Presentation 4

Renewable Energy Based CDM Projects

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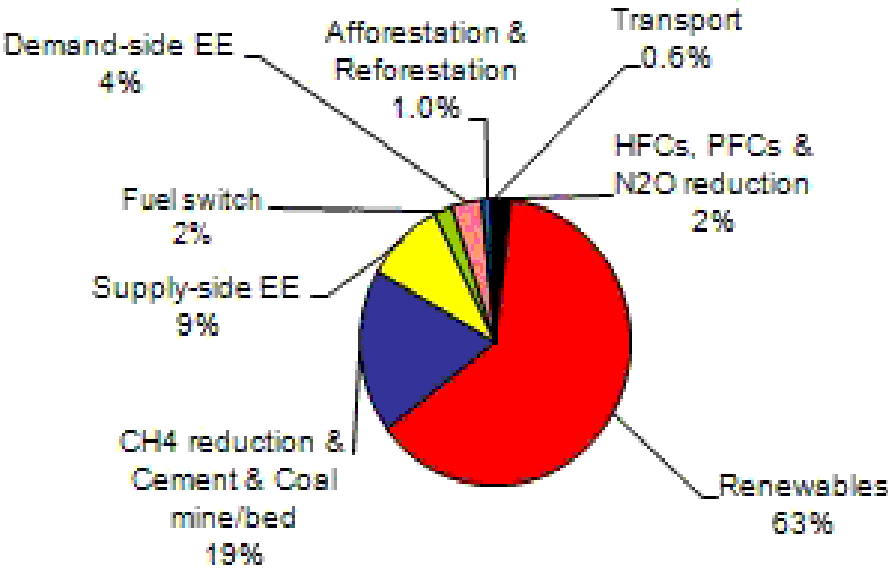
1.0 Introduction

Renewable energy based projects have been most successful in achieving the CDM EB approval. Fig. 1 shows the distribution of CDM projects across different sectors and it can be seen that renewable energy based projects overwhelmingly dominate the registered projects (63 % of the total).



Source: cdmpipeline.org

The share of RE projects has continuously increased over the years compared to other sectors.Fig.2 shows the trend in the share of registered project types .

