WORKSHOP PROCEEDINGS

State Level Capacity Building Workshop on Clean Development Mechanism

Organised by

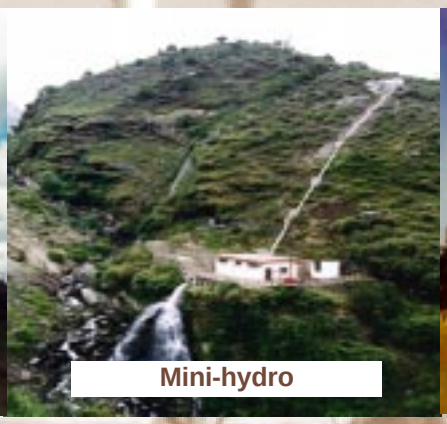
Winrock International India, New Delhi
and
Institute for Global Environmental Strategies, Japan

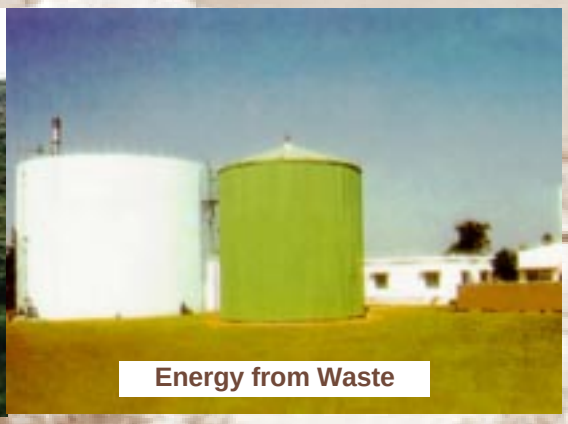
at
Kolkata (West Bengal, India), March 17-18, 2004
and
Ahmedabad (Gujarat, India), March 23-24, 2004

under the

INTEGRATED CAPACITY STRENGTHENING FOR CLEAN DEVELOPMENT MECHANISM (ICS-CDM) PROGRAM, AN INITIATIVE OF IGES


Wind Power


Mini-hydro


Energy from Waste

ORGANIZERS' PROFILE

WINROCK INTERNATIONAL INDIA (WII)

Winrock International India (WII) is an NGO registered under the Indian Societies Act of 1860 and is based in New Delhi. WII is affiliated to Winrock International, USA, a global not-for-profit organisation. The main program areas of WII are Energy and Environment, Climate Change, and Natural Resources Management. WII's mission is to "develop and implement solutions that balance the need for food, income and environmental quality".

The scope of climate change activities at WII is wide-ranging: from hosting the National Communication Cell (NATCOM) for preparing India's Initial National Communication to UNFCCC, examining financing options and mechanisms for implementing GHG mitigation strategies and projects, and evolving abatement strategies and policies, to developing mitigation projects, impact assessment and adaptation strategies, and training on climate change issues.

Further information about WII can be seen on the website http://www.winrockindia.org

INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES (IGES)

Established in 1998, the Institute for Global Environmental Strategies (IGES) is an independent, not-for-profit think tank, based in Japan, that goes beyond research to provide practical ways to protect the earth's environment and to realize greater sustainability and equity in the global community. The principal geographical scope of its activities is Asia-Pacific region, an area which is experiencing rapid economic development and which will affect the global environment through its population growth, urban environmental problems and other environmental issues.

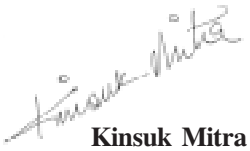
The IGES mission is to move human society to become more environmentally and socio-economically sustainable. The ultimate goal of IGES is to create a new paradigm for the global community so that the unsustainable production and consumption patterns currently observed can be changed into sustainable ones.

Further information about IGES can be seen on the website http://www.iges.or.jp

PREFACE

Under the Clean Development Mechanism (CDM), introduced in Article 12 of the Kyoto Protocol at the 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 1997, a legal entity in a developed country is allowed to invest in a project that reduces greenhouse gas emissions in a developing country. Certified emission reductions can be used to meet the commitments made by the developed country under the Kyoto Protocol. For a developing country it can be seen as an additional source of foreign direct investment to national mitigation projects, which, at the same time, would contribute to sustainable development and decrease in global GHG emission levels. The carbon market is growing and there are several options to sell emission reductions in carbon investment funds, government procurements tenders, and voluntary trading schemes. India is a competitive supplier for cost-effective GHG offset projects. Recognizing the possible benefits derived from such investment flows to India, the Government of India has also placed CDM at the top of its climate change agenda.

In order to create awareness on this emerging subject, IGES in collaboration with WII organized two state level capacity building workshops on CDM in March 2004. The workshops were organized under the aegis of Integrated Capacity Strengthening for Clean Development Mechanism project of IGES, and focused on opportunities to take advantage of the CDM mechanism for renewable energy projects. The present volume is published from the proceedings of these two workshops, one held in Kolkata on March 17-18, 2004, and one in Ahmedabad on March 23-24, 2004. The guidelines and tools introduced in the workshops provided insights on how to develop credible, workable and transparent baselines for quantifying the mitigation effects of CDM projects in the renewable energy sector. The workshops also provided a forum for reviewing the current status of climate change negotiations, national policies and strategies, growth prospects of carbon markets and some key issues in CDM project design.



Kinsuk Mitra
President, WII
April 2004

ACKNOWLEDGMENTS

Winrock International India (WII) would like to express sincere appreciation to the Institute for Global Environmental Strategies (IGES) for their valuable support in organizing the workshops. WII would like to thank all the chairpersons and eminent speakers for making valuable contributions, and would like to place on record the extremely enthusiastic response of the participants, many of who attended a CDM workshop for the first time. Last, but not the least, WII wishes to acknowledge the efforts of its staff members, who worked towards making these workshops a success.

EXECUTIVE SUMMARY

The workshop in Kolkata was held on March 17-18, 2004. Hon'ble Shri Mrinal Banerjee, Minister-in-charge, Department of Power and Non-conventional Energy Sources, Govt. of West Bengal, formally inaugurated the workshop. The external resource persons included 12 leading experts, including those from the eastern region to strengthen the local content. Fifty-five participants attended the two-day workshop, representing various stakeholders of renewable energy projects. The workshop at Ahmedabad was held on March 23-24, 2004 and was inaugurated by Shri K. V. Bhanujan, Chairman, Gujarat Pollution Control Board. The external resource persons here included 14 leading experts including those from the western region. A total of fifty participants, representing various stakeholders of renewable energy projects attended the workshop.

In both the workshops, there were five technical sessions spread over the two days. In the first technical session, an overview of climate change, an overview of the UNFCCC and key rules of the Kyoto Protocol were presented. In the second technical session, the linkages of development issues of the host country with respect to CDM and climate change and National Strategy Study on CDM were explained. The third technical session comprised of presentations about the size of the GHG market, the implications of various countries ratifying or not ratifying the Protocol, determinants of price and the issues involved in setting the baselines for projects and on the legal and contractual issues that could emerge as bottlenecks when it comes to realization of the CERs. The fourth technical session focused on CDM project development, which included an overview of the CDM project cycle, followed by renewable energy case studies covering various technologies. In the final technical session, the issues dealing with the process of carbon finance was explained, including the transaction costs. There was a concluding panel discussion on the last day of both the workshops, wherein representatives from the state Governments, and the local industry presented their viewpoint on the CDM opportunities in their respective states.

At both the workshops, the participants were initially requested to fill a questionnaire on their expectations from the workshop, and also their feedback at the end. Through these questionnaires it was also found that most of the participants were attending such CDM capacity building workshop for the first time. While several participants mentioned that they are currently working on projects that might have CDM potential, most of the participants mentioned their future interest to work on a project that has the potential to be framed as a CDM project. Based on the feedback received from the participants and the interest shown by various stakeholders, it is strongly felt that there is a good demand for capacity building initiatives on a regional basis. Many participants felt that it would greatly benefit them if a more sustained initiative is launched in the area of CDM capacity building, as being a relatively new subject, it would need some degree of hand holding in the initial stages.

CONTENTS

State Level Capacity Building Workshop on Clean Development Mechanism (CDM)

March 17-18, 2004
Crystal Hall, Hotel Taj Bengal, Kolkata

PROGRAM

DAY 1: March 17, 2004

Time	Agenda	Speakers
10:00 – 11:00	**Inaugural Session**	**Welcome Address & Introduction**: Dr. Kinsuk Mitra, *President, WII* **Inaugural Address**: Hon'ble Shri Mrinal Banerjee *Minister-in-charge, Department of Power and Non-conventional Energy Sources, Govt. of West Bengal* **Special Address:** Mr. Shinichi Iioka, *CDM Program Manager, Climate Policy Project, IGES (read out in absentia)* **Vote of Thanks:** Dr. Ashish Rana, *Senior Program Officer, WII*
11.00 – 11.15	**Tea Break**	
11.15 – 13.00	**Technical Session 1:** Clean Development Mechanism (CDM) – An Overview **Chair:** Mr. D.N. Mozumdar, *Co-chair, Energy and Environment Cell, Bengal Chamber of Commerce and Industry*	**Expectations of participants from the workshop** **Introduction to Climate Change:** Dr. Sumana Bhattacharya, *Expert Consultant, NATCOM Project, WII* **Introduction to CDM:** Dr. Ashish Rana, *Senior Program Officer, WII* **Discussions**
13:00 – 14:00	**Lunch**	
14:00 – 15:45	**Technical Session 2:** Host country issues **Chair:** Prof. P.R. Shukla *IIM Ahmedabad*	**Development & Climate:** Dr. Kalipada Chatterjee, *Manager, Development Alternatives* **National Strategy Study on CDM:** Mr. N Yuvaraj Dinesh Babu, *Area Convenor, Centre for Global Environmental Research, TERI* **Discussions**
15:45 – 16:00	**Tea Break**	
16:00 – 17:30	**Technical Session 3:** GHG Market **Chair**: Dr. Kalipada Chatterjee, *Manager, Development Alternatives*	**GHG Market, Price & Baseline Issues for India**: Prof. P R Shukla, *IIM Ahmedabad* **Legal issues in CDM Project**: Ms. Amee Yagnik, *Advocate, Gujarat High Court* **Discussions**

contd...

DAY 2: March 18, 2004

Time	Agenda	Speakers
09:30 – 10:45	**Technical Session 4:** CDM Project Development **Chair**: Prof P. R. Shukla, *IIM Ahmedabad*	**CDM project Cycle:** Ms. Aditi Dass, *Senior Program Officer, WII* **Case Study – Solar Energy**: Prof. Joyashree Roy, *Jadavpur University* **Case Study - Biofuels:** Mr. Jai Uppal, *Advisor, WII* **Discussions**
10:45 – 11:00	**Tea Break**	
11:00 – 12:30	**Technical Session 4** (continued): CDM Project Development **Chair**: Mr. Subir Nathak, *MD, Market Dynamics Ltd.*	**Case Study – Cogeneration Sector:** Mr. Dhirendra Kumar, *Program Officer, WII* **Case Study - Micro Hydel project:** Mr. V. Ramasubramaniam, *Managing Director, Sahyadri Energy Systems Private Limited* **Discussions**
12:30 – 13:30	**Lunch**	
13:30 – 15:00	**Technical Session 5:** Financing Issues **Chair**: Mr. Hemant Kanoria, *Managing Director SREI International Finance Ltd.*	**Carbon Finance & CER Purchase**: Mr. Chintan Shah, *GM, Senergy Global* **Financing of Renewable Energy Projects in India**: Mr. Abhijit Chatterjee, *Consultant, WII* **Discussions**
15:00 – 15:45	**Panel Session**	**Panel Discussion on "CDM Opportunities and Barriers for States"** Mr. Hirak Ghosh, *Ex-Secretary, Environment Department, Govt. of West Bengal (Chair)* Mr. S. P. Gon Choudhary, *Director, West Bengal Renewable Energy Development Agency* Mr. Subir Nathak, *MD, Market Dynamics Ltd.* Feedback by participants **Closing Remarks**: WII
15:45 – 16:00	**Tea Break & Wrap-up**	

PRESENTATIONS

Technical Session 1
Clean Development Mechanism (CDM) – An Overview

Chairperson

D. N. Mozumdar
Co-chair, Energy and Environment Cell
Bengal Chamber of Commerce and Industry

Introduction to Climate Change

Sumana Bhattacharya
Expert Consultant, National Communication Project
Winrock International India

CDM – Climate Change Convention, Kyoto Protocol and Issues of Additionality

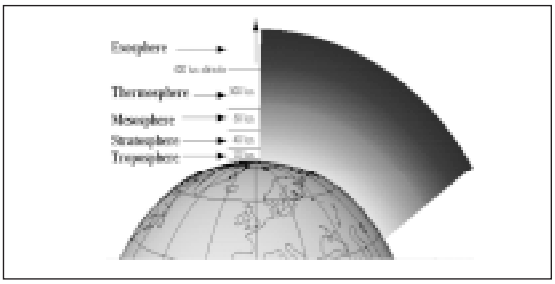
Ashish Rana
Senior Program Officer
Winrock International India

INTRODUCTION TO CLIMATE CHANGE

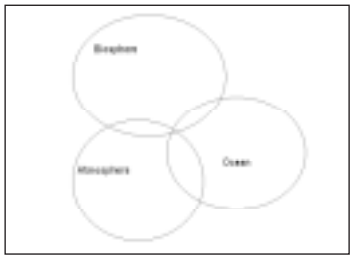
SUMANA BHATTACHARYA
Expert Consultant, National Communication Project
Winrock International India

SUMANA BHATTACHARYA is one of the expert consultants on the NATCOM project. She holds about nine years of experience in the area of climate change and impact assessment, and is a recipient of the "START Young Scientist" award in 1998 for her achievements in developing emission inventory methodologies (START is System for Analysis Research and Training, Washington DC). She holds a PhD in Physics and has to her credit over 30 publications in national and international journals. She presented an overview of climate change, its impacts, GHG inventory estimation and international response.

1 THE EARTH'S ATMOSPHERE



2 THE GLOBAL CLIMATE SYSTEMS AND INTERACTIONS



3 THE NATURAL GREENHOUSE EFFECT

Solar Radiation passes through the clear atmosphere
Most of the radiation is absorbed by earths surface and warms it

4 THE NATURAL GREENHOUSE EFFECT

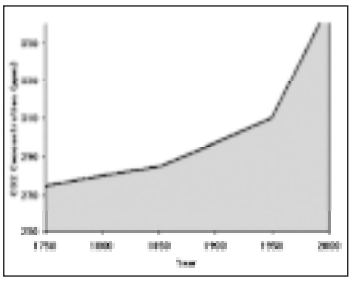
Most radiation is absorbed by the earths surface and
Infrared radiation is emitted back into the upper atmosphere

5 THE NATURAL GREENHOUSE EFFECT

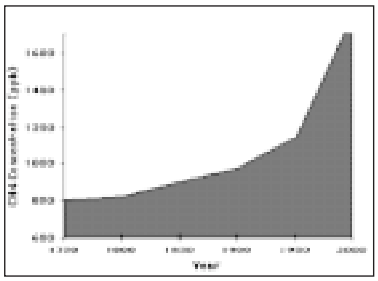
Some of the infrared radiation passes through the atmosphere and some is absorbed and re-emitted in all directions by greenhouse gas molecules
The effect of this is to warm the earths surface and the lower atmosphere

- Earth's Climate has remained relatively stable during last 10000 years
- Modern society has evolved and adapted to the climate variability
- Present society faces potentially rapid changes because of human activities that alter the atmospheric composition and change the earth's radiation balance
- Human activities lead to generation of certain gases through - Combustion of fuel
  - Land use changes
  - Agricultural practices
  - Various industrial processes
- The gases are
  - Carbon dioxide
  - Methane
  - Nitrous oxide
  - HFC
  - PFC
  - SF_6

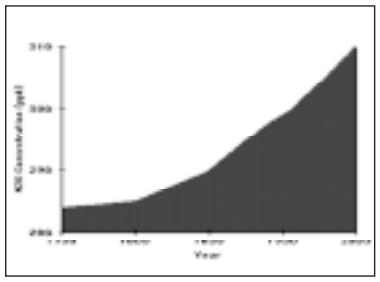
6 Increasing concentrations of Green House Gases in the Atmosphere



CO_2 increased from 280ppm in 1750 to 368 ppm in 2000. 2/3rd of this increase during last 20 years (since 1980) due to fossil fuel burning.



