 Research design and strategy

I based this thesis on a qualitative research method designed around a case study. As Bryman (2012) suggests, qualitative research strategy considers social reality as something that is always changing

due to individuals' activities in society. Using qualitative methods allows me to interpret the actual status of a community energy facility through the years of its operation. Qualitative research also encourages purposive sampling to strategically accommodate unit selection in finding answers to research questions (Bryman, 2012). As such, during each interview, I followed up on prospective hints for snowball samplings. Bryman (2012) explained that snowball sampling technique permits researchers to use their initial informants to lead them to other actors who possibly have a better understanding of and relevant information on a particular case. Starting this research from online sources to build contacts, I found that using snowball sampling was very fruitful in the field. In a way, this method helped me to become connected with trusted informants in the community.

Accordingly, I used case study as Bryman (2012) argued that it intends to produce an intensive examination of a single case. In my fieldwork, I met with several informants from different backgrounds (from government to local people). This approach allowed me to examine a single case and comprehend various perceptions and views of the specific matter (Flyvbjerg, 2006). In this thesis, I selected PLTH Pantai Baru, Ngentak as a case of implementation of community energy in a rural area. I aim to analyse the social phenomenon that has affected the area in the past 10 years. Before I went to the field, I learned from news and previous research that the PLTH is still operating to some extent and benefiting the local economy. Although certain news sources claimed that the facility was not working to its original capacity due to technical issues, I intended to directly observe the case while also examining the social processes around it that have developed for almost a decade since the PLTH's establishment. I identify my case as an exemplifying case that permits me to examine social processes within the framework of a selection of theories (Bryman, 2012).

3.2 Data collection methods

In this thesis, I applied a triangulation method to strengthen my data and findings. Triangulation rationale requires using more than one data source and/or method to obtain a better grasp of social phenomena (Bryman, 2012). During my field research, it was necessary to implement triangulation to avoid misunderstanding of an observation or information by acquiring data from another source or method.

In line with this, I gathered both primary and secondary data from at least three different kinds of stakeholder: local governmental bodies, local people and a key actor from the central government who was involved in starting the project. Regarding collection of the primary data, I conducted in-depth semi-structured interviews and direct observation. The interviews were held to gather perceptions from relevant stakeholders who have been affected by the process of the PLTH's

establishment and operation. Additionally, direct observation helped me to develop more dynamic interview sessions on-site by adding more detailed questions that were not covered in my initial interview guides. For the secondary data, I collected relevant documentation to support the findings from primary data.

3.2.1 In-depth, semi-structured interviews

I started to conduct the on-site interviews on 3 February and continued until 10 February 2020. The length of each interview ranged between 45 to 90 minutes. My method of interview was semi-structured, wherein I, as the interviewer, prepared a list of general questions, but enquiries could be further developed according to the dynamics of the interview (Bryman, 2012).

As mentioned, snowball sampling was employed in this thesis. The first parties I contacted were the provincial government, regency government, the village government and PLTH Pantai Baru itself. I was helped by the generosity of a friend who lives in Yogyakarta and delivered a hardcopy of my research proposal in December 2019. Because of that gesture, I received a formal approval letter from the provincial government as their response to my research plan. I acknowledge this approval letter as a powerful instrument illustrating my commitment to research ethics in this thesis and an enabling tool that streamlined my email correspondence with the officials in village government and PLTH personnel.

During my 10 days of fieldwork, I managed to conduct interviews with various actors, from those who represent governmental institutions to the local people. To develop a clearer categorisation of each informant, I divided participants into two different groups: the government and the community. Interviewees from the government group are coded with the letter 'G' and community members with the letter 'L'. Furthermore, I divided the local people into community leaders, PLTH staff, beach workers, and non-beach workers (farmers, livestock farmers, etc.) (Table 2).

Table 2. List of informants and their affiliations (Own creation, 2020).

Informant	Affiliation	Gender	Time of Interview
G11	The government (one of project initiators)	Male	18 February 2020
G21	The government (provincial)	Male	03 February 2020
G31	Village government	Male	04 February 2020
G32	Village government	Female	03 February 2020
L11	Community leader	Male	04 February 2020
L12	Community leader	Male	04 February 2020
L13	Farmers group	Male	04 February 2020
L14	Animal farmers group	Male	04 February 2020
L15	Fishermen group	Male	06 February 2020
L21	PLTH	Male	03 February 2020
L22	PLTH	Male	10 February 2020
L31	Beach worker - food stall	Female	06 February 2020
L32	Beach worker - food stall	Female	05 February 2020
L33	Beach worker - food stall	Female	05 February 2020
L34	Beach worker - food stall	Female	04 February 2020
L35	Beach worker - food stall	Female	04 February 2020
L36	Beach worker - ATV	Male	05 February 2020
L41	Animal farmer/ food stall	Female	10 February 2020
L42	Farmers / food stall	Female	10 February 2020

After my fieldwork, I coded and categorised a collection of interview transcriptions and notes using the application NVivo 12 Plus. Using the software, I made themed categories and subcategories according to the theories and concepts that I use. As Bryman (2012) suggested, this thematic analysis approach lets the researcher categorise their data into theme and subtheme. My interview guides are available in Appendix I, followed by a sample of an interview notes in Appendix II.

3.2.2 Direct observation

Referring to Gold's (1958) classification of participant observer models, my involvement with the Ngentak community and government officials can be described as observer-as-participant. DeWalt and DeWalt (2002) suggest that this role applies to researchers who observe a group or community while putting themselves on the periphery. Additionally, my observation type was unstructured, wherein the observer is free from a fixed schedule of documenting social settings (Bryman, 2012). Consequently, I was always able to conduct direct observation during my presence. For example, I could observe the physical form of the PLTH and note how they carry out daily activities from services to cooperative projects between the PLTH and scholars. What is more, I managed to observe Ngentak's surroundings as well, including how the beach workers, fishermen and stock farmers carry out their activities and interact with each other. This method enabled me to construct a narrative account from a form of direct sighting (Bryman, 2012), which, in some cases, required that I re-determine the direct observation findings through the interviews. Therefore, this method also assisted in strengthening my interview questions.

3.2.3 Document review

As Yin (2003) suggested, relevant documentation, such as a written report, is a stable and exact source of evidence. Therefore, to support the primary data derived from the interviews, I also conducted an official document review specifically regarding the PLTH project establishment. This documentation consisted of a comprehensive project report that I acquired from a government official during a field visit. This report, which was published in 2013 by RISTEK, specifically documents the overarching experiences in building the wind and solar PLTH in Ngentak, Bantul, from the planning period until the point that the project initiators finished assisting the community.

3.3 Ethical considerations

To ensure an ethical data collection process, I examined the necessary permissions for my fieldwork area and spent considerable time building contacts. I treated the early stage of my research as the most delicate stage for building contacts. Relying on online information and communication, I initially reached out to a few relevant institutions in December 2019 through email correspondence. Later, in January 2020, I managed to reach some personnel of the village government and the PLTH through text messages and phone calls. These contacts were made to introduce myself while at the same time confirming in-person meetings with these individuals upon my arrival in February 2020. In Indonesian culture, this gesture may be viewed as courteous and respectful by avoiding the impression of my presence as impromptu. In Javanese terms, it is well-known as '*kulonuwun*', or pleading for permission to enter.

In qualitative research, using consent forms for informants can be beneficial for research as all the informants' roles and views will be fully acknowledged by the participants (Bryman, 2012). However, I decided to obtain verbal consent from all the informants so that they would be more at ease in participating in the semi-structured interviews. Furthermore, in relation to comfort and confidentiality, most of the informants seemed relaxed after they learned that they will be nameless in the data. Before each interview, every informant was verbally informed about my identity as a master's student; the research background, aim and direction; why their role was essential in this thesis; and if they would allow me to record the conversation. Ultimately, there were 18 recorded interviews as well as one interview that was not recorded to respect the interviewee's aversion to being recorded.

As a form of ethical stand, in this thesis I keep certain information and identities confidential. Flick (2014) suggested that anonymisation sometimes is insufficient in guaranteeing the confidentiality of

informants. Thus, for ethical reasons, I do not directly refer to institution names in narrating my findings in the effort to avoid the possibility of reidentification of any individuals herein (Flick, 2014). However, to clarify the context of each informant, I categorise them into two major groups: the government and the local people (see Table 2).