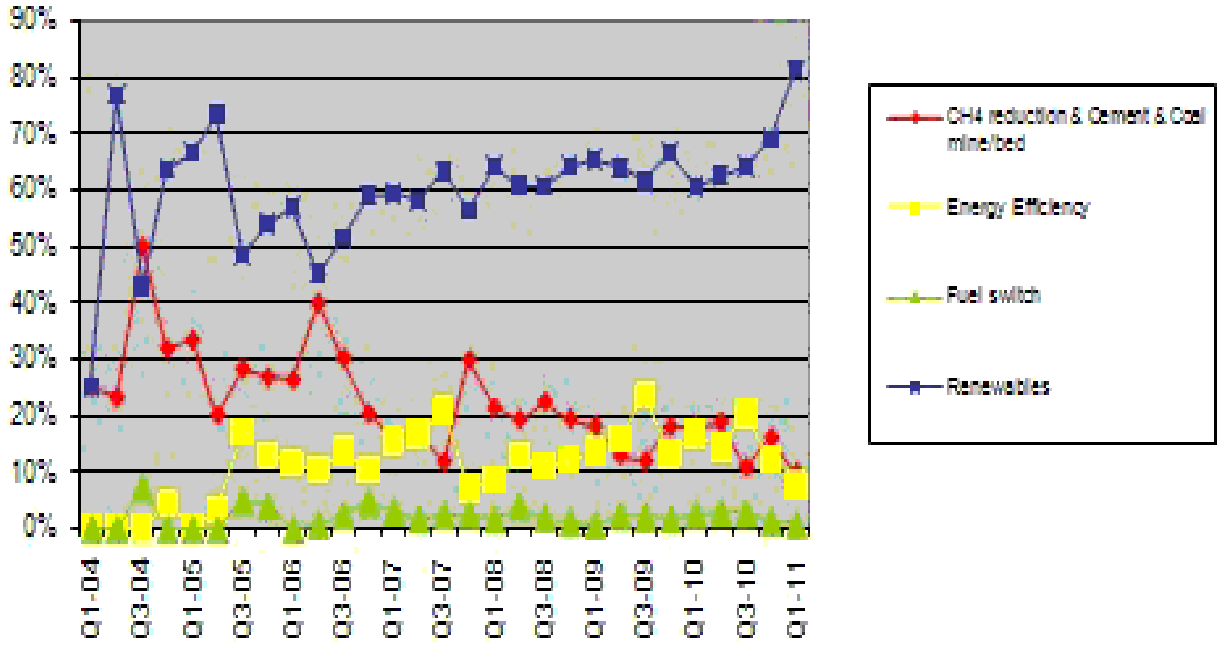


Fig.2 Share of project types (Source : cdmpipeline.org)

RE based projects development

There are good prospects for developing RE based small scale (and programmatic) CDM projects in the Pacific island countries. A number of RE powered electrification schemes are being developed in the region. In Fiji, independent power producers (IPPs) are in the process of developing following projects:

Viti Levu

- Fiji Sugar Corporation (FSC) Rarawai – A new Power Station at FSC Rarawai Sugar Mill operating at 20-25MW on bagasse during the crushing season and hog fuel during other months
- FSC Lautoka – Potential for generation output to be made available by FSC throughout the year by 2012
- A private entity I-Viti plans for a 10MW Waste to Energy plant in Sigatoka with anticipated commissioning by October 2013
- Pacific Renewable Energy – An 18MW dedicated wood-fired
- biomass power plant planned to be constructed in Lautoka- 2013.

Vanua Levu

- FSC Labasa – FSC to develop a co-generation Power Station at the Labasa Sugar Mill, which has the potential to generate electricity throughout the year.
- Labasa Biomass –proposal for a 8.5MW biomass plant over a period of 5 years with the first 3MW to be commissioned by May 2012.

All the above projects have the potential to be developed as CDM projects.

The following two Fiji based projects have been submitted for possible CDM registration:

- Labasa Biomass Power Station, Environmental Intermediaries & Trading Group Limited Fiji.
- Nadarivatu Hydropower Project Fiji Electricity Authority (Large scale).

Possible CDM projects in Papua New Guinea

- Biogas recovery from wastewater treatment in HARGY OIL PALMS Ltd., palm oil mill.
- Warastone POME Methane Capture Project in West New Britain,
- Mosa POME Methane Capture Project in West New Britain,
- POME Methane Capture Project New Britain Palm Oil Limited (NBPOL)
- Numundo POME Methane Capture Project New Britain Palm Oil Limited (NBPOL)
- Kumbango POME Methane Capture Project New Britain
- Kapiura POME Methane Capture Project New Britain Palm Oil Limited (NBPOL)
- A small Hydropower based programmatic CDM projects

Possible CDM project in Samoa

- Alaoa Hydro Power Project Electric Power Corporation Samoa.

Examples of RE based CDM projects

Solar PV small scale project (India)[i]

Salient features:

Project Description : 5 MW Grid connected Solar PV Power System in Sivagangai Village, Sivaganga District, Tamil Nadu.

The DC electric power generated by the photo voltaic modules will be converted into 415V, 3 phase,50Hz, AC power in a number of outdoor inverters, and then stepped up to 11000V.

Project participant: Sapphire Industrial Infrastructures Private Limited (Private Entity)

Methodology employed : Grid connected renewable electricity generation , AMS I.D./Version 15/ EB 50.

Additionality Criteria: hown using Barrier Analysis (EB 35)

Investment barrier A calculation of project profitability over project life time the Project IRR without considering the revenues from CDM works out to be 9.99% as against the Benchmark of 12.75%.

