



ITT Alumni Seminar

*"Rio+20: From Recommendation to Practice
- Regional Showcases for Implementation"*

Book of Abstracts 2013



Fachhochschule Köln
Cologne University of Applied Sciences

Institute for Technology and
Resources Management
in the Tropics and Subtropics (ITT)
Cologne University of Applied Sciences
Germany

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“Rio+20: From Recommendation to Practice - Regional Showcases for Implement”

Publisher

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Resources Management in the Tropics and Subtropics (ITT)
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Cologne Cathedral

Welcome to the ITT Alumni Seminar 2013!

How can green ideas be translated into reality? After the Rio+20 conference, Green Economy and Green Growth have emerged as a new paradigm for sustainable development. Many initiatives and projects are being initiated worldwide to implement the recommendations of the conference. With the Alumni Seminar "Rio+20: From Recommendation to Practice – Regional Showcases for Implementation", the Institute for Technology and Resources Management in the Tropics and Subtropics (ITT) is willing to support its alumni to display innovative project ideas that aims to implement the outcomes of the Rio+20 conference into practice.

The ITT offers various master programs related to natural resources management with special reference to tropical and subtropical regions. Some of the master programs are offered together with partners abroad providing students the chance to study in different settings gaining insights into other cultural, environmental and social realities. The current partners are: University of Jordan, University San Luis Potosi (Mexico) and the Vietnam Academy of Water Resources.

- Global: Technology and Resources Management in the Tropics and Subtropics (TERMA) <http://www.terma-master.info/>
- Mexico: Environment and Resources Management for Latin American and German Young Professionals in San Luis Potosi (ENREM). <http://www.enrem-master.info>
- Jordan: Integrated Water Resources Management (IWRM) – International Master Program in Jordan and Germany <http://www.iwrm-master.info>



- Vietnam: Technology and Resources Management in the Tropics and Subtropics. A German Master Program for Vietnam (TERMA-VN). www.termavn-master.info

A fruitful global network of more than 600 Alumni has arisen from our long lasting educational experience. Now, we are happy to welcome 20 Alumni with the best project ideas in Cologne.

Altogether, 16 projects were selected for the attendance-phase of the seminar in Cologne, in the categories Research, Green Economy and Green Development in NRM.

This book of Abstracts gives the reader an overview of the project ideas.

The coordination team of the ITT Alumni Seminar will provide any necessary support to guarantee that you take the highest advantage of the Seminar.

We wish you an inspiring seminar and a nice stay in Cologne!

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Production of Biogas from Hodeida Wastewater Treatment Plant

Biogas is a mixture of methane and carbon dioxide resulting from the decomposition of organic waste material by bacteria without oxygen, called anaerobic digestion. Biogas is produced from many sources: decomposed vegetation and animal manure, the treatment of human waste in anaerobic digesters and decomposed landfills.

Global climate change is declared the latest threat to the world by the United Nations Environmental Program (UNEP). Climate change happens because of producing greenhouse gas (mainly carbon dioxide and methane) emissions, so biogas could be a sustainable, renewable, natural resource to reduce the effects of this problem.

Yemen is one of many developing countries facing problems. Taking advantage of a green economy concept will help Yemen in solving most development issues. Producing biogas from wastewater treatment plants (WWTP) could be a good application towards a green economy in Yemen; more than 51 WWTP in Yemen process more than 108 million m3 of wastewater. The first big project of producing biogas from WWTP is under construction in Sana'a, the capital of Yemen.

There is potential in generating biogas from the WWTP in Hodeida Governorate because the high temperatures will help in digesting organic material efficiently. That will enable Yemen to reduce emissions 143,507 CER/year. One certified emission reduction (CER) is equivalent to one ton of CO2.