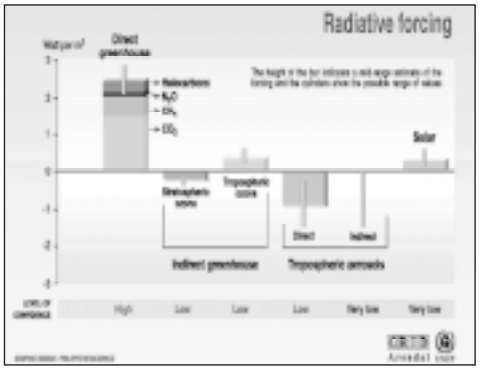
Methane increased by 2.5 times since 1750 from 700-1750 ppb



Nitrous oxide increased by 16 % from 270 ppb in 1750 to 316 ppb in 2000

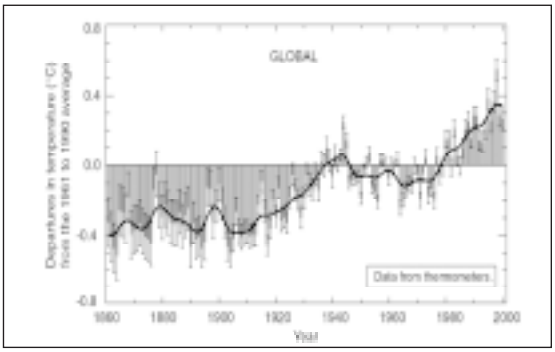
7 Enhanced Green House Gas Effect

- Increasing concentrations of the greenhouse gases and other trace gases have *changed the radiative forcing* of the atmosphere leading to a net warming

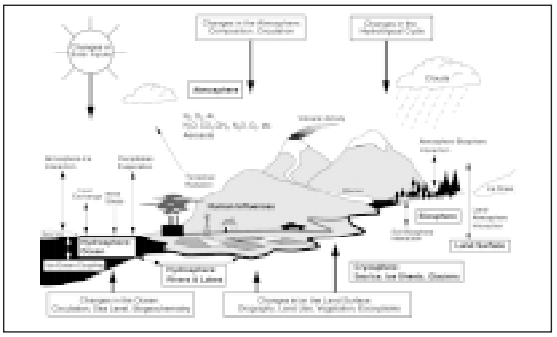


8 Evidences of Climate Change

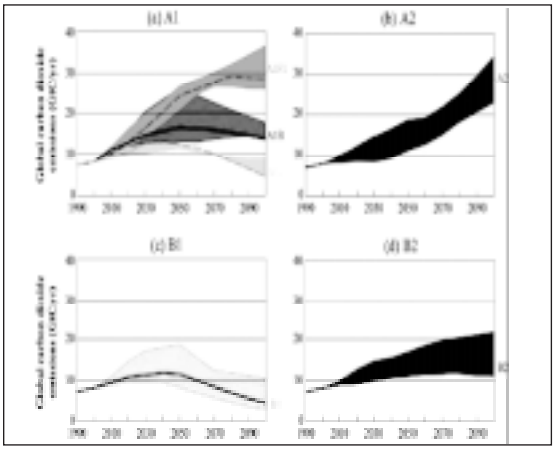
- *Global av. surface temperature has increased by 0.4*°C to 0.8°C over the 20th Century
- No set pattern in change in global precipitation in 20th century, however,
- Global av. Sea level has risen between 0.1 - 0.2m per decade during 20th century

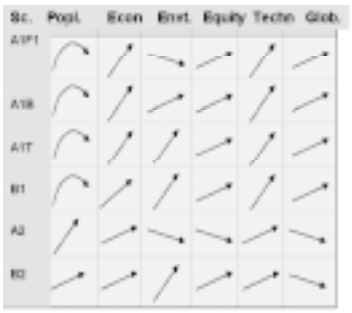


9 The climate human interaction



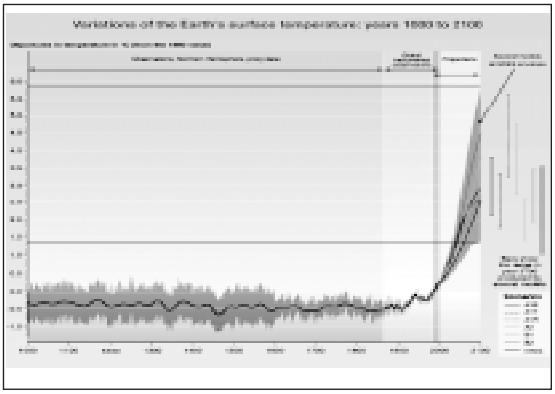
10 The SRES* Scenarios



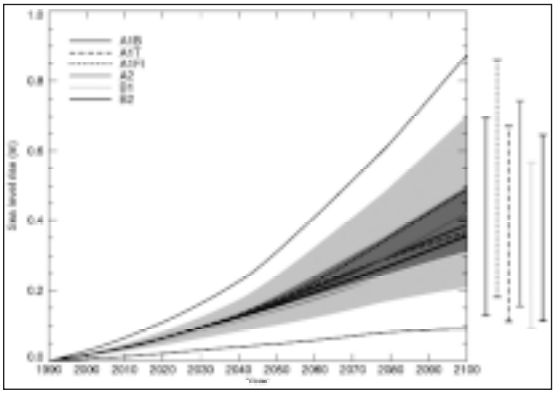


*IPCC Special Report on Emission Scenarios, 2000

11 TEMPERATURE CHANGES AT DIFFERENT FUTURE CO_2 CONCENTRATIONS



14 GLOBAL AVERAGE SEA LEVEL RISE SCENARIOS



This change will be rapid and will ride over natural climate variability

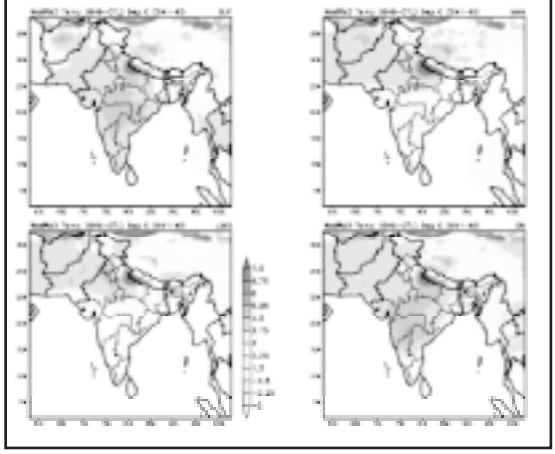
12 IMPACTS OF CLIMATE CHANGE

13 CLIMATE CHANGE

- Emerged as a
  - Global environmental issue in the last decade
  - Engaged the world's attention
  - Relates to a global common atmosphere
  - Scientifically complex climate systems – sub system air / ocean
  - Politically contentious, acquired north-south dimension
- And above all
  - Climate affects us all
  - Change will impact our activities in various economic sectors and ultimately
  - Economic growth and development

15 PROJECTED CLIMATE CHANGE FOR INDIA

Projected temperatures



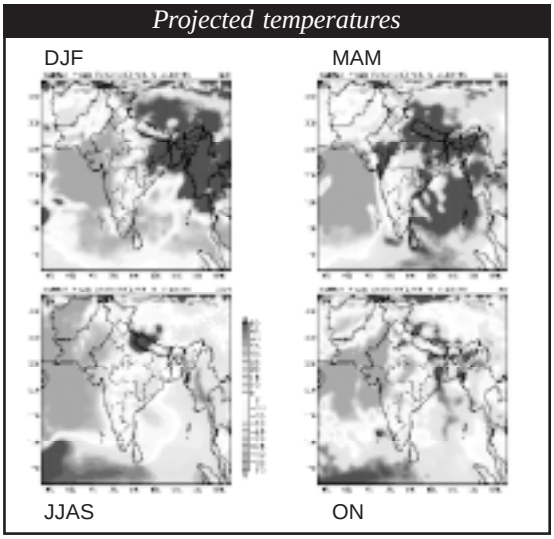
South of 25^{0}C: increase by 2-4^0‹C
Northern region: Exceeding 4^0‹C

Source: Climate Change and India - Vulnerability Assessment & Adaptation, edited by Shukla et al, 2003

16 PROJECTED CLIMATE CHANGE ON INDIA

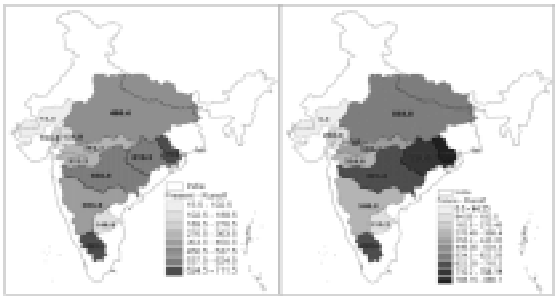
- Overall precipitation will remain the same with regional variations
- Decrease in number of rainy days over a major part of the country
- Decrease is more in western and central part (by more than 15 days)

- Near foothills of Himalayas and in northeast the number of rainy days may increase by 5-10 days



Source: Climate Change and India - Vulnerability Assessment & Adaptation, edited by Shukla et al, 2003

17 Impacts of climate change in India – Water resources

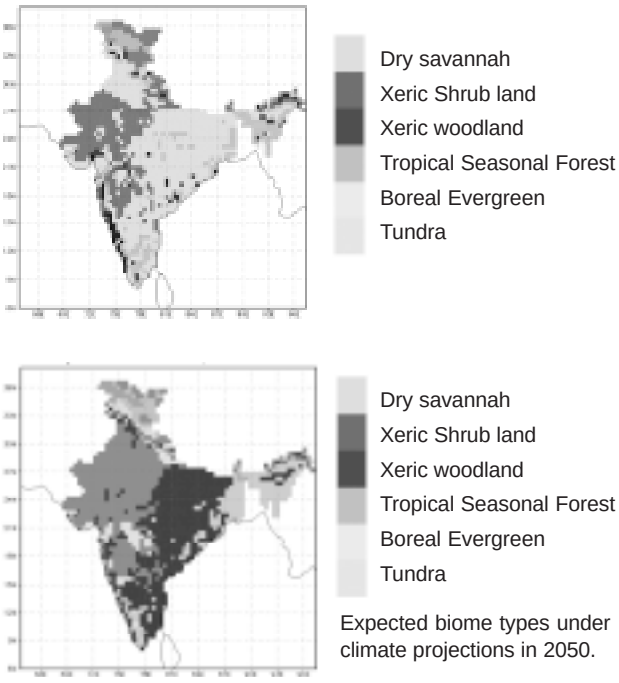


Average trend in surface runoff in river basins for
(a) present (1960 -1990)
(b) future (2041-2060)

Source: Climate Change and India - Vulnerability Assessment & Adaptation, edited by Shukla et al, 2003

- Projected regional variation in surface runoff and general reduction quantity of available water
- Increase in precipitation in Mahanadi, Brahmani, Ganga, Godavari, and Cauvery basins
- Sabarmati and Luni basins show drastic decrease in precipitation and consequent decrease of total runoff to the tune of 2/3rd of the prevailing runoff leading to severe drought conditions Flooding conditions may deteriorate in two river systems namely Mahanadi and Brahmani.

18 Impacts of climate change in India – Forests



Expected biome types under climate projections in 2050.

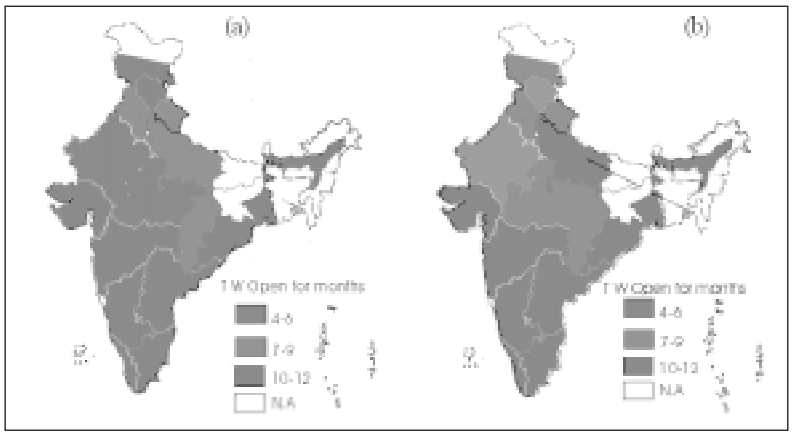
Source: Climate Change and India - Vulnerability Assessment & Adaptation, edited by Shukla et al, 2003

- Productivity: increase in net primary productivity (NPP) of forest ecosystems with more than 75% of the grids showing an increase in NPP.
- Shift in forest types: in 70% of the area under forests
- Biodiversity
- Habitats of many species will move north ward from their current locations
- Upward migration of plants in the Himalayas could reduce the alpine meadows and related vegetation, thus impacting the habitats of several high altitude mammals including wild sheep, goat, antelope and cattle.

- Increase in precipitation over northeastern India leading to severe floods could place the wildlife in Kaziranga National Park at risk

19 Impacts of climate change in India – Health -Malaria

- It is projected that in 2080s, malaria will penetrate elevations above 1800 meters and some coastal areas.
- 10% more states may offer climatic opportunities for malaria vector breeding throughout the year with respect to the year 2000

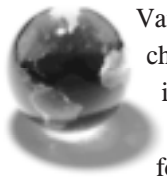


Source: Climate Change and India - Vulnerability Assessment & Adaptation, edited by Shukla et al, 2003

20 Must note

- Climate change is a long term issue
- Changes have occurred over the last hundred years and cannot be reversed quickly
- Precautionary action would help
- Delay may leave nations poorly prepared to deal with adverse changes
- May be helpful/ desirable for other reasons even though uncertainties do exist
- Scientists recommend halving of the emissions (1990 levels)

21 The International Response



Various nations around the world, with a view to taking positive steps to combat climate change, adopted the United Nations Framework Convention on Climate Change (UNFCCC) in 1992.

The Convention aims to stabilize the concentration of greenhouse gases in the atmosphere for preventing human induced interference with the climate system. Prevent dangerous human interference with the climate system, enabling economic development in a sustainable manner

It is stipulated that Parties to the Convention protect the climate according to their common but differentiated responsibilities.

22 Commitment of the Developing Country Parties (non-Annex 1) to UNFCCC

- Prepare national communications giving inventory of GHGs by Sources and removal by Sinks
- General description of steps taken or envisaged to implement the commitments
- Undertake sustainable development activities

23 Components of NATCOM

- Inventory Estimation
- Uncertainty Reduction
- Vulnerability Assessment and Adaptation
- Education and training
- Website
- Data center
- National circumstances
- Financial and technological constrains and capacity needs
- Research and Systematic Observation
- Targeted Research

24 GHG Inventory

- Sectors Covered:
  - Energy and Transformation
  - Industrial Processes
  - Agriculture
  - Land Use, Land Use Change & Forestry
  - Waste
- Gases Covered:
  - *Carbon dioxide (CO_2)*
  - Methane (CH_4)
  - Nitrous Oxide (N_2O)

Base year: 1994

Guidelines: IPCC 1996

25 Uncertainty Reduction in GHG Inventory estimates

- To capture the diversity of Indian emission characteristics
- To enhance the quality of the inventory
- Fresh emissions measurements / estimations were undertaken in some sectors

Some of the key areas covered include:

Energy and Transformation Sector

Calorific values of Indian coals

CH_4 from Coal mining

GHGs from Road Transport

Industrial Process

N_2O from Nitric Acid Production

CO_2 from Cement

Agriculture Sector

CH_4 from Enteric Fermentation

CH_4 from Rice Cultivation

26 Vulnerability Assessment

- Approach
  - National modeling exercise conducted for some sectors with additional case studies
- Sectors Covered
  - Climate and Extreme event scenarios
    - Construction of Future scenarios of Precipitation, Temperature, and intense Rainfall events for 2060 and 2080
  - Future emission scenarios
    - GHG emission scenarios up to 2030
  - Water resources
    - Water availability in selected river basins of the country in 2060 &2080
    - Glacier melt studies using remote sensing and insitu measurements
    - Ground water studies in Deccan besalt and Ganga basin
    - Nutrient cycling in the Achnokovil river
  - Agriculture
    - Impact of climate change and variability on major crops in the country
    - Free Air Carbon dioxide Experiment on mustard and rice
    - Climate variability impacts
    - Climate change Adaptation studies
  - Forestry
    - Impacts of climate change on forests in Western ghats and eastern Himalayas of India
  - Coastal zone
    - Sea level rise along the Indian Coasts
    - Impact of climate hazards on coastal districts of India
  - Industry, energy and infrastructure
    - Impacts of climate change on Energy systems of the country and a specific study on infrastructure related to Konkan Railways
  - Natural ecosystems
    - Assessment of impacts of climate change on Wet lands, Coastal ecosystems and Grasslands,
  - Health
    - Impact of climate change on Malaria

27 Commitment of the Developed Country Parties (Annex-1) to UNFCCC

- Return to 1990 levels of GHGs by 2000
- Provide financial resources (agreed full cost) to developing countries for implementing commitment eg support non-Annex 1 National communication
- Promote, facilitate and finance the transfer or access to environmentally sound technologies to developing countries
- Regularly provide and update a national inventory of anthropogenic emissions by sources and removal by sinks of all GHGs not controlled by the Montreal protocol using comparable methodologies to be promoted and agreed upon by the Conference of Parties
- A general description of steps taken or envisaged by the Party to implement the Convention
- Any other information relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculation of global emission trends

28 Kyoto Protocol

- The Kyoto Protocol is an addendum to the United Nations Framework Convention on Climate Change (UNFCCC or the Convention) that was adopted in December 1997.
- The Kyoto Protocol represents a potentially binding international treaty that stipulates actions to be taken by nations to combat global climate change. Six specific greenhouse gases are regulated under the Kyoto Protocol.
  - Carbon dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous oxide (N_2O)
  - Hydrofluorocarbons (HFCs)
  - Perfluorocarbons (PFCs)
  - Sulphur hexafluoride (SF_6)

29 The reduction Commitments under the Kyoto Protocol

- *Most industrialized (Annex B) countries are to reduce their* collective emissions of greenhouse