Barrier due to prevailing practice: The high initial cost of solar energy systems which is a barrier in large scale utilization of solar energy systems, especially for power generation.

Technological barrier: A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty.

Emission reductions

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2010 – 2011	7866
2011 – 2012	7866
2012 – 2013	7866
2013 – 2014	7866
2014 – 2015	7866
2015 – 2016	7866
2016 – 2017	7866
Total estimated reductions (tonnes of CO_2e)	**55062**
Total Number of crediting years[2]	7
Annual average of the estimated reductions over the crediting period	**7866**

Grid Emission factor (Combined Margin)

Particulars	Details	Remarks
Operating Margin (tCO_2/MWh)	0.9875564	-
Build Margin (tCO_2/MWh)	0.8179232	-
Combined Margin (tCO_2/MWh)	**0.9451481**	Weighted Average considering 75:25 weightage on OM & BM respectively

Calculations of emission reduction

Baseline emission calculation was done using the following formulae :

Baseline Emissions:

$BE_y = EG_{BL,y} \times EF_{CO2}$ (1)

Where,

BE_y is the baseline emissions in year y, tCO2

$EG_{BL,y}$ is the energy baseline in year y, kWh

EF_{CO2} is the CO2 emission factor of the grid in year y (tCO2/kWh).

Project emission (PE_y):

Since it is a renewable energy project . there are no project activity emissions ..(Project emission=0)

Leakage (L_y):

Leakage due to transfer of equipments from another activity:

The equipments installed in the project activity are not transferred from any other activity. Hence leakage for this part is zero.

The net emission reductions is the difference between the baseline emission and the sum of the project emission and leakage.

$$ER_y = BE_y – (PE_y + L_y)$$

Emission reduction calculations:

EG_y = 5MW*19%*365days*24 hrs = 8322MWh

Using EF_y = **0.9451481** tCO2e/MWh

We get baseline emissions = BE_y = 7866tCO2/annum . Since project emissions and leakage emissions are both zero, the net emission reduction is same as the baseline emissions i.e. 7866 tonnes of CO_2 per annum.

Biomass based projects

Following are some possible CDM projects using bioenergy

- Bagasse based electricity generation
- Programmatic CDM- Biogas digesters
- Coconut oil blended diesel for transport
- Coconut oil based Biodiesel production
- **CDM methodologies applicable to biofuels**

Following two methodologies can be used for baseline calculations in biofuel based CDM projects:

AM 0047 : Production of biodiesel based on waste oils and /or waste fats from biogenic origin for use as fuel.

and

AMS-III T : Plant oil production and use for transport applications

Example : Plant oil CDM (Paraguay)[ii]

Project : Plant-Oil Production for Usage in Vehicles, Paraguay

The project objective is to substitute diesel fuel in transport with vegetable oil (Bio fuel)- Castor oil from castor, Crambe and Oilseed radish plants.

