

## FINAL REPORT

# RESOURCE EFFICIENT AND CLEANER PRODUCTION (RECP) IN TOURISM INDUSTRY PROGRAMME INDONESIA

## Pulesari Tourism Village Sleman



### National Expert Team

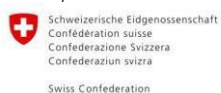
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Shavitri Nurmala Dewi

2016

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## KESIMPULAN

### Temuan-temuan Pokok

Berdasarkan hasil studi lapangan dan pengambilan data, dapat disimpulkan bahwa Desa wisata Pulesari memiliki tiga aktifitas utama yang berkaitan dengan program RECP. Pertama adalah aktivitas di dapur, dimana proses pembuatan makanan dan minuman bagi wisatawan. Yang kedua adalah aktifitas di *homestay* (rumah penduduk) tempat wisatawan menginap dan beristirahat selepas kegiatan outbound. Tempat yang terakhir adalah di Pendopo, dimana wisatawan menghabiskan waktu bermain outbound, mengadakan rapat/pertemuan atau hanya sekedar berkumpul.

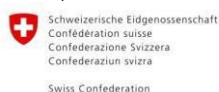
Desa Wisata Pulesari memiliki sumber air yang melimpah. Warga dusun tidak pernah mengalami kekeringan meskipun pada musim kemarau. Akan tetapi, penggunaan sumber air di Desa Wisata Pulesari sangat tidak efisien. Hampir seluruh warga membiarkan kran air di penampungan umum dan di rumah-rumah mereka tetap terbuka dan air dibiarkan mengalir begitu saja. Ketika musim hujan tiba maka air di penampungan akan tumpah dan terbuang sia-sia. Satu pertanyaan dilontarkan kepada masyarakat, mengapa mereka tidak menutup keran air di rumah mereka, mereka menjawab jika keran ditutup maka air tidak akan atau sulit untuk mengalir lagi karena mereka masih menggunakan cara tradisional untuk mengalirkan air ke rumah-rumah yaitu dengan mengandalkan gravitasi.

Selain menggunakan air sungai sebagai sumber air, hampir semua warga juga memiliki sumur di rumah masing-masing. Mereka menggunakan pompa air elektrik untuk mengambil air sumur. Kedua sumber air tersebut memiliki perbedaan penggunaan. Sumber air dari sungai biasanya digunakan warga untuk mandi, mencuci, mengisi kolam, menyiram tanaman dan mencuci piring, gelas dan mencuci baju. Sedangkan sumber air dari sumur mereka gunakan untuk minum dan memasak. Semua warga memasak makanan untuk wisatawan maupun untuk keluarganya sendiri menggunakan kayu dan gas sebagai bahan bakar utama. Pulesari merupakan dusun yang sangat hijau yang ditumbuhi dengan berbagai jenis pohon dan tanaman, terutama salak yang menjadi komoditas utama. Masyarakat dengan mudah mendapatkan kayu bakar di perkebunan sekitar mereka namun terkadang mereka juga membeli kayu bakar dan menyimpannya di dapur atau di tempat penyimpanan khusus kayu bakar. Warga Pulesari masih berfikir bahwa makanan yang dimasak menggunakan kayu bakar memiliki cita rasa yang lebih enak dibanding masakan yang dimasak menggunakan gas LPG.

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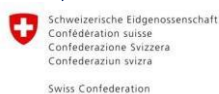
Akan tetapi, asap yang ditimbulkan kayu bakar sangat berbahaya bagi sistem pernafasan dan makanan yang dimasak dapat mengandung amonia dan karsinogen. Dapur yang digunakan warga juga terlihat kurang rapi dan dinding-dinding dapur berwarna hitam karena asap yang dihasilkan oleh kayu bakar. Para juru masak yang tergabung dalam Dasa Wisma juga belum banyak mengetahui tentang higienitas, keselamatan kerja. Mereka memasak masih menggunakan cara tradisional dengan tanpa menggunakan serbet dan sarung tangan.

Di rumah penduduk yang dijadikan *homestay* dan di pendopo juga ditemukan penggunaan air dan listrik yang kurang efisien. Air yang ada di kamar mandi di rumah-rumah warga dibiarkan mengalir dan terbuang ke selokan. Hampir tidak ada warga yang menggunakan lampu hemat energi seperti LED. Namun, para warga biasanya memperbaiki lampu bekas ke tukang servis lampu dengan biaya Rp. 5.000 sampai Rp. 25.000 per lampu dan bisa bertahan hingga dua tahun lamanya. Kemudian, di pendopo bagian selatan mereka tidak membayar listrik karena listrik diambil secara gratis dengan mencuri aliran listrik utama yang berada di jalan kampung.

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## SUMMARY FOR MANAGEMENT

### Main Findings

From the walkthrough and data collection, it can be concluded that this village has three main activities that consume energy and relate to RECP programme. The first one is in kitchen where the food production process for guests existed. The second is in homestay where the guest taking a rest after doing outbound activities. The last activity is in Pendopo (meeting hall) where the guests have meetings or outbound activities.

Pulesari tourism village has a lot of water source. The local people never get drought. However, they use the water inefficiently. They always turn the faucet on, so that when the winter season come the water will always overflow. A question gave to the people, why they don't stop or close the faucet, the answer was if the faucet closed or turned off then the water will never flow again. It is difficult to get the water flow to their house again, it needs a kind of pipe system or air system to flow the water. The local people still use gravitation method to flow the water to their house by using many pipes.

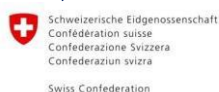
Beside using the water from the river, most of the local people also have wells in their houses. They use jet pumps to flow it into their houses. Those two water sources have different use. The river water is usually for showering, laundry, watering the garden and dish washing. The water from the well is usually for drinking and cooking. For cooking, the local people use wood as the fuel. Pulesari is a green area that has a lot of trees, especially Salak trees. Local people get the wood easily from their surroundings. Sometimes they buy the wood or just collect and save the wood in the kitchen or storage. Local people think that using firewood in cooking may result a good taste in their food.

However, the smoke of the firewood may be dangerous for their lungs and the food also may contain ammonia and carcinogenic. Kitchens are setted with unwell organized and looked dirty. In every wall of the kitchen filled with black color which is caused by the smoke of firewood. The cooks who were divided into six teams called *Dasa Wisma* have no standard operation procedure for cooking. They are lack of knowledge about hygiene, safety and packaging. They cook in traditional way. They do not wear apron, gloves or even safety things in kitchens.

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In homestays and Pendopo, it is found that the use of electricity and water are inefficient. Sometime, they turn the lamps in a daylight, especially in toilet. It is fine since they get the electricity without pay for it. The use of water in Pendopo is also inefficient, they keep the water overflow all the time. The electricity, especially the lamps, do not have LED lamps in each rooms. It consumes a lot of electricity by using incandescent lamp. However, the local people repair the lamps and it survives for one to two years long. Repairing the lamp is only five to twenty five thousand rupiahs.

After seeing the fact in Pulesari tourism village, the team forms some RECP practice recommendations for the tourism village. The recommendation can be an equipment modification, technology change and good housekeeping practice for kitchens and homestays. The priority area is in the Kitchen, the *Dasa Wisma* Kitchen. The first recommendation is to build a communal kitchen with clean equipments, strict standard procedures especially in hygiene. Some trainings may be needed to socialize the local people about hygiene and cleaner production. However, it really **needs high cost** to buy kitchen set and the land for the communal kitchen.

The second recommendation is to have at least 12 “rocket stoves” or traditional efficient stove in six *Dasa Wisma* to reduce the smoke and maximize the fire and the heat. Rocket stove can be made by using brick and other materials, it is simple and low cost. The black wall which is caused by the smoke from the stove can be minimized by using “air cooler” which is constructed by some plastic bottles waste. The kitchen also can use “solar bottle light” to change the lamps. The other option is using “blower” to maximize the fire and minimize the ashes.

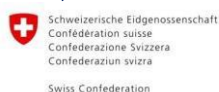
Next, homestays should change their lamps to LED lamps. Using LED lamps save more cost and energy. The other option is using the solar bottle light to change the lamps in some rooms. Repairing the lamps to a lamp repairation shop is another option. This recommendation needs medium cost and it can be an immediate action and it depends on the owner of the houses.

Then, using magic jar or rice cooker to cook the rice is a good RECP practice than using firewood. Another recommendation is to built a communal sanitation to process the water waste from the toilet. This recommendation also needs highly cost.

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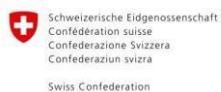
The last recommendation is enriching local people's knowledge about hygiene in their cooking ways for a cleaner production. It can be an immediate action and it is low cost.

**Table 1: Recommendations**

No	Recommendations	Low Cost	Medium Cost	High Cost	Immediate action
1.	Build a communal kitchen and kitchen set	-	-	√	-
2.	Make rocket stoves in some of Dasa Wisma	√	-	-	√
3.	Using blower to reduce the ashes and maximize fire for the stove	-	√	-	-
4.	Air cooler installation from plastic bottle waste	√	-	-	√
5.	Solar bottle lights installation to change lamps	-	√	-	-
6.	Repairing the lamps in a reparation lamp shop			-	
7.	Use LED lamps in homestays	-	√	-	√
8.	Use magic jar in cooking the rice	-	√	-	-
9.	Build communal sanitation or water waste treatment	-	-	√	-
10.	Enriching hygiene knowledge	√	-	-	√

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## CHAPTER I INTRODUCTION

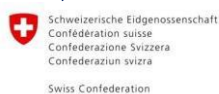
The United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate closely to advance sustainable industrial development and sustainable consumption and production in developing and transition countries. Since 1994, UNIDO and UNEP have worked together to establish and support National Cleaner Production Centres (NCPCs), which are currently operational in over 45 countries. These centres provide services to businesses, governments and other stakeholders in their home countries for the promotion and implementation of Resource Efficient and Cleaner Production (RECP) methods, practices, technologies and policies. In 2009, UNIDO and UNEP agreed on a new Joint Programme on RECP, with the overall aim of expanding and scaling up the activities and impacts of the global network of NCPCs.

A key feature of the success of RECP initiatives is the monitoring of performance improvements in terms both of increased resource productivity, and of decreased pollution intensity. Performance indicators enable companies to monitor their use of energy, water and materials and the generation of waste and emissions. While absolute amounts are important from the point of view of protecting environmental quality, in particular at the local level, they do not necessarily provide an adequate measure of the successes of RECP initiatives. This Primer, therefore, places emphasis on linking resource use and pollution generation to product outputs, thereby creating relative indicators that can be tracked over time. The indicators selected are central to RECP and are relevant to the manufacturing, processing and service sectors. The indicator system provides a framework for initiating and focusing RECP activities, monitoring, setting targets, sustaining performance achievements and reporting progress.

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In 2016, the Ministry of Tourism Indonesia has a join program with UNIDO (United Nation Industrial Development) to build a sustainable tourism industries in Indonesia. It is in line with the GSTC criteria that use resource efficiency and cleaner production as some indicators for sustainable tourism. The CRECPI ITB (Center for Resource Efficient and Cleaner Production Indonesia) helps the Ministry of Tourism runs the program in Sleman and Magelang as pilot projects in Java.

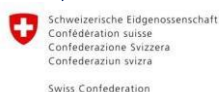
Resource Efficient and Cleaner Production (RECP) is a preventive, enterprise-level approach to improving resource use, reducing environmental pollution and contributing to sustainable industrial development. It is based on the continuous application of an integrated preventive environmental strategy to processes, products and services in order to increase overall efficiency and to reduce risks to humans and the environment. RECP can be applied to the processes used in any industry, to products and to various services provided in society.

In Sleman, there are 9 industries which is joined the RECP program, various industries in tourism like hotels, restaurant and tourism village are included. There are six hotels, one restaurant and two tourism villages. This report is about the two tourism villages, called Pulesari and Pancoh tourism village. The head of Pulesari tourism villages hope that RECP program can bring them to more sustainable tourism village by implementing the resource efficient and cleaner production program such as reduce the use of firewoods or maximize the use of the firewoods with minimum smoke.

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## CHAPTER II BASELINE SITUATION

Pulesari is located far away from Yogyakarta downtown. This village is an agricultural area with 26 springs flow from multiple streams like Krasak and Bedog River. The population of this village based on the national identity card is 235 people. The Village is flanked by two rivers, West Bedog River and East Bedog River. Local people use the rivers as their water source for washing and showering. For drinking, most people use water from well (the deep is about 10-15 meters). This village is located in the slope of Merapi, about 12 kilometers from the peak of Merapi. The altitude is about 600-700 above sea level. Most of the people are farmers, they plant Salak (snake fruit). Pulesari is part of Turi subdistricts, it is wellknown as an Salak Agrotourism in Sleman. It is surrounded by many tourism villages which almost have similar characteristics, it's also near from Kaliurang, the most well known tourism place in Sleman district.

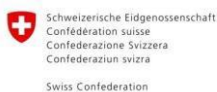
Pulesari tourism village offers cultural and natural attractions like traditional dance, river trekking, live in (stay in the village and do the local people activities), fun games and culinary. Pulesari has 40 homestays, 6 kitchens, 2 public Pendopo and 6 public toilets. In 2015, Pulesari tourism village has 52.271 number of guests, not all guests were staying the whole days and nights in Pulesari. Some guests are just play the outbound and get traditional lunch. Others are having a “live in” program, a program that guest should stay in the village at least for one day to enjoy the local living culture. This tourism village employs 180 persons of local people.

The summary of production process, main inputs and outputs and associated environmental costs, general observations on level of housekeeping and maintenance in Pulesari tourism village are shown in the data below:

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**Tabel 2. Resource input and waste in 2015**

Resource inputs			Waste and emissions		
Materials	Total material use	52849 kg/yr	Waste	Total waste	2,6 ton/yr
	Material productivity	0,99 guest/kg		Waste intensity	0,05 ton/person
Energy	Total energy use	569596,15 kWh/yr	Emissions	Total emissions	400299 kgCO <sub>2</sub> -eq/yr
	Energy productivity	10,8 kWh / guest		Emissions intensity	7,62 kg CO <sub>2</sub> -eq/guest
Water	Total water use	4846,3 m <sup>3</sup> /yr	Waste water	Total effluent	2907,7 m <sup>3</sup> /yr
	Water productivity	0,09 m <sup>3</sup> /guest		Effluent intensity	0.055 m <sup>3</sup> /guest

Note:

Waste water is 60% from total water use

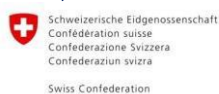
Material waste formula = total materials x 5%

It is a challenging process to measure in the exact amount of water, material and energy use since the local people did not have the complete data for the use of materials and energy especially in electricity and raw food materials for cooking. The local people still use manual data record (handwriting method) in an old book and some pieces of papers. Then, it is assumed that to measure the energy of electricity is based on the electric stuffs in a homestay. It consists at least 14 lights (15 watt), a television (68 watt), a refrigerator (100 watt), a rice cooker (433 watt), some gadgets to charge (3,68 watt), a jet water pump (650 watt), a dispenser or water heater for drinking (250 watt), an iron (300 watt), a washing machine (250 watt) and blender (130 watt) in every homestay.

In measuring the water use, a measuring cup was used to know the water discharge in Pulesari, the rate amount is about 0.2 liter per second. It is assumed that the guest and the local people used the water for showering, laundry, drinking, dish washing and other activities about one hour in a day. So, it was multiplied by the guest who came to Pulesari and the local people. For measuring the material use, it was assumed that the local people

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usually collected for about 100,65 kilos of raw material for serving 100 guest per day. So, it was multiplied by the guest who came in the 2015.

**Table 3. Resource input costs and waste costs in 2015**

Resource inputs Cost		
Materials	Material Annual cost	796.673.422 DR/yr
	Material cost intensity	15.172,93 IDR / guest
Energy	Energy annual use cost	430.251.114 IDR/yr
	Energy cost intensity	8.194 IDR/guest
Water	Water annual cost	0
	Water cost intensity	0

Note: people in Pulesari do not pay for the water source, emission and the waste water treatment.

