CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Gianyar Waste Recovery Project

PDD Version 3, April 8, 2008

A.2. Description of the small-scale project activity:

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Background

Bali, Indonesia's primary travel destination faces an escalating waste problem that already affects its tourist sector. In the formerly pristine environment, waste is now disposed indiscriminately in rivers, canals and roadside. The waste problem in Bali, like elsewhere in Indonesia needs urgent attention and the Rotary Club of Bali Ubud together with other donors is sponsoring a solution that can be replicated elsewhere. Currently the collected waste of the project region in Gianyar Regency in Bali is dumped on a landfill without methane capturing and flaring nearby the village of Temesi.

85% of the waste in this region is of organic matter, which can be composted instead of disposed on the existing landfill. About 5% is non-organic material (mostly plastic) that can be recovered and sold to recyclers. The remaining 10% of the collected waste can be dumped safely on the neighbouring landfill. Composting of the organic fraction will avoid methane emissions from anaerobic decay, increase the lifetime of the existing landfill massively and produce high quality compost for use as natural fertilizer.

As compost is the major product, the production of consistent high-quality compost must be assured during the critical scale-up stage. A sufficient demand already exists for the large quantities of compost and other recyclables that the Gianyar facility markets or intends to market. Continues efforts are being made to promote the value of farming with compost that is inoculated with effective micro-organisms. Yet to fully assure a profitable operation and mitigate financial risks during operation, Carbon Credits under the Kyoto Protocol's Clean Development Mechanism (CDM) are sought.

Project description

<u>Pilot plant</u>

The Rotary Club Bali Ubud has already implemented a USD 140'000 pilot facility for waste recovery with processing capacity of 4 tons of waste per day. In the past years 2 tons of waste per day was routinely processed. This facility has been build next to the existing landfill and is operational since early 2005. The facility is well equipped with laboratory and research station where large scale forced aeration composting is studied and continuously improved. Main research directions of the pilot facility have been:

Optimal aeration	The parameters bacteria count, moisture, temperature, oxygen and carbon dioxide concentration, processing time depend all on an adequate aeration by pressure and/or vacuum. The aeration design and control needs to be better understood to optimize the interaction

	between all parameters.
Optimal pile size and shape	The economics of scale also depend on the composting pile size and pile shape. The larger the piles the less area is needed and manipulations become more efficient. While maintaining the need for a short processing time and high quality, the optimal pile size and shape must be established.
Active moisture control	Moisture is lost by microorganism activity and evaporation due to aeration and needs to be replaced to keep it within the optimal range. Water does not migrate well within the composting piles. Various watering methods need to be explored to assure an even moisture content and distribution throughout the piles.
Pathogen, weed and pest control	Pathogens, disease organisms, weed seeds, fly larvae and other pests must be destroyed during the composting process. Heat treatment or inoculations of compost with beneficial bacteria (which are antagonists of plant and soil pathogens) are still too little understood, especially under tropical conditions.
Designer compost	Many plant and soil diseases can be controlled by microorganisms. They also can improve crop quality. In Bali the growth of vanilla and melons are already successful examples of dedicated composts. In collaboration with a microbiology laboratory, tailor-made composts for further crops and soil conditioning will be developed.

Main purpose of the pilot facility is to optimize composting processes and develop a replicable waste treatment model for the region. The first result of this research is the extension of the pilot facility to a full scale composting plant.

Project activity

The project activity is the expansion of the facility's capacity to 50 tons of waste per day or around 17'500 tons per year, to cope with all waste in the Gianyar Regency with its 500'000 inhabitants. This capacity expansion requires additional space and equipment, amounting to additional USD 383'000 investment.

The existing 400 m^2 building will accommodate two additional shredder, blowers to aerate the compost piles and the existing baler. A new covered 5'000 m^2 area under light steel constructions will house waste sorting on 700 m^2, composting in table piles on 3'200 m^2, compost curing and compost storage on 1'100 m^2, as well as an additional compost sieve and compost mixer. For managing and handling of compost and waste on-site additional vehicles are required. A new waste water garden will process the waste water from the facility. Annex 5 gives a detailed list of the additional technical requirements and installations. The plant is expected to commence operation end 2007.

The project plan contains the option to extent the processing capacity in the future up to 100 tons of waste per day to cope with increasing waste volumes due to increased collection capacity and economic growth in the region. The execution of the option depends on the successful operation of the facility in its initial capacity. A significant contribution to the commercially viable operation of the plant are the revenues from the sale of the carbon credits during the critical first years. (see also section B.5.)

Expected results and benefits

- A decentralized and politically easy to implement waste recovery model with low risks as alternative to expensive and often problematic centralized "Waste-to-Energy" facilities,
- Reduction of emissions of hazardous smoke and toxic seepage from the landfill in the village of Temesi,
- Reducing the waste volume going to the landfill by 90 %, thus extending the useful life of the landfill,
- Recovery of non-renewable resources,
- Poverty alleviation by creating over 85 new jobs, predominantly women,
- Capacity building in a community empowerment project,
- All tools to replicate the model large scale waste recovery facility elsewhere,
- A detailed scientifically based Composting Manual for dissemination.

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants	Party involved wishes to be considered as project participant
Republic of Indonesia	Rotary Club of Bali Ubud	No
Republic of Indonesia	Yayasan GUS (Gelombang Udara Segar)	No
Switzerland	MyClimate, The climate protection partnership	No

>> Detailed information on the project participant is available in Annex 1

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

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Republic of Indonesia, South Asia

A.4.1.2. **Region/State/Province etc.:**

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Province of Bali

A.4.1.3. **City/Town/Community etc:**

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Town of Temesi, Regency of Gianyar, Bali

A.4.1.4. **Details of physical location, including information allowing the unique identification of this small-scale project activity :**

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The town of Temesi is situated two kilometres east of Gianyar, the capital of the Regency with the same name. It lies 115° 21' east of Greenwich and 8° 33' south of the equator. The region east of Gianyar profits little from Bali's tourism and is thus relatively poor. The main occupation of the villagers is in agriculture, with rice being the major crop, but there are also a considerable number of family owned furnaces to produce traditional bricks for temples and traditional houses.

The location of the composting facility is depicted in Figure 1.

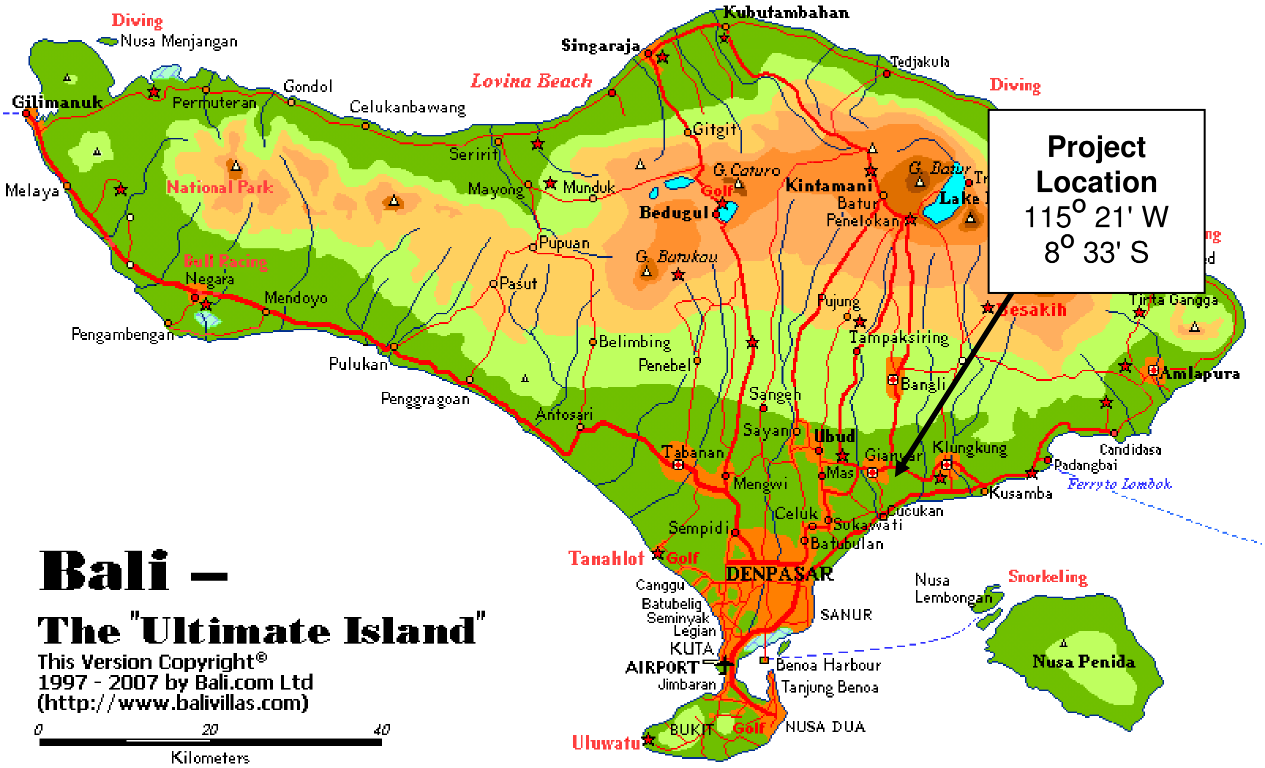

Figure 1: Map of Bali with project location

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Sectoral scope of the project activity is: 13, Waste handling and disposal.

