Composting reduces methane emissions on Bali

Project summary

With the carbon offset project "Gianyar Waste Recovery" on Bali, Indonesia, myclimate and its local partner Yayasan Pemilahan Sampah Temesi (Waste Sorting Temesi Foundation) not only contribute to climate protection, but also to environmental protection and the long-term improvement of living conditions for inhabitants of the region of Gianyar. By composting organic waste, various environmental and general improvements are made to living conditions, such as reducing hazardous smoke and pests, recovering non-renewable resources, capacity building in a community and creating new jobs, to name only a few.

Project benefits

The project not only leads to a reduction of methane, but also makes a significant contribution to sustainable development in the region:

- A decentralised and politically easy-to-implement waste recovery model with low risks as an alternative to expensive and often problematic centralised "waste-to-energy" facilities
- Reduction of emissions of hazardous smoke and toxic seepage from the landfill in the village of Temesi
- Recovery of non-renewable resources
- Poverty alleviation by creating more than 100 jobs in the facility and in the outsourced waste separation process
- Capacity building in a community empowerment project
- All tools to replicate the model for a large-scale waste recovery facility elsewhere
- A detailed, scientifically based composting manual

Facts and figures on the carbon offset project

Project location	Indonesia, province of Bali, town of Temesi
Project standard	CDM
Project type	CH_4 Methane reductions
Emission reductions	72,998 t CO_2e (over 10 years)
Situation without project	Methane emissions from the landfill
Project start	November 2008

The project country

With the tourist boom starting in the early 1970s, Bali became much more modern with regard to public services such as roads, telecommunications, education and health. Nevertheless, the local culture stayed remarkably resilient to outside influences. One of Bali's major environmental challenges at the present time is local waste management and traffic on the island. Bali as primary travel destination is confronted with increasing waste and traffic problems that are already having negative effects on the island's tourist sector. Due to an increasing population, tourism and the prosperity of the Balinese people, huge amounts of waste are often disposed of in rivers, canals and on roadsides. At present, Bali's government is making strong efforts to raise people's awareness regarding more sustainable waste collection. Nevertheless, there is still no modern waste infrastructure, which means waste is often dumped in landfills close to villages without methane capturing. The burning of this waste not only causes environmental pollution in nearby living areas, affecting people's health and tourism directly, but also creates very high amounts of CO_2. Moreover, landfills without methane capturing create the strong greenhouse gas methane, which is approximately 21 times more harmful than CO_2.

Map of Bali: the red circle shows the project region with the village of Ubud.


Employees filling the high-quality compost into bags.

Indicator	Indonesia	Switzerland
Total area (in km²)	1,904,569	41,285
Population	237,556,363	7,870,134
GDP in USD per capita (2010)	2,946 USD	67,464 USD
Share of population living below the national poverty lines (2010)	13.3 %	6.9 %
Energy use per capita (kg of oil, 2009)	851 kg	3,362 kg
CO_2-emissions per capita (in 2008)	1.7 t	5.3 t
	Jakarta	Zurich
Min. working time to buy 1 kg of rice in min.	47	9
Min. working time to buy 1 kg of bread in min.	80	12

Indonesia vs. Switzerland (Source: World Development Indicators, web.worldbank.org; CIA World Factbook, web.cia.gov; Bundesamt für Statistik [2010])

The situation in the project region

The people of the Regency of Gianyar and the village of Temesi face the impact of the local waste pollution directly. This waste pollution is even more problematic in rural regions, as agriculture is the main occupation of the local villagers. Besides agriculture, many inhabitants of the Regency of Gianyar find work in the production of traditional bricks, which are used to build temples and traditional houses. Even though waste was already collected and brought to a landfill before the implementation of the project, there was no methane capturing and the waste was burned nearby the village of Temesi. As organic matter makes up 85 percent of the local waste, huge amounts of the harmful greenhouse gas methane can be avoided by composting. Moreover, the resulting high-quality compost can be used as a natural fertiliser, helping local farmers to cultivate their crop fields more effectively and sustainably.

