

# Technology Transfer

The technology chosen for the Gianyar Waste Project is a decentralized low tech solution with low investment and operating cost. The project goal is to create a model that can be copied all over Indonesia or even South-East Asia to solve waste problems. Especially if replicated on existing landfills, this approach can eliminate the inherent problems and hazards of existing landfills and therefore will be welcomed by the population.

Composting organics in an aerobic process on this scale is a new technology for Indonesia. The policy of the project is to source all equipment locally, which requires the transfer of technology for solutions not yet implemented elsewhere in Indonesia. Locally manufactured equipment reduces the cost and problems associated with importing them. Furthermore locally produced equipment allows easy modifications and repair. The technology transfer was implemented with local machine manufactures and concerned new designs as well as improvement in design and construction materials of existing designs.

## 1. Shredders for Organic Waste

The scale of the project required shredders with a capacity not yet produced locally. Improvements in materials, noise abatement and safety were introduced. Solutions are still being explored to reduce the energy consumption and thus operating cost. So far all shredders produced in Indonesia have a horizontal axle on which the cutting knives are mounted. A new design from Thailand with a vertical axle reduces fuel consumption and plugging up. Such a vertical axle shredder has been imported and can now be copied in Indonesia.

## 2. Compost Sieves

A new concept for compost sieving was introduced leading to a new non-conical and self-cleaning design with improved construction material that increases the operational life and the capacity, while reducing maintenance.

## 3. Air (Oxygen) Delivery System

Reducing back pressure and thus operating costs is essential for a low cost operation. Therefore the air delivery ducts should be dimensioned to have air speeds below 20 km/hour. There are radial and blowers available. Axial blowers are not suited as they back-surge when the backpressure becomes too high (reversed airflow at the outside of the rotor blades). Radial (centrifugal) blowers do not have this shortcoming as they just increase pressure at the expense of air delivery when the backpressure becomes too high.

## 4. Flow Meters and Air valves

Adjusting the airflow is essential in forced aeration composting. The project developed flow meters for a wide range of air flow that can be manufactured and calibrated locally at about 3 % of the cost of imports. To adjust the airflow, the project developed very low cost butterfly valves that cost a fraction of commercial valves.

## 5. Research and Development (R&D)

Cooperation with the Swiss Institute of Technology in Zurich and other academic institutions as well as with large scale Swiss composting facilities significantly improved the quality and result of the R&D carried out since 2004. The cooperation consisted of mutual visits and the fielding of students, who did their thesis in the research facility. Nearly one hundred research experiments were conducted.

Specific research topics were assessing the permissible range of C/N ratio; the usefulness of inoculants (starters) like processing compost or commercial products (e.g. EM); the necessity of a roof over the decomposing organics; decomposition speed; impact of shredding; impact of temperature and humidity; influence of the prevailing salt content; suitability of composting food processing residues; plus other parameters thought to be essential. Besides research on compost, the project also investigated the feasibility of using organic waste for the silage making, production of biogas or proteins (larvae of Black Soldier Fly) as well as vermiculture.

#### 6. Analytical Support

The Swiss Institute of Technology also analyzed raw materials and finished products for hazardous pollutants like dioxins, PCB, PAH and heavy metals to assure a safe product. Levels of dioxin, PCB and PAH found in Gianyar organics were mostly at only 10 % of average Swiss levels. All analyses results were below the very stringent Swiss maximum levels.

#### 7. Cross Semination

Project visitors from foreign countries like Environmental Ministers and Ambassadors met with the local Government, which led to cooperation in environmental education and other issues like handicraft and cultural exchange.