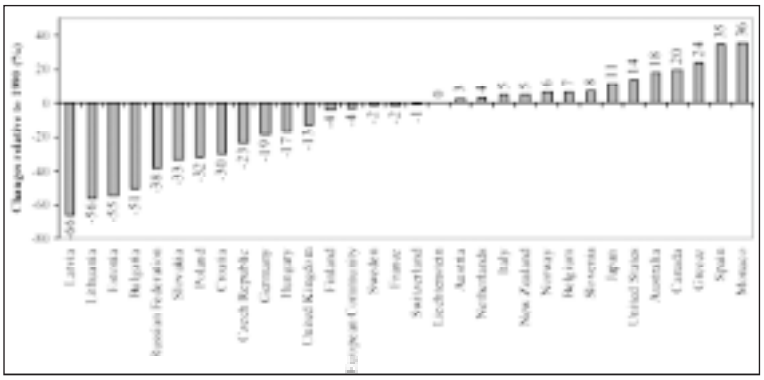
gases by an average of 5.2% by the commitment period of 2008 to 2012,

- While developing nations (non-Annex B) are not subject to emissions reduction caps.
- The deadline for signing the Kyoto Protocol was March 1999, and by this time it had received 84 signatures. The Kyoto Protocol shall enter into force when a minimum of 55 parties that account for at least 55% of the Annex I carbon dioxide emissions in 1990 have ratified

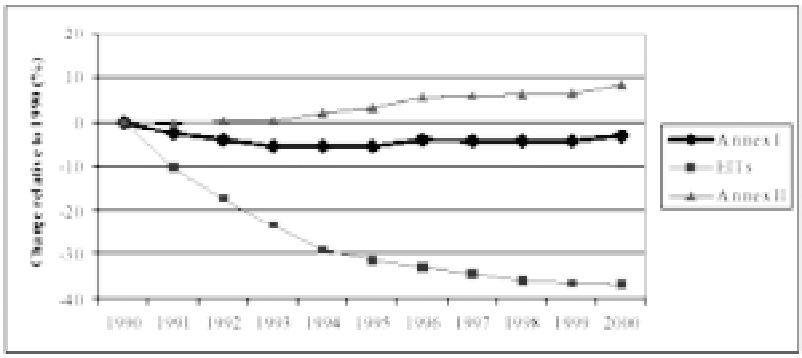
The emission reduction targets (with respect to 1990 levels) taken on by developed countries under the Kyoto Protocol are

Switzerland, Central & East European states, European Union	:	- 8%
United States	:	-7%
Canada, Hungary, Japan, Poland	:	-6%
New Zealand, Russia, Ukraine	:	0%
Norway	:	+1%
Australia	:	+8%
Iceland	:	+10%

30 CHANGES IN AGGREGATED GHG EMISSIONS, 1990-2000



31 TRENDS IN AGGREGATED GHG EMISSIONS, 1990-2000



32 KYOTO PROTOCOL FLEXIBILITY MECHANISMS

- To assist developed states in meeting their emissions reduction targets, the Kyoto Protocol defines
  - a schedule for emissions reduction activities and
  - advocates adoption of international emissions trading as a primary tool for greenhouse gas emission reduction.
- Emissions trading can occur between and among combinations of Annex I nations as well as between Annex I and non-Annex I nations.
- The Kyoto Protocol describes the following mechanisms for emissions trading:
  - International Emissions Trading (IET),
  - Joint Implementation (JI) —— targets Annex I Countries
  - the Clean Development Mechanism (CDM) ——targets non-Annex I Countries

33 CLEAN DEVELOPMENT MECHANISM

- The purpose of the clean development mechanism shall be to assist
  - Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to
  - assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3
- Under the clean development mechanism:
  - Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and
  - Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.
- Participation under the clean development mechanism, and in the acquisition of certified emission reductions, may involve *private and/or public entities*, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.
- Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

CDM – Climate Change Convention, Kyoto Protocol and Issues of Additionality

Ashish Rana
Senior Program Officer
Winrock International India

ASHISH RANA is a Senior Program Officer in Climate Change Program at Winrock International India. He holds a PhD from the Indian Institute of Management, Ahmedabad. He has worked extensively on integrated assessment models for energy and climate policy analyses while focusing on macroeconomic modeling and applications for developing countries. His chief interests are in the field of climate change mitigation and adaptation, particularly on technological choices and economic impacts. He is one of the authors in the IPCC Third Assessment Report and IPCC Special Report on Carbon Dioxide Capture and Sequestration. He gave an overview of the climate change convention and key rules of the Kyoto Protocol.

1 Outline of presentation

- Convention timeline
- Protocol rules
- Kyoto mechanisms
- Additionality

2 Convention Timeline – Initial years

1979 First World Climate Conference (WCC)

1988 IPCC established

1990 IPCC and second WCC call for global treaty on climate change.
September, United Nations General Assembly negotiations on a framework convention

1991 First meeting of the Intergovernmental Negotiating Committee (INC)

1992 May, INC adopts UNFCCC text
June, Convention opened for signature at Earth Summit

1994 March, Convention enters into force

3 Convention Timeline – Last decade

1995 March and April, COP 1 (Berlin, Germany)

1997 December, COP 3 (Kyoto, Japan)
Kyoto Protocol adopted

1998 November, COP 4 (Buenos Aires, Argentina)
Buenos Aires Plan of Action

2000 November, COP 6 (The Hague, Netherlands)
Talks based on the Plan break down

2001 April, IPCC Third Assessment Report
July, COP 6 resumes (Bonn, Germany)
Bonn Agreements
Oct. and Nov. COP 7 (Marrakesh, Morocco)
Marrakesh Accords

2002 August and September World Summit on Sustainable Development
November, COP 8 (New Delhi, India); Delhi Declaration

2003 December, COP 9 (Milan, Italy)

2004 December, COP 10 (Buenos Aires, Argentina)

4 Kyoto Protocol

- Rules focus on
  - Commitments
  - Implementation
  - Minimizing impacts on developing countries
  - Accounting, reporting and review
  - Compliance

5 General rules

- Improve quality of emissions data
- National mitigation & adaptation programs
- Promote environment friendly technology transfer
- Cooperation in scientific research and international climate observation networks
- Support education, training, public awareness & capacity building initiatives

6 COMMITMENTS

- Aggregate reduction of at least 5% from 1990 levels by 2008-2012.
- Individual targets for all Annex-I countries
- 6 GHGs in one basket, GWP weighted
- *EITs – Base year 1990 or 1995 for HFCs, PFCs, SF_6*
- Use of LULUCF for sinks permitted

7 EMISSION TARGETS

- Average over 'First Commitment Period'
- Early action: 'demonstrable progress'
- Carry over
  - Difference in targets allowed to carry over beyond 2012
  - Credits earned from sinks not allowed
  - Credits from JI/CDM: 2.5% of assigned amount

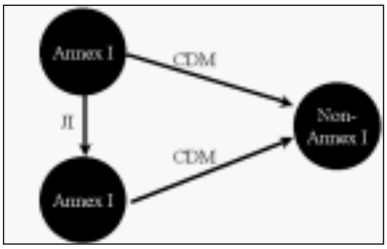
8 POLICIES AND MEASURES

- Suggested actions
  - Enhancing energy efficiency
  - Promoting renewable energy
  - Favouring sustainable agriculture
  - Methane recovery through waste management
  - Sinks
  - Market reforms
  - Transport sector emissions
- Use of SBSTA for enhancing effectiveness

9 KYOTO MECHANISMS

- Flexibility mechanisms
  - Joint Implementation
  - Clean Development Mechanism
  - Emissions Trading
- Designed to boost cost-effectiveness
- Supplemental to domestic action

10 KYOTO MECHANISMS



11 JOINT IMPLEMENTATION

- Additional Emission Reductions or removals
- Projects starting from 2000, ERUs can be issued only after 2008
- Track I: Host country fully meets all eligible requirements
- Track II: Host country does not fully meet all eligible requirements

12 EMISSION TRADING

- Annex I acquire Assigned Amount Units
  - CERs from CDM projects
  - ERUs from JI projects
  - RMUs from sink activities
- Hold 'Commitment Period Reserve': 90% of AAUs

13 CLEAN DEVELOPMENT MECHANISM

"Real, measurable and long-term climate benefits in form of ERs or Removals that are additional"

- Generate investment in developing countries
- Enhance environment friendly tech. transfer
- Promote Sustainable Development
- Additionality: Finance, Tech. Transfer
- No diversion of ODA

14 CLEAN DEVELOPMENT MECHANISM

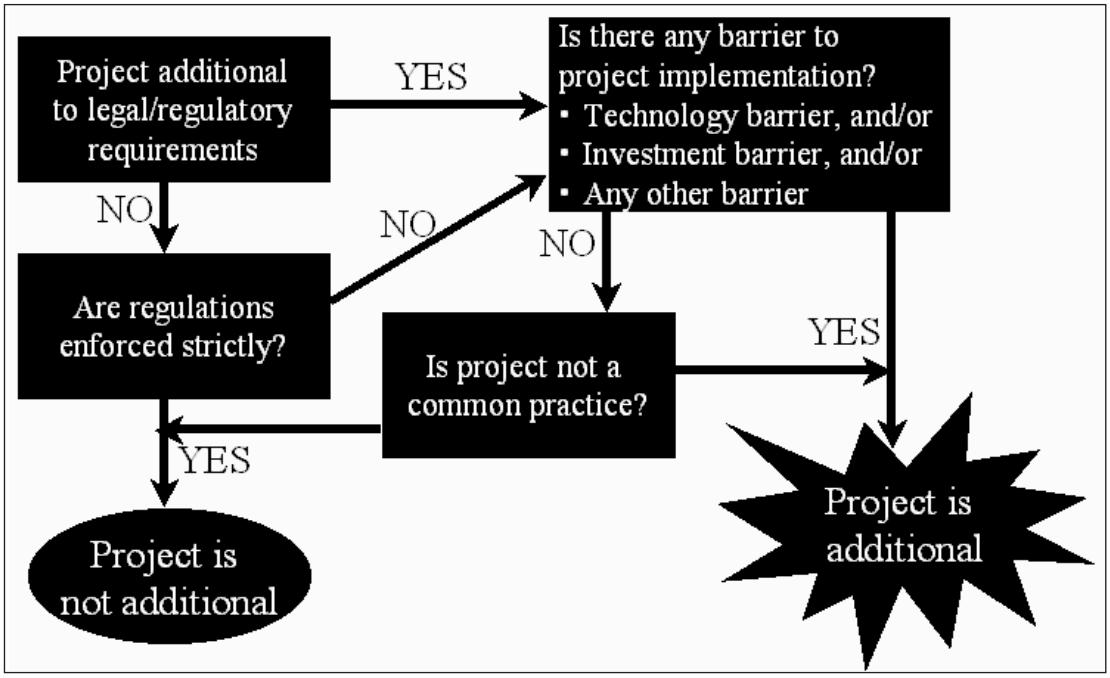
- CERs to accrue from project from 2000
- CDM – Executive Board overseeing practical arrangements
  - Defines procedures for accepting projects and encouraging the development of Small Scale Projects (esp. in Renewable Energy, Energy Efficiency)
- Appropriate, transparent, conservative baselines
- Rigorous monitoring plan to collect accurate emissions data

15 MINIMIZING IMPACTS

- Removing subsidies for environment friendly technologies
- Develop carbon capture & storage technologies, advance fossil fuel technologies
- Capacity building to improve efficiency
- Diversify economies that rely heavily on fossil-fuel production or commerce

16 ADDITIONALITY

- To ensure that Emission Reduction due to BAU measures in developing countries should not be credited under CDM
- Baseline determination
  - Scenario that reasonably represents the anthropogenic emissions by sources of GHG that would occur in the absence of the proposed project activity
- Project Design Document requires "Brief explanation of how emissions are to be reduced by the proposed project, including why the emission reductions would not occur in the absence of the proposed project activity"
- Necessary Condition
  - The emissions from the proposed project are less than the baseline emissions
- Sufficient Condition
  - The proposed CDM project is not a baseline scenario project and hence would not have been implemented in absence of CDM



Technical Session 2
Host country issues

Chairperson

P. R. Shukla

Professor, IIM Ahmedabad

Development and Climate

Kalipada Chatterjee

Manager, Climate Change Centre, Development Alternatives

National Strategy Study: CDM Implementation in India

N. Yuvaraj Dinesh Babu

Area Convener, Centre for Global Environment Research

The Energy and Resources Institute (TERI), New Delhi

DEVELOPMENT AND CLIMATE

KALIPADA CHATTERJEE
Manager, Climate Change Centre, Development Alternatives

KALIPADA CHATTERJEE is Manager, Climate Change Centre, Global Environmental Systems Group in Development Alternatives, an NGO based in Delhi. He is a well-known expert in the field of climate change. He has extensively published articles, papers and books and has spoken on the subject of development and climate change at various national and international forums including the side events of COPs. He explained about the linkages of development issues of the host country with respect to CDM and climate change.

1 DEVELOPMENT & CLIMATE ARE INTERRELATED

- Development so far has taken place at the cost of environment - both local and global
- Conference on human environment Stockholm in 1972 was the first international effort to focus on the human impact of environment and the need to protect the environment
- However it took 20 years for the international community to concretise action in the form of a UN Framework Convention on Climate Change (UNFCCC) at the UN Conference on Environment and Development (UNCED) held in June 1992 in Rio known as the Rio Earth Summit

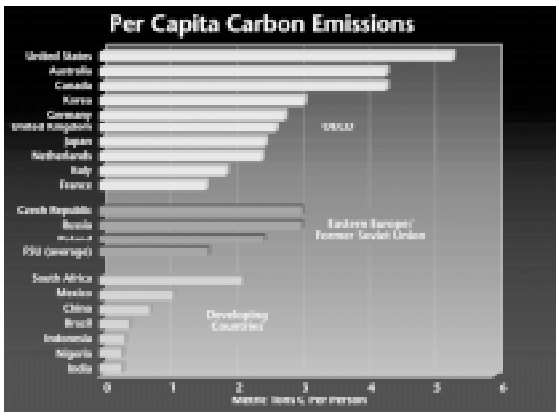
2 DEVELOPMENT ACTIVITIES SUCH AS

- Energy production for fossil fuels
- Transportation
- Construction (brick, cement, steel, etc.)
- Agriculture (methane)
- Landuse change and deforestation emit greenhouse gases increasing their atmospheric concentrations and tend to warm the atmosphere resulting in global warming and climate change.

3 A LARGE PERCENTAGE OF PEOPLE LIVE BELOW POVERTY LINE IN DEVELOPING COUNTRIES

These people do not have access the basic amenities of life such as:

- Safe drinking water
- Sanitation
- Basic health facilities
- Many live without home
- In India alone several (about 7) million jobs need to be created every year
- Added to these education is to be provided to all children



Against these back drop immediate priority of the developing countries is rapid economic growth to eradicate poverty, provide better quality of life and basic needs of their people

- Energy is the key driving force in the process of development
- Energy use from fossil fuels is one of the major source of emissions and is increasing in developing countries to meet their development needs but their per capita energy consumption remains far below that of the industrialized countries.

4 IPCC (1990, 1995 AND 2000 ASSESSMENT)

- Scientific evidence suggests that the observed changes in the Earth's Climate are at least, in part, due to human activities
- Projected emissions of GHGs range from 5 to 35 GtC per year for the year 2100 (present emissions being about 6.3 GtC)
- Atmospheric concentrations of CO_2 is projected to increase between 550 and 1000 ppmv by 2100 from today's level of about 365 ppmv
- Projected increase in global mean surface temperature of about 1.4 to 5.8^{0}C by 2100
- Associated increase in sea level of about 15-95 cm

5 IMPACT OF CLIMATE CHANGE

- Climate change adversely affects the
  - Terrestrial and aquatic ecosystems such as forests, deserts, lakes, stream and wetlands
  - Water resources
    - currently 1.3 billion people do not have access to adequate supplies of safe water
  - Food and fiber production
  - Infrastructure and human settlements in coastal areas, due to flooding and inundation,
  - Increased mortality and illness due to heat waves & vector borne diseases
  - Climate change could increase the frequency and magnitude of floods, droughts and cyclones
  - See level would rise causing extensive inundation in the coastal areas, displacement, economic disruption, etc.

