Findings from a study on climate change mitigation funded by WB Carbon Finance Assist

Dr. Ha Dang Son – Managing Director of RCEE.

Overview

- World Bank Carbon Finance Assist program

  A multi-donor single purpose trust fund set up to ensure that developing countries and the economies in transition are able to fully participate in the flexible mechanisms defined under the Kyoto Protocol.

- Project identification for Mitigation in Vietnam

  - Within the Country Assistance Partnership Strategy for Vietnam (2007-2011) developed by the World Bank and the Government of Vietnam, and approved in January 2007.

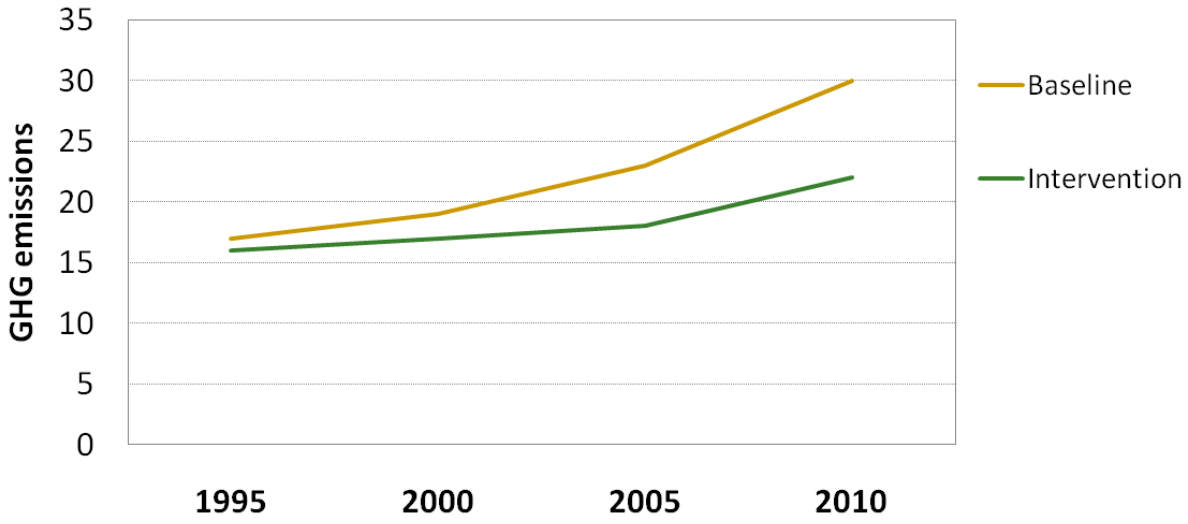
  - The study would help identifying both short and medium term opportunities for project, program and policy-based interventions to reduce GHG emissions.

Methodology

Difference in GHG emissions between baseline scenario and intervention scenario

- Baseline scenario: Existing technology or common practices for each activity

- Intervention scenario: New technologies/processes proposed



- Approach

  - IPCC 2006 guidelines

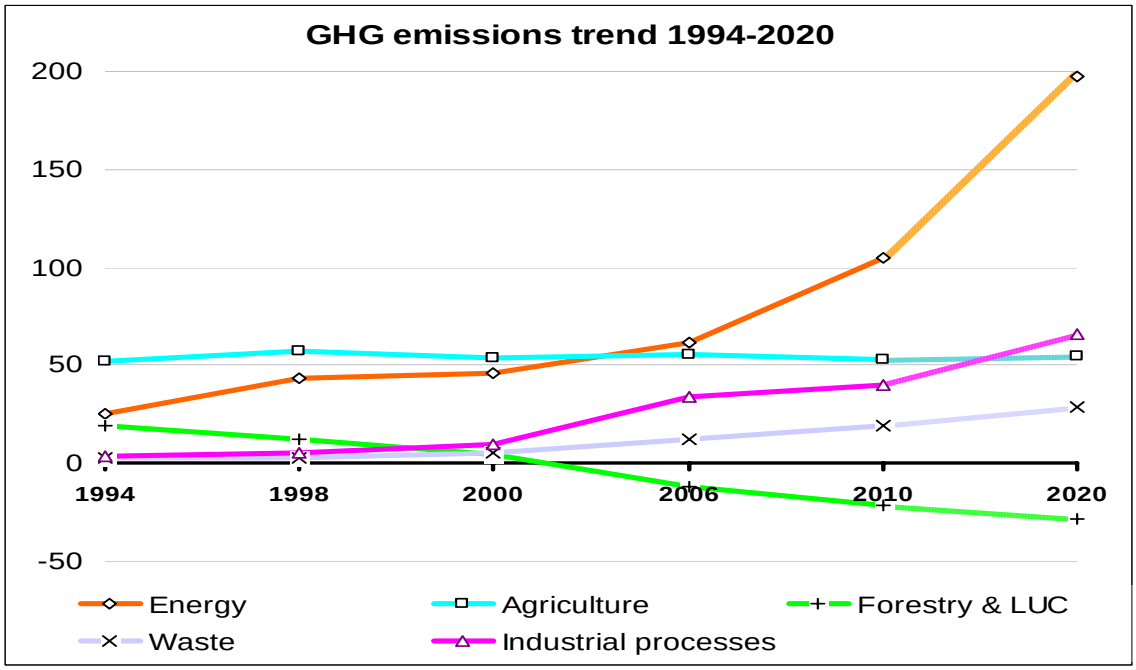
  - UNFCCC approved methodologies

- Data source:
    - Initial National Communication to UNFCCC
    - Statistical data from General Statistics Office
    - Data from sectoral reports

GHG emission trends by sector:

Considered sectors:

- Energy: focus on energy use including extraction, transportation and end-use
- Industry: focus on industrial process, excluding industrial waste treatment
- Agriculture: focus on non-energy use
- Forestry and land-use-change
- Waste: including municipal waste, industrial waste, agriculture waste



Reasons for trends in emissions

- Energy:
    - Increase in energy consumption
        - Electricity: 14.7–15.8%/yr
        - Coal: 16–17%/yr

        - Oil: 12–13%/yr
        - Gas: 20%
    - Increase in fossil-fired power plant
    - Low efficient equipment
    - Less popular use of alternative renewable sources
        - only 2.5% of total power supply
- Transport
    - Increased number of vehicles (10% annually) and traffic volumes.
    - Increase in motorcycle use which has most intensive per person per kilometer (15% annually).
    - Others:
        - Lagging infrastructure improvements;
        - Slight changes in modes are increasing emissions:
            - Decreasing use of inland waterways for both freight and passengers
            - Increasing use of maritime traffic for freight.
- Industry process
    - Cement Industry:
        - High demand for cement for construction (14% in 2004 and estimated 10-12% until 2010).
        - Lack of investment in energy efficiency.
    - Brick Making:
        - High demand for bricks for construction (average 13% annual growth in demand from 2000-2005).
        - Slow conversion from traditional to more energy efficient kilns (government decree but slow adoption with 65% still traditional)
    - Iron and Steel:
        - Demand for iron and steel for construction rapidly growing (18-20% average between 2000 and 2004).

        - Some improvements in energy efficiency (2-7% average annually between 2000 and 2004 depending on the process).
    - Pulp and Paper industry:
        - Growth in paper demand (13% anticipated between 2005 and 2010) is increasing energy demand from industry
        - Continued used of old technology for some plants.
        - Continued reliance on fossil fuels.

- Agriculture
    - Livestock: Steadily increasing domestic demand combined with continued use of open manure management methods.
    - Rice: Area under rice production is decreasing only slightly with similar irrigation practices; higher yields obtained mainly by using more N-based fertilizers annually.

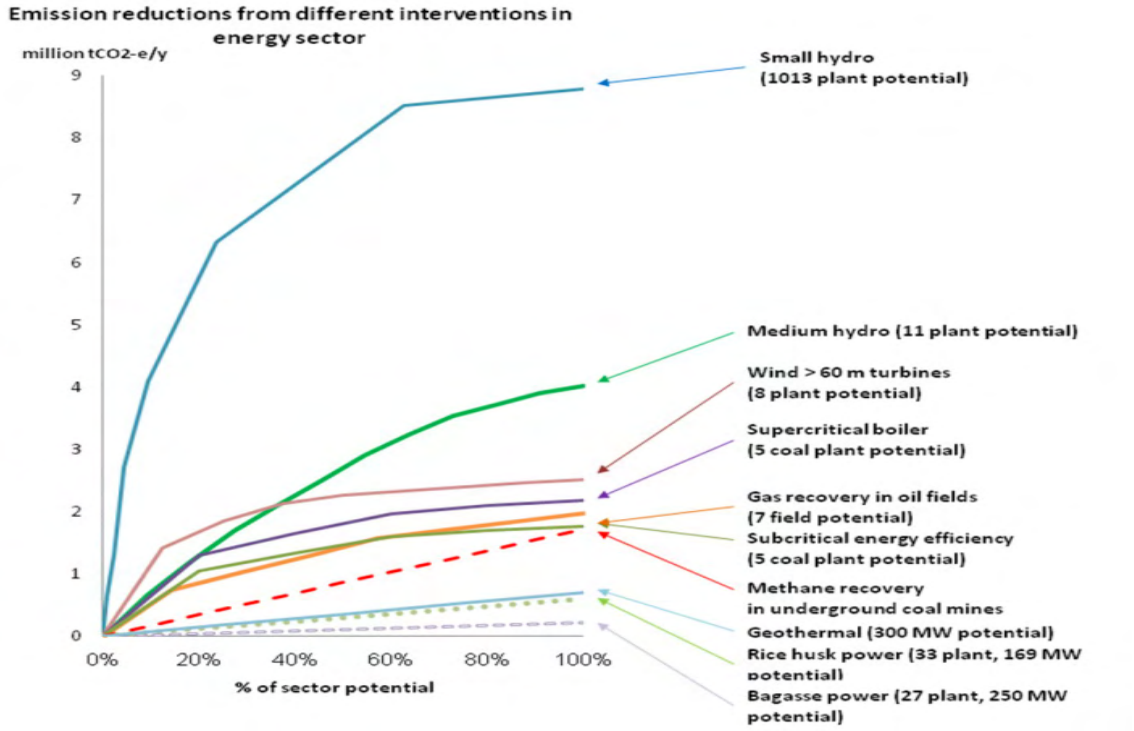
- Forestry and Land Use Changes
    - Pressures for conversion of forest land will remain:
    - Continued growth of wood processing and wood products industries.
    - Conversion of forest land to cash crops (coffee, pepper, rubber and cashews).
    - Shifting cultivation in uplands.
    - Infrastructure development.
    - Implementation of government programs aimed to
    - Increase forest cover to 43% of national land area by 2015 will continue to increase the biomass growth.
    - Reduce deforestation and degradation and thus emissions from land use change

- Waste Management
    - Municipal Wastes: Population growth (1.4% annually); Growth in urban population (4.4% annually); Installation of aerobic/anaerobic treatment systems (will grow from 2 to 30% in 2010); Wastewater sludge disposal practices use landfills; Continued use of latrines and septic tanks in rural and urban areas; Increase in consumption but with less significant decrease in proportion of organic matter; Establishment of sanitary landfills without methane capture or composting will increase emissions

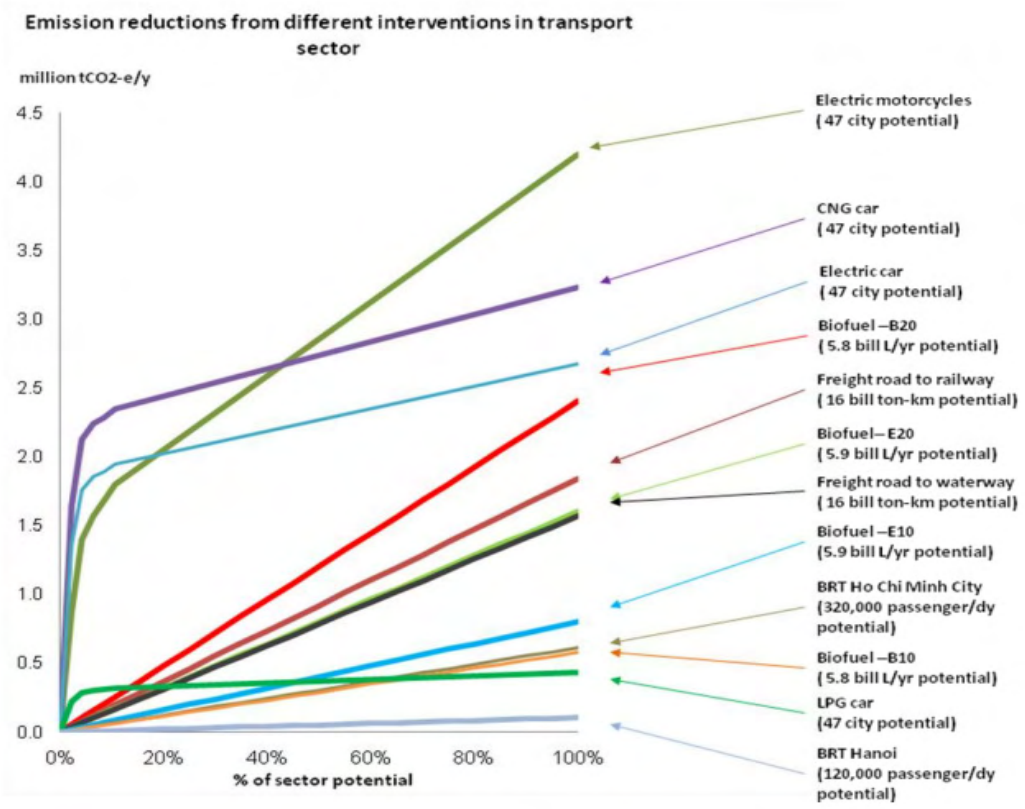
- Industrial wastewater: Growth in output from high BOD industries (average for top BOD producers 9% annually); Growth in bioethanol industry (will account for between 17% and 44% of emissions in 2010); Adoption of open anaerobic treatment systems for a portion of the industries; Lack of treatment for a portion of the industries.

GHG reduction potential

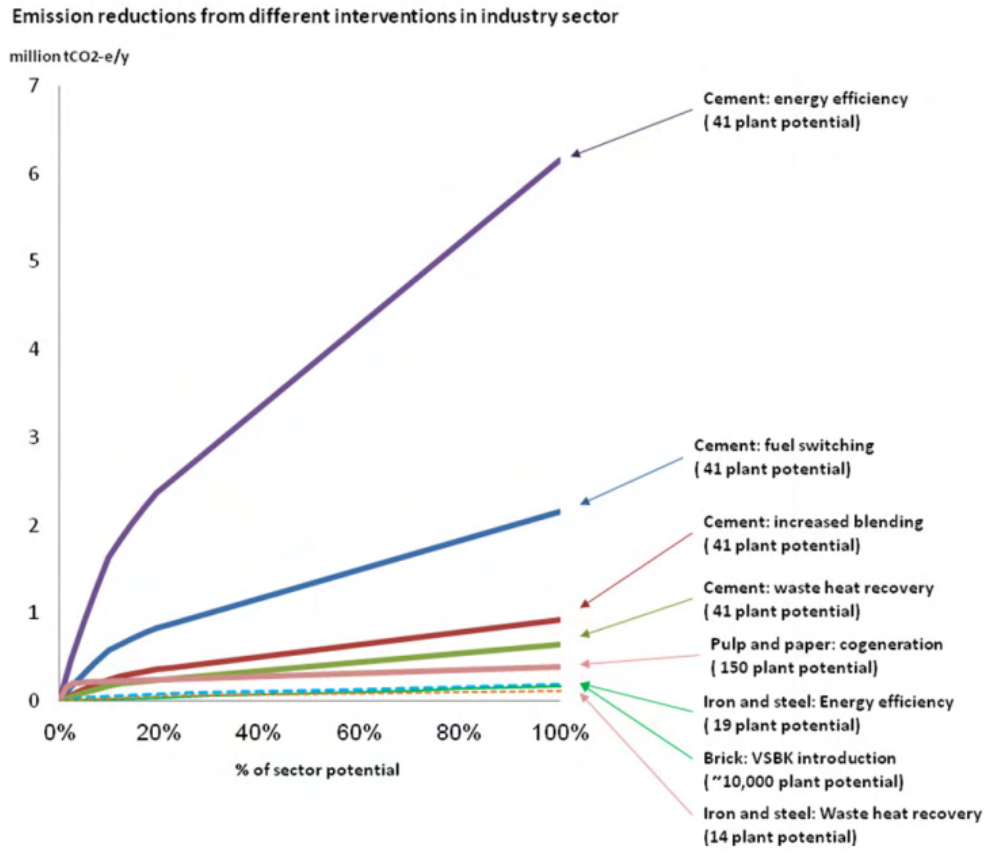
- Energy



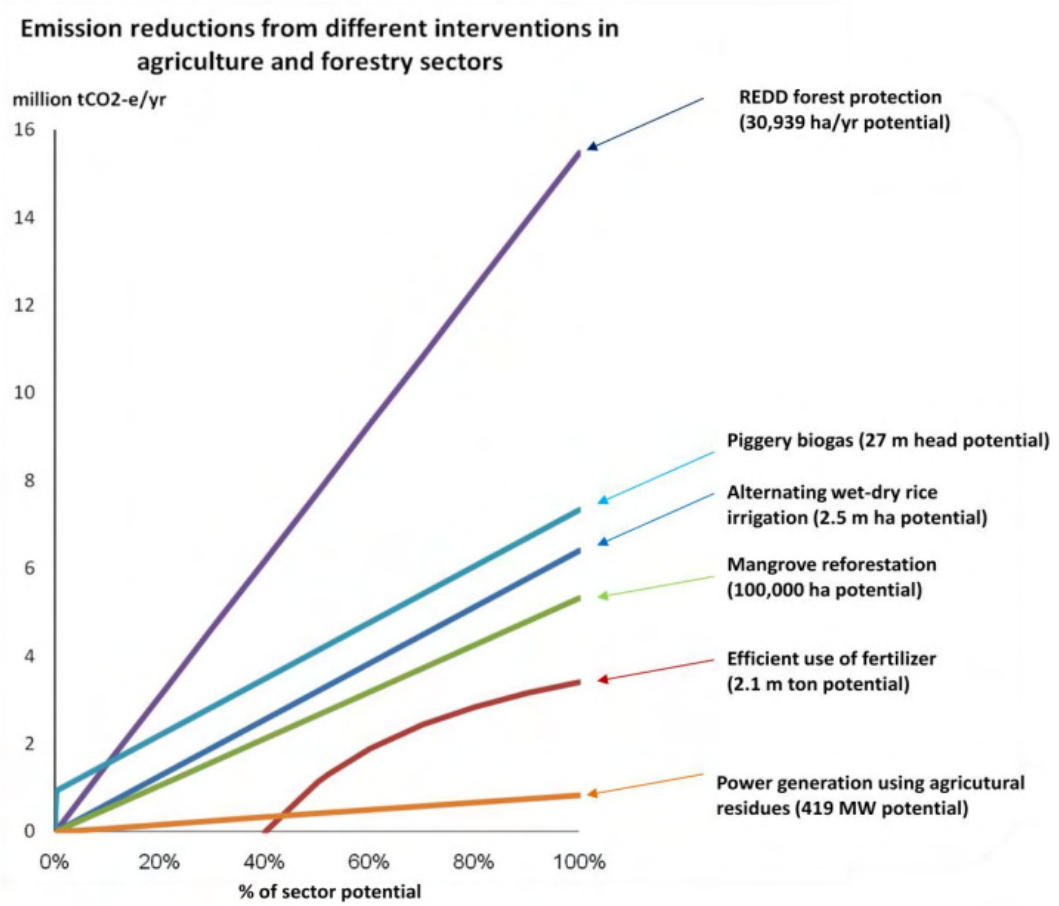
- Transport



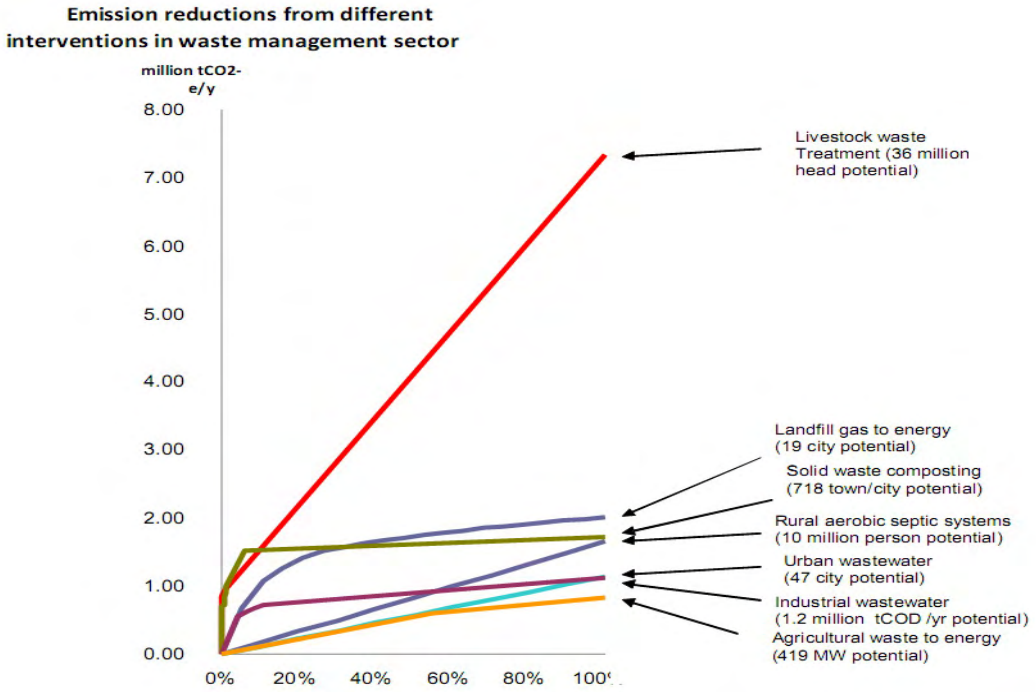
- Industrial process



- Agriculture/Forestry



- Waste Management



Workshop on Policies and Strategies to Mitigate Climate Change and Energy Poverty in South East Asia and China
Sofitel Plaza Hotel – 5 October 2009

Study on Climate Change Mitigation options for Vietnam

Ha Dang Son
RCEE Energy & Environment, JSC

Outline

- Overview
- Methodology
- GHG emission trend
- Climate Change Mitigation options

