Resource Efficient and Cleaner Production Assessment (RECP) in Pancoh Ecotourism Village, Regency of Sleman, Yogyakarta

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ABSTRACT

This study aims to assess the Resource Efficiency and Cleaner Production (RECP) in tourism sector especially in Pancoh Ecotourism Village (PEV), Sleman. It assessed by using the RECP United Nations Industrial Development Organization (UNIDO) indicators for small and medium enterprise. It also used RECP assessment cycle method. The results show that there were two main activities that mostly use resources and energy in Pancoh Ecotourism Village (PEV), they are homestays and *Pendopo*. The use of energy in a homestay was bigger than in *Pendopo*. Also, inefficient use of energy and resources were found in homestays. The RECP recommendations for PEV were to use efficient stove, to use light-emitting diode (LED) lights and to attach magnets in the gas hose. If the PEV applied the recommendations, it has potential to reduce carbon by 22,535.68 CO2eq kg/year and it has potential to save IDR. 39,463,267/year. The indicators in RECP assessment for tourism village requires modifications since the pattern of resources and energy use in tourism villages is different from the small and medium enterprises that have implemented RECP method before.

Keywords: *RECP; Small Enterprise; Ecotourism; Pancoh*

1. Introduction

Tourism is one of the leading sectors in the world due to its key roles of export revenues, job creator, enterprises and infrastructure development. It has become one of the largest and fastest growing economic sectors in the world with uninterrupted growth of international tourist arrival for the past 50 years. Tourism has experienced continued expansion and diversification, becoming one of the largest and fastest-growing economic sector in the world (UNEP, 2010; United Nations Industrial Development Organization, 2011; United Nations Industrial Development Organization & United Nations Environment Programme, 2010; UNWTO, 2011).

Indonesia tourism products consist of 60% of Culture, 35% Nature, and 5% Manmade (Ministry of Tourism, 2016). One of the growing tourism sectors in Indonesia is Tourism Village

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(*Desa Wisata*) (Firdaus, Hardjosoekarto, & Lawang, 2021). It is built based on the concept of community-based tourism. It means tourism from, managed by and for the local people. Desa Wisata uses its potential resources to attract tourists, usually it offers local culture, daily lives, arts, foods and nature (Agung & Andriyani, 2017; Dewi, Fandeli, & Baiquni, 2013; Fandeli & Mukhlison, 2000; Hamzah & Khalifah, 2009; Hastuti, Purwantara, & Khotimah, 2008; Sesotyaningtyas & Manaf, 2015; Syafi & Suwandono, 2015).

The United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP) work closely together to promote sustainable industrial development, consumption and production in developing and countries with economies in transition. Then United Nations World Tourism Organization (UNWTO) also initiate the sustainable tourism in every tourism destination in the world to achieve sustainable development goals (SDGs). It relates to the concept of green economy which based on knowledge and technology to integrate the connection between nature as a resource and human to minimize the climate change

Sleman district in Yogyakarta has 42 tourism villages in 2020 which classifies in three categories, they are raising, developing and independent. In the year of 2016, Sleman was chosen as one of model for Indonesia sustainable tourism destinations program by Ministry of Tourism. The program has joined collaboration between Ministry of Tourism and UNIDO to gain sustainable tourism indicators. Then, the Sleman Tourism Office in 2018 has chosen nine models to be the RECP UNIDO demo units. Those nine enterprises were six hotels, one restaurant and two tourism villages. One of those demo units is Pancoh Ecotourism Village.

Pancoh Ecotourism Village (PEV) is located in Sleman Regency, northern side of Yogyakarta. It is actually a hamlet (*Padukuhan*) with the population of 545 people in western and eastern side (*Pancoh Kulon* and *Pancoh Wetan*). It was established in 2012, it offers natural, cultural and educational packages like river trekking, *Laras Madyo* performance, *Gamelan* learning, rice planting, snake fruit (*Salak*) planting and harvesting process, outbound and fun games, local culinary learning and bio gas education and many others. PEV is one of independent tourism villages that was classified by the Sleman Regency Tourism Office in 2018. This criterion was given because of the continuing improvement by the management of PEV which resulted more than 700 million with more than 10,000 tourist visits in 2018. The PEV achievement is a part of the top 10 tourism village achievement in Sleman Regency.