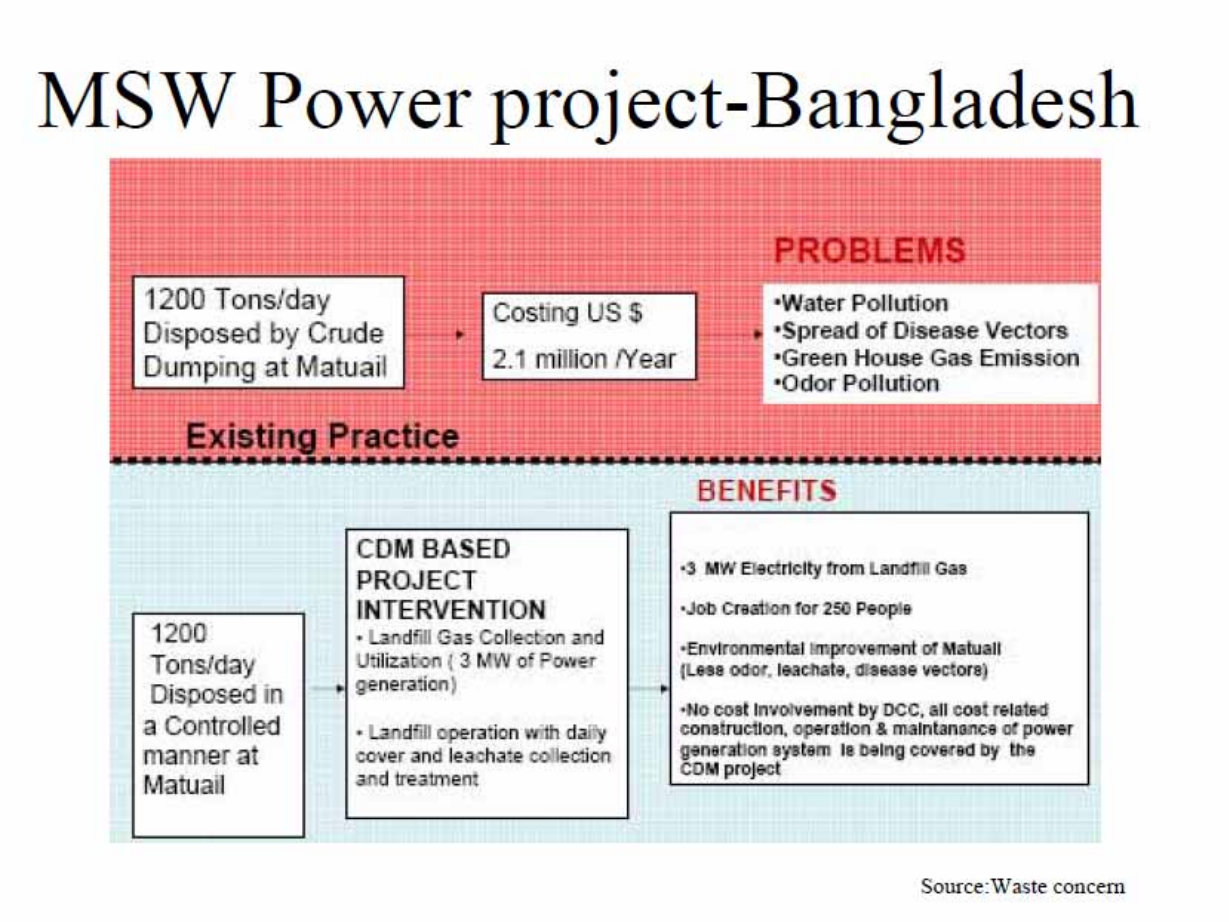
- Estimated emission reduction ; 17,188 tCO_2 /annum
- Financing: Fully private finance - no Annex 1 public funding
- Methodology ; Version 1 of AMS-III.T.: Plant oil production and use for transport applications.

Municipal Solid Waste (MSW) based power projects

Every tonne of waste in a landfill produces approximately 250 m^3 of methane. This methane could be used for electricity generation . If less than 15 MW capacity, AMS I.D and AMS- III G methodologies can be applied .

Example

Following figure shows the outcomes of a MSW power project based in Bangladesh. The sustainable development indicators of this project are remarkable.



Efficient Lighting based CDM project

More than 75 % of the population PICs does not have access to electricity and most of the households use fuel based lamps for their lighting needs . Besides being the most inefficient lighting devices , these lamps together produce a huge amount of CO_2. Replacing these lamps with solar based LED lights will help in two ways : by reducing the use of fossil fuels and by providing a more cost-effective and beter quality light.