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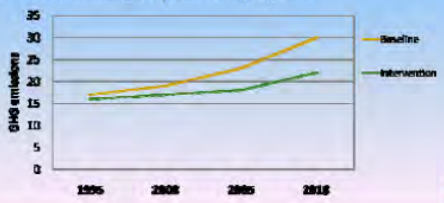

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- **Approach**
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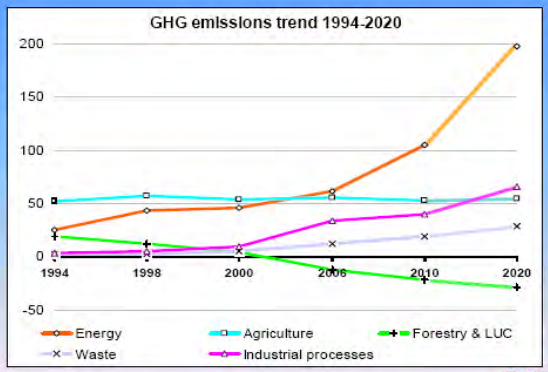

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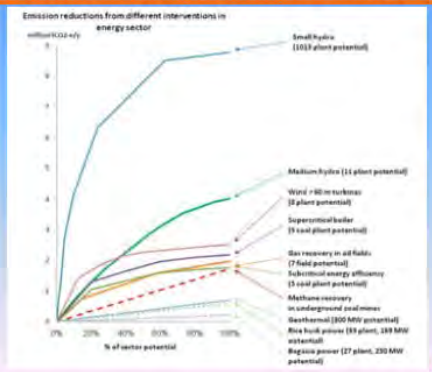
GHG reduction potential – Energy



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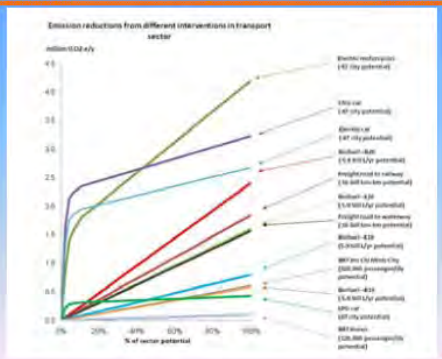
GHG reduction potential – Transport



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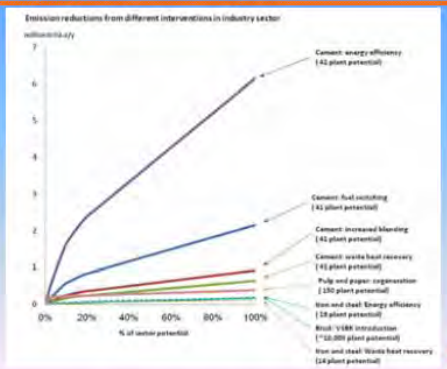
GHG reduction potential – Industrial process



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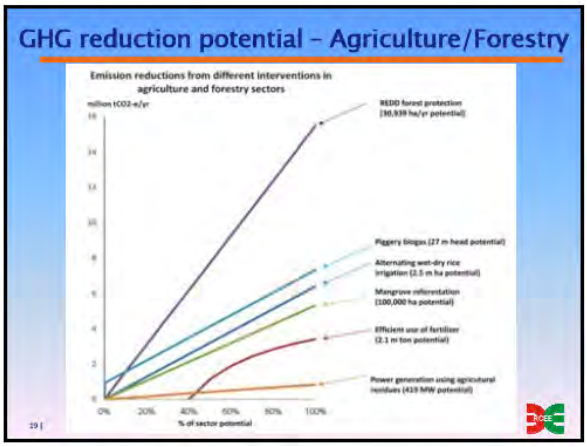
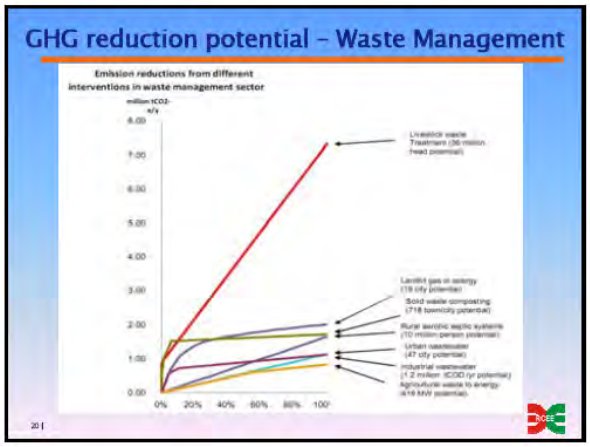

GHG reduction potential – Agriculture/Forestry
Emission reductions from different interventions in agriculture and forestry sectors
million tCO2-e/yr
REDD forest protection (30,939 ha/yr potential)
Piggery biogas (27 m head potential)
Alternating wet-dry rice irrigation (2.5 m ha potential)
Mangrove reforestation (100,000 ha potential)
Efficient use of fertilizer (2.1 m ton potential)
Power generation using agricultural residues (410 MW potential)
0%
20%
40%
60%
80%
100%
% of sector potential
19


GHG reduction potential – Waste Management
Emission reductions from different interventions in waste management sector
million tCO2-e/y
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0%
20%
40%
60%
80%
100
Livestock waste Treatment (36 million head potential)
Landfill gas to energy (19 city potential)
Solid waste composting (718 township potential)
Rural aerobic septic systems (10 million person potential)
Urban wastewater (47 city potential)
Industrial wastewater (1.2 million tCOD/yr potential)
Agricultural waste to energy (418 MW potential)
20

Visit of Biogas Plant in Bac Ninh province

Policies and Strategies to Mitigate Climate Change and Energy Poverty in Rural Industrialization - MGIRI's Role in Energy and Infrastructure

Ravikumar Kandasamy - Deputy Director (Energy&Infrastructure)/
Mahatma Gandhi Institute for Rural Induatrialisation (MGIRI), Wardha, India

Abstract

The Mahatma Gandhi Institute for Rural Industrialization (MGIRI) at Wardha was developed during 2001 to 2008 by the collaborative efforts of KVIC and IIT Delhi. It was decided to set up this National Institute at the historical premises of Maganwadi, Wardha where Mahatma Gandhi initiated the All India Village Industries Association (AIVIA) way back in 1934 and involved prominent scientists and technologists like Sir C.V. Raman, Dr.J.C. Bose to contribute towards Rural Industrialization. The Jamnalal Bajaj Central Research Institute (JBCRI) was established in 1956 under the KVIC to take over the works of AIVIA and to promote rural industrialization through innovative S&T inputs. This historical institute was revamped in order to cope with the changes & challenges of the nineties and MGIRI was an outcome of this.

1. This institute has a vision of 'to make the rural products and services globally competitive' and an objective of 'integrating traditional strength with modern methods to promote rural entrepreneurship at a large scale and in a sustainable way'

2. MGIRI, Wardha consists of six major (Khadi and Textile Industries, Bio processing and Herbal Industries, Chemical Industries Section, Rural Craft and Engineering, Rural Infrastructure and Energy, Management and systems) sections catering to the generic areas of rural.

3. MGIRI will be primarily to act as a facilitator and as a nodal networking institute for promoting Rural Industrialization. Only selective R & D work will be carried out at the MGIRI campus and all efforts will be made to direct the projects to respective interfacial working groups and expert organizations after appropriate need identification as well as competence matching. Presently there are 13 interface institutions (IISc, IITs, NITs and other institutions) and it is planned to setup another 50 interface institutions during the next 5 years to create a wide network throughout the country.

4. In the past six years Rural Infrastructure and Energy Section has effectively demonstrated
    - Development of energy efficient production systems- for example pottery kiln.
    - Energy back up for rural industrial complexes through locally available energy resources like biomass from Goshala, agricultural residues and micro hydel
    - Providing alternative fuels for home and industries through briquetting etc
    - Evolving viable solar energy backed innovative production and utility systems like solar potter's wheel, LED based lighting system, solar office etc
    - Energy auditing and energy efficient habitat

In the forth coming years MGIRI want to expand operations through in a multidimensional approach. It developed strategies to approach the RI focusing to Energy & Infrastructure in the following:

- S&T Intervention in the areas of Energy &Infrastructure
- Innovation (Redesigning the energy systems for MSM)
- Productivity (Redesigning the products keeping in mind the man- machine-system)
- Quality (the products in incorporating intelligence) and
- Marketing strategies (redesigning the policies, programmes etc)

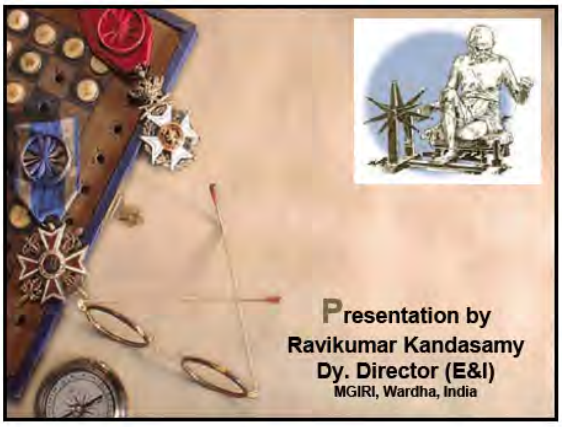
MGIRI wants to be a National level hub for rural industries by connecting the Ministries, Organizations, Entrepreneurs, National and International level institutions through the actions in policy making, programs development, S& T interventions, innovations (R&D), viable projects as models etc.

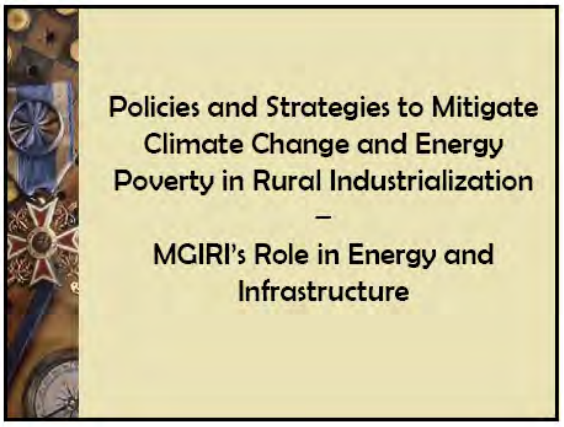
Energy and Infrastructure sector strategies of MGIRI in Rural Industrialization:

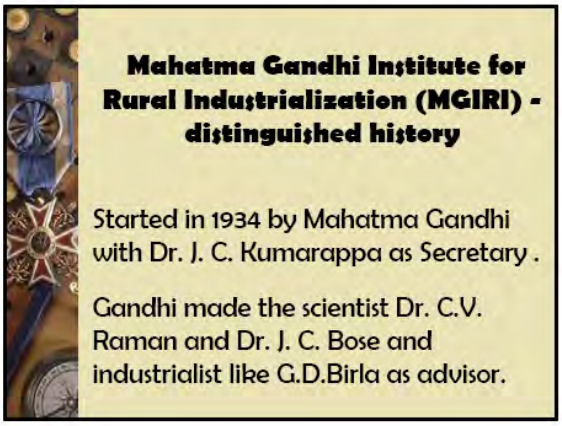
- Setting up two way linkages between MGIRI, Rural Industries and technical experts in professional institutions - MGIRI wants to play a role of linking Rural Industries and technical expertise of experts from different professional institutions through Rural Innovation workshop, Design studio, Innovation museum
- Be a technology hub for KVI sector through interfacing other institutions through Web site support-This support with the help of MIS department will enable to link the Rural Industries, Entrepreneurs, Research Institutions, Universities organizations etc to share the knowledge. As a result MGIRI can be a hub.
- Build a data base of technologies in MSM - Industrial information, Data base on problems related to MSMs, Professional data base, Inventors/Innovations data base and Formalities/ procedures for starting up of industries data base can give the information about the all the available industries related to MSM and their energy situation, energy requirement, options and types of technology available etc and a system can be developed with the help of MIS department to pool the identified problems and solutions of the MSMs both General and Energy related. This can help the researchers to identify some problems and work on it for the benefit of MSM, which will be very useful to the RIs / Society.
- Setting up Rural Industrial Estates and Clusters: Concept of Rural Economic Zones (REZ): Rural economic Zones is a cluster of rural industries (Micro, Small and Medium) in a rural area for a village or cluster of villages. The basic idea is that the local resources available can be value added for the purpose of income generation for the farmers or small entrepreneurs. Also the locally available energy resources can be made use to generate power for REZs. This can help to sustain the environment, increase the income generation of the local and create employment for the rural masses.
- Undertake sponsored projects from different Ministries, organizations etc. There is a high possibility of utilizing the programmes (sponsored projects) available in many agencies.
- Conduct specialized human resource development programs-Total Quality Management, Design Innovation Centre (DIC), Rural enterprise development (Business Incubation programme)

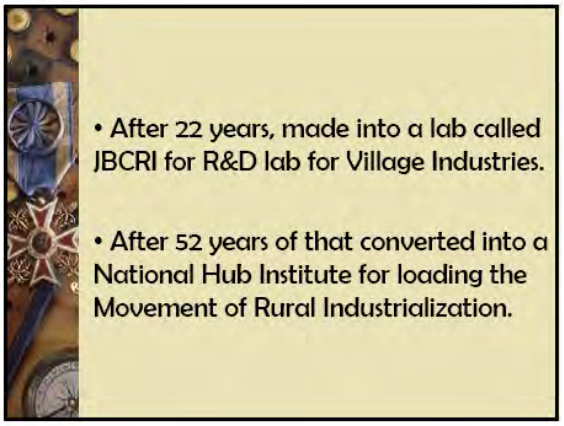
- Providing training for the trainers: Training support, Seminars and workshops will be organized in the areas of Solar, Biomass, Energy conservation, Entrepreneurship development, creating awareness about innovation, Quality Management for the trainers so that they will be in a position to transfer this in large scale. Also some selected students interested in innovation can be trained and allowed to use the existing facilities for further development.

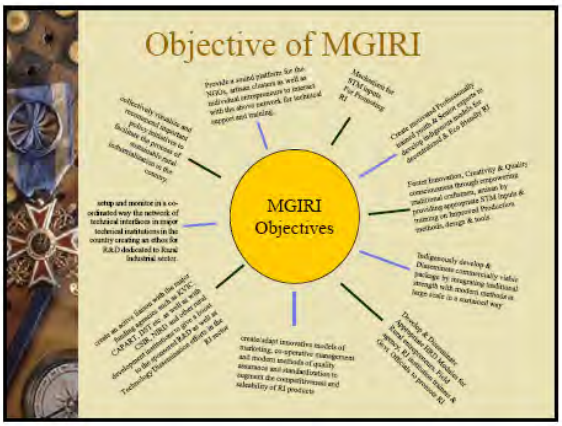
Presentation



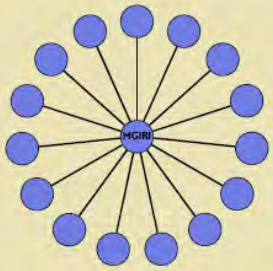








MGIRI as hub Institution



5 FOLD FUNCTION

- S &T intervention for solving the problem of Rural Industrialization.
- Innovation at Product and System Level .
- Quality Guidance Structure.
- Productivity w/o loss of employment
- HRD Quality , Entrepreneurship, Technology Leadership.

STRUCTURE

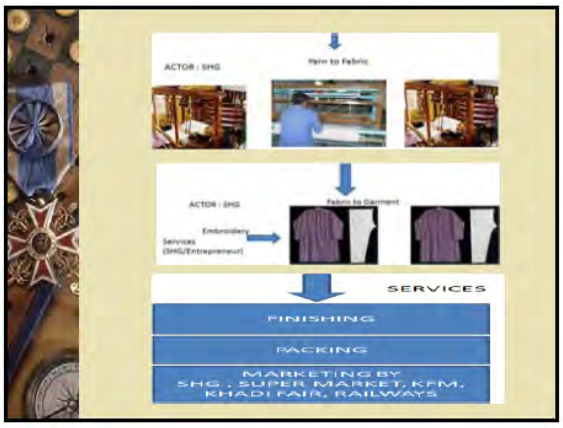
Khadi & Textile Division

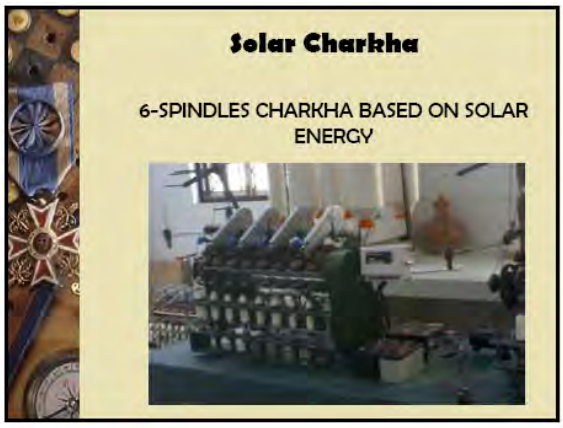
INCUBATION PROGRAMME ON PRODUCTION OF SOLAR GARMENTS

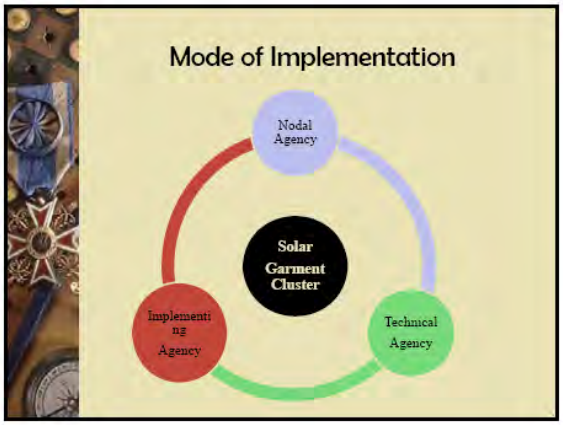
CONCEPT:

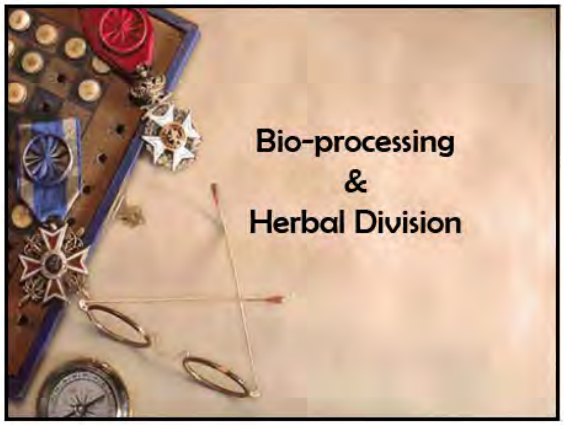
- To enhance the employment generation in Rural areas
- To adopt cluster concept to promote Textile activities in villages thereby providing employment round the year.
- To utilize the renewable energy in the yarn production which leads to cost reduction of products.

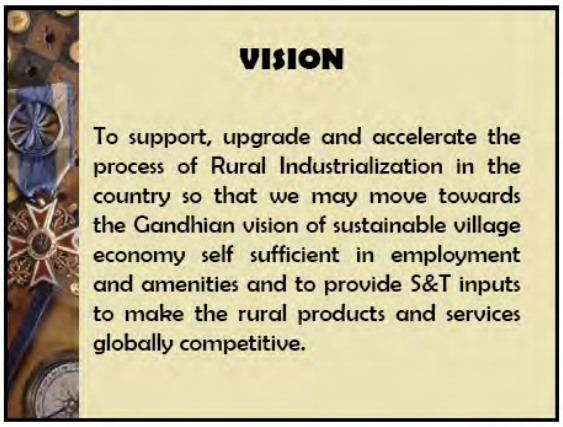
Philosophy of Cluster

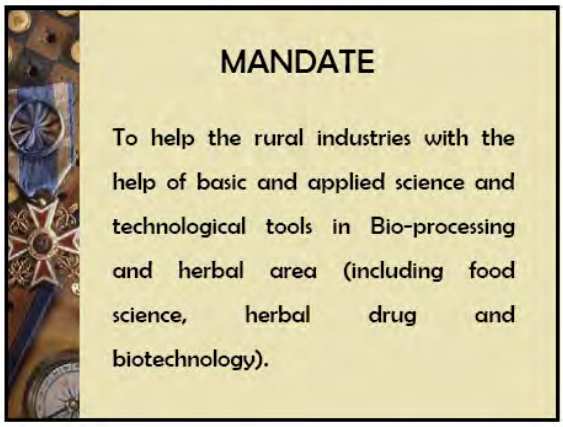

ACTOR : SHG
Yarn to Fabric
ACTOR : SHG
Fabric to Garment
Embroidery
Services (SHG/Entrepreneur)
SERVICES
FINISHING
PACKING
MARKETING BY SHG ; SUPER MARKET, KFM, KHADI FAIR, RAILWAYS


Solar Charkha
6-SPINDLES CHARKHA BASED ON SOLAR ENERGY


Mode of Implementation
Nodal Agency
Solar Garment Cluster
Implementing Agency
Technical Agency


Bio-processing
&
Herbal Division


VISION
To support, upgrade and accelerate the process of Rural Industrialization in the country so that we may move towards the Gandhian vision of sustainable village economy self sufficient in employment and amenities and to provide S&T inputs to make the rural products and services globally competitive.


MANDATE
To help the rural industries with the help of basic and applied science and technological tools in Bio-processing and herbal area (including food science, herbal drug and biotechnology).

Facilities at B&H Section

High Performance Thin Layer Chromatography For Qualitative and Quantitative Analysis of Plant sterial

Fermentor For Biotechnological Fermentation Processes

Facility For Analysis of Microbial Contamination and Safety For Food and Herbal Drugs

Spray Dryer for the Drying of Biotechnological Materials

Ultramodern Well Equipped Lab for Quality Control and Quality Assurance in Food, Herbal Drugs and Biotechnological Materials

Focused Sector

Micro, small and medium sector industries, Self – help groups; NGO'S development and promotion of innovative products for agri, Food, feed and Pharmaceuticals inputs.

Rural Chemical Industries

OBJECTIVE

- To provide quality control & guidance support to the R C I sector
- To help rural entrepreneurs to come-up with globally competitive products using local resources.
- To provide best possible S & T and indigenous innovative to boost and encourage the rural chemical industries.
- To facilitate, improve the process and quality of rural industries products by providing technical assistance and training to tackle their problems.