Table 1. Number of visitors and income of PEV

Year	Number of Visitor	Income (IDR)
2012	55	2,585,000
2013	105	4,935,000
2014	402	18,894,000
2015	968	45,496,000
2016	2,633	94,752,000
2017	6,819	347,566,000
2018	10,490	700,230,000

Source: PEV Management, 2019

In general, the attractiveness of PEV is the life cycle of the community itself with all their daily activities. Those daily activities automatically increased when the tourists came, they certainly use a lot of resources and energy which produce effluent, solid waste and emissions (Ahmad, Draz, Su, Ozturk, & Rauf, 2018; Sunlu, 2003). Besides that, Pancoh Ecotourism Village became a tourism village model for sustainable tourism destination program by Indonesia Ministry of Tourism along with other 19 destinations in Indonesia. Because of those reasons, PEV became one of the demo units of Resource Efficient and Cleaner Production (RECP) in Sleman Regency which held by United Nations Industrial Development Organization (UNIDO).

This study was carried out over a period of six months. The objective of this study is to assess the RECP in PEV and give RECP recommendations for PEV.

2. Literature Review

RECP or mostly known as cleaner production (CP) is intended at avoiding the generation of wastes and emissions by using resources and energy in more efficient way. It can be achieved through the modification in the process, input materials, operating procedures and practices, products and services (Berkel, 2014; Hens et al., 2018; UNIDO & UNEP, 2010). RECP is mostly used by large industries which has a long production process, using huge materials and generates more waste. In 2010, there are some experts that tried to make RECP applicable for small and medium enterprise (Agyeiwaah, 2019; Berkel, 2014; UNEP, 2010). The interesting thing in RECP assessment process in PEV is the scale of baseline data which gathered in the household level which has different pattern with other industrial levels.

Besides cleaner production, resource efficiency is also matters when connected or integrated with tourism industries. A paper by Wang Qin, Yang Li and Yue Zhonggang (Wang, Yang, & Yue, 2022) indicates that SBI Index Model has positive effect on improving the efficiency of tourism resource allocation. In the end of their paper, it verifies that digital finance improves the efficiency of tourism resource allocation by promoting the demand for tourism consumption and optimizing the supply of tourism factors.

Lee (2001) in the journal of cleaner production says that cleaner production has important role in tourism to reach the sustainable tourism. Cleaner Production plays in terms of developing sustainable tourism destinations. Cleaner production has an important role, to ensure that "prevention" is built into the concept of sustainable tourism destinations. It contributes by providing both a general strategy and specific experiences which may enhance other existing tools, concepts and policies.

Yet, the RECP implementation and assessment for tourism industry especially for tourism village is lack of study. There is one study talk about RECP in tourism village by Dzulkifli & Masjhoer (2020) which using the RECP Method from UNIDO but different cycle and object. This study tried to enrich the knowledge about RECP in small tourism enterprise especially in tourism village.

Later on, RECP study which only focus for the investment was written by Özbuğday, Fındık, Metin Özcan, & Başçı (2020), it discusses about the implementation of resource efficiency investment from Europe especially in energy-intensive sectors. The samples were from France, Italy, Germany, Sweden, Switzerland, Australia, Japan, Portugal, USA, Holland, Austria, Bulgaria, Spain and United Kingdom. The findings have significant policy implications for actions and measures to be taken by domestic and international policymakers regarding cleaner production investment by companies.

3. Method

RECP is a cycle process, it needs management commitment and continuity. RECP assessment methodology has a systemic planned procedure to identify, evaluate, install and sustain the cycle. In a simple way it is like plan, do and check (PDCA) cycle or action research cycle that need continuous improvements.