Type and category:

The following type and category apply to the proposed project activity in accordance with Appendix B[1] to the simplified modalities and procedures for small-scale CDM project activities:

Type III – Other project activities

Category III.F. – avoidance of methane production from biomass decay through composting, version 05

Technology of the project activity:

The technology used and measures applied in this project activity is to avoid the production of methane from the biomass fraction of municipal waste that would have otherwise been left for anaerobic decay in a solid waste disposal site without methane capture and flaring or power production. The decay is prevented through aerobic treatment by composting the organic waste fraction and proper soil application of the compost. The proper composting process is secured by adequate compost handling procedures and measures, including active aeration.

Compliance with the small-scale criteria:

The project activity results in annual average emission reductions of around 7'600 tons of CO_2e (see section E), which is below the 60 kilo tonnes limit for type III small-scale projects. The project activity therefore qualifies as small-scale project activity.

Since the project contains the option to expand the processing capacity after certain years the annual emission reductions will increase. However, even by doubling the capacity, the emission reductions will still be significantly below the limit for small-scale projects.

Technology transfer to host country

No environmentally safe and sound technology and know-how is transferred to the host country, since the technology is simple and commonly known. Specific additional know-how is developed in the on-site research station. However, volunteers and students from internationally recognized waste research institutions (Sandec, EAWAG ETH Zürich, Switzerland) contribute to a significant know-how inflow by optimizing processes with state-of-the-art knowledge.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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[1] http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

Table 1: Estimated emission reduction over the crediting period. The actually achieved values in each year of the crediting period depend on the waste proportion processed for composting and other parameters monitored during the crediting period.

Year	Estimated Certified Emission Reductions (CER) in t CO_2
2008	1'947
2009	3'830
2010	5'411
2011	6'741
2012	7'862
2013	8'809
2014	9'609
2015	10'287
2016	10'862
2017	11'349
Total over crediting period	**76'707**
Total number of crediting years	**10**
Annual average over crediting period	**7'671**

A.4.4. Public funding of the small-scale project activity:

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Public funding is involved in the project financing, but does not result in a diversion of Official Development Assistance (ODA) as per definition[2]. The returns from selling the carbon credits on the international compliance or voluntary market are for the benefit of the waste management facility and not for the compliance of an Annex I project sponsor. Respective detailed information about the funding structure is given in Annex 2.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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[2] http://www.oecd.org/dataoecd/12/47/33657913.pdf, ODA Eligibility Issues for Expenditures under the Clean Development Mechanism (CDM), 2004

In accordance with Appendix C[3] of the Simplified Modalities and Procedures for Small-Scale CDM project activities "DETERMINING THE OCCURANCE OF DEBUNDLING", it can be confirmed that this project activity is not a debundled component of a larger CDM project:

No other CDM activity has been undertaken by the project participant, which is in the same project category and whose boundary is within 1 km of the project boundary of this project activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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III.F. Avoidance of methane production from biomass decay through composting (Version 05, August 2007) The baseline methodology used is described in detail in Appendix B of the simplified modalities and procedures for small-scale project activities: "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activities".

Note: the estimation of the baseline emissions for this methodology refers to the III.G. Landfill Methane Recovery using the First Order Decay model (FOD).

Additional methodologies and tools used:

- For the purpose of estimating the project emissions from electricity, the grid emission factor of the project grid has been determined per AMS I.D. in its latest version.
- The emission reductions have been determined using the "Tool to determine methane emissions avoided from dumping waste at solid waste disposal site" (Version 02, EB 35, Annex 10[4])
- The additionality has been determined following the "Tool for demonstration and assessment of additionality", version 03, considering simplifications for small-scale projects as appropriate.

B.2 Justification of the choice of the project category:

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Justification of the baseline applicability

The category III comprises projects other than renewable energy production and energy efficiency projects, such as agricultural projects, fuel switching, industrial processes and waste management. The proposed project activity is a waste management project, where methane emissions are avoided through waste composting instead of dumping it on a landfill, and therefore qualifies as a category III.F project.

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[3] http://cdm.unfccc.int/EB/Meetings/007/eb7ra07.pdf

[4] http://cdm.unfccc.int/EB/035/eb35_repan10.pdf

In addition, as required by the applicability criteria of the methodology AMS III.F the project activity results in lower annual emission reductions than the cap of 60’000 tons CO_2e per year over crediting period (as depicted in section A.4.3). However, if the emission reductions in a particular year exceed this limit, then the verified emission reductions will be capped to 60’000 tons.

B.3. Description of the project boundary:

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Per definition of AMS III.F the project boundary is the physical, geographical site:

a) where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;

b) where the treatment of biomass through composting takes place;

c) where the soil application of the produced compost takes place;

d) and the itineraries between them (a, b and c), where the transportation of waste or compost occurs.

For the proposed project activity the project boundary can regularly and completely be applied. It encompasses a) the existing landfill site where the remainder part of the waste is deposited and b) the composting facility where the organic waste proportion is treated, which lays next to the landfill area. The project boundary encompasses also c) the sites of soil application (see also monitoring section D.3 to D.5), and the itineraries between a, b an c, this means all transport activities from or organized by the facility operator with its lorries and vehicles used for waste and compost transportation and management.

B.4. Details of the baseline and its development:

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The baseline of this project activity has been developed by following strictly the guidelines and rules defined in the respective methodologies and tools (see section B.1.)

The baseline scenario is the continued dumping of the waste on the existing landfill site in the absence of the project activity. The resulting baseline emissions are calculated based on the First Order Decay model (FOD) as required by the methodology. The formula and its parameters are explained in detail in section B.6. For most of the parameters the IPCC default values or recommendations given in the methodology have been followed, since no location or region specific information is available. Where required and available project specific data and information from the plant operator is used.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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According to Attachment A to Appendix B[5] of the simplified modalities and procedures for CDM small-scale project activities, the project participants shall provide an explanation to show that the project activity would not have occurred due to at least one of the following barriers:

a) Investment barrier;

b) Technological barrier;

c) Barrier due to prevailing practice;

d) Other barriers, identified by the project participant.

However, the additionality determination of the project activity follows roughly the "Tool for demonstration and assessment of additionality, version 03", with simplification for small-scale project activities as applicable.

Step 0. Preliminary screening based on the starting date of the project activity

The crediting period starts after successful CDM registration. Hence, no retroactive credits are claimed. However, the CDM has been considered at an early stage in project development as a significant financial resource and is an integral part for the operation of the composting plant. This can be confirmed by respective documents and communications between the project developer and third-parties, including the CDM advisory company preparing this project design document.

Step 1. Identification of alternatives to the project activity consistent with current regulations

Sub-step 1a. Define alternatives to the project activity

The following alternative waste management options are identified:

Alternative 1: The proposed project activity not undertaken as CDM project activity.

Alternative 2: Incineration of the municipal waste (MSW). Due to the relatively high moisture content, the low calorific value and small total amount of waste, incineration is not a viable option or alternative in this project scale. Additionally such projects are coupled with high investments and operational costs, and respective technology is not easily available in the host country.

Alternative 3: Building a sanitary landfill including the capture and use of LFG for electricity production. Similar to the incineration of waste, LFG capturing and flaring is not an approach for the rural areas of Bali. The same financial restrictions and limitations of scale apply. Additionally Indonesia has relatively large fossil fuel resources such as oil and gas, which makes the use of biogas hardly competitive.

Alternative 4: Continuation of the current situation.

Considering the arguments above, the only serious alternatives to the project scenario are option 1) and option 4).

[5] http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

Sub-step 1b. Enforcement of applicable laws and regulations

There is no legislation providing solid waste management rules or enforcing the landfill gas extraction in Bali, Indonesia, therefore all selected alternatives comply with the existing laws and regulations.

Since the proposed project activity is not the only remaining option amongst the all considered alternatives, step 1 is satisfied.

The additionality assessment is further based on Step 3 (Barrier Analysis) as per additionality tool.