4 Theory

4.1 Energy justice

In this thesis, I use Sovacool's and other scholars' work on energy justice, which is in turn based on the social justice theory used in social science energy research. Sovacool and Dworkin (2015, pp 436) define energy justice as "a global energy system that fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making". Therefore, this thesis uses energy justice to examine social processes that have occurred in relation to the operation of community energy in the Ngentak hamlet. Energy justice entails a fair distribution of primary goods that cover distribution of rights, freedom, opportunities and power (Sovacool & Dworkin, 2015). To identify if an energy project is conducted fairly, it can be evaluated according to energy justice groundings that include recognition, procedural and distributional justice (Sovacool & Dworkin, 2015; Jenkins et al, 2015).

4.1.1 Recognition

Sovacool and Dworkin (2015) acknowledged that lack of justice in recognition may lead to faults in procedural matters that create marginalisation and discrimination. Furthermore, recognition is more than just mere tolerance but extends to assuring that people's culture, norms, values and perspectives are unharmed and acknowledged (Fraser, 1999; Schlosberg, 2003). Specifically, Fraser (1999, pp 73) detailed recognition justice into forms of "cultural domination, non-recognition and disrespect". In this thesis, recognition-based justice is used not only to help in assessing the data for misrecognition of individuals or a group of specific people, but it is also used to identify forms of recognition in the community.

4.1.2 Procedural justice

Sovacool and Dworkin (2015) explained that procedural justice relates to mechanisms of decision-making for a social cause, how decisions were made, and who is able to make and influence such decisions. Sovacool and Dworkin (2015) adapted Gordon Walker's four keys to procedural justice: information, participation in making decisions, decision makers (considering bias), and options for

legal process if disputes occur. Additionally, Jenkins (2015) detailed procedural justice into mobilising local knowledge and seeking the inclusion and engagement of affected publics (Jenkins, 2015). In this thesis, I referred to the above views to identify types of community engagement around the energy system. Lastly, according to these ideas, I used procedural justice to analyse how the project initiators included the community in the decision-making process regarding the project that would affect the community afterwards (Sovacool and Dworkin, 2015).

4.1.3 Distributive justice

According to Jenkins et al. (2015), distributive justice identifies unjust allocation of benefits and difficulties in a society in relation to both the placement of and access to energy infrastructure and services. Specifically explained by Owens & Driffill (2008, pp 4414), distributional justice evaluates “questions about the desirability of technologies in principle become entangled with issues that relate to specific localities”. While it also reflects on the distribution of benefits such as material outcomes or goods, as well as distribution of consequences to energy projects such as poorness or pollution (Sovacool and Dworkin, 2015). For a case where there is a locally-managed REF, distributional justice is used to examine who received the energy being produced, who can obtain the allotment of benefits is determined, how the energy is distributed, and how a material outcome is managed. Equally, it is important to consider how responsibilities and operational costs are distributed among society members.

4.2 Capabilities perspective

To answer my third research question, I analysed my findings through the capabilities that emerge from the operation of this community energy project. As Day et al. (2016) summarised regarding the works of Sen and Nussbaum, capability perspective is an approach to conceptualising the intention of economic development. Furthermore, both Nussbaum and Sen (1993) posited that capability approach should not only bring out individuals’ various functions but also give people freedom to choose the kind of life they want to lead.

Fundamentally, if social justice requires equal opportunity that permits people to meet basic needs and obtain goods in order to develop their ability to flourish and achieve positive well-being, then fair distribution of energy services is just as crucial (Sovacool et al., 2014). Sovacool et al. (2014) further elaborate this fair distribution according to Sen’s *The Idea of Justice* (2009): when energy service is being distributed to an area, then it has become the right of the people in that area to be able to exercise their ability to use opportunities stemming from the outcome of that energy service

(Sovacool et al., 2014). Sovacool and Dworkin (2015) concluded that this fairness to define capabilities must also promote the freedom for people to choose how they want to improve their life as a community. In the case of energy services, Day et al. (2016) suggested that in connection with the outcomes, energy services should enable the fulfilment of basic and secondary capabilities. Basic capabilities include health, education, social respect and maintaining relationships, while secondary capabilities include using machineries, storage or preparing food, among other things.

5 PLTH Pantai Baru: the community renewable energy

In this section, according to interviews and personal communications that I have acquired from the field, I describe how the Ngentak community has been affected by and utilised the establishment of the PLTH. This description also covers how the community arranges and distributes the outcomes of the project among themselves. To give a clearer structure to the discussion section, I categorise all findings according to the variables of energy justice based on its three tenets: recognition, procedural and distributive justice.

5.1 Findings for procedural justice and recognition

For this subchapter, I summarise the processes that adopt procedural and recognition aspects, spanning processes from the previous time of Pandansimo Beach up to the moment of PLTH Pantai Baru's establishment. All processes from both the community and the government sides are provided and differentiated by colour (Figure 2).

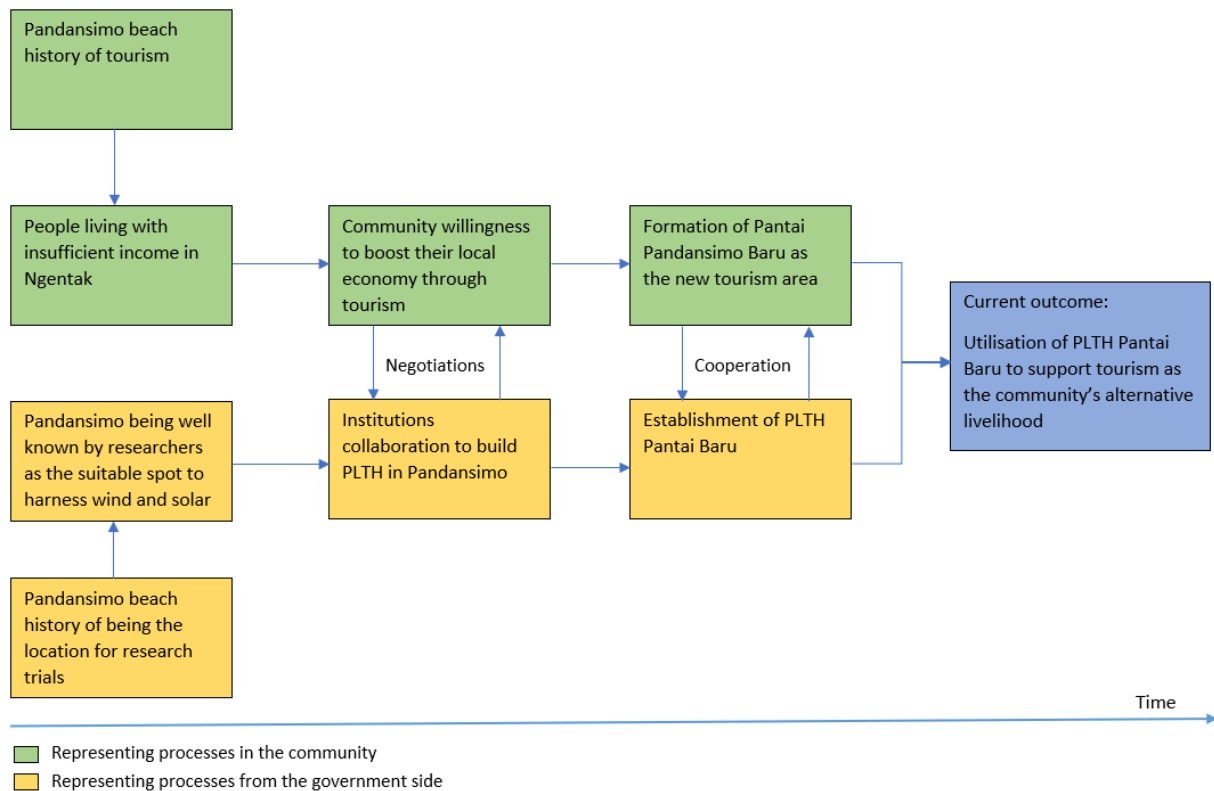


Figure 2. Summary of the historical journey of tourism and establishment of the PLTH establishment to the current outcome (Own creation, 2020).