The RECP assessment methodology carried out the main four phases and key task, they are (UNIDO, 2016):

1. *Getting started*, it engages management and staff and assesses baseline performance. It assures the commitment and the team to run RECP and also confirms the baseline data.
2. *Assessing operation and practices*, it consists of mapping the activities and flows, inspecting the operations, benchmarking with the good practices and performance in other enterprise and establishing the priorities and actions

3. *Developing Solutions*, it deals with developing and evaluating RECP options/recommendations and its feasibility for operational, environmental and economic.
4. *Achieving continuous improvement*, this last step in circle is about to implement, to monitor, and manage for continuous improvement. It aims to enhance resource productivity and reduce pollution intensity.

Due to the achieving continuous improvement phase needs a long time to implement and monitor, and to consider this study is only for the assessment, not the implementation, this study is limited in only three main steps of the phases above and is done in one sequence. The cycle of this study is shown in the figure below:

Figure 1. The RECP Assessment Cycle

Source: RECP UNIDO, 2018

RECP assessment needs a baseline data that consist of resource use, energy use, number of visitors, number of rooms that is collected from the management and the community that contribute to the use of materials and products. The primary data were obtained from the PEV management by observation, documentation and interview. The secondary data were collected by literature review from journal, book chapters and RECP guidelines.

Table 2. Form of baseline performance example

Material Use			**Energy Use**			**Water use**		
Type	**Volume**	**Cost**	**Type**	**Quantity (kWh)**	**Cost**	**Type**	**Volume (m3)**	**Cost**
Food	-	-	Electricity	-	-	Ground Water	-	-
Cleaning agents	-	-	Gas	-	-	City Water	-	-
Paper	-	-	-	-	-	-	-	-
Waste Generation			**Air Emission**			**Waste Water**		
Type	**Volume**	**Cost**	**Type**	**Quantity (kg)**	**Cost**	**Type**	**Volume (m3)**	**Cost**
Kitchen waste	-	-	GHGs	-	-	Storm water	-	-
Office waste	-	-	Odor	-	-	Kitchen waste	-	-
Garden waste	-	-	-	-	-	Sanitary effluents	-	-

Source: RECP UNIDO, 2018

The collected data were analyzed by calculating the total of energy and resources use based on the cycle and the table above. After that, the data were used to estimate the energy saving potentials, energy cost saving, emission reduction, cost investment, net present value and the payback period.

On the Planetarium can be accessed using the website. This VR is quite easy to use because of its simple display and navigation. The Planetarium features extraterrestrial content such as stars,

planets and more. The features in this VR can be navigated to explore the content separately according to the name of the object want to explore with a 360-degree system.

4. Results and Discussion

4.1. Baseline Situation

PEV is an agricultural area that has a spring that made a river called *Adhem* River and a reservoir. Local people use the river as their water source for washing and showering. For drinking, most people use water from well (about 10-15 meters). They flow the water to houses using gravitation method. This village is located in the slope of Merapi, about 10 kilometers from Merapi. Its altitude is about 600-700 above sea level. Most of the people are farmers, they plant *Salak* (snake fruit). PEV has 41 homestays with 65 rooms, 1 public kitchen, two public meetings (*Pendopo* and *Aula*) and 6 public toilets. The homestays are actually the local people's house that have one to two rooms to rent. The tourists who stayed overnight in PEV usually had food in their homestays with host families, for those who did not, they cooked the food in public kitchen near *Pendopo* or simply in one of the local person's kitchens. There were only two main activities that mostly use source and energy, they were homestay and *Pendopo*.

Table 3. Pancoh resource input and waste in 2015

Resource Inputs		Waste and Emissions	
Total material use	1.421,14 kg/yr	Total waste	71,05 kg/yr
Total energy use	1.240.438,87 kWh/yr	Total emissions	871149 kg CO2 eq/yr
Total water use	1217,06 m3/yr	Total effluent	730.24 m3/yr