6 VULNERABILITY TO CLIMATE CHANGE

Vulnerability to climate change can be addressed through the ability of human systems to adapt and cope with climate change but it depends on such factors as :

- Wealth
- Education
- Skills
- Access to resources
- Technology
- Information
- Infrastructure
- Management capabilities

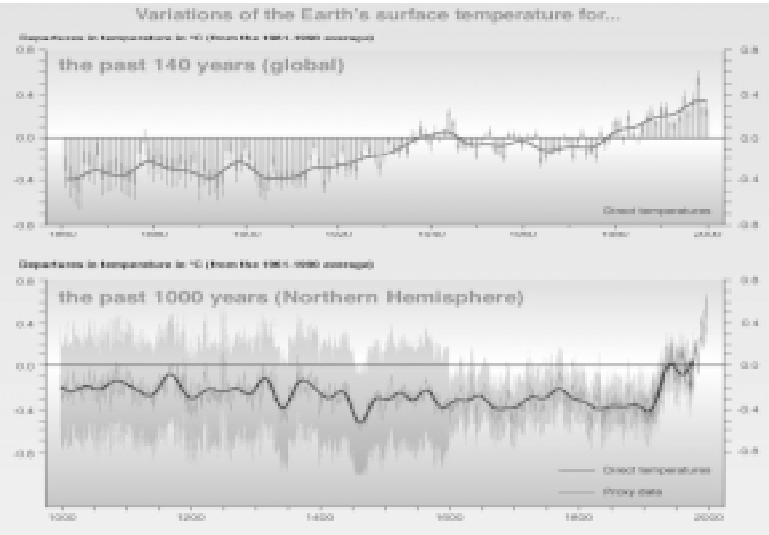
In addition many communities and regions that are vulnerable to climate change are also under pressure from forces such as :

- Population growth
- Poverty
- Resource depletion

Signals of climate change are already becoming visible

- Many regions of the world particularly developing countries are experiencing devastating floods

7 GLOBAL MEAN SURFACE TEMPERATURES HAVE INCREASED



- Unprecedented continental scale droughts. Such climate variabilities resulting in loss of :
  - human life
  - biodiversity
  - food production
  - slowing down economic growth, and
  - affecting development

Orissa super cyclone of October 1999, continental scale drought during the summer of 2002 in India, severe heat waves over some parts of Europe during the summer of 2003 are few examples

8 Climate Change Convention

- Objectives of the UNFCCC
  - To achieve stabilisation of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system
  - Such a level should be achieved within a time-frame to :
    - ensure food production is not threatened, and
    - enable economic development to proceed in a sustainable manner

During the June'92 Earth Summit at Rio de Janerio representatives of 154 countries signed the UN Framework Convention on Climate change

9 Basic Principle Agreed Upon in UNFCCC

- Protecting the climate system
  - for the benefit of present and future generations of human kind
    - on the basis of equity and
    - in accordance with their common but differentiated responsibilities and respective capabilities.
- Developed country Parties agreed to take the lead in combating climate change and adverse effects thereof

10 Development and Climate in the Indian Context

- For improving the quality of life of more than one billion people and eradicate poverty, India must plan and implement measures for rapid economic development in all sectors of economy particularly in the rural India where more than 70% of the India's population live.
- Availability of a reliable, efficient and adequate power infrastructure in the country is very crucial to achieve our social and economic goals. The power sector primarily relies on the thermal generation of power using coal, an indigenous source. India's emissions is projected to increase in the next 20 years from 139 to 780 million tone of CO_2 (as carbon) by 2020 (ALGAS)
- Energy efficiency and renewable energy are the key aspects of the government of India's development efforts and mandate to alleviate poverty

11 Reducing Emissions / GDP

- Such increase in emissions is a matter of concern but many workers in the field of development have expressed hope and belief that India's aspirations can be well met by reducing emissions per unit of GDP (energy intensity) through various measures such as :
  - Better management of economy
  - Improvement in energy efficiency
  - Introducing advanced technologies
  - Large scale of RETs for rapid rural development
  - There is significant potential for power generation from non-conventional energy sources based on rural resources such as biomass

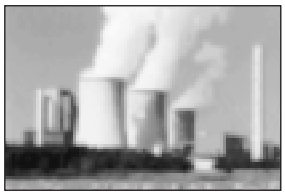
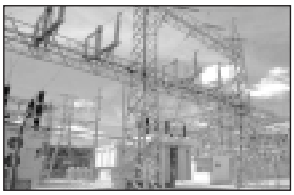
12 CDM has the Potential to Promote Development while Mitigating Climate Change

The country must take advantage of the clean development mechanism under the Kyoto Protocol to address not only to the mitigation of climate change but to usher social wellbeing, economic wellbeing, environmental wellbeing to people and finally to eradicate poverty and provide basic necessities of life to the one billion people of India.

National Strategy Study: CDM Implementation in India

N. Yuvaraj Dinesh Babu
Area Convenor, Centre for Global Environment Research
The Energy and Resources Institute, New Delhi

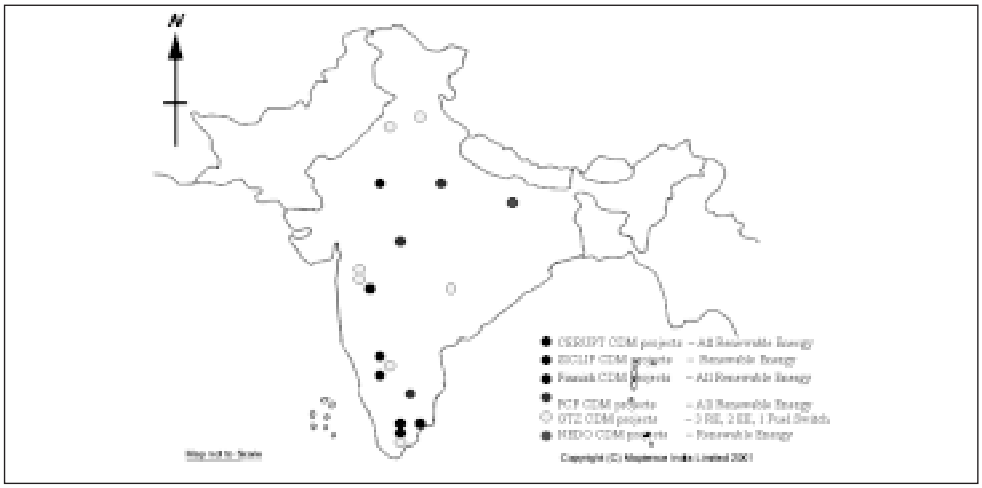
N. Yuvraj Dinesh Babu is Area Convenor of Centre for Global Environment Research at The Energy and Resources Institute (TERI), New Delhi. He has more than 10 years of work experience and specializes in biomass conversion technologies. He is one of the core team member of the World Bank's assignment on National Strategy Study on CDM implementation in India. He explained to the participants about the World Bank funded National Strategy Study on CDM being undertaken at The Energy and Resources Institute.


1 CDM in India: Operational Mode

- What is happening ?
  - Operationalising CDM
  - Transactions and deals
- What is required ?
  - Policy and operational procedures
  - Institutional frameworks
    - Keep costs down
    - Ensure creation of a healthy market

2 Indian CDM Projects Map



3 Relevance of NSS-India

- Involvement of project developers and key stakeholders
- Complement Indian Government's process of establishing CDM institutions and procedures
- Strategic recommendations for CDM participation

4 National Strategy Study - India

■ Objectives
- Assess issues & opportunities presented by potential international markets for GHG offsets
- Evaluate processes & methodologies to facilitate CDM project cycle

■ Partners
- TERI
- IDFC & Legal expert
- INFRAS AG
- Ernst Basler+Partners Ltd.
- LASEN, Swiss Federal Institute of Technology

Emphasis on capacity building and project development

■ Action plan
- Priority sectors
- CDM Policy framework
- Methodological & technical guidelines for project preparation
- Capacity building for CDM project development & implementation
- Portfolio of potential CDM projects

5 Tasks and Activities

Task 1: Review of past and current studies

Task 2: Assessment of CDM potential at sectoral levels

Task 3: International demand for GHG offsets, and India's options and opportunities

Task 4: CDM project cycle design, identification, characterisation of institutional process and related barriers

Task 5: Development of pipelines of potential CDM projects at sectoral levels and methodological guidelines

Final report: August 2004

6 NSS Launch – feedback

■ No prioritization of sectors
■ No additional SD criteria
■ DNA – need of the hour
■ Capacity building essential for key stakeholders (Private sector, FIs, Insurance, Regulators, Industry Associations, Policy makers etc.,)
■ Legal status,sharing,taxing of CERs
■ Regulatory concerns : Additionality

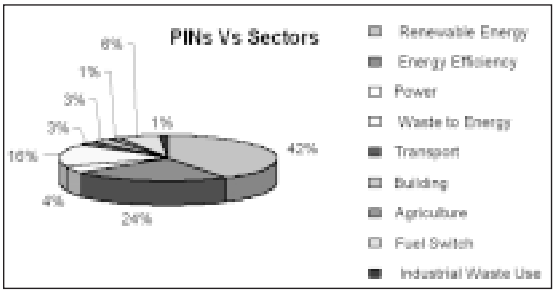
7 Key issues

■ Streamlining government approval procedures - DNA establishment
■ Various legislations (energy and environment) - additionality
■ Role of states in encouraging CDM - minimize conflicts and disincentives
■ Entitlement of CER
■ Transaction costs
■ Strengthening local operational entities, FIs, insurance sector
■ Synergising bilateral & multilateral capacity building efforts in India (awareness, development and facilitation)

8 National call for CDM PINs

Outreach : Launch event, website, email, individual contacts with private sector and GoI

Result : Significant response. 67 PINs



9 Emphasis on consultation , capacity building and partnership

10 Synergise with Existing efforts- bilateral & multilateral- in India for CB

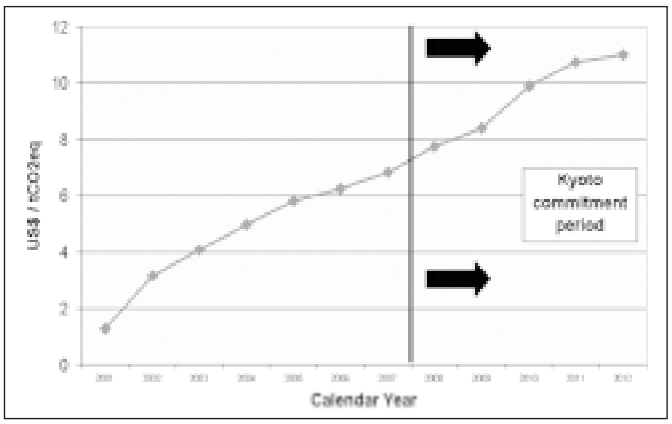
11 Web-based discussions-project website already launched

12 CDM: Financing Tool

- How CDM funds flow in the project
  - Improved cash flow
  - Equity
  - Debt
  - Improved DSCR
  - Risk sharing

13 CDM: Financing Tool

Speculated price for CERs as the first commitment period approaches



Source: CO2e.com Bid/Offer Boards

14 Need for building the capacity

- Stakeholders
  - State : Nodal agencies, Technical consultancy organisations, Financing institutions, Industrial development corporations, Municipal bodies, Regulatory Commissions, Legal firms etc
  - Central : DNA member ministries / departments
  - Private sector (consultants, developers & promoters)
  - Financing Institutions including Insurance Cos.
  - Academic and research institutions

15 CDM capacity building initiatives in India

- GTZ – IGEEP CDM capacity building project
- CDM Pool, IT power – ECN
- CDM and Indian Industry, Ecosecurities & FCO, UK
- ADB CDM Facility
- Integrated Capacity Building –CDM, METI, Japan - IGES
- CDM capacity building programme for Biomethanation sector, UNDP-MOEF
- Canada small scale CDM projects facility with Pembina Institute, CII-RFI round table
- NSS, World Bank -TERI

16 TERI's initiatives in CDM

- Country baseline for Ministry of Non-Conventional Energy Sources (MNES) (report posted for comments: http://mnes.nic.in)
- Developing CDM projects in power sector for Ministry of Power
- Developing CDM projects for private sector
- Capacity building (brain storming, training programme, workshops)

Technical Session 3
GHG Market

Chairperson

Kalipada Chatterjee
Manager, Climate Change Centre
Development Alternatives

■ Carbon Market, Price and Baseline Issues for CDM Projects in India

P.R. Shukla
Professor, Indian Institute of Management, Ahmedabad

■ Emission Reductions: Linking International and National Legal Regimes

Amee Yajnik
Advocate, Gujarat High Court

Carbon Market, Price and Baseline Issues for CDM Projects in India

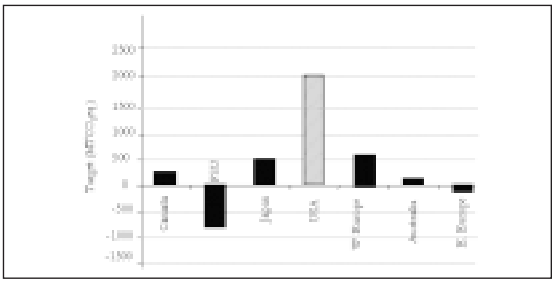
P.R. Shukla
Professor, Indian Institute of Management, Ahmedabad

P. R. SHUKLA is a Professor in the Public Systems Group at Indian Institute of Management, Ahmedabad. He holds a Ph.D. from Stanford University. He has worked on numerous research and consulting assignments for Indian and international organizations. He is a lead author of several Intergovernmental Panel on Climate Change (IPCC) reports and has co-authored ten books and numerous publications in international journals. He explained about the size of the GHG market, the implications of various parties ratifying or not ratifying the Protocol, determinants of price and the issues involved in setting the baselines for projects.

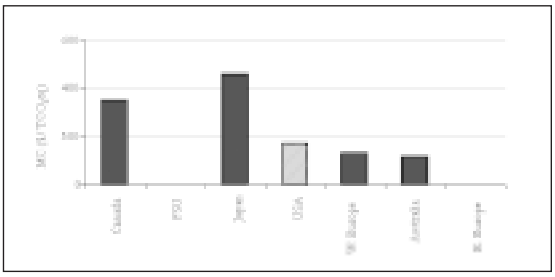
1 Presentation Agenda

- What will be the size of the carbon market and price of carbon?
- What will be India's potential in carbon market?
- What shall be the baseline for projects (e.g. power)?
- What are the complexities, uncertainties and risks of operating in CDM market?
- What are the key issues and concerns for implementation of CDM?

2 Carbon Mitigation Targets (in 2010) (Kyoto without US)



3 Mitigation Cost of Domestic Action (2010) (Kyoto without US)



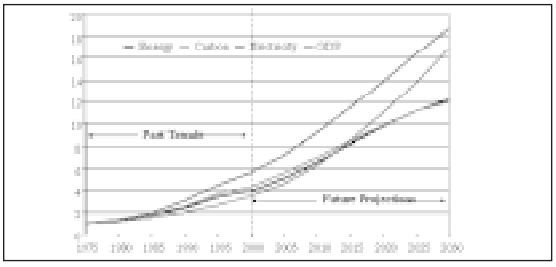
4 Carbon Market: Size and Price

- OECD: Annual Mitigation Target (2008-2012) 1.5 - 1.8 Billion $TCO_2Eq.$
- Hot Air: 0.7 - 1 Billion $TCO_2Eq.$
- Marginal Mitigation Cost (in Year 2010)

Domestic Action	US $/$TCO_2$ Eq.
• Japan Alone	127
• W. Europe Alone	36
• Annex I Trading	4 - 8
• An I Trade +CDM	3 - 6

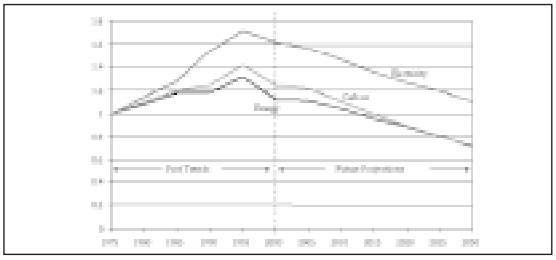
5 Energy, Carbon, Electricity and GDP

(History and Projections for Reference Scenario)

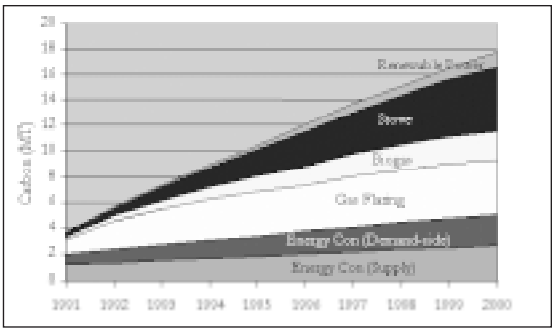


6 GDP intensities of Energy, Electricity and Carbon

(Reference Scenario)

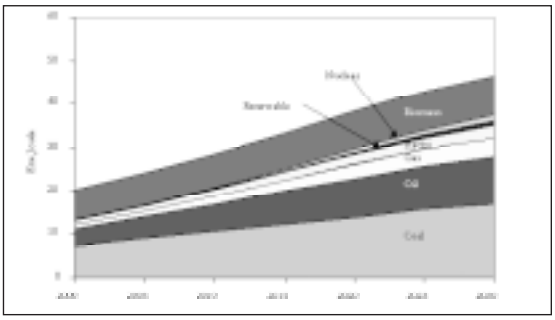


7 Carbon Mitigation in Past Decade?



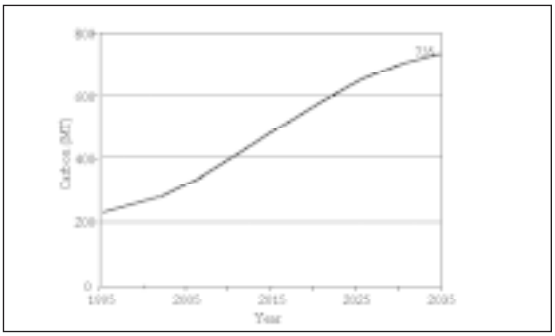
8 Future Energy Demand for India

(Base Scenario)

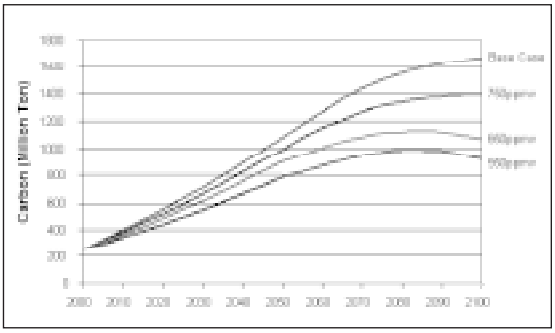


9 Carbon Emissions for India

(Base Scenario)



10 Global Carbon Mitigation Scenarios (2000 - 2100)



11 Global Carbon Price

(under different Post-Kyoto Scenarios)