Step 3. Barrier analysis

In this step, it is determined whether the proposed project activity faces barriers that:

a) Prevent the implementation of this type of proposed project activity; and

b) Do not prevent the implementation of at least one of the alternatives.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

As per small-scale requirement only one significant barrier needs to be identified. However, the argumentation is based on two closely related barriers: financial barrier and market barrier.

A. Financial barriers:

Due to a number of reasons, it is very difficult to make any waste management projects of this scale commercially viable. Yet financial debility is almost a common syndrome for the local bodies, and the limited financial strength of a municipality is therefore one of the main barriers to such a project to be implemented and operated by the official regional authorities. The financial viability problems also prevented any private sector participation so far, unless non-profit organizations, as in this project, initiate innovative approaches by spending a lot of time and voluntary work.

The capital investment in the compost plant is primarily for the civil structures, mechanical equipment and vehicles. Despite the fact that composting technology is relatively simple and less expensive, in absolute terms the capital investment is still high and the financial prospects too low to attract any private investment. However, most of the necessary capital investment has been funded, donated respectively by private or public entities. The operation and maintenance cost is fairly high compared to the uncertain market price and demand of compost (end product). Therefore additional support is necessary to make the urban waste based compost plant viable and sustainable. In this context CDM revenues could make a very positive impact in making such projects viable and would also open up possibilities for private sector participation in the future.

To support the financial barrier argument a monthly profit and loss statement is attached as Annex 6.

B. Market barrier:

In Indonesia and Bali, the concept of soil conditioner is still not widely known amongst the farmers, the largest potential client/ user group of the composting facility, and compost from municipal waste is still considered as being "dirty". This coupled with the low levels of certain plant nutrients on a per ton basis in comparison to the chemical fertilizers leads to low market price of compost. The additional costs for building the distribution network and the current lack of a sales network and experience pose other significant barriers for the market entry of the project organisation.

Potential revenues generated from trading in the Emission Reduction (ER) from this project would therefore assist in:

a) Making the product available at a competitive price,

b) Market development for compost.

All the above described barriers pose a serious obstacle to the project activity, and would lead to high operational uncertainties if not implemented as CDM project activity.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives

Non of the above barrier prevents the implementation of alternative 4 (baseline scenario) – the non-implementation of the composting plant, the continuation of the current situation respectively.

Step 4. Common practise analysis

At the moment there are only very few similar waste management projects in Indonesia. The clear aim of the pilot compost plant and this project activity is to serve as model for replication of similar projects in Bali and Indonesia.

In Bali and probably the whole of Indonesia, actively aerated composting with blowers or other means is not yet performed, which emphasises the innovative character of this project. Even passively aerated composting sites can be found on Bali only in a few hotels and gardens of expatriates, usually as a result of training conducted by NGO. The only exception is the waste recovery facility in Jimbaran, Bali, where the waste of about a dozen hotels is processed. There, garden waste is composted with passive aeration in windrows. However, all these endeavours compost far less than 100 kg organic waste per day.

More common is the anaerobic digestion of organics, which is performed on a larger level by two institutions on Bali. The botanical garden in Bedugul processes about 100 kg / day of its garden waste in windrows that are not aerated. On a larger scale, the popular Pak Oles Company produces a Bokashi-type anaerobic digest after the method of Dr. Terno Higa, Japan.

Sub-step 4a. Analyse other activities similar to the proposed project activity

There are no implemented or planned projects on Bali that pursue similar activities. However, there is another waste management related project in Denpasar the capital of Bali that intends to produce electricity with gas captured from the existing landfill, from a gasification process of dry waste and an anaerobic digestion for wet organic waste. It is registered as a CDM project.

Sub-step 4b. Discuss any similar options that are occurring

There are none.

Step 5. Impact of CDM registration

The CDM approval and registration of this project activity will have some important positive impacts besides the local environmental and economic aspects described in section A.1 under "Contribution to sustainable development". Summarized, the main impacts are seen as follows:

1. Greenhouse gas reductions: The project leads to average direct emission reductions of 7'700 t of CO_2 equivalents per year.

2. Impact on the project viability: The CDM returns increase the returns for covering the operating costs and helps mitigating the risk and impact of compost market barriers (competitive compost price and sales fluctuations) during the critical first years of operation, by predictable and secured returns. Additionally, the CDM returns are in a stable foreign currency, which is not subject to possible national monetary fluctuations and the local market risks described.

   The successful operation under the CDM in turn triggers the execution of the capacity extension option, since surplus revenues can be used to finance the implementation without making necessary additional donations.

3. Triggering a change in waste management principles: The CDM registration will serve as a show case for other municipalities, accelerate the multiplication of this waste management approach within the region, and could even lead to increased interest of private investor participation.

Passing all the steps above, the project is clearly additional and would not be realised as proposed without the CDM.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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(A) Equations used and calculation of baseline emissions

Emissions in the baseline scenario (BE_y)

To calculate the baseline emissions the formulae as elaborated in the methodology in the baseline section are used. The project activity contains composting of wastewater. Hence the equation used to calculate the baseline is reduced to:

$$BE_y = MB_y - MD_{reg,y} \qquad (1)$$

where:

BE_y = Emissions in the baseline scenario (t CO_2e)
MB_y = Methane produced in the landfill in the absence of the project activity in year y (t CO_2e

$MD_{reg,y}$	=	Methane that would have been destroyed in the absence of the project acitivity in year y (t CO_2e)

In Indonesia there are no waste management regulations that require a certain amount of LFG to be captured and destroyed. Hence, $MD_{reg,y}$ in case equals zero, and $BE_y = MB_y$.

Note: unlike in the formula provide in the methodology, the GWP of methane is already included in the calculation as per "Tool to determine methane avoided from dumping waste at a solid waste disposal site". No further adjustment is necessary to get the volumes in t CO_2e.

Baseline emission in year y ($BE_{CH4,SWDS,y}$):

The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site is calculated with a multi-phase model, based on the First Order Decay model (FOD), and as described in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"[6].

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot (1-e^{-k_j}) \cdot e^{-k_j \cdot (y-x)}$$

where:

$BE_{CH4,SWDS,y}$	=	Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
φ	=	Model correction factor to account for model uncertainties (0.9)
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose
MCF	=	Methane correction factor
$W_{j,x}$	=	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)
DOC_j	=	Fraction of degradable organic carbon (by weight) in the waste type *j*
k_j	=	Decay rate for the waste type *j*
j	=	Waste type category (index)
x	=	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y	=	Year for which methane emissions are calculated

[6] http://cdm.unfccc.int/EB/035/eb35_repan10.pdf

The amount of the different waste types j are determined through sampling and calculated as mean from the samples, as follows:

$$W_{j,y} = W_y \cdot \frac{\sum_{n=1}^{z} p_{n,j,y}}{z}$$

where:

$W_{j,y}$	=	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)
W_y	=	Total amount of organic waste prevented from disposal in year x (tons)
$p_{n,j,y}$	=	Weight fraction of the waste type j in the sample n collected during the year x
z	=	Number of samples collected during the year x

The details for each parameter applied are discussed in section B.6.2 and B.7.1.

Baseline emissions shall exclude methane emissions that would have to be captured, fuelled or flared to comply with national or local safety requirements or legal regulations. The effective baseline emissions from a project in year y are therefore:

$$BE_y = BE_{CH4,SWDS,y} - MD_{y,reg} * GWP_{CH4} \quad (2)$$

In Indonesia /Bali there are no national or local regulations requiring the capture of methane for safety and environmental protection reasons. Therefore MD_y equals zero and:

$$BE_y = BE_{CH4,SWDS,y}$$

(B) <u>Equations used and calculation of project emissions</u>

The project activity related emissions consists of:

a) CO_2 emissions from trucks due to incremental distances between the collection points to the composting site and to the baseline disposal site, as well as transportation of compost from composting site to soil application ($PE_{y,transport}$)

b) CO_2 emissions related to the power or fossil fuel used by the project activity facilities. Emission factors for grid electricity shall be calculated as described in methodology AMS I.D.