Striving for tourism: the background and initial processes

Before establishment of the PLTH, the Ngentak community generally worked as farmers, stock farmers, fishermen, and sand miners (L11, L12 & G32). The women also worked in agriculture, animal husbandry and other occupations, except for sand mining (L31, G32). L35 explained that before owning a food stall by the Pantai Baru beach, she sold snacks on school premises while also working part-time as a janitor to add to her income. Based on the interviews with G32, L13, L14, L15, L32, L34, L41 and L42, Ngentak residents are used to holding multiple occupations to sustain themselves; this is because each occupation, such as agricultural work, is not a reliable means of income because the area is somewhat dry and seldom gets rains (L13, L32). While G32 pointed out “...our farmers and fishermen often have uncertain income and depend on the season.”, L13 narrated that “Agriculture in our paddy fields lacks water, so the results are not very optimal here. [...] This year is indeed very short of water, so the harvest is not optimal”.

As shown in Figure 2 and mentioned by L11 and L12, tourism is not a completely new activity in Ngentak. Pandansimo Beach was a popular religious tourism destination in the 1970s and 1980s. However, gradually, this somewhat unorganised tourism activity induced other trends that damaged the tourism itself, such as the rise of prostitution and beach pollution (L11, L12). According to L11,

that kind of beach tourism was not only socially improper but also did not produce advantages in the form of livelihood opportunities for the community. Hence, as L11 and L12 emphasised, in 2010, the community wanted to rebrand their coastal area as 'Pantai Pandansimo Baru' (likewise mentioned in RISTEK, 2013), with economic improvement as the fundamental motivation for the people of Ngentak to increase their income from tourism in the coastal areas. Nevertheless, they were aware of the lack of infrastructure to support the tourism plan (L11).

As L11 and L12 stated, in March 2010, they held a joint meeting with Ngentak community leaders to discuss plans to organise tourism activities in the coastal areas. The meeting was followed up with a submission to the regional government requesting public services such as national grid connections in the coastal areas (L11, L12). Although they did not acquire national grid coverage until 2013, they procured another outcome from the meeting: information delivery (regarding the tourism development plan) for all residents if they were willing to register for a food stall by the beach (L31, L34). An informant who now works as a stock farmer as well as running a food stall by the beach (L41) illustrated that there were meetings for each stage of planning for tourism, including meetings for (1) when the community plotted the beach area for stalls, (2) to decide the model and design of the stalls, and (3) when the stalls were ready to be built. After the community plotted the food stalls area, they opened applications for those who wanted to have a slot. There are three categories of stalls, and the allocation arrangement was set by lottery to ensure fairness and avoid dispute (L11, L12, L41). Those who obtained slots built their own stalls according to the agreed specifications (L11, L12). To promote fair distribution of the available stalls, L11 and L12 explained that one family could only apply for one stall. Eventually, this arrangement resulted in the establishment of the Pantai Baru tourist area consisting of 124 food stalls (each usually employing three workers), 30 parking personnel, 41 ATV personnel, 14 public toilets and more than 70 hawkers.

Project refusal and negotiations

When RISTEK came to Ngentak in 2010 to build a hybrid power plant, the plan was received with criticism, particularly from the sandy soil farmers group. Before the PLTH was established, several residents had utilised the plot of sandy soil to farm vegetables, chilli and other plants to support their soil-based farming activities (L11, L13, L22, and L42). Therefore, they viewed the plan as a threat, especially since farming lands are already scarce in Ngentak (L11). They worried whether the wind turbines would affect or prevent their previous activities (L11, L13). Faced with these constraints, the project initiators held meetings with community leaders to coordinate solutions (G11, L11, L13). L11 and L13 explained that they first discussed concerns with affected residents prior to meeting the

project initiators. L34 stated that they were approached and invited to a meeting to discuss the establishment plan for the PLTH. L11 explained that the results of the negotiation were in favour of the residents' wishes because they would still be allowed to make use of the sandy soils while it was also used for wind turbines (Figure 3). Moreover, the project initiators improved the offer by extending energy services to support sandy soil farming activities by providing irrigation and building freshwater fishponds oxygenated by PLTH electricity (Figure 4).



Figure 3. A plot of sandy soil that is still actively utilised for farming by the community (Own photograph, 2020).



Figure 4. Freshwater fishponds below solar panels on a sandy soil built by the project initiators and oxygenated with PLTH electricity (Own photograph, 2020).

Beyond the issue of land use, the community leaders who attended the negotiations presented another critical demand to the project initiators. L13 mentioned that they had noticed how governmental projects in other areas were often abandoned not long after their establishment, leaving the local people lacking technical skills and burdened with a deteriorated facility (L11, L13, L22). As such, they specifically requested that the project initiators would provide a sufficiently long period of technical assistance until the local people who were assigned to run the PLTH acquired the needed skills.

From the project initiators’ side, this negotiation result required re-planning for additional technicalities because the plan was meant to only supply electricity for street lighting and ice block production (L22). Moreover, as G11 clarified, “this PLTH was intended as a one-year project which would thereafter be handed over to the community.” However, the project initiators responded to the request and assisted the facility for two more years (L21 & L22). The assistance involved assigning an on-field technical expert as the PLTH coordinator, a position. Furthermore, assistance covered equipment replacement, such as when the facility was struck by lightning in December 2012 and all the inverters were damaged (G11, L21).

PLTH Pantai Baru: the starting point

In the early stages of the PLTH’s construction, the project initiators accepted anyone in the community who was willing work for the PLTH (G11). Those who joined were trained to acquire the skills to be electrical technicians and mechanical technicians (G11, L13). The community seemed to embrace this chance to invest strategic thinking into the staff line-up, and they not only encouraged anyone who had an interest to take the opportunity, but they also encouraged those who were active in the community groups to participate (L11, L21). Consequently, the constellation of PLTH staff is somewhat varied in age and community group background (see Table 2). All the staff are male and Ngentak residents, except for two individuals (Staff 2 & 7) who are residents of the neighbouring village in the Bantul region (Table 3). Additionally, all the staff are vocational high school graduates, except one who is a diploma graduate.

Table 3. PLTH staff with their age group and affiliation (Own creation, 2020).

PLTH staff	Age Group	Affiliation
Staff 1/ coordinator	30-35	Youth group
Staff 2	35-40	none
Staff 3	60-65	Farmers' group
Staff 4	50-55	Stock farmers' group
Staff 5	40-45	Fishermen's group
Staff 6	20-25	none
Staff 7	20-25	none

5.2 Findings for distributive justice of community energy

5.2.1 Benefits

Tourism establishment

As L12 explained, it was a positive coincidence that the PLTH's establishment occurred at the same time as the new beach development (see Figure 2), which has supported tourism activities. Nevertheless, the community's aim to improve their economy through tourism has not only been reflected in how the PLTH is harnessed today, but also in how the community went the extra mile to ensure its preparedness for tourism. Community leaders were serious in preparing the stall owners, organising collective enrolment in culinary training for those who would own food stalls (L11, L12, L31). L11 explained that this was one of the efforts to ensure their tourism activity, as another means of procuring their livelihood, sustainable.

At first, energy services from PLTH were limited to electricity for streetlights, stall electrification, water irrigation and producing ice (L22). Nonetheless, requests from the stall owners to obtain electricity from the PLTH emerged after a couple of stalls were powered by the PLTH as trials (L22). The project initiators then installed an electricity metering box for every two stalls so that PLTH staff could arrange and control energy distribution according to PLTH's capacity (L22, L35). Over time, PLTH services have added clean water provision as an additional service for the beach area, which has been beneficial for the beach workers although the service quality can still be improved (L31, L31, L33, L34, L41). L31 added that PLTH has worked side by side with the community's tourism group (Pokdarwis) to produce services or ideas to the community's advantage, particularly in tourism. L11 explained that Pokdarwis facilitates interaction between the people who work in tourism and addresses their aspirations collectively.

Furthermore, beyond providing power for their tourism activities, G32, L12, L31 and L34 see the PLTH itself as a beneficial tourist attraction. G21 and L36 emphasised that PLTH Pantai Baru has been acknowledged as an official hotspot for academia in the region to undertake research and field practice in relation to renewable energy technology. As G32 argued, "Other areas are competing to draw tourists in. If it were not for the PLTH, maybe there would be no Pantai Baru as we know it now. These wind turbines and PLTH facilities have become a unique tourist icon of Pantai Baru". Additionally, all stall owners interviewed stated that they would be worried if the PLTH stopped working because their small businesses depend on it. Although some individuals have finally connected their stalls to the national grid, they are still dependent on the PLTH for water supply (L31,

L32). One of the stall owners expressed a wish that the PLTH facilities could be more developed in order to support their activities with better services (L33).