FACILITIES AVAILABLE

- Quality Assurance of products like food grains, spices, oils & fats, organic food, honey, processed food products, water etc.
- Testing facility for rural resource based chemical products such as non- edible oils, soaps, detergents, cosmetics etc.
- A sophisticated instrumentation laboratory for the determination of residues of metals, pesticides, food flavors, essential oils, fats, sugars, vitamins, proteins, food preservatives, amino acids, organic acids etc. in various products.

MAJOR EQUIPMENTS AVAILABLE

- High Pressure Liquid Chromatograph (IR & UV Detector)
- Gas Chromatograph (FID & ECD)
- Atomic Absorption Spectrometer (Fe,Cu,Mn,Pb,Cr,Co,Mg,As,Hg,Cd,B,Mo)
- Tintometer
- Polarimeter
- Microwave Digester
- Vacuum Oven
- BOD Incubator
- Centrifuge

TECHNOLOGY DEVELOPED

- Soap, Detergent and Raw material's quality testing kit has been developed and transferred to the KVIC's MDTCs and Jharkhand Handmade Soap Manufacturers.

Soap, Detergent, Vessel Cleaner formulations for the SHGs. These are also Transferred into the field.

CURRENT ACTIVITIES

- Lab. Accreditation under NABL
- Q C: Quality Testing of the R I products
- Training: Technology dissemination training for SHGs, NGOs, MDTCs, DRDA, Entrepreneurs etc.
- R & D:
  - Downscaling the process of Epoxidised Soya oil production for micro & small level entrepreneurs.
  - Development of oil based Mosquito Repellant.
  - Development of Aloevera based face cream and shampoo.

PROPOSED ACTIVITIES

- Entrepreneur Development Programme for Vidarbha region – 5
- R & D :
  - Development of Antibacterial Transparent Soap
  - Development of Biodiesel from soap stalk
- SFURTI Cluster:
  - Lac cluster: New product development and value addition
  - Coir Cluster: New process and machine development

Rural Craft & Engineering

OBJECTIVES

- To upgrade the skill, creativity & productivity of rural artisans and to provide science and technology support for value addition & quality improvement of their products.

- To provide support in the design and fabrication of prototypes and machines and in the development of new products.

FACILITIES

•A unique Artisan's Complex to enable training artisanal entrepreneurs in the Vishwakarma Gurukul style and to enable market feedback for their products.

•Design studio for Khadi fashion bags, Terracotta jewellery, Pottery, Decorative candles and Lacquer Turn wood toys.

•Well equipped workshop for design and fabrication of prototypes needed by various industries.

TECHNOLOGY DEVELOPMENT

Design of craft products and development of tools and machines for artisans like

- Value added pottery,
- Natural terracotta jewellery
- Khadi fashion bag,
- Decorative candles and
- Lacquer Turn wood toys.

R & D WORKS

- Natural clay colors for terracotta products

•For self-sustainable development nurturing of local design man-power

R & D WORKS

For continuous design support to clusters/SHG's it is necessary to develop the design skill within the local region in following steps:-

•Nurturing of technically qualified locally available professionals & artisans.

•For specific problems consultation with subject matter specialist to get proper solutions.

R & D WORKS

- To develop products based on cultural heritage & present market trends, continuous guidance is required for artisan clusters/SHGs.

•From every group, some tenanted artisan must be located to nurture as a design craftsperson.

•The trained good skilled craftsman should be identified as a master trainer.

•Further training at cluster area through trained skilled-craftsman .

Terracotta beads with clay paint

Design & development of Khadi fashion handbags

Natural colour terracotta jewelery

Natural clay colour terracotta jewellery

The SHG of Selu started production of natural colour jewellery

CARVING AROMA CANDLE

Management & System

Management & Systems

VISION

Management and Systems department of MGIRI would be a leading technological solution provider for rural industrialization using simple, innovative, sustainable, reliable solutions with Information and Communication Technologies, thereby empowering Micro, Small, and Medium Enterprises to attain higher level of global competitiveness.

Mission of Management & systems

- Mission is to provide a range of services and products including:
- Enable e–Trading
  - A web enabled secured e-trading platform that would help MSME, to display their products for selling and buying online
- End user support :
  - Workgroup collaboration and Internal process automation support for MSME sector
- Information System :
  - Generate a database that would help MSME, to assess the value additions that could be done to their existing products. Transparent feedback would help MSME, to do business with thorough knowledge and confidence.
- Expert Systems :
  - Expert systems would guide MSME's
    - in knowledge sharing,
    - in getting expert advices,
    - support in organization creation
    - dissemination of business, product and Product quality knowledge

Planned activities of M&S

- Laying a Strong foundation for stable backbone ICT Infrastructure at MGIRI, Wardha Campus.
- Automating internal processes of MGIRI, Wardha Campus
- Creating a visible platform for MGIRI by networking with other providers, NGOs and experts involved in providing value enhancing support to MSME
- Using Multilingual Web Technologies to Create a Platform for dissemination of information – Process, Product, Service, technology knowhow, Government schemes, Financial Schemes
- Creating an expert network based assistance to MSME sector, communicate their difficulties and hardships, where a pool of experts could provide solutions using Multi lingual technologies, translators and also using Communication technologies such as SMS
- Provide a platform where some of their internal automation tools necessary for the rural industrial sector to be compliant with the standards downloadable at a nominal charges
- Potential use of IVRS, KIOSK technologies could also be pursued so as to boost rural industrialization growth.

Expertise & Strength

UDYOG MITRA - Entrepreneur guidance Wizard

- Project Objective
  - Build a Information Dash board to facilitate an aspirant entrepreneur, on possible options, from one source, based on a set of questionnaire.
- Methodology

  The Project methodology would be based on
  - Phase I
    - Information gathering
  - Phase II
    - Analysis and Design of scalable Systems flow
    - Implementation through Outsourcing
    - Testing of the Udyog Mitra System
    - Deployment on Rajiv Gandhi Science & Technology Servers
  - Phase III
    - Training on Usage to ensure have 1000 (of which 500 would be SC/ST and Women) aspirant entrepreneur

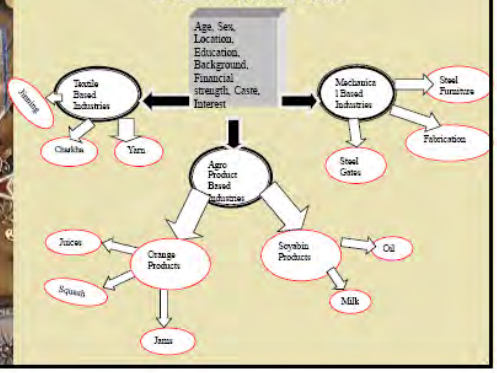
Project Scope

- Project Scope
  - Data Gathering
  - Database creation
  - Software Development
  - Software Testing
  - Software Deployment
  - Training of community with special emphasis on SC/ST/Women
  - All the above in Nagpur Revenue Block comprising of 6 districts .

Main features of Udyog Mitra

- Information Database for entrepreneurship aspirant
- Single window top level details
- Intelligently Guides entrepreneur based on Sex, Age, Social Status, caste, Marital status, Location, financial strength, interests, education and background of the aspirant
- Collects information of such aspirants for information updates
- Allows agencies for updating information then and there to a centralized database
- Multilingual
- User Friendly

User Interface



Expected Benefits

- Growth of new entrepreneurship
- Confidence building
- Socio-Economic growth of society
- Integration with SMS
- Employment generation
- Effective use of Natural Resources
- Value Addition
- Can be enhanced to Rural ICT vision.

Top level Architectural Solution

Rural IT Vision

- Internal process automation
- Disaster Recovery Plan
- Security
- Training support
- Helpdesk Voice (toll free) & Internet based
- Backups
- Application deployment support

Energy & Infrastructure Division

VISION

To develop the Rural Industries through S&T intervention, innovation, productivity, quality improvement and Human Resources.

MISSION

Enabling Rural Industries in terms of energy, infrastructure and connectivity so that its resources are transformed to value added products in a globally competitive way

ACTIVITIES

- To help evolve innovative plans for other connectivities / infrastructure to enable rural industries to emerge and sustainable.
- Making rural industries / crafts viable by use of power tools, energy based designs etc.
- Help to conserve energy through energy auditing and make it viable to fulfill the energy demand by appropriately designed mixer of environmentally friendly sources of energy and redesigned products.
- Man-Machine combine to achieve adequate products and employment.

CURRENT FOCUS OF THE DEPARTMENT

Currently focuses of the department:

- Energy (Biomass, Solar and Energy Efficiency)
- Infrastructure (thrust on storage system, water recycling, housing, waste recycling, transport & communication)

How do we get into RI's through Renewable Energy?

- Rural industries may differ from the big industries in scale or different means but Energy is necessary.

-Rural Industries sector (Specifically Micro industries) can have the advantage of being small to get the energy needs through renewable energies or energy conservation through modification of the existing systems.

- For Small and Medium range industries different mode of operation can be possible depending upon the locally available materials.

CURRENT FOCUS OF THE DEPARTMENT - Infra

Some thrust areas in Infrastructure:

- Storage system
- Water recycling
- Housing elements
- Waste recycling
- Transport and communication

MAJOR ACTIVITIES

- Setting up of requisite lab facilities.
- Development of Solar charka for more productivity.
- Development of Solar driven pottery wheel.
- Energy audit of pottery and smithy clusters and development of energy efficient pottery kiln.
- Redesigning of machines in the packaging sector etc
- Design and development of LED based lighting system for energy conservation

MAJOR ACTIVITIES

- Training on LED lighting systems production
- Consultancy for new and existing entrepreneurs in project development and machine redesign
- Involving in project and scheme development on energy backups, Solar potter wheel, Solar tracking with cleaning mechanism etc
- Incubation on Solar charka manufacturing and LED lighting systems
- Developing linkages for technical co-operation.

FUTURE ACTIVITIES IN PLAN

- S&T Intervention in the areas of Energy &Infrastructure
- Innovation (Redesigning the energy systems for MSM)
- Productivity (Redesigning the products keeping in mind the man- machine-system)
- Quality Control (Lab accreditation)
- Human Resource Development (Training of Trainers)

FUTURE ACTIVITIES IN PLAN

• For the threat of development of KVIs (Rural Industries), it has to compete with larger scale industries in all aspects like reduction of production cost, maintenance of better quality, compatibility etccare.

•MGIRI will be a National level hub for rural industries by connecting the Ministries, Organizations, Entrepreneurs, National and International level institutions through the actions in policy making, programs development, S&T interventions, innovations (R&D), viable projects as models etc.

•To achieve this objectives a road map is developed and it is expected to be activated through orientation, planning and action.

PLANNED ACTIVITIES

•Setting up two way linkages between MGIRI, Rural Industries and technical experts in professional institutions through collaborations with institutions and develop Rural innovation workshop for innovators with threat free ambient

•Building up a energy based data base of technologies in MSME in different categories like industrial information, problems related to MSM, energy & infrastructure professional, Inventors/Innovators and formalities/ procedures for starting up of industries etc.

•Setting up rural industrial estates and cluster of Micro, Small and Medium industries in Vidarbha region and in the North East states through the concept of Rural Economic Zones (REZs) and provide them the energy backup with the locally available resources of energy like Ghosalas for biogas generation for thermal and electrical power generation or innovative hydro power generation. At the later stages this can be a model for implementation at the national level.

PLANNED ACTIVITIES

•Developing innovative assembling type houses suitable for the rural areas using locally available materials.
•Enabling us to get into R&D (Technical/Social) aspects as well as networking sponsored projects for various Government Ministries and International organizations like Min MSME, Min of MNRE, Min Of Rural Development, Min of Women and Child development, Min of Science and Technology, Min of Tribal Affairs, Min of Development of North Eastern Region, UNIDO, UNEP, UNDP World Bank through the Min of MSME.
•To develop a design innovation centre (DIC) for the development of innovative projects and to motivate the researchers, academicians (students from school and university), entrepreneurs, inventors etc
•Giving training to the top layer officials on energy and infrastructure issues related to RIs.

PLANNED ACTIVITIES

- Organise workshops and seminars for innovation, energy related entrepreneurship development, energy conservation etc
- To develop lab facilities for testing and certification of products related to the departmental areas.
- To develop consultancy bureau for providing information, project formulation etc at a nominal cost for the development of RIs.
- To provide choice of appropriate and cost-effective technologies in energy and infrastructure:
  - With an emphasis on employment creation;
  - On the use of labour intensive technology;
  - The use of local material and other resources;
  - The application of cost-in-use techniques to balance initial and recurrent costs.

PROJECTS IN PIPELINE

Project title:	Innovation for Rural Industrial Systems (IRIS)
Funding Agency:	Ministry of MSME
Amount:	4 Million USD
Expected date :	November 2009

PROJECTS IN PIPELINE

Project Title	:Vidarbha
Funding agency	:Ministry of MSME, Govt of India
Total Budget	:4 Million USD
Expected date	: November 2009

Objectives :

Setting up a decentralised and sustainable blend of micro, small and medium industries mainly based on local resources and mainly to satisfy regional needs

To fortify the above industries through a well defined science and technology support system so that it becomes globally competitive in terms of innovation, quality and productivity and is capable of engaging the emerging globalism with benign grace and poise.

To develop service sector activities capable of replication in similar regions.

To do the above to usher in a scenario of value oriented sustainable prosperity, inclusiveness and with no ambition of becoming a partner in a global trade war.

Thank You !

Biodiversity and Climate Change

MSc. Li Qingsong and Luis Waldmueller - Sustainable Agrobiodiversity Management, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, China

Abstract

Climate change is affecting biodiversity and disrupting the function of most ecosystems. It has recently been assessed that 20-30% of all species will be at risk of extinction if there is a 1.5^{o}C-2.5^{o}C rise in temperature. Agricultural genetic resources are not only a victim of climate change; they are of fundamental importance for adaptation to this change and are crucial to coping with the problems it poses. Genetic diversity within crop and livestock species will be an invaluable resource to enabling adaptation to changing conditions through breeding.

The paper will introduce the adaptation and mitigation measures which implemented by Sustainable Management Project on Agrobiodiversity in the mountains areas of Southern China. The project selected 28 pilot villages from 5 provinces to develop and test different strategy at the village level..

Introduction

According to the assessment report from Intergovernmental Panel on Climate Change(IPCC), the main impacts of climate change in China is as following:1) increased frequency of heat waves, 2)more strong cyclones, 3) a seven-fold increase in floods since 1950s 4) about 22-33% increase in rainfall in NW China and 5) more than 6 million hectares increase in areas affected by droughts since 2000.

Scientists also observed that China's glaciers are melting fast. Dr. Barry Baker from Nature Conservancy has measured that the main glacier on the Meili Xueshan in NW Yunan has retreated 350m in 10 years. Another Chinese Academy of Siences study estimates that glacier coverage in Xinjing has declined by 20% in only 40 years. Glaciers on the Qinghai-Tibetan plateau are shrinking by 7% per year.

Glaciers melt leads to floods, landslides and loss of some important water resources. The movement of vegetation zones up the face of mountains may pose threats to some species such as long-lived trees cannot cope with such fast changes.

How are the linkages between Climate change and biodiversity? Climate change is affecting biodiversity and disrupting the function of most ecosystems. It has recently been assessed that 20-30% of all species will be at risk of extinction if there is a 1.5 -2.5 rise in temperature.
Agricultural genetic resources are not only a victim of climate change, they are of fundamental importance for adaptation to this change and are crucial to coping with the problems it poses.
However this subject has received little attention in the international debate on adaptation to climate change.
In many tropical areas there is already increased cultivation of drought-tolerant plant varieties. Similar trends can be observed in animal husbandry. For instance, camels are replacing cattle and goats in very drought-prone areas of Ethiopia.
Genetic diversity within crop and livestock species will be an invaluable resource to enabling adaptation to changing conditions through breeding.
Climate change poses a serious challenge to agriculture and is expected to affect agriculture activities through a number of factors, including changes in water availability;
Increases in exposure to heat stress; Greater leaching of nutrients from the soil during intense rains.
Meanwhile, global agriculture is estimated to account for about 20% of the total anthropogenic emissions of greenhouse gases (GHG) (UNEP 2001). The most important categories of agriculture emissions are:

1) Increasing land under cultivation by decreasing carbon sinks, including deforestation and the conversion of wetlands, especially peatlands;
2) Carbon dioxide (CO2) emissions from burning forests, crop residues and land;
3) Methane(CH4)emissions from rice cultivation;
4) Use of nitrogen fertilizers from that release nitrous oxide (N2O) and
5) CO2 emissions from farm machinery, facilities, processing and transport.

Gtz (on behalf of BMZ) together with Chinese Ministry of Agriculture initiated a Project on Sustainable Management on Agrobiodiversity in the mountains areas of Southern China. The project selected 28 pilot villages from 5 provinces to develop and test following activities for the adaptation to climate change and mitigation of GHG emission.

- Promotion of local landraces that are adapted to different climatic conditions
- Seed exchange between farmer groups
- Farmer groups on farm experimentations
- Improvement of local cropping systems

- Biodiversity planning (improve micro climate)

  As for the Mitigation of green house gases in agriculture, following measures have been carried out at village level.

  - controlling use fertilizer
  - supporting biogas project
  - improving the management of rice cultivation.

Conclusion

Biodiversity is fundamental importance for adaptation to climate change and are crucial to coping with the problems it poses. However this subject has received not enough attention in the international debate on adaptation to climate change.

References:

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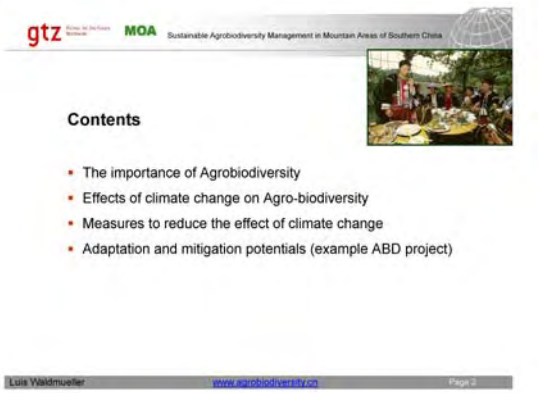
4. *ECBP NEWSLETTER(2007) Biodiversity Matter : Issue 3*

Presentation



Agrobiodiversity (ABD)

Agricultural biodiversity (ABD) includes all parts of biodiversity of importance for food and agriculture; including plants, animals and micro organisms as well as their ecosystems.

Agricultural biodiversity includes:

- Domesticated crop and 'wild' plants (called: crop wild relatives), including woodland and aquatic plants,
- Domestic and wild animals, fish and other aquatic animals (within fields)
- and forest rangeland

"Biodiversity loss is one of the great challenges of our time, alongside and closely linked to both climate change and global poverty."

Joshua Bishop, Senior Adviser, IUCN-The World Conservation Union

Effects of climate change on biodiversity and ABD

- The loss of genetic resources and species diversity (extinction)
- Destabilisation of locally adapted ecosystems
- Occurrence of more extreme wheather events (such as floods, hurricanes, snowstorms, etc.)
- Serious long-term threat to international food security and to sources of medicine and other valuable plants with potential use
- Increased vulnerability to pests, diseases and invasive alien species (monocrops)
- Migration of rural population, loss of cultural identity
- Increase of poverty in rural areas

Measures to reduce the effect of climate change

- Through adaptation to changing environmental conditions
  - use of genetic diversity (adapted local cultivars)
  - support species diversity (e.g. mixed cropping)
  - enhance ecosystems diversity (build up adapted ecosystems)
  - plan for landscape diversity
- Mitigation of green house gases in agriculture
  - Reducing emissions (from ruminants, fertilizer application)
  - Enhancing removals (diverse agroeco systems, AF)
  - Avoiding emissions (cultivation of new lands, drainage of wetlands)

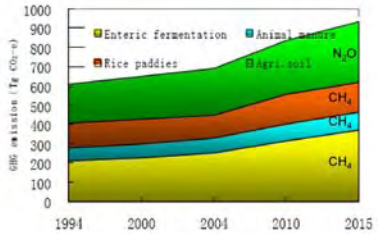
Examples for emissions caused by agriculture

Global agricultural GHG emissions per year by source and GHG, 2005

Source	GHG	Mt CO_2-eq	%
Enteric fermentation	CH_4	1 928	31.8
Rice cultivation	CH_4	672	11.1
Manure management	CH_4	235	3.9
Other sources	CH_4	455	7.5
Agricultural soils	N_2O	2 299	37.8
Manure management	N_2O	211	3.5
Other sources	N_2O	274	4.5
Total	Non-CO_2 GHG	6 075	100.0

Source: Steffen Noleppa, Optimising German Cooperation contributions to greenhouse gas mitigation, 2008

GHG emissions in the Agricultural sector in China



Source: Yang Xiongnian, Ministry of Agriculture submission to UNFCCC.

Adaptation potential in the ABD project

- Promotion of local landraces that are adapted to different climatic conditions
- Seed exchange between farmer groups
- Farmer groups on farm experimentations
- Improvement of local cropping systems
- Promotion of soil and water conservation techniques (maintain groundwater level)
- Biodiversity planning (improve micro climate)

Mitigation potential in the ABD project

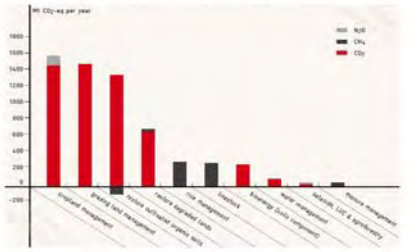
- Restoration of degraded lands
- Agroforestry
- Village land plantation
- Introduction of ABD crops (less intensive, less fertilizer and pesticides)
- Organic farming
- Improved paddy rice cultivation techniques
- Promotion of biogas

Mitigation potential of specific Sustainable Agricultural Land management practices

- Improved agronomy (0.98 tCO_2e/ha/yr.)
- Nutrient management (0.62 tCO_2e/ha/yr.)
- Tillage/residue management (0.72 tCO_2e/ha/yr.)
- Rice management (0.62 tCO_2e/ha/yr.)
- Agroforestry (0.72 tCO_2e/ha/yr.)
- Fire management (mitigation potential not specifically specified)
- Restoration of degraded land (3.45 tCO_2e/ha/yr.)
- Set-aside land for biodiversity conservation (5.36 tCO_2e/ha/yr.)