Socio-economically, the project will provide 6,834 tons of methane gas which will make essential savings in operation costs exceeding 60% of Hodeida WWTP energy consumption. Digesters will help in providing farmers to get safe treated wastewater and safe fertilizers for use on the farm and cultivating alfalfa for animals, securing more food and will improve their incomes. Environmentally applying this idea will help in the fight against global warming and minimize environmental impacts comparing with using diesel and petrol generators which produce a lot of CO2, noise and odors. Using safe fertilizers from biogas systems will provide cultivating practices without transferring diseases.

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Renewable Technologies Implementation and Empowerment Program on Dairy / Cattle Farm Community in Rural Areas Indonesia

In small villages and rural areas in Indonesia, majority of the community has low socio- and economic life. Efforts had been taken, which involved local government, NGO and other stakeholder to improve their life standards in the area of economy, health and education. The case study is a cow farm communities in a small village in West Java, Indonesia. Regarding to their poor community and environment, educating and mentoring the low educated farmers to implement biogas technology, which is new for them, has some obstacles due to the social and cultural aspects. Applying an appropriate biogas technology in their farm eventually has many advantages. From the cow farm wastes, the dungs is processed to produce methane. The methane gas produced will become the energy source for cooking (eliminate wood burning and the use of kerosene), lighting (by the means of generator, save electricity) and generating useful machines for cow farming matters. The sludge from fermentation can also be used for fertilizer to support healthy and organic plants. This paper aims to discuss and analyze the mechanism of applying Biogas Technology in a cow farm community in small village with low cost methods. The discussion then will be expanded to the actors who can support the measure of implementing the new

technology with concerns of social and cultural aspects. The effect of the new technology application in the village will result in a new management methods of handling the products from the cow's farm. The multiple research methods are data and statistic collection, interviews, and questionnaire, used to conduct the research analysis.

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The Payment for ecosystem services - the case study of mangrove forest in Giao Thuy, Nam Dinh, Vietnam

Mangrove forests are a key marine biome supplying valuable ecosystem goods and services such as water quality control, climate regulation, fisheries production, nursery habitats and storm and flood protection etc.,. Like other forests, mangroves are efficient carbon dioxide sinks as 'blue carbon', as blue carbon represents 55% of the biological carbon on earth, the conservation and restoration of these 'blue carbon' habitats can play an important role in climate change mitigation. However at present, mangrove forests on over the world are being lost and degraded at an alarming rate due to both anthropogenic and natural reasons such as pollution, land clearing, coastal development, natural disasters and climate change. A possible mechanism to reduce the decline of mangrove forests is the use of payments for ecosystem services (PES). Recent assessments indicate that tropical mangroves are among the most carbon-rich forests in the tropics, thus PES and carbon credit systems may offer the opportunity to achieve dual goals of poverty reduction and protection of global marine carbon sinks.

Giao Thuy district, Nam Dinh Province located in Red River delta, Northern Vietnam is a typical agricultural economic district, with high poor rate households and depend much on the natural resources especially the mangrove forest. In recent decades, under the economic development pressure, thousands hectares of mangroves are degraded and vanished, it lead to the threatened of the livelihoods of the local people. This research aim to figure out an acceptable and feasible PES model which would be applied in Giao Thuy district as well as promoting the positive role of the PES in the creation of financial resources for the conservation of natural resources and develop sustainable livelihoods and improve the quality of life for local people.

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Strategy for the implementation of eco-technologies and cleaner production methods in small and medium size dairies: Project Uruguay

The 4.433 dairies, of which 65% are of medium and 29% of small size (in 2012), are a big environmental risk for Uruguay. The dairies have extensive water consumption between 25-100 litre/cow/day (DINAMA, 2008). Most of the water is used for cleaning the milking sheds. Dung and urine is flushed into drains, which generally lead to solids retention ponds and anaerobic lagoons. A big amount is also required as drinking water for the cow.

In addition to the high water consumption a very critical issue is handling and disposal of manure. The treatment of dairy sewage often is inappropriate and causes superficial and ground water pollution (Facultad de Agronomía, Universidad de la República, 2013). For example, the watershed Santa Lucía, the main basin for potable water in Uruguay, is exposed to such a pollution case (El Observador: Informes de la DINAMA ratifican contaminación en el río Santa Lucía, 2013).