The total project emissions (PE_y) for year y are therefore calculated as:

$$PE_y = PE_{y,transport} + PE_{y,power} + PE_{y,fossil} \quad (3)$$

Calculation of transport emissions ($PE_{y,transport}$):

The formula used to estimate the project emissions from transportation is given by the equation:

$$PE_{y,transport} = (Q_y/CT_y) * DAF_w * EF_{CO2} + (Q_{y,comp}/CT_{y,comp}) * DAF_{comp} * EF_{CO2} \quad (4)$$

where:

Q_y:	Quantity of waste transported to compost facility in the year "y" (tonnes)
CT_y:	Average truck capacity for waste transportation (tonnes/truck)
DAF_w:	Average incremental distance for waste transportation (km/truck)
EF_{CO2}:	CO_2 emission factor from fuel use for transport (kg CO_2 / km, IPCC default values or local values can be used).
$Q_{y,comp}$:	Quantity of compost produced in the year "y" (tonnes)
$CT_{y,comp}$:	Average truck capacity for compost transportation (tonnes/truck)
DAF_{comp}:	Average distance for compost transportation (km/truck)

<u>Waste transport:</u>

There is no difference in waste collection and transportation patterns due to the project activity compared to the baseline case, where the waste is just dumped on the landfill site, since landfill and composting facility are at the same location. Additionally, the total amount of waste collected remains the same, with or without the project activity. Project emission related to transport of waste are therefore negligible ($PE_{y,transp} = 0$)

For two other reasons this reflects a conservative approach:

1. Fuel which is used to shift remaining waste from the composting plant to the nearby landfill is included under the emission from fuel consumption on-site.

2. The amount of waste finally shifted to the landfill decreases to estimated 10% of the original volume due to the project. It is expected that fuel consumption of excavator and earthmover managing the delivered waste on the landfill decreases respectively. Historic consumption was 22'000 liter diesel per year, and is expected to come down to 3000 liters.(Note: the decreasing fuel consumption of excavator and earthmover will not be monitored since they belong to the landfill operator, which is the environmental agency of Bali.

<u>Compost transport:</u>

Part of the produced compost is picked up by customers with their own vehicles (approx. 80%), the remaining part is delivered with trucks belonging to the compost facility. Emissions resulting from this 20% facility deliveries are already included in the calculation of the on-site emissions from fuel use.

An accurate determination of the additional emissions from transport by customers is difficult because no monitoring can be applied. However, for a rough estimation to estimate the additional transport emissions from customer vehicles the following procedure is adopted:

$$PE_{y,transport} = (Q_{y,comp} * S_{y,comp}/CT_{y,comp}) * DAF_{comp} * EF_{transport} \quad (5)$$

where:

$EF_{transport}$: CO_2 emission factor from fuel use for transport (kg CO_2 / km).
$Q_{y,comp}$: Quantity of compost produced in the year "y" (tonnes)
$S_{y,comp}$: Share of produced compost picked up by customers (not delivered by facility)
$CT_{y,comp}$: Average truck capacity for compost transportation (tonnes/truck)
DAF_{comp}: Average distance for compost transportation (km/truck)

The share of compost picked up by customers directly, the average truck capacity and the average distance traveled for compost transport is estimated yearly based on sales figures and expert judgement. The CO_2 emission factor per kilometers is estimated by assuming that main fuel used is diesel and the average fuel consumption 12 liter per 100 kilometer for small trucks.

Calculation of emission from power consumption ($PE_{y,power}$):

Emissions related to power used on the facility are calculated as follows:

$$PE_{y,power} = EL_y * EF_{grid} \quad (6)$$

Where:

EL_y: Power consumption of project activity in year y
EF_{grid}: Emission factor of the grid, calculated according to AMS I.D.

The emission factor for the Java-Bali grid is 0.728 t CO_2 / MWh, Source: Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the committee, Directorate General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006). This is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization, Renewable energy division, 2006. Since no power generation or fuel consumption data is directly available to the project developer, and also not expected to be available in the coming years, this emission factor remains fixed over the crediting period. However, with regard to the small amount of emissions resulting from power consumption this approach is considered appropriate.

Calculation of emission from on-site fuel consumption (PE_y):

Emissions from fuel use on-site are related to vehicles used on-site for waste and compost management, but also for other technical installations. The emissions are calculated from the quantity of fuel used and the specific CO_2 emission factor of the fuel. Only diesel is used on-site.

$$PE_{y,fuel} = F_y * EF_{fuel} \quad (7)$$

Where:

$PE_{y,fuel}$:	CO_2 emissions due to on-site fuel combustion in year y (t CO_2)
F_y:	Fuel consumption on site in year y (l)
EF_{fuel}:	CO_2 emission factor for fuel used on-site (kg CO_2e / l)

(C) <u>Equations and calculation of leakage</u>

No leakage needs to be considered, since no composting technology equipment is transferred from or to another activity (L_y=0)

(D) <u>Emission reductions due to the project activity</u>

The emission reductions due to the project activity per year (y) are given by the equation:

Emission reductions in year y (ER_y): $ER_y = BE_y – PE_y – L_y$ (8)

where $L_y = 0$

(E) <u>Adjustment for volumes processed in the baseline case</u>

Since the project activity is the increase of the capacity, the achieved emission reductions must be adjusted for the volumes processed already in the pilot facility:

Emission reductions in year y (ER_y): $ER_y = ER_y * (1-r)$ (9)

R is defined as:

Adjustment factor (r): $r = WCOM_{BAU} / TWCOM_y$ (10)

Where:

$TWCOM_y$:	total quantity of waste composted in year y at the facility (t)
$TWCOM_{BAU}$:	registered annual amount of waste composted at the facility on a BAU basis (pilot facility), calculated as the highest amount in the last five years prior to the project implementation.

The pilot facility was operational for approximately three years, but not continuously running. The methodology requirements of five year period can not be met. However, the highest amount of waste composted is derived by taking the average processing volume under operation, times the maximum processing days per year. This results in 595 t of waste processed in the BAU scenario ($TWCOM_{BAU}$).

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**φ**
Data unit:	-

Description:	Model corrections factor to account for model uncertainties
Source of data used:	See below
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value selected as proposed by methodology.
Any comment:	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
Source of data used:	
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	0.1 is to be used for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. For other solid waste disposal sites a value of 0 can be used. The landfill where the waste would be disposed in the absence of the composting project activity is not covered with oxidizing material, hence a value of 0 is appropriate.
Any comment:	

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value as proposed by the methodology is applied.
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5

Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value as proposed by the methodology is applied.
Any comment:	

<table>
<tr><td>Data / Parameter:</td><td>MCF</td></tr>
<tr><td>Data unit:</td><td>-</td></tr>
<tr><td>Description:</td><td>Methane correction factor</td></tr>
<tr><td>Source of data used:</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories</td></tr>
<tr><td>Value applied:</td><td>0.8</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied :</td><td>MCF for the following types of solid wastes disposal sites are possible:
<table>
<tr><td>Disposal site type</td><td>MCF</td></tr>
<tr><td>Managed – anaerobic</td><td>1.0</td></tr>
<tr><td>Managed – aerobic</td><td>0.5</td></tr>
<tr><td>Unmanaged – deep (>5m) or high water table</td><td>0.8</td></tr>
<tr><td>Unmanaged – shallow (<5m)</td><td>0.4</td></tr>
<tr><td>Uncategorised SWDS</td><td>0.6</td></tr>
</table>
The landfill where the waste would be disposed in the absence of the composting project activity has an average depth of 6 meters and the waste is mechanically compacted. Hence, a value between 1 and 0.8 would be appropriate. For conservativeness a value of 0.8 has been applied.</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>DOC_j</td></tr>
<tr><td>Data unit:</td><td>-</td></tr>
<tr><td>Description:</td><td>Fraction of degradable organic carbon (by weight) in the waste type j</td></tr>
<tr><td>Source of data used:</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)</td></tr>
<tr><td>Value applied:</td><td>DOC_j values for wet waste have been applied → see below</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied :</td><td>The methodology distinguishes between five types of waste and respective DOC_j values under wet and dry waste conditions given as percentage of the total organic waste stream of the project:
<table>
<tr><td>Waste type j</td><td>% DOC wet waste</td><td>% DOC dry waste</td></tr>
<tr><td>Wood and wood products</td><td>43</td><td>50</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>40</td><td>44</td></tr>
<tr><td>Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td><td>38</td></tr>
<tr><td>Textiles</td><td>24</td><td>30</td></tr>
<tr><td>Garden, yard and park waste</td><td>20</td><td>49</td></tr>
</table></td></tr>
</table>

	Measures of the moisture content have shown values between 45-50% of the total waste amount (depending also on seasonal climatic circumstances and the waste composition). In average the waste can be considered as wet waste and respective DOCj values as given in the second column above apply.
Any comment:	

Data / Parameter:	**k_j**
Data unit:	-
Description:	Decay rate for the waste type *j*
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 3.3
Value applied:	K_j values for tropical / wet conditions have been applied → see below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The methodology is based on the IPCC 2006 Guidelines and gives the following default values for tropical conditions: (see table below) Bali is located in tropical area with MAP of around 1700 mm per year and an average annual temperature (MAT) of 27°C. Therefore the proposed k values for wet conditions can be used.
Any comment:	Temperature and precipitation values and references for Bali are presented in Annex 3.