Source: Smith et al., 2007 – warm moist climate zone, global average values

Technical agricultural mitigation potential by 2030



Source: GTZ 2008 from Smith et al. (2007)

ABD PROJECT SITES

Mountains (3)	Province (5)	County (14)	Villages (28)
1. Wuzhi Mountains (Tropical zone)	Hainan	Wuzhishan	3
		Baoting	2
		Sanya	1
2. Wuling Mountains (Subtropical zone)	Hunan*	Sangzhi	2
		Yongding	2
		Baojing	2
		Guzhang	2
	Chongqing	Youyang	2
		Pengshui	2
	Hubei	Laifeng	2
3. Dabie Mountains (Subtropical and temperate zone	Hubei	Luotian	2
		Macheng	2
	Anhui	Jinzhai	2
		Huoshan	2

Renewable Energy Technology for Mitigation of Climate Change and Energy Poverty in Developing Countries: Case Study for Indonesia

Dr.-Ing. Oo Abdul Rosyid, Balai Besar Teknologi Energi (B2TE-BPPT), Indonesia

Abstract

As an archipelago with high population density makes Indonesia one the most vulnerable country to the climate change impacts. Indonesia largely depends on fossil fuel reserves to meet its energy demand, and contribute to GHG emission as the primary cause of global climate change. Although, emissions from the energy sector are small but are growing very rapidly. Due to economic constraints, depletion of oil reserve, and environmental needs Indonesia is now leading towards greater exploitation of renewable energy sources. Renewable energy technologies have become synonymous with GHG emission reduction, and as important tool for climate change mitigation.

Key words: *climate change, GHG emission, renewable energy, Indonesia.*

INTRODUCTION

Indonesian energy sector is heavily dependent on fossil fuels, which are finite, gradually depleting, and contribute to GHG emission as the primary cause of global climate change. Deforestation and forest fires have put Indonesia among the top three largest emitters of GHG in the world. While, emission from energy sector is relatively small but is growing very rapidly.

As an archipelago with high population density makes Indonesia one the most vulnerable country to the climate change impacts. Indonesia signed the Kyoto Protocol in 1998, ratified in 2004 through Law No. 17/2004, and hosted the 13th the UNFCCC in Bali, Dec. 2007.

Renewable energy technologies have become synonymous with GHG emission reduction, and as important tool for climate change mitigation.

INDONESIA COUNTRY OVERVIEW

Indonesia is the world's largest archipelago, consisting of about 17,500 islands, that stretches from 06°08'N to 11°15'S, and from 94°45' to 141°05'E. It includes 3.1 mio.km^2 of territorial waters (62% of its total area), almost 2 mio. km^2 of land (38%), and 81,000 km of coastline.

Fig. 1. Map of Indonesia

The Indonesian climate is tropical—hot and humid, but more moderate in the highlands. Climatic and weather conditions of the archipelago are characterized by an equatorial double rainy season. The dry season generally prevails from May to September, and the wet season prevails from December to March. The mean annual relative air humidity ranges from 80 to 90 %, and the mean maximum and minimum temperature reach 33^{o}C and 21^{o}C, respectively.

The total population reached 234.7 Mio. (2007), representing the fourth most populated country in the world. The urban population was about 43%. The current population growth rate is about 1.5% annually, and it is projected with the growth rate the population will exceed 300 million by 2030

Indonesian Energy Situation

Indonesia largely depends on fossil fuel reserves to meet its energy demand. However, economic constraints, depletion of oil reserves, and environmental needs are leading Indonesia towards greater exploitation of renewable energy sources. Indonesia has vast potential resources of renewable energy, unfortunately has not been exploited optimally.

Energy Supply

Proven oil reserves are estimated at 585 Mt (9.1 Miliar barel) and are experiencing a rapid decline since 1990s. The gas reserves reach 2820 Gm^3 (185.8 TSCF) and proven coal reserves are estimated at 19.3 Miliar ton. Largely under-exploited, hydroelectric and geothermal potentials are estimated at 76 GW and 27 GW, respectively.

Table. 1. Energy Resources and Reserves

PRIMARY ENERGY	RESOURCES	RESERVES	PRODUCTION (/YEAR)	RATIO RES/PROD (YEAR)
Oil	86.9 Miliar barel	9.1 Miliar barel	387 Mio. barel	23
Gas	384.7 TSCF	185.8 TSCF	2.97 TSCF	62
Coal	58 Miliar Ton	19.3 Miliar Ton	132 Miliar Ton	146

PRIMARY ENERGY	RESOURCES	EQUIVALENT	UTILIZATION	INSTALLED CAPACITY
Hydro	845.0 Mio BOE	75.67 GW	6,885.1 GWh	4,200.00 GW
Geothermal	219 Mio SBM	27.14 GW	2,593.5 GWh	852.00 MW
Mini/micro hydro	0.46 GW	0.46 GW		84.00 MW
Biomass		49.81 GW		302.00 MW
Solar		4.8 kWh/m^2/d		8.00 MW
Wind		9.29 GW		0.50 MW
Uranium	24,112.0 ton*	33.0 GW		

Since 1991, Indonesia's oil output has been declining rapidly to 45 Mt in 2007 and the country is about to become a net crude oil importer. Indonesian gas output is decreasing (59 Gm^3 in 2007). Half of the production is exported, mainly in the form of LNG (86%) to Japan, Korea, Singapore and Taiwan (2006). The country's coal production increased very rapidly, reaching 202 Mt in 2007 of which 72% is exported to Japan, Taiwan and Hong-Kong.

Total installed capacity of electric power is 43 GW (2007), dominated by thermal electricity with 38.9 GW (89%), followed by hydroelectricity 3.4 GW (8%) and geothermal 1 GW (2%). Electricity production reached 139 TWh (2007), of which 88% from thermal energy (25% oil, 14% gas, and 49% coal), 7% from hydro power, and 5% from geothermal sources.

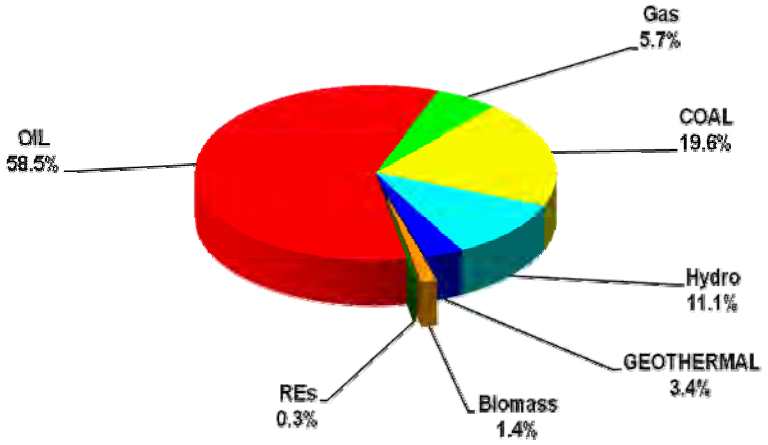
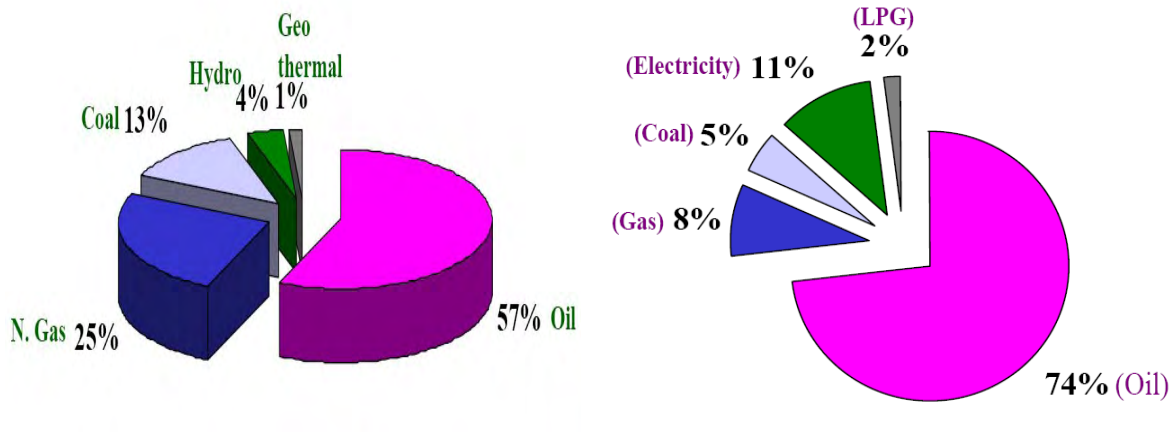


Fig. 2. Generating capacity by fuel sources

Energy Demand

Figure 3a shows that oil is the country's dominant source of energy, providing 57% of energy. Natural gas comes second with 25%. Coal is rising sharply and accounts for 13%, hydroelectricity and geothermal for 5%. Final energy consumption is made of oil (74%), electricity (11%), gas (8%), coal (5%) and LPG (2%). The sector shares are as follows: 37% for transport, 36% for industry, and 27% for the residential tertiary sector.

The energy consumption per capita is 0.8 toe, while electricity consumption per capita has grown rapidly to 550 kWh (8%/year).



(a) (b)

Fig. 3. The energy consumption by (a) primary sources, (b) final energy

CO2 emissions

Figure 4 shows that Indonesia is among the top three green house gas (GHG) emitters in the world due to land use change and deforestation. Deforestation and land conversion are the largest sources of the emission.

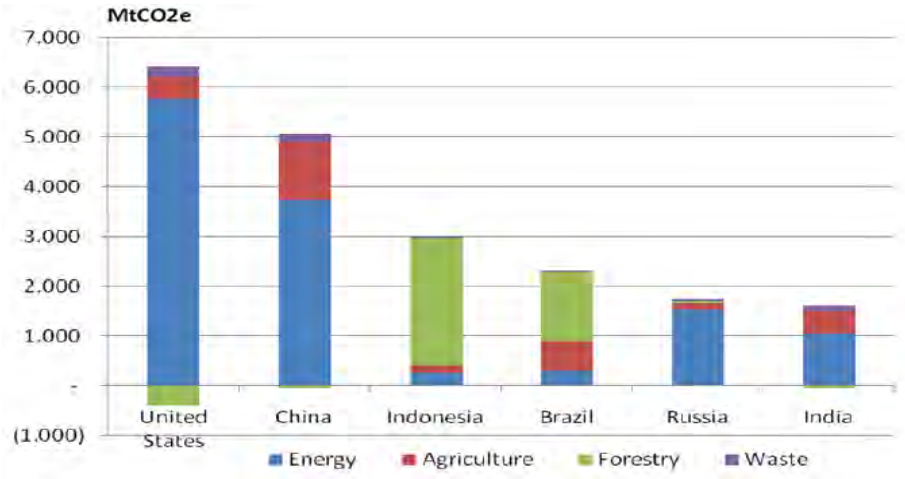


Fig. 4. Comparison CO2 emission

Meanwhile, emissions from the energy sector are small but are growing very rapidly. The annual emission in the energy sector reached 275.4 MtCO2s in 2004. It‘s 17% higher than the emission intensity in 1990. The largest share (40%) of CO2 emission from energy sector in Indonesia was from the industrial sector, followed by power plant (26.7%), transportation (23.6%), and household & comercial sector (19%). More than half (56.6%) of annual CO2 emissions was due to burning oil, fllowed by coal (25%), and natural gas (18.5%).

Emission intensity (expressed as emission per dollar of GDP ranges between 1.37 and 1.71 tCO2 per million dollar of GDP. Per capita emission in Indonesia‘s energy sector between 1.26 and 1.55 ton per person per year.

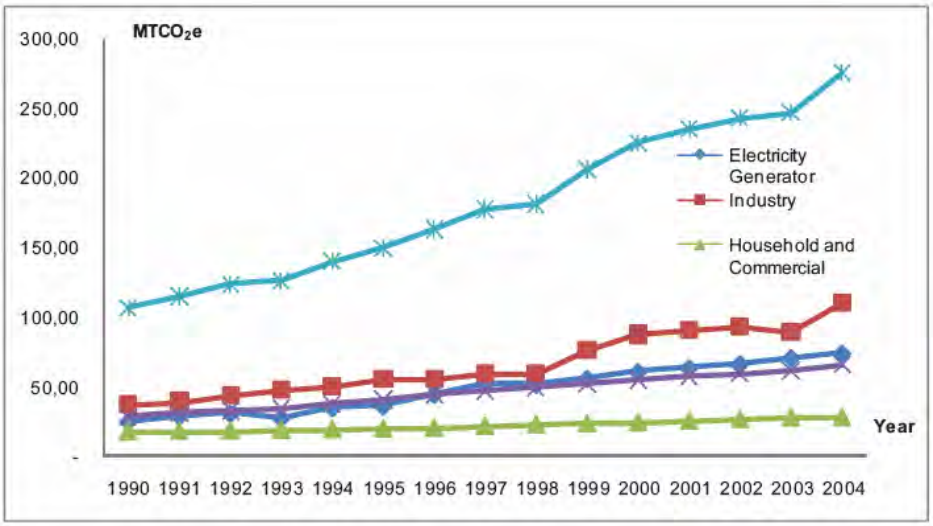


Fig. 5. CO2 emission from energy sectors

National Energy Policy

The goal of the National Energy Policy is to direct efforts to the creation of sufficiency of domestic energy supply. Targets of the National Energy Policy are: Achievement of energy elasticity of less than one in 2005; Creation of mix (printer) energy optimally in 2025, namely the role of each type of energy in national energy consumption: (a) Oil becomes less than twenty percent (20%); (b) Gas becomes less than thirty percent (30%); (c) Coal becomes less than thirty-three percent (33%); (d) Biofuel becomes more than five percent (5%); (e) Geothermal becomes more than five percent (5%); (f) Other new energy and renewable energy, particularly biomass, nuclear, hydropower, solar power, and wind power becomes more than five percent (5%); (g) Liquified coal becomes more than two percent (2%).

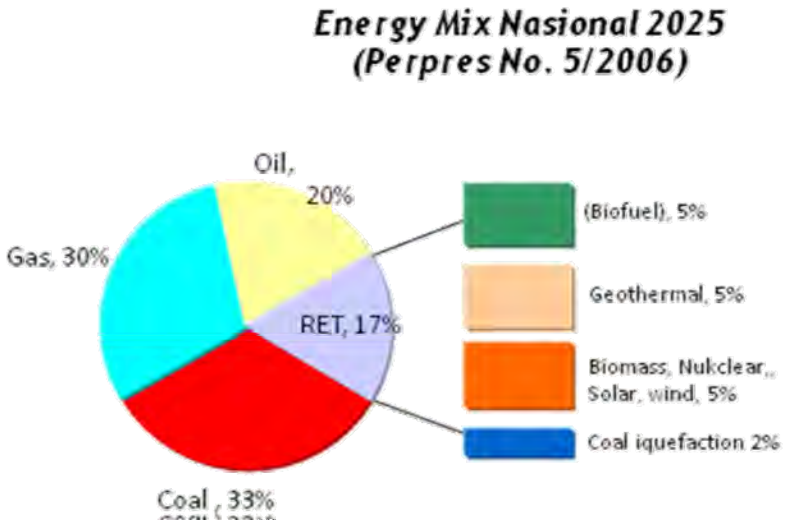


Fig. 6. The National Energy Policy

CLIMATE CHANGE IN INDONESIA

Indonesia has an energy system that is highly carbon intensive may cause to the global climate change. The climate change is a global phenomenon, where its impact will be felt globally by all human beings throughout the hemisphere, including Indonesia. As a tropical archipelago country, Indonesia is very vulnerable to climate change. Increasing of sea water as one of the impacts may cause danger to millions of people living in coastal areas, etc.

Indonesia will experience modest temperature increase. The mean annual temperature in the country has increased by 0.3°C, while overall annual precipitation has decreased by 2-3%. Besides, the seasonality of precipitation (wet and dry seasons) has changed; the wet season rainfall in the southern region of Indonesia has increased while the dry season rainfall in the northern region has decreased.

Climate Change Impacts

Global warming is a phenomenon where the increased concentration of GHGs traps the energy from the sun in the atmosphere, and thus leads to earth's temperature increase. The temperature increase may changes in the seasonal cycle and rainfall patterns. The impacts on water resources, agriculture sector and food security, and human health. In general, Indonesia, partly situated along the equator, will experience modest temperature increase.

Indonesia will experience modest temperature increase. Annual mean temperature in Indonesia has been observed as increasing by around 0.3 degrees Celsius (^{o}C) since 1990 and

has occurred in all seasons of the year, relatively consistent if not slightly lower than the expectation of the warming trend due to climate change. The modest temperature increase will result in number of impacts. First, the rise of temperature will significantly affect the hydrological cycle. It results in a warming world, there will be increase intensity of rainfall, but in shorter periods due to prolonged dry seasons. Eventually, this will pose serious problem for agriculture, as well as increase the risks of flooding. Decreasing in crop production due to changes in soil moisture, hydrological cycle, and prolonged drought will likely threaten food security.

Indonesia will experience more intense rainfall. Climate change is predicted to result in 2% to 3% more rainfall per year in Indonesia (Susandi 2007). The entire country will experience more rainfall. The increased rainfall is expected to continue and,due to climate change, result in a shorter rainy season (fewer number of rainy days in a year), with significant increase in the risk of flooding.

Food security in Indonesia will be threatened by climate change. Perhaps the largest concern for Indonesia with regards to the impacts of climate change is the risk of

decreased food security. Climate change will alter precipitation, evaporation, run-off water

and soil moisture; hence will have effects on agriculture and thus food security.

Sea level rise will inundate productive coastal zones. Climate change will also increase the average sea level due to increased volume of the sea water and the melting of polar ice caps. It will increase the risks from sea level rise that in turn will likely to cause inundation of productive coastal zones. Indonesia, an archipelago country with over 17,000 islands and 80,000 km of coastlines is very vulnerable to sea level rise. If the trend of rising sea level continuous, Indonesia may lose as many as 2,000 island by 2030. low-lying coastal cities (Jkt and Surabaya) will have higher risks of flooding. Water level in Jakarta Bay would rise by 57 mm/year. Some 160 sq km of Jakarta would be underwater by 2050 (The Jakarta post, 2007). The risk of sea level rise to Indonesia, areas with density of more than 1000 people/sq km are

areas which will get hit the most by level rise. In total of 41.6 million people live whiting 10m of the average sea level, the most vulnerable to sea level change.

Climate Change Mitigation

Promoting renewable energy technologies (RETs) in energy sectors may reduce GHG emissions, contributes to poverty reduction efforts. In addition, they can help address local and national environmental problems like urban air pollution and acid rain, as well as climate change. Current mechanism for developing country like Indonesia to participate in the global emission regime is through a cooperative instrument such as the Clean Development Mechanism (CDM). CDM is a voluntary mechanism for promoting GHG emission mitigation in Non-Annex I (non-industrialized) countries in cooperation with the Annex I (industrialized) countries. CDM projects can reap benefits such as technology transfers, improvements in local environment and share of surplus from CDM projects. To date there have been various research and studies on CDM that serve important roles in the implementation of CDM in Indonesia.

Policy and Capacity Constraints

Indonesia signed the Kyoto Protocol in 1998 and ratified it in 2004 through Law No. 17/2004. Since then, a lot has happened, notably in the field of the clean development mechanism (CDM), although less so in the other fields.

Renewable energy sources are underdeveloped, with barriers but few incentives. At the same time, there are barriers but few incentives in Indonesia for the development of renewable energy. Development of renewable energy has slowed if not halted. While energy policies may call for development of renewable sources, supporting instruments, such as fiscal and financial incentives, have not been fully developed.

Indonesia has not yet been able to take advantage of the opportunities in the Clean Development Mechanism. Indonesia has at least 235 MtCO2e of emissions reduction potential that can be developed as CDM projects, ranging from reduction of gas flaring in large oil and gas facilities, to development of geothermal and other clean and renewable energy sources, to production of biogas from agriculture and animal waste. However, at

present only 11 projects have received approval from the Designated National CDM Authority (DNA). Of these, eight have been registered by the Executive Board of CDM with a potential to produce 13 MtCO2e. From the registered projects, most are renewable and waste management projects (UNEP Risoe 2007). Compared with the potential, this is not significant.

The policy to rapidly expand the use of coal will increase emissions further. Indonesia greenhouse gas emissions from coal burning by the year 2025 will be 20 times higher than in 2005 or 1.3 times higher than all energy sector emissions for the same year (Hutapea, 2007).

The decision to rapidly expand coal-fired power generation (by 10,000 MW in Java alone)

may increase these emissions even further.

RENEWABLE ENERGY TECHNOLOGY

The bulk of greenhouse gases emissions (GHG) coming from energy sector is resulting from burning fossil fuels to provide electrical power, heat, transportation, and energy for industrial processes. Promoting renewable energy technologies (RETs) in energy sectors may reduce GHG emissions, contributes to poverty reduction efforts. Three major advantages of renewable energy resources, includes these power will never run out, reduce dependence on current sources, and the most importantly they put extra burden on environment by reducing carbon dioxide emissions.

RET Potentials, Development, and Barriers

Table 1 also shows that Indonesia has vast potential resources of renewable energy, of which only a small portion has been exploited. The potential of solar energy ranks the highest, followed by biomass and geothermal. Indonesian people who living in remote area has very limited access to technology, hence the cost of solar energy, even though advanced technologically is usually considered as having a high cost.

RET Development in Indonesia is regulated by Presidential Decree No.5/2006 regarding the national energy policy. This decree states that the contribution of NRET in the 2025 national energy mix is 17% (5% bio-fuel; 5% geothermal; and biomass, nuclear, hydro, wind, and liquefied coal at 2%). By 2025, the government will take measures to add the capacity of

micro hydro power plants to 2,846 MW, Biomass of 180 MW, wind power of 0,97 GW, solar of 0,87 GW, and nuclear power of 4,2 GW.

Table 2 and 3 show that total installed capacity of renewable energies for electricity production is about 10.3 MW, where 99% of the capacity utilized for rural electrification (off-grid), and only 1% for urban aplications. Micro-hydro is still by far the largest contributor of renewable resources, followed by solar, and the Government is now actively exploring the potential to utilize wind energy.