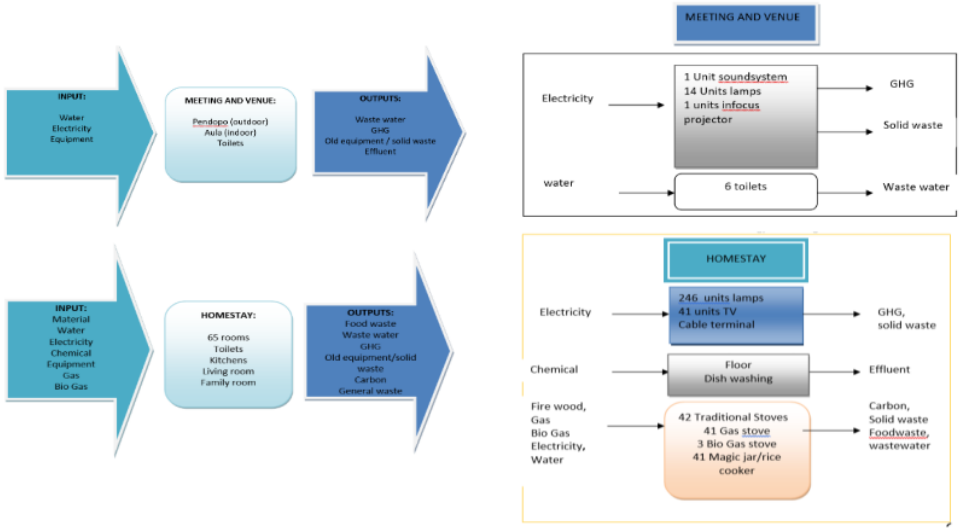
Source: Data Analysis, 2015

note:
waste water is 60% from total water use
material waste formula = total materials x 5%

4.2. Map Activities and Flows

Mapping the activities and knowing the flow of the energy used are important things before deciding the recommendations. This part figured out the complete picture of the main activity in PEV. The map and the flow are shown below:

Figure 2. Map Activities and Flow in PEV Main Activity



Source: Data Analysis, 2015

4.3. Inspect Operations

Inspect operations are aimed to clarify what is said by the management and to see if any leaks or lossess that can be found during the observation. Here are the result of inspect operation in PEV:

Table 4. Inspect operation in PEV main activity

Observations 1: General workplace appearance, housekeeping and standard operating practices	There are a lot of trees which can make the air so fresh. It has a clean water source from spring and river. However, if we look inside the homestay, there are some challenges to make the village better than now especially for the hygiene in food production process, the toilets and the efficiency of water and resource use.
Observations 2: Leaks, spills or other losses observed	There are so many leaks in water source, they let the water overflow in water tank. They always open their faucets. They use a lot of wood for cooking, let the smoke and the ashes spread unorganized.
Observations 3: Level of technology, its maintenance and control status	They still keep the traditional way of cooking by using firewood and traditional stove. For the electricity, they use the government service (PLN). There is no control from the government. The waste a lot of water, use inefficient water source.
Observations 4: Materials and waste – main users and sources, current controls and handling and disposal practices	The kitchen is so dark, full of smoke, ashes, the wall is black because of the smoke. Some cooks do not wear glove in hand and apron. The good things are they manage the waste in a good way. For the food waste, they use it for feeding the fish, chicken, duck, birds or turned to be a fertilizer. For the solid and plastic waste, they sort them and give them to Waste Bank.
Observations 5: Water and waste water – main users and sources, current control and discharge practices	For the waste water, they flow it to the garden, most of people in village have garden. Most of them are snake fruit farmer. For the human waste like feces, urine, some villagers flow them to septic tanks, some others flow them to a different fishpond with catfish inside and flow again to garden and river. So far, there is no control from any organization or government.
Observations 6: Energy – main users, losses, waste energy discharges	The main users of the source are the guest and the local people. The guests use the water for showering and drinking. Pancoh is rich of water source, the guests feel they are free to use and waste it like they want. The local people also let the water flow all the time and let it over flow.
Observations 7: Chemicals and emissions – main users, losses, hazards	The chemicals are the dish soap, detergent for laundry, toiletries (shampoo sachet). The main users of toiletries are the guests, the dish soap and detergent are the local people. They wash their clothes and the dish with the water that always flow, they let the water faucet open, sometimes they hold/keep the water in a bucket and wash them inside the bucket.
Observations 8: Occupational health and safety issues identified	Local people who are part of tourism village manage their house, their homestay well organized with clean toilet, rooms because clean rooms and toilet are the least requirement for homestay.
Observations 9: (Food) hygiene and consumer safety issues identified	They cook the food with their own ways, using no glove, no apron. They cook the food with firewood which has a lot of smoke, dangerous smoke. For health, of course it is not healthy at all, but the taste is good, at least for me.