How the project is implemented

In order to face the waste problem of the Regency of Gianyar effectively and sustainably, the Rotary Club of Bali Ubud firstly implemented a pilot facility in 2004 to set up all parameters for the intended large-scale waste recovery facility. This 400 m^2 pilot facility was built on the old landfill in Temesi, which means it was built on about seven metres of waste that cannot produce any emissions any more. The pilot facility was built with the goal of later functioning as an ecological park and raising awareness of environmental issues among pupils, local adults and tourists. The installation worth USD 140,000 could process four tonnes of waste daily and was operating from 2004 to 2007.

By June 2007, enough experience and information had been gained to start the main facility. At this time, the pilot facility had already gained wide local and international attention. Consequently, the stakeholder's expectations for the main facility were raised and the project worker's motivation was strengthened to meet these expectations.

To start the main facility, the construction of a 2,400 m^2 roof over the old landfill became necessary, as waste separation and composting can only be carried out with an appropriate covering. In 2008, the first part of the large-scale facility was finished, processing 30 tonnes daily or about six times the amount of the pilot facility. In November of the same year, the CDM (Clean Development Mechanism) registration of the United Nations was received. For the purpose of processing the waste efficiently and sustainably, the facility was equipped with a shredder for organics, a compost

Waste is becoming more and more of a problem for agriculture and tourism in Bali.

"Keep Bali clean – stop pollution" poster from the local partner GUS Foundation

Employees separating waste on a convey belt

The photovoltaic cells and the wind turbine are part of the Education Park.

The Education Park is intended to sharpen people's environmental awareness and demonstrate the possibilities of sustainable energies.

sieve and a blower system with air ducts for forced aeration composting.

Nevertheless, 30 tonnes more had to be processed daily to finally cope with the entire waste of the 500,000 inhabitants of the Regency of Gianyar and to serve as a replicable full-scale model facility. Therefore, another roof had to be built in 2009, providing a further 2,400 m^2 of covered space and more equipment had to be brought in. By the end of 2009, the facility could already process 60 tonnes of waste per day or 21,000 tonnes per year.

At the same time as the large-scale facility commenced operations, the redundant pilot facility was converted into an ecological park. This park forms part of the Complementary Educational Centre where information on environmental subjects is given to visitors such as schools, local adults and tourists. Approximately 5,000 visitors from all of Indonesia's regions and cities are attracted by the centre every year. Even at the present time, the pilot plant's research station and laboratory are still being used for further technical improvements to the process cycle of the main facility.

Organisation of the project

The construction of the facility as well as its expansion was initiated and carried out by the Rotary Club of Bali Ubud together with the local GUS Foundation. International institutions like SANDEC (Department of Water and Sanitation in Developing Countries) from the Swiss Federal Institute of Technology as well as local institutions such as the Regency of Gianyar are supporting the project, for example by providing technical knowledge (in the case of SANDEC), helping with administrative matters, lending the land or providing free health services (in the case of the Regency of Gianyar). In 2008, the Rotary Club of Bali Ubud transferred all assets and the management of the Gianyar Waste Project in Temesi to the local foundation Yayasan Pemilahan Sampah Temesi (YPST), but it continues to support the facility financially and with consultancy. These decentralised waste recovery facilities have met with high acceptance from the population, as they not only reduce emissions, but also create highly welcomed jobs. The partner in terms of CDM carbon credits is myclimate, which is the buyer of all the emission reductions generated in this project. The Swiss travel agency Kuoni, as a client of myclimate, took the unique opportunity to offset its emissions and those of its travel customers in this composting project. The revenues from myclimate were and will be used for covering implementation and operating costs, facility expansions and, if possible, for the funding of project replications.

Replicable full-scale model facility

One of the project's most important and sustainable benefits is the criterion of replication of the full-scale model facility. Subsequently, it was essential for the Gianyar Waste Recovery Project that the facility can process at least the entire 60 tonnes of waste collected each day in the Regency of Gianyar. Only if a full-scale facility is able to process this amount of waste can it be a credible model for replication in about 500 regencies and municipalities of Indonesia or even for various developing countries. The model facility's potential for replication has already raised high interest from officials from all provinces of Indonesia and from many NGOs. Some identical full-scale facilities are already in the planning stage.

Composting in the Gianyar Waste Recovery Project

The 60 tonnes of waste generated daily by the 500,000 or so inhabitants of the Regency of Gianyar consist of various matters of which a multitude can be separated in an environmentally friendly manner. The main component (about 85 percent) of the waste is organic matter that can be composted instead of being disposed of on the old landfill, as was the case before the project was implemented. The non-organic material, mostly plastic, forms about five percent of the waste and is sold to recyclers. The remaining residual ten percent can be disposed of safely on the neighbouring landfill after hazardous material has been removed. This approach allows an extension of the landfill's life by a factor of ten.