Dairies also demand high energy consumption for cheese production and cooling process of the milk in a refrigerated bulk tank, where it can be stored safely for a few days.

Since pollution caused by dairies has a high impact on the environment and recently has endangered human beings' health, society

and government have become aware of this problem and started attempts to reduce the environmental impacts. Different sustainable technologies were implemented, but in many cases without long-term success. Failure of these projects mainly occurred due to lack of knowledge and low environmental awareness, high project and technology costs, complexity and high maintenance requirements as well as inappropriate finance structures.

The case study will propose a strategy for the implementation of cleaner production methods and eco-technologies on small and medium size dairies from a livestock farming region in Uruguay. The purpose is to achieve long-term sustainable operations, to reduce the environmental impacts and improve quality of life. Therefore, following objectives are presented in the paper: (1) Create consciences about environmental impacts and health risks of dairies activities, (2) show advantages of working in cooperatives, (3) identify national and international financial sources for cooperatives, (4) analyse the potential of sustainable development of dairies with technologies already implemented, jointly with dairies owners, (5) propose this strategy as part of the green economy plan of Uruguay.

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Sustainable Management of urban green areas in Brazil

The work of the administration of urban green areas in Fortaleza is done by the municipality. The rational use of water is one of the primordial themes in the sustainable environmental management of these areas. Currently, the management of green areas utilizes a strategy of environmental, economic and social sustainability. Some strategies of sustainability in the management of such areas include: the taking of lake water, which receives pluviometric precipitation and sewage treated as aquiferous recharge. Nightly irrigation by means of pipe trucks, in the city's busiest avenue dividers, the suspension of irrigation by pipe trucks and the intensive planting of trees during the rainy season, and the proposals of complementary irrigation with the reuse of treated wastewater. Ten species of medicinal plants are also cultivated in some public parks of Fortaleza. The evacuation of solid residue in urban green areas and water courses is being controlled through environmental education and the supervising of the same. The pollution of hydric resources with illegal waste is being controlled by supervision, the application of fines on the transgressors and obliging the same to connect their waste to the municipal network. It is also proposed the treating the final effluent of treatment plant of factories with aquatic macrophytes in constructed wetlands. Other forms of economizing water include the usage of xerophilous plants originating from the caatinga biome, the irrigation of plazas from artesian wells,

the use of organic compost and the creation of basins around the trees, which help in water retention, the planting of frutiferous trees from dry regions of the planet, such as the African savannahs, and environmental education in schools and society by means of local Agenda 21. The pulp and paper mill is a major industrial sector present in Fortaleza and in its surrounds which utilizes huge amounts of natural biomass, inorganic and organic materials along with a large volume of water in different stages of the papermaking process. The effluents in pulp and paper mills may contain significant charges of lignocellulosic residues that are considered as "waste" fractions. By developing dedicated extraction processes in combination with microorganisms, lignin and cellulose fractions will be recovered from the effluents. Optimum conditions for precipitation of the lignin fraction and filtration of the cellulose fraction will be determined. Next, the recovered lignocellulosic mass will be characterized and used for the formulation of biopolymer composites. The chemical purity and eventual degradation of the lignin and cellulose fractions will be analysed in combination with the degree of crystallization. These properties are essential for determining the reactivity of the obtained components and their ability to be further processed.

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Waste water Management through constructed Wetlands

Wastewater is a serious ecological problem throughout rural areas in El Salvador, Central America, because normally there is no service or facility for the treatment and because of that wastewater is thrown out of the houses into rural roads and rivers.

Pollution on the ecosystem comes as a result of this situation specially rivers and subterranean water sources; infection focus for insects and germs and bad odor results also as a consequence of stagnated water.

An ecological alternative for the wastewater treatment in rural areas is the Constructed Wetland.