The GoI has been considered to use renewable energy for rural electrification projects. Of the 70,000 Indonesian villages over 91% has access to electricity either from the grid or stand alone. In spite of this, mainly due to the geographical difficulties of an Island nation, only 64% of households had access to electricity. The Government has set a target for 2025 to have 95% of all households with access to electricity by 2025. This means that on average we need to provide roughly 1.3 million new connections per year. This requires a serious scale-up program. Some other reasons of the low development speed, includes: high cost, high dependency on imported technology, lack of incentive provided by government, and low ability of human resources.

Table 2. Current development of renewable energies for rural electrification

Type	Year				Total (kW)
	2005	2006	2007	2008	
WECs (kW)	80	240	735	200	1255
	(1 unit)	(3 Unit)	(9 unit)	(2 unit)	(15 units)
PV-SHS (kWp)	111.5	1574	2029	1865	5579.5
	(2,390 unit)	(31,488 unit)	(40,598 unit)	(37,279 unit)	(111,755 units)
PV-centralized (kWp)	18	0	102.4	150	270.4
	(5 unit)		(5 unit)	(9 unit)	(19 units)
Micro-hydro (kW)	155	702	1169	935	2961
	(4 unit)	(12 unit)	(7 unit)	(7 unit)	(30 units)
Pico-hydro (kW)	50	30	45		125
	(25 unit)	(15 unit)	(18 units)		(58 units)

Table 3. Development of PV in building (BIPV), 2008

Building	Unit	Capacity (kW)
ESDM	3	90
BPPT	1	10
Depdiknas	1	1
German Intl. School	1	11.2
Total	**6**	**112.2**

Current R & D on PV and Fuel cell Applications

Photovoltaic (PV) technology has recently evolved as an attractive option for rural electrification worldwide, particularly in the developing countries. However, a number of barriers need to be addressed for its widespread introduction. The research is focused on decreasing the nation's reliance on fossil-fuel generated electricity and reducing the environmental problems by optimization the cost of delivered electricity and improving the efficiency of PV systems. Capabilities of our institution includes include research and development, testing and evaluation, and deployment. Some projects under development and deployment, includes:

- PV power hybrid system for rural communities (includes solar, wind, Diesel, etc)
- PV power for the Indonesian Tsunami Early Warning System (INA-TEWS)
- PV components and system testing and evaluation
- Hydrogen and fuel cell for household and transport applications, etc.

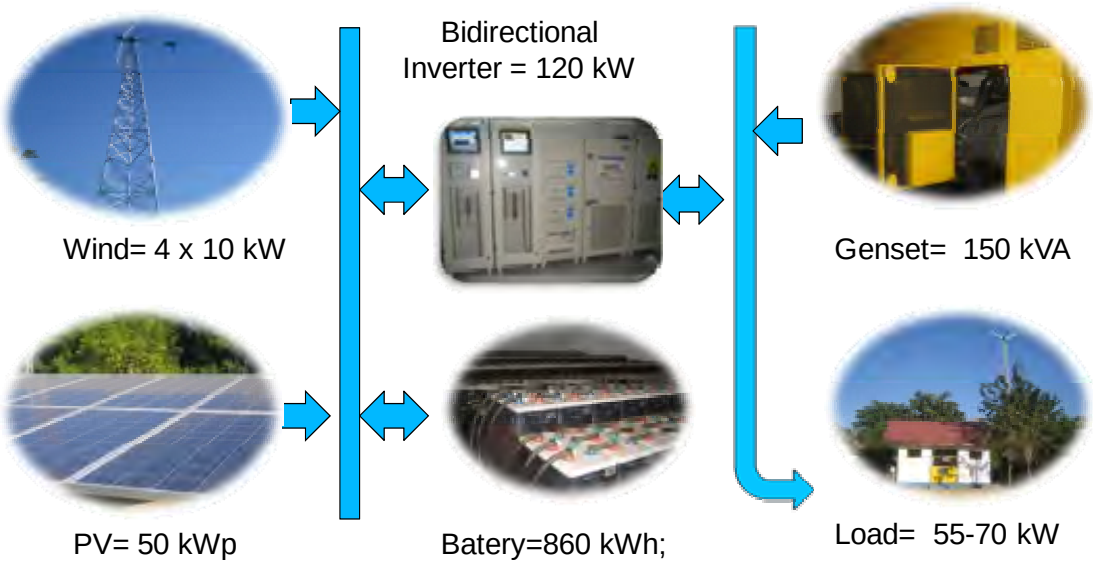


Fig. 7. Configuration of PV power hybrid system for rural communities (PV-wind-diesel)

CONCLUSION AND REMARKS

Indonesia has an energy system that is highly carbon intensive may cause to the global climate change. Deforestation and forest fires have put Indonesia among the top three largest emitters of GHG in the world. Emission from energy sector is relatively small, but is growing very rapidly.

Renewable energy technologies may reduce GHG emissions, contributes to climate change mitigation and poverty reduction. Indonesia has vast potential resources of renewable energy, but has not been exploited optimally, due to some barriers and few incentives. CDM projects can open up a wide possibility of GHG emissions reduction and removal. Unfortunately, Indonesia has not yet been able to take advantage of the opportunities in the CDM.

The mitigation options most feasible in Indonesia are geothermal energy, the utilization of flared gas, integrated combined cycle, fuel switching, and cogeneration and heating systems.

Potential and Technical Aspect Of Solar Photovoltaic Systems In Agriculture (Emphasis On Irrigation) In Bangladesh

A.B.M. Aminul Islam Solar System Engineer, Green Energy LLC, Dubai, UAE.

Abstract

Solar photovoltaic (PV) system is a promising option for electrification especially in developing countries where there is no grid electricity. Due to gradual price decreases of PV cells, various applications are becoming economically attractive and experience is gained with use of PV electricity in household purpose, communal services, agriculture which can lead a significance impact on development activity, mitigating climate change and poverty alleviation. Still there is lack information, technical knowledge and PV cell availability affects the potentiality which is creating limitations of PV systems with inborn limitations like low efficiency and higher initial investment. Bangladesh is agriculture dominated country where 63% people are involved within this field and most of people are living in village. Energy crisis is a common phenomenon of Bangladesh which is the main barrier of poverty alleviation and development activities. Every year agriculture sector falls in big trouble to mitigate fuel demand for irrigation. Four and half million cultivated land is under irrigation and yearly estimated diesel demand 840,000 tons and government has to allocate huge subsidy on diesel for irrigation (110 million USD),(Energy Bangla, 2008).

By using solar water pump, irrigation can land can be increased from 35% to 65% and it will boost up country's food production and decrease fuel demand and electricity significantly. According to news locally innovated solar pump cost would be 3.75 Lakh (5500.00USD) to 42 Lakh (60,000.00USD) with the capacity of pump varying from 1HP to 10HP (The Day Independent, 2009). Solar generated water pump can be implemented in two ways, replacing existing diesel generator by PV (Photovoltaic) system with electric motor (DC/AC) and battery bank, second installing new pump. Depending on the size of pump it can be DC or AC power generated. DC powered PV water pump are available in the market. To modify the existing shallow and low lift pump, it will require PV panel, Battery Bank, Electric motor and Inverter (DC to AC).

In the country, existing 75000 shallow tubewell (STW) is using for 340000 ha of land irrigation, 6000 low lift pumps (LLP) for 120000 ha of land irrigation which can be featured with PV generator gradually by government and non government initiative (Energy Bangla, 2008). The core aim of this study is to contribute better understanding of PV application in irrigation and system integration technical details.

Conclusion

Bangladesh is low lying and agriculture based country. By using PV system it can be benefited by two ways, decrease fuel demand and mitigating climate change. The main limitations of PV system are higher initial investment, initiatives, policies. Government, non government and development organization can play a vital role to integrated PV generator in agriculture sector especially for irrigation. Due to higher investment farmers are not able to

pay for that. Subsidy, donation and low interest loan will be key drivers of PV pump implementation.

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SESAM ALUMNI WORKSHOP
ON
"POLICIES AND STRATEGIES TO MITIGATE CLIMATE CHANGE AND ENERGY POVERTY IN SOUTH EAST ASIA AND CHINA"

PRESENTATION TOPIC:
"Potential of Solar Photovoltaic System to mitigate energy poverty in agriculture (emphasis on irrigation) in Bangladesh"

HANOI AND HALONG BAY, VIETNAM
5-9 OCTOBER 2009

Presented by
A.B.M. Aminul Islam
Solar System Engineer
Green Energy LLC, Dubai, UAE.

Outline of the presentation

- Introduction
- PV Potential
- PV pump selection/design
- Problems and barriers
- Cost of PV pump
- Conclusion and recommendation

Introduction

What is photovoltaic system?
Conversion to solar energy to electric energy
Why photovoltaic system ?
-Power crisis
-Sun Energy is free
-Reduce dependency on fossil fuel
-No direct impact on environment
-Long life and durability as well as low operating cost
-No moving parts
-Poverty alleviation
-Food production could be increased by using PV pumping
-Bangladesh is in Risk of climate change

Background of Bangladesh

- Population 153 million (about 1000 per sq km)
- Two basic resources natural gas and coal
- Gas Reserves 14.4 tcf. Estimated to last until 2015
- Electricity installed capacity 5245MW and load shedding 950MW as of July 2008
- 30% population has accessed to grid connection

Source: IAEA 2006, Siddique, 2007, BPDB 2008, and Barua 2005

Applications of PV system

- Solar Home Power System(SHPS)
  - Lighting, Radio, TV, Fan
- Social and Communal
  - potable water, health centres, education and communal centres
- Off-farm productive activity
  - Restaurant, bar, rural cinemas, telephone shops, technical and artisanal workshops
- Telecommunication

Source: FAO, ROME 2000

Applications of PV system

Irrigation

Insect killer

Other use
Aeration of aquaculture
Electric Fence

Irrigation process in Bangladesh

- Electric Pump
  - Grid available

- Diesel
  - Off Grid

Source: http://www.duboisag.com/catalog.php?product_id=7

PV Potential in irrigation

- 1.4 million pump using for irrigation
- 75% pump run by diesel
- 840,000 tons diesel require for irrigation
- 110 million USD subsidy per year
- 75000 shallow tubewell
- 6000 low lift pumps
- 2,000-3,000 megawatt additional electricity
- Co2 saving 72 million ton/year

Source: The Day Independent. (2009, September)

PV Systems

- Off grid system
  - PV panel, battery, Controller and Inverter
- Grid system
  - PV panel, grid tie Inverter
- Hybrid system
  - Solar wind
  - Solar with Generator
  - Gird interact solar system

PV pump Selection/design

1. DC pump
   - Lorentz Submersible pump
   - Grundfos

Lorentz pump

Model	Water lift (m)	Capacity m3/day	Panel size max. (Wp)
PS-150	Up to 22	35	450
PS-600	Up to 180	100	840
PS-1200	Up to 240	125	1200
PS-1800	Up to 90	155	1800

Source: PTL solar

PV pump Selection/design

2. PV electricity with existing pump

Required components
- PV panel
- Controller
- Battery
- Electric motor (dc or ac)
- Inverter (for AC only)

Source: Author

PV pump Selection/design

Panel (Wp)	Charge controller (A)	*Battery (AH)	Inverter	Insulation (kWh/m²/day)	Avg. Output (kWh) max**	max**load (W)	**Hours/day max**
80x1	10Ax1, pt	100AH x1	375W	6	0.40	80	5
80x2	20Ax1, pt	150AHx1	375W	6	0.80	160	5
80x3	30Ax1,pt	200AHx1	375W	6	1.20	240	5
100x3	30Ax1,pt	150AHx2	750W	6	1.50	300	5
100x4	40Ax1,pt	200AHx2	750W	6	2.00	400	5
130x4	40Ax1,pt	150AHx3	750W	6	2.60	520	5
130x5	40Ax1,pt	200AHx3	750W	6	3.25	650	5
130x6	60Ax1,xan	150AHx5	1250W	6	3.90	780	5
130x7	60Ax1,xan	200AHx4	1250W	6	4.55	910	5
130x8	40Ax2, pt	200AHx5	1250W	6	5.20	1040	5
100x12	40Ax2,pt	200AHx6	1250W	6	6.00	1200	5
130x10	40Ax2,pt	200AHx7	2012W	6	6.50	1300	5
180x8	40Ax1,pt	150AHx8	2424W	6	7.20	1440	5
130x12	40Ax2,pt	150AHx10	2012W	6	7.80	1560	5
180x10	40Ax2, pt	200AHx8	2424W	6	9.00	1800	5
130x16	40Ax3,pt	200AHx10	2424W	6	10.40	2080	5

Source:

Solar irradiation

Countries	Avg. Insulation (kWh/m2/day)
Bangladesh	4.65
Bhutan	4.15
Cameroon	5.01
China	4.17
Congo	4.71
Djubouti	6.20
Etheopia	5.41
Germany	2.78
India	4.61
Indonesia	4.86
Iraq	4.64
Kenya	5.48
KSA	4.94
Kuwait	4.95
Malaysia	4.26
Nepal	4.86

Countries	Avg. Insulation (kWh/m2/day)
Nigeria	5.45
Pakistan	4.78
Pakistan	4.78
Qatar	4.56
Sierra Leone	5.31
Syria	4.53
Tanzania	4.14
Thailand	4.51
UAE	5.70
Uganda	4.50
Vietnam	3.84
Zambia	5.96

Source: NASA, Atmospheric Science Data

Cost of PV Pump

- Lorentz pump price1300USD
- PV panel price 3.00 to 4.00 USD/Wp
- Charge controller price: 50 to 200USD
- Battery 150 to 200USD

Total cost: 5000.00 to 60000.00USD

Problems and barriers

- Higher initial investment
- Theft
- Initiative/ investor
- Policy
- Market
- Technical knowledge
- Space requirement

Conclusion and Recommendation

- Bangladesh has huge possibility of PV application in agricultural purpose
- Need subsidy
- Proper Policy
- Technical knowledge
- Investment

Global Carbon Market Beyond 2012

Ms. Fumi Harahap - E.ON Carbon Sourcing Ltd. Suite 709 7th Floor PJ Tower, 18 Persiaran Barat 46200 Petaling Jaya, Malaysia

Abstract

Future climate regime is highly influenced by the outcome of UNFCCC conference in Copenhagen, December 2009. The conflict between developed and developing nations will be a significant issue to determine what action to drive towards climate change mitigation. Clean Development Mechanism (CDM) as the only part of Kyoto Protocol that provides an article role for developing countries and build an effective international relations is still likely play a major role in the next commitment period.

1. Introduction

1992 was an important milestone as the international response to the need for action on climate change. Requiring international participation, in 1997, the Kyoto Protocol was adopted; entering legally into force in 2005 to regulate such activities and now has 192 parties. The signing governments were segmented into Annex I countries (industrialized countries) and non Annex I countries (developing countries).

Each of Annex I countries are obliged to reduce their Green House Gas (GHG) emissions from pre industrialized level in 1990. The protocol allows the Annex I countries to reduce their emission through three flexible mechanisms:

- Emission trading – intended as government to government market where the sovereign states can buy or sell credits they are issued as part of their cap under the Kyoto Protocol, known as Assigned Amount Unit (AAUs)
- Clean Development Mechanism (CDM) – where tradable carbon credits are awarded to projects that are hosted in developing countries. The credits are known as Certified Emission Reduction (CER)
- Joint implementation (JI) – similar to the CDM, except that the projects are implemented in Annex I countries. The credits are known as Emission Reduction Unit (ERU)

In order to support and facilitate government action, several countries have developed regional Emission Trading Scheme (ETS) where private sector/industry can buy or sell credits to comply their target. In EU ETS (European Union Emission Trading Scheme) the credit is known as European Union Allowance (EUA). European Commission approve the amount of cap for government and government allocates the compliance need for private sectors. Besides trading the carbon credit internationally or regionally, private and public sectors are allowed to comply their targets through credit from offset projects (CDM and JI). The amount of credit based project that can be used for target compliance for private sector,

known as supplementartity constraint, is determined by government. The underlying idea of offset projects is to reduce the cost of cap and trade system through technology transfer.
The first Kyoto commitment period ends in 31st December 2011. The idea of carbon offsetting is the central to the discussion about Post-2012 climate governance. There are many uncertainties with respect to future climate regime beyond 2012.

The post 2012 discussion started in Montreal, 2005 and opened two tracks of negotiations i.e. (1) the Kyoto track, with the Ad-Hoc Working Group on further commitments for Annex I parties under the Kyoto Protocol (AWG-KP) which is the basis for hammering out reduction targets for current Annex I countries; (2) a non binding dialogue under the UNFCC to engage the US and Australia (both had not ratified Kyoto at that time), also known as the convention track. Furthermore, at the COP/CMP 14 meeting in Bali in December 2007, the last dialogue was transformed into the Ad-Hoc Working Group on Long-term cooperative action under the Convention (AWG-LCA). This is now the main negotiation track of post-2012 future climate regime. At the Bali conference, the parties agreed to open continuous negotiations towards a post-2012 agreement, to be signed in December 2009. Poznan, 2008 is the half way towards Copenhagen. The major talk was how developed countries could contribute in adaptation fund. As a consequence countries which are facing the most dramatic results of climate change will launch first adaptation projects in 2009. The UN Climate Talks in Bonn, Bangkok, and Barcelona in 2009 have initially started the discussion of international concurrence before the Copenhagen treaty in place. Emission reduction level of Annex I parties, adaptation fund implementation, CDM reform including new technologies and new methodologies for REDD (Reduced Emissions from Deforestation and Forest Degradation) are some highlights which discuss in these meeting.

2. Post 2012 Issues

The foremost issue of post 2012 Kyoto discussion is disagreement between developing and developed nations with regards to what action should be undertaken and until what extent. Industrialized countries want emerging countries like India and China to take measures such as improving the efficiency of power generation and encouraging development of renewable. Only if such measures are agreed, then industrialized countries will be willing to provide funds to help poorer nations to cut emissions and adapt to the effects of climate change. On the other hand, developing countries push developed countries to set an ambitious GHGs reduction target and to define a substantial supplementary constraint of international credit in order to make the offset project work. The emerging ETS scheme could be an upcoming discussion as well in Copenhagen.

Because of the role of developing countries in future climate regime is one of the major issues in the climate negotiations, the CDM becomes crucial since it is the only part of the Kyoto protocol that provides an article role for developing countries. Nevertheless CDM application pre 2012 receive number of criticisms. Several topics of CDM project application post 2012 comprises credit bankability, improving institutional performance, new technologies include (carbon capture storage, avoided deforestation), new methodologies of

REDD, and expanding CDM projects e.g. sectoral CDM or discounted credit of CER from large developing countries.

3. Future Carbon Balance until 2020

At present situation both in volume and value terms, EU ETS holds the largest physical global carbon market and CDM market comes in the second place. Presumably in best scenario that US agrees to participate in the international agreement, it is expected that in post kyoto period the highest CER demand will come from the US ETS. According to New Energy Finance (August, 2009) database, between 2013 and 2020, if US put 14% reduction target on 2003 emission level, 2,635 Mton of CER will be demanded from US to comply their target. Being opposed of credit from project based mechanism at the beginning, now US shows interest in it and active support to the reform of CDM, more specifically forestry credit. Whereas if EU put 20% reduction target most probably only 1,683 Mton come from its scheme. In the kyoto period EU dominates the CDM market. Lower demand from EU ETS compared to United States Emission Trading Scheme (US ETS) is because in post 2012, it is likely that EU will commit to set the stringent requirement of CER and likely only high quality CER and generated in least developed countries are eligible for compliance. Another important buyer could come from Japan and Australia with total CER demand of 927 Mton and 317 Mton respectively. It is foreseed that the global CER demand will be 5,720 Mton until 2020.

From the seller side, China and India would still dominates the market. Supply of credit from agriculture and waste projects are expected to take over the domination of credit from high global warming potential project pre 2012. Credit from renewable energy project will continue to be important due to requirement of some buyers. It is projected that the global CER supply will be 17,000 Mton until 2020. It shows that supply over exceed demand significantly. Future of CDM project is highly rely on the Copenhagen treaty.

The sums demand/supply are based on official data and headline projections. They are subject to many factors that will change. The demand supply dynamic notably evolving government policy and economic growth factors.

4. Carbon Pricing

There is not one single price in the global carbon markets. The reason for this is that each of tradable instruments have different risks and usability which has led to a fragmented price. Presently, the secondary CER (sCER) prices with guarantee delivery is traded at a discounted rate of EUA price and respond to volatility in EU ETS market. Statistic shows that sCER price is in range between 75%-80% of EUA price. The effect of volatility is felt in the pricing of sCER, but the bulk of CDM market, the primary market (CER which is not yet traded in the international market), does not respond to the EU ETS in a daily basis rather to particular abatement cost in the countries. Trend of sCER pricing may change in the future with regard to US involvement. Government and private willingness to pay will also influence the sCER

price as the government always have the choice of cheaper AAUs option. Russia as one of the big AAU's supplier has announced that they are not willing to sell any AAUs in the market but other AAUs supplier particularly from economic in transition countries have a big chance to sell AAUs. Chinese floor price, although unregulated, is determined as the international primary CER (pCER) floor price. Chinese floor price is currently 8€/tCER generated from HFC project. If HFC project is no longer eligible for compliance in the next commitment period, the pCER price will go up and will effect the sCER price accordingly. If the sCER price higher than EUA price or other regional ETS credit then private sector will tend to buy ETS' credit to meet the target. This will create competitiveness of CER and other carbon credit. Economic and political situation also play a significant role in the future CER price setting.

5. Conclusion

- CDM will continue to be a policy designed mechanism and play an important role in post 2012 as CDM is the only part of Kyoto protocol that requires the participation of developing countries.
- One of the important factor influence need for CERs in the market are the emission reduction target. It is expected that developed nations will put an ambitious emission reduction target to make CDM work.
- CDM reform is highly needed to succeed future CDM e.g improve institutional performance; spread the distribution of CDM project particularly in least developed countries.

The consensus is that an accord in Copenhagen will be a "last minute" framework deal, with much of the detail to be agreed afterwards. Delegates are working to solve issues within their competence, but the "big" decisions will be taken at higher level – in Copenhagen or elsewhere.