Economic improvement

“Life (in Ngentak) now is so much better than ten years ago”. I heard similar statements from most of the informants (G31, G32, L11, L12, L31, L32, L33, L34, L35, L36, L41, L42)—even those who do not work directly in the tourism sector, such as the fishermen, but who benefit from tourism (L15). This view was based on how income has been improved due to the beach area’s active tourism. G32 explained that many people treat this new occupation as an economic safety net alongside their other jobs or other family members who work as farmers, fishermen or sand miners.

During my field research, I noticed that almost all food stalls are run by women. Only a few are run by men (L11). L31 explained that the establishment of Pantai Baru has presented additional sources of income and promoted women to be able to have their own income source. Having previously doubled as a hawker and janitor, L35 expressed feeling ‘liberated’ by running her own food stall. Some others explained that running the food stalls along with working as farmers or stock farmers better their family's livelihood (L32, L34, L41, L42). The women’s husbands mostly work as sand miners, farmers or fishermen who usually come by the stalls to help after they finish their work (L32). However, all stall owners who were previously farmers or stock farmers stated that they had not left their initial occupations (L32, L33, L34, L41). Busy with daily work, L32 stated that she shared the household chores with her husband. Meanwhile, L34 described herself as solely responsible for household chores because juggling housework with her stall’s opening hours is still manageable.

From the broader view of community economic benefits, L11 mentioned the collective usage of tourism income for Ngentak’s development. Organised by the community groups Pokdarwis and Pokgiat, L11 explained that the income collected from parking tickets is considerable. Therefore, as agreed during a community group meeting, half of the income is collected by the group as community capital to be used for the establishment and improvement of public infrastructure and other social purposes (L11). L11 added, “The collected fund has been used for fixing our roads and pathways (Figure 5, left), building the beach icon (Figure 5, right), to support those who are sick and to take care of the elderly who are no longer capable of working”.



Figure 5. Establishment and improvement of public infrastructure in Ngentak hamlet. The picture depicts a neatly paved area leading towards the Pantai Baru parking lot (left), and the Pantai Baru icon statues (right) (Own photographs, 2020).

Obstacle in producing benefit

Finding shows complications in allocating funds for community needs in relations with PLTH operation due to government's strict rules on how to use the given budget (G32, L21, L22). When explaining the mechanism of the specific budget that is allocated for PLTH, G32 stated, "As the common procedure in governmental authorities, if there is a plan of repairs or such [at PLTH] then it must be submitted a year before. For example, last year we proposed to replace the lightning rod. And this only the application for budget use. Regarding how much it would be agreed, it depends on the approval from the central government. Therefore, we usually sort out which priority to put forward. And the results of this submission cannot be received in the form of money, but in the form of procurement of work carried out by third parties". Consequently, L13 explained that, "if a damage occurs, it is impossible to immediately repair it. Often, we are forced to leave the damage be for months until the third parties arrived to carry out repairs. [...] if we had self-managed funds, we could have the opportunity to find solutions and implement repairs more quickly". Furthermore, L22 explained how this policy create restrictions for the PLTH to effectively carry out services that are particularly needed by the community, such as daily repairs and maintenance, and even to provide more proper derivative services such as clean water supply.

5.2.2 Shared responsibilities & challenges

Arrangement of PLTH utilisation

To manage the tourism activities and the distribution of PLTH services, there have been several arrangements adopted by the community through the PLTH and Pokdarwis. PLTH capacity is limited, and it must be shared evenly; this condition was recognised by all the stall owners interviewed, who

stated that they were informed through the meetings with Pokdarwis and in which PLTH staff were also included (L12). For example, L31 expressed her understanding of why the PLTH must be turned off during bad weather. She explained that electricity was limited for several hours a day so that every stall owner could enjoy the same amount of electricity while sharing it with the ice machine and streetlights. As L31 stated, “we are aware of the setting of PLTH because it was informed and understood in a joint meeting”. L35 also exhibited her knowledge of the PLTH, stating how its electricity is still limited to an extent: “The stalls that rely on the PLTH for electricity can only use it for lights, a fan, and a rice cooker. I cannot add a blender because the power will not be sufficient”.

Arrangements to preserve tourism

When L11 told me the story of how the community rebuilt Pantai Baru as a new tourist destination, he explained that the efforts were made communally. The community worked together to clean debris from the beach and prepare it to host tourists (L11). As L35 stated, “It used to be like a messy jungle here in Pantai Baru. Then, communal work was carried out every night by the men to open the beach for tourism”. This community effort has been one of the reasons community leaders have limited benefit distribution to Ngentak residents before other people (L11, L31). L11 expressed how he had to firmly refuse several people who were not even Poncosari villagers but demanded a stall at the already developed Pantai Baru. However, the community still allowed other hamlet residents to come and work in the area as hawkers or vegetable vendors at the people’s market (L11, L31). L11 further noted that this approach was necessary because the community, comprised of fishermen and farmers with low socioeconomic means, would be unable to compete if the limited stalls were offered openly to non-Ngentak residents.

Another set of arrangements related to the continuation of tourism are environmental cleanliness and price standardisation. These arrangements aim to maintain customers and avoid unhealthy price competition between community members (L11, L12, L31, L32, L33, L34, L41). L33 and L41 stated that these rules were agreed upon and regularly reviewed in monthly meetings which all beach workers are encouraged to attend. This mechanism helps to avoid conflict between beach workers if someone has created discomfort. For instance, some stalls littered or fixed much higher prices. The beach workers addresses such complaints through the smaller group first (beach workers divide themselves into smaller group which each represents of 10 stalls), so when it is discussed in the bigger meeting under Pokdarwis, it can be addressed as a community group issue (L42, L33). Additionally, the meetings also support stall owners in addressing ideas or suggestions (L34). During my direct observations, I came across a stall whose exterior decorated with dried branches. Knowing that a standard model was set for each type of stall (L11, L12), I asked about this specific stall’s

different look. L12 explained that, in a meeting some stall owners asked to be able to decorate their stalls, and as agreed, decorating was up to each stall owner.

Challenges and hopes

Because a solar-wind hybrid power plant heavily depends on the availability of sunlight and wind, the readability of power storage is key to smooth operation. In Ngentak, the community depends on the weather to have sufficient power for the PLTH. However, the plant's battery capacity has already decreased to half of its original state (L21, L22). The reduced and limited capacity was understood by the stall owners as PLTH end-users (G32, L32, & L35). However, they still hope for better services from the PLTH in the future (L12, L31, L35). L21 explained that the root problem of the PLTH now is the capacity for energy storage. "Power cannot be kept for long", L21 emphasised. In the broader view, G21 argued that one of the challenges for REF in Indonesia has been the high maintenance costs, such as batteries for energy storage. Cost-wise, it is already difficult for RE services to compete with the cheaper, subsidised national grid (G21). This challenge was revealed when the national grid finally reached the Pantai Baru area, and some stall owners who could afford the PLN tariff changed their subscription from the PLTH for a more stable and sufficient electricity. Because the community did not bear the subscription cost of the PLTH, the PLN tariff is more expensive than that of the PLTH. However, it affects the idea of a renewable energy transition plan.

5.3 Findings for capabilities approach

PLTH staff: fundamental motives

From the first time I visited PLTH Pantai Baru, I immediately observed the everyday activities at the facility. Some staff were out for repairs (Figure 6, left), others were building a wind turbine's blade (Figure 6, right), and the rest were with some students working on wind turbines (Figure 7). From the interviews, L21 and L22 explained that they decided to work for the plant out of curiosity and the call for employment. Employed by the provincial government as honorary workers, PLTH staff earn income according to regional minimum wage (as of 2019, this is estimated as around USD 112 per month). Nevertheless, they expressed a sense of ownership, challenge, and fulfilment with the facility and claimed money was not their main motivation for working as PLTH technicians (L21, L22). L21 stated that "working at PLTH is a source of work and innovation". He has been working at the PLTH for almost a decade and, despite the low salary, he works for other sources of satisfaction: "We can explain how to make a propeller to our research and fieldwork friends. I enjoyed the activities, the fulfilment of self-actualisation. The results (money) are not much, but I am happy. And, in

general, my friends [the PLTH staff] here are the same with their income, but we survive because some of us have a side income from the stall, while I own a public toilet [by the new beach]. Ultimately, the income is not so bad”.