Local people in Pulesari have a good waste management. They give the food production waste to their fishes. They also collect the plastic waste and the solid waste to waste bank called “Bank Sampah Handayani”, they get money for their rubbish monthly. For the water waste from laundry and dish washing, the waste water directly flow to their gardens. The last, the waste from the toilet, some local people use septic tank and some others directly flow it into a different fishpond with catfishes inside, the waste is the feed for the catfishes.

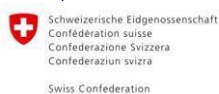
There are three main activities in Pulesari tourism village namely kitchen, homestay and meeting venue (Pendopo) which reflect the use of energy and resources. Those three activities result the waste that explained above. Based on the walkthrough and the data collection, the following descriptions are the specific identification of three main activities:

1) **Kitchens**

There are six groups of cooks in Pulesari, it means they have six kitchens. In every

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kitchen has at least four stoves. The kitchens are private kitchens which use to be a public kitchen when the guest came. Those six kitchens are in traditional style, the main tool are the traditional stoves which use firewoods with full of smoke when it burns. There is a gas stove in every kitchen but it is only for additional. Using the firewoods to cook their food is part of culture for them. It takes a lot of firewood to cook rice for guests, for 350 guests it takes two hours for cooking the rice and consume 100 kg of firewood.

There are two water sources which is used in this activity, the water from river and well. They use the water from the river for dish washing while the water from the well they use for drinking and making soup. Beside water and firewoods, they use gas stove for frying.

People in Pulesari have a lack of knowledge about hygiene. The cooks never use gloves and apron in the cooking process. The kitchen area is not well-organized, they put the preparation waste everywhere, they just cleaned it when the cooking process is finish. They use firewood to cook because they think that if they use wood as a fire to cook it will make the food taste good, delicious.

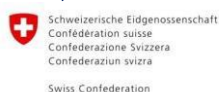
For lighting, they use national electric company (PLN) only one lamp in every kitchen. they use the lamp starts from 5 pm to 7 am, at least 14 hours they use the lamps. The activity of cooking usually starts in the early morning at 4:00 am and finish at 2:00 pm after lunch. The most consuming energy activity in cooking is cooking the rice, it takes a lot of firewoods and a lot of time. For 100 guests they need at least 10 kg of rice, 10 kg of herbs and spices for seasoning, 10 kilos of chicken, 10 kg of vegetables etc. The key point is to serve 10 people they need at least one kilo of ingredient. For the firewoods, they need to prepare at least 5 bundles of wood which has 20 kg in each bundle in serving 350 guests. .

The kitchens should have some improvements, the first is the cooks they have to be aware about hygiene such as wearing apron and gloves. If it is possible, they have to make a clean and hygiene communal kitchen with more air ventilations or install the “air cooler” by using bottle plastic waste. Next, changing the way to cook the rice with big size of magic jar or rice cooker using electricity, it’s easier and it is not time consuming. Another option is to change the traditional stove with a rocket stove, still using a firewoods but it maximizes the

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use of the fire, or using a blower to minimize the smoke and the ashes. Changing the lamps with solar bottle light to minimize the use of electricity is another option.

## 2) Homestay

There are 40 homestays in Pulesari, homestay means the local house. Every house prepares at least one room for the guest. In fact, the guest also uses the family room and the toilet. The local people use national electric company (PLN) for lighting their houses. The water sources come from the river and the well. In every homestay, there are at least 14 lamps and one television. The guest usually only uses one room for sleeping, one room for watching the tv in the family room and the toilet. One homestay suits for 4 to 10 people, depend on the size of the room.

In homestay, the guest activity mostly just take a rest, showering, charging the gadgets and sometimes watching the TV. The guest activity is mainly in Pendopo, they usually play outbound activities. The guests do not having a breakfast, dinner or lunch in the homestay, they usually have it in pendopo or in secretariat. Some improvement may be needed to give more comfort for guests, the clean toilet and room is a must, they need to change the lamps with the LED lamps which more efficient or even change it with solar bottle light in some rooms.

## 3) Meeting and venue (Pendopo)

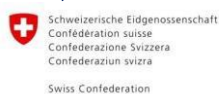
There are two public meeting venues (Pendopo) in Pulesari. They called *Pendopo atas* (northern side) dan *pendopo bawah* (southern). There are three toilets in each pendopo. Those two meeting venue consist of 28 lamps with 9 to 50 watt, 4 soundsystem with 300 to 1000 watt of electricity and two infocus projectors with 255 watt of electricity.

The southern Pendopo do not pay for the electricity and of course for the water too. The pendopo is usually for meeting, venue and outbound activities. It has yard in front. The activities usually needs electricity to use soundsystem, infocus projector and lamps. The toilet is usually for rinsing/cleaning after the guests playing in the river. The volume of the water in Pulesari is 0,2 liter/second. For laundry, it needs 5 minutes per person and for showering needs 15 minutes.

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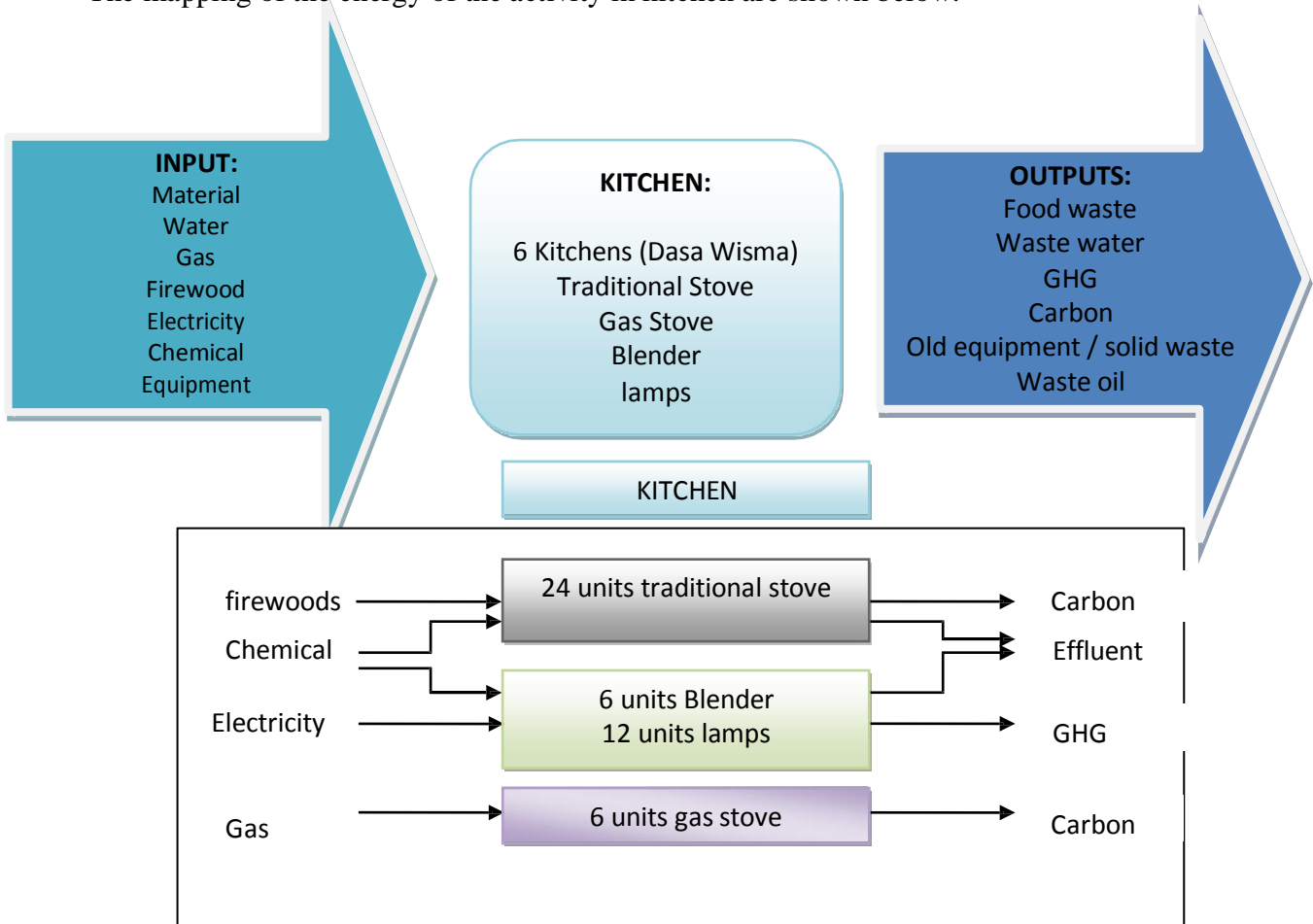
## CHAPTER III AREAS OF IMPROVEMENT

### 3.1. Map Activities and Flow

This chapter will show the activities of Pulesari tourism village, a complete process from input, process and output. The following chart and figure may reflects the whole activities in Pulesari.

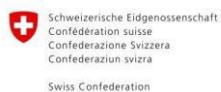
#### A. Kitchen

The mapping of the energy of the activity in kitchen are shown below:



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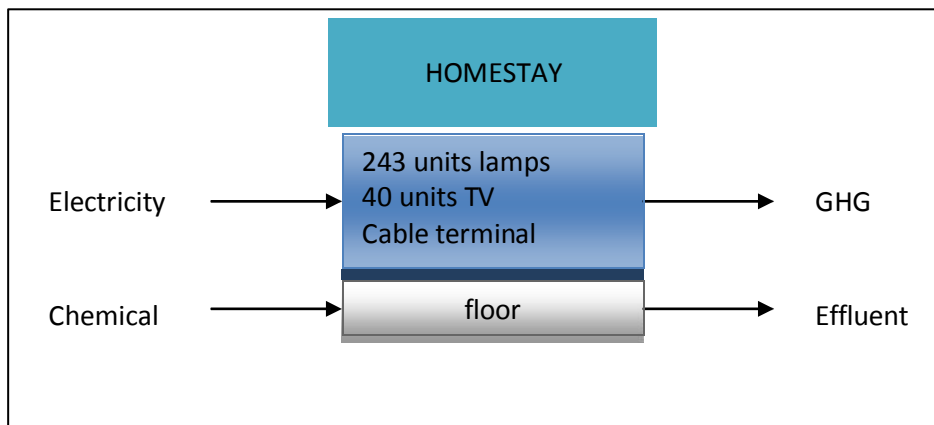
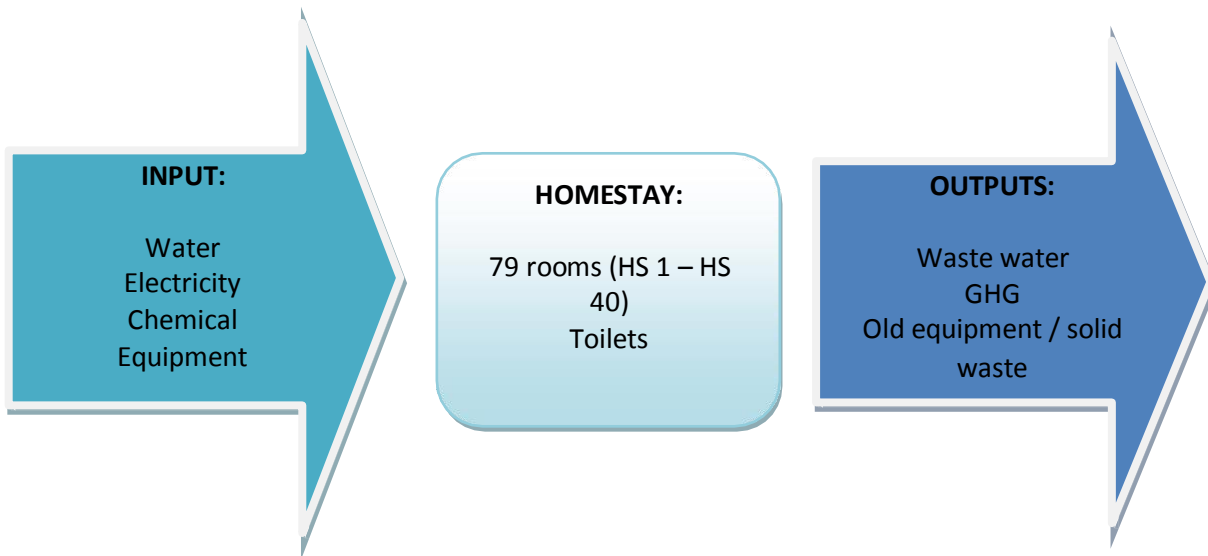
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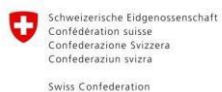


## B. Homestay



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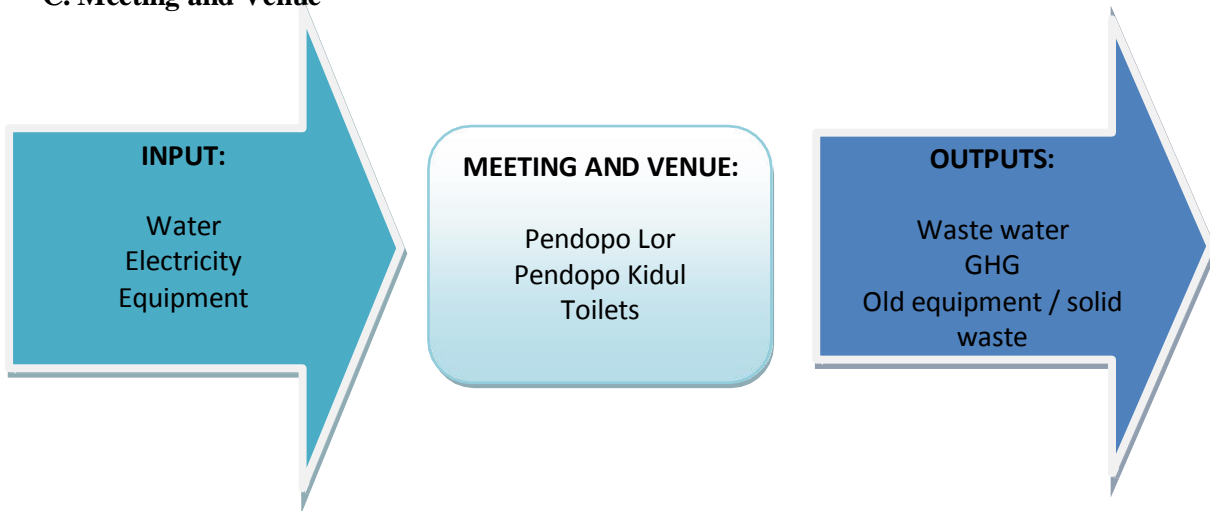
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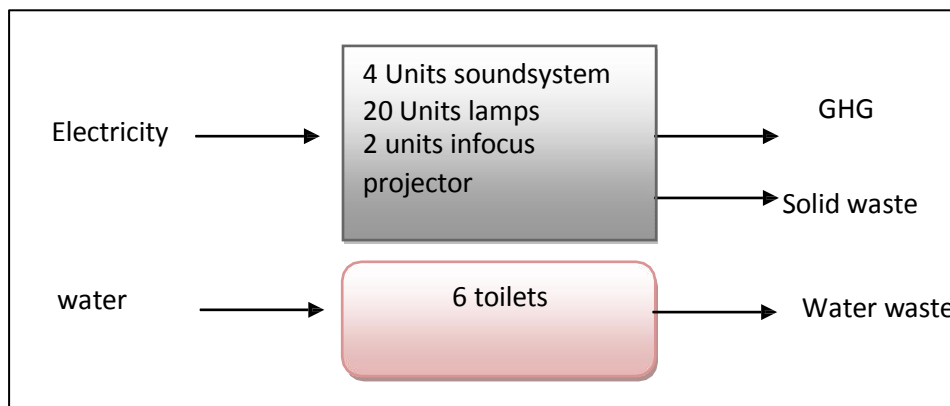
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### C. Meeting and Venue

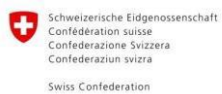


#### MEETING AND VENUE



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### 3.2. Inspect Operations

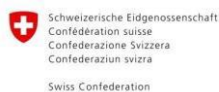
Inspect operation are aimed to clarify what is said by the management and to see if any leaks or lossess that can be found during the observation.