Waste type j		**Tropical (MAT* > 20°C)**	
		Dry (MAP* < 1000 mm)	**Wet (MAP > 1000mm)**
Slowly degrading	Pulp. Paper, cardboard, textiles	0.045	**0.07**
	Wood, wood products, straw	0.025	**0.035**
Moderately degrading	Garden and park waste	0.065	**0.17**
Rapidly degrading	Food, food waste, beverages, tobacco	0.085	**0.4**
MAT: mean annual temperature MAP: mean annual precipitation			

Data / Parameter:	**EF_{diesel}**
Data unit:	kg/l
Description:	Diesel CO_2 emission factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	2.664
Justification of the choice of data or description of measurement methods and procedures	The emission factor of diesel in kg/l has been calculated using IPCC default values for: (see table below)

NCV diesel	43.33 GJ/t
Density diesel	0.83 kg/l

actually applied :	CO_2 emission factor diesel: 74.07 t/TJ
Any comment:	

Data / Parameter:	EF_{grid}
Data unit:	t CO_2/MWh
Description:	Grid emission factor
Source of data used:	Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the committee, Directorate General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006).
Value applied:	0.728
Justification of the choice of data or description of measurement methods and procedures actually applied :	This emission factor is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization, Renewable energy division, 2006. Since no data is directly available to the project developer and also not expected to be available in the coming years, this emission factor remains fixed over the crediting period. However, with regard to the small amount of emissions resulting from power consumption this approach is considered appropriate.
Any comment:	Determined ex-ante and fix over crediting period.

Data / Parameter:	$EF_{transport}$
Data unit:	kg CO_2 / km
Description:	Average CO_2 emissions per 100 km of customer vehicles used for compost transport
Source of data used:	Based on estimated average values and IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.2664 Kg/km
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor is calculated using the EF_{diesel} (2.664 kg/l) times estimated average diesel consumption of customer vehicles per 100 km (12 l)
Any comment:	Determined ex-ante and fix over crediting period.

Data / Parameter:	$TWCOM_{BAU}$
Data unit:	t
Description:	Maximum amount of organic waste processed for composting per year in the BAU scenario (pilot facility)
Source of data used:	Plant records
Value applied:	595 t per year
Justification of the choice of data or description of measurement methods and procedures actually applied :	This figure reflects a conservative approach. It was calculated based on the average processed total volume per day (2 t) times the maximum operating days of the plant (350), times the average organic fraction of the waste (0.85, see Table 3 below).

Any comment:	Determined ex-ante and fix over crediting period.

B.6.3 Ex-ante calculation of emission reductions:

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Calculation of baseline emissions

As described in section B.6.1 the baseline emissions are calculated based on the FOD-Model. The detailed calculations are available to the DOE as Excel-Spreadsheet.

Input parameters:

The methodology distinguishes between five types of waste and respective decay rates. Table 2 shows the applied organic waste categories, IPCC defaults for DOC_j and decay rate (k_j), and the respective amount of waste (A_j), which is given as percentage of the total organic waste stream of the project.

Table 2: Waste types (streams), IPCC defaults for DOC_j and decay rate (k_j) and projects specific values for the amount of organic waste in year j (W_j) in per cent of total organic waste as measured by the project participant. Note: inert material is normally separate before composting and therefore not considered in the calculation.

Waste types (j)	**DOC_j – IPCC default (fraction of dry waste)**	**W_j – project value (% of total organic waste composted)**	**k_j – IPCC default**	**Waste deposition of project activity per year (t)**
A. Wood, wood products	0.50	3	0.035	446.25
B. Pulp, paper and cardboard	0.44	0.5	0.070	74.38
C. Food, food waste, beverages and tobacco	0.38	3	0.400	446.25
D. Textiles	0.30	0.5	0.070	74.38
E. Garden, yard, and park waste	0.49	93	0.170	13'833.75
Total	**--**	**100**	**--**	**14'875**

Table 3: Break down of waste categories

Total waste collected (50 t / day (350) / year)	17'500 t
- thereof waste for recycling (5%)	875 t
- thereof waste shifted to landfill (10%)	1'750 t

- **thereof waste processed for composting (organic waste)**	**14'875 t**

Other parameters as indicated in section B.6.2.

Total baseline emissions:

Detailed calculations as Excel spreadsheet are not given here but available to the validating DOE. The resulting baseline emissions from the FOD model over the crediting period are available in Table 4.

Table 4: Baseline emissions per year over the crediting period of ten years.

Year	Baseline emissions (BE_y) in t CO2e
2008	2'341
2009	4'302
2010	5'948
2011	7'334
2012	8'502
2013	9'488
2014	10'322
2015	11'028
2016	11'627
2017	12'135
Total	83'027

<u>Calculation of project emissions</u>

Emissions from power consumption:

Using equation 6:

Table 5: Calculation of emissions from onsite power consumption using equation 6 and 7.

Parameter	Description	Unit	Value
EL_y	Power consumption of project activity in year y	kWh	50'000
EF_{grid}	Emission factor of the grid	t CO2 / MWh	0.728
$PE_{y,power}$	**Emission from use of grid electricity in year y**	**t CO2**	**36**

Emissions from onsite fuel consumption:

Using equation 7:

Table 6: Project emission from diesel consumption

Parameter	Description	Unit	Value
$F_{y,diesel}$	Diesel consumption of project activity in year y	liter	94'000
NCV_{diesel}	Net calorific value of diesel fuel (IPCC)	GJ / t	43.33
D_{diesel}	Density of diesel (IPCC)	kg / l	0.83
EF_{diesel}	CO2 emission factor for diesel (IPCC)	t CO2 / TJ	74.07
$PE_{y,diesel}$	**Emissions from diesel use on-site in year y**	**t CO2**	**250**

Emissions from compost transportation

Using equation 5:

Table 7: Project emissions from compost transportation

Parameter	Description	Unit	Value
$Q_{y,comp}$	Quantity of compost produced per year	t	7'200
$S_{y,comp}$	Share of compost picked by customers directly		0.80
$CT_{y,comp}$	Average truck capacity for compost transportation (customers)	t	3
DAF_{comp}	Average distance for compost transportation	km/truck	50.00
$EF_{transport}$	CO2 emission factor for diesel (IPCC)	kg / km	0.27
$PE_{y,transport}$	**Emissions from compost transportation**	**t CO2**	**26**

Total project emission per year:

$PE_y = PE_{y,power} + PE_{y,diesel} + PE_{y,transport}$	**312 t CO_2e**

<u>Calculation of leakage</u>

No leakage needs to be considered, since no composting technology equipment is transferred from or to another activity (L_y=0)

<u>Emission reductions</u>

The total emission reductions per year are the difference between the baseline emissions and the project emissions: $ER_y = BE_y – PE_y$.

Adjustement for volumes processed in the baseline case (BAU)

Using equation 9 and 10:

$ER_y = ER_y * (1-r)$, with r = 595t / 14'875t = 0.04

Results are given in Table 8 in section B.6.4 below.

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Table 8: Ex-ante estimation of the emission reductions

Year	Estimation of baseline emission	Estimation of project emissions	Estimation of leakage	Adjustment factor (1-r)	Estimation of overall emission reductions (CER)
	t CO2e	t CO2e	t CO2e		t CO2e
2008	2'341	312	0	0.96	1'947
2009	4'302	312	0	0.96	3'830
2010	5'948	312	0	0.96	5'411
2011	7'334	312	0	0.96	6'741
2012	8'502	312	0	0.96	7'862
2013	9'488	312	0	0.96	8'809
2014	10'322	312	0	0.96	9'609
2015	11'028	312	0	0.96	10'287
2016	11'627	312	0	0.96	10'862
2017	12'135	312	0	0.96	11'349
until 2012	28'427	1'562	0		25'791
Total	**83'027**	**3'124**	**0**		**76'707**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**f**
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data to be used:	Written confirmation by landfill operator

Value of data	0
Description of measurement methods and procedures to be applied:	Monitoring frequency: yearly
QA/QC procedures to be applied:	-
Any comment:	There are no LFG capture and flaring installations at the landfill. However, the landfill operator will issue yearly a confirmation that no such equipment is installed and operated.