Global Carbon Market Beyond 2012

Fumi Harahap – E.ON Carbon Sourcing Ltd.
Workshop "Policies & Strategies to Mitigate Climate Change & Energy Poverty in SEA and China"
Hanoi, Vietnam, 5-9 October 2009

Agenda

1. Overview of Global Carbon Market
2. Roadmap to Copenhagen
3. Post 2012 Issue
4. Carbon Balance : Supply Demand Analysis
5. Carbon Pricing
6. Conclusion

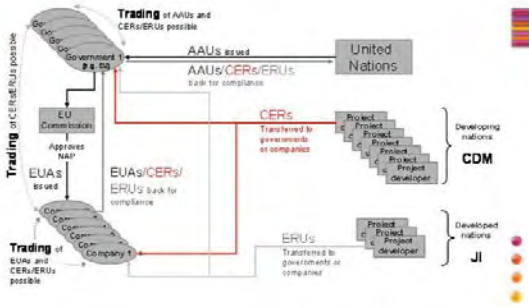
Global Carbon Market

	Regulation	Description	Carbon credits
"Cap and trade" systems	• Kyoto Protocol	• International agreement to limit greenhouse gas emissions through a cap-and-trade system - 36 countries ratified it (called "Annex I")	• AAUs
	• EU ETS	• Cap-and-trade system for large European CO_2-emitting assets	• EUAs
"Offset projects mechanisms"	• Clean Development Mechanism (CDM)	• Carbon offset projects in non Annex I countries - that can be purchased by compliance buyers (e.g., Annex I country governments, EU ETS participants)	• CERs
	• Joint Implementation (JI)	• Similar to the Clean Development Mechanism, except that the projects are implemented in Annex I countries	• ERUs

Source: UNFCCC, EU ETS

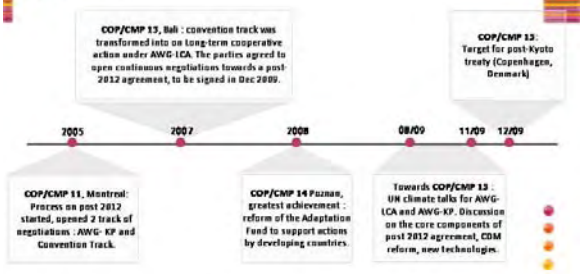
3

Simplified Function Principle of The Global Carbon Market



Roadmap to Copenhagen

Key Milestones :

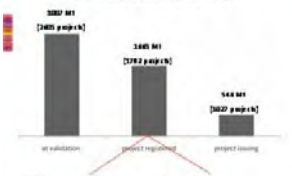


Post-2012 Issue: "uncertainties"

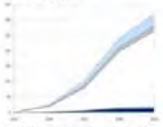
Developed nations	Developing nations
• Several Annex B countries want emerging economies to take serious measures to the extent necessary until Annex B countries agreed to provide funds for adaptation • Certificate eligible for compliance and bankability • Emerging of regional ETS • New Annex B Parties e.g. S. Korea, Mexico	• How and to what extent large emitting developing countries will be involved in new international agreement (very few believe they will take on commitment post 2012) • Pushing developed countries to set significant emission reduction target
Role of CDM	**CDM Reform**
• World : The only part of Kyoto protocol that provides an article role for developing countries & build an effective international relations • Providing low cost emission reductions, Facilitating technology transfer, Increase the flow of capital from developed countries, Provide sustainable development, Poverty alleviation	• New technologies : CCS, aviation, avoided deforestation • New methodologies of REDD • Improve institutional performance • Reforming and expanding CDM projects e.g. sectoral CDM, discounted credit of CER from large developing countries

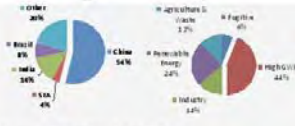
Global CDM Project Pipeline

Total volumes expected until 2012



- Total credit issued to date is 325 Mton from 546 projects





- China currently covers more than half of CDM market
- High GWP dominated by HFC projects with 19 projects equal to more than 25% of global project pipeline

Source : UNEP Risoe, Point Carbon, 2009

CER Demand

Where the demand comes from

- EU ETS phase 3
  - Demand for offset credit (CER/ERU) is probable to be stringent in the next commitment period.
  - "High quality" CER and generate from least developed countries
- US is predicted to be the largest credit buyer post 2012.
- Other upcoming markets
  - Japan, New Zealand, Australia

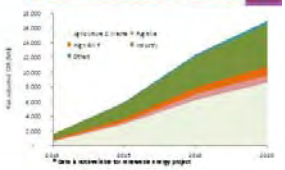
Future Carbon Balance until 2020

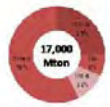
EXPECTED CER DEMAND

[NEF base case]

Country	2020 target	Demand (Mton)
EU-27 + EEA	20% reduction on 1990 level	1,583
US	14% reduction on 2005 level	2,535
Australia	5% reduction on 2000 level	317
Japan	15% reduction on 1990 level	927
New Zealand	10% reduction on 1990 level	48
S. Korea	8% increase on 2005 level	109
5,720 Mton		

PROJECTED CER SUPPLY POTENTIAL





Source : NEF, 2009

Carbon Pricing

- Primary CER
  - Risk apportioned
- Secondary CER
  - Marginal buyer.
    - Pre 2012, EU ETS participants dominate carbon market. sCER price leans to follow EUA's price trend (~80% of EUA's price)
    - US ETS is likely to take over the lead
  - Price floor and ceiling price
- Government and private willingness to pay which create competitiveness of CER and other carbon credit
- Future price setting : marginal abatement cost

Conclusion

- CDM will continue to be a policy designed mechanism and play an important role in post 2012
- Factor influence of CERs need in the market:
  - Reduction target
    Serious emission reduction of developed nations is needed to make CDM work
  - Price setting
- CDM reform is highly needed to succeed future CDM e.g improve institutional performance, spread the distribution of CDM project particularly in least developed countries

"The consensus is that an accord in Copenhagen will be a "last minute" framework deal, with much of the detail to be agreed afterwards. Delegates are working to solve issues within their competence, but the "big" decisions will be taken at higher level – in Copenhagen or elsewhere."

Thank you

For further reading : UNFCCC, UNEP Risoe, IGES, etc

Contact : Fumi.Harahap@eon-uk.com,my

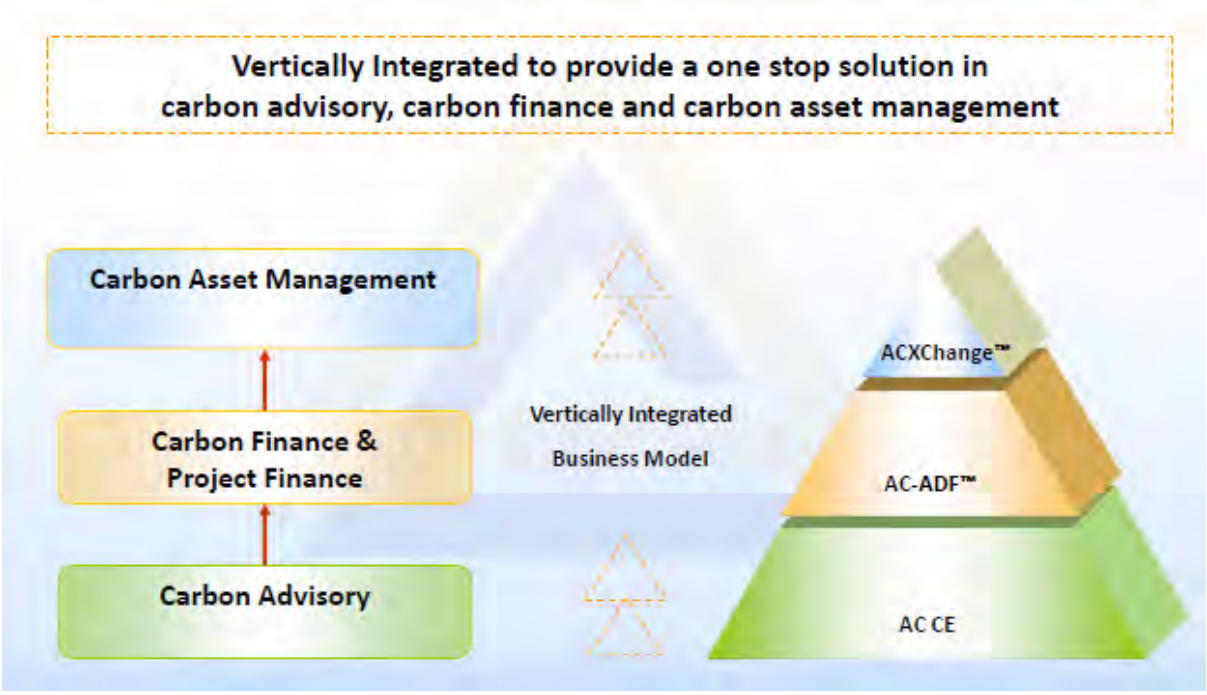
Carbon Market

MSc. Susy Marisi Simarangkir, General Manager CDM and Carbon Trading, PT. Asia Carbon Indonesia

Asia Carbon Global

Establishment : 4 February 2003

Projects : ±150 Carbon Projects



How quick global temperatures…

How far is our commitment?

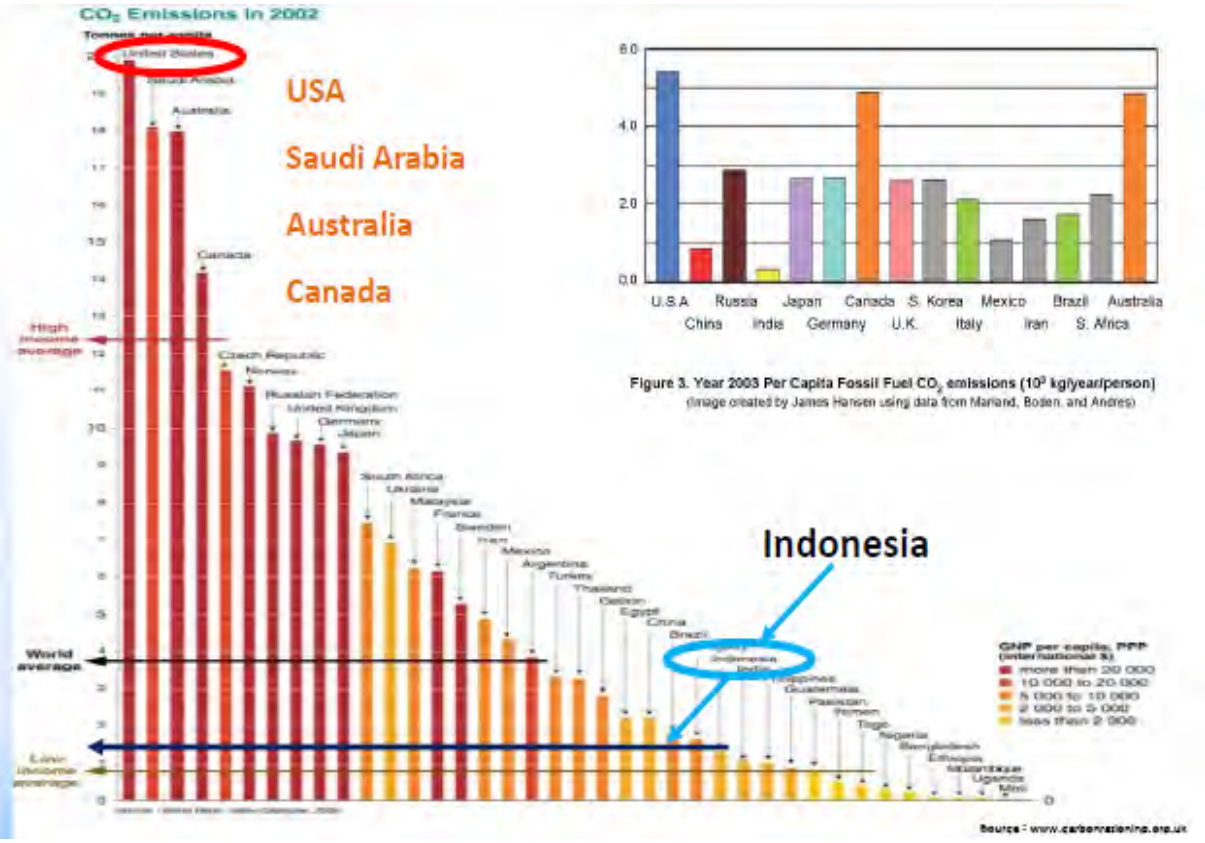


Figure 3. Year 2003 Per Capita Fossil Fuel CO_2 emissions (10^3 kg/year/person)
(Image created by James Hansen using data from Marland, Boden, and Andres)

Uncertainty in Future CO2 Emissions

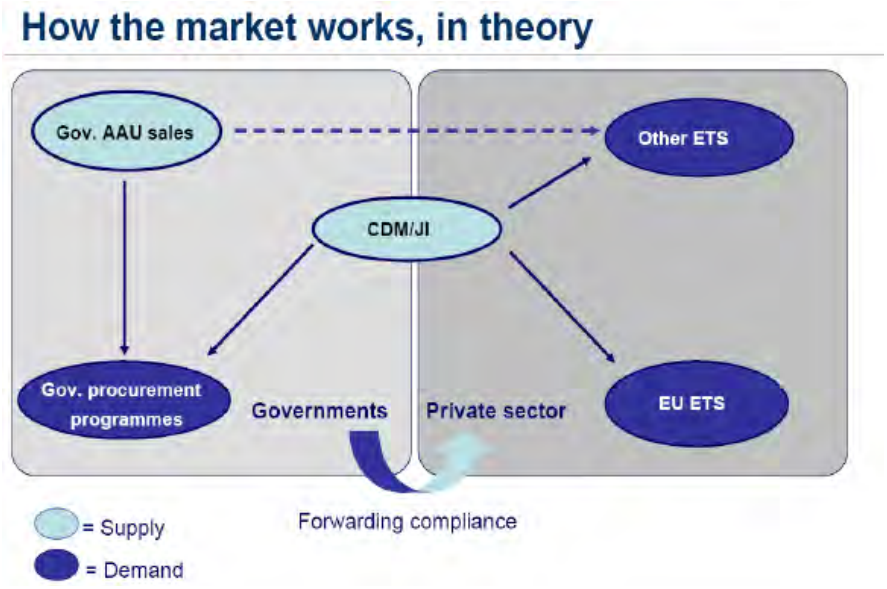
Country	Projected Growth, 2000–2025 (%)		
	Low Growth Estimate	High Growth Estimate	% Point Difference
India	73	225	152
Mexico	68	215	147
China	50	181	131
Brazil	84	165	81
South Korea	43	117	74
Former Sov. Union	37	109	72
Japan	4	46	42
EU-15	-1	39	40
United States	20	52	32
World	33	93	60

Sources & Notes: Scenarios are drawn from EIA, 2004; POLES (EC, 2003); and IEA, 2004c. EU here includes Switzerland and Norway. Figures exclude CO_2 from international bunker fuels and land use change and forestry.

The way of GHG Reduction

A.Kyoto Protocol (under UNFCCC)-Clean Development Mechanism (Unit : Certified Emission Reductions / CERs)-Emission Trading (Unit : Assigned Amount Units / AAUs)-Joint Implementation (Unit : Emission Reduction Units / ERUs)B. Beyond UNFCCC-Voluntary Markets : JVETS, CCX, etc.-Other Local Markets : US, Australia, UK

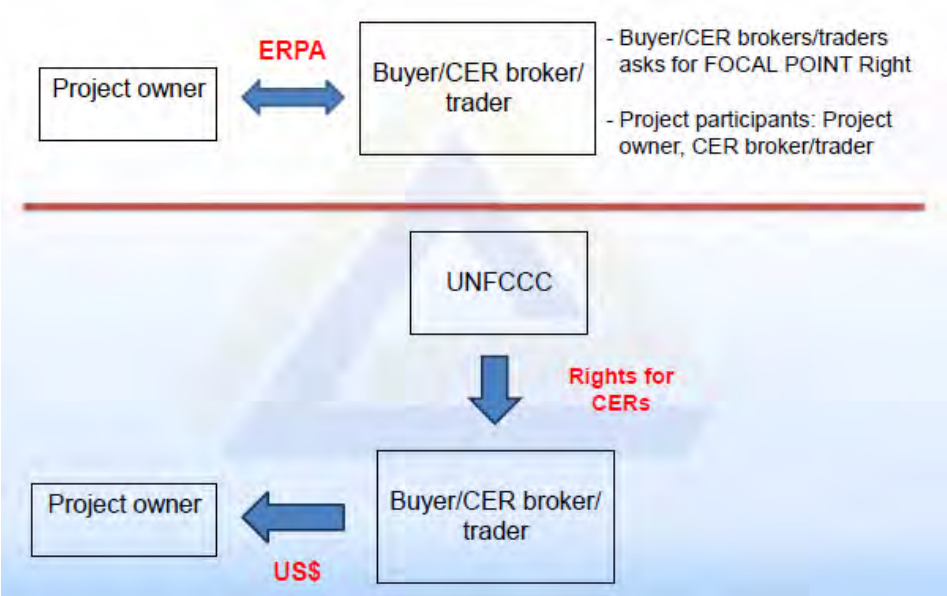
Carbon Market in Kyoto Protocol



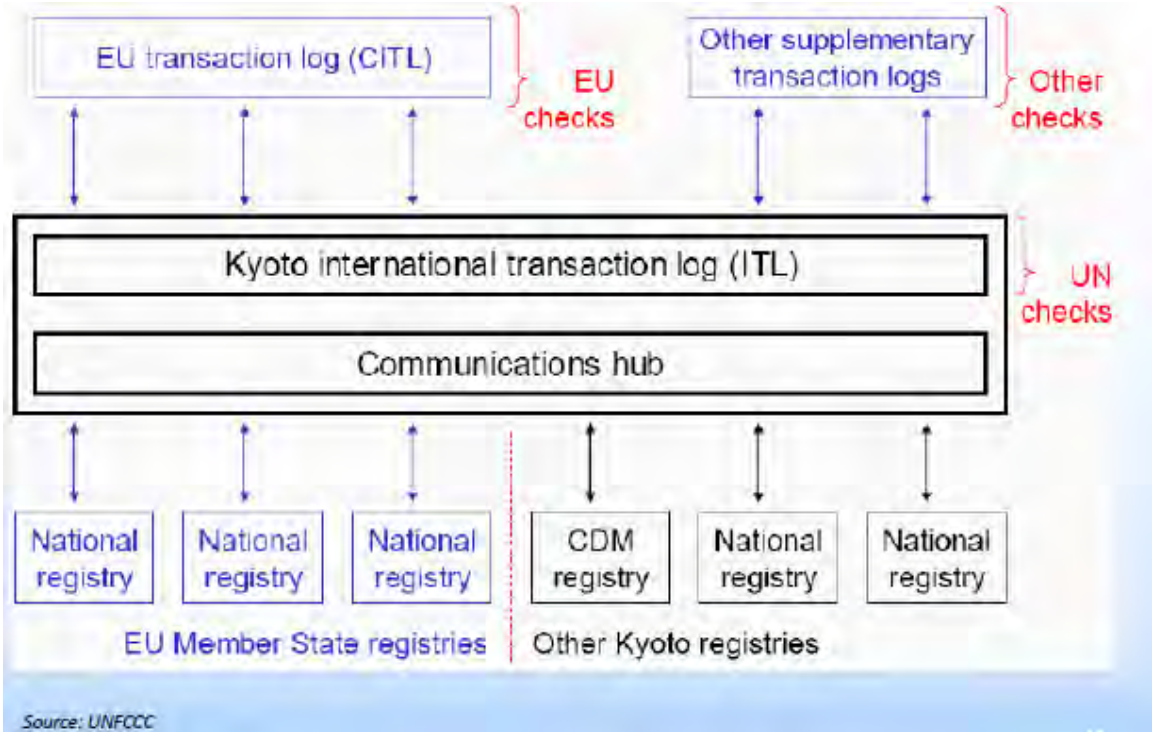
Main Types of Carbon Credits

- European Union Allowance (EUA)
  - Allocated by European governments to local industry
  - EUETS is linked to Kyoto through CDM, JI, Emission Trading ("flexible mechanisms")
- Certified Emissions Reduction (CER)
  - Non-Annex 1; used for compliance in cap and trade schemes
  - Carbon credits derived from CDM projects
- Emission Reduction Units (ERU)
  - Annex B; used for compliance in cap and trade schemes
  - Similar to CERs but derived from JI (Joint Implementation). Targeted at "economies in transition"
- Voluntary or Verified Emissions Reduction (VER)
  - Voluntary action, no formal connection with compliance market
  - Carbon credits from projects that are independently certified from Kyoto system
  - Active market with different standards