**Table 4: Inspect Operation**

<p><u>Observations 1:</u> General workplace appearance, housekeeping and standard operating practices</p>	<p>Pulesari is a tourism village. It has natural,cultural and culinary attractions. The famous attractions are outbound activities, such as river trekking and fun games. Most of the local people still keep their traditional ways including the process of cooking, food production. This village is rich of water source, they still use gravitation to flow the water to the houses. It has two public meeting venue (pendopo). The local people lack of knowledge about resource efficient and cleaner production, especially in hygiene. There are three main service activities which consumes energy and resources, namely kitchen, homestays and Pendopo.</p>
<p><u>Observations 2:</u> Leaks, spills or other losses observed</p>	<p>There are so many leaks in water source, they let the water overflow in water tank. They always turn their tap/faucet all day . They use a lot of wood for cooking, let the smoke and the charcoal spread in the kitchen.</p>
<p><u>Observations 3:</u> Level of technology, its maintenance and control status</p>	<p>Pulesari tourism Village still uses traditional technology with lack of hygienity. The maintenance is also in a traditional way. They still keep the traditional way of cooking and using the water source. For the electricity, they use national electricity company (PLN). There is no control from the government about the waste. inefficient use of water source.</p>
<p><u>Observations 4:</u> Materials and waste – main users and sources, current controls and handling and disposal practices</p>	<p>They produce/cook the foods and beverages in traditional ways, it means unhygienic. The kitchen is so dark, full of smoke, ashes, the wall is black because of the smoke. The cooks use no glove in hand and apron. The good things are they manage the waste in a good way. For the food waste, they use the waste for feeding the fishes, most of villagers have fishpond. For the solid and plastic waste, they sort them and give them to Waste Bank.</p>
<p><u>Observations 5:</u> Water and waste water – main users and sources, current control and discharge practices</p>	<p>They get the water source from river and well. For the waste water, they flow it to the garden, most of people in village have snake fruit garden. For the human waste like feces, urine, some villagers flow them to septic tanks, some others send 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</p>

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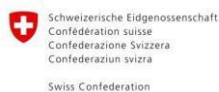
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	about the waste water management.
<u>Observations 6:</u> Energy – main users, losses, waste energy discharges	The main users of the source are the guest, because almost everyday the village always have guest to come. The total guests who came is greater than the local people. The guests use the water for showering and drinking. Because the village 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.
<u>Observations 7:</u> Chemicals and emissions – main users, losses, hazards	The chemicals are soaps, detergent for laundry and toiletries. The main users for toiletries are the guests, the dish soap and detergent are the local people. They wash their clothes and the dish with running water, they let the water faucet open, sometimes they hold/keep the water in a bucket and wash them inside the bucket.
<u>Observations 8:</u> Occupational health and safety issues identified	Some local people who are part of tourism village manage their homestay well organized with clean toilet, rooms because clean rooms and toilet are the least requirement for homestay.
<u>Observations 9:</u> (Food) hygiene and consumer safety issues identified	They cook local foods by using no glove, no apron. They cook the food with firewood which has a lot of smoke, dangerous smoke. It is not healthy but for some people the taste of the food is good.

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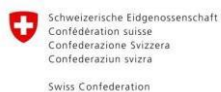
### 3.3. Benchmark Practice and Performance

**Table 5: Benchmark Practice and Performance**

Main activity 1: Kitchen		
Leading practice (benchmark)	Company practice	Improvement potential (high, medium or low)
1.1. Track and monitor the waste items, reduce the waste at minimum amount.	Collecting the plastic waste, solid waste and have no treatment in oil waste	High
1.2. Using dish washer machine and uses it when it is already full. So it can minimize the use of water	Manual dish wash, the water is always on	High
1.3. Communal waste for water waste	Septic tank and manual waste using pool and catfishes	High
1.4. Using grease trap for oil, not pouring the oil to the drainage, should be placed in specific container	Throw the grease or oil directly in the drainage along with another water waste	High
1.5. Using standard of safety and hygiene in kitchen	No standard safety and hygiene in kitchen	Medium
1.6. Using gas and magic jar to cook the rice	Using traditional stove with firewoods and gas	Medium
1.7. Using blower to maximize fire and minimize the ashes in stove	No blower, only use a pipe from bamboo to maximize the fire	Medium
1.8. Using Solar Bottle Light to minimize lamps in kitchen	Use incandescent bulb in kitchens	Medium
Main activity 2: Homestay		
Leading practice (benchmark)	Company practice	Improvement potential (high, medium or low)
2.1. Rain harvesting	Water sources from river and wells	Low
2.2. Purification plants enabling water to reused	Let the waste flow to a garden and river	Low
2.3. Buy product with the reuse packaging design	Buy product with a lot of plastics waste	Low
2.4. Dry and wet garbage storage	One garbage for all waste	Low
2.5. Measure the initial	Never measure the use of	Low

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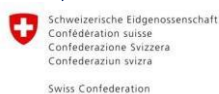
consumption of electricity, water, gas and materials	water, and materials daily or in every events.	
2.6. Information and awareness raising among employee and guests to safe energy	No information for guest and local people to save the energy.	Low
<b>Main activity 3: Meeting Room (Pendopo)</b>		
<b>Leading Practice</b>	<b>Company practice</b>	<b>Improvement potential (<i>high, medium or low</i>)</b>
3.1. Turn off the electric devices when it is not in use	20 minutes before the guests (group) come, the sound system is on.	Low
3.2. Awareness raising among employee and guests to safe energy	No information for guest and local people to save the energy.	Low
3.3. Using LED lamp	Use incandescent bulb	Medium

Based on the benchmark , there are some practices and performance that can be applied in Pulesari tourism village, in order to cost saving and cleaner production. Some best practices are rain harvesting, build a communal kitchen and waste. In the kitchen area, the cooks can start using hand gloves and apron to make a cleaner production. Rocket stove or efficient stove can minimize the fire and the smoke. A blower can also help to maximize the fire and minimize the ashes.

The whole assessment result can be shown in the table data below with traffic light system to ease understanding the result.

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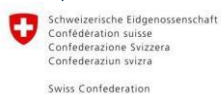
**Table 6: Assessment Result with Traffic light System**

Main Activities	Resource Use	Environmental Burden	Costs	Hazards (incl. occupational health & safety)
• Activity 1: Kitchens				
• Activity 2: Homestay				
• Activity 3: Pendopo				

Overall assessment with the traffic light shows that the high priority with almost red line is in the kitchen area. In homestay area, it only as one red line it means it is in the medium area, while the pendopo, there is non red in the pendopo area, it means not really impact the resource. However, it still need to improve to make a better clean and efficient environment. The next step for detail assessment is in the kitchen area because there are a lot of energy lossess and leaks, the use of water and firewoods needs to improve in order to make a better life in Pulesari.

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## CHAPTER IV

### RECOMMENDATIONS

After seeing the fact in Pulesari tourism village, the team forms some RECP practice recommendations for the tourism village. The recommendation can be an equipment modification, technology change and good housekeeping practice for kitchens and homestays. The priority area is in the Kitchen, the *Dasa Wisma* Kitchen. The first recommendation is to build a communal kitchen with clean equipments, strict standard procedures especially in hygiene. Some trainings may be needed to socialize the local people about hygiene and cleaner production. However, it really **needs high cost** to buy kitchen set and the land for the communal kitchen.

The second recommendation is to have at least 12 “rocket stoves” or traditional efficient stove in six *Dasa Wisma* to reduce the smoke and maximize the fire and the heat. Rocket stove can be made by using brick and other materials, it is simple and low cost. The black wall which is caused by the smoke from the stove can be minimized by using “air cooler” which is constructed by some plastic bottles waste. The kitchen also can use “solar bottle light” to change the lamps. The other option is using “blower” to maximize the fire and minimize the ashes.

Next, homestays should change their lamps to LED lamps. Using LED lamps save more cost and energy. The other option is using the solar bottle light to change the lamps in some rooms. Repairing the lamps to a lamp repairation shop is another option. This recommendation needs medium cost and it can be an immediate action and it depends on the owner of the houses.

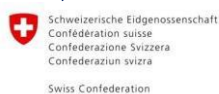
Then, using magic jar or rice cooker to cook the rice is a good RECP practice than using firewood. Another recommendation is to built a communal sanitation to process the water waste from the toilet. This recommendation also needs highly cost.

The last recommendation is enriching local people’s knowledge about hygiene in their cooking ways for a cleaner production. It can be an immediate action and it is low cost.

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## CHAPTER V DEVELOPING SOLUTION

In this chapter, a root cause and source analysis will be discussed. From the root cause and root source analysis, there will be some options generation to consider to be implemented in Pulesari tourism village. It is aimed at compiling catalogues (or lists) of feasible RECP solutions for each of the established RECP priority areas, through further generation and customization of RECP options and assessing their technical, environmental and economic feasibility

### 5.1. RECP Options

This part is giving some some RECP options, 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 long 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 three main activities in Pulesari tourism village namely Kitchen, Homestay (room) and Pendopo (hall). Then, the concern is only in two areas namely kitchen and homestay.

#### A. Main Activity 1: Kitchen

##### 1. Root Source Analysis

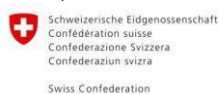
Kitchen is the main activity which consume a lot of source and energy such as firewood, water, electricity and gas in Pulesari tourism village.

**Table 7. Root Source Analysis for Kitchen**

<b>Food Waste (kg/day)</b>	<b>Gas Consumption (kWh/day)</b>	<b>Firewood (kWh/day)</b>	<b>Electricity (kWh/day)</b>	<b>Water (m3/day)</b>
Preparation and serving  7,2	Cooking  16,1	Cooking  791,18	Lamps, Blender, rice cooker  730,77	Dish wash, drinking, cooking  16,09

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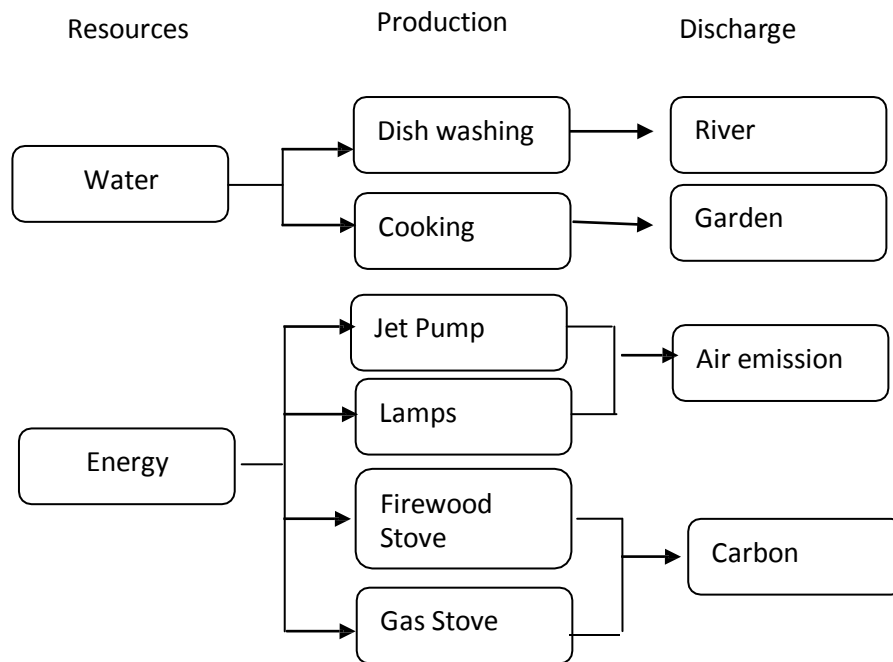


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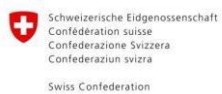
To know the root source, the flow chart is given below, it is also to make easier in generating options in RECP practice.

## 2. Flow Chart



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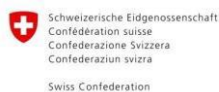
## 2. Kitchen Root Cause Analysis

**Table 8. Root Cause Analysis for Kitchen**

Root Cause Category		Causes existed
Process Input		<p>There is no sign or information to save energy and resource in the kitchen</p> <p>Manual record data (hand writing), no back up data, incomplete data</p> <p>Local people still using firewood to cook because they believe it will produce more delicious food. The stove produces a lot of smoke when cooking. The local people also lack of knowledge about hygiene and cleanliness. When doing preparation, the cooks will throw the waste (onion skin, etc.) directly to the ground and clean them later.</p>
People		<ul style="list-style-type: none"> <li>- Lack knowldge about hygine</li> <li>- Don't wear gloves, apron or head cover</li> <li>- Let the rubbish spread along the ground</li> <li>- Use traditional stove that consumes a lot of firewood</li> </ul>
Facility	Process Control	Because the stove is not efficient, it takes lot of firewood and very time consuming to cook. Also, the kitchen does not have ventilation, the people would suffer from smoke when cooking. The kitchen floor is still clay (ground) causing dust if it's dry.
	Equipment	They never clean the stove from cinder after cooking so there's clearly no maintenance. <ul style="list-style-type: none"> <li>- Traditional stove still become a popular stove for cooking in the village</li> </ul>
	Technology	- Traditional technlogy to keep the cultural value and the taste
Product		Some of the stove is three stone stove which only has 15% efficiency
Waste	Internal Value	- They use the food waste for feeding their fishes
	External Value	They sell the plastoc waste into a waste bank.

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### 3. Option Generation

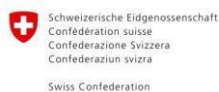
Some RECP option categories as a guidance to conserve energy, water and materials are shown in the table below. This option can be apply in Pulesari tourism Village in order to make cleaner production and efficient energy use.

**Table 9. Option Generation for Kitchen**

Root Cause Category		Options
Process Input		The cooking process should be done in better hygiene practice like wearing apron and gloves. Clean the equipment directly after finish. Cover the floor with ceramics.
People		Raising awareness of sanitation and hygiene for all staff and local people.
Facility	Process Control	record the use of materials, electricity and the equipment, total guests who eat in the village. Minimize the use of plastic for food
	Equipment	Replace the traditional stove with rocket stove which is more efficient. Install smoke blower so the smoke would not stay in the kitchen. Add magnet to the LPG pipe for more efficient use of LPG. Using blower for the stove to maximize the fire and minimize the smoke and ashes
	Technology	Use rice cooker to cook rice which is the longest product to cook with traditional stove.
Product		Design the stove to be more efficient and doesn't produce lot of smokes. A clean and have enough light kitchen can produce a good product. More creative Packaging design is needed to attract tourist
Waste	Internal Value	n/a
	External Value	n/a

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#### 4. RECP Starter

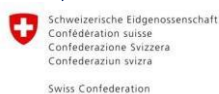
In the table below is what need to be done in reaching the options to achieve the successful RECP practice. This table prepares a good RECP practice about the time, the result and the specific target in detail which exists in other eco village.