New compost sieve: non-conical, self-cleaning and long-living.

The pilot plant's laboratory is still used for further technical improvements to the process cycle of the main facility.

The old landfill where waste was dumped and burned without methane capturing.

The old landfill

Environmental aspects

Waste was dumped in the old landfill close to the village without methane capturing.

Waste was burned and caused high amounts of CO_2 as well as environmental pollution in nearby living areas.

A lack of methane capturing created high amounts of methane.

Sustainable aspects

People's health and tourism were affected by pollution created by the burning of waste.

Tourism was negatively affected by waste and pollution.

The new facility with the Educational Centre in the front.

The new waste recovery facility

Environmental aspects

Emission reduction of hazardous smoke and pests from the landfill in the village of Temesi.

Reduction of the waste volume going to the landfill by 90 per cent, thus extending the useful life of the landfill.

Recovery of non-renewable resources.

Sustainable aspects

Poverty alleviation by creating more than 100 jobs in the facility and in the outsourced waste separating process.

Development of a composting manual and tools to replicate the model facility.

Sharpening of environmental awareness thanks to the Educational Centre.

High-quality compost is used as a natural fertiliser and helps farmers to cultivate their crop fields.

Selling 15 tonnes of compost per day is a major headache

The main environmental component of the project is the implementation of aerobic composting that allows the avoidance of the strong greenhouse gas methane from anaerobic decay, which is about 21 times as harmful as CO_2. Pumping air into the windrows with a horizontal system of pipes ensures aerobic decomposition and a reduction of volatile organic compounds. This generates high-quality compost that can be used as a natural fertiliser. This high-quality compost is sold preferably to farmers and allows for the restoration of valuable soil that was depleted before by an overuse of chemical fertilisers.

Sufficient demand for the high-quality compost is a main condition of the project. Even though such demand generally exists, continuous efforts are being made to guarantee sufficient demand in the future as well. The sale of the compost has proved to be the main problem for the project according to responsible persons on-site: "Selling 15 tonnes of compost per day

To ensure aerobic decompostition, air is pumped into the compost material.

The end product is high-quality compost that can be used by local farmers as natural fertiliser.

is a major headache. Originally it was planned to sell it to farmers to allow them to harvest organic produce. However, they have access to fertilisers that are subsidised at a rate of 92 percent. This leaves us with applications in the landscaping, recreational and hotel market. The project still struggles to breakeven without the help of carbon offset credits." The main effort in this area is promoting the value of farming with compost, which is inoculated with effective micro-organisms.

Training and awareness building

In order to raise environmental education, a Complementary Educational Centre was built in the redundant 400 m^2 of the pilot plant building. The visitors to the centre (mainly schools with up to 350 students, government officials, non-profit organisations or tourists) find interesting and important facts on climate change, energy saving, recycling, alternative energy and water issues in the indoor part.

The outdoor section includes the waste recovery facility, wind and photovoltaic energy production, biogas from toilet waste, composting and renewable building material. To gain the full attention of the visitors, all information is adapted didactically, some of it in an interactive way.

Monitoring and emission reduction calculation

The facility management has introduced a quality system, which is similar to ISO 9001. This quality system has three hierarchical levels. The first level relates to the quality manual. The second level is operating procedures (OP). The OP´s document the activities that need to be carried out to ensure CDM-related issues and to achieve the necessary level of quality in the products and services. They also define how CDM and quality records are maintained to provide evidence of monitoring.

A number of different parameters, such as the total weight of the organic waste composted, the weight fraction of the different waste types and the total on-site diesel consumption, are monitored regularly or even continuously and recorded. All the calculations and the different quality control measures must follow the instructions and guidelines set by the corresponding CDM methodology in order to guarantee a conservative quantification of the emission reductions. The accuracy of the monitoring is controlled and verified by an external body.

The sale of the compost is still a major challenge for the project.


The largest share of work is the separation of the waste components.


The Educational Centre is frequently visited by schools and tourists.

All environmental and health information is adapted didactically.

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