The Constructed Wetland (Artificial Wetland or Biojardin) is an infrastructure basically made as an artificial excavated pond that has a filter of different materials (like gravel, rocks); the water flows slowly through the filter. On this pond should be cropped plants, which absorb the minerals from the wastewater.

There are three main benefits resulting from the Constructed Wetland: 1- Wastewater could be purified up to 85 – 90%. 2- The purified water could be thrown into the rivers or reused for irrigation purposes and at the same time is helping to alleviate poverty, due

to the water scarcity this is a good alternative. 3- Plants to crop in the constructed filters could be of economic importance like flowers to sell, alleviating poverty.

Other additional benefits are: reduction of pollution and environmental risks, reduction in CO₂, production of O₂, and improved human well-being in rural communities.

This project aims to execute a pilot plan with some amount of houses. The Constructed Wetland technology could be implemented in rural villages, in association with community water associations and local government agencies (Health Ministry for example). People should be also empowered and take active work in the solution of their own problems.

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Creation of the Seed Guardian`s Network

Mexico is one of the diversity centers of cultivated plants with global importance. Trends such as agricultural industrialization, rural depopulation and conventional consumerism are only some of the driving forces for the loss of agrobiodiversity. Unfortunately, conservation efforts and political interventions in order to promote local varieties are hindered by the lack of information on where to find rare crop varieties and missing data about rural producers who are cultivating and providing local varieties or landraces. Our project idea is to gather information about local varieties and to bring local producers together, who are interested in the cultivation and distribution of native food crops in Mexico, through a Seed Guardians Network. Being affiliated to the network, local farmers (future Seed Guardians) will have more possibilities to exchange seeds and plants. The network will also help to establish contacts between the rural farmers and the consumers, which is necessary to reintroduce almost forgotten varieties on the commercial markets and to facilitate their access for the present and future generations. Furthermore, the Seed Guardians Network will provide a database and resources for scientists, policy makers and other stakeholders interested in the conservation and pro-

motion of local crop varieties. All the information, which will be updated on a regular base, will be transparent and accessible for everybody. By this way, our project will contribute to the conservation of agrobiodiversity in Mexico, create new income opportunities and counteract food security concerns worldwide.

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The House of Cities of the Future

The project aims at designing the House of Cities of the Future (HoCoFu), which sustains water and energy resources at a house/building level by using nonconventional water resources and clean energy. The project's main task is building a model that captures best available technologies, depending on previous research, in order to present a decision support system that can give the best solution for designing the (HoCoFu). The model may also work as an expert system and lead users step by step to the final design. The final house design will, depending on the area's climatic conditions, suggest the type of clean energy to be used, the best water saving practices that can be implemented, a final design, and an economic analysis. Although the research will be carried out at a house or building level, the main future vision is to implement the methodology in small cities and rural areas in arid and semi-arid regions and in developing countries. Within the project a selected area will be fully studied as a pilot project to calibrate the model.

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Green Academy

To ensure the acceptance of any green growth strategy and its implementation, awareness is essential. For developing countries, increasing awareness is important and represents one of the most serious challenges for them to follow the recommendations of Rio+20. Public should be aware of the importance of green growth and sustainability concepts. Transferring know-how and simplifying scientific knowledge regarding green growth and sustainability is very crucial. For green economy concepts to be implemented, they should be shared and discussed by many stakeholders. So, it's very important to have a body that not only works to increase public awareness, but also to work as a mediator between governmental institutions, NGOs, academicians, private sector and public people. Green Academy is aiming to act as a green growth mediator in Sudan, where potentiality for following a green economy path is high. The academy is going to work extensively with the public by conducting academic and leadership programs, seminars, workshops and by supporting green initiatives. At the academy, public would have access to traditional and e-libraries. Practical training for green careers would be provided in highly sophisticated labs. The academy would work to be a symbol for green practices by following green practices inside the academy buildings.