**Table 10. RECP Starter for Kitchen**

Activities	RECP Starter
- Kitchen	<ul style="list-style-type: none"> <li>- Use more efficient stove for cooking, little firewood that generate maximum fire and heat</li> <li>- Using blower to maximize fire and minimize the smoke and ashes</li> <li>- Cover the floor with ceramics</li> <li>- Clean all the cooking stuff directly when it's done</li> <li>- Install air cooler to minimize the heat in room temperature and it can minimize the smoke in the room</li> <li>- Change the lamps with solar bottle light</li> <li>- Using magnet in the gas stove to maximize the heat and to make it more efficient</li> <li>- Giving information sign/note for staff and guest to save the resource and energy.</li> <li>- Wear glove, apron and cap for head/hair</li> <li>- Giving local people knowledge about hygiene and good packaging</li> </ul>

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## B. Main Activity 2: Homestays

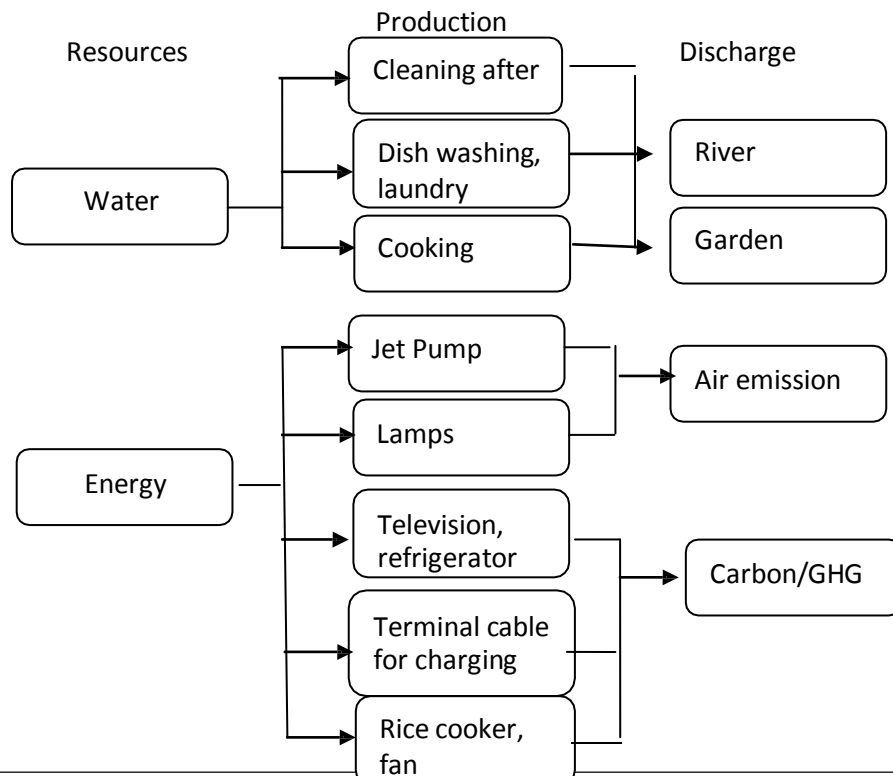
### 1. Root Source Analysis

Homestays or local people houses are the place for guest who stay and have a live in program. Just like guest room in hotels. Pulesari has 40 homestay in 2015 base year. It is very important to keep it clean and sustainable by applying RECP practice. Root source analysis is needed to identify the contributors of the energy and resource.

Table 11. Homestay Root Source Analysis

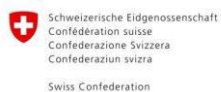
Electricity (kWh/day)	Water (m3/day)
Household appliance, TV, refrigerator, lamps etc  720,92	Laundry, cleaning, drinking, cooking  531,10

### 2. Homestay Flow Chart



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## 2. Homestay Root Cause Analysis

Table 12. Homestay Root Cause Analysis

Root Cause Category		Causes existed
Process Input		Because they still use gravitation in traditional way to flow the water, there are water spills on the water tank. No specific individual data for the use of energy, total electrical devices and total gueststay in homestay
People		The village use gravitation to flow their water from the source and let the water overflow. Not all of the local people use septic tank for human waste. There is no awareness about saving water because of abundant water source. There is also no awareness to save electricity to guest.
Facility	Process Control	The water spill from overflowed water tank has wasted much fresh water.
	Equipment	Many out of date electronical devices like TV and refrigerator
	Technology	Almost every homestay doesn't use LED lamp
Product		Looks untidy, just the way it is and some rooms are humid
Waste	Internal Value	One garbage for all waste
	External Value	n/a

## 3. Option Generation

Table 13. Option Generation for Homestay

Root Cause Category		Options
Process Input		Record the use of energy, electricity and resource use, the total guest who stay in homestay (individual)
People		Change the bed cover when the new guest come. Giving information to save energy and resource for guest
Facility	Process Control	Flow the water to fishpond or garden
	Equipment	Use LED lamps for more efficient in electricity use. Use solar bottle light to change some lamps
	Technology	Use LED lamps or solar bottle light and change the old equipment
Product		Clean the room before the guest come, paint the wall in white color
Waste	Internal Value	Separate the waste, at least two bins for the waste
	External Value	n/a

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#### 4. RECP Starter

Table 14. RECP Starter for Homestay

Activity	RECP Starter
Homestay	<ul style="list-style-type: none"> <li>- Use LED to save electricity</li> <li>- Change some lamps with solar bottle light</li> <li>- Giving information for guest to use energy and sources in an efficient way</li> <li>- Clean the room before the guest come</li> <li>- Paint the room with white color</li> </ul>

### 5.2. 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 Pulesari tourism village.

#### A. Rocket Stove or Energy Saving/Efficient Stove

##### 1) The objective of the implementation

This rocket stove or energy saving stove is for the six kitchens in DasaWisma Pulesari which still uses out of date stove. This is also to achieve energy saving and cost saving because of the use of firewood for cooking.

##### 2) Scope of Implementation

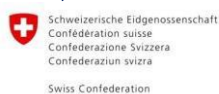
This rocket stove or energy saving stove will be implemented in the six Dasa Wisma in Pulesari. In every kitchen at least has two stoves. The recommendation of the rocket stove or energy efficient stove model is shown in figure below. *Keren* stove which saves 15% firewood is an up to date model of the existed traditional stove.

##### 3) Energy and Cost Saving Potential

The rocket stove or energy saving stove needs only a few firewood supply, because the hole of the stove is not too big but it can maximize the fire and the heat and minimize the smoke during cooking process.

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Figure 1. Keren Stove and Rocket Stove

Table 15. Rocket Stove Energy Saving Potential

Description	Unit	Existing condition	After Implementation
Efficient Stove		Old stove	Installed
Firewood use perday	kWh, satuannya Kg?	791,18	118,67
Emission perday	kWh	0,55	0,08
Energy saving Potential (kWh/yr)			43317,45
Emission Reduction (kg/yr)			30442
Cost Saving (IDR/yr)			2.244.632

- 4) Estimated Cost of Investment  
 hitungan tabel diatas utk mendapatkan cost saving rumus pengalinya bagaimana ?. mohon disebutkan sumber referensi atau perhitungan diatas hasil dari monitoring di lapangan ?

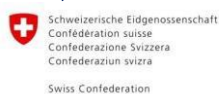
The total estimated investment for rocket stove or Keren stove for six Dasa Wisma is IDR 3.480.000,-. It consist of four new stove in six Dasa Wisma. The stove is IDR 145.000,-. It is multiplied with 24 stove for six Dasa Wisma. It is estimated that the stove can save about IDR 2.244.632 per year. The operational cost for the stove is zero cost, just wipe them with a piece of spon or cloth. The payback period is only 0,9 year with NPV IDR 2.224.632 per year. The feasibility amount of rocket stove/Keren Stove is shown in the table below:

Table 16. Estimated Investation for Rocket Stove

Cost Component	Amount	Price per unit (IDR)	Total Cost (IDR)
Rocket Stove/Keren Stove	6 Dasa Wisma 6 x 4= 24 stove	145.000,-	3.480.000,-
Total Estimated cost of Investment			3.480.000
Net Present Value (IDR/year)			2.224.632
Payback Period			0,002

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## B. LED Lamps

### 1) Objective of the Implementation

It is expected that the use of LED lamps can save more energy and cost. It is also environmentally friendly. A 15 watt of lamp can replace with a 5 watt of LED lamp.

### 2) Scope of Implementation

The LED lamps is expected to use in 40 homestay, in every homestay at least there are 5 to 10 LED lamps for piloting in a homestay, especially the lamp that has a high watt.

### 3) Saving Potentials

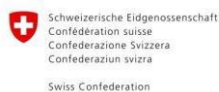
LED lamps can save energy because LED needs less electricity power than incandescent lamps to produce the same performance. There are 40 homestay which has at least 14 lamps in every houses. With total cost saving is about IDR 42.924.000,- the local people will keep the environment with a bit emission.

Table 17. LED Lamps Saving Potentials

Description	Unit	Existing Condition	Implementation Suggestion
Replacement of corridor lamps		Incandescent 15 W	LED 5 Watt
Power consumption	Watt	15	5
The amount of lamp	unit	560	560
Operation hour/year (@14 hour/day)	hour	5110	5110
Energy consumption/year	kWh	42924	14308
Emission (CO <sub>2</sub> ) production/year	kg	30166	10055
Energy cost/year @(Rp 1.500/kWh)	IDR	64386000	21462000
Energy saving potential kWh /year			28616
Emission (CO <sub>2</sub> ) reduction kg/year			20111
Energy Cost saving IDR/year			42.924.000

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#### 4) Estimated Cost of Investation

It is estimated that LED lamp replacement needed about Rp 29.933.750 for investment. By considering the cost saving of Rp 34.381.292/year, then the payback period of this implemtation is around 0,871 years

Table 19. LED Estimated Cost Investation

Cost Component	Amount (unit)	Price per Unit (IDR)	Total Cost (IDR)
Phillips LED 5 Watt Purchasing	560	40.000	22.400.000
Total Estimated Cost of Investation			22.400.000
Net Present Value			20.524.000
Payback Period			0,016?

rumusnya :  
22.400K : 20.524K =  
1.09 tahun =13 bulan

### C. Magnet for Gas Efficiency

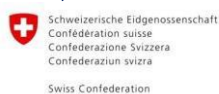
By sticking the magnet in the hose of the LPG, it can save the use of the gas 20% to 50%. For this case, it is assumed that it will be save 30% of gas. It is proven by comparing two gas stove in boiling water, one stove uses the magnet and the other stove without magnet. The stove that uses magnet is boiled faster than the one which is not using the magnet.

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 need two couples of magnet for each gas. Total investment for this magnet is about IDR 60.000,-. One couple of magnet is IDR 5.000,-. It needs 12 couples of magnet for six Dasa Wisma. The detail about this investment is in the table below:



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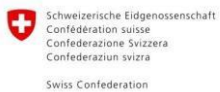


Figure 2: Magnet for Gas Stove

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Table 20. Potential Energy Saving for Magnet

Description	Unit	Existing Condition	Implementation Suggestion
Magnet for Gas Stove in Dasa Wisma		-	Two Couples of Magnet
Gas LPG per year (six Dasa Wisma)	kg	432	129,6?. perhitungannya drmn ?
Energy consumption/year	kWh	5875,2	1762,56
Emission (CO <sub>2</sub> ) production/year	kg	4192	1239
Energy cost/year	IDR	2.880.000	864.000, perhitungannya drmn?
Energy saving potential kWh /year			4112,64
Emission (CO <sub>2</sub> ) reduction kg/year			2953
Energy Cost saving IDR/year			2.016.000

Table 21. Estimated Cost Investation for Magnet

Cost Component	Amount (couple)	Price per couple (IDR)	Total Cost (IDR)
Oval Magnet	12	5.000	600.000
Total Estimated Cost of Investation			600.000
Net Present Value			1.416.000, drmn angkanya ?
Payback Period			0,001?

$$1.416.000:600.000 =$$

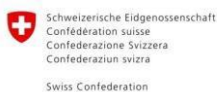
#### D. Solar Bottle Light

The Solar Bottle light can replace some lamps in the kitchen and toilet in homestay. It is assumed that in every homestay needs two lamps in kitchen and two lamps in toilet (usually every house has two toilets). The light of this solar bottle light is equal with 50-55 watt of incandescent bulb lamp. The detail for the energy and cost investment are shown in the table below:



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Table 22. Solar Bottle Light Energy Saving Potential

Description	Unit	Existing Condition	Recommendation
Solar Bottle Light		-	-
Two Kitchen Lamps and Toilet (@10watt x 40 houses)	Watt	1600	-
Energy consumption/year (@14 hour/day)	kWh	8176	-
Emission (CO <sub>2</sub> ) production/year	kg	5746	-
Energy cost/year	IDR	12.264.000	-
Energy saving potential kWh /year			8176
Emission (CO <sub>2</sub> ) reduction kg/year			5746
Energy Cost saving IDR/year			12.264.000

Tabel 23. Cost Saving Potentials for Solar Bottle Light

Cost Component	Amount (unit)	Price per Unit (IDR)	Total Cost (IDR)
Solar Panel Kit	160	220.000? drmn angkanya ?	35.200.000
Bleach Liquid 500 ml	40	3.400	136.000
Total Estimated Cost of Investation			35.336.000?
Net Present Value			23.072.000?
Payback Period			0,025?

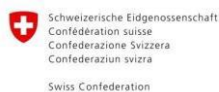
## E. All Options

It is explained before with data calculation about all options for RECP Practice in Pulesari Tourism village. Those options should be applicable, reliable and viable to implement both economically and environmentally. The investment in economy (money) should be able to provide a return on the money they (management) have spent. It is expected that the local people will apply those options. For the first time, they (local people) will say it is hard to pay for all the options because of the amount of the options seems too expensive. However, they will know the differences (benefit) for one or two years later.

The summary of all options are shown below:

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masukkan angka tabel dibawah  
setelah revisi perhitungan

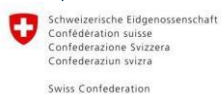
Table 24. Summary of All Options

Option description	Economics				Environment	
	Investment (IDR)	Revenue (IDR)	Pay back	NPV	Resources Conservation (kWh/yr)	Waste Reduction (CO2 eq kg/yr)
Rocket stove	3.480.000	2.224.632	0,002		43317,45	30442
LED lamps	22.400.000	20.524.000	0,016		28616	20111
LPG magnet	600.000	1.416.000	0,001		4112,64	2953
Solar Bottle lights	35.336.000	23.072.000	0,025		8176	5746

Those options are the most applicable and most possible to do immediately for the Pulesari tourism village. Actually there are also communal water waste and communal kitchen options recommendations for the village. Considering that communal water waste and kitchen are need very high cost so the team only gives the capable options for them.

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## CHAPTER VI ACHIEVING CONTINUOUS IMPROVEMENT

This part is about how to make sure the RECP implementation in Pulesari tourism village. There are many ways to do the implementations/recommendations like monitoring. However, if only just a monitoring it can't be so successful. There should be a cycle for the sustainable improvement in Pulesari like PDCA (plan do act check) method and PAM (Plan, Act, Monitor). To make it sure that the RECP options are implemented, it needs strong coordination and team work. All the staffs and management should have commitment to do the implementation. If it is possible, the management should have a new standard operational procedure for all divisions that relates to the RECP practice.



Figure 4. A Cyclus for RECP Implementation

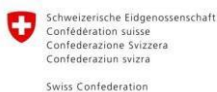
### 1) Plan

For the first time, an identification of resources and sharing responsibility is needed. Choose a team and person in charge in each plan. It is important to limit the project time to achieve the target. Planning is not just a human thing, it includes technical, management and financial resources.

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## 2) Do and Act

The same meaning, it needs all management and staff to work in a team. It can't be done with only a single department/division in tourism village. Employees should be included and empowered. Top management needs to be accommodating in accepting the proposals of employees, in so far as it supports the company's commitment.

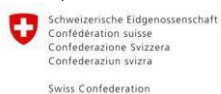
## 4) Check

Checking is not the end of the implementation. It should be continued again with plan. If something happened when checking the data then should have a plan to resolve the problem. This stage will never stop. Always check and recheck then plan, then do and check again.

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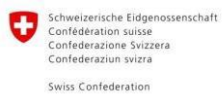
## ANNEXES

### (ASSESSMENT DOCUMENTATION PROTOCOL)

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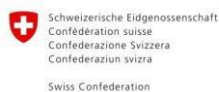


<b>Company name</b>	PULESARI TOURISM VILLAGE (DESA WISATA PULESARI )
<b>Profile of Company</b>	
<i>Provide a general profile of the company, its operations and its physical location</i>	
Type of business and sector	Tourism Village
Main products and/or services	A village with Culture, nature, live in local homestays, outbound activities, typical/traditional foods and beverages
Markets ( <i>domestic, international..</i> )	Domestic
Ownership ( <i>state, private,..</i> )	Communal
Year of establishment ( <i>of company and its present factory/premises</i> )	2012
Business size and/or production capacity ( <i>by main product categories</i> )	Small business tourism village with 40 local homestays with 79 rooms and 124 toilets. 2 Pendopo (public hall/venue) with 6 public toilets.
Capitalization ( <i>establishment and current registered capital</i> )	—
Annual turnover( <i>million IDR</i> )	IDR 1,4 billion (1,4 M)
Total number of staff and workers ( <i>permanent, seasonal, others..</i> )	180 persons 1 person (4 months apprentice student)
Location ( <i>street address</i> )	Pulesari Village, Wonokerto Hamlet, Turi Subdistrict, Sleman District, Yogyakarta Special Region
Physical location( <i>summary observations on company location, including nearby land use (residential, industrial, commercial, etc.), distance to communities, water bodies (river, lake..) and environmental sensitivity</i> )	Pulesari is located far away from Yogyakarta down town. This village is an agricultural area with 26 springs flow from multiple streams like Krasak and Bedog River. The Village is flanked by two rivers, West Bedog River and East Bedog River. Local people use the rivers as their water source for washing and showering. For drinking, most people use water from well (about 10-15 meters). This village is located in the slope of Merapi, it is about 12 kilometers from Merapi. Its altituted is about 600 meters above sea level. Most of the people are farmers, they plant Salak (snake fruit). Turi subdistricts is wellknown as an Salak Agrotourism in Sleman. Pulesari is surrounded by many tourism villages which almost have similar characteristics, it's also near from Kaliurang, the most well known tourism place in Sleman district.