Figure 6. Daily activities of PLTH staff (1). Two PLTH staff was repairing cables for the streetlight while being observed by a group of students (left), and some PLTH staff were building a wind turbine (right) (Own photograph, 2020)

Enhancing skills and expertise despite limitations

The opportunity to continue developing skills and expertise has been another reason for staff to remain at the PLTH. L21 and L22 observed that they are doing what they are passionate about at the PLTH. L22 described that their main tasks are operation and maintenance. To complete the tasks, they rely on technical data to control operations as well as to detect faults or damage. When something needs immediate repairs, they utilise available materials and infrastructure such as spare parts and the PLTH workshop space. Occasionally, they need to seek out spare parts in other areas within the region (L21, L22, L13, L14). However, for some things, they have acquired the skills to make their own parts, such as wind turbines and inverters (G11, L21, L22).

Due to limitations in funds, parts and equipment, workers anticipate daily challenges. As L21 narrated, one of their most memorable experiences was when lightning struck the facility in 2012 and irreparably damaged the imported inverter. Although they were still technically being assisted by the project initiators, who then replaced the inverter, they learned a valuable lesson from the incident (G11, L21, L22). As L21 commented, “If we want to survive on our own, we need to have the ability to build our own equipment, including inverters, the key machine for this hybrid facility”.

Sarcastically, he joked that their old, worn-out batteries force them to outsmart the situation: “This actually makes things more exciting and prevents us [the staff] from being too relaxed and lazy”. As L21 explained, the batteries in the PLTH are no longer capable of maintaining stored energy even for one night; hence, the staff must keep manual logs to plan technical strategies so that the PLTH can have power continuously for the next day, every day. They realised that such difficulties can be avoided if they are connected to the national grid (by selling electricity to PLN). Yet they are not promoting this idea because the initial spirit of the PLTH is not to sell electricity and make a profit but to be beneficial to local livelihoods (L21).

Self-actualisation opportunity

Furthermore, as L21 stated, he feels a sense of self-actualisation from the activities with researchers and students. In a way, their work is beneficial to scholars as many people are studying the facility and gaining knowledge from the staff’s work. Reciprocally, these activities let the staff and technical students work on problems or invent new mechanisms for the facility. Figures 7, for instance, are the result of a master’s student’s work with PLTH staff on a new mechanism of wind turbines combined with a solar panel. L21 and L36 expressed how they feel a sense of pride and contentment from this activity. L21 added that PLTH may produce limited amounts of electricity, but it also produces human resources—students and researchers who study the facility.



Figure 7. Daily activities of PLTH staff (2). A PLTH staff member with two students working on a wind turbine (left) to be placed in the wind turbine and solar panel combination tower (right) (Own photographs, 2020).

Additionally, the PLTH staff developed skills and expertise that has been acknowledged by the government, which frequently hires them to work as trainers for other renewable energy projects (G11, L21, L22). While G11 refers to this activity as the staff's bestselling points, L22 explained that it is in accordance with the initial spirit of PLTH Pantai Baru development, which was From Bantul Illuminating Indonesia. L22 further elaborated on how this additional work is shared with the whole crew, noting "We usually get requests from parties who visit PLTH Pantai Baru and need help in the renewable energy field. Every request we receive is always discussed with all staff related to deciding the follow-up. The discussion covers decisions on the appointment of the staff (to take the work) up to compensation arrangements, which are partly shared among all staff and saved as PLTH cash funds". Today, due to their current employment arrangements, it is still possible for them to teach and train people who are running similar energy facilities elsewhere in Indonesia as long as the training takes place in the PLTH or Srandakan workshop (L21). They aim to train technical skills so that other people can run and maintain facilities as independently and inexpensively as possible (L21). L21 clarified, "We teach them to build foundations, propellers, generators themselves so that if the tool is damaged, they can fix it with low costs. For us in the PLTH, despite being close to the city (Yogyakarta), we still have difficulty finding spare parts. I imagine it would be even more difficult for those who run energy plants in even more remote areas".

Capabilities formation and shifting mindset in the community

Ngentak's economic improvement has led to the affordability of other elements such as education, better housing and household machinery. G32 and L42 stated that the main improvement that can be seen is in how their housing quality has improved. Furthermore, L11, L41 and L42 pointed out that now they are capable of equipping their homes with household appliances and motor vehicles. L34 asserted that the income from her stall helps her to afford education for her children, while L31 stated that income from tourism has enabled her children to enjoy higher education in universities. Indeed, a further effect of this affordability, as L31 stressed, is that Ngentak residents today have a new understanding of and value for higher education. G32 observed that it has become more common that the young people of Ngentak are university graduates, as opposed to 10 years ago. L31 explained, "The community shares understanding about the importance of using income for education through routine community group meetings. The parents who met at the meeting must have had the opportunity to exchange information and talk about their plans with their children".

6 Analysis and discussion

6.1 Energy justice

In this section, I analyse how Ngentak residents are being accounted for and included in the negotiation processes (see Figure 2) that are crucial for fair distribution of benefits and responsibilities. I order the analysis using the three interrelated tenets of energy justice: recognition, procedural and distributive justice. This will simultaneously answer the research question regarding how the community distributes benefits and responsibilities and how their decision-making operates. In this study, apart from using Sovacool and Dworkin's (2015) works on energy justice, I also look at Jenkins et al. (2015) as they re-articulated each of the three principles of energy justice. I analyse the case study according to Jenkins et al. (2015), who interpreted the principles to evaluate the following questions: 'Where are the injustices?' (distributive justice); 'Who or whose views are being neglected or disrespected?' (recognition); and lastly, whether 'the decision-making process is fair' (procedural).

6.1.2 Recognition & procedural justice

Recognition and procedures in the early project

Barry et al. (2008) indicate that the important factor for a successful renewable energy transition is not about its technology but rather the local people's acceptance of that energy transition project. They further suggest that one of the keys to this acceptance is to include the local people in the decision-making processes in the effort to understand the nuances of their potential benefits and concerns. Regarding the PLTH as an energy project, the community was seen not only as the project beneficiary but also the affected community whose demands and worries should be acknowledged; this is in line with Jenkins' (2015) view of procedural justice, which requires efforts to include and involve the affected party in taking decisions. Clearly, the community was served with recognition and procedural justice when the sandy soil farmers could persist in their rights to use the land, even receiving technical support for their farming activities. The community leaders specifically requested sufficient technical assistance from the project initiators, and the project initiators responded accordingly. This approach gave the community room to express their opinions on how they wanted to accept and run the energy transition project.

After the period of acceptance, the community proceeded to plans of economy improvement. Their own mechanism of regular meetings and discussions were ways of recognising and facilitating the residents' existence and aspirations. Their lands remain free to utilise, and everyone has the freedom to choose if they want to work on the new beach. This accessibility was emphasised not only in the

interviews with the community leaders who led the collective action, but also in interviews with members of the community such as PLTH staff and beach and non-beach workers. As injustices in recognition may lead to marginalisation (Sovacool and Dworkin, 2015), my findings show patterns of recognition rather than misrecognition when it comes to this outcome arrangement.

Recognition of the developed skills

Another form of the project initiators' recognition was illustrated in their choice to prolong their project in order to sufficiently prepare the staff with technical skills. This finding corresponds with how energy justice views energy beyond the importance of its hardware and technology (Sovacool and Dworkin, 2015). This view is seen in the way the project initiators invested those who would be the REF operators with the proper knowledge and skills, as if the PLTH staff had been the part of the outcomes of the energy project they planned. In fact, the staff's acquired knowledge goes beyond the necessity to keep the PLTH running; their expertise has been acknowledged by and beneficial to other RE transition projects in the country. Moreover, because the staff share their knowledge with scholars and researchers, the provincial government recognises and supports them. More than the initial conception of recognition justice (Jenkins et al., 2015), this finding illustrates a form of respect for and recognition of the trained and skilled staff as the outcome of the energy transition. Evidently, they are one of the crucial factors that keep the REF running.

Recognition between the locals

Noting that Ngentak does not bear substantial differences in race and religion, I anticipated finding a form of struggle for recognition arising from a specific gender group's exclusion or a specific group that dominates access to resources (Fraser, 1999). However, my interviews with a range of actors at the local level (from local leaders and PLTH officials to common people like simple farmers who do not actually understand the concept of PLTH) shows inclusivity regardless of group background rather than oppression. Nonetheless, prevalent conditions of a patriarchal society were discovered where gender-based task division occurred. For example, men tend to lead community or local initiatives (Nilan & Dermartoto, 2012), while most food stalls are run by women. Sand mining is done by men, and all the PLTH staff are men. However, according to the data, this task division does not promote discrimination that can lead to oppression of a gender group (Sovacool and Dworkin, 2015). On the contrary, every stall owner was asked if they agree with the tourism and PLTH plan, and they are now being served by the PLTH and attending meetings regardless of gender or role. I am not arguing that this is an ideal case of gender equality. However, the inability to harness modern energy cuts opportunities to alleviate poverty (Sovacool & Drupady, 2012), which then greatly impacts

women's and children's lives and livelihoods (Rehfuss & WHO, 2006). Therefore, in this case, it is as important to regard the community's willingness in harnessing REF to power their new tourism sector, which has opened up access to alternative livelihoods, specifically for women, and improved families' livelihood and living standards.