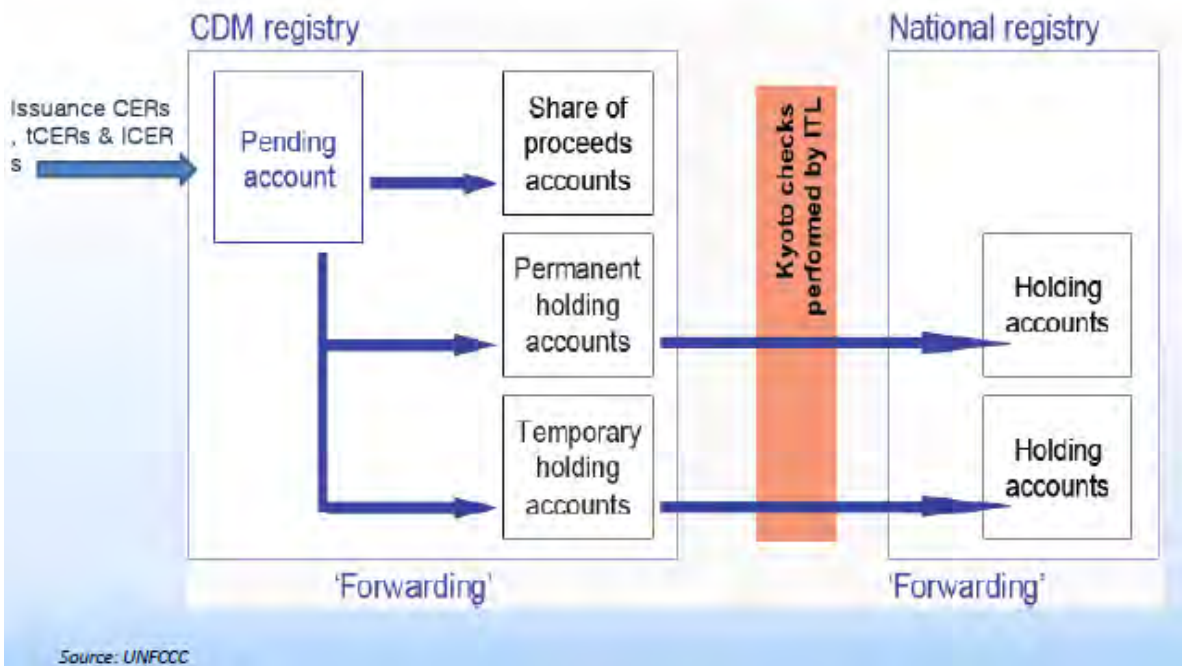
Flow Diagram –CER Purchase



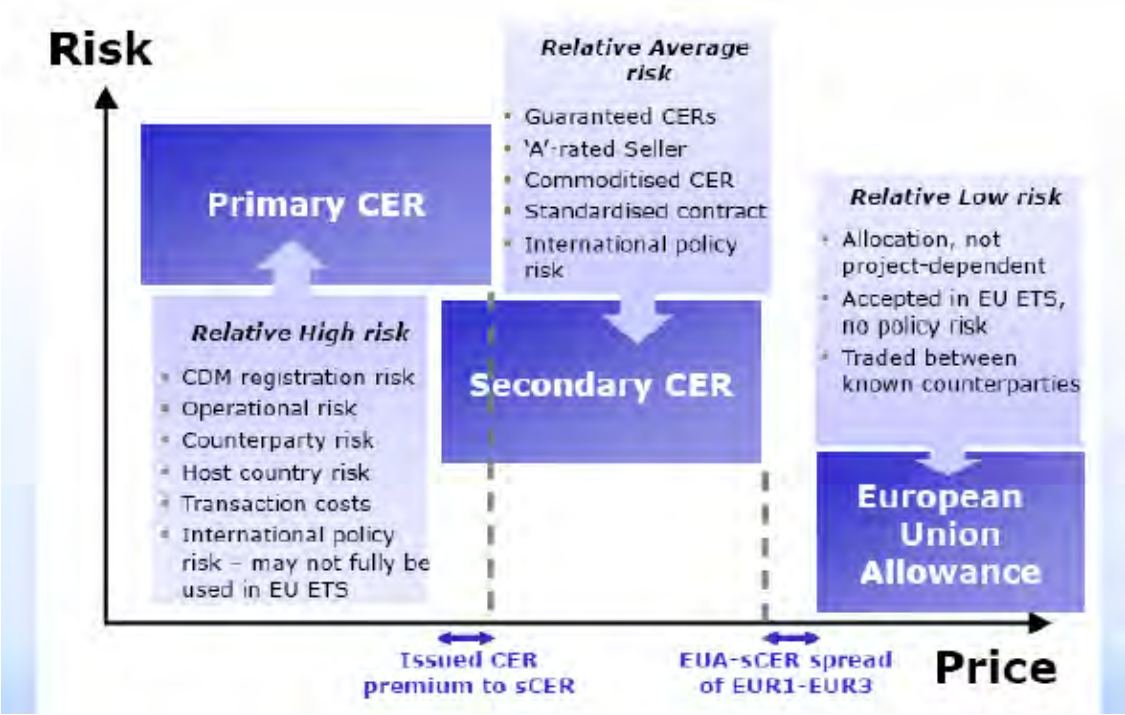
Registry System



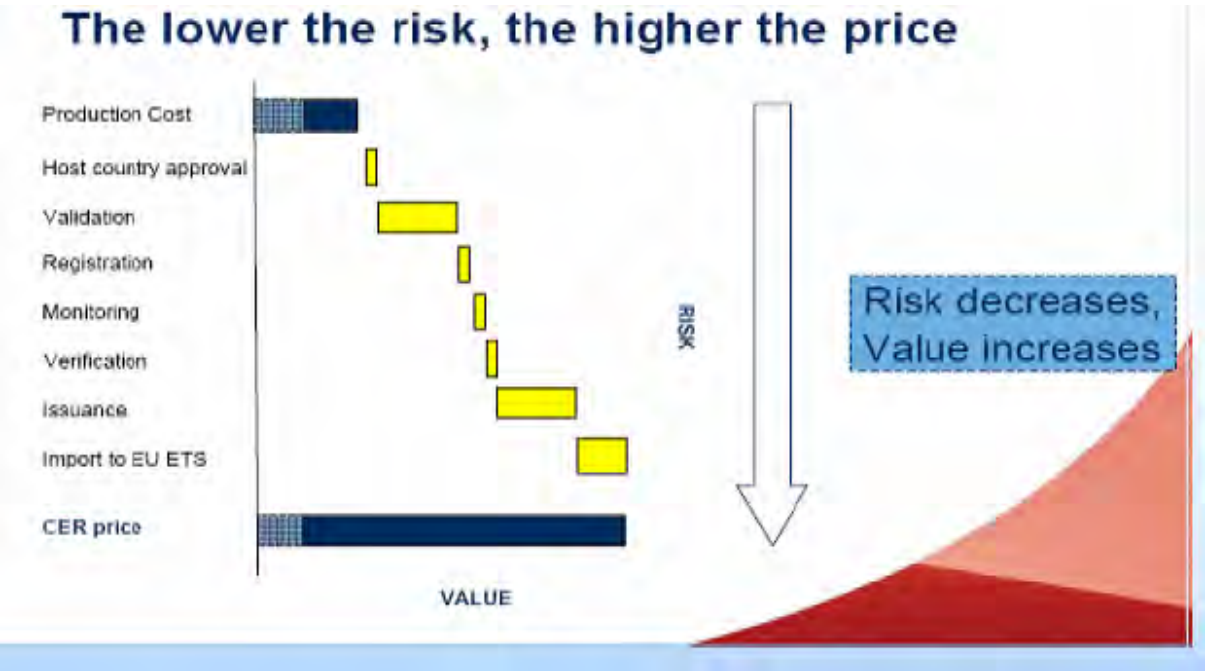
CDM to National Registry



Type of CERs & EUA



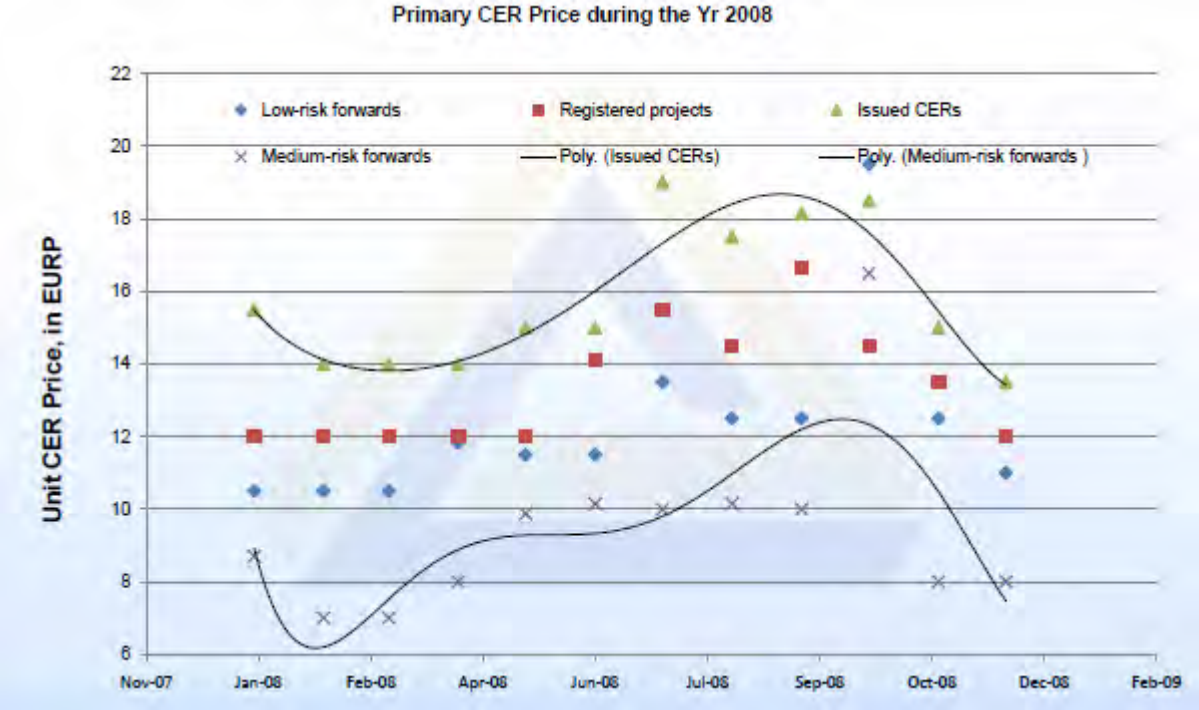
CERs : Risk Vs Price



Main Market Volume

	2007		2008	
	Volume (MtCO$_2$e)	Value (M€)	Volume (MtCO$_2$e)	Value (M€)
Project-based Transactions				
Primary CDM	552	7,433	389	6,519
JI	41	499	20	294
Voluntary market	43	263	54	397
Sub total	**636**	**8,195**	**463**	**7,210**
Secondary CDM				
Sub total	**240**	**5,451**	**1,072**	**26,277**
Allowances Markets				
EU ETS	2,060	49,065	3,093	91,970
New South Wales	25	224	51	183
Chicago Climate Exchange	23	72	69	309
RGGI	08	08	63	246
AAUs	08	08	18	211
Sub total	**2,108**	**49,361**	**3,276**	**92,859**
TOTAL	**2,984**	**63,007**	**4,811**	**126,345**

Carbon Prices in 2008



Carbon Prices Prediction

EUA Prices (EU-ETS)	Date	Dec-09	Dec-10	Dec-11	Dec-12	09-12 Strip
ECX Futures	31-Aug	€ 14.93	€ 15.30	€ 15.92	€ 16.95	€ 15.78
BlueNext Spot	31-Aug	€ 14.92				
CER Prices (OTC)		**Dec-09**	**Dec-10**	**Dec-11**	**Dec-12**	**09-12 Strip**
Broker						
CantorCO2e	31-Aug	N/A	N/A	N/A	N/A	N/A
Evolution	31-Aug	N/A	N/A	N/A	N/A	N/A
GFI Group	31-Aug	N/A	N/A	N/A	N/A	N/A
ICAP	31-Aug	N/A	N/A	N/A	N/A	N/A
MF Global	31-Aug	N/A	N/A	N/A	N/A	N/A
Spectron	31-Aug	€ 13.43	€ 13.40	€ 13.14	€ 13.47	€ 13.29
Tradition	31-Aug	N/A	N/A	N/A	N/A	N/A
Tullett Prebon	31-Aug	€ 13.35	€ 13.15	€ 13.16	€ 13.45	€ 13.28
		Dec-09	**Dec-10**	**Dec-11**	**Dec-12**	**09-12-Strip**
*REUTERS CER INDEX	31-Aug	€ 13.39	€ 13.28	€ 13.15	€ 13.46	€ 13.29
Net Change		-€ 0.05	€ 0.06	-€ 0.05	-€ 0.07	-€ 0.04
€ Spread		€ 1.54	€ 2.03	€ 2.77	€ 3.49	€ 2.49
CER Prices (Exchange)		**Dec-09**	**Dec-10**	**Dec-11**	**Dec-12**	
ECX Futures	31-Aug	€ 13.32	€ 13.11	€ 13.13	€ 13.46	
BlueNext Spot	31-Aug	€ 13.36				

Carbon Prices Drivers

- Market Participants
  - New buyers and sellers enter into the primary CER market

  - high degree of development
- CER/ERU Supply
  - China, India and Brazil dominated the CDM
  - Obstacles and bottle necks on CDM cycle
  - JI Projects: Russia and Ukraine with Track II ERUs
- Inefficiencies created by policy
  - Limits on imports of KP credits
  - Free and borrowing allowances on EU ETS
  - Price caps and floors
- CER/ERU Demand
  - More trading schemes, competition to access carbon credits
  - New Sectors with the EU-ETS: Aviation starting from 2012, Demand prediction 150mt per annum
  - Governments demand (i.e., Italy, Spain, Germany, Japan)
  - Project diversification and Risk management
- Uncertainties
  - International treaty Post 2012
- Change in Expected Emission & Market sentiment
  - Fuel price, weather, industrial production, switching and power price
- Growth in Renewables
  - 20% target at the EU members

Carbon Market Status

MARKET	Up to 2012 (Million tCO_2)		Up to 2020 (Million tons CO_2)
	Supply	Shortage	Supply
CDM	2,540	3,750	5,706
JI	240		-

Source :UNEP Risø

Post 2012 –Overview

Market Outlook

- EU will proceed on international Post Kyoto long-term agreement and allow usage of CERs in EU ETS III

- Low CER/ERU supply will have a strong impact on trading markets Post 2012
- Contracting of CDM/JI projects includes a huge performace risk

Post 2012 –Investor's Perspective

- Private Investors & Banks increasingly targeting Post 2012
- EUR 125 Million Fund (March 2008) to support project based carbon credits post 2012
- CERs and ERUs for compliance on International treaty
- Sectors include : RE, EE, Fuel Switch, Methane, Fugitive Industrial gases, Forestry, CCS

Carbon Price for Post 2012

- €38 EUA price on 2020 –estimated €79 last year
- mid-2009 to 2012 carbon price lower than €20
- market imperfections post 2012 -2020

Post 2012 –Impact of International Treaty

With International treaty

- Market convergence and integration
- Fungibility of assets and revelation of long-term carbon price
- Vast benefits of carbon for both developed and developing countries

Without international treaty

- Fragmented market
- Continued price volatility
- Limited benefits of carbon trading with many untapped potential

Post 2012 –Option for Developing Countries

- Set up of Emission Reduction Target :

  a. No Cap & Trade (International / Domestic)

  b. Cap & Trade (International / Domestic)

  c. Cap and No International Trade

- Approach :

  a. Sector targets (Energy Efficiency) : most favored option

  b. TT & Investment approach

  c. Extending CDM (Programmatic CDM)

Post 2012 –Indonesia Preparation

- Carbon: only an option!!
- Focus on the sectors rather only on CDM/carbon :
  - How to diversify the energy resources from fossil to less carbon fuel/renewable?
  - Forestry sector
  - Municipal solid waste
- Focus on low hanging fruits in Indonesia:
  - Geothermal
  - Flare reduction
  - Renewable energy: Hydro, biomass and biogas
  - Municipal solid wastes
- Do we have a clear policy/regulation guideline to promote the above sectors?

Setting up CDM projects

Rachot Indradesa, GreenStream Network GmbH, Scholß str. 12 Potsdam 14467, Germany

rachot.indradesa@greenstream.net

Abstract

Many people have been informed about Clean Development Mechanism (CDM) but not so many people are involved in operative level. Questions on what required for setting up a CDM project are often asked. From author experiences there are 4 areas to be evaluated and fulfilled: the project generates real emission reduction, the project is additional, emission reduction is measurable, and the money for all transaction costs in CDM management could be provided. This document describes requirement for setting up a CDM project.

Introduction

One key factor to alleviate climate change impact is to reduce level of green house gases (GHGs) emissions. Main measures are to keep balance of GHG emissions and GHG absorption through increase of carbon pool or carbon sink with afforestration and/or reforestration activities and in parallel reduce release of GHGs from industrial activities including measure like combustion of non-renewable energy sources especially fossil fuels. Under the aforementioned measures, many renewable energy and agricultural projects can also be developed into GHGs emission reduction projects and receives co-financing revenue for each ton of GHG emission reduction reduced under international emission trading scheme (IETS). The mechanism that developing countries host these projects and sell carbon credit projects generated to developed countries are called Development Mechanism (CDM) one mechanisms under Kyoto Protocol. To set up a CDM project and subsequently receive issuance of carbon credits for selling, all necessary registration and monitoring criteria must be fulfilled and transaction costs must be provided.

Approach

Clean Development Mechanism (CDM), a project base mechanism under Kyoto protocol, has been a helping tool in developed and developing nations in achieving green house gases (GHGs) emission reductions at the most cost effective. CDM implementation involves, nevertheless, long procedure, and transaction costs which are relatively high for a project that could generate small amount of Certified Emission Reduction (CER) which can be sold to Kyoto Protocol complier and bring financial revenue to the CDM project. A bottom-up approach was selected to find a threshold value which tells what a layman needs in order to run and cover CDM management costs which involve a lot of third party costs and all bureaucratic procedures.

The author looked for threshold values of required CER which could sufficiently cover these CDM transaction costs and consequently looked for threshold value of required power generation, energy saving, and numbers of livestock. Beside financial threshold, the authors also tried to summarize critical criteria which could be used as check-list for readiness of CDM implementation.

Based from the experience and involvement in carbon management, not limited to United Nations Framework Convention on Climate Change (UNFCCC) project mechanism of CDM, Joint Implementation (JI) under the framework of Kyoto Protocol, but also to voluntary carbon offsetting program such as Voluntary Carbon Standard (VCS) the author listed carbon management transaction and its costs required throughout carbon cycle in a presumable crediting period of 10 year. Overall carbon cycle costs could be summed.

Price of carbon credits are assumed at €10 for a unit of CER which is generated from a CDM project, €3 for VCU which is generated from a VCS project. With this price a number of carbon credits required to generate an equal amount of overall carbon cycle costs in the 10 year crediting period could be estimated.

The followed question is where these demanded carbon credits could be found in field of renewable energy, energy saving, and agriculture. In terms of power the author simplified the UNFCCC methodology. The methodology defines emission reduction (ER) equals to the difference of baseline emission (BE) and project emission (PE). For simplification in this study, PE is neglected, assuming ER equals to BE.

In energy form, BE is the produced renewable energy displacing baseline fossil based energy used in the absence of the project, in this study grid electricity, expressed with renewable energy generated (measured in Megawatt hour; MWh) multiplied by emission factor of the grid electricity (measured in ton of carbon dioxide equivalent per Megawatt hour; tCO_2e/MWh) assuming fossil based grid electricity is the most likely energy source in the absence of CDM projects.

The simplified formula is $BE=EG*EF_{grid}$

Where
BE = baseline emissions (tCO_2e)
EG = electricity generation (MWh)
EF_{grid} = grid emission factors (tCO_2e/MWh)

Grid emission factors vary from country to country and region to region depending on the extension of connected electrical grid network and its attached power plants. In this study it is assumed 1.0 tCO_2e/MWh.

In term of livestock, it is related to livestock manure management. Dairy cow was chosen for the livestock of the study. The selection is taken based on the fact that the participated

countries of the workshop have constraint in piggery farming and are more familiar with dairy cows. The BE from this livestock agricultural activity comes from methane (CH_4) emission avoidance. BE is calculated with the amount of destruction of methane embodied in biogas burnt (measured in volume; m^3) multiplied with content of methane (measured in volume fraction; m^3CH_4/m^3biogas), with density of methane (measured in mass per volume; tCH_4/m^3CH_4), and with global warming potential (GWP) of methane (measured in factor).

The simplified formula is $BE = BG * W_{CH4} * D_{CH4} * GWP$

Where
BG = biogas burnt (m^3)
W= methane content volume fraction (m^3CH_4/ m^3biogas)
D= methane density (0.00067; tCH_4/m^3CH_4, 20c, 1atm)
GWP = global warming potential of methane (21)

The potential biogas that would generate the required amount of BE could be calculated with the given methodology in UNFCCC. From this number of animal to be included can be determined.

The simplified formula is $BG = VS /1000 * n * 365 * Bo * MCF * W_{CH4} * D_{CH4} * GWP$

Where
VS = volatile solid excreted by animal (kg/head/d)
n = number of animal (head)
1000 = conversion (kg/t)
365 = days that manure management system is operated (d)
Bo= biogas potential (m^3 biogas/ kg VS)
MCF = methane correction factor of the manure management system (fraction)

In the simplified calculation, model correction factor 0.9 used in the original UNFCCC formula is neglected. Because baseline always refers to the scenario of what is happening in the absence of the project. MCF in this study is assumed situation of manure managed under open lagoon/liquid slurry which is reported the highest share of manure management style for dairy cows in IPCC 2006.

Findings

The author found the overall costs of carbon management is approx. € 377,000 over the 10 years crediting period. To fulfill this amount of money, a project would require annual amount of approx. 4,750 CERs or 16,000 VCUs based on the predicted price listed above. This amount of carbon credit could come from 4750 MWh or 16,000 MWh of renewable energy generated or energy saving from CDM and VCS project respectively when assuming 1.0 tCO_2e/MWh grid emission factor. This renewable energy could be generated from an installed electrical capacity of 0.6 MW for CDM project or 2.1 MW for VCS project, with annual operating hours of 7500 assumed. The number of dairy cows required annually for

manure collection and biogas production is 3,200 heads for CDM project or 10,600 heads for VCS project.

The model does not take into account other non-carbon costs which actually are the core measures of project financing and implementation. The non-carbon costs are such investment, operation and maintenance, revenue of power generation, opportunity cost from energy saving, etc. The reason of excluding these non-carbon costs is that these costs; such as, available investment capital, subsidy, feed-in tariff, energy price; vary much depending on national regulatory schemes. The readiness of CDM implementation shall not be determined dependently only on sufficient energy generation and numbers of livestock. Carbon credits shall be considered only as co-financing also because of underlying CDM criterion that a project must be additional not business as usual. Going ahead with the project without considering and inclusion of carbon credit as key decision can fail to fulfill additionality assessment.

Therefore readiness of GHG emission reduction project needs an evaluation to assess risk of the bottle neck situation, especially CDM projects, that less and less projects are approved and registered and less and less registered projects could issue CERs subsequently the sellable carbon credits to obtain supporting revenue fostering implementation and operation of GHG emission reduction technology in developing countries.

In author opinion, the evaluation includes 3 main criteria: additionality, real GHG emission reduction, measurable GHG emission reduction. Additionality is defined “A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity” [UNFCCC: 3/CMP.1, Annex, paragraph 43]. UNFCCC has provided guidance to assess project’s additionality on its website. Real emission reduction is proved with positive emission reduction, baseline emission is higher than project emission, meaning the project does not lead to higher emission than that in the absence of the project. Measurable emission reduction is processed through project monitoring as described by UNFCCC approved methodology. Monitoring of emission reduction is method and formulae used for obtaining data and parameters that determine emission reduction during crediting period with quality control and quality assurance in a conservative manner. Failure to monitor GHGs emission reduction will fail verification and carbon credits cannot be issued.