Stabilization Target	Kyoto Period (2000-2012)	Post-Kyoto Regime	
		2012-2030	2030-2100
750 ppmv	$5-8/ton	$8-18/ ton	$18-65/ton
650 ppmv	$5-10/ton	$10-24/ton	$24-88/ton
550 ppmv	$5-14/ton	$14-35/ton	$35-120/ton

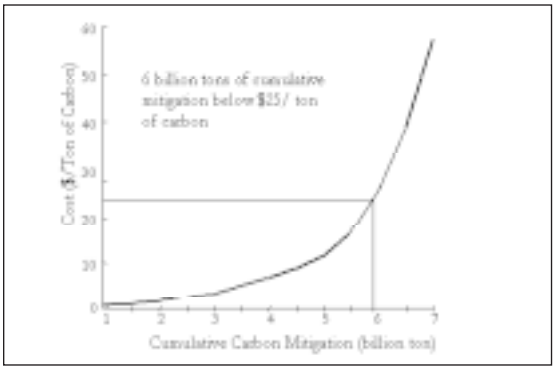
12 Carbon Mitigation for India

(under different Post-Kyoto Scenarios)

(Cumulative: in Million Ton)

Stabilization Target	Kyoto Period 2000-2012	Medium Term 2000-2030	Long Term 2000-2100
750 ppmv	138 (3%)	743 (5%)	11334 (11%)
650 ppmv	301 (7%)	1555 (11%)	23666 (23%)
550 ppmv	449 (10%)	2503 (17%)	33284 (32%)

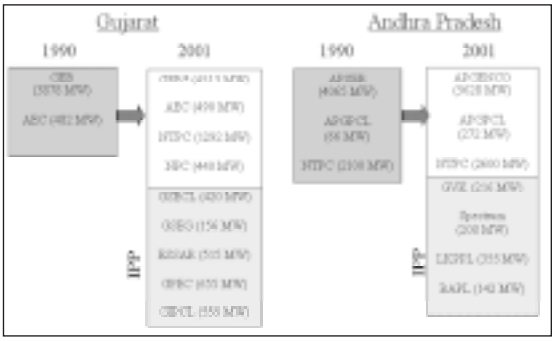
13 Carbon Mitigation Supply Curve for India (2005-2035)



14 Baseline for Power Projects

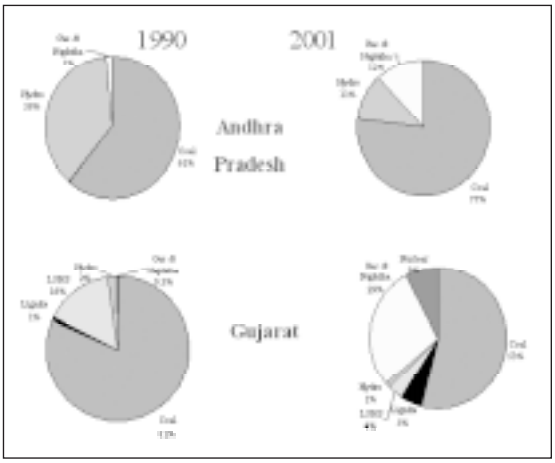
(Results from IIMA-Stanford Study)

15 Shifts in Generation in Gujarat & AP

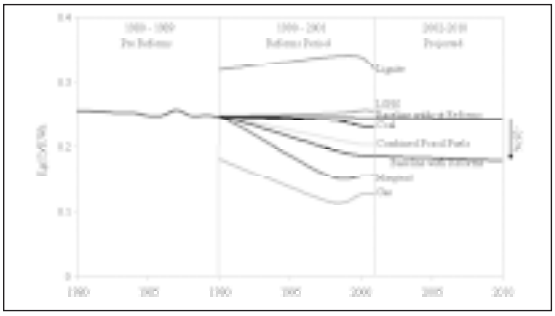


16 Energy Efficiency of Generation in AP & Gujarat

17 Generation Mix (GWh) in AP & Gujarat



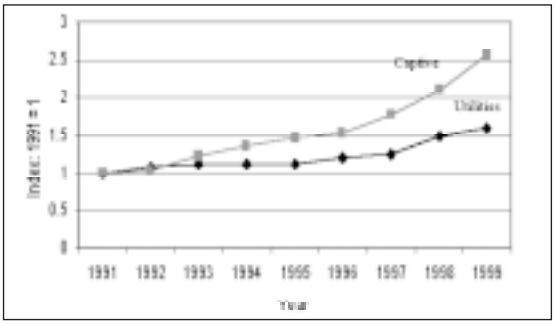
18 Carbon Baseline: Gujarat



19 Complexities, Uncertainties and Risks of Operating in CDM Market

- Key issues:
  - Baselines (Complexities)
  - Market Risks (Uncertainties - Market Size, Price)
  - Future Climate Regime (Uncertainties - Scientific, Political)
  - Legal Risks

20 Added Baseline Complexities Post-reform Power Capacity Addition in Gujarat



21 Captive Power Plant: Cost Heterogeneity

Fuel Type	Installation cost (million rupees per MW)	Generation cost (rupees per unit)
Lignite	50 - 52.5	1.59 - 1.90
Coal	42.5 – 45	1.78 - 1.92
FO	10 - 12	3.5 - 3.75
LDO	7.5 - 10	4.25 - 4.6
HFO	10 - 15	4.5
Naptha	35 - 41	3 - 3.25
Natural Gas	42.5 - 50	2.3 - 3.3

22 Segmentation of the CPPs

Objective/Segment	Size	Preferred Fuel	Typical Consumer
Hedging against interrupted power supply (Back Up)	Small	Oil (HSO, FO, LDO)	Small units (Textiles, Paints, Paper)
Better Control, Quality power	Small-Medium	Gas, Naptha	Facilities with sensitive equipments
Joint production of steam and Electricity (Cogeneration)	Small-Medium	Gas, Naptha, Bagasse	Sugar mills, Cotton Textile
Reduced cost of generation (below industrial tariff)	Medium-Large	Coal, Gas, Naptha	Petrochemicals, Cement

23 Market Uncertainties: Size and Price

- OECD: Annual Mitigation Target (2008-2012)
  1.5 - 1.8 Billion $TCO_2Eq.$
- Hot Air
  0.7 - 1 Billion $TCO_2Eq.$
- Marginal Mitigation Cost (in Year 2010)

Domestic Action	US $/$TCO_2$ Eq.
• Japan Alone	127
• W. Europe Alone	36
• Annex I Trading	4 - 8
• An I Trade +CDM	3 - 6

24 Uncertainties of Future Climate Regime

- Global and Long-term nature of Climate Change problem
- Scientific Uncertainties and Controversies
- Large Number of Players
- Divergent Perspectives
- *Need for Cooperation (Leakage, Competitiveness)*

25 Operational Issues and Concerns

- Transaction Costs (How to Minimize?)
- Subsidies (What would happen to existing subsidies?)
- Portfolio versus Isolated Projects (How to Coordinate?)
- Fast Track (What to put on fast track?)
- Shifting Baseline
- Share of CER Market (What market share to target?)
- Fragmented Market (How to operate in the fragmented carbon market?)
- CER Contracts and Laws (How CER contracts be structures between participants?)
- Legal Risks (What risks the host country laws would pose?)

26 Strategic Issues and Concerns

- Linking with CDM with National Development Priorities
- Integrated Projects (Can integrated projects such as infrastructure be considered?)
- Programs (Can programs like energy efficiency be included?)
- Soft versus Hard Projects (How can soft projects be included?)
- Multi-country projects (e.g. Gas Pipeline passing through several countries)
- Reforms and Institutional Developments
- Post-Kyoto Regime
- Mitigation and the Long-term Competitiveness of Indian Industry

EMISSION REDUCTIONS: LINKING INTERNATIONAL AND NATIONAL LEGAL REGIMES

AMEE YAJNIK
Advocate, Gujarat High Court

AMEE YAJNIK is an Advocate at the Gujarat High Court. She has a Master's of Science of Law from Stanford University and is also pursuing the doctoral degree from the same university. She has a special interest in the field of energy and environmental law and has delivered lectures on the subject at various international and national conferences and workshops. She also has a Master's degree in Ecology and Environment. She is also a guest faculty at several leading institutes like Lal Bahadur Shastri National Academy for Administration, Mussoorie, Institute of Company Secretaries of India, Ahmedabad, and IIM, Ahmedabad. In her presentation, she drew attention to the legal and contractual issues that could emerge as bottlenecks when it comes to realization of the CERs.

1 PRESENTATION AGENDA

- Ownership of Atmosphere (Property Rights)
- Ownership of ERs and legal process of transfer
- Would specific law be needed in India/Non-Annex I?
- Contract Risks
- How to make the contracts robust to ensure tradable rights?

2 OWNERSHIP OF ATMOSPHERE: THE PROPERTY RIGHTS ISSUES

- Atmosphere is global common property
- Atmosphere is a scarce resource
- Utilization of the resource is skewed
- Property regime defined by KP has limitations
  - "Grandfathering" is used for assigned amount (AA) allocation
  - Whether AA is an "entitlement"?
  - Whether the AA allocation under KP distort future rights regime?
- Long-term emissions regime issues
  - "Convergence" of AA rights allocation (e.g. per capita entitlements)
  - "No harm" principle for developing counties will continue

3 OWNERSHIP OF ERS AND LEGAL PROCESS OF TRANSFER

- ER has international legal origin under KP.
- ER is a product of a CDM/JI Project.
- If Project is "legal" in domestic jurisdiction and ERs are "certified" and "verified" by authorized agents, then ERs are legal commodities
- Ownership of ERs is with the Project Stakeholders
- Distribution of ERs is a contract among stakeholders
- Rules pertaining to export of a legal commodity in a country are applicable for transfer to an international agent

4 WOULD SPECIFIC LAW BE NEEDED IN INDIA/NON-ANNEX I?

ERs are new commodities, but not different. Therefore present laws/ rules are applicable and adequate.

- State/ Central Government Laws/ rules
- Project clearances (e.g. for DPC phase I, there were 28 clearances pre-closing and 14 post-closing)
- Project Contracts/ Agreements (Complex Structure)

However existing structure is complex and has high transaction costs.

For ERs, new rules may have to be added. Question is whether these be handled within existing machinery or a new institution is needed (e.g. independent CDM authority)

5 CONTRACT RISKS

Country risks associated with Project in general are applicable

- Legal Risks

- Regulatory Risks
- Political and Social Risks
- Administrative / Bureaucratic Risks
- Missing dimensions of rule of law

6 Additional Legal Risk for ERs

Country risks associated with Project in general are applicable ERs bring additional risks:

- Baseline
  - Dynamic Baseline
  - Altered Operating Conditions (AEC Case study)
- ER Price

7 AEC Case

- Ahmedabad Electricity Company (AEC), a coal based power company, started a 200 MW gas based plant in1997
  - In 2000, gas supply dried up (weak-contract, gas monopoly)
  - Shifted to oil as a fuel in 2000
  - Recent oil price rise has inflated electricity generation cost
  - AEC is unable to get the higher electricity price from GERC
  - Since past 2 months, AEC gas/oil plant is inoperative
- Risk is transferred from weak gas contract and electricity price regulation
- What happens to ERs if this was a CDM project?

8 DPC: Project Agreements Structure

9 How to make the contracts robust to ensure tradable rights?

- Clauses for dispute resolution
  - Clear ER Ownership definition (legal entitlement)
  - International arbitration (high transaction costs/ more confidence)
  - Host country dispute settlement (low cost/ low confidence due to weak legal regime/ delays)
- Size of project matters
  - Large project can have international arbitration
  - For Small projects, robust host country mechanism would help

10 Conclusions

- Project operates within the domestic jurisdiction, therefore all the dynamics of the domestic regime will influence ERs
- Domestic legal regimes need to establish explicit laws/ rules/ institutions/ authorities to recognize ERs legally.
- International regime needs to take into account the diversity of domestic legal systems
- Harmonization of international and domestic legal regimes apart, the near-term the effectiveness of ERs and ER transactions can best be achieved by overcoming barriers by contracting and arbitration processes

Technical Session 4
Project Development

Chairperson

P.R. Shukla

Professor, IIM Ahmedabad

CDM Project Cycle

Aditi Dass

Senior Program Officer, Climate Change Program

Winrock International India

CDM: Project Development

Joyashree Roy

Professor of Economics and Co-ordinator, Global Change Programme

Jadavpur University, Kolkata

Biofuels - A Global Overview, Benefits and Potential CDM Opportunities

Jai Uppal

Advisor - Renewable Energy, Winrock International India

CDM Project Cycle

Aditi Dass
Senior Program Officer, Winrock International India

ADITI DASS is working at Winrock International India, Climate Change Unit. She has been working on global and local environmental issues for over 10 years in research/ academic institutions, private organizations, NGOs and the government, focusing extensively on urban transport, energy and environmental aspects & policies and climate change issues. She was with the Asian Institute of Technology (AIT) Bangkok, prior to joining WII. She holds a master's degree in Planning (with specialization in transportation planning). In her presentation, she covered the CDM project cycle.

1 Outline

- Overview – Climate Change
- What is CDM
- CDM Eligibility Criteria
- CDM Project Cycle
- Typical Renewable Energy CDM Projects submitted to UNFCCC
- CDM activities at Winrock International India

2 World Response to Climate Change

- UNFCC signed at Rio in 1992
- Parties to Convention meet every year to review the progress on implementation - Conference of Parties (COP)
- Kyoto Protocol - Signed at Kyoto, Japan in 1997 (COP-3) - Reduction of emissions by developed countries

3 Clean Development Mechanism (CDM)

- Adopted in Kyoto in COP-3, 1997
- Two main purposes
  - Assist Annex I Parties in achieving compliance with their quantified emission reduction commitments under the protocol
  - To assist developing country parties in achieving sustainable development
- Rules agreed
  - Projects starting in 2000 & later are eligible to earn CERs
  - Should lead to real, measurable and long term GHG reductions which are additional to any that would occur in absence of the CDM project

4 CDM Project: Steps Involved

- Project Identification
- Project Idea Note (PIN)
- Government Endorsement
- Project Development
- Validation
- Registration
- Monitoring
- Verification
- Certification
- Issuance of CERs

5 Eligibility Criteria

- Additionality
- Project should not be a baseline case (BAU)
- Reduction in emissions that are additional to any that would occur in the absence of the certified project activity (Article 12.5c)
- Meets host country sustainable development criteria
- Project activity initiated after Jan 01 2000
- Special provisions for small-scale CDM projects

6 Eligible Sectors

- Energy/Renewable Energy
- Industrial Process
- Waste
- Forestry
- Nuclear Energy - Discouraged

7 Eligible Projects

- Energy
  - Renewables - Wind; Solar; biomass; hydro; geothermal
  - Power Generation - Combined Cycle turbines; distributive networks; clean coal technology
  - Fuel Switching - Natural gas; methane; biomass and biogas; hydrogen
  - Cogeneration - Sugarcane; chemical byproducts
- Household
  - Conservation - Lighting, solar water heaters, efficient equipment
- Industry
  - Efficiency - Boilers; motors; lighting
  - Cogeneration - chemical; paper; metallurgy; oil refining
  - Retrofits
  - Production process
  - Waste Fuel Recovery - Including Landfills
- Transportation
  - Alternative Fuel Vehicles
  - Mass transit systems

8 GOI Approval Criteria

- Purpose – two fold
- Eligibility
- Additionality (Emission, Financial & Technical)
- Sustainable Development Indicators
- Social, Economic, Environmental & Technological well-being
- Baseline
- Transparent methodology, system boundaries, project lifetime
- Financial Indicators
- Flow of additional investment, IRR with & without CERs, MoU/agreements with stakeholders, Funding available etc
- Technological Feasibility – New / Improved / Innovative
- Risk Analysis – Carbon Risk / Country Risk / Regulatory Risk
- Credentials

9 Project Development

- Project Design Document
  - Baseline Design
  - Monitoring and Verification Protocol
  - Local Stakeholder Consultations
- Identification / Negotiation with Buyer of ERs
  - Unilateral CDM
- Finalization of Contracts – signing of the ERPA

10 Validation Designated Operational Entity (DOE)

- A DOE under the CDM:
  - is either a domestic legal entity or an international organization accredited/ designated by EB
  - Validates and subsequently requests EB for registration
  - Until today, the CDM EB has not accredited and recommended for designation of any Indian entity.
  - EB is in the process of considering applications which are regionally distributed

11 CDM Project Registration

- Registration is the formal acceptance by EB of a validated project as a CDM project activity
- Registration is the prerequisite for verification, certification and issuance of CERs
- Process: DOE shall
  - Submit CDM Project Activity Registration Form alongwith
    - CDM-PDD
    - Approval of host party
  - Pay Registration Fee
- The Registration
  - Registration by EB shall be deemed final 8 weeks after the date of receipt of request for registration unless there is a request for review

12 Registration Fees

Average tonnes of CO_2 equivalent reductions/year over the crediting period (estimated/approved)	US $ (*)
< = 15,000	5,000
>15,000 and < = 50,000	10,000
>50,000 and < = 100,000	15,000
> 100,000 and < = 200,000	20,000
> 200,000	30,000

13 Monitoring and Verification Designated Operational Entity (DOE)

- A DOE under the CDM:
  - Verifies emission reductions
  - Certifies and
  - Requests EB for issuance of CERs
- For Small Scale CDM Projects, the DoE agency entrusted with the task of validating the project can execute the Monitoring Plan and Project Verification