### Stage 1: GETTING STARTED

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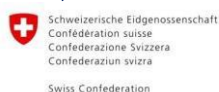
*GETTING STARTED is concerned with securing commitment and engagement of management and staff of the company and documenting baseline performance (using a common set of RECP indicators) and associated costs.*

**Task 1.1 Engage management and staff**

Date of briefing of management	Tuesday, May 3 <sup>rd</sup> , 2016	
Name and function of senior manager(s) briefed	- Mr. Amin Sarjana (Chief) - Mr. Didik Irwanto (Secretary)	
Date of signature of cooperation agreement	Tuesday, May 3 <sup>rd</sup> , 2016	
Past and ongoing environment and/or energy related initiatives reported by management	Never	
Future plans of company reported by management	Build some private Pendopo for venue and other Javanese classical buildings. The purpose is to remind the guest the Javanese Village atmosphere just like the old time.	
Specific environment and/or energy related concerns expressed by management	Ineffective and inefficient use of water and firewood	
Specific expectations of management in regard to undertaking the RECP assessment	The ways to more effective and efficient in using the resources especially water and firewood.	
Initial focus areas of RECP assessment discussed and agreed with management	Food and beverage productions (kitchens)	
Past internal communications and/or staff training activities on environment and resource uses	Irrigation program from Ministry of Agriculture in associate with Japan Government	
Team leader (company)(name and function)	Mr. Amin Sarjana	
Team members (company)(name and function)	1. Mr. Didik Irwanto (Secretary)	
	2. Mr. Rokhim (Homestay coordinator)	
	3.	
Team members (associate RECP experts)	1. Muhammad Dzulkifli (coordinator)	
	2. Shavitri Nurmala Dewi (member)	
<b>Task 1.2 Assess baseline performance and costs</b>		
Calculation period	January – December 2015	<i>Typically last completed reporting year prior to RECP assessment</i>

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Total production or service outputs (in units, tons, and/or financial value)	Total 52.506 guests in 2015.	<i>Sum up the annual output of products and/or services from the company's operations</i>	
<b>Materials Use and Costs</b> (consider product raw materials, auxiliary materials (e.g. for cleaning, lubrication, etc.), packaging materials, etc.)			
Material	Annual use [kg/yr]	Annual costs [M IDR/yr]	Main purpose
1. Goods (vegetables, fruits, Meat, seafood, poultry, rice, pour, etc)	52.259,22 kg/yr	796.673.422,8 /yr	Kitchens
2. Tissue and plastics	525.06 kg/yr	11.813.850 /yr	Kitchens,
3. Chemicals (dish soap)	65 kg/yr	1.008.000/yr	Kitchens
Total	52.849,28 kg/yr	796.973.422,8 /yr	<i>Sum up in weight units and costs all materials used</i>
Materials Productivity [kg or unit/kg]	0,99 guest/kg	<i>Divide total production by total materials consumption</i>	
Materials Cost Intensity [in IDR/kg or unit of product]	IDR 15.172,9 / guest	<i>Divide total materials costs by total production</i>	
<b>Water Use and Costs</b> (consider all water sources, including city water, ground water, surface water, rain water, etc.)			
Water source/type	Annual use [m3/yr]	Annual costs [M IDR/yr]	Main purpose
1. well	120,76 m3/yr	0	Drinking, cooking
2. river	4.725,54 m3/yr	0	Shower, dishwashing, cleaning after outbond, laundry
3.			
Total	4.846,3 m3/yr	0	<i>Sum up in volume units and costs all water sources</i>
Water Productivity [in kg or unit of product/m3 water]	10,83 guest/m3	<i>Divide total production by total water consumption</i>	
Water Cost Intensity of Production [in IDR/kg or unit of product]	0	<i>Divide total water costs by total production</i>	

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<b>Energy Use and Costs</b> (consider all energy sources and carriers, including fuels and electricity for all sources; convert each to same energy unit (either kWh or MJ))			
Energy source/type	Annual use [kWh/yr]	Annual costs [M IDR/yr]	Main purpose
1. Electricity	Homestay (home appliance, lamps): 266.732,6 kWh/yr  Public facilities (pendopo/venue hall): 8205,3 kWh/yr	Homestay: 400.098.984/yr Public facilities (pendopo/venue hall): 12.307.950	Living, Lighting (Homestay and Pendopo)
2. Firewood	288.783 kWh/yr	14.964.210 /yr	Cooking (kitchen)
3. Gas	5.875,2 kWh/yr	2.880.000 /yr	Coking (kitchen)
Total	569.596,15 kWh/yr	430.251.144 /yr	<i>Sum up in energy units and costs all energy uses</i>
Energy Productivity [in kg or unit of product/kWh energy]	10,8 guest/kWh	<i>Divide total production by total energy consumption</i>	
Energy Cost Intensity of Production [in IDR/kg or unit of product]	8194,3 /guest	<i>Divide total energy costs by total production</i>	
<b>Waste Generation and Costs</b> (consider all waste types (industrial, commercial, hazardous, etc.), regardless of further reuse, recycling, treatment or disposal)			
Waste stream/type	Annual volume [ton/yr]	Annual costs [M IDR/yr]	Main sources
1. General waste	2.6 ton/yr	0	Kitchen
		0	
		0	
Total	2.6 ton/yr	0	<i>Sum up in weight units and costs all waste streams</i>
Waste Intensity [in kg/kg or unit of product]	0.05 kg/person	<i>Divide total waste generation by total production</i>	
Waste Cost Intensity of Production [in IDR/kg or unit of product]	0	<i>Divide total waste costs by total production</i>	

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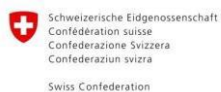
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<b>Waste Water (Effluent) Generation and Costs</b> (consider all types of waste water, including process, cooling, sanitary and other waste water streams)			
Waste water stream/type	Annual volume [m <sup>3</sup> /yr]	Annual costs [M IDR/yr]	Main sources
1. water waste	2.907,7 m <sup>3</sup> /yr	0	Toilet, dish washing, showering, cooking, laundry
2.			
Total	2.907,7 m <sup>3</sup> /yr	0	<i>Sum up in volume units and costs all waste water streams</i>
Waste Water Intensity [in m <sup>3</sup> /kg or unit of product]	0,092 m <sup>3</sup> /person	<i>Divide total waste water generation by total production</i>	
Waste Water Cost Intensity of Production [in IDR/kg or unit of product]	0	<i>Divide total waste water costs by total production</i>	
<b>Emission (Carbon) Generation and Costs</b> (consider Greenhouse Gas (GHG) emissions from all energy and non-energy sources, convert all GHG emissions to kg CO <sub>2</sub> -eq)			
Emission type	Annual volume [kg CO <sub>2</sub> -eq/yr]	Annual costs [M IDR/yr]	Main sources
1. Carbon	202.950 kg CO <sub>2</sub> -eq/yr	-	Firewood
2. GHG	193.220 kg CO <sub>2</sub> -eq/yr	0	Electricity
3. Carbon	4.129 kg CO <sub>2</sub> -eq/yr	0	LPG
Total	400.299 kg CO <sub>2</sub> -eq/yr		<i>Sum up in GHG units and costs all emissions</i>
Emission (Carbon) Intensity [in kg CO <sub>2</sub> -eq/kg or unit of product]	7,62 kg CO <sub>2</sub> -eq/yr	<i>Divide total GHG emissions by total production</i>	
Emission Cost Intensity of Production [in IDR/kg or unit of product]	0	<i>Divide emission (carbon) costs by total production</i>	

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**Stage 2: ASSESSING OPERATIONS AND PRACTICES**

*ASSESSING OPERATION AND PRACTICES is undertaken to map, review and, where possible, benchmark operational performance, and on basis thereof identify and select priority areas and actions for RECP implementation*

**Task 2.1: Map activities and flows**

*The search for RECP solutions starts with an inventory of main activities and mapping of associated flows of materials, water and energy*

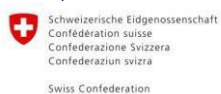
Main activities or processes conducted by the company	1. Kitchen
	2. Homestay
	3. Meeting and venue (outbound)
	4.
	5.

**Main Activity 1. Kitchen (There are 6 kitchens)**

Sub-activity	Equipment used	Scale/volume of activity	Resource inputs	Waste outputs
1.1. Cooking	Traditional Cook Stove Gas Stove Blender	24 stoves 6 stoves, Gas = 6x 3= 18 kg 1 Blender = 130 watt 6x130 = 780 watt	firewood Gas Electricity	Carbon Carbon GHG
1.2. Washing	Manual wash uses Dish Soap	1 liter dish soap for 500 plates . 120 liters	Water	Water waste
1.3. Lighting	Lamps	12 lamps. 25 watt x12= 300 watt	Electricity	GHG

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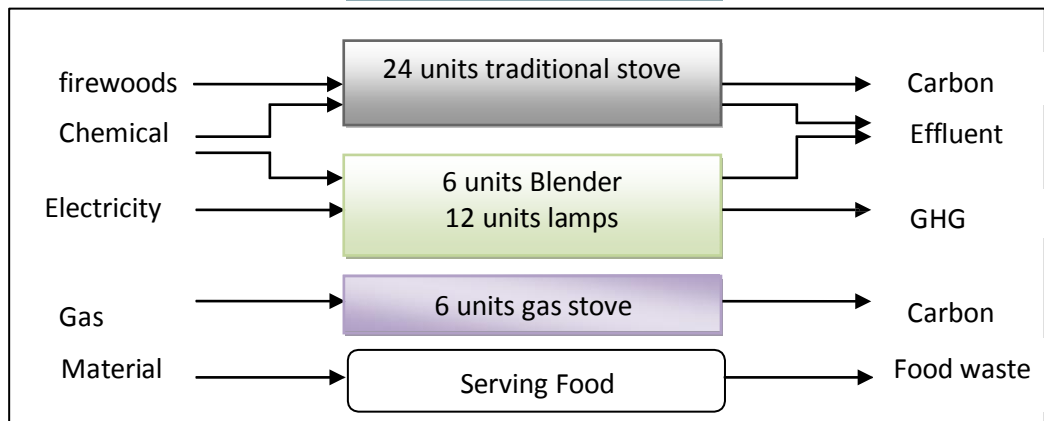


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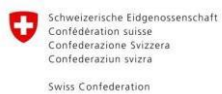


KITCHEN



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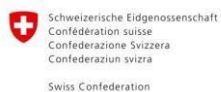


### Main Activity 2: Homestays (There are 40 Homestays)

Sub-activity	Equipment used	Scale/volume of activity	Resource inputs	Waste outputs
3.1. Showering	Lamps	124 toilets 124x15watt= 1860 watt	Electricity Water	GHG Waste water Solid waste
3.2. Room Lighting	Lamps	79 lamps, 79 x 15 watt = 1185 watt	Electricity	GHG Solid waste
3.3. Entertainment	Televisions (in family room)	40 x 68 watt = 2720 watt (TV) 40 x 15 watt= 600 watt (lamp)	Electricity	GHG Solid waste
3.4. Household activity	Irons, dispensers, refrigerators, rice cookers, water electric pumps, blender, phone charger, washing machine	40 x 300 watt= 1200 watt (iron) 40 x 250 watt= 10000 watt (dispenser) 40 x 100 watt= 4000 watt (refrigerator) 40 x 433 watt= 17320 watt (rice cooker) 40 x 650 watt= 26000 watt 40 x 130 watt= 5200 watt (blender) 80 x 3,68 watt= 294,4 watt (phone charger) 40 x 250 watt= 10000 watt (washing machine)	Electricity	GHG

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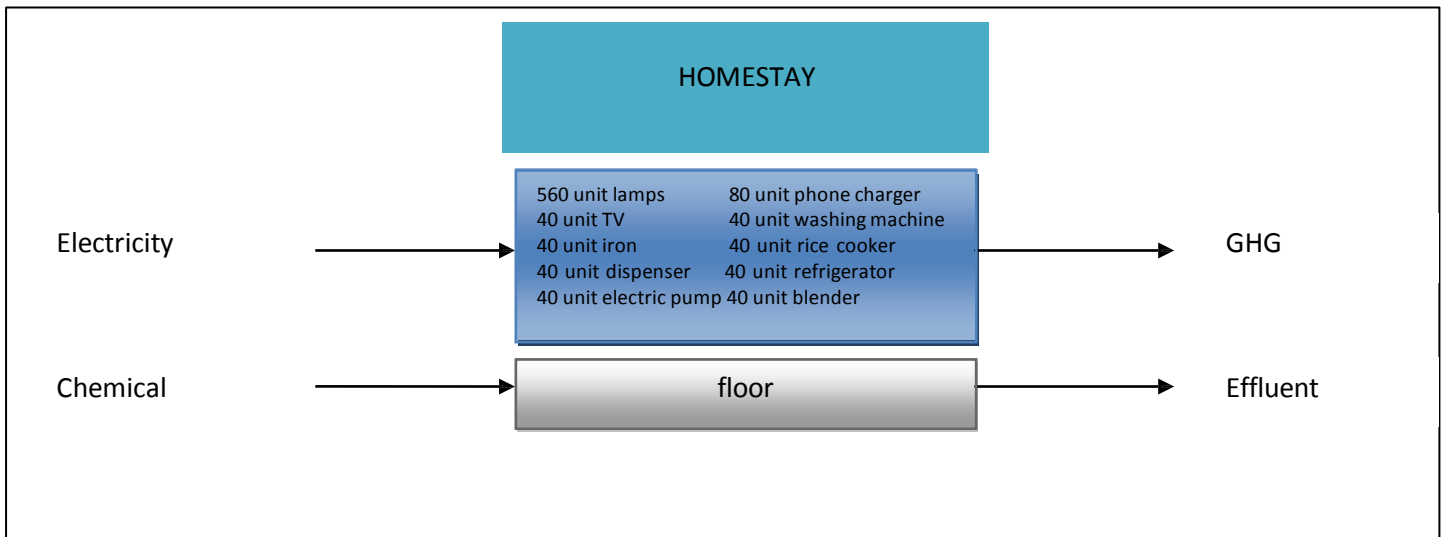
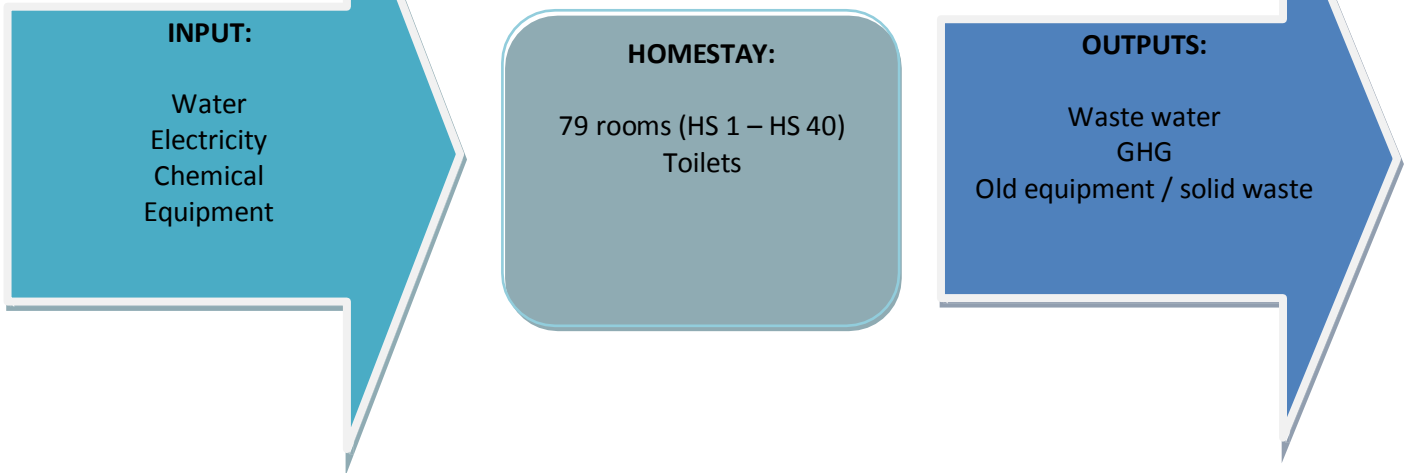