Source: Data Analysis, 2015

4.4. Benchmark Practice

Based on the inspect operations, there are some benchmarks of RECP practices that can be applied in PEV. The best practices were to build a communal kitchen, communal water waste, to use efficient modified-traditional stove rather than the traditional stove. The cooks can start using hand gloves and apron to make a cleaner cooking process and start doing the standard procedure for hygiene food. The overall benchmark practices showed that there were some practices which potentially can be applied in PEV to improve the quality of management.

Table 5. Benchmark practice for PEV

Main activity 1: Homestay		
Leading practice (benchmark)	**PEV practice**	**Improvement potential (high, medium or low)**
1.1. rain harvesting	Using river and well	Low
1.2. Save the water waste in a big communal waste	Let the waste flow to a garden and river	Medium
1.3. buy product with the reuse packaging design	Buy product with a lot of plastics waste	Low
1.4. dry and wet garbage storage	One garbage for all waste	Low
1.5. measure the initial consumption of electricity, water, gas and materials	Never measure the use of water, and materials daily or in every event	Medium
1.6. information and awareness raising among employee and guests to safe energy	No information for guest and local people to save the energy in homestay.	Low
1.7 communal waste for water waste	Septic tank and manual waste using pool and catfishes	Medium
1.8. using standard of safety and hygiene in kitchen	No standard safety and hygiene in kitchen	Medium
1.9. using gas and magic jar to cook the rice and food	Using traditional stove with firewood	Medium
1.10. Using efficient modified-traditional stove	Using traditional and old stove for cooking	Medium
1.11. installing air cooler from plastic waste in kitchens	Only small wind-way ventilation in kitchen	Medium
Main activity 2: Meeting Room (Pendopo and Aula)		
Leading Practice	**PEV practice**	**Improvement potential (high, medium or low)**
2.1. turn off the electric devices when it is not in use	30 minutes before the guests (group) come, the big amplifier is on (SOP).	Low
2.2. information and awareness raising among employee and guests to save energy	No information for guest and local people to save the energy.	Low
2.3. Using LED lamp for lighting the toilet in Pendopo	Using many ordinary old lamps to light the toilets, rooms and Pendopo	Medium
2.4. Paint the toilet wall with white color	No paintings	Medium

Source: Data Analysis, 2015

Figure 3. Public Kitchen Situation and Toilet in a Homestay

Source: Documentation, 2015

4.5. Establish Priorities and Actions

Based on the benchmark, there were some good potentials to improve the service quality in PEV. If the benchmark practices are applied it could be a huge potential savings and great reduction of resource use. To show the overall assessment, a traffic light table system below would be easier to understand which activity area should be prioritized.

Table 6. Assessment results in traffic light system

Main Activities	Resource Use	Environmental Burden	Costs	Hazards (incl. occupational health & safety)
Activity 1: Homestay				
Activity 2: Pendopo and Aula				

Source: Data Analysis, 2015

Note:
Green means on target
Yellow means below target
Red meand far below target

Overall assessment with the traffic light shows that homestay is the high priority with the red color. In meeting and venue area, it has no red, it should not be a priority to fix. So, the next step for detail assessment is in the homestay area because there are a lot of energy lossess and leaks, the use of water, energy and firewoods needs to improve in order to make a good service quality in PEV.

4.6. Develop RECP Options

This part is giving some RECP options/recommendations, but before that, we have to review/refine balances with root source and cause analysis and generate further options for the company. It is expected to be list of possible RECP options first prioritization of options for implementation with categorization or estimation such as low cost or no cost. Based on the baseline assessment, there are two main activities in PEV namely Homestay (room) and *Pendopo* (hall). Then, the priority is only in one area namely homestay.