Green Academy is going to write books, newsletters and design brochures, especially for kids, and distribute them free of charge. translate interesting toolkits, papers and references into local languages, so language is no longer a barrier. Moreover, in its animation studio, the academy is going to create awareness movies and share them on media. A Green Fund would be a key project for the Academy to assist public people to follow and adapt green practices. Grants would be provided to poor people and should be recoverable with no interest rates and in small installments and wider time span.

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Solar micro grid for an isolated off-grid coastal community in Bangladesh for supplying mainly drinking water and additionally providing low cost lighting & mobile phone charging facility

The coastal area of Bangladesh is the biggest victim to natural disasters such as cyclones and floods. By frequent natural disasters in coastal areas, traditional ponds or surface water bodies become inundated with sea water and lead to the contamination making unsuitable for any form of human consumption.

The situation has become worse by intrusion of brackish water for massive shrimp farming. So, access to a fresh water supply for drinking has become a question of survival. By drinking unsafe water, people frequently suffer from different casualties and diseases. On the other hand, in rural and coastal areas of Bangladesh, where 80% of the population live, only 30% have electricity. These villagers do most of their work from dawn to dusk, and in the evenings they depend on kerosene lamps, which provide poor illumination and produce emissions that cause respiratory and eye problems. Kerosene is also a potential cause of fire hazards and the chance that children may accidentally drink it. People using mobile phone in these areas need to go far away to get it charged.

Solar powered pump through establishment of a solar micro grid system can lift underground potable water to an overhead tank

and supply by gravity flow through pipelines to several collection points nearest to the households. The solar pump remains idle when the overhead water storage tank is full; the excess solar energy gained by the panels during day can be stored in battery banks and distributed to the surrounding households at night. Energy efficient 2-3 watt LED lighting will be provided to replace the dirty kerosene lamps, plus a way to charge their mobile phones. The capacity of the panel will be estimated according to the numbers of households. Cumulative contribution from the users will be used for maintenance and sustainable operation of the plant. The main objective is to provide drinking water, additionally low-cost lighting and mobile phone charging. Benefits would be to solve drinking water problem, enhance the scope of children's study in healthy indoor atmosphere, to get extended working hours for additional income, to reduce health and fire hazards for using kerosene lamps, to use mobile phones keeping villagers in touch with market prices for their produce & social communication with relatives living in another places. Overall benefits would be to improve the quality of lives of the rural coastal people through maximizing the use of renewable resources.

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Social responsibility and carbon emission reduction in the panamanian private energy sector

Carbon emissions; as Green House Gas, became a fundamental climate change factor. Great efforts are been done in order to establish broader controls to reduce GHG emissions. With the purpose to create companies with a continuous improvement production, a technological and finance market was developed around this phenomenon becoming a tool of the green economy concept.

Taking in to consideration the growth of worldwide extreme events and the last publication of the LOA Observation Institute; was informed that carbon emissions nowadays are 399.72 ppm, a greener economy which include stronger Natural Resources Managements Policies for local; as well as, regional level is a fundamental key to achieve sustainable development according to national circumstances.

Considering that sustainable development is not only an environmental responsibility, but also a commercial and social responsibility recognizing that both private and government sectors share different ranks of responsibility and commitment to common welfare; understanding the urgency to build resilience in most vulnerable stakeholders, this project intent to evaluate, identify and define how private energy sector, as part as their social responsibility, could contribute

with Panama's sustainability as part of a non-monetary and voluntary governmental pilot incentive system.

The project will identify simpler ways for the Panamanian Private Energy Sector to recognize how carbon emission reductions must be a part of their social responsibility strategy and link it with women empowerment, poverty alleviation and energy access in vulnerable communities at national level.

This initiative will facilitate a change in the way of how companies approach social responsibility, how energy sector foresee their role within the climate change fight.