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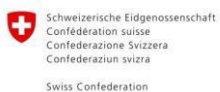
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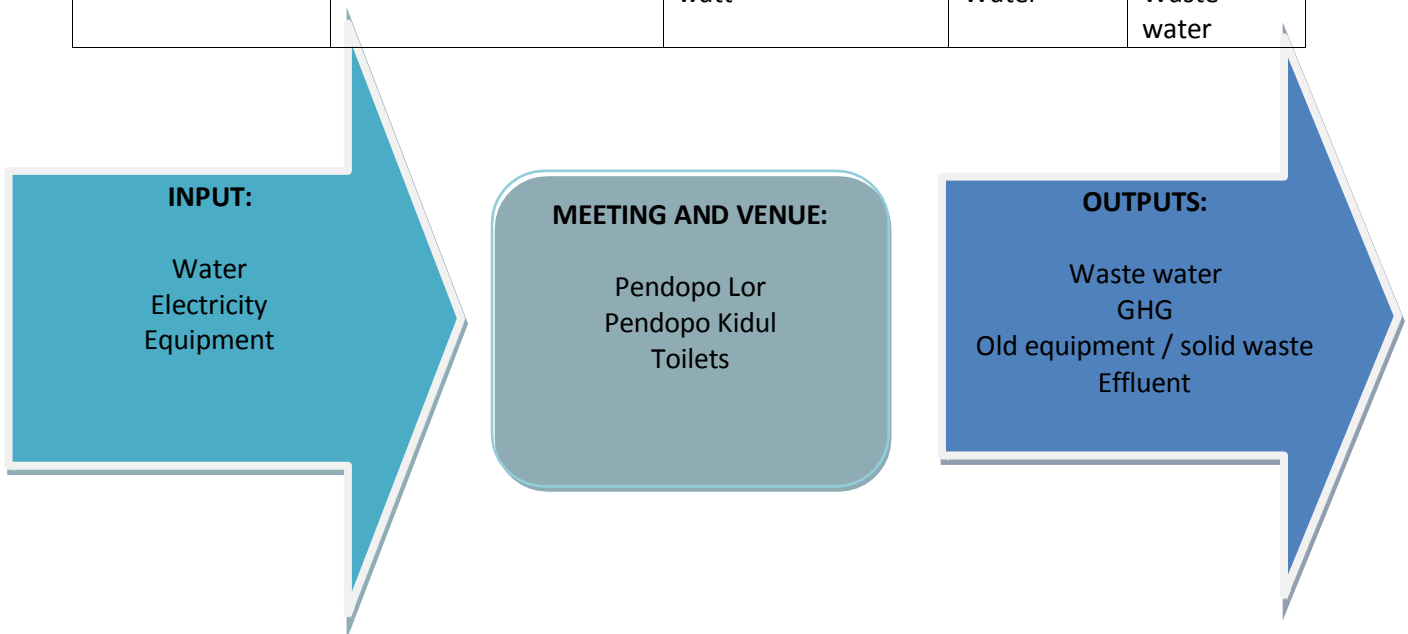


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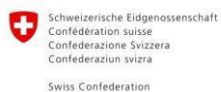
### Main Activity 3: Meeting and Venue (2 Pendopo)

Sub-activity	Equipment used	Scale/volume of activity	Resource inputs	Waste outputs
3.1. Meeting	Sound System Infocus Projector	3 sounds , 3 x 300 watt = 900 watt, plus 1 sound , 1 x 1000 watt. Total 1900 watt  2 Infocus , 2 x 255 watt = 510 watt	Electricity	GHG
3.2. Lighting	Lamps	28 lamps: 6 x 50 watt= 300 watt 4 x 30 watt= 120 watt 6 x 20 watt= 120 watt 10 x 9 watt= 90 watt 2 x 12 watt= 24 watt Total: 654 watt	Electricity	GHG
3.3. Toilet	Lamps	6 x 15 watt = 90 watt	Electricity Water	GHG Waste water



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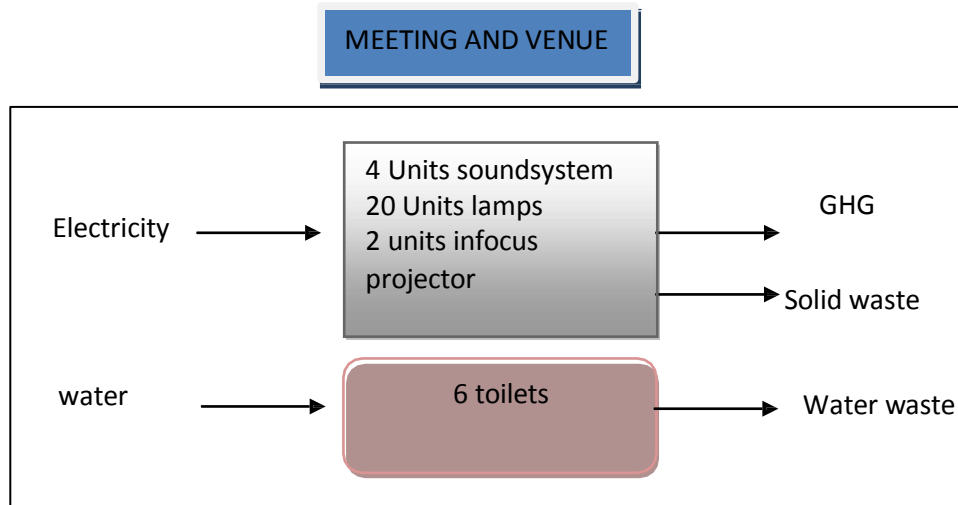


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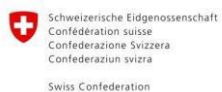




<b>Task 2.2: Inspect operations</b>	
<i>Inspect operations to complement and review activity and flow maps, assess operation and maintenance practices and procedures and identify improvement areas</i>	
Date performed	June 4 <sup>th</sup> 2016, June 19 <sup>th</sup> 2016 and 25 <sup>th</sup> 2016
Participants	Mr. Sarjana, Mr. Rokhim and Mr. Didik Irwanto

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Documentation  
*(refer to photos,  
measurements and other  
records taken during the  
walk through)*

**Kitchen:**

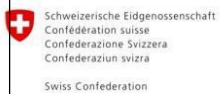


**Homestay**



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Kementerian Lingkungan  
dan Kehutanan



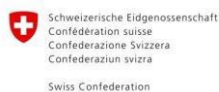
**Pendopo**



<p><b>Observations 1:</b> General workplace appearance, housekeeping and standard operating practices</p>	<p>Pulesari is a tourism village. It main attraction is outbound activities, the river trekking. Most of the local people still keep their traditional ways including the process of cooking, food production. This village is rich of water source, they still use gravitation to flow the water to the houses. It has two public meeting venue (pendopo). The local people lack of knowledge about resource efficient and cleaner production, especially in hygiene.</p>
<p><b>Observations 2:</b> Leaks, spills or other losses observed</p>	<p>There are so many leaks in water source, they let the water overflow in water tank. They always open their They use a lot of wood for cooking, let the smoke and the charcoal spread unorganized.</p>
<p><b>Observations 3:</b> Level of technology, its maintenance and control status</p>	<p>Pulesari toursim Village still uses traditional technology with very low hygiene. The maintenance is also in a traditional way. They still keep the traditional way of cookingand using the water source. For the electricity, they use the govermnet service (PLN). There is no control from the government.the waste a lot of water, use inefficient water source.</p>
<p><b>Observations 4:</b> Materials and waste – main users and sources, current controls and handling and disposal practices</p>	<p>They produce/cook the foods and beverages in traditional ways, it means unhygienic. The kitchen is so dark, full of smoke, ashes, the wall is black because of the smoke. The cooks use no glove in hand and apron. The good things are they manage the waste in a good way. For the food waste, they use the foodwaste for feeding the fish in pool, most of villagers have pool. For the solid and plastic waste, they sort them and give them to Rubbish Bank .</p>
<p><b>Observations 5:</b> Water and waste water – main users and sources, current control and discharge practices</p>	<p>For the waste water, they flow it to the garden, most of people in village have garden. Most of themare barkfruit farmer. For the human waste like feces, urine, some villagers flow them to septictanks, some others flow them to a different pool with catfish inside and flow again to garden and river. So far, there is no control from any organization or govenrment.</p>
<p><b>Observations 6:</b> Energy – main users, losses, waste energy discharges</p>	<p>The main users of the source are the guest, because almost everyday the village always have guest to come. The total of the guest is greater than the local people. The guests use the water for showering and drinking. Because the village 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.</p>

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<b>Observations 7:</b> Chemicals and emissions – main users, losses, hazards	The chemicals are the dish soap, detergent for laundry, toiletries. The main users for toiletries are the guests, the dish soap and detergent are the local people. They wash their clothes and the dish with running water, they let the water faucet open, sometimes they hold/keep the water in a bucket and wash them inside the bucket.
<b>Observations 8:</b> 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.
<b>Observations 9:</b> (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, ofcourse it is not healthy at all, but the taste is good, at least for me.

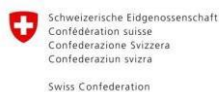
### Task 2.3: Benchmark practices and performance

Compare the company's practices and its key performance indicators (KPI) with the 'best' in class to determine improvement potential.

Best Practice Benchmarking (repeat for each of main activities of the company)	Main activity 1: Kitchen		
	Leading practice (benchmark)	Company practice	Improvement potential (high, medium or low)
	1.1 track and monitor the waste items, reduce the waste at minimum amount.	Collecting the plastic waste, solid waste and have no treatment in oil waste	High
	1.2 using dish washer machine and uses it when it is already full. So it can minimize the use of water	Manual dish wash, the water is always on	High
	1.3 communal waste for water waste	Septic tank and manual waste using pool and catfishes	Medium
	1.4 using grease trap for oil, not pouring the oil to the drainage, should be placed in specific container	Throw the grease or oil directly in the drainage along with another water waste	High

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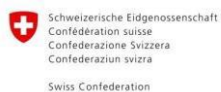
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	1.5. using standard of safety and hygiene in kitchen	No standard safety and hygiene in kitchen	Medium
	1.6. using gas and magic jar to cook the rice	Using traditional stove with firewoods	Medium
	<b>Main activity 2: Homestay</b>		
	<b>Leading practice (benchmark)</b>	<b>Company practice</b>	<b>Improvement potential (high, medium or low)</b>
	2.1. rain harvesting	Using river and well	Low
	2.2. purification plants enabling water to reused	Let the waste flow to a garden and river	Low
	2.3. buy product with the reuse packaging design	Buy product with a lot of plastics waste	Low
	2.4. dry and wet garbage storage	One garbage for all	Low
	2.5. measure the intial consumption of electricity, water, gas and materials	Never measure the use of water, and materials daily or in every events	Medium
	2.6. information and awareness raising among employee and gueststo safe energy	No information for guest and local people to save the energy.	Low
	<b>Main activity 3: Meeting Room (Pendopo)</b>		
	<b>Leading Practice</b>	<b>Company practice</b>	<b>Improvement potential (high, medium or low)</b>
	3.1. turn off the electric devices when it is not in use	20minutes beforethe guests (group) come, the sound is on.	Low
	3.2. information and awareness raising among employee and guests to safe energy	No information for guest and local people to save the energy.	Low
	3.3		
	3.4		
Performance	<b>Main service or product 1: Food and beverage</b>		

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Benchmarking (repeat for each of main products or services of the company)

Aspect (e.g. energy, water, waste)	Benchmarking Unit (e.g. kWh/guest night)	Leading practice (benchmark)	Company practice
1.1. energy	kWh/guest night	>195	715
1.2. material	Kg/guest night	3.1-4.5	0.8
1.3			
<b>Main service or product 2: homestay</b>			
Aspect (e.g. energy, water, waste)	Benchmarking Unit (e.g. kWh/guest night)	Leading practice (benchmark)	Company practice
2.1. water	m3/guest	> 0.7	0.9
2.2.			
2.3			

**Task 2.4: Establish priorities and actions**

Based on mapping of activities and flows, inspection of operations and benchmarking of the company practices and performance appraise potential for RECP implementation and determine priority areas (for further assessment) and priority actions (for immediate implementation), with particular focus for no or low cost options that can be implemented without further analysis and delay <sup>(1)</sup>.

List specific RECP options for consideration (repeat for each main activity area)

Main activity 1: Kitchens	
Specific RECP options for consideration	Applicable RECP practice(s) (please consider applicability of all, i.e. GH, IS, BPC, EM, TC, OSR, UBP and/or PM) <sup>(2)</sup>

<sup>1</sup> Please use relevant guidance documents as a source of 'inspiration' to compile list of possible RECP options (or ideas), including for example: Promoting Resource Efficiency in Small and Medium Enterprises: industrial training handbook, UNEP, 2010 ([http://www.unep.org/pdf/PRE-SME\\_handbook\\_2010.pdf](http://www.unep.org/pdf/PRE-SME_handbook_2010.pdf)); Enterprise-Level Indicators for Resource Productivity and Pollution Intensity: a primer for small and medium enterprises, UNIDO, Vienna, 2010. [http://www.unep.org/resourceefficiency/Portals/24147/scp/presme/pdf/web\\_sme\\_indicator\\_primer.pdf](http://www.unep.org/resourceefficiency/Portals/24147/scp/presme/pdf/web_sme_indicator_primer.pdf); Good Housekeeping Guideline, GTZ, Indonesia, 2010.

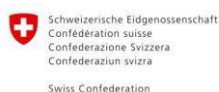
<sup>2</sup> GH = Good Housekeeping; IS = Input Substitution; BPC = Better Process Control; EM = Equipment Modification; TC = Technology Change; OSR = Onsite Reuse & Recycling; UBP = Useful By Product; and PM = Product Modification.

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	1.1. the use of firewood	Use rocket stove, gas or electric rice cooker	
	1.2 traditional stove	Using blower to maximize the fore and minimize the smoke	
	1.3		
	1.4		
	<b>Main activity 2: Homestay</b>		
	Specific RECP options for consideration	Applicable RECP practice(s) (please consider applicability of all, i.e. GH, IS, BPC, EM, TC, OSR, UBP and/or PM)	
	2.1. Lamps	Use LED lamps	
	2.2		
	2.3		
	2.4		
	<b>Main Activity 3: meeting Venue (Pendopo)</b>		
	Specific RECP options for consideration	Applicable RECP practice(s) (please consider applicability of all, i.e. GH, IS, BPC, EM, TC, OSR, UBP and/or PM)	
	3.1. lamps	Use LED lamps	
	3.2. sound system	Only turn the soundsystem when the guests fully come	
	3.3		
<b>RECP Solutions agreed for immediate implementation</b>			
Description	Expected economic benefit	Expected resource use and/or environment benefit	Person responsible
1. using LED lamps	Three times more efficient	Longlasting, reduce solid waste	Sarjana dan Didik Irwanto/ NE
2. using electric rice cooker for cooking the rice	Save more money and reduce illegal logging	No air pollution such carbon and reduce ashes	Sarjana dan Didik Irwanto/ NE.
3. awareness raising among local people and guests about efficiency energy and clean production		More efficient in using the water and other sources	NE

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Overall assessment	Main Activities	Resource Use	Environmental Burden	Costs	Hazards (incl. occupational health & safety)
<i>Use traffic light system to summarize team's overall assessment of the status of use of materials, water and energy ('resource use'), of the generation of waste, waste water and emissions ('environmental burden') and associated costs in different parts of the company. Red = high impact or cost; orange = medium impact or cost; and green = low impact or cost.</i>	<ul style="list-style-type: none"> <li>Activity 1: Kitchens</li> </ul>				
	<ul style="list-style-type: none"> <li>Activity 2: Homestay</li> </ul>				
	<ul style="list-style-type: none"> <li>Activity 3: Pendopo</li> </ul>				
Priority areas agreed for detailed RECP assessment	1. Kitchen 2. Homestay 3. 4.				