Procedural justice

In managing tourism activities (as the major outcome of the RE transition project), the community holds a collective mechanism in distributing the outcomes. My data shows that this community went through processes that included the whole community, namely agreement to and involvement in building the new beach, consensus to accept the establishment of the PLTH, and an open invitation to families to own stalls by the new beach. Given that the tangible form of the deliverables was stalls, it is notable that the community divided stall arrangement by lottery to promote fairness regardless of who led the initiative. Referring to Jenkins et al. (2015), this can be identified as an attempt to apply distributional justice in allocating derivatives benefits, which are the livelihood alternatives that have emerged from the REF's power.

The community procedural activities occur through meetings and discussions that are formally driven by the main community group, Pokgiat, and the tourism group, Pokdarwis. Although they hold regular monthly meetings to which all members are invited, I noted a unique enforcement on seeking consensus, particularly when the community first wanted to form the new beach and the PLTH. As previously explained, the group leader reached out to residents to survey their views about both plans and invite them to the follow-up meeting; this approach fulfils the description of how decisions were made and by whom (Sovacool and Dworkin, 2015), including the members of the community. Following almost a decade of the PLTH's operation and the new tourism activity, everyone who is involved is represented in Pokdarwis through regular meetings.

The aim of these groups and meetings is to facilitate issues and ideas submission while updating community members with new information and local knowledge, such as news on PLTH services or tourism management. In these meetings, people who run the PLTH are always present because they share interest in the tourism sector. Hence, the community members actively exchange information not only about the derivative benefits of energy services but also about the state of their renewable energy service. Thus, the Ngentak community has practiced mobilising local knowledge through social inclusion and engagement in relation with their own energy system (Jenkins et al., 2015).

6.1.3 Distributive justice on benefits

Findings support that the Ngentak community's ability to harness energy services for their specific interests has been the reason for their ongoing acceptance and support of the PLTH as an RE project. In relation to energy services, people are often intrigued by the plentiful benefits that can be provided (Sovacool et al., 2014), but such interest in technology can vary according to local characteristics and desires (Owens and Driffill, 2008). As Sovacool and Dworkin (2015) suggested regarding the importance of obtaining benefits from energy, the community has utilised the energy project in Pantai Baru according to their specific desire to encourage economic improvement. Historically, they aimed to receive energy services enabling them to strive for better well-being and livelihoods. Through the REF, the Ngentak community has harnessed the PLTH for the development of tourism, which has resulted in improved livelihoods. Intangibly, the facility has not only provided an alternative source of electricity and clean water, but it has formed Ngentak's new identity based on pride in the renewable energy that epitomises the area. Sovacool (2014) argued that local aims and interests are frequently overlooked by engineers and economists while working on energy studies. However, in Ngentak's case, the project initiators seemed to support the community by adjusting their technical and administrative plans according to the community's demands.

Nevertheless, findings indicate that the PLTH has experienced budget-use constraints in their efforts to generate benefits. Allocating funds for community needs is limited as government has strict rules on how to use the allocated budget. As illustrated by Sovacool and Dworkin (2015), one of the aspects of distributive justice evaluates the goods that are being distributed from energy projects which one of them is power. In this case, there has been an absence of power distribution to the community to manage the allocated funds according to their needs to enhance the community and the REF as well. Hence, this can be seen as a major challenge of a community scale energy projects as they are often dependent on formal rules applied by the government.

6.1.4 Distributive justice on responsibilities

Distributive justice not only covers the uneven distribution of 'goods' and 'ills' but also the allocation of responsibilities and consequences (Jenkins et al., 2015). The findings show forms of responsibilities allocated within the community through the arrangement of rules. Furthermore, as the community's livelihood is bolstered by tourism, findings demonstrate that the community members also consider the consequence that they must overcome together: tourism waste. Because tourism is associated with increased waste (Arbulu et al., 2016), the community applies rules among themselves to manage their waste and keep their environment clean. Thus, the community also distributes the

consequences from the beneficial outcome in order to prevent pollution (Sovacool and Dworkin, 2015).

6.2 Capabilities approach and lasting community renewable energy

From Day et al.'s (2016) capability perspective, as an energy transition project, PLTH Pantai Baru can be identified as an intervention to the alternative provision of energy services that has led to the formation of capabilities in the community. The utilisation of this energy service has improved the community's livelihood, enabling them to acquire basic capabilities such as access to information and higher education, as well as secondary capabilities such as ownership of better appliances and motor vehicles. Interestingly, the ability to afford higher education has redefined perceptions of education in connection with social respect. Day et al. (2016) delineated how social respect as a capability can be fulfilled when underpinned by other forms of capabilities such as accessing information. As a result of the technical aspects of the facility, PLTH staff have become the experts who have upheld the facility as an energy service provider for almost a decade. Such dedication was rewarded through basic capabilities gains, including in recognition and acknowledgement, along with personal passions for acquiring new skills and knowledge.

The basic right to have minimal energy services in order to achieve better well-being (Sovacool and Dworkin, 2015) is complemented by acquiring capabilities and benefits out of an energy service, such as improved livelihoods, unpolluted environment, access to education and gaining expertise. Although commercial activities are proven to be one of the common outcomes from energy access in Indonesia (Sovacool and Drupady, 2012), there is something more prominent in the Ngentak case. Instead of individuals running their own initiatives for power utilisation, the Ngentak community collectively flexed their entrepreneurship in tourism so that this new means of livelihood could last longer. What is more, the Ngentak case has also shown how an REF has successfully functioned for almost a decade, and the fulfilment of community's ability to adjust some of the project arrangements is one of the contributing factors of project acceptance. Another notable factor is how PLTH staff have contributed to the national efforts to achieve energy mix by sharing their knowledge and expertise with other REF in the country.

6.3 Lessons learned from PLTH Pantai Baru and other community-based REFs

Although short-term deployment of RE projects usually fail only a few years after being delegated to the community (Retnanestri and Outhred, 2013), this is not always the case. Proper and sufficient technical assistance for the community as the project beneficiary can prevent failure (Guerreiro and

Botetzagias, 2016; Setiawan and Setiawan, 2013). According to Sen and Nussbaum's (1993) concept of freedom and capabilities, success fundamentally depends on alignment with the community's wishes of what they want to do with the energy access. Previous studies correspond with the findings of this thesis as the staff of PLTH Pantai Baru have been one of the main reasons for the lasting achievement of the REF in the Ngentak hamlet. There was a time window presented by the project initiators to process the community's input for the project and a sufficient period allotted to assist those running the facility to acquire technical capabilities. However, it is also crucial that the community should be empowered to be self-sufficient in managing finances intended for the REF enhancement, so that the utilisation can be effective and accurate in supporting community development needs. These are significant factors that can be adopted by other off-grid facilities in Indonesia in order to suitably integrate the facility with the community's needs and desires.

7 Conclusions

I investigated the background of PLTH Pantai Baru's establishment—an REF—in the Ngentak hamlet, Central Java, Indonesia, along with the relevant social processes that have happened in the community for almost a decade as the project beneficiary. Having shared control over PLTH planning with the project initiators from the early period, the community gained the ability to collectively arrange the utilisation of the PLTH according to community needs. This period has led the community to demonstrate recognition and procedural justice and has brought a fair distribution of benefits and responsibilities. Underpinned by the PLTH, tourism has become an effective alternative means of livelihood for the community, which has contributed to the establishment of capabilities. On the other hand, the PLTH has shaped the community members who run the facility into technical experts on their field. In Ngentak's case, these combined findings on energy justice and capabilities prove that the REF has successfully integrated into the Ngentak community.

In light of Indonesia's need to enhance electrification rates in remote areas, research focus on community renewable energy is needed. Future research comparing multiple case studies on existing community renewable energy in Indonesia can give more insight into patterns and suitable guides to build a sustainable and integrated community-based REF. In broader view, such future research may establish guidance or sustainable pathways for the national transition to renewable energy.