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Integrated waste to energy management for sustainable development of communities in Plateau state, Nigeria

Synopsis:

The inevitability of generating waste and a growing population continue to undermine government's efforts in waste management with a consequent health and environmental impact in both rural and urban communities of Plateau state, Nigeria. Conversely, energy supply continues to decline with the upsurge in energy demand and failing energy generation and distribution networks. Hence the role of deploying waste to energy technologies cannot be overemphasized in this regard as a means managing waste and providing clean energy. However, putting in place a coordinated system with relevant expertise and technology is of great significance in promoting sustainable environmental and socioeconomic development in Plateau state.

Keywords:

Green economy, renewable energy, resources management, sustainable development, and waste management.

Core project focus and methods:

The promotion of green economy through re-use of waste for provision of clean energy is to be realized by a three-phased approach that includes a Planning phase (Feasibility study, partnership, community engagement, etc.), Establishment phase (working facilities,

machinery and personals) and Implementation phase.

Objectives:

1. Design and implement a functioning waste to energy system tailored for communities in Plateau state.
2. Promote sustainable utilization of resources and the reuse of waste for energy production.
3. Encourage environmental protection leading to health and socio-economic development.

Expected outcome:

Provision of clean energy particularly to the rural communities, effective control of environmental pollution resulting from poor waste management, reduce dependence of fossil energy thereby reducing environment pollution caused by their use, resource management and conservation in the target areas, and the improvement of the social and economic status of beneficiaries of this project. Main tools for achieving these goals will be the deployment of Biogas technology and where applicable solar technology.

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Water and Energy Saving at the Industrial Sector in Jordan

Sustainable economic development depends on adequate water and energy supplies at competitive prices. In Jordan, the water and energy resources are severely limited, total imported energy amounted to 96% of Jordan's total energy needs(1). Thus, the fluctuating supply and price of water and energy require industries to improve water and energy conservation. On the other hand the improper disposal of industrial waste damages limited water resources and constitutes a public health hazard. Knowing that the industrial sector in Jordan consumes 23% of energy resources, and 6% of the water resources, on the other hand the National Water Master Plan for Jordan shows that the industrial Energy and Water demand will increase to 30% and 10% respectively by 2025(2).

We have to recognize the urgent need to protect and conserve scarce resources through regulation, education, and coordination with industries, local communities and the private sector. To address this need we have to launch the Water and Energy Conservation Project in the industrial sector, which aims at increase the efficiency of water and energy usage, and improve liquid and solid waste handling practices in the industrial sector of Jordan.

Methodology:

The project will identify industrial facilities that have the opportunities for water and energy savings and better waste management,

and then develop environmental management systems (EMS), pollution prevention (P2) programs, and conduct awareness program by applying the following points:

- Field visits to the facilities,
- Meeting with the top management of factories to communicate and clearing up of the saving plan,
- Walkthrough the factories in order to breakdown all water and energy consumptions,
- Writing the water and energy saving options as an action plan,
- Direct the industrial facilities to apply all saving options and calculate the saving money,

Objectives and expected results:

- Enhance water and energy usage efficiency,
- Use unconventional water resources (harvester and treated water),
- Use renewable energy (PV and Thermal system),
- Increase industrial facilities' awareness of the benefits of resource conservation,
- Reduce operating costs,
- Improve competitiveness and sustain economic growth,
- Reduce and manage pollutant disposal,
- Reduce carbon emission,
- Enhance the industrial facilities to implement cleaner production programs.

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Native silvicultural-industrial systems as a multifunctional alternative to green economy in Amazonian production

Land use change in Ecuador, especially due to deforestation; is causing a yearly 77000 to 198000 loss of native forest, and silviculture together with land use change are contributing with 69,5% of greenhouse emissions in the national account. This deforestation is affecting also the Amazon Region which holds 80% of native forest in the country. In this regard, the research proposes a multifunctional silvicultural-industrial system as an alternative that incorporates native species (*Ocotea quixos* and *myroxylon balsamum*) with a non-timber forest product potential as a green economy solution for this matter. The interest is to assess the carbon content of soil and vegetation in order to estimate the amount of carbon captured by the essay as an early alternative for cost recovery of the system; however the essay is looking to evaluate in the long run the amount of trees' production (leaves and latex) that will represent the midterm strategy to support the system.