Unless all the 3 criteria can be fulfilled, the project should not implement carbon cycle in order to avoid risk of financial loss in case of failure to registration and issuance. However, if carbon cycle has to be initiated due to some reasons, the project developer/owner shall look for risk hedging. In terms of monitoring, the project must ensure that monitoring is implemented as validated in the PDD which is normally referred to as approved CDM methodologies. In terms of financing carbon cycle, one of many ways is to ask for assistance from a credit buyer to support carbon cycle development cost and offer the share of carbon credits from the project as compensation. This way, the project could secure the commercialization position for carbon credits to respectable market. This type of agreement

for the delivery of carbon credit in form of forward contract is known in carbon term: Emission Reduction Purchase Agreement (ERPA). It is also important to mention that price of carbon credit being traded reflects risk of credit issuance. Already issued carbon credits (also called secondary carbon credit) can be sold at higher price than non-issued carbon credits (also called primary carbon credit), either the project is not yet registered or not yet complete verification.

If the CDM evaluation result is positive, the project may consider an option to develop the project until secondary carbon credits are issued and sell these credits under bidding process to procure best price offers available in the market at that time. It is not limited that a project must sell carbon credits through one method. It could be a mix. A project could set aside one part of carbon credits to be sold in primary market whereas the remaining credits to be sold in secondary market. Another example is to sell a part of carbon credits in stock exchange and the other part under ERPA. The commercialization of carbon credits shall be strategized against the market status and price status. A good CDM consultant or a good broker usually provides such advice.

Conclusion

Directly linked to GHGs emission reduction, renewable energy and agriculture projects could receive co-financing through carbon credits. Although it gives revenue but carbon management involves high transaction cost. Careful evaluation of financial feasibility and likelihood of the projects get successful registration is recommended in order to avoid risk and loss in any failure during carbon development.

Reference

- UNFCCC approved methodology AMS-III.D Methane recovery in animal manure management systems

- UNFCCC approved methodology AMS-I.D Grid connected renewable electricity generation

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4; Chapter 10: Emissions from Livestock and Manure Management

Setting up CDM projects

a perspective from a project developer

Rachot Indradesa (Kobbie)
GreenStream Network
SESAM 2006-2007

GreenStream Network

- GreenStream is a leading company in carbon and renewable market in northern Europe:
  - Renewable energy projects
  - Greenhouse gas offset projects ; CDM, JI, VER, GS
  - Trading of carbon units and renewable energy certificates
- Over 40 experts from professional academic backgrounds around the world are ready to bring you to success

GreenStream's Businesses

Core competence	Services offered
Green investment	• Fund management (carbon and renewable energy); current investment vehicles include - Multilateral Carbon Credit Fund (EBRD and EIB) - Fine Carbon Fund - Bläfall - Nordic Carbon Fund - Biogas Fund Europe • Own direct investments
Intermediary	• Brokerage of carbon credits and green certificates • Portfolio management services
Advisory	• Climate and renewable energy strategies, market analysis, financing solutions • CDM/JI/GIS project sourcing and development

Kobbie at GreenStream Network

Me

- Project Manager/ Carbon Manager
- Carbon Managment: CDM, JI, VCS
- Renewable energy: Biogas, LFG, hydropower
- Other projcts: energy efficiency, ferroalloy, associated gas, fuel switching
- Carbon funds: originates CERs, ERUs, VCUs
- Project validation, Project monitoring
- CDM New Methodology development
- Capacity building, training young CDM expert

My colleague

- Portfolio and assets management
- Procure
- Capital investment Brokerage
- Green Certificates and carbon credits transaction

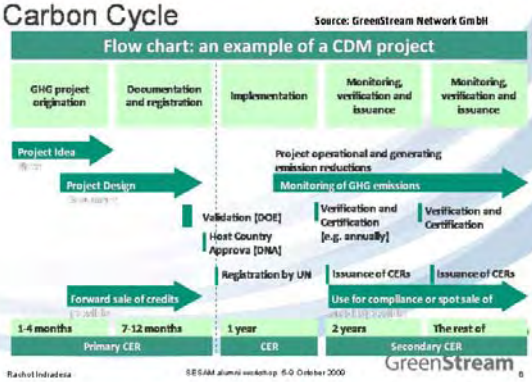
Brief of CDM

"common but differentiated responsibilities"

- Article 12 of Kyoto Protocol
- Annex I ←→ Non-Annex I country (host)
- Real project
  - 15 sectoral scopes are defined under UNFCCC, e.g. Renewable energy , Fuel switching, Methane avoidance, Energy efficiency, waste management, agricultural, fugitive gases, transportation, afforestration
- 6 GHGs in first commitment period 2007-1012
  - CO2, CH4, N20, HFC, SF6, and PFC
- Emission reduction is real and measurable
- Project is additional

Carbon Cycle

Source: GreenStream Network GmbH



Evaluate your CDM carbon potentials

- Check list for giving greenlight to your project
  - Your carbon credits is positive, project does not emits more than the scenario in the absence of the project
  - Your project is additional
  - Your monitoring plan is tidy, reliable, can be verified
  - Your project has reference and evidential document for whatever you put into the PDD
  - Your carbon credits cover all costs in carbon cycle

Carbon Credits

- CERs from CDM projects
- ERUs from JI projects
- VCUs from voluntary carbon offsetting projects

Carbon Financial Model

- 10 years crediting period
- Starts 2009, registered 2009
- Assuming price of carbon credits
  - CER 10€
  - ERU 8€
  - VCU 3€

model:

Carbon revenue

- To cover all costs in carbon cycle (expecting crediting period of 10 year)
  - 4 750 CERs
  - 6 000 ERUs
  - 16 000VCUs
  - Not including investment, O&M, administration, development

Renewable energy and carbon credits

$BE = EG * EF\ CO2\ grid$

BE = baseline emissions (tCO2e)
EG = electricity generation (MWh)
EF grid = grid emission factors (tCO2e/MWh)

$BE = BG * W_{CH4} * D_{CH4} * GWP$

BG = biogas burnt (m3)
W= CH4 volume fraction (m3 CH4/ m3 bigoas)
D= density (0.00067 tCH4/ m3 CH4, 20c, 1atm)
GWP = global warming potential of methane (21)

Power generation and energy saving

- CDM Methodological Tool to calculate emissions from grid system
- In this model EF = 1.0 tCO2/MWh
- Result: Needing electricity produced/saved during a year, at least
  - CER 4 750 MWh/a 0.6 MW installed capacity (7500 h/a)
  - VCU 15 834 MWh/a 2.1 MW installed capacity (7500 h/a)

Biogas and methane avoidance

- 1 Asian Dairy cow = 242 m3 biogas/head/y
  - 350 kg/head
  - 2.8 kg VS/head/year
  - 0.13 m3 CH4/ kg VS
- Result: Needing dairy cows, at least
  - CER 3 200 head/y (deep lagoon, hot climate 30c, as baseline)
  - VCU 10 600 head/y (deep lagoon, hot climate 30c, as baseline)

Remarks

- The calculation does not include return on investment
- The project should pay itself back by production revenue/saving opportunity cost
- The project cannot be feasible without carbon credits (against additionality)

Is your project additional?

- Theoretically
  Additionality is:
  - "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (3/CMP.1, Annex, paragraph 43)"
- Practically
  Project is additional, for example, in the following cases:
  - First of its kind, only few projects could claim on this
  - Financial barrier, benchmark, simple cost
  - Investment barrier, no access to investment

Additionality

- The project is additional only if implementation of CDM is considered before the starting date of the project
- The starting date of the project is the earliest date of
  Construction/ Financial closure/ Major payment / equipment ordered

Is your emission reduction measurable?

- Monitoring is given in methodology
- No valid monitoring plan, no PDD could be validated
- Good monitoring plan, but monitoring action is not inline with monitoring plan, difficulty in issuance of CERs
- No issuance of CERs, no revenue
- No revenue → what happen to your project?????

CDM development risks

- Revenue from CDM contains risk
  - Risk of registration
  - Risk of operation
  - Risk of CER issuance
  - Risk of CER price
- "Hedging"
  - Seller vs Buyer
  - Forward contract (ERPA)

When to consider and include carbon credits?

- Carbon credits as post-financing
  - Compensation of your project development with carbon revenues
- Carbon credits at pre-financing
  - Provision of technical assistance and PDD consultancy
- The higher higher risk in issuing carbon credits, lower the price of your carbon credits → reduce risk
  - ERPA (Emission Reduction Purchase Agreement)
  - Risk participation for project validation and verification
  - Tender of Reference
  - Evaluate your carbon potentials

Conclusion :

Are you ready to set up a CDM project?

- Feasible carbon cycle cost
- Project is additional
- Measurable and Real emission reduction
- Verifiable monitoring plan
- Proof of evidential document
- You are ready to advocate for you project

Last but not least

- We have people
  - in renewable energies and energy efficiency
  - in carbon management
  - in financing projects
  - in carbon policy and strategies
- We have access
  - to renewable energy and energy saving projects
  - to technological advisory
  - to credit buyers

Thank you for your attention!!!!!

Rachot Indradesa (Kobbie)
Project Manager / Carbon Manager

Mobile +49 (0) 177.682.7047
Tel +49 (0) 331.581.64.514
Fax +49 (0) 331.581.64.529
rachot.indradesa@greenstream.net
www.greenstream.net
Skype: Kobbiekob

Carbon financing opportunity for sustainable operation of small technology – Case of Improved Water Mill Programme in Nepal

MSc. Shakya Bhupendra, Programme Manager, Centre for Rural Technology Nepal

Traditional water mills, through the use of water resources, have been in use in the hilly areas of Nepal for centuries especially for grain grinding purposes. The energy produced from these mills (less than 0.5 kW) is insufficient to meet ever increasing energy needs of the rural communities. The Improved Water Mill (IWM) is an intermediate technology that increases the efficiency of traditional water mills resulting in increased energy output thus helping both the millers as well as its users, mainly the women. The improvement is basically done with the replacement of wooden parts with metallic ones with engineering design. The improved water mill service is translated not only to higher agro processing capacity but also to diversified range of services such as: paddy-hulling, paddy de-husking, rice polishing, saw-milling, oil expelling, lokta beating, chiura making, etc. In addition to that it offers the opportunity to generate electricity for lighting and for operating communication equipments such as TV, radio and computer. IWM with short shaft provides only grinding services while IWM with long shaft provides other end uses as well.

The programme has the main objective of improving the living condition of the traditional water mill owners and the users, mainly the women through meeting their energy requirements by improving the mills. The other objective is to develop the institutional capacity thereby strengthen the sustainability of the sector as a whole.

By end of May 2009 the programme has helped to install around 5,004 improved water mills in 18 districts out of the estimated 25,000 units in the country. Among 5,004 units improved, 4,350 are of short shafts, used for efficient grinding and 654 units are of long shafts also for other end uses.

IWM provides energy services to households at lower investment and maintenance cost within relatively short time required for construction work. IWM technology can generate electricity up to 3 kW sufficient for lighting and operating small electric and electronic devices. Research and field tests are being carried out to increase the capacity up to 5 kW. The expected outcomes of this capacity enhancement will ensure better coverage of households, diversification of different end use ranges and opening up of possibility for new enterprises (e.g. power run micro enterprises, etc).

Installation of 5000 IWMs has helped to generate about 7.5 MW mechanical power. The programme also has helped in replacing as well as in checking entry of diesel run mills contributing to the environment conservation and further helped to reduce CO2 emissions and global warming.

The IWM Programme has won the UK based Green Energy Award for the year 2007 within the framework of "Ashden Award for Sustainable Energy" for its contribution towards improving livelihood of the mill owners and its users and contributing to check the environment degradation through replacement of the diesel mills in the rural setting.

The IWM programme has a number of environmental benefits as well as social ones. IWM has been either replaced the diesel mill or checked the diesel mill entering in the rural area to meet their agro-processing and other energy need. The process reduces the carbon emission ensuring better environment. Around 15,000 ton of CO_2 per annum has been reduced from 5,000 IWMs including end uses. Moreover, the reduction will be increased to 170,464 ton through out the life of IWM (considering a life period of 10 years. Thus, global impact from local action will have been achieved through the reduction of carbon emission from the operation of IWM.

Similarly, the replacement of the wooden parts of the traditional water mills by more durable metallic and HDPE materials reduces use of fast depleting forest resources and contributes to environmental conservation.

The revenue available from CDM will be definitely helpful for sustainable implementation of IWM Programme and will be used for the promotion of Long Shaft IWMs especially for electrification projects. The carbon financing in IWM will be beneficial to the nation and IWM Programme both by promotion of clean energy and reduction harmful greenhouse gasses.

"Carbon financing, an opportunity for sustainable operation of small technology-case study of Improved Water Mill programme in Nepal"

October 5 to 9
Hanoi

SNV

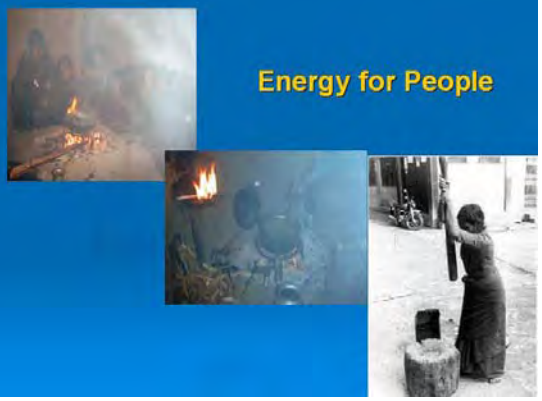
Bhupendra Shakya
Manager
Improved Water Mill Programme
Centre for Rural Technology, Nepal

Contents

- Background
- IWM Programme
- IWM in carbon financing
- Conclusion

Supply of Energy

Energy for People



Renewable energy is possible solution

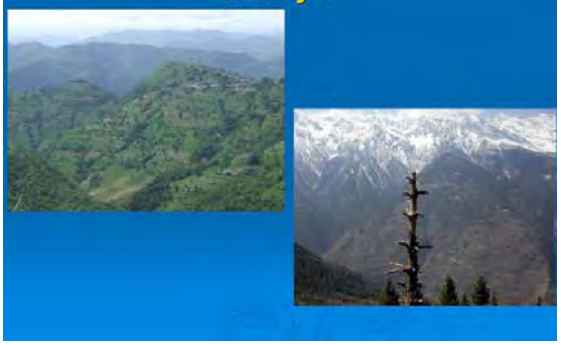
•Agro-processing
•End-use operation
(micro enterprises)
3-4 kW
mechanical

Lighting and communication equipment

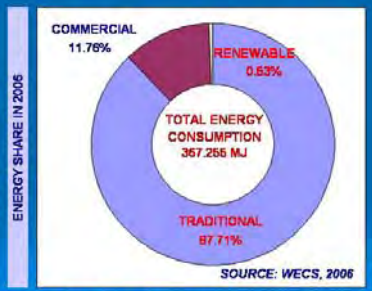
40W (4* 7W CFL lamps+ 1* 12W radio)

90% for Cooking: Biogas, ICS

Reality!!!



Energy Consumption Scenario



Electrification: Total Population : 40%, Rural Population: 27%

Impacts of Global Warming

- Higher altitude areas of Nepal experiencing a rise of 1.5°C to 2.5°C in the moderate scenario
- High Snow melting rate (20-70 m/ year)
  - Short term: increased threats of glacial lake outburst floods (20 glacial lakes are in danger);
  - Long term: water shortages??
- Increase in the severity and length of extreme weather events
- In Nepal the crop of barley marked a loss compared to 2008 of over 133 thousand tons, forcing 3.4 million people to seek humanitarian aid *

*http://www.asianews.it/index.php?l=en&art=16229

Traditional vs Improved Water Mill

Increase in efficiency

Traditional Water Mill
For grain grinding only (25000 nos., 30 MW)
Not efficient:
20-25%
Available power 0.5-1.5 kW
Processing capacity :
10-20 kg / hour

Improved Water Mill
For grain grinding and other end-uses, locally manufactured
Efficient : 40 -50%
Available power: 1-3 kW
Processing capacity:
20-50 kg/ hour

Short Shaft
Only for efficient grain grinding

Long Shaft
Opportunities for grinding and various end-uses like: paddy hulling, oil expelling, saw milling, electricity generation etc.

AEPC is apex body for promotion and regulation of the renewable energy projects

Government → Policy Support → Consumer

AEPC (Rural Energy Fund) → Subsidy → Private Sector

AEPC (Rural Energy Fund) → Training → Private Sector

Donor → AEPC (Rural Energy Fund)

Most of the energy projects are supported by donors

Source: AEPC

AEPC's Major Programmes

- UNDP and WB supported **REDP**
- SNV and KFW supported BSP
- DANIDA and NORAD supported ESAP
- EU supported REP
- SNV supported IWMP

Source: AEPC

What is Water Mill?

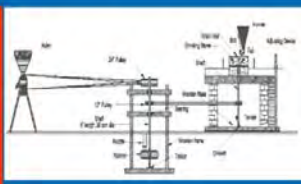
- Indigenous technology for Agro-processing using water power with the use of wooden runner and shaft
- Suitable in Nepal due to availability of water resources and suitable geography
- Low head (2-20 m) and high discharge (30-100 Lps) technology

IWM CDM Project

- Previously prepared for the first phase programme (2003-2009) , PIN already approved from DNA
- At the moment prepared for the second phase programme (2010-2014) on the process of PDD preparation
- Prepared under Small scale project Type I projects:
  - I.A. Electricity Generation by the User
  - I.B. Mechanical Energy for the User
- Project life time: 10 years
- Crediting period: 10 years (2010-2020)
- Total plants: 8000 plants (IWMs)
- Total power output: 13.76 MW (small scale project)

IWM is one of the possible solutions

- Clean energy from local resources
- Cheap :
(USD 300 - 150 subsidy for SS, USD: 800- 400 subsidy for LS)
- Easy to install, operate and maintain and manage
- Locally manufactured
- Capable to meet the rural energy need with multiple end-uses



Provide opportunities for enterprise development
"The Wheel of Prosperity"

Improved Water Mill (IWM) Programme

Financial, policy related support — Financial, Advisory support

Objectives :

- To improve the living condition of rural households especially of the traditional water millers and women users
- To improve the sustainability of the IWM sector as a whole through institutional strengthening and local capability development

Target :

- Installation of 5000 IWM (till end of 2008), additional 2000 till mid of 2010 (neutral budget extension)
- Short Shaft:5950 Long Shaft:1050 (15%) , 125 Electrification

Achievements and Impacts

- Installation of 5300 IWM that provides clean energy to 265,000 HHs
- Reduction of drudgery of women and girl by 2 hours per milling (1.2 million days/ year)
- Local Income and employment opportunities (25% - SS and 100% -LS, additional employment - 800)
- Benefit for grass root and socially excluded group (73% socially excluded, poor strata)
- Maximum service coverage (52HHs/IWM)
- High plant factor
- Environment friendly favoring climate

Ashden Award winner in 2007

Estimated Emission reduction and Revenue

Year	Carbon reduction in ton	Cost for CDM, USD
2010	1759	50000
2011	9064	20000
2012	17586	20000
2013	27326	20000
2014	36795	20000
2015	43289	20000
2016	43289	20000
2017	43289	20000
2018	43289	20000
2019	43289	20000
2020	21338	10000
Total	330310	240000

Estimated revenue per CER= USD 10/ton Co2

Cost for CDM Preparation = USD 50,000

Annual monitoring cost = USD 20,000

Profit from carbon up to 4 years = USD 795,293

Profit from carbon up to 10 years = USD 3,063,098

Baseline

- The project will lead to reduced GHG emissions by replacement of diesel mills currently used and those which would be installed for agro-processing in the absence of the project.
- Some IWMs will also generate electricity and will replace GHG emissions from kerosene and fatwood being used for lighting.
- In the absence of the CDM project, very few IWMs will be installed in the country.
- The CDM project activity provides subsidies on installations along with quality control. Without the project these units would be installed without subsidy and without quality control.

Total Capacity of IWM CDM project

S. no.	Type of IWM	No of IWM	Average Capacity (kW)	Total Capacity (kW)
1	Short Shaft	6400	1.65	10560
2	Long shaft	1600	2	3200
3	Long shaft electrification	(320)	2	
	Total	**8000**		**13760**

Emission calculation

- Short shaft: Grinder only

Emission displaced (ED) = the power requirement (1.15kW) * hours of operation per year (2760hour/year) *the emission factor for diesel generator systems (1.4)
= 4.41 kg CO2/yr/IWM

- Long shaft: Grinder + One end use

Emission displaced (ED) = the power requirement (1. 5kW) * hours of operation per year (2973 hour/year) *the emission factor for diesel generator systems (1.4)
= 6.2 kgCO2/yr/IWM

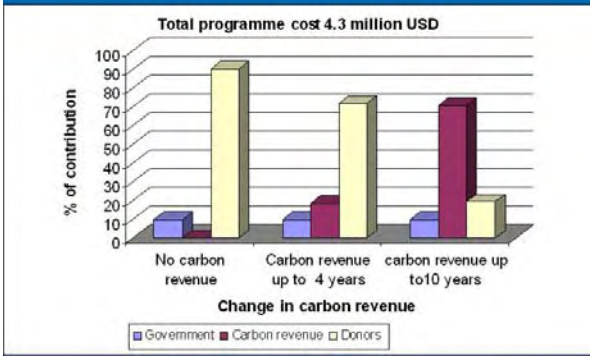
- Long-shaft: Grinder + One End use + Electrification

Energy baseline, EB = sum(O/(1 - l)
= 6.8 kg CO2/yr/IWM

Thank You!

"IWM is not only for grain Grinding, but also for meeting the Rural Energy needs"

Impacts of carbon revenue



Benefits

- Avoided local pollution from diesel mills in communities.
- Reduction of indoor air pollution as a result of reduced kerosene and burning fatwoods (Diyalo) for lighting where electricity is generated.
- Faster milling and less waiting time with more efficient mills.
- Reduction of workload (mainly women and children) from mechanized milling of paddy and pressing oil thus avoiding drudgery related to manual milling.
- Improved lighting from electricity in certain cases.
- Improved family health as a result of improved indoor air quality where electricity is generated from the IWM.

Conclusions

- Promotion of renewable energy meets the rural energy demand reducing the energy poverty as well as can generate significant amount from carbon trading
- IWM being small and simple technology has great impacts in the rural community
- RE technology including IWM certainly have contribution in reduction of green house gas emission
- Revenue generation from carbon financing can be utilised for further promotion of project reducing dependency upon donors