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9 Appendices

Appendix 1 – Interview guide

Interview guide for the government

A. Personal information

B. Can you tell me what you think of this PLTH? How did it begin and how is the operation now?

1. The origin of PLTH establishment (main trigger)
2. Who are the bodies / actors involved in the establishment?
3. Project ownership and funding from the beginning until now
4. About building community trust at the beginning of the project
5. Relations with the population in the early days until now

C. Can you tell us how about your daily duties in the ESDM related to this PLTH? What are the challenges and benefits for both yourself and the local population?

1. How is the management of PLTH?
2. Who are the parties / actors involved in management?
3. PLTH organizational structure?
4. The main problems / challenges of PLTH?
5. Are there daily challenges in managing PLTH? (both technical and financial challenges)
6. Benefits of PLTH other than as an energy supplier?
7. The main benefits of PLTH for the govt and the community
8. Impact / implications on society
9. Knowledge and expertise built for the community on this project
10. Are there conflicts as a result of this PLTH?

D. What kind of support and where does this PLTH need?

1. What connections / collaborations will be expected and who is expected to manage the PLTH?
2. Organizations / NGOs / private bodies that are suitable to support the management of PLTH?
3. What kind of support / services does PLTH require?
4. Are there similar projects that emulate this PLTH?
5. To what extent is management collaboration with the community?

E. Can you tell us what this PLTH energy distribution service looks like, then the relationship with PLN?

1. Rules for the distribution of energy from PLTH
2. Specific rules related to the use of energy from this PLTH?
3. Rules / procedures if there are technical problems?
4. Your opinion about the importance of this PLTH procurement?
5. Opinions about PLTH not connected to PLN (off grid)?
6. The difference in energy services from PLTH and PLN
7. The role of the central government and regional governments
8. Is profit one of the considerations for managing this PLTH?

F. What influence is given from and obtained by the community on the existence of this PLTH?

1. Have there been any input / requests regarding energy supply from local residents? If yes, how is the input handled?
2. Changes that have occurred in the community since PLTH
3. Is there any formation of community structures / organizations related to PLTH?
4. Important learning aspects of PLTH for other regions if you want to build a similar facility.

G. Are there any environmental changes and climate change impacts that have been felt so far?

1. Changes in the environment related to PLTH development
2. Increased frequency and volume of local weather?

3. Community reports of extreme weather changes
4. Impacts on extreme weather (flooding, moving, crop failure, etc.)

Interview guide for the community: PLTH staff

A. Personal information

B. Can you tell me what you think of this PLTH? How did it begin and how is the operation now?

1. The origin of PLTH establishment (main trigger)
2. Who are the bodies / actors involved in the establishment?
3. Project ownership from the beginning until now
4. Relationships / coordination with residents from the beginning to the present
5. About building public trust
6. Knowledge and expertise built for the community on this project
7. Are there conflicts as a result of this PLTH?

C. Can you tell us how you do your daily duties at this PLTH? What are the challenges and benefits for both yourself and the local population?

1. Daily challenges as PLTH officer?
2. How is the management of PLTH?
3. Who are the parties / actors involved in management?
4. PLTH organizational structure under the govt institution?
5. The main benefits of PLTH for the community
6. The main problems / challenges of PLTH?
7. Are there daily challenges in managing PLTH? (both technical and financial challenges)
8. Benefits of PLTH apart from being an energy supplier?

D. What kind of support and where does this PLTH need?

1. What connections / collaborations will be expected and who is expected to manage the PLTH?
2. Organizations / NGOs / private bodies that are suitable to support the management of PLTH?
3. What kind of support / services does PLTH require?
4. Are there similar projects that emulate this PLTH?
5. To what extent is management collaboration with the community?

E. Can you tell us what this PLTH energy distribution service looks like, then the relationship with PLN?

1. Rules for the distribution of energy from PLTH
2. Specific rules related to the use of energy from this PLTH?
3. Rules / procedures if there are technical problems?
4. Your opinion about the importance of this PLTH procurement?
5. Opinions about PLTH not connected to PLN (off grid)?
6. The difference in energy services from PLTH and PLN
7. The role of the central government and regional governments
8. Is profit one of the considerations for managing this PLTH?

F. What influence is given from and obtained by the community on the existence of this PLTH?

1. Have there been any input / requests regarding energy supply / services from local residents? If yes, how is the input handled?
2. Changes that have occurred in the community since PLTH
3. Is there any formation of community structures / organizations related to PLTH?
4. Important learning aspects of PLTH for other regions if you want to build a similar facility.

G. Are there any environmental changes and climate change impacts that have been felt so far?

1. Changes in the environment related to PLTH development
2. Increased frequency and volume of local weather?
3. Community reports of extreme weather changes
4. Impacts on extreme weather (flooding, moving, crop failure, etc.)

Interview guide for the community

A. Personal information

B. Can you tell me what was the main reason for the construction of this PLTH?

1. Origin and time of PLTH establishment (main trigger)
2. Special events that initiated the previous procurement of PLTH?
3. Have there been any input / requests regarding energy supply from local residents? If yes, how is the input handled?

C. Can you tell me how is your daily life after this PLTH?

1. Your daily life, family and village before and after PLTH?
2. Your feelings about PLTH from the beginning until now?
3. The main benefits of PLTH for daily life
4. Daily challenges arising from energy / electricity needs

D. Can you tell us about the electricity needs in the village before and after PLTH? Then also related to community livelihoods before and after PLTH?

1. Role of PLTH towards livelihoods?
2. Daily challenges in working related to electricity needs
3. What is the affordability of energy prices for income?
4. Electricity needs before and after PLTH

E. Can you tell us how is the energy distribution from this PLTH is, then how is the relationship/difference with PLN?

1. Specific rules related to the use of energy from this PLTH?
2. Your opinion about the importance of procurement of this PLTH?
3. Is the cost of electricity distribution currently quite affordable?
4. The difference in energy services from PLTH and PLN

F. What influences and changes did the community have on the existence of this PLTH?

1. Changes that have occurred in the community since PLTH
2. Community involvement in daily PLTH management?
3. Is there an organization / working group formation from the community related to PLTH?
4. Are there projects / jobs that have been managed and owned by the community since PLTH was formed?
5. How would you feel if PLTH was damaged or absent?

G. Are there any environmental changes and climate change impacts that have been felt so far?

1. Changes in the environment related to PLTH development
2. Increased frequency and volume of local weather?
3. Have you experienced extreme weather changes?
4. Impacts on extreme weather (flooding, moving, crop failure, etc.)

Appendix 2 – A sample of interview notes

Sample of interview notes from the interview with an informant

Transfer of authority / ownership flow: RISTEK (and LAPAN) managed and transferred technology for the first three years then moved to the regional government, then to the provincial government. During this technology transfer period we were coached by teachers from LAPAN (2 people).

recruitment process: Only announced through the village head for those who wish to join PLTH, there is no selection process.

The challenge during this time: the longer the tools / equipment are heavily damaged and difficult to repair and cost great. What we really need today is battery replacement but the cost for this is indeed great. Moreover, in fact we need a battery with a bigger capacity but for this our budget funds are not enough.

Even after a budget fund, often the search for spare parts is difficult. Sometimes also if the spare parts exist but there are overseas or very expensive. So we here think how to make your own spare parts or equipment, for example, we were finally able to make our own inverter. Because here the risk of damage from lightning is quite high. Lightning, then wind or rain carries salt content. Our equipment is very easy to break.

Problem of lightning, we have equipped a lightning rod, but we are still traumatized from the incident of December 12, 2012, where there was great lightning, and it destroys the inverter and the entire facility went off. Although at that time, lightning rod was already installed. Fortunately, we were still handled by the ministry (RISTEK) so they replaced the inverter afterwards.

But indeed after lightning 2012 it so many facilities that do not operate. For example the ice-making machine that requires a large electrical power from the large capacity inverter, well it is, broken. So since then the ice machine is not operating anymore. Then replaced with another type of ice machine. But the longer the time, the battery capacity is decreasing, we have to choose whether to prioritise ice or street lighting. Finally we decided to drop the ice machine. this ice machine was a dilemma anyway. Because we actually are not allowed to sell/ make profit (from ice), but if we make it (ice) free, then people would fight over it. So, honestly, we feel more relaxed when we no longer produce ice.