Because the project will be implemented in a degraded pasture land, in the first year the essay will evaluate the growth of the native species; the carbon stored in the biomass around species of interest and the carbon content of the soil microbial biomass, against basal soil respiration to give an idea about the organic matter behavior in the future. These series of tests will allow the project to have a good base line for further research in the next years of implementation.

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Adopting 3Rs toward Green Economy in Hai Phong province, Vietnam

Toward Green Economy, Vietnam National Green Growth strategy (VGGG) was approved and announced in September 2012. In the conference of collaboration in implementation of the VGGG in April 2013, recycling resources, managing pollution, and restoring ecosystem to protect the environment were one of five proposed directions of the core green technologies. However, more than 80% of domestic waste in rural areas has not been collected and treated (IWE-MARD, 2012). Average amount of waste per person is about 0.6 - 0.7kg/day. With 50 million people living in countryside (70%), this equates to about 30,000 - 35,000 ton of wastes per day. Waste is released in villages, markets in ponds, lakes, rivers and canals causing bad smells and is a disease source. Waste water leaks out and seeps into the soil causing water pollution. Recently, in many countries, a practical approach is the use of 3Rs in solid waste management. These are Reduce - Reuse - Recycle. The first R means Reduce waste by choosing to use resources with care. The second R is Reuse which is the repeated use or exchange of usable items. The third R is Recycle which is used to prevent waste of useful materials and reduce the consumption of raw materials. 3Rs is a balance between environmental protection and economic development. In the context of natural resources depleted and solid waste disposal encoun-

tering many problems, 3Rs is the handy solution to this crisis. The objectives of the proposed project are to enhance the participation of the individual, waste collection companies and other stakeholders to 3Rs. A collection network in which solid waste is divided into two categories of recycle (bottles, papers and packing covers, vegetables) and non-recycle from the levels of each household to villages, communes, districts, provinces and collection companies will be established. The 3Rs will become a lifestyle in a pilot province (Hai Phong). The products such as compost from recycling can be used for farms and gardens, bottles and papers can be re-produced. Waste minimization, resources maximization can be achieved in the efficient way.

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A strategy for the implementation of River Information Services in Brazil

Renewable energy sources X efficient multi modal transport: a challenge in Brazil.

Water is closely linked to a number of key global challenges and the importance of integrating the three topics: access to water, renewable energy and energy-efficient transport systems is of ultimate importance, particularly when talking about sustainable development in a country such as Brazil. In Brazil, where the hydropower generations is responsible for approximately 70% of all energy produced in the country, the access to energy is directly related to poverty eradication, being a input to production. On the other hand energy-efficient multimodal transport systems, by means, for example, of investing in inland waterway transportation (IWT), are also relevant to enhance economic growth, improving accessibility to productivity of rural areas, situated in general far from the Brazil's ports.

Brazil is facing severe logistics problems and that is affecting the country's market for exportation of grains, one of the country's most relevant commodities. Investments in IWT have been pointed out as one of the strategies to improve Brazil's logistics. Studies have shown that the IWT is much more efficient, less polluting and with few accidents, in comparison to the road transport. One of the aspects that hinders the development of

this transport mode is the lack of locks in existing and planned hydropower dams. Furthermore, despite the considerable amount of large rivers in the country some are already facing decreases in the water level, creating a disputing scenario for both sectors. The operation of locks can impact on the efficiency of hydropowers and the conflicts between the energy and transport sectors may increase if water levels decrease even more, as predicted in some studies of climate change, but investments in both sectors are considered strategically for boosting Brazil economy. The aim of this research project is to present the importance of adopting more efficient technologies, in this case less water demanding, that guarantee the use of renewable energy combined with an energy efficient transport mode in order to guarantee Brazil's shift toward a more integrated use of water and consequently sustainable development.

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