14 Certification and Issuance of CERs

- Certification by the CDM Executive Board on the basis of verification report
- This is followed by the issuance of the CERs to the project applicant entity/ies
- This step is repeated after every round of submission of verification report

15 CDM – Operational Management

- Conference of Parties (COP)
  - Overall guiding body
    - Designation of operational entities
    - Guidance on rules and procedures
    - Geographically equitable distribution
- Executive Board (EB)
  - Management of CDM
    - Reviewing, suggesting and detailing modalities and procedures for CDM
    - Frame criteria for developing and selecting projects
    - Appoint operational entities to validate projects
    - Verify and certify CERs generated through an approved project
    - Maintain the registry for CDM projects and related information
- Designated Operational Entities
  - Implementation
    - Validation
    - Verification
    - Certification

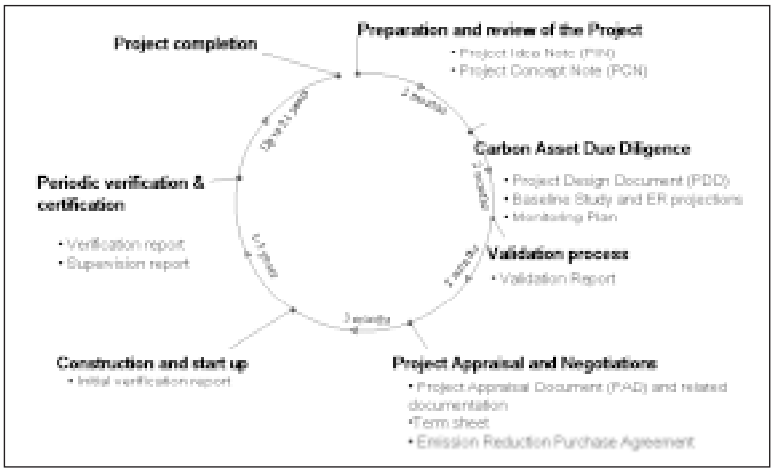
16 CDM Terminology

- Project Host
  - Entity in the developing country that promotes the project
    - Can propose the project either individually or in partnership with a developed country party entity
    - The project host and developed country entity could either be a private entity, a public sector entity or a government organization.
- Participating Country
  - Country participating in the CDM
    - Should have ratified Kyoto Protocol
- CDM Authority
  - Authority in the participating country
    - To be designated by the participating country
- Measurable Reductions
  - Monitoring
    - Any proposed project should have built into it a monitoring plan that would provide information for estimating emission reductions during the course of project operations

17 Small-scale projects

- Categories:
  - Renewable Energy Project activities with a maximum output capacity equivalent of up to 15 MW
  - Energy Efficiency improvement project activities which reduce energy consumption, on the supply and /or demand side by up to equivalent of 15 GWh/annum
  - Other project activity that both reduce anthropogenic emissions by sources and that directly emits less than 15 kilotonnes of CO_2 equivalent annually.

18 CDM Project Cycle - The Documentation



19 Small-Scale Project Guidelines

A simplified Baseline Methodology can be used if project participants are able to demonstrate that the project activity would not otherwise be implemented due to existence of one or more of the following barriers:

- Investment barrier
- Technology Barrier
- Barrier due to prevailing practice
- Other barriers
  - institutional barrier or limited information
  - organization capacity
  - capacity to absorb new technology
  - financial or managerial resources

20 Some Examples of Renewable Energy Projects submitted to UNFCCC

- TA Sugars co-generation and fuel switch project - capacity augmentation component – Tamil Nadu, 4 Plants, Capacity: 6MW-13MW (WII)
- 18 MW Biomass Power Project in Tamilnadu, India
- Colombia: Jepirachi Windpower Project – Uribia Region, Colombia, Capacity: 19.5 MW
- El Gallo Hydroelectric Project – Guerrero Region, Mexico, Capacity: 30 MW
- A.T. Biopower rice husk power project - Pichit province, North of Bangkok, Capacity: 22MW
- Wigton wind farm project – Jamaica, Capacity: 20.7 MW

21 Present Scenario

- India, Brazil, China, Costa Rica and Philippines are market leaders in supplying CDM projects.
- Market dominated by gas capture / removal of biomethanation projects, renewable energy projects and fuel switch projects.
- About 15 Indian projects have entered the CDM project cycle.
- Indian projects represent approximately 30% of the global CDM market
- Not a single project yet registered by EB

22 Climate Change Unit: Winrock International India

- Policy Support
  - Indian National Communications on CC
- CDM Facilitation Services for Buyers and Sellers
- Capacity Building though workshops/Conferences
- Vulnerability and Adaptation Issues

23 CDM Project Pipeline

- Prototype Carbon Fund
  - Cogeneration
  - Waste to Energy
- Baselines for small-scale RE projects
  - Wind - CERUPT
- Rabo India Finance
  - Wind, Cement
- UNDP - GEF
  - Biomethanation

24 CDM Projects at WII

- Cogeneration
  - TA Sugars
- Waste to Energy
  - EDL India (14.85 MW at Chennai)
- Wind
  - Vestas RRB India (14.45 MW)
- Biomethanation
  - 6 projects (paper and pulp, tannery, MSW)

25 CDM Project on Wind 14.45 MW Wind Power Project

- Project Developer: Vestas RRB India Ltd.
- Buyer: Senter International, The Hague
- Location: Rameswaram, Tamil Nadu, India
- Project Details:
  - Small Scale (Type I D) project category (as per decision 17/CP.7, paragraph 6 (c) (i) of the UNFCCC)
  - 17 Nos. Vestas type V52-850 kW Wind Electric Generators (WEG)
  - produce 41.18 million kWh of 'green' power per year
  - first CER delivery proposed in January 2006 for year 2005
  - Weighted average emissions of current generation mix (2003): 0.79 kg CO_2 equ/kWh.
  - Annual power generation: 41.18 million kWh
  - Annual emission reduction: 32.49 thousand tonnes of CO_2/year
  - Total projected emission reduction: 324.9 thousands tons CO_2 for the credit period of 10 years (2005-2014)
  - The project lifetime is 20 years and the crediting period agreed between the developer and the financier is fixed crediting period for 10 years
- Project Additionality:
  - Since the project do not intend to access government financial incentives and funds, this can qualify as additional.
  - Project cost of generating electricity from wind is higher than that for the least cost option of coal. The annualized cost of power generation for a 100 MW coal plant Rs 2.21 per kWh, whereas the cost of electricity production from the proposed project is Rs 2.70 per kWh.
  - Power generation mix in Tamil Nadu is mostly thermal (86%) due to higher capacity utilization of thermal plants resulting in substantial GHG emission. Whereas, the wind project will lead to zero GHG emission thereby proving additionality.
  - advanced Vestas type V52-850 kW WEG technology is used instead of 225/250 KW – technical additionality.

CDM: Project Development

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JOYASHREE ROY is the Professor of Economics and coordinator of Global Change Programme of Jadavpur University (JU), Kolkata. She has a teaching and research experience of 21 years in Resource and Environmental Economics. Her research covers non-renewables to renewable resources, national to international and urban to rural problems. The bias is more towards econometric model building, statistical analysis especially for deriving policy implication for developing countries with special reference to the Indian economy. She explained the baseline setting process for new solar power plants under CDM.

1 Steps and Institutions

- Project Development, design, financing
  - (national govt.,, project developers, NGOs, development banks,other investors)
- Validation and Registration of Project
  - Independent third party, CDM/EC
- Project Monitoring
  - Project operators
- Verification, Certification and Issuance of Credits
  - Independent third parties and CDM EC

2 Project Development, design, financing

- Identify
- Feasibility
- Baseline
- Finance
- Approval
- Sustainability Goal of Host

3 Issues in preparation of Baseline

- BAU, happening in ER power sector (anyway) without project.
- Backward or forward looking
  - Observable vs. unobservable
- Credit if better than BAU

4 Alternative approaches to baseline construction

- Aggregate sectoral trends in past some years, or a decade
- Average of generation by fuel type
  - coal, oil, hydro, nuclear
- Specific to generation companies, i.e., by ownership type
- Project-specific

5 Multi-Project Baselines for Power Sector in the Eastern Region of India

Prepared in collaboration with LBNL, USA

6 Eastern Region

- States of West Bengal, Orissa, and Bihar
- Power grid includes: Private and Public Sector Units, and those of Public Sector Companies

7 Overview

- Total installed capacity: 16,973 MW.
- 29% is government owned — 4945 MW
- 57% is shared by six public sector undertakings (DVC, GRIDCO, NTPC, CHPC, NHPC), and
- 14 % owned by a private company (CESC)
- Power is generated using coal , oil and hydro as a primary resource
- Capacity:
  - Thermal : 14211 MW (82%)
  - Hydroelectric: 2567 MW (15%)
  - Gas turbine (Liquid fuel): 195 MW (1.1%)
  - 7 MW is by renewables

8 Future Power Grid Plans

- To increase efficiency, generation. safety, reliability and reduction in pollution.
- Renovation, and refurbishment of old plants
- Introduction of new technology to increase plant lifetimes
- Energy audits
- Adoption of new hydro projects
- Mega power projects to serve more than one state to be supported by power purchase security through the Power Trading Corporation
- Encourage private sector investment

9 Multi-project Emissions Factors

- (a) A weighted average,
- (b) 25th percentile,
- (c) 10th percentile or
- (d) the best plant.
- The above alternatives will have declining carbon intensity. CDM projects will have to demonstrate lower carbon intensity than selected baseline.

10 Energy and Carbon Intensity of Recent past base lines

			Average	Weighted Average	Percentile 25%	Percentile 10%	Best Plant
All fossil	Energy intensity	MJ/k Wh	15.89	13.84	9.39	8.43	8.43
	Carbon	Kg C/kWh	0.390	0.345	0.241	0.217	0.217
Sector wide	Carbon intensity	Kg C/kWh	0.280	0.341	0.228	0.192	0.000

11 Key characteristics of potential CDM projects

	Project I	Project II	Project III	Project IV	Renewable
Capacity [MW]	500	1000	1020	1710	6
Annual generation [TWh]	3.504	6.132	4.468	7.490	0.006
Annual fuel use [GJ]					
Coal	29,852,328	52,241,574			
Oil	783,137	1,370,489			
Carbon intensity [kg C / kWh]	0.220	0.220	0.000	0.000	0.000

12 Performance of CDM Projects

Carbon reductions by project based on recent past baseline [kilotons C/yr]

	Baseline standard	Project I	Project II	Project III	Project IV	Renewable
All fossil	Weighted average	440	770	1,543	2,587	2
	25th percentile	73	129	1,076	1,803	1
	10th percentile	none	none	967	1,622	1
	Best plant	none	none	967	1,622	1
Sector wide	Weighted average	426	746	1,526	2,558	2
	25th percentile	27	47	1,016	1,704	1
	10th percentile	none	none	859	1,441	1
	Best plant	none	none	none	none	none

13 Results

- plants that have come up over last six years are taken to reflect 'what would have happened anyway'.
- four scenarios
- Carbon intensity represents the Multi-Project Baselines

14 CDM projects and Potentialities

We demonstrate performance of five projects (projects proposed for the Eastern region in the Tenth Plan period (2003-2008)) relative to baseline.

The potential CDM Projects do generate carbon credits

Thermal units generate less credits as expected than the Hydro projects.

The Hydro projects look good even to the Best fossil plants. But the thermal projects do not look better than the Best plants under all fossil scenario. If we take a sector wide baseline then the thermal plants are comparable to only two scenarios: weighted average and the 25th percentile

15 Reasons for Worry

16 CDM Mechanism: Why?

Economic tool to achieve efficiency and cooperation

- Least cost solution for Annex I (incentive for co-operation).
- Technology transfer from developed countries to the developing countries (incentive for co-operation) earns revenue from CER

Net value addition : Cleaner growth path due to 'carbon reduction potential' (incentive for all)

17 Objectives

- Annex I compliance: cheaper option
- Should be additional: to avoid free riding
- Should bring real benefit to the climate
- Should address sustainability
  - National objective:
    - Net welfare gain: subsidy removal programme must be matched by similar balancing flow through poverty alleviation/ employment generation etc..
    - Generation of investment fund

18 India's Options

- CDM
  - Gain and loss of annex I is clear –CER and CER price
  - Gain and loss to Annex II unclear- 'additionality', low price now vs uncertain price in future (what happens beyond 2012??)

  Question of equity
- Caveat
  - Price for carbon trading?
    - With developed countries as buyers and developing countries as sellers in this hypothetical market, price is indeterminate.
    - Floor price is $2-3 per ton of carbon and the ceiling is $100-300. The actual price would depend finally on bargaining strength of either block. Developing countries can increase their bargaining strength by remaining united.

19 Additionality (climate): caution

- Easily forgotten vital parameter:developing country specificities
- Explanation follows with an example

20 Case of Small Projects

- Rural solar domestic lighting project in the villages of West Bengal

21 Source of Wrong Calculation

- Energy efficiency programme in developing countries with supply constraint

- Unmet demand: demand-supply gap generate huge positive 'rebound effect'
- Rebound if ignored leads to over estimation of climate benefit, underestimation of social cost, wrong baseline calculation and CER

22 Rebound effect : Implication

- Adoption of energy efficient technology as win-win option
- Final impact depend on rebound effect:

■ Rebound mechanism:

23 WITH AND WITHOUT THE VITAL PARAMETER

■ Without rebound
■ Energy saved 100%
■ Take back 0%
■ Effective savings 100% to be credited
■ With rebound (50%)
■ Energy saved 100%
■ Take back 50%
■ Effective savings 50% which can be credited

24 FUEL SWITCHING PROGRAMME: EXAMPLE

■ Current
  - technology: kerosene lamps
  - consumption: lighting service for 2 hours
  - Fuel: 2.5 litres of kerosene per week per household

■ Programme: solar PV
  - Consumption: Lighting service for 2 hours
  - Target: to reduce fuel consumption to zero

- CDM credit: reduction of emission from 2.5 litres of kerosene

25 ACTUAL SCENARIO

■ New
  - Technology: solar PV
  - Consumption: lighting service for 4 hours
  - Fuel saving: 0.5-1.5 litres per week per household

■ Real climate benefit: reduction of emissions from 1.5 (with rebound) litres per week and not 2.5 litres (without rebound)

26 INDIA'S OPTIONS

200% of rebound is valid for 76.89 % of the households in India

Implies huge potential for increase in future demand with any policy towards technical efficiency improvement.

27 WELFARE IMPLICATION

■ Another related question with new technology:
■ Removal of subsidy
■ Welfare loss for the consumer
■ Compensation needed to maintain them at the same welfare level: may be done through various market instruments labour income, cross subsidisation of set up cost, loanable funds etc.
■ Need for investment/subsidy/development fund tied up with these projects.

28 IMPLICATION FOR PRICE

■ These projects should generate such funds:
■ CER fund
■ Price too low to generate the necessary fund after meeting the project cost.
■ Unless prices are high CDM imposes indirect cost on the society by way of welfare loss of the poorer section.

29 WHAT NEXT?

■ Carbon market is bound to emerge
■ Cooperation must succeed
■ "Visible", "Certain" incentive structure needs to be worked out

Kyoto or "?" will evolve through capacity building

30 INDIA'S STRATEGIES

■ Participation in CDM can bring in moderate investible funds in India
■ Steps in project development needs to continue **Simultaneously and definitely**

India should bargain for higher carbon price under CDM for participation and need to strengthen cooperation among developing countries for a successful bargaining strategy.

31 RELEVANT PUBLICATIONS

■ Sathaye, J, Scott Murtishaw, and Lynn Price, Maurice Lefranc, **Joyashree Roy,** Harald Winkler, Randall Spalding-Fecher, (2003), Multiproject Baselines for Evaluation of Electric Power Projects. *Energy Policy, Vol 32/11 pp 1303-1317.*
■ **Roy, Joyashree**, S Das, Jayant Sathaye, Lynn Price, (2003) Estimating Baselines for CDM Case of Eastern Regional Power Grid in India. *Environmental Economics and Policy Studies* (Forthcoming)

- Dasgupta, Mitali and **Joyashree Roy** (2001) Estimation and Analysis of Carbon dioxide Emissions from Energy Intensive Manufacturing Industries in India. International *Journal of Energy, Environment and Economics* , Vol 11,no 3,pp 165-179.
- Dasgupta, M and **Joyashree Roy** (2000), Manufacturing Energy Use in India: A Decomposition Analysis, *Asian Journal of Energy and Environment,* September Vol. 1, No3.
- **Roy, Joyashree** (2000), Rebound Effect: Some empirical evidence from India, *EnergyPolicy*, 28, pp 433-438.
- **Roy Joyashree** and S.Jana (1998) "Solar Lanterns for Rural Households", Energy-the International Journal, vol.23, no.1, pp 67-68.
- **Roy Joyashree** and S. Gupta (1996), "Cost of Oil Based Decentralised Power Generation in India - Scope for SPV Technology", Solar Energy,vol.57, No 3:pp 231-237.
- **Roy, Joyashree** and S. Das (2003), Clean Development Mechanism: Challenge for Indian Power Sector in Climate Change –ed. P Bhattacharyya and Sugata Hazra, Oxford University Press.
- Dasgupta Mitali and **Joyashree Roy** (2002), "Energy Consumption in India: an Indicator Analysis", COP 8: Issue of News letter of Development Alternatives , October, pp 12-13.
- Das Gupta M and **J Roy** (2001), "Understanding Changes in Energy Consumption by Energy Intensive Manufacturing Industries in India", Staff paper, CSO. Government of India.
- **Roy Joyashree** (1997), "Socio economic Evaluation of the Solar Lantern Programme in rural India", SESI Journal.