### Stage 3: DEVELOPING SOLUTIONS

*DEVELOPING SOLUTIONS is aimed at compiling catalogues (or lists) of feasible RECP solutions for each of the established RECP priority areas, through further generation and customization of RECP options and assessing their technical, environmental and economic feasibility*

#### Task 3.1: Develop RECP Options

*Generate a set of RECP options that is most appropriate to the company's business (its operations, scale, products and services)*

Root Source Analysis  
(for each of RECP priority areas)

RECP Priority Area 1: Kitchen

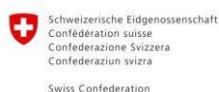
Resource use of concern: Energy and water

Environment issue of concern: GHG emission and effluent

Users	% contribution	Sources	% contribution
1. Stove	70%	1. Firewood, LPG	70%

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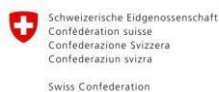


	2. Cooking and dishwashing	25%	2. Water	25%
	3. Lighting	5%	3. Electricity	5%
<b>RECP Priority Area 2: Homestay</b>				
<b>Resource use of concern: Energy and water</b>			<b>Environment issue of concern: GHG emission and effluent</b>	
	<b>Users</b>	<b>% contribution</b>	<b>Sources</b>	<b>% contribution</b>
	1. Household activity	55%	1. Electricity	55%
	2. lighting	15%	2. Electricity	15%
	3. Showering/cleaning	30%	3. Water	30%

Root Cause Diagnosis (undertake for each RECP priority area)	RECP Priority Area 1: Kitchen	RECP Priority Area 2: Homestay
1. How do PRACTICES OF WORKERS AND STAFF contribute to observed resource inefficiencies and/or waste generation?	<p>There is no sign or information to save energy and resource in the kitchen</p> <p>Manual record data (hand writing), no back up data, incomplete data</p> <p>Local people still using firewood to cook because they believe it will produce more delicious food. The stove produces a lot of smoke when cooking. The local people also lack of knowledge about hygiene and cleanliness. When doing preparation, the cooks will throw the waste (onion skin, etc.) directly to the ground and clean them later.</p>	<p>The village use gravitation to flow their water from the source and let the water overflow.</p> <p>Not all of the local people use septic tank for human waste.</p> <p>There is no awareness about saving water because of abundant water source.</p> <p>There is also no awareness to save electricity to guest.</p>
2. How does SELECTION AND USE OF PROCESS INPUTS contribute to observed resource inefficiencies and/or waste generation?	<p>Cooking with traditional stove is not efficient and takes long time to cook. It also wasting almost all the energy from firewood burning.</p> <p>Also, the smoke from the stove would fill the kitchen.</p> <p>Not using glove or apron</p> <p>Let the rubbish spread along the floor</p>	<p>Because they still use gravitation in traditional way to flow the water, there are water spills on the water tank.</p>

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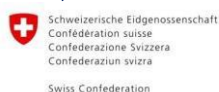


3. How do PROCESS CONDITIONS contribute to observed resource inefficiencies and/or waste generation?	Because the stove is not efficient, it takes lot of firewood and very time consuming to cook. Also, the kitchen does not have ventilation, the people would suffer from smoke when cooking. The kitchen floor is still clay (ground) causing dust if it's dry.	The water spill from overflowed water tank has wasted much fresh water.
4. How do OPERATION AND MAINTENANCE STATUS OF EQUIPMENT contribute to observed resource inefficiencies and/or waste generation?	They never clean the stove from cinder after cooking so there's clearly no maintenance. Traditional stove still become a popular stove for cooking in the village	Many out of date electronical devices like TV and refrigerator
5. How does the CHOICE OF PROCESS TECHNOLOGY contribute to observed resource inefficiencies and/or waste generation?	Traditional technology is still used as part of the culture such as cooking with firewood and traditional stove.	Almost every homestay doesn't use LED lamp
6. What INTERNAL VALUE remains available in the waste streams?	The food waste is used to feed the fish. Also the effluent is used to water the salak field. One garbage for all waste	One garbage for all waste
7. sWhat EXTERNAL VALUE remains available in the waste streams?	The village has a waste bank in partnership with Handayani waste bank.	The village has a waste bank in partnership with Handayani waste bank.
8. How do PRODUCT SPECIFICATIONS contribute to observed resource inefficiencies and/or waste generation?	Some of the stove is three stone stove which only has 15% efficiency.	Looks untidy, just the way it is and some rooms are humid

Option Generation ( <i>undertake for each RECP priority area</i> )	RECP Priority Area 1: Kitchen	RECP Priority Area 2: Homestay
1. What changes in (GOOD) HOUSEKEEPING practices are necessary to minimize observed resource inefficiencies and/or waste generation?	The cooking process should be done in better hygiene practice like wearing apron and gloves. Clean the equipment directly after finish. Cover the floor with ceramics.	Change the bed cover when the new guest come. Giving information to save energy and resource for guest

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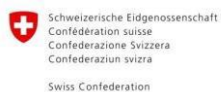
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<p>2. What changes in ENTERPRISE INPUTS are necessary to minimize observed resource inefficiencies and/or waste generation?</p>	<p>record the use of materials, electricity and the equipment, total guests who eat in the village. Minimize the use of plastic for food Build a communal kitchen</p>	<p>Record the use of energy, electricity and resource use, the total guest who stay in homestay (individual)</p>
<p>3. What changes in OPERATING PRACTICES are necessary to minimize observed resource inefficiencies and/or waste generation?</p>	<p>Cooks wear gloves, aprons, and caps when cooking. Wash the dishes when all pile up in one time. Throw the preparation waste right after done to the waste bin, not to the floor. Need to socialize the hygiene and sanitation production practices to the cooks. Change the kitchen floor with ceramic to eliminate dust from the ground.</p>	<p>Raising awareness to both homestay owners and guests about saving electricity and water.</p>
<p>4. What changes in EQUIPMENT are necessary to minimize observed resource inefficiencies and/or waste generation?</p>	<p>Replace the traditional stove with rocket stove which is more efficient. Install smoke blower so the smoke would not stay in the kitchen. Add magnet to the LPG pipe for more efficient use of LPG. Using blower for the stove to maximize the fire and minimize the smoke and ashes</p>	<p>Use LED lamps for more efficient in electricity use. Use solar bottle light to change some lamps in rooms</p>
<p>5. What changes in PROCESS TECHNOLOGY are necessary to minimize observed resource inefficiencies and/or waste generation?</p>	<p>Use rice cooker to cook rice which is the longest product to cook with traditional stove.</p>	<p>Flow the water to fishpond or garden Change the old equipment</p>
<p>6. How can residual value of waste streams be REUSED ON SITE?</p>	<p>n/a</p>	<p>Separate the waste, at least two bins for the waste</p>
<p>7. How can waste streams be converted into USEFUL BYPRODUCT for external use?</p>	<p>n/a</p>	<p>n/a</p>

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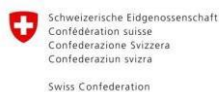


<p>8. What changes in PRODUCT DESIGN AND SPECIFICATIONS are necessary to minimize observed resource inefficiencies and/or waste generation?</p>	<p>Design the stove to be more efficient and doesn't produce lot of smokes. A clean and have enough light kitchen can produce a good product. More creative Packaging design is needed to attract tourist</p>	<p>Change the lamps to LED lamps. Clean the room before the guest come, paint the wall in white color</p>
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Task 3.2: Evaluate feasibility of RECP options									
Options for modification of equipment, processes and/or inputs require further analysis to determine feasibility of investments and changes in costs									
Option 1: Rocket stove									
<p>Technical Summary <i>(succinct description of the best possible technical design and its key operating parameters)</i></p>	<p>Rocket stove or energy saving stove (Tungku Sehat Hemat Energi) is a firewood fueled stove made from clay and aluminum, with smaller diameter of fuel chamber to maximize the efficiency of the heat from firewood. Rocket stove used less fuel compared to traditional stove with 18-37 percent more efficient.</p>								
<p>Is the option operable? <i>(can the option be put in practice)</i></p>	<p><input checked="" type="radio"/> yes <input type="radio"/> no, if no, please explain in brief:</p>								
<p>Specify <i>(what needs to be done to put the option practice)</i></p>	<p>Equipment to be acquired <i>(including process equipment, utilities, monitoring..)</i>: Safety equipment (glove, mask), cleaning supplies (broom, etc.)</p> <p>Works to be performed <i>(including civil, construction, installation..)</i>: Dispose broken traditional stove from the kitchen. Installing the rocket stoves in all dasa wisma's kitchen.</p> <p>Approvals and other support to be secured <i>(including permits, training..)</i> Get the permit from dasa wisma to replace the traditional stove with rocket stove. Socialization on operating and maintaining rocket stove to cooks in all dasa wisma.</p>								
<p>Projected Performance <i>(differentials in</i></p>	<table border="1"> <thead> <tr> <th data-bbox="470 1628 715 1662">Item</th> <th data-bbox="715 1628 847 1662">Unit</th> <th data-bbox="847 1628 1078 1686">Before implementation</th> <th data-bbox="1078 1628 1399 1662">After implementation</th> </tr> </thead> <tbody> <tr> <td colspan="4" data-bbox="470 1686 1399 1722" style="text-align: center;"><b>Productivity Differential</b></td> </tr> </tbody> </table>	Item	Unit	Before implementation	After implementation	<b>Productivity Differential</b>			
Item	Unit	Before implementation	After implementation						
<b>Productivity Differential</b>									

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<i>business output, resource use, waste generation and other operational inputs/outputs, after implementation relative to before implementation)</i>	Business/Product output	Kg of rice	Cook 7,53 kg rice with 28,5 kg firewood	Cook 8,65 kg rice with 28,5 kg firewood.
	Product/Service quality		The cooked food is prone to catch the flying dust from the stove	The cooking process is cleaner with less dust flying out.
	Others...			
	<b>Operational Differential</b>			
	Resource use	Kg of firewood	100 kg of firewood for 350 guests.	85 kg of firewood for 350 guests.
	Waste generation		woods saving = 15 Kg hitung total saving kayu mp	er tahun ?
	Labor requirements		Esti asi harga kayu per K	g nya !
Other process inputs				
Principal environmental and/or resource conservation benefits( <i>narrative summary with quantification to extent reasonably feasible</i> )	To operate rocket stove, it only needed a little fuel to cook the same amount of food. It also save more time to cook since the heat will directly goes to the cooking pot and produce less smoke than using traditional stove. The process condition also become cleaner because the cinder will stay in the chamber of the rocket stove, instead flying out from the stove.			
Is there a net decrease in the use of resources and/or generation of wastes?	<input checked="" type="radio"/> yes (there are no trade-offs) <input type="radio"/> no (there are trade-offs) If no, please explain what trade-offs between different environmental impacts exist, and how these will be mitigated:			
Are any new chemical substances used or created or hazardous conditions created?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the new environmental risks arising from the implementation of the RECP option and summarize control measures:			
Do significant environmental impacts and risks remain after option implementation?	<input type="radio"/> no <input checked="" type="radio"/> yes If yes, please summarize the remaining impacts and risks and specify control measures:			
Annual	Total Material Savings		n/a	[kg/vr]

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Environmental and Resource Conservation Benefits <i>(optional calculation of total benefit, multiplying operational benefits (from technical evaluation) by annual production volume)</i>	Total Water Savings		n/a	[m3/yr]
	Total Energy Savings		43.317,45	[kWh/yr]
	Total Waste Reduction		n/a	[kg/yr]
	Total Waste Water Reduction		n/a	[m3/yr]
	Total Emission Reduction		30.442	[kg/yr]
Calculate the investment cost		Items	Costs (M IDR)	
<i>(using results from specification under technical evaluation)</i>	+	Cost of Acquisitions <ul style="list-style-type: none"> <li>• Cost of equipment</li> <li>• Cost of works</li> <li>• Cost of permits and training</li> </ul>	• Rocket stove cost: 24 x 145.000= 3.480.000	
	+	Cost of Disposal <ul style="list-style-type: none"> <li>• Demolition</li> <li>• Disposal</li> </ul>		
	-	Revenue from Resale <ul style="list-style-type: none"> <li>• Second hand equipment</li> <li>• Obsolete inventory</li> </ul>		
	-	Financial Benefit <ul style="list-style-type: none"> <li>• Subsidies</li> </ul>		
	=	INVESTMENT	3.480.000	
Calculate the operational revenue		Items	Benefit (M IDR/yr)	
<i>(using results from projection under technical evaluation)</i>	+	Revenue Difference <ul style="list-style-type: none"> <li>• Productivity</li> <li>• Quality</li> </ul>		
	-	Cost Difference <ul style="list-style-type: none"> <li>• Process inputs</li> <li>• Non Product process outputs</li> </ul>		
	-	Incidental Support <ul style="list-style-type: none"> <li>• Expert service etc.</li> </ul>	Firewood potential	
	-	Other costs <ul style="list-style-type: none"> <li>• Recruitments, etc.</li> </ul>	cost saving: 2.244.632 ? drmn	
	=	OPERATIONAL REVENUE	2.244.632	
Pay Back Period	0,9 ?	Divide INVESTMENT by OPERATIONAL REVENUE		

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Net Present Value	12.891.100,28	Calculate and sum up discounted cash flow over the economic lifespan of the option using set discount ratio

### Task 3.2: Evaluate feasibility of RECP options

Options for modification of equipment, processes and/or inputs require further analysis to determine feasibility of investments and changes in costs

#### Option 2: LED lamps

Technical Summary (succinct description of the best possible technical design and its key operating parameters)	LED (Light Emitting Diode) is a two-lead semiconductor light source product and active (emits light) when activated when suitable voltage is applied. LED is assembled in a lamp for lighting purposes. It is seen as more efficient source of light rather than most fluorescent lamps.			
Is the option operable? (can the option be put in practice)	<input checked="" type="radio"/> yes <input type="radio"/> no, if no, please explain in brief:			
Specify (what needs to be done to put the option practice)	Equipment to be acquired (including process equipment, utilities, monitoring..):			
	Safety equipment, lamp changer kit			
	Works to be performed (including civil, construction, installation..):			
	Remove old lamps from the socket of light fixture in homestays. Install the LED lamps.			
Projected Performance (differentials in business output, resource use, waste generation and other operational inputs/outputs, after implementation relative to before)	Approvals and other support to be secured (including permits, training,..)			
	Ask for a permit from the homestay owner to change the bulb with LED lamps. Educate about the benefit on using LED lamps.			
	Item	Unit	Before implementation	After implementation
	<b>Productivity Differential</b>			
Business/Product output	Electricity (kWh/year)	560 of 15 watt Fluorecent Lamps used 42924 kWh/year	560 of 5 watt LED lamps used 14308 kWh/year	
Product/Service quality				
Others...				