Data / Parameter:	**GWP_{CH4}**
Data unit:	t CO_2e / t CH_4
Description:	Global warming potential (GWP) of methane, valid for the relevant commitment period
Source of data to be used:	Decisions under the UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period if the Kyoto Protocol)
Value of data	-
Description of measurement methods and procedures to be applied:	After each commitment period GWP is adjusted according UNFCCC decisions. Monitoring frequency: yearly
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$W_y = TWCOM_y$**
Data unit:	t
Description:	Total organic waste prevented from disposal in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	Total organic waste composted is derived from the total waste ($W_{total,y}$) delivered to the facility minus the recycled ($W_{recycled,y}$) and landfilled ($W_{landfill,y}$) fraction. Monitoring frequency: yearly
QA/QC procedures to be applied:	QA/QC procedures are related to the procedures undertaken for measuring the total waste and the recycled and landfilled fraction.
Any comment:	-

Data / Parameter:	**$p_{n,j,y}$**
Data unit:	t
Description:	Weight fraction of waste type j in the sample n collected during year y
Source of data to be used:	Sample measurements by project participant as per monitoring plan. (see section B.7.2 and Annex 4)
Value of data	-
Description of	The size and frequency of sampling should provide statistically significant data

measurement methods and procedures to be applied:	with a maximum uncertainty range of 20% at a 95% confidence level. Since waste composition is relatively stable over the year, a sampling will be undertaken quarterly (4 times a year). The weighted average of these samplings will be taken as weight fraction of waste type j in year y.
QA/QC procedures to be applied:	A detailed sampling procedure will be elaborated, written down and applied to ensure a consistent approach over the crediting period. (see section B.7.2 and Annex 4)
Any comment:	-

Data / Parameter:	$\mathbf{W_{total,y}}$
Data unit:	t
Description:	Total waste delivered to the composting facility in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	The total waste delivered is weighted with a weighbridge at the entrance to the composting facility. Monitoring frequency: continuously
QA/QC procedures to be applied:	Weighbridge is calibrated each year.
Any comment:	-

Data / Parameter:	$\mathbf{W_{recycled,y}}$
Data unit:	t
Description:	Waste fraction processed for recycling in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	The waste separated for recycling is measured with weighbridge at the composting facility prior to processing. Monitoring frequency: continuously
QA/QC procedures to be applied:	Weighbridge is calibrated each year.
Any comment:	-

Data / Parameter:	$\mathbf{W_{landfill,y}}$
Data unit:	t
Description:	Waste fraction diverted to landfill in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	The waste separated for landfill disposal is measured continuously with weighbridge at the composting facility prior to delivery to landfill. Monitoring frequency: continuously

QA/QC procedures to be applied:	Weighbridge is calibrated each year
Any comment:	-

Data / Parameter:	$F_{y,diesel}$
Data unit:	Liter
Description:	Total on-site diesel consumption of composting facility in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	Purchase records and invoices are used to estimate diesel consumption in year y. If possible accuracy will be cross-checked with direct measurements. Monitoring frequency: yearly / continuously
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	EL_y
Data unit:	MWh
Description:	Total power consumption of composting facility in year y
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	Power consumption is directly measured with meters. Monitoring frequency: continuously.
QA/QC procedures to be applied:	Cross check of consumption with power invoices from power transmission and distribution company. Meters are subject to regular calibration by the power company.
Any comment:	-

Data / Parameter:	$Q_{y,comp}$
Data unit:	t
Description:	Amount of compost produced in year y.
Source of data to be used:	Plant records
Value of data	-
Description of measurement methods and procedures to be applied:	Quantity of compost produced / sold in year y. Measured and monitored continuously.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$S_{y,comp}$**
Data unit:	%
Description:	Share of compost bought and transported by customers in year y
Source of data to be used:	Plant records
Value of data	Approx 80% of total sold compost
Description of measurement methods and procedures to be applied:	The share of compost picked up by customers at the facility is estimated using sales figures and expert judgement.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$CT_{y,comp}$**
Data unit:	t
Description:	Average capacity of vehicles used by customers
Source of data to be used:	Expert estimations
Value of data	3
Description of measurement methods and procedures to be applied:	Monitoring by expert estimations at the end of the crediting year.
QA/QC procedures to be applied:	-
Any comment:	Estimations can be made more accurately in case there are long term customers. Currently there are no figures based on past experiences available.

Data / Parameter:	**DAF_{comp}**
Data unit:	Km / truck
Description:	Average distance for compost transportation
Source of data to be used:	Plant records
Value of data	50
Description of measurement methods and procedures to be applied:	The share of compost picked up by customers at the facility is estimated using sales figures and expert judgement.
QA/QC procedures to be applied:	-
Any comment:	Estimations can be made more accurately in case there are long term customers. Currently there are no figures based on past experiences available.

B.7.2 Description of the monitoring plan:

>>
The monitoring plan defines the standards, which are applied to monitor the projects performance and resulting emission reductions, in conformance with all relevant requirements of the CDM. The procedures defined in this section, including details provided in Annex 4, become an integral part of the regular operation manual as soon as the project is up and running. All issues addressed here in this monitoring plan are subject to the regular yearly verification procedures defined by UNFCCC.

This monitoring plan includes responsibilities and procedures for data collection and archiving as well as report preparation and communication for the purpose of verification by the DOE. In detail the plan comprises of:

- Monitoring management
- Monitoring processes
- Data recording and storage
- Quality Control procedures
- Report compilation and verification

Monitoring management

The overall responsibility for the project monitoring and verification lies with David Küper (project initiator) from the Rotary Club Bali Ubud (hereafter called management advisor), which act as advisor for the plant management after project implementation. The responsibility at facility level is assigned to the future plant manager.

The plant manager in turn assigns the necessary responsibilities to the operating personnel and supervises the monitoring processes. He ensures that the staff in charge receives the required training for conducting the monitoring and that all processes are defined in the regular operation manual.

For the purpose of quality control and assessment of accuracy of the monitoring procedures a CDM committee is appointed. This committee comprises of the management advisor, the plant manager and one delegate from the operating personal. Any decisions taken during the quarterly committee meetings are to be documented for verification. Changes in monitoring processes are adjusted in the respective section of the operating manual, an respective instructions are provided to the operating personnel.

Monitoring processes

For each monitoring section described below the procedures for monitoring are incorporated in the regular operation and maintenance manual of the facility providing the details for reliable measurement and recording of parameters. This manual will be elaborated and applied before the plant is operational. Basic monitoring processes are:

<u>Waste measurement:</u>

The amount of organic waste processed for composting can be determined in two ways:

1. Either the organic fraction is determined directly after separation of recyclables and material to be disposed on the landfill,

2. or the organic fraction can be calculated as difference of the total incoming waste minus the proportions put on the landfill or recycled.

In both cases a weighbridge is used to measure the respective proportion on-site. The finally applied process depends on the implemented design at the facility and organisational issues yet to be fixed. This process will be documented in the operational manual.

Waste composition:

Quaterly, during 3-4 days, the waste composition will be analysed to determine the five waste types as per methodology. The average value per waste stream over all samples will be transferred to the FOD-model and used to calculate the yearly emission reductions.

The sampling plan for determination of the share of different types of waste is based on statistical methods as required by the methodology. Details are provided in Annex 4.

The sampling is organised by the plant management. Details about the processes will be specified as soon the plant is in operation and integrated in the regular operating procedures. The process will be described in detail in the future operation manual.

Energy consumption:

Monitoring and measuring based on invoices and purchase and/or direct metering (power consumption). The data will be recorded continuously and processed at the end of each crediting year by the plant management.

Transport emissions:

Since emissions from transport of compost are difficult to monitor accurately, the estimations are based on compost sales figures and on expert judgement about average capacity of customers vehicles and distance travelled to application sites. Underlying assumptions and calculations will be included in the verification report at the end of each crediting year.

Note: Compost volumes delivered by facility operator will not be considered since this transport emissions are already included in the calculation of on-site emissions.

Other parameters required by the methodology:

Operation of the composting facility will be documented in a quality control program. This includes monitoring the conditions and procedures that ensure the aerobic conditions of the waste during the composting process and has already been implemented as part of the pilot facility. Respective laboratory equipment is in place and all required parameters are already measured and documented on a regular basis. Respective figures and data is available to the DOE upon verification.

Market development for compost is a crucial part for the success of the project. This also contains efforts to promote and control the proper soil application of the compost by customers to ensure aerobic conditions for the further decay. Documentary evidence for any finally applied instruments used (training, course, on-site controls) can be audited by the DOE.

The methodology requires the project participant to demonstrate annually through the assessment of common practices at the proximate waste disposal site, that the amount of waste composted in the project activity facility would have been disposed in a solid waste disposal site without methane recovery in the absence of the project activity. In this project activity the waste disposal site is right next to the composting facility, hence it can be verified by the DOE during yearly verification that methane recovery is not common practice. Any required documentation or written confirmation by the landfill operator can be obtained if required.