32 EFFORTS AT JU

- Kinds of research efforts at Jadavpur university under the "Global Change Programme":
- Inventorisation of GHGs :Emission measurement to come up with correct estimates of India's contribution to climate change.
- Impact and Vulnerability assessment along with adaptation strategy designing in climate sensitive ecosystems like coastal areas.
- Hydrological model formulation to understand region specific impact of climate change
- Modelling and analysis of
- India's socio-economic scenarios under alternative policies of carbon tax, permits.
- Understanding of Implications for CDM Option for Power sector in India.
- Gain/loss of human welfare due to climate related water stress in South Asia, India.
- Energy - Economic Modelling to provide empirical support for Integrated

Assessment Models of global and regional scale.

BIOFUELS - A GLOBAL OVERVIEW, BENEFITS AND POTENTIAL CDM OPPORTUNITIES

JAI UPPAL
Advisor - Renewable Energy, Winrock International India

JAI UPPAL specializes in biomass research and utilization in industry and as a transport fuel. In his 30 years of experience, he has worked in the areas of design and fabrication of process plants and equipment, joint ventures, project conceptualization, diversification, and project financing and implementation. He is a Fellow of the Institution of Engineers and Past Chairman of the Indian Institute of Chemical Engineers (Northern Regional Centre). He holds a bachelor's degree in Chemical Engineering from the Institute of Technology, Banaras Hindu University, and a master's in Chemical Engineering from the University of Michigan. He is working at Winrock International India as Adviser, Renewable Energy. He explained energy from bio-fuels and potential of bio-fuel plantation projects for CDM.

1 WII - BIOFUELS ACTIVITIES:

- Publication of Biofuels India (earlier Ethanol Newsletter)
- Launched India Ethanol Coalition - Feb 2000
- Conducted study tours to Brazil & USA
- Organised visit by Brazilian & USA Delegation to visit India
- Conducted Annual Seminars on Ethanol/Biofuels
- Organised Roundtable With UNDP on Ethanol
- Reports such as Techno –Commercial, Feasibility, Detailed Project & Policy etc. (Funding of Ethanol Projects for IREDA)
- Advisory/consultancy services including setting of Projects in Ethanol,TBO Plantations, Biodiesel, Biomass, Bioenergy and other renewable fuels (GMR Ltd, Dr Vikhe Patil SSK Ltd)
- Promotion of Projects such as Biodiesel Project of Naturol etc.
- Energy Efficiency studies, water utilization, pollution control

2 BIOFUELS - INTRODUCTION

- Liquid Biofuels:
- Ethanol
- Biodiesel/Straight vegetable oils
- Fuels derived from pyrolysis of biomass.
- At present first two are major biofuels

3 GLOBAL OVERVIEW

- Long term operational experience:
  - Up to EP 25 no problems in Brazil only Engine tuning
  - +E25-100 requires engine modification and significant reduction in mileage
  - Up to ED 15 with hydrated alcohol & emulsifier no problems in trials in buses in Australia and Sweden.
  - B20 no problems, no engine modifications in Europe, USA etc.
  - B100 no problems widely used in Europe but USA standards do not permit above B20.
  - Warranty issue yet to be addressed in USA

4 GLOBAL OVERVIEW - ETHANOL

- Consumption of Ethanol in Brazil + 11 bill L per year (20-25% blend and neat - 100%)
- Consumption of Ethanol in USA - 10 bill L per year (mainly 10% blend but +85% also)
- Canada – 200 mill L,
- France – 120 mill L (ETBE),
- Spain – 100 mill L
- Sweden – 60 Mill L, Poland etc

5 GLOBAL OVERVIEW - BIODIESEL

- German Capacity + 1 mill Tonnes (1.25 bill L per year) Consumption - +600 mill L

- France Capacity +500 mill Tonnes
- Italy, Belgium, Austria, Sweden
- Australia, Malaysia, Indonesia
- Africa – Mali, Zambia, Kenya etc.
- Brazil

6 Indian Ethanol Experience

- India had a flourishing sugar industry & its byproduct, molasses, was used for manufacture of potable alcohol, animal feed etc or was discharged in water stream causing acute pollution problems.
- The Indian Ethanol Program started during World War II - there was a shortage of petrol (gasoline) & 'Power Alcohol' was encouraged by the British.
- A large number of new units were set up in the mid 40s to manufacture Ethanol using Azeotropic distillation - particularly in the state of Uttar Pradesh.
- The program died after World War II because of cheap availability of petrol and probably because oil companies were not interested in blending.
- These units converted to potable alcohol and/or supply of alcohol for various applications including Alcohol based chemical (ABC) units which came up in the 60s.
- The 'Oil Shock' of mid 70s saw a revival of interest in Ethanol. Successful trials in 1979 - IOC/IIP on 15 cars found Ethanol (10% & 20% blends) suitable
- Large number of Univs. conducted engine trials.
- Since 1977 - 6 technical committees & 4 study groups have examined this issue – no action !
- 1986 onwards R&D demonstration projects supported by Ministry of Non Conventional Energy Sources.
- Ethanol/methanol (3%)diesel in buses & successful field trials with E5/10 blends using 93vehicles, in Delhi (93-95). 1.8 million kms without operational problems & comparable efficiency.
- Support for the program gained momentum from mid 1990s
- Power Alcohol Committee of Secretaries GOI was set up in 1997.
- WII - The India Ethanol Coalition (Feb 2000) during first Ethanol Seminar in 2000, Roundtable Meeting (with UNDP)in July 2001 & yearly Conference thereafter. 2003 named "Biofuels – Progress, Policies & Prospects.
- Qtly Ethanol Newsletter since July 2001 named Biofuels India Newsletter (March 2003) –only one of its kind.

7 Indian Policy Initiatives

- Finally (April 2001) 3 successful Pilot Projects using E5 – 2 Maharashtra & 1 UP – mixing at oil depots and supply to nearly 300 petrol pumps with supply from U.P. – 1500km
- Announcement of December 10, 2001
  - Policy announced to blend 5% ethanol with petrol
  - Inter Ministerial Task Force constituted
  - Rs 4 Cr.(US$ 1 Mill.) for R&D on Ethanol diesel blends
  - Amend Sugar Development Act for financing Ethanol
- Announcement of March 20, 2002
  - A Technical Committee Report - Ethanol most appropriate oxygenate for India
- Auto fuel Policy of August 2002
- " The development of technologies for producing ethanol and bio-fuels from different renewable sources can play a major role in commercialization of bio-fuels vehicle in the country, which should be encouraged by providing R&D & other support through suitable fiscal incentive."
- September 13, 2002 Notification making 5% Ethanol blending in gasoline mandatory in 9 States (Sugar producing States)& 4 UTs by January1, 2003 - a notice period of just 3.5 months.
- Amendment to the Sugar Development Fund to enable access to fund for producing Ethanol from Alcohol at interest rate of 6% - 2002.
- Budget of Feb 2002 -Excise duty concession of Rs 0.75 per litre (detaxation of green Fuels) passed by parliament but not notified.
- Reduced to Rs 0.30/L after nearly 6/7 months valid till Feb 28, 2003

- Budget of Feb 2003 -Excise duty concession of Rs 0.30 per litre valid till Feb 29, 2004

8 Present Status

- Nearly 300 units with total installed Alcohol capacity is 3.2 billion L with 40% to 45% utilization before Ethanol was introduced. Main use of alcohol was Potable and ABC. The health of independent alcohol units was not good.
- Substantial Progress made - nearly 750 mill L Ethanol capacity built up in little more than one year after notification.

9 Ethanol Potential

- Positive Picture: Production of 300 mill T sugarcane, 20 mill T sugar, 350 MW power to grid, 3 bill L of Alcohol & 500 mill L of Ethanol capacity despite problems - draught, Politics, Red tape & ongoing efforts of detractors !
- Sugar cane from 4 mill Hctr – just 4% of cultivated land.
- Sugar Production record – 3 to 4 mill T excess – This year may be a different year - draught
- Glut in sugar prices & Mills running at a loss!
- Excess sugar can be used to produce 3 billion L of Ethanol for India & world market.

10 Petroleum & Transport Status

- Indian Scenario:
  - Petroleum Products/crude oil Consumption 100 mill T & growing at 5 -7%
  - Import component 2/3rd & domestic crude oil production stagnating for the last 15 years except Natural gas
  - Gasoline consumption 8 million T & growing at +7%
  - Diesel consumption 40 million T growing at <5%
  - Vehicle population about 50 mill growing at + 7%
  - Sales of two-wheelers – about 75% of vehicles.
  - Petroleum sector largely Govt controlled, Auto in Pvt. Sector

11 Biofuels Benefits

- Decentralized form of energy
- Enhance Rural Employment & rural development
- Provide energy security
- Reduce vulnerability to oil supply disruptions
- Potential for use of wastelands and combating desertification & greening of landmass
- Additional benefits of BD:
  - Low in sulfur content and high in lubricity
  - Ultra Low sulfur diesel is poor in lubricity thus biodiesel provides unique synergy as a blend.
  - Degraded lands and low rainfall regions can be used to grow TBOs plantations & provide rural employment
  - Reduces net CO_2 emissions by 78.45% compared to petro-diesel
  - 3.24 units of energy yield for every unit of energy used in production of Biodiesel
  - Polycyclic aromatic Hydrocarbon (PAH) reduced to the extent of 75% to 85%
  - Use of B100 in urban buses reduces life cycle emissions of PM by 32%, CO by 35% and SOx by 8% compared to petro-diesel
  - Overall ozone forming potential of BD is 50% less than PD
  - High flash point & good caloric value
  - High Cetane Number
  - Readily Biodegradable
- Major technical issues :
  - Shelf life
  - Compatible elastomer required
  - Possible corrosion problems
  - Disposal of glycerol

12 Table for reduction of Emissions

Emission	B100	B20
Carbon Monoxide	-47%	-12%
Hydrocarbon	-67%	-20%
Particulates	-48%	-12%
Nitrogen Oxides	+10%	+2%
Air toxics	-60%-90%	-12%-20%

13 Ethanol Benefits

- Additional benefits of Ethanol:
  - Uses molasses which is readily available & waste by product of sugar production
  - Diversifies the Sugar industry as there is an huge excess of sugar production in the country leading to a glut.
  - Potential of use of sugar cane, sweet sorghum, rotten and damaged grain.
  - Improves Octane Number
  - Replaces harmful Oxygenates such as MTBE
  - High Oxygen content – half the quantity required when compared to MTBE.

14 Ethanol – Issues

- Technical issues:
  - Increases RVP of blend
  - Has lower Calorific value – 3% less theoretical energy content (almost same as MTBE) for E10 but practically no change in 'mileage' up to 10%
  - Precautions required to be taken to avoid ingress of water to avoid phase separation.
  - Imaginary problems: cold start, vapour lock, pick up of moisture from atmosphere, corrosion, aldehydes.

15 Reduction of Emissions

Emissions	For E10-E100
Carbon monoxide	-10%-40%
HC	-5%-17%
SO_2	Up to –80%
CO_2	50 to 100%
Lead	Eliminated
NOx	+1%

16 Biofuels Potential in India

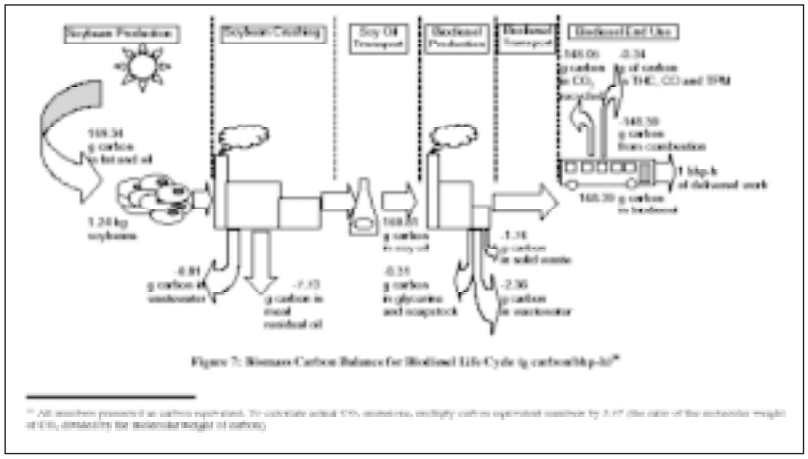
The future of biofuels industry is bright with a huge potential that can be tapped by 2012:

- Ethanol:
  - 4 mill tonnes per year of excess sugar can be used to produce 3 bill L of Ethanol for India
  - India has more than 40 mill tonnes of grain stocks. 4 mill tonnes of grains can produce 1.5 bill L of Ethanol per year.
  - Sugar occupies less than 4% cultivable land
  - Once Biomass to Ethanol is commercialized it can become a source of almost limitless source of Biofuels.
  - Ethanol with a consumption of 4000 million litres can have a retail turn over of Rs 140,000 million per year
  - Export Potential of 3 to 4 bill L.
  - Total Potential of Ethanol – 10 bill. L
- BIODIESEL:
  - 8 to12 mill Ha of degraded lands can provide Biodiesel for 20% blend (12 mill Tonnes per year).
  - Biodiesel with a potential consumption of 15000 million litres can have a retail turn over of more than Rs 330, 000 million per year.
  - It can provide huge rural employment potential of 40 to 50 million families and transform the rural economy

17 Life Cycle Overview- Biodiesel & Petrodiesel

- Life Cycle Consumption of petroleum reduced by 95% if Biodiesel is used in buses.
- "Biodiesel yields 3.2 units of fuel product energy for every unit of fossil energy consumed in its life cycle."
- "Biodiesel reduces net CO_2 emissions by 78.45% compared to petroleum diesel"
- Biodiesel in urban busses reduces life cycle emissions of total PM by 32%, CO by 35%, Sox by 8% compared to petroleum diesel but increases NOx life cycle emissions by 13.35%
- Major BD Life Cycle operations include:
- Production of seeds, Transportation of seeds, Oil extraction,conversion to BD, Transportation of BD, Use in bus
- Major PD Life Cycle operations includes:
- extraction from wells,Transportation, Refining, Transportation of diesel, Use in bus
- Same Geographical Boundaries
- Same Time Frame
- Same basis – Engine & bus parameters
- Assumptions

18 LIFE CYCLE OVERVIEW- BIODIESEL & PETRODIESEL



- Total Life Cycle Fossil CO_2 (gm per BHP-Hr) :
- Petro Diesel – 633.28
- Biodiesel – 136.45
- We therefore get a net reduction of 78.45% reduction of CO_2 emissions in BD as compared to PD in life cycle.
- We can therefore use this for calculations for Buses using 100% BD and proportionate reduction for various blends after estimating replacement of Petro-diesel by biodiesel.

19 POTENTIAL EARNING THRU CERS

- 1 kg of Petro-diesel releases 3.2 Kg of Carbon dioxide
- The use of Biodiesel therefore gives a reduction of 2.51Kg of CO_2
- For production of 100,000 tonnes per year of BD the CO_2 reduction works out to be 251,000 tonnes.
- At a price of CER of US$ 5 per tonne of CO_2 potential earning of US$1.25 mill per year
- For 10 mill tonnes – earning potential for India by the year US$ 125 million (Rs 565 Cr.)

20 CONCLUSIONS

- The potential of Biofuels is tremendous
- The Program should go forward with clear policy from GOI and State Governments.
- Winrock is committed to promoting the Program & individual Projects by Entrepreneurs
- Winrock is ready & willing to assist you by undertaking any assignment in CDM area in Biofuels

Technical Session 4 (contd)
CDM Project Development

Chairperson

Subir Nathak
MD, Market Dynamics Ltd.

Sugar Cogeneration and Fuel Switch Project

Dhirendra Kumar
Program Officer, Winrock International India

Micro Hydro Power and CDM

V. Ramasubramanian
Managing Director, Sahyadri Energy Systems Private Limited
Bangalore

SUGAR COGENERATION AND FUEL SWITCH PROJECT

DHIRENDRA KUMAR
Program Officer, Winrock International India

DHIRENDRA KUMAR is a Program Officer in Climate Change Program at Winrock International India. He has been working on global and local environmental issues for over seven years in government and non-government organizations. Dhirendra holds a master's degree in Environmental Engineering (with specialization in industrial pollution prevention and control) and bachelors in Civil Engineering. He explained the process of formulating the Project Design Document by WII in case of a sugar cogeneration plant. This PDD was submitted to the Methodology Panel of the UNFCCC.

1 PROJECT DEVELOPER

Thiru Arooran Sugars Ltd
Eldorado, 5th floor
112 Nungambakkam High Road
Chennai 600 034
Tel: 0091-44-8270636
Fax: 0091-44-8284961
e-mail: rvt@tasugars.com

2 PROJECT DESCRIPTION...

- Thiru Arooran Sugars Group (TASG) own and operate four sugar plants located at Tirumandankudi (TMK-I and TMK-II), A Chitoor, Pennadam and Kottur in the Tamil Nadu (TN) state of India
- Each plant operates cogeneration facilities which burn sugar bagasse during the sugar cane crushing season
- During off-season, only the high efficiency facilities at TMK-I and A Chitoor are operational, using coal and lignite as fuel input

Baseline Scenario

Plant	Off-season		In-season	
	Fuel	Supply to Grid	Fuel	Supply to Grid
TMK-I	Lignite/ Coal	Yes	Bagasse	Yes
TMK-II	Not Operational	No	Bagasse	Yes
A Chitoor	Lignite/ Coal	Yes	Bagasse	Yes
Kottur	Not Operational	No	Bagasse	No
Pennadam	Not Operational	No	Bagasse	No

3 CDM PROJECT ACTIVITY

- Renewable based power supply to TNEB grid
  - Cogeneration capacity augmented at three sites (TMK-II, Pennadam and Kottur) resulting in the generation of excess electricity for TNEB grid
- Fuel switch from coal/lignite to renewable biomass during the off-season operation of the cogeneration facility.