Table 7. Options generation for homestay

Root Cause Category		Options
Process Input		Record the use of energy, electricity and resource use and the total guests who stay in homestay (individual)
		The cooking process should be done in better process like wearing apron and gloves. Clean the equipment directly after finish. Cover the floor with ceramics.
People		Change the bed cover when the new guests come.
		Giving information to save energy and resource for guests (spoken and written)
		Raising awareness of sanitation and hygiene for all staff and local people.
	Process Control	Record the use of materials, electricity, the equipment and the total guests who had meals in the village.
		Minimize the use of plastic for food and mineral water.
	Equipment	Use LED lamps for more efficient in electricity use.
		Replace the traditional stove with more efficient stove.
		Add magnet to the LPG pipe for more efficient use of LPG.
Facility	Technology	Use rice cooker or magic jar to cook rice
Product		Clean the room before the guest come, paint the wall in white color
		Design the stove to be more efficient and doesn't produce lot of smokes.
		More creative Packaging design is needed to attract tourist
Waste	Internal Value	Separate the waste, at least two bins for the waste
	External Value	n/a

Source: Data Analysis, 2015

4.7. Evaluate Feasibility

This part describes the recommendations option with estimated cost investment and saving. It also elaborates the environmental benefit of the option recommendations for RECP practices in PEV. Based on the RECP options, there are three recommendations that are considered for

RECP implementation in PEV that can affect the use of resource and energy. They are, to use efficient stove, LED lamps and attaching magnet in the hose of LPG.

4.7.1. Using Efficient Stove

This efficient stove called *Keren* will be implemented in 41 kitchens in PEV. Every kitchen at least has two stoves. The recommendation of efficient stove model is shown in figure below. *Keren* stove saves 26,8% of firewood, it maximizes the heat and minimize the residue, it is a customize model of the traditional stove.

Table 8. Environment benefit of Keren

Description	Unit	Existing condition	After Implementation (26,8%)
Efficient Stove		Old stove	Installed
Firewood use perday	kg	1.05	0.28
Emission perday	Kg CO2eq	4.08	1.09
		Firewood saving Potential (kg/yr)	282.13
		Emission Reduction (kg/yr)	1,090.68
		Cost Saving (IDR/yr)	1,410,650

Source: Data Analysis, 2015

Table 9. Economic benefit of Keren stove

Cost Component	Amount	Price per unit (IDR)	Total Cost (IDR)
Rocket Stove/Keren Stove	41 stoves	145,000	5,945,000
		Total Estimated cost of Investment	5,945,000
		Net Present Value (IDR/year)	5,662,867
		Payback Period	1.04

Source: Data Analysis, 2015

4.7.2. Using LED Lamps

To produce the same performance, LED lamps consume less electricity power than incandescent lamps. A 15-watt of ordinary lamp can replace with a 5-watt LED lamp. There are 41 homestays in PEV which has at least 14 lamps in each house. The total cost saving is about IDR 43,394,400.

Table 10. Environment benefit of LED lamps

Description	Unit	Existing Condition	Implementation Suggestion
Replacement of corridor lamps		**Incandescent 15 W**	**LED 5 Watt**
Power consumptions	Watt	15	5
The amount of lamp	unit	574	574
Operation hour/year (@14 hour/day)	hour	5,110	5,110
Energy consumption/year	kWh	3,616.2	1,205.4
Emission (CO2) production/year	kg	2,542	847
Energy cost/year @(Rp 1.500/kWh)	IDR	65,091,600	21,697,200
		Energy saving potential kWh /year	2,410.8
		Emission (CO2) reduction kg/year	1,695
		Energy Cost saving IDR/year	43,394,400

Source: Data Analysis, 2015

Table 11. Economic benefit of LED

Cost Component	Amount (unit)	Price per Unit (IDR)	Total Cost (IDR)
Phillips LED 5 Watt Purchasing	574	40.000	22.960.000
		Total Estimated Cost of Investment	22.960.000
		Net Present Value	20.434.400
		Payback Period	1,12

Source: Data Analysis, 2015

4.7.3. Attaching Magnet for Gas Efficiency

By attaching the magnet in the hose of the LPG, it can save the use of the gas 20% to 50% (Harianto & Santoso, 2016). For PEV case, it is assumed that it saved 30% of gas. The combustion will be better because of the improved ion structure which caused by the magnet. Then, the heat will also in maximum performance because of the improved ion. It needs two couples of magnets for each gas. Total investment for this magnet is about IDR 410,000.