Data recording and archiving

Data collection and archiving is organised by the plant management. Each described parameter is recorded in appropriate technical log-books and/or accountancy records as per defined monitoring frequency. All relevant data is transferred and aggregated each month in a separate monitoring file. Review of figures is subject to the quarterly CDM committee meeting. All the above parameters monitored and information generated under the monitoring protocol will be kept for 2 years after the end of crediting period or the last issuance of CERs for this project activity whichever occurs later.

Quality control procedures

Technical monitoring is done by operational personal. Problems with the day-to-day monitoring is escalated to the management level. The plant management has the responsibility to define appropriate measures to cope with problems and ensure the required quality and accuracy. The plant management is also responsible for organizing the calibration of critical equipment as described in the monitoring section B.7.1.

The monitoring procedures are reviewed and where necessary adjusted quarterly to the changed conditions and circumstances by the CDM committee.

Report compilation and verification

The monitoring report is written and compiled by the plant management. The management advisor or its delegate is responsible for review and submission for verification after each year of the crediting period. The management advisor or its representative is also main point of communication with the verifying DOE and the UNFCCC.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

For details of the baseline application please see section B.2

Date of completion: 24.07.2007

Baseline applied by:

Mr. Till Danckwardt
Project Manager, CDM Consultant
Factor Consulting + Management AG
Binzstrasse 18
8045 Zürich – Switzerland
Tel: +41 44 455 6109
Fax: +41 44 455 6069
Mail: till.danckwardt@factorglobal.com

Project participant: NO

Mr. David Küper
PO-Box 10011
Ubud, Bali 80571
Indonesia

Tel: +62 361 980 205
Fax: +62 361 980 205
Mail: dkuper@indo.net.id

Project participant: YES

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
Starting date of project implementation: 18/08/2007

C.1.2. Expected operational lifetime of the project activity:

>>
25y-0m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
Not applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Start of the crediting period: 01/05/2008 or date of the registration, whichever is later.

C.2.2.2. Length:

>>
10y-0m

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>
No negative environmental impacts are expected to result from the project activity and no analysis of the environmental impacts of the project activity is required by the host party.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
No negative environmental impacts are expected to result from the project activity and no analysis of the environmental impacts of the project activity is required by the host party.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>
Between deciding on the future location of the project in March 2004 until March 2007, a total of 46 project related meetings have been held with the population and authorities. These meetings were conducted by the executing NGO and the Rotary Club of Bali Ubud on one side and the whole population of the village of Temesi, Gianyar or delegates of the village and the regional Government on the other side. The project was socialized with the whole village population on four occasions. As the project replaces the existing unmanaged landfill, there was little anxiety but plenty of relief that the polluting emissions and pests of the landfill would significantly decrease with the project. Questions and comments fell into four categories:

a) Employment opportunities, capacity building and working conditions.

b) Financial and operational feasibility as well as potential village support.

c) Project ownership and other legal aspects.

d) Environmental impact and specifically future emissions.

All meetings and discussions took place in a positive and constructive atmosphere. They were quite exhaustive as villages in Bali usually decide by finding a consensus acceptable to all.

E.2. Summary of the comments received:

>>
The community warmly welcomed the project as it eliminates hazardous emissions from the existing landfill. The opportunity of the village to take free ownership of the Gianyar solid waste recovery facility that creates about 125 new jobs was highly appreciated and helped in getting full support.

A few villagers voiced concern about the capability of a rural, agricultural village to take full ownership and about working conditions in a solid waste recovery facility.

E.3. Report on how due account was taken of any comments received:

>>
In response to the comments received and in observance of general good practices, the following actions were taken:

- A contract was signed between the village of Temesi as recipient and the Rotary Club of Bali Ubud as sponsor that regulates among others ownership, management, rights and duties, responsibilities, allocation of potential profits, health and safety issues.

- A separate contract is presently negotiated with the Region (Kabupaten) of Gianyar that supplements above village / Rotary contract in case interventions of the regional Government are indicated.

- All employees were vaccinated against tetanus and receive regular health check-ups conducted free by the regional health service.

- A presentation to the village explained the environmental aspects before and after the implementation of the project with a focus on emissions.

- The village elected delegates to participate in regular meetings between the stakeholders.

With these instruments in place the project implementation proceeds without any noteworthy problems.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Rotary Club Bali Ubud
Street/P.O.Box:	PO-BOX 10010
Building:	
City:	Ubud
State/Region:	
Postfix/ZIP:	805701
Country:	Bali, Indonesia
Telephone:	
FAX:	
Represented by:	
Title:	Past President
Salutation:	Mr.
Last Name:	Küper
Middle Name:	Herbert
First Name:	David
Department:	
Mobile:	
Direct FAX:	+62 361 980 205
Direct tel:	+62 361 980 205
Personal E-Mail:	dkuper@indo.net.id

Organization:	Yayasan GUS (Gelombang Udara Segar)
Street/P.O.Box:	Jalan Legian 138
Building:	
City:	Kuta
State/Region:	
Postfix/ZIP:	80361
Country:	Bali, Indonesia
Telephone:	+62 361 759 323
FAX:	+62 361 767 654
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	

Personal E-Mail:	info@gus-bali.org

Organization:	Stiftung Myclimate – The climate protection partnership
Street/P.O.Box:	Technoparkstrasse 1
Building:	
City:	Zürich
State/Region:	
Postfix/ZIP:	8005
Country:	Switzerland
Telephone:	+41 (0) 44 633 77 50
FAX:	+41 (0) 44 633 15 85
Represented by:	
Title:	
Salutation:	Mr
Last Name:	Schili
Middle Name:	
First Name:	Alain
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	alain.schilli@myclimate.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Donors:

		Total Grant	For facility expansion
Grant Agreements signed:			
International Development and Research Centre, Canada [1)]	USD	158'000	46'000
Swiss Agency for Development and Cooperation [2)]	USD	80'000	80'000
Grants in pipeline:			
Rotary International and Rotary Clubs/Districts [3)]	USD	130'000	120'000
KOHA, New Zealand [4)]	USD	160'000	50'000
In process of being sourced:			
Various sources	USD	87'000	87'000
Total investment	USD		383'000

Remarks:

[1)] The IDRC funds only part of the facility expansion. The rest of the grant is for research activities, NGO activities, training/capacity building, the dissemination of results to encourage replications and obtaining CDM certification.

[2)] The Swiss grant was given in view of the replication potential of the Temesi model facility for waste recovery.

[3)] A small part of the grant is for the Educational Centre for the Environment.

[4)] Only part of the KOHA grant can be used for investing into the facility expansion. The rest of the grant is for expenses like the Educational Centre for the Environment or training and capacity building.

No ODA money from an Annex 1 party is included for the purpose of buying CERs from the project.

Note: Since the inception of the Gianyar Waste Recovery Project, it was a declared goal to build a facility that can serve as a replicable model for other projects in Bali and Indonesia, a fact that can be traced to early project information. This contribution towards a solution to Indonesia's overwhelming waste problem facilitated the fundraising process. For various reasons, donors were also attracted by the planned registration with CDM. One of the reasons is that Indonesia as fourth populous nation in the world has so far only eight projects that are registered with the EB.

The intended function as a model increased the investment volume as it is essential to demonstrate an optimal facility infrastructure. The model character of the project will be enhanced by an Educational Centre for the Environment, which will be built adjacent to the project. However, this centre is not part of the CDM registration. In an interactive and hands-on fashion the centre will demonstrate solid and liquid waste solutions, methods for clean drinking water, alternative energy, energy saving potentials, CDM and climate change issues to all the schools, Government officials, media representatives, NGO and others that frequently visit the waste recovery facility.

Annex 3

BASELINE INFORMATION

Climatic conditions Bali (Denpasar, Meteostation):

Month	**24 h average temperature (°C)**	**Average rainfall (mm)**
Jan	27.6	347.0
Feb	27.7	287.9
Mar	27.6	213.5
Apr	27.8	94.8
May	27.3	76.1
Jun	26.6	70.8
Jul	25.9	50.0
Aug	25.8	23.9
Sep	26.4	40.5
Oct	26.2	90.3
Nov	27.8	154.5
Dec	27.7	293.0
Year	**27.1**	**Total: 1738**
Weather station DENPASAR/NGURAH-RAI is at about 8.75°S 115.10°E Reference: http://www.worldclimate.com/cgi-bin/grid.pl?gr=S08E115		

Annex 4

MONITORING INFORMATION

Determination of waste composition – sampling plan

According to the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site " (EB 26, Annex 14), the weight fraction of the waste types j should be determined by sample measurements. The following waste types will be distinguished:

A Wood and wood products
B Pulp, paper and cardboard
C Food, food waste, beverages and tobacco
D Textiles
E Garden, yard and park waste

Since samples are taken from the organic waste proportion only, after separation of recyclable and inert material, category F (glass, plastic, metal and other inert material) is not included in the measurement. Organic waste proportions are relatively stable and therefore estimated only quarterly (defined as minimum sampling frequency per year by the methodology). However, the size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level.

