

Final Report

Resource Augmentation by Tapping Renewable Resource and by Utilizing Waste

Rainwater Harvesting, Wastewater Reuse and Composting/biogas

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Preface

Resource augmentation is becoming one of the most important challenges for developed and developing countries alike to support economic activities and to improve the living standards. Natural resources are under intense pressure due to rapid increase in the demand in the wake of urbanization and industrialization. Rainwater harvesting can reduce the stress on freshwater resources. Natural resources are also being affected due to discharge of untreated wastewater and solid waste. By recycling wastewater, on the one hand, demand for freshwater could be decreased. On the other hand, by avoiding the discharge of untreated wastewater into water reservoirs, the risk of polluting freshwater sources could be lowered. Similarly, compost and biogas from biodegradable waste can increase the availability of these resources to support agriculture and industrial activities. This also reduces the costs, which are otherwise incurred for managing the waste.

To assist developing countries to initiate resource augmentation by tapping renewable sources such as rainwater and by utilizing waste such as wastewater and biodegradable waste, UNEP-DTIE-IETC implemented a project in sugar industry in Viet Nam. The aims of the project were to raise awareness, build local capacity for designing and implementation of similar systems and demonstrate resource augmentation by designing and implementing rainwater harvesting system, wastewater reuse system and composting at a sugar company.

This report provides the details of all the activities of this project. This report aims to raise the awareness in other developing countries for undertaking similar initiatives on resource augmentation. This report also highlights the important issue of stakeholder participation, as the sugar company implemented the system without taking any financial support from UNEP-DTIE-IETC.

This project was a success mainly due to strong support from UNEP and UNEP-DTIE top management in Nairobi and Paris. The strong and continuous support from national and provincial governments in Viet Nam played a vital role. Active participation of all the local partners and other stakeholders made this project a good example of local capacity building for scaling up and replication of similar initiatives.

The queries and comments on this report are highly appreciated, as these will be very useful to plan for the future projects.

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Executive Summary

In the recent years, there has been a lot of emphasis on sustainable development in terms of linking economic development with sustainable use of natural resources. Many developing countries have seen rapid economic growth through industrialization. This has resulted into rapid urbanization and improved living standards. These countries are facing a major challenge to sustain their economic growth rates. One of the vital considerations would be the availability of resources to support industrialization and improve living standards. Water and energy are crucial resources in this regard. Many developing countries are already water-stressed and their increasing population base requires essential water resources to support drinking water supply and to support agriculture. Rapid industrialization is having double impact on water resources. Firstly, freshwater is required to support industrial activities. Secondly, they discharge wastewater that pollutes the reservoirs. Rainwater harvesting and wastewater reuse by industries could reduce the pressure on freshwater resources. Similarly, energy is another vital resource as developing countries usually spend huge sum of foreign exchange to import energy. By converting organic waste into an energy source such as biogas, energy security could be increased and some precious foreign exchange could be saved. Biodegradable waste from industries could also be converted into fertilizer to support agriculture activities.

UNEP-DTIE-IETC assists member countries on application of environmentally sound technologies (EST) under its three pillars: water and sanitation, production and consumption, and disaster prevention. The aim is to build local capacity and provide technology support under Bali Strategic Plan for Capacity Building and Technology Support. This project, “Resource Augmentation by Tapping Renewable Resources and by Utilizing Waste” was planned to raise awareness of key stakeholders such as governments and industries, to build the capacity of local partners for designing and implementing rainwater harvesting, wastewater reuse and composting/biogas in industrial sector, and to disseminate the lessons learned. The capacity building is aimed to enable local partners to scale up and replicate similar initiatives on their own. This project was focused to create active partnership with industries, so that they implement EST for rainwater harvesting, wastewater reuse and composting.

The first activity for this project was to identify an appropriate country and then an industry. It is evident from global statistics that Southeast Asian region has seen a rapid economic growth due to rapid industrialization. This region faces enormous challenges to make sure that natural resources and energy are available to sustain these economic growth rates and improved living standards. This region has seen a rapid increase in demand for water resources and energy over the few decades. Within this region, Viet Nam is one of the countries, where demand for resources is increasing rapidly. Keeping in view the large number of people who do not have access to safe drinking water, rapid industrialization requiring water for industrial activities, and traditional agriculture base, freshwater augmentation has become priority for the government. Similarly, energy and compost are other key issues for the government to sustain rapid industrialization, agriculture and living standards.

Within industrial sector in Viet Nam, sugar industry is a traditional industry using huge amount of water and discharging it back to reservoirs. Sugar industry also produces a large amount of biodegradable waste that could be converted into compost/biogas. There has been a growing demand in sugar in domestic and international markets, leading to formation of many more sugar companies in Viet Nam. To make these efforts sustainable, there was an urgent need to address water demand, wastewater discharge and biodegradable waste from these companies. This project on resource augmentation was a timely answer for these efforts.