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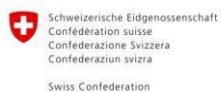
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<i>implementation)</i>	<b>Operational Differential</b>			
	Resource use	Electricity (kWh/year)	560 15 watt Fluorecent Lamps used 42924 kWh/year	560 of 5 watt LED lamps used 14308 kWh/year
	Waste generation			
	Labor requirements			
	Other process inputs			
Principal environmental and/or resource conservation benefits( <i>narrative summary with quantification to extent reasonably feasible</i> )	LED lamp is an energy efficient lamp that emits light with less electricity compared to fluorescent lamp thus have less emission. It is also have longer life-span, for about 10-15 years.			
Is there a net decrease in the use of resources and/or generation of wastes?	<input checked="" type="radio"/> yes (there are no trade-offs) <input type="radio"/> no (there are trade-offs) If no, please explain what trade-offs between different environmental impacts exist, and how these will be mitigated:			
Are any new chemical substances used or created or hazardous conditions created?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the new environmental risks arising from the implementation of the RECP option and summarize control measures:			
Do significant environmental impacts and risks remain after option implementation?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the remaining impacts and risks and specify control measures:			
Annual Environmental and Resource Conservation Benefits ( <i>optional</i> )	Total Material Savings			[kg/yr]
	Total Water Savings			[m3/yr]
	Total Energy Savings		28616	[kWh/yr]
	Total Waste Reduction			[kg/yr]
	Total Waste Water Reduction			[m3/yr]

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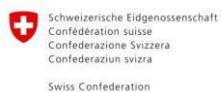
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<i>calculation of total benefit, multiplying operational benefits (from technical evaluation) by annual production volume)</i>	Total Emission Reduction		20111	[kg/yr]
Calculate the investment cost		Items	Costs (M IDR)	
<i>(using results from specification under technical evaluation)</i>	+	Cost of Acquisitions <ul style="list-style-type: none"> <li>• Cost of equipment</li> <li>• Cost of works</li> <li>• Cost of permits and training</li> </ul>	560 LED lamps: 560 x 40.000= 22.400.000	
	+	Cost of Disposal <ul style="list-style-type: none"> <li>• Demolition</li> <li>• Disposal</li> </ul>	n/a	
	-	Revenue from Resale <ul style="list-style-type: none"> <li>• Second hand equipment</li> <li>• Obsolete inventory</li> </ul>	n/a	
	-	Financial Benefit <ul style="list-style-type: none"> <li>• Subsidies</li> </ul>		
	=	INVESTMENT	22.400.000	
Calculate the operational revenue		Items	Benefit (M IDR/yr)	
<i>(using results from projection under technical evaluation)</i>	+	Revenue Difference <ul style="list-style-type: none"> <li>• Productivity</li> <li>• Quality</li> </ul>	LED potential cost saving: 21.462.000	
	-	Cost Difference <ul style="list-style-type: none"> <li>• Process inputs</li> <li>• Non Product process outputs</li> </ul>		
	-	Incidental Support <ul style="list-style-type: none"> <li>• Expert service etc.</li> </ul>		
	-	Other costs <ul style="list-style-type: none"> <li>• Recruitments, etc.</li> </ul>		
	=	OPERATIONAL REVENUE	-	
Pay Back Period	0,016	<i>Divide INVESTMENT by OPERATIONAL REVENUE</i>		
Net Present Value	20.524.000	<i>Calculate and sum up discounted cash flow over the economic lifespan of the option using set discount ratio</i>		

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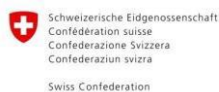
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<b>Option 3: LPG magnet (repeat for subsequent options)</b>																																									
Technical Summary <i>(succinct description of the best possible technical design and its key operating parameters)</i>	Two couple of Magnet can maximize the fire and the heat by attaching the magnet in the hose of the LPG. It can be proven by comparing the cooking water with magnet and without the magnet. It can be saved 20%-50%.																																								
Is the option operable? <i>(can the option be put in practice)</i>	<input checked="" type="radio"/> yes <input type="radio"/> no, if no, please explain in brief:																																								
Specify <i>(what needs to be done to put the option practice)</i>	Equipment to be acquired <i>(including process equipment, utilities, monitoring..):</i>																																								
	It needs a tape, attach or stick the hose of LPG by magnet with a cut of tape like a circle.																																								
	Works to be performed <i>(including civil, construction, installation..):</i>																																								
	Just need to make sure that the attach/the stick is strong.																																								
	Approvals and other support to be secured <i>(including permits, training,..)</i>																																								
	Simple installation just like we stick or unite something with a cut of tape.																																								
Projected Performance <i>(differentials in business output, resource use, waste generation and other operational inputs/outputs, after implementation relative to before implementation)</i>	<table border="1"> <thead> <tr> <th>Item</th> <th>Unit</th> <th>Before implementation</th> <th>After implementation</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="text-align: center;"><b>Productivity Differential</b></td> </tr> <tr> <td>Business/Product output</td> <td>Electricity (kWh/year)</td> <td></td> <td></td> </tr> <tr> <td>Product/Service quality</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Others...</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="4" style="text-align: center;"><b>Operational Differential</b></td> </tr> <tr> <td>Resource use</td> <td>Electricity (kWh/year)</td> <td></td> <td></td> </tr> <tr> <td>Waste generation</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Labor requirements</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Other process inputs</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Item	Unit	Before implementation	After implementation	<b>Productivity Differential</b>				Business/Product output	Electricity (kWh/year)			Product/Service quality				Others...				<b>Operational Differential</b>				Resource use	Electricity (kWh/year)			Waste generation				Labor requirements				Other process inputs			
	Item	Unit	Before implementation	After implementation																																					
	<b>Productivity Differential</b>																																								
	Business/Product output	Electricity (kWh/year)																																							
	Product/Service quality																																								
	Others...																																								
	<b>Operational Differential</b>																																								
	Resource use	Electricity (kWh/year)																																							
	Waste generation																																								
	Labor requirements																																								
Other process inputs																																									

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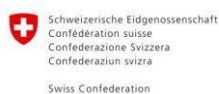
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Principal environmental and/or resource conservation benefits ( <i>narrative summary with quantification to extent reasonably feasible</i> )	LED lamp is an energy efficient lamp that emits light with less electricity compared to fluorescent lamp thus have less emission. It is also have longer life-span, for about 10-15 years.		
Is there a net decrease in the use of resources and/or generation of wastes?	<input checked="" type="radio"/> yes (there are no trade-offs) <input type="radio"/> no (there are trade-offs) If no, please explain what trade-offs between different environmental impacts exist, and how these will be mitigated:		
Are any new chemical substances used or created or hazardous conditions created?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the new environmental risks arising from the implementation of the RECP option and summarize control measures:		
Do significant environmental impacts and risks remain after option implementation?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the remaining impacts and risks and specify control measures:		
Annual Environmental and Resource Conservation Benefits ( <i>optional calculation of total benefit, multiplying operational benefits (from technical evaluation) by annual production volume</i> )	Total Material Savings		[kg/yr]
	Total Water Savings		[m3/yr]
	Total Energy Savings		20-50% [kWh/yr]
	Total Waste Reduction		[kg/yr]
	Total Waste Water Reduction		[m3/yr]
	Total Emission Reduction		10.055 [kg/yr]
Calculate the investment cost		Items	Costs (M IDR)
( <i>using results from specification under technical evaluation</i> )	+	Cost of Acquisitions <ul style="list-style-type: none"> <li>• Cost of equipment</li> <li>• Cost of works</li> <li>• Cost of permits and training</li> </ul>	

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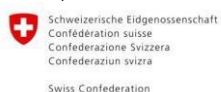
	+	Cost of Disposal <ul style="list-style-type: none"> <li>• Demolition</li> <li>• Disposal</li> </ul>	
	-	Revenue from Resale <ul style="list-style-type: none"> <li>• Second hand equipment</li> <li>• Obsolete inventory</li> </ul>	
	-	Financial Benefit <ul style="list-style-type: none"> <li>• Subsidies</li> </ul>	
	=	INVESTMENT	
Calculate the operational revenue		Items	Benefit (M IDR/yr)
<i>(using results from projection under technical evaluation)</i>	+	Revenue Difference <ul style="list-style-type: none"> <li>• Productivity</li> <li>• Quality</li> </ul>	
	-	Cost Difference <ul style="list-style-type: none"> <li>• Process inputs</li> <li>• Non Product process outputs</li> </ul>	
	-	Incidental Support <ul style="list-style-type: none"> <li>• Expert service etc.</li> </ul>	
	-	Other costs <ul style="list-style-type: none"> <li>• Recruitments, etc.</li> </ul>	
	=	OPERATIONAL REVENUE	
Pay Back Period			<i>Divide INVESTMENT by OPERATIONAL REVENUE</i>
Net Present Value			<i>Calculate and sum up discounted cash flow over the economic lifespan of the option using set discount ratio</i>

#### **Option 4: Air cooler (repeat for subsequent options)**

Technical Summary <i>(succinct description of the best possible technical design and its key operating parameters)</i>	LED (Light Emitting Diode) is a two-lead semiconductor light source product and active (emits light) when activated when suitable voltage is applied. LED is assembled in a lamp for lighting purposes. It is seen as more efficient source of light rather than most fluorescent lamps.
Is the option operable? <i>(can the option be put in practice)</i>	<input checked="" type="radio"/> yes <input type="radio"/> no, if no, please explain in brief:

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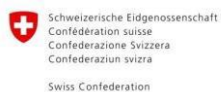
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Specify (what needs to be done to put the option practice)	Equipment to be acquired (including process equipment, utilities, monitoring..):			
	Safety equipment, lamp changer kit			
	Works to be performed (including civil, construction, installation..):			
	Remove old lamps from the socket of light fixture in homestays. Install the LED lamps.			
	Approvals and other support to be secured (including permits, training,..)			
	Ask for a permit from the homestay owner to change the bulb with LED lamps. Educate about the benefit on using LED lamps.			
	Projected Performance (differentials in business output, resource use, waste generation and other operational inputs/outputs, after implementation relative to before implementation)	<b>Item</b>	<b>Unit</b>	<b>Before implementation</b>
<b>Productivity Differential</b>				
Business/Product output		Electricity (kWh/year)	560 15 watt Fluorecent Lamps used 42924 kWh/year	560 10 watt LED lamps used 28616 kWh/year
Product/Service quality				
Others...				
<b>Operational Differential</b>				
Resource use		Electricity (kWh/year)		
Waste generation				
Labor requirements				
Other process inputs				
Principal environmental and/or resource conservation benefits(narrative summary with quantification to extent reasonably feasible)	LED lamp is an energy efficient lamp that emits light with less electricity compared to fluorescent lamp thus have less emission. It is also have longer life-span, for about 10-15 years.			

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Is there a net decrease in the use of resources and/or generation of wastes?	<input checked="" type="radio"/> yes (there are no trade-offs) <input type="radio"/> no (there are trade-offs) If no, please explain what trade-offs between different environmental impacts exist, and how these will be mitigated:		
Are any new chemical substances used or created or hazardous conditions created?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the new environmental risks arising from the implementation of the RECP option and summarize control measures:		
Do significant environmental impacts and risks remain after option implementation?	<input checked="" type="radio"/> no <input type="radio"/> yes If yes, please summarize the remaining impacts and risks and specify control measures:		
Annual Environmental and Resource Conservation Benefits ( <i>optional calculation of total benefit, multiplying operational benefits (from technical evaluation) by annual production volume</i> )	Total Material Savings		[kg/yr]
	Total Water Savings		[m3/yr]
	Total Energy Savings	14308	[kWh/yr]
	Total Waste Reduction		[kg/yr]
	Total Waste Water Reduction		[m3/yr]
	Total Emission Reduction		[kg/yr]
Calculate the investment cost		Items	Costs (M IDR)
<i>(using results from specification under technical evaluation)</i>	+	Cost of Acquisitions <ul style="list-style-type: none"> <li>• Cost of equipment</li> <li>• Cost of works</li> <li>• Cost of permits and training</li> </ul>	
	+	Cost of Disposal <ul style="list-style-type: none"> <li>• Demolition</li> <li>• Disposal</li> </ul>	
	-	Revenue from Resale <ul style="list-style-type: none"> <li>• Second hand equipment</li> <li>• Obsolete inventory</li> </ul>	
	-	Financial Benefit <ul style="list-style-type: none"> <li>• Subsidies</li> </ul>	
	=	INVESTMENT	

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Calculate the operational revenue		Items	Benefit (M IDR/yr)
<i>(using results from projection under technical evaluation)</i>	+	Revenue Difference <ul style="list-style-type: none"> <li>• Productivity</li> <li>• Quality</li> </ul>	
	-	Cost Difference <ul style="list-style-type: none"> <li>• Process inputs</li> <li>• Non Product process outputs</li> </ul>	
	-	Incidental Support <ul style="list-style-type: none"> <li>• Expert service etc.</li> </ul>	
	-	Other costs <ul style="list-style-type: none"> <li>• Recruitments, etc.</li> </ul>	
	=	OPERATIONAL REVENUE	
Pay Back Period		<i>Divide INVESTMENT by OPERATIONAL REVENUE</i>	
Net Present Value		<i>Calculate and sum up discounted cash flow over the economic lifespan of the option using set discount ratio</i>	

#### ALL OPTIONS

Option description	Economics				Environment	
	Investment (IDR)	Revenue (IDR)	Pay back	NPV	Resources Conservation (kWh/yr)	Waste Reduction (CO2 eq kg/yr)
Rocket stove	3.480.000	2.224.632	0,002		43317,45	30442
LED lamps	22.400.000	20.524.000	0,016		28616	20111
LPG magnet	600.000	1.416.000	0,001		4112,64	2953
Solar Bottle lights	35.336.000	23.072.000	0,025		8176	5746

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**Stage 4: ACHIEVING CONTINUOUS IMPROVEMENT**

*ACHIEVING CONTINUOUS IMPROVEMENT is concerned with ensuring that feasible RECP solutions get implemented, results thereof are monitored and enabling conditions created for continuing and expanding the application of RECP in the company.*

**Task 4.1: Implement and monitor feasible RECP solutions**

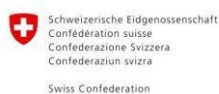
Action Plan	AGREED RECP solutions	Responsible person	Start implementation	Complete implementation	Milestones
<i>Put together the options agreed for implementation in task 2.4 and 3.2 and agree on timeline, milestone and responsibilities for implementation</i>	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
RECP Accomplishments	IMPLEMENTED RECP Solutions	Actual Investment (million IDR)	Actual Annual Savings (million IDR/yr)	Actual Annual Resource Savings (water, materials & energy)	Actual Annual Pollution Reduction (waste, waste water & emissions)
<i>Prepare and regularly update table of achievements covering all implemented options, analyse any differences with projected benefits (from feasibility studies) for further optimization of RECP options</i>	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
Update RECP profile, relative to baseline (task 1.2) to track relative improvements					

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Calculation period		<i>Typically first year since start of RECP assessment</i>
Total production (in units, tons, and/or financial value)		<i>Sum up the annual production volume of the company's products</i>
Total materials use (in kg, ton and/or total costs)		<i>Sum up in weight units all materials used, including product raw materials, auxiliary materials, packaging, etc.</i>
Total water use (in m <sup>3</sup> , GL and/or total costs)		<i>Sum up in volume units water used for all uses (process, cleaning, cooling etc.) from all sources, including city water, ground water, surface water</i>
Total energy use (in MJ, kWh and/or total costs)		<i>Convert all types of energy (power, fuels, etc.) into common energy unit and sum up their use</i>
Total waste generation (in kg, ton and/or total costs)		<i>Sum up in weight units all waste streams from company, regardless of their disposal or recycling method</i>
Total waste water generation (in m <sup>3</sup> , GL and/or total costs)		<i>Sum up in volume units all waste water streams leaving company, regardless of their treatment or discharge method</i>
Total air emissions (in kg, ton and/or associated costs)		<i>Convert energy use, using equivalent greenhouse gas emission factors and sum up</i>
Materials Productivity		<i>Divide total production by total materials consumption</i>
Water Productivity		<i>Divide total production by total water consumption</i>
Energy Productivity		<i>Divide total production by total energy consumption</i>
Waste Intensity		<i>Divide total waste generation by total production</i>
Waste Water Intensity		<i>Divide total waste water generation by total production</i>
Emission Intensity		<i>Divide total emission by total production</i>

**Task 4.2: Manage for continuous improvement**

*Provide recommendations to help company make RECP a daily routine and integrate RECP into its management and information systems*

Recommendations with regard to FUTURE RECP PRIORITIES for company (for assessment and/or investment)

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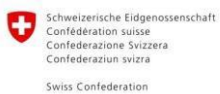
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<p>Recommendations for IMPROVEMENT OF ENVIRONMENTAL ACCOUNTING in company</p>	
<p>Recommendations for ENVIRONMENTAL POLICY AND LEADERSHIP of the company</p>	
<p>Recommendations for ENGAGING AND REWARDING employees and staff for their environmental initiatives and achievements</p>	

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