The sampling plan is defined as follows:

1. Sampling happens quarterly on three (3) randomly selected days.

2. Based on the volume of around 42.5 t organic waste per day, at each of the sampling days around 200 kg of organic waste is analysed.

The proposed amount is fairly above the required level to assure the statistically significance (100 kg would be necessary at 95% confidence level and 10% sampling error). However, this volume seems appropriate to guarantee respective accuracy in the first years of operation. After the analysis has proven relatively stable measurement, this amount will be reduced to the proposed level.

Annex 5

TECHNICAL DETAILS

Table 9: Equipment and installations of the project activity

Three shredder for organics to be composted (15 m^3/hour), 120 HP diesel engines
Two electric compost sieve (8 m^3/hour)
Composting surface (3'200 m^2) and forced aeration system
One covered light structures for waste processing, composting & compost storage (5'000 m^2)
One front loader for piling and loading compost on site
One transport vehicle for transporting organics & compost inside the facility
One compost turner (if needed)
Forced aeration system
Wastewater garden for effluent treatment
Weighbridge

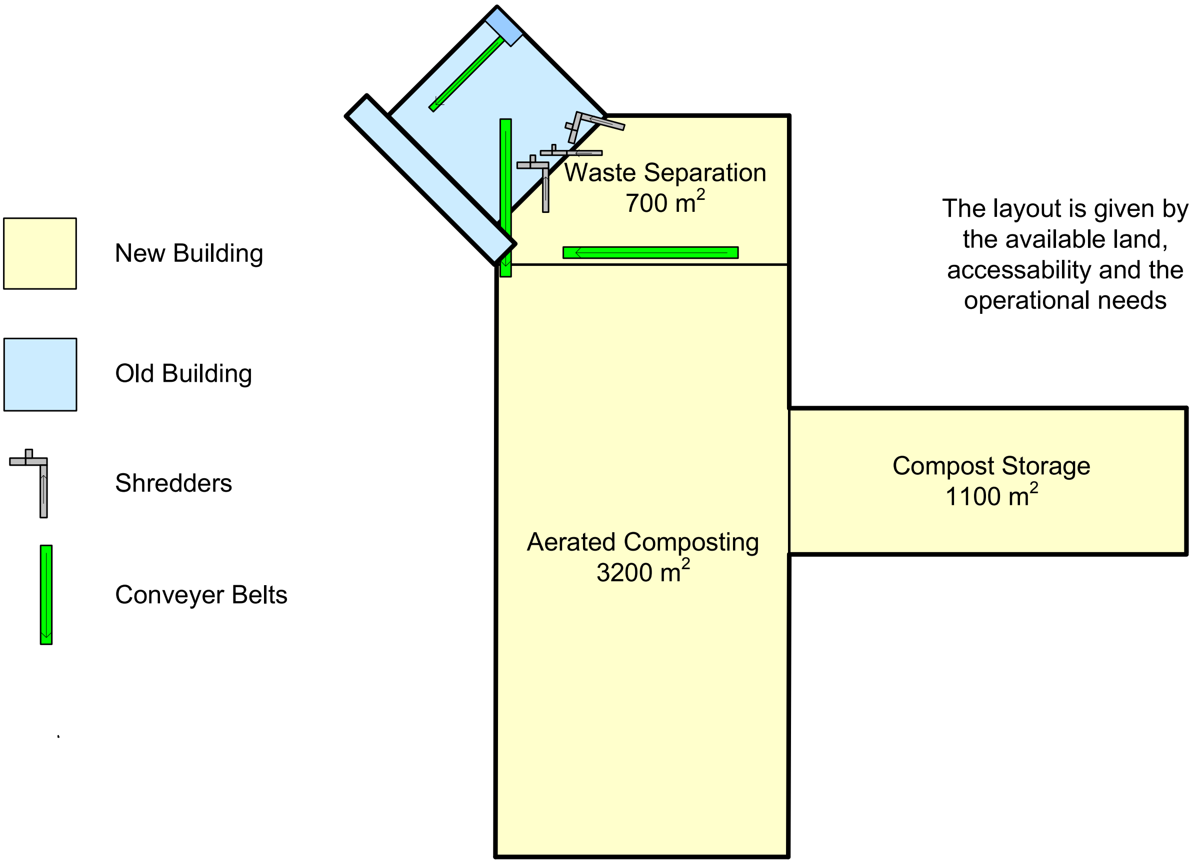

Figure 2: Layout of the Temesi Capacity Expansion from 5 to 50 tons per day.

<u>The Gianyar Waste Recovery Pilot Facility (4 tons/day processing capacity)</u>


Pilot facility from the northeast


... and from the south


The two project trucks


Waste separation conveyer belt


Shredder with diesel engine


Electric compost sieve

<u>The Composting Research Station</u>

Traditional piles, where the air distributes in 2 dimension yielding very uneven conditions

Research in boxes with laminar flow, simulating large compost tables with even conditions

Drums for laminar research with pressure and vacuum, which is preferred by the project

Control of laminar flow boxes

Blowers and flow controls

Electronic blower control

Self-made flow meters

Temperature/Oxygen Control

Compost analysis lab

Figure 3: Images from the pilot facility and the compost research station.

Annex 6

Yearly profit and loss statement of Gianyar Waste Project

The outsourcing of tasks like waste sorting in the expanded facility is integrated as internal cost this budget.

Yearly Statement	**Budget Optimized Pilot Facility**			**Budget Planned Expanded Facility**		
Based on 350 working days	Based on 3 tons / day [1]			50 tons / day		
Item	**Units**	**US$/Unit**	**US$**	**Units**	**US$/Unit**	**US$**
1. Expenses						
Salaries, Workers (6 hours/day)	28	540.0	15'120			
Salaries, Workers (8 hours/day) [2]				95	1'055.0	100'225
Salaries, Foremen	2	840.0	1'680	4	1'320.0	5'280
Salaries, Department Managers				3	1'800.0	5'400
Salary, General Manager	1	1'440.0	1'440	1	2'400.0	2'400
Subtotal Salaries			18'240			113'305
Purchase of non-organic recyclables			5'880			10'800
Utilities			840			2'280
Telephone			420			660
Diesel fuel for trucks, shredders	13'104	0.5	6'552	87'000	0.5	43'500
Operating material			960			5'640
Maintenance & repair			1'200			7'800
Depreciation			NA			27'251
Subtotal Expenses			**34'092**			**211'236**
2. Income						
Compost sales (tons wet weight)	370	40.0	14'800	5'250	35.0	183'750
Other recovered material sales (tons)	72	22.0	1'584	600	22.0	13'200
Waste collection fees from hotels paying subsidies	4	1'620.0	6'480			
Subtotal Income, without CER Credits			**22'864**			**196'950**
3a. Profit without CER Credits			**-11'228**			**-14'286**
			-32.9%			-6.8%
CER credits (CO_2 equivalents) [3]			NA	7'671	10.0	76'710
3b. Profit with CER Credits [4]			NA			**62'424**
			NA			31.7%

Notes:

[1] This is a not auditable hypothetical budget including all the operational improvements that have been made 2006 and early 2007. The loss still incurred is due to a lack of mechanization and economies of scale.

[2] Salary increased to above the minimum salary in Bali, which is very low compared to Western countries.

[3] The CER credit is based on an average 7'671 CO_2e per year sold at an assumed conservative prize of US$ 10.00 per ton. The CER income amounts to an average of US$ 45,000 during the first 4 years and US$ 100,000 for the last 6 years, depriving the project of essential income during the critical start-up years.

[4] Profits will be allocated to expansion, repair, equipment replacement, contributions to the community and 2 model facility replications.

Risk Assessment

1. Income will improve, when the ongoing efforts to reduce pilfering by waste truck crews and scavengers are successful.
2. Without CER the expanded facility cannot operate sustainably.
3. Profit could turn into loss for the expanded facility if:
   - it is impossible to sell 15 tons of compost per day at the assumed price, contrary to our market research.
   - the price for CO_2e in Carbon Trading decreases significantly below the assumed already conservative price.

Calculation of Depreciation

Facility:	Pilot Facility (3 tons/day)			Expanded Facility (50 tons/day)		
Investment Type	Investment	Depreciation		Investment	Depreciation	
(based on Project Proposal July 30, 2007)	Cost US$	Years	Yearly US$	Cost US$	Years	Yearly US$
Building	43'000	20	2'150	150'080	20	7'504
Equipment	33'000	10	3'300	197'470	10	19'747
Total	76'000		5'450	347'550		27'251