The project was planned with the following objectives:

- 1 Awareness raising on resource augmentation by tapping renewable resources (rainwater harvesting) and by utilizing waste (wastewater and organic waste)
- 2 Identification of potential for resource augmentation at a sugar industry – baseline

study

- 3 Identification of environmentally sound technologies for rainwater harvesting, wastewater reuse and composting at industry level
- 4 Design and implementation of project related technologies/systems: rainwater harvesting, wastewater reuse and composting at a sugar industry with local support

To achieve the above objectives, following activities were designed:

- 1 Three awareness raising and capacity building workshops for local partners (sugar industry and Viet Nam Cleaner Production Centre) and stakeholders (national and local government, industry representatives and community representatives) on policy framework for resource augmentation, rainwater harvesting, wastewater reuse and composting
- 2 Development of detailed designs for rainwater harvesting, waste water reuse and composting at a selected sugar company
- 3 Capacity building of local partners to design similar EST for other industries
- 4 Implementation of project components at a sugar company

Following outcomes were expected to be achieved:

- 1 Enhanced availability of resources (water and compost) from renewable resources and from waste
- 2 Demonstration of environmentally sound, techno-economically viable and socially acceptable technique and technologies for resource augmentation for rainwater harvesting, wastewater reuse and organic waste composting.
- 3 Enhanced capacity of local partners to design and implement technologies and system for rainwater harvesting, wastewater reuse and organic waste composting
- 4 Demonstration of 3R principles and ESTs in sugar industry which can serve as model for other industries in the region for replication and adoption.

To implement the project, an MOU was signed between UNEP and Viet Nam Cleaner Production Centre (VNCPC). The local partners, VNCPC were required to provide local support to carry out all the project activities. It was aimed that UNEP would assist VNCPC to develop in-house capacity to design rainwater harvesting, wastewater reuse and composting systems, so that VNCPC continue to support the implementation of these systems at other industries. After reviewing a few candidate sugar companies, Binh Dinh Sugar Company was selected as their top management was very committed and made an upfront commitment for installation of rainwater harvesting system, wastewater reuse system and improved composting plant through a MOU with VNCPC. They provided all the local support including local technical staff. However, after designs for EST were completed, Binh Dinh Sugar Company was sold to an international private company that kept all the commitments on hold till institutional and financial restructuring. VNCPC again reviewed other candidate sugar companies and selected Song Con Sugar Company for the implementation of project components. VNCPC modified the designs as per the local conditions.

For activity to promote awareness raising on resource augmentation by rainwater harvesting, wastewater reuse and producing compost/biogas, following four workshops were held, two in Ha Noi and two in Binh Dinh respectively:

1. Enabling Policy Framework for Resource Augmentation
2. Environmentally sound Technologies for Composting
3. Rainwater Harvesting
4. Wastewater Reuse

For data collection and designing EST for project components (rainwater harvesting, wastewater reuse and composting/biogas system), international consultants were invited for their expert support to assist local partners. The local partners were trained on-site to design the specific systems. The salient features of each project component at Binh Dinh Sugar Company are as under:

Rainwater harvesting:

1. It was estimated that about 12000m³ of rainwater would be harvested during rainy season over the six months per annum.
2. Flow: Rainwater collection and distribution system was designed based on the gravity to save energy required for pumping
3. Treatment: Simple inline filtration technology was considered in order to save costs and due to the good quality of rainwater
4. Intended use: The harvested rainwater was supposed to be used for industrial processing and not for potable purposes.
5. Maximum rainfall: Peak flow design criteria was based on 40% of maximum daily cumulative rainfall intensity is could be reached in 15 min.
6. Currently available freshwater tank, with a capacity of 600m³, was considered to be appropriate for collection of rainwater due to its connection with distribution system
7. The system was designed based on locally available materials and fabrication capacity. Total cost was estimated at about US\$ 15,000.

Wastewater reuse:

Based on the data collection, as shown in the following table, attention was focused on areas where treated freshwater is used. For freshwater consumption, Ash Filter and Dust Filter had highest tolerance values for suspended solids and are also high consumption areas. Accordingly, it was decided to target these two application points for using wastewater.

Wastewater Stream							
Source of Generation	Quantity m ³ /hr	Quality (as given by Sugar Company)					Discharge into
		COD	BOD ₅	SS	Temp	pH	
1 Vacuum Water	63912	5 to 12	2 to 10	20 to 27	33	NA	River
2 C.W for equipment	531	150	0	≤50	40	NA	WWTP
3 Sanitary	280	4000	2400	>100	50	10 - 11	WWTP
4 Cloth Cleaning	200	1500	NA	1800	80	NA	WWTP
5 Ash filter	300	29	0	≤20	35	NA	Sedimentation tank
6 Dust filter	400	0	9	>100	25-27	NA	Sedimentation tank
7 Treated wastewater	1000	≤50	0	≤30	≤35	6.7	

NA: Not Available

Composting:

1. Mixing pressed mud with dry organic waste and proper aeration
2. Removable roof during rain season for press mud, which is kept outside to get dry
3. Leachate collection and treatment system
4. To control odour through proper mixing of materials, turning piles and avoiding seepage of water