Table 12. Environment benefit of magnet for gas

Description	Unit	Existing Condition	Implementation Suggestion (30%)
Magnet for Gas Stove in Homestays		**-**	**Two Couples of Magnet**
Gas LPG per year (41 homestays)	kg	2,952	885.6
Energy consumption/year	kWh	40,147.2	12,044.16
Emission (CO2) production/year	kg	28,214	8,464
Energy cost/year	IDR	19,680,000	5,904,000
		Energy saving potential kWh /year	28,103,04
		Emission (CO2) reduction kg/year	19,750
		Energy Cost saving IDR/year	13,776,000

Source: Data Analysis, 2015

Table 13. Economic benefit of magnet for gas

Cost Component	Amount (couple)	Price per couple (IDR)	Total Cost (IDR)
Oval Magnet	2x41=82	5,000	410,000
		Total Estimated Cost of Investment	410,000
		Net Present Value	13,366,000
		Payback Period	0.03

Source: Data Analysis, 2015

5. Discussion

PEV can save more energy which leads to save more money. From the use of clean stoves, LED lights and the use of magnets, PEV can reduce carbon up to 22,535.68 CO2eq kg/year. Whereas in terms of economic savings, from the three options by investing IDR. 29,315,000, PEV can save total of IDR. 39,463,267/year.

Table 14. Summary of All Options

Option description	Economics			Environment	
	Investment (IDR)	Revenue (IDR)	Pay back Period (yr)	Resources Conservation (kWh/yr)	Waste Reduction (CO2 eq kg/yr)
Keren stove	5,945,000	5,662,867	1.04	282,13 (kg/yr)	1,090.68
LED lamps	22,960,000	20,434,400	1.12	2,410.8	1,695
LPG magnet	410,000	13,366,000	0.03	28,103.04	19,750
Total	29,315,000	39,463,267	2.19	-	22,535.68

Source: Data Analysis, 2015

The firewood for daily needs is usually taken from their surroundings, they pick at the ground or cut some trees that are already old. Almost all PEV residents have their own firewood storage in their houses. They are forced to buy firewood when a large number of guests staying overnight. Even though the majority of the wood resources are free, the expert team must still calculate the feasibility and consider some aspects like the environmental and the economic aspects.

Furthermore, almost all household waste in PEV is actually zero waste, plastic waste is sent into the Waste Bank monthly, food waste is given to fish, duck, bird or used as fertilizer. The waste water/effluent is returned to the *Salak* plantations, absorbed by the soil and flows into the

river. In some houses, a household waste segregation program has been established by dividing the waste into at least two parts, organic and non-organic.

6. Conclusions

The RECP program by UNIDO can describe the cycle of resource and energy use in Pancoh Ecotourism Village. It also figured out the varieties of wastes in Pancoh, like solid waste, effluent and emissions. Then, inefficient use of resources and energy can be mapped and found in detail. There were two main activities that mostly use resources and energy in Pancoh Ecotourism Village (PEV), they are homestays and Pendopo. The use of energy in a homestay was bigger than in Pendopo. Also, inefficient use of energy and resources were found in homestays.

The RECP recommendations for PEV were to use efficient stove, to use light-emitting diode (LED) lights and to attach magnets in the gas hose. If the PEV applied the recommendations, it has potential to reduce carbon by 22,535.68 CO2eq kg/year and it has potential to save IDR. 39,463,267/year.

Baseline data on the resource and energy consumption in the tourism village is the initial key for RECP assessment. Unfortunately, the amount of water uses and wood fuel resources in PEV was not measured properly so that the inefficiencies found were not a big problem for the management.

Further studies are needed to see the success of the RECP recommendations that have been implemented. It is necessary to measure the benefits received by the community from the economic side and the direct impact on natural resources and energy consumed. In addition, RECP assessments in tourism villages require some modifications in the indicators that assessed. This is because the character of the use of resources and energy in tourism villages are different from the industry that applies the RECP method from UNIDO.

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9. Conflicts of Interest

Author declare that there is no conflict of interest in writing this research

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