Exampls : REDS project - India

This itype !-small scale project envisages providing solar LED/CFL lights to 60,000 households. A baseline of 0.16 L/lamp/day and an emission factor of 2.68 kg of CO_2 per litre of kerosene used(IPCC value). This project would help reduce 46,484 tCO_2

Methodology for LED lighting CDM project

A new methodology AMS III R has been developed for LED lighting projects. This methodology can be applied if the batteries are charged using:

- Using a renewable energy system
- Using a standalone (diesel) system or a mini grid
- Using a grid connected to regional national grid

The methodology stipulates that the LED used satisfy following standards:

- The LED lamps must have a minimum life of 5,000 hours.
- The lamps must have a minimum one year warranty.
- Illumination level: task light : 20 lux , ambient light : 4 lux at 1 m distance.
- There should not be more than 5 lamps per house or business, and
- The overall GHG reduction should be less than 60 tonnes of CO_2 annually.(small scale project)

The baseline lamp must consume fossil fuel. The default annual baseline emission factor is taken as 2.4 kg CO_2 per litre.

Transaction costs[1]

The tables below give an indication of the transaction costs involved in a CDM project registration:

Activity	Cost (large-scale, US$)	Cost (small-scale, US$)	Type of cost
Planning Phase			
Initial feasibility study, i.e. Project Idea Note (PIN)	5,000–30,000	2,000–7,500	Consultancy fee or internal
Project Design Document (PDD)	15,000–100,000	10,000–25,000	Consultancy fee or internal
New methodology	8,000-30,000	6,500-10,000	DOE fee
Validation	8,000–30,000	6,500–10,000	DOE fee
Registration fee (advance on SOP-Admin – see below)	10,500–350,000[20]	0–24,500[21]	EB fee
Total CDM-specific costs – planning phase	38,500–610,000	18,500–117,000	

Source: CDM pipeline

[1] For SIDS, there is no UN adaptation fund fee. .

Construction Phase			
Construction, plant & equipment	Variable, depending on project type		Contractors fees
Installation of monitoring equipment	Usually minimal relative to total plant & equipment cost		Contractors fees
Total CDM-specific costs – construction phase	Usually minimal relative to total plant & equipment cost		
Operation Phase			
UN Adaptation Fund Fee	2% of CERs	2% of CERs	EB fee
Initial verification (incl. system check)	5,000–30,000	5,000–15,000	DOE fee
Ongoing verification (periodically)	5,000–25,000	5,000–10,000	DOE fee
Share of Proceeds to cover administration expenses (SOP-Admin)	The fee paid at registration is effectively an advance that will be 'trued up' against actual CERs issued over the crediting period (if different to emission reductions projected at registration). SOP-Admin is not capped.		EB fee
Total CDM-specific costs – operation phase	Variable – minimum 2% of CERs plus 5,000/year (if verification undertaken annually)		

Source: CDM pipeline

Biomass CDM example

Following is an example of a biomass based CDM project :

A Biomass based bundled Project in Tamilnadu, India. The project comprises 5 Biomass Gasifiers with a capacity of 1 MW each. The main features of the project are :

- Baseline : Regional Grid mix
- Emissions reduction: Approx. 25, 000 t CO_{2e} / Year
- Crediting period: 10 years
- Project developer : Southern Green Power Pvt. Ltd

The additionality of the project is shown using economic barrier . The IRR with the CDM revenues included is 15.6% whereas without the CDM financing it was 13%.

Solar PV CDM example

Project Title :LG Solar Energy Taean Photovoltaic Power Plant Project

This is a 13.772 MW (small scale) grid connected PV system in South Korea . The project is set up by a private entity (LG Solar Energy) which is the sole project participant. The crediting period is 7 years and the project is expected to reduce 12,275 t CO_{2e} per annum.

Wind power CDM example

This project is based on a 10.2 MW wind farm established to supply power to Lafarge cement factory in Morocco. The project was registered in 2005 with a 10-years crediting period. During this period , the project will help reduce 286,510 tonnes of CO_{2e} .

Biomass (woodchips) CDM example

A final example of RE CDM is another biomass based project using wood chips for electricity generation. A 4 MW power station is established in Indonesia saving 14,602 t CO_{2e} / Year.

[i] PDD available at cdm.unfccc.int
[ii] PDD available at cdm.unfccc.int