Once designs were ready, the sugar industry was privatized and Song Con Sugar Company was selected for the implementation of the project components. It was a great achievement of capacity building activities during the earlier design phase, that VNCPD designed the project components for this sugar company on its own. For rainwater harvesting, the expected amount is 448m³/year. The system would cost about 4 million VND or USD 2,500. For wastewater reuse, currently company was recycling about 280m³/hour of wastewater and additional 50m³/hour or 1,200m³/day would be recycled with the installation of cooling tower at a cost of 234 million VND or about USD15,000. For composting, the current capacity would be improved from 10,000 tons/year to 20,000 tons/year and environmental improvements would also be introduced at a cost of about 1 billion VND or about US60,000.

After the implementation of the project, following impacts and results were achieved:

1. Capacity building – A very important objective of the project – capacity building at local level – has been very well achieved and amply demonstrated, thanks to an unexpected problem (backing out by the management of the first company) which came as a boon in disguise. The partner technical institution VNCPD (including its host institution – Institute of Environmental Science and Technology) developed the designs for the new

partner industry (Song Cong Sugar Company) almost on its own thus demonstrating that the capacity has actually been built.

2. Technology Support – The information and technical knowledge provided by UNEP through specially prepared manuals and training programmes resulted in a better understanding of Environmentally Sound Technologies for resource augmentation. The technology support component was further strengthened by involving international experts with intensive knowledge and experience in the field. Technology support activities were even extended beyond the project focus area and the partner industry was provided information and knowledge on sugar manufacturing technology also.
3. EST Implementation – The ESTs developed and designed for rainwater harvesting, wastewater reuse and organic waste composting were all implemented at Song Song Sugar Company. The results are as follows:
 - A pilot rainwater harvesting system has been designed and implemented at the Administrative Building. With a total catchment area of 280m² the system has the potential of harvesting approx. 448 m³ of rainwater in an average rainy year. The implementation of the system was completed in August 2007 and in the consequent two month the RWH system enabled the company to collect 150m³ of rainwater. Encouraged by the success of the pilot system the sugar company is keen to expand the rainwater harvesting to other buildings during the next off-season period.
 - A pilot wastewater reuse system has been designed and implemented. A 50m³/h cooling system was designed and implemented to recycle wastewater from vacuum tuyars. The system is in continuous operation since its commissioning in September and has enabled the company to recycle 36,000m³ of wastewater in the first month of its operation. The company has spent VND 240 million (US\$15,000) towards fabrication and implementation of the system. The investment is likely to be paid back in 3 months due to reduced freshwater levy and even after accounting for additional cost towards operated cost of the system. The company is already making additional investments for expanding the pilot wastewater cooling and reuse system and is also keen to identify and implement other wastewater reuse operations.
 - Designs for modification in the existing composting system as well as design for a new, bigger and more scientific composting systems have been prepared. The company has already implemented the removable roof design in the existing system. It will soon implement the leachate collection and treatment system. The total investment will be in the range of VND 1.0 billion (US\$60,000). The operating practices have been improved which is expected to result in improved quality of product. The company has committed to implement the new scientifically designed composting system. The land has already been procured. It will take at least 1 year to built the plant and put it into operation. The total investment for composting plant is expected to be in VND 2.0 mission (US\$ 125,000). Additional investment of VND 8.0 billion (US\$ 500,000) will be required for leachate treatment plant to treat the leachate from composting plant.
4. Dissemination and replication – The partner technical institution (VNCPC) organized a Dissemination Workshop on 12 December 2007 to disseminate the experience gained and lessons learnt. It was a good surprise that Binh Dinh Sugar Company also made a presentation on their wastewater reuse system, which was implemented by the new management as they got impressed with this project and they utilized their own technical capacity, which was built during the design phase of this project. The partner technical institution has conveyed its willingness to include resource augmentation related achieving in its programme of work. The support to the partner industry was provided on the premise that the company will disseminate with knowledge to other industries and invite them to its premises to see the solution implemented. It is therefore reasonable to expect that this demonstration project will have an extensive dissemination and replication – UNEP-DTIE-IETC will continue to support and build further capacity in Viet Nam, and will also develop and implement similar projects in other countries.

Acronyms

BISUCO	Binh Dinh Sugar Joint Stock Company
DONRE	Department of Natural Resources and Environment (Provincial Government)
DOST	Department of Science and Technology (Provincial Government)
DTIE	Division of Technology, Industry and Economics
ETP	Effluent Treatment Plant
EST	Environmentally Sound Technologies
HUT	Hanoi University of Technology
IETC	International Environmental Technology Centre
MONRE	Ministry of Natural Resources and Environment (National Government)
MOU	Memorandum of Understanding
PPP	Purchasing Power Parity
UNEP	United Nations Environment Programme
VNCPCC	Viet Nam Cleaner Production Centre
VND	Viet Nam Dong (Currency)

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