4 CDM PROJECT COMPONENTS...

- Capacity Augmentation – TMK-II, Pennadam & Kottur
  - Replacing the existing low efficiency boilers with high efficiency boilers and by installing additional turbines
  - Low efficiency boilers at Pennadam replaced with state-of-the-art high temperature, high pressure boilers (515^{0}C, 86 KSC, 100 TPH)
  - The cogeneration facilities at TMK-II, Kottur, and Pennadam (after boiler replacement) have underutilized boiler capacity
  - Excess capacity captured through the installation of additional turbines
    - TMK-II – 16 MW, 410^0 C, 42 KSC (only

for off-season)

- Pennadam - 20 MW, 510^0 C, 83 KSC (2 nos.) & 14 MW, 510^0 C, 83 KSC (1 no. – only for off-season)
- Kottur - 16.2 MW, 418^0 C, 41 KSC

Project Components	Power Generation (MW) – Baseline Scenario		Power Generation (MW) – CDM Project Scenario	
	Season	Off-season	Season	Off season
TMK-I	13.20	18.56	13.20	18.56
TMK-II	9.4	NIL	10.95	16.0
A Chitoor	13.20	18.56	13.20	18.56
Kottur	6.0	NIL	10.95	16.0
Pennadam	7.25	NIL	39.20	54.0

5 Fuel Switch – Coal/lignite-to-biomass

- Baseline Scenario - steam and electricity production at the cogeneration facilities at all four sites based on bagasse during the season and on coal/lignite during the off-season
- CDM project - the fossil fuel used during off-season replaced by locally procured agro-biomass, such as wood chips, sugarcane trash, Prosopis Julifora, and coconut and groundnut shells
- Over a 7-year period, 90% of the current consumption of coal and lignite will be gradually replaced with agro-biomass

6 CDM Project – Sustainable Development

The proposed CDM project will contribute to the sustainable development of India by

- Increasing the supply of renewable energy to the grid
- the project will add to the reliability of power supply and stabilization of the voltage, which will create business opportunities and stimulate the economic development in rural areas where the sugar plants are situated
- Reduction in particulate emissions and ash generation associated with the burning of coal, which is a dominant fuel in the Tamil Nadu generation mix
- The substitution of biomass for coal and lignite during off-season will establish a market for biomass, which is presently a zero priced resource. This will create job opportunities in the rural areas and directly benefit the local population

7 CDM Project – Additionality

- Additionality of Capacity Augmentation:
  - Technical Additionality - The project uses an advanced cogeneration technology in the form of high-pressure boilers (86 KSC, 515^{0}C) with steam turbines coupled to an alternator for the generation of power. Currently, the sugar industry in India predominantly uses low efficiency, low temperature boilers for their own power generation (32 KSC, 380^{0}C).
  - Financial Additionality - The proposed cogeneration plants are sized to produce power over and above the sugar plants' own steam and electricity needs to sell electricity to the grid. However, in the absence of subsidies, the costs for generation of electricity are significantly higher than those of other options for power generation. The cost of electricity generation at TMK - II, Kottur and Pennadam are Rs. 2.58/kWh, Rs. 3.01/kWh and Rs. 2.31.kWh respectively. The annualized costs of power generation from a 100 MW coal plant are estimated at Rs. 2.21/kWh.
  - Exceeds Regulatory Requirements - The existing boilers at all project sites fully meet the regulatory standards. The Government of India (GoI) mandates the installation of 32 KSC boilers in new cogeneration plants but does not require existing boilers to be upgraded to this standard. Thus, the refurbishment of the boilers at Pennadam is not mandated by law and clearly exceeds the legal requirements.
  - Barriers to implementation - The lack of familiarity with handling high-pressure boilers coupled with the operation of condensing and extraction multistage turbines (the existing mills mostly use backpressure turbines) is a major barrier to adoption of the proposed new technology. Furthermore, making investments

in cogeneration facility, which costs approximately Rs 35 million/MW, is an issue.

- Displacement of electricity generated from fossil fuels - The project will use bagasse to generate power for export to the TNEB. In absence of the project same power would have been supplied through the power generation mix of TNEB, resulting in CO_2 emissions. The TNEB mix generation capacity mix is 63% thermal, 22% hydro, 4% nuclear and the remainder is renewable energy based capacity. The power generation mix though is highly dominated by thermal (86%) due to higher capacity utilization of thermal plants. Therefore, zero emission bagasse based power will result in emissions from projects in the baseline, dominated by thermal power.

■ Additionality of the fuel switch:

- Substitution of coal and lignite use in the existing TMK-I and A Chitoor plants and the new cogeneration facilities at TMK-II, Pennadam and Kottur with renewable biomass will result in a reduction of CO_2 emissions through the displacement of fossil fuels.
- Due to the non-existence of a market for biomass, the collection and transportation of biomass is estimated to be more costly than the purchase of coal and lignite and hence the cost of electricity generation.

Projects	Cost of electricity Generation(Rs./kWh)	
	With Coal/Lignite	With 90% Biomass
TMK I & II	2.58	3.30
A Chitoor	2.68	3.50
Kottur	3.01	3.89
Pennadam	2.31	2.98

8 CDM Project – Emission Reduction Potential

■ The proposed CDM projects will produce 110 MW of green power during the off-season (June – December) and 34 MW during the crushing season (January – May) to be delivered to the TNEB grid.

■ Green power will reduce the air pollution and Green House Gas emissions by reducing the quantum of fossil fuel to be burned for producing the equivalent amount of power.

■ Emission reduction potential is estimated to be approximately 500 kilo tons of CO_2 per year

CDM Baseline Scenario				
	Off-season		*In-season*	
Plant	Fuel	Supply to Grid	Fuel	Supply to Grid
TMK-I	Biomass*	Yes	Bagasse	Yes
TMK-II	Biomass*	Yes	Bagasse	Yes
A Chitoor	Biomass*	Yes	Bagasse	Yes
Kottur	Biomass*	Yes	Bagasse	Yes
Pennadam	Biomass*	Yes	Bagasse	Yes

** Biomass will gradually substitute 90% of coal/ lignite over a 7 years period*

9 WII Role

■ Carbon Advisor for TASG

■ Helped TASG in designing CDM projects involving sugar cogeneration capacity augmentation and fuel switch, in line with the CDM project cycle

■ WII carried out preparation of the required documentations of

- Project Information Note (PIN)
- Baseline study
- Project Design Document (PDD)
- Monitoring and Verification Protocol (MVP)

■ Assistance during validation

■ Assistance during Emission Reduction Purchase Agreement

10 Developments

■ The proposed new methodology was submitted to the Meth Panel on September 10, 2003 and is now available on UNFCCC website for public comments (http://cdm.unfccc.int/methodologies/process)

- NM0028
- NM0035

■ The Prototype Carbon Fund (PCF) has given in-principle acceptance to procure the CO_2 reductions generated by the proposed project

MICRO HYDRO POWER AND CDM

V. RAMASUBRAMANIAN
MD, Sahyadri Energy Systems Private Limited
Bangalore

V. RAMASUBRAMANIAM is founder member and Managing Director of Sahyadri Energy Systems. He has 15 years of professional experience on Alternative Technologies, including 9 years on renewable energy sources, and 5 years of rural development programmes. He has worked with IT Power India, an international consultancy group for renewable energy sources and Auroville Energy Products' Micro Hydro Systems. He has designed, fabricated and installed 10 micro hydro units so far. He presented the case study of micro hydel project for tea estates in Darjeeling.

1 INTRODUCTION

- Old Hydro plants in the tea gardens of Darjeeling area
- Energy Shortage / unreliability
- Hydro availability season suits well peak demand period

2 AMBOOTIA TEA ESTATE

- Largest organic tea garden
- Striving to be self sustainable.

For more info…

Sampad Vikas Limited, 34A Matcalfe Street, Kolkata –13.

3 ENERGY DEMAND & SUPPLY

- Electrical
  - State Grid: West Bengal Power Development Corporation Limited (WBPDCL)
  - Captive Power Generation
    - Diesel
    - Hydro
- Thermal
  - Leco – Low quality lignite
  - Firewood
  - Biomass
- Lighting and household energy

4 CDM PROSPECT

- High diesel consumption during monsoon
- Inefficient, low output from existing old hydro plant
- Desire to explore new ways to minimise cost of rehabilitation and maximise benefits

5 MICRO HYDRO

- Latest developments in micro hydro
  - Cheaper, efficient machines
  - Simplified operation
  - Very low maintenance
- Resource availability meets the peak demand period
  - Monsoon is also the period when the tea factory is in full swing
- Plant Factor : 0.35
  - Still a reliable, viable source. . .

6 CDM PROCEDURE

- PDD preparation

- Validation
- Registration
- Verification and Certification
- Additionality

How to select baselines, estimate the impact of carbon credit sales on the project, and decide whether to use the CDM

How to set monitoring protocols for GHG, and fill out a PDD for the projects.

7 BASELINE

- Grid as baseline
  - Avoided Emission from grid 1.26 kg CO_2 / kWH
- Diesel as baseline
  - Avoided Emission(simplified baseline) 1.00 kg CO_2 / kWH
- Combined Emission factor: 1.197 kg CO_2 / kWH
- Total Generation from hydro : 271,160 kWH

Emissions reduction to the tune of 325 tonnes per year.

8 BASELINE METHODOLOGY

- As a small scale CDM project, Simplified PDD
- Replaces grid & diesel, per Table 1.D of the simplified Modalities and Procedures for Small Scale CDM
- Local stakeholders consulted
- Emissions reduction to the tune of 325 tons p.a.
- Project proposes to sell 90%, keep 10% as cushion
- Total 292 tons of ER supplied for sale p.a, through VER and/or retail route.
- Project currently negotiating with buyers at an advanced stage

9 CERS

- High Value ERs because of additional factors like organic tea, fair and equitable working conditions,etc.
- As of now, it is VER!!

10 ISSUES

- Transaction Costs
- Project Registration fees may not apply for VER projects
- Payments to Designated (?) Operational Entities to validate the project and verify emissions reductions each year have to be carried out
- For VER projects, transaction costs are quite low

11 QUESTIONS TO ASK

- What will be the annual income from the sale of CERs at different carbon prices?
- What will be the upfront and annual transaction costs of participating in the CDM?
- What improvement will this income from CERs produce in the financial viability of the project?
  - Will the CER income remove any other financial or market barriers that are holding back the project?
- Is it worthwhile participating in the CDM at current carbon prices?
  - Is there a carbon price that would make it worthwhile?

Technical Session 5
Financing Issues

Chairperson

Hemant Kanoria
Managing Director, SREI International Finance Ltd.

Carbon Finance & CER Purchase

Chintan Shah
GM, Senergy Global

Developing and Financing CDM Projects in the Eastern Region

Abhijit Chatterjee
Consultant, Winrock International India

CARBON FINANCE & CER PURCHASE

CHINTAN SHAH
GM, Senergy Global

CHINTAN SHAH is a General Manager at Senergy Global, which is the first Indian company in the field fo CER Asset creation and trading activities. Earlier, he was the General Manager (Strategic Planning) at Suzlon Energy Limited, a leading company in the field of wind energy generation in India. Prior to Suzlon Group, he was working with the Renewable Energy Group of TERI. His work at Senergy Global is to develop Carbon Asset instruments and products on one hand, and entering into energy trading on the other.

1 WHAT IS CARBON FINANCE ?

- Carbon finance, is nothing but an additional revenue stream emerging from a project based activity
  - Passes the various additionality tests
  - Meet all necessary compliances (viz. Kyoto Protocol)
  - Has a positive sustainable development impacts for the host country (in this case, India)
- Some exceptions, in which investor invests (equity) into the project
  - Returns as CERs

2 FOUR COMBINATIONS

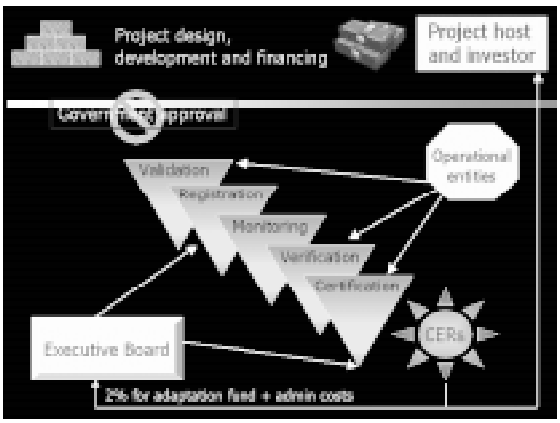
- Programmatic
  - Annex I Government to Non-Annex Government
  - Private Annex I company to Non-Annex Government
- Project based
  - Annex I Government to Private Non-Annex I Company
  - Private Annex I Company to Private Non-Annex I Company
- Programmatic
  - Annex I Government to Non-Annex Government (viz. Higher penetration of solar thermal collectors)
  - Private Annex I company to Non-Annex Government
- Project based
  - Annex I Government to Private Non-Annex I Company
  - Private Annex I Company to Private Non-Annex I Company
- Facts about CDM: Cop-6 bis & Marrakech Accord
- RE up to 15 MW are going to be benefited the most under fast-track procedures
  - Gestation period is less than 1 year, at times 3 months also
  - 15 MW project may look small on the basis of GHG emissions, but it is large enough for the RE sector
  - For, India
    - Institutional mechanisms and enabling mechanism is in place
    - Investors and financing mechanism are present
    - Full-fledged RE programme is also present

3 SIZE OF THE PROJECT ?

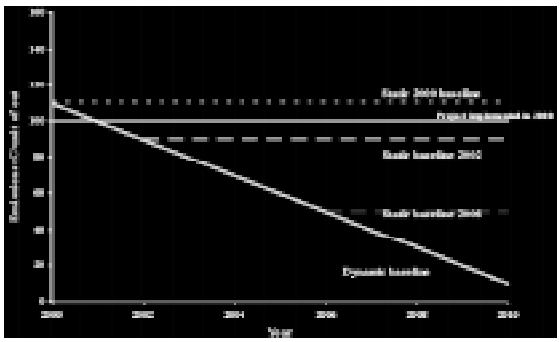
- Apart from small scale project modalities
  - Transaction costs ~ at times constant irrespective of the size of the project
  - Delivered benefit in terms of US$, € or ¥ per CER!!
- Transaction costs depends on
  - Selection of baseline (how strict) & PDD development
    - Higher the strictness higher the CER proceeds
    - Accompanied with Monitoring Protocol (strictness in baseline would lead to higher verification costs)
  - Validation & Witnessing by AOE

Finally a trade-off by fixing the optimum parameters
No Thumb Rule : It is highly project specific

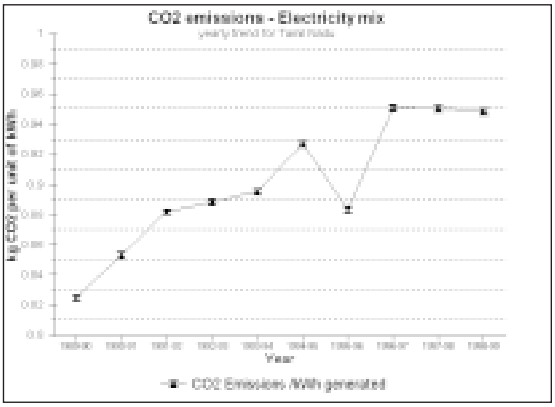
4 BASELINES



5 BASELINE



6 RE DICHOTOMY FOR CDM PROJECTS



- Grid connected RE projects (generally large in size)
  - Wind energy
  - Biomass
  - Waste to Energy
- Off-grid RE projects (generally small in size)
  - Wind and solar photovoltaic based projects
    - Lighting and other electricity based end use applications
  - Small biomass (gasification)
    - Electricity and thermal based end use applications
  - Solar thermal based projects
    - Electricity and thermal based end use applications

7 PREPARATION OF PDD

- Identification of consultants to prepare the detailed baseline document & Monitoring and Verification Protocol
  - Preparation of baseline is a very tricky issue
    - The most crucial design phase
    - Rules for small scale projects is in place
    - Has a great ramification in the amount of delivery of CERs, and also the transaction cost with respect to recurring expenditure of Verification and Certification
  - Baseline rules have been simplified, however, additionality issues still prevail for any kind of projects

8 ADDITIONALITY

- Financial additionality
  - The project is not viable on economic basis
    - Risk perceptions & mitigation
    - Cost of generation higher vis-à-vis baseline options
    - Project itself is exposed to very high operating risks

9 ANNOUNCEMENT OF FIRST CDM CDOT : CERUPT

- CERUPT stands for Carbon Emission Reduction Unit Procurement Tender
- Objective: The Netherlands to use CERs to help meet its commitment under KP
- Tender period: November 2001-January 2002
- GHG offsets: 3 Mio CERs
- Per. of purchase: 7-14 years

Eligible projects & Price per CER