What about the ponds for irrigation? Yes. It's still up until now, but right now it's almost no longer a sand field farmer (his irrigation is not for ordinary farmland). It is reasonable in my opinion, because the results may not be amplifying compared to new beach tours. Then there is also a sand mine business that results quite large, yes so many also turn to this sand mining.

Community groups.

We have a pokdarwis (tourism group), members of this group are more or less knowledgeable. It means the people who manage the tour in this Pokdarwis understand the role of PLTH to promote tourism. For media material, PLTH is for international scope of news. We don't have to call (journalists) them, they will come anyway. Different story with the common people, they typically don't know the true benefit of PLTH. Therefore, we use the system of meetings (community meeting) to take the chance to make them understand about the connection of PLTH to other things that benefit them.

Distribution of PLTH is limited to food stalls around the beach (the amount may be 80 stalls) with electricity that is that much but covering lighting, rice cooker, fan. Besides the food stalls, also for street lighting, garden, then there is also for clean water pumps for stalls activity.

A lot of news media that says PLTH is already “mangkrak”, while in reality, our log book is very much still active daily that displays that electricity from this PLTH still continue its way until now.

Probably the produced electricity from PLTH indeed is limited, but THIS PLTH produce human resources. Yes, they are – those who research and study here.

Benefits of PLTH

Certainly, the benefits of increasing local economic for the community. From tourism in particular. The residents here are now always longing for holiday dates. In Poncosari village it can be said that the most good economic level it is here (Dusun Ngentak). We can see it from the houses of the people, the school of his children, the teachers, the lectures, the Doctor. It was a very drastic change than the time when I was a kid.

Before PLTH, I was still in school, and now there is a PLTH, to me it's a source of work and innovation. I have been almost 10 years working here, only as per contract (not a permanent worker). What I make per month, you can say it's very low. But the satisfaction that I can get so far, is what I was looking for. Can explain to friends here (Research student/field work) How to make a propeller like what. I am glad that way. Fulfillment of self-actualisation. The result (money) is not much but we are happy. And most of us (staff PLTH) here survive because we have side income from the stall, while I run a public toilet (at the beach). Yes, quite decent results.

Operational daily challenges between PLTH and users

The root problem of PLTH now is the battery for energy storage that is generated. Our batteries are so old already, resulting power cannot be kept for long. So if we have to arrange manual log book to know precisely about the generated energy, otherwise, maybe later in the night will no longer have power for the morning. So we have to keep the manual track of our generated power, in order to have power continuously. I see this on a bright note for PLTH staffs as we are basically “laid back” type of people. We would be lazy if everything is automatically calculated. This way, we force ourselves to always be diligently in control, taking notes. So, we can use the information to take the right decisions in the results and use of electricity from PLTH.

The rules of PLTH for customers

Only limited to the application of the current barrier so that usage is not excessive. We keep consumers, without them we do not exist. Our electricity is free, our service is also free. So if they ask for any service (related to electricity PLTH), even to change the lights bulbs, sometimes they ask us as well. Culinary perpetrators of those stalls are all women, well, they don't fond of doing such works, so they ask us who help. Almost every day there must be such a case. Especially if the day of the weekend, it can be several requests for service at one time.

PLTH staff

There are currently 6. There used to be 2 that came out, replaced by XX and YY.

Motivation/reasons to stay working at PLTH

A sense of ownership, there are also messages from parents so that I stay and work close to them. But also yeah I like the job here (PLTH). From the start of the first three years I focused on mechanics. [...] I was given an opportunity like this, yes I must keep and accountable to be able to raise this (PLTH).

PLTH and the central government plan

[...] in the end this (procedural arrangement) is important for administrative matters such as budgeting to cover the cost of maintenance. But for PLTH future to be like what, I don't think we are on some kind of track to reach any particular goal. I think the government's focus is limited to maintenance. But in the future, what will we be, still difficult to imagine.

If no more PLTH in this village

I think it would be a negative thing: news in the media will surely be writing a lot about why PLTH: renewable energy project has been stopped. The negative effect surely will expose our tourism. And certainly, there will be many stalls owner or any other tourism actors who have previously relied on PLTH will have to procure electricity (extra fee) for PLN.

How do you feel after the national grid (PLN) entered this coastal area in Ngentak?

I think there is no problem with the PLN to be here too. PLN also considered the market [that has grown in Pantai baru]. Having this crowd (economy activities) at the coast is market to them. Even though with the presence of PLTH, the caretaker of our tourism group also had to ask PLN to enter because they worried if the PLTH operation would not be long/reliable. They asked PLN before PLTH, it seemed impossible for PLN to just exist here, asking us to pay hefty price only for installation. But soon after PLTH, and tourism activity (economic development began to run) in the coastal area, eventually PLN was entered itself without being asked. I think because this is market for PLN. I (PLTH) have no problem when there are stalls that FINALLY use PLN. Usually those are who need big electricity, for example to preserve fish. Moreover, when PLN enter Pantai Baru, they had maritime program/fishery: Free meter for fishermen (provision of cool boxes). I myself at home also still use PLN. We are here too pampered by PLN (subsidised price). That's why renewable energy (operational) price will always be too expensive, if compared to PLN. Indeed, if renewable energy is installed in such a place in Marampit near the Philippines (where PLN can't reach), then RE would be the only power source that they should rely on to.

About the challenge on energy storage (battery) and maintenance

Yes, right. But if it is as if we are on-grid (to PLN) we have no need to use storage anymore. Whatever electricity we generate will directly enter the PLN network.

Suppose a short story of PLTH being on-grid, what do you think?

we seem to still focus for off grid because it's still a focus to be the research center. Moreover, personally I think it is more challenging off-grid. We can never be relaxed here, full of anticipation. How to cast lightning, energy that has not been coupled with battery, and others. Full of challenges. If we're on-grid, we must be quiet-just relax.

if we talk about finding profit may be more profitable when on-grid. But we under the condition to never focus on making profit. Us here (PLTH staff) bring stairs everywhere to repair of electricity, cables, etc. Never we do that while thinking about profit. For us, what is important is to develop our area and community even more.

And if you talk service yes it could be better if by PLN. But it's if PLN is more to non-social business, so its electricity will be paid. (unlike PLTH is currently free).

Complaints from citizens

There, related to the land-use which were used by residents to plant crops around the existence of windmills. Currently the land is still being used.

PLTH and communication with the community

Fortunately, us at PLTH is well-respected in the community, and actively engaged in community groups. So, to negotiate with the people if there is a problem usually is not very difficult.

What is the factor that makes this PLTH still lasts until now for almost 10 years?

With the college students being here (come and go), we become more passionate to always learn something new. When we encounter a damage, we learn how to make it work together. So, it's

always exciting. The average damage that there is not from society but from the nature of the equipment itself.

How is the community character towards the existence of PLTH?

I think it is still good and usually all the problems that arise can be communicated. Although it may initially be difficult but later solved when we all meet together. Some of us are seniors and trusted/respected, some of us also young and active. So the dynamic is good.

PLTH's staff all have a role in the community, entering the community organization. There are youth chairmen, chiefs of cattle groups, etc. We were set up being in this PLTH to also hold groups in the community. I was not aware of the reason of this but now I realise it had good results/impact in facilitating social communication here.

Environmental or climate change

I think it is getting better here. It used to be here so dry. Now it's too lush to block the wind but at the same time blocking wind for the wind turbines. And we cannot cut down the trees because these trees are protected by the governments.

If for the change of rainfall and wind, I'm not very conscious anyway. Maybe only the direction of the wind is changing affects the routine if you want to sail for fishing.

Nowadays it should be raining big but yes until now it is still dry here. May be a little late a bit (rainy season). I think the rainfall decreases. Because the water of the well now salty.

Learning points from PLTH for other areas with similar projects

Better bureaucracy for financial matters. To plan about the feasibility/availability of spare parts, the technology used should be locally made and can be obtained in the area itself. Don't install a grand inverter from abroad only to have it futile when broken because our inability to repair. I think it's the problem in RE projects in our country. That is why we here decided to force ourselves to be able to make our own inverter.

So when we give out trainings (in other area), we teach them to build foundations, propellers, generators themselves. So that if the tool is damaged we can fix it ourselves with a cheap cost. Us, despite being close to the city (Yogyakarta) still have difficulty to find spare parts. What about RE project in even more remote areas? Maybe in Indonesia there are hundreds of RE projects that have been installed and then only 3 months got damaged and stop operating. It is important that RE technology is familiarised with the community. Who has science about it should be generous enough to share the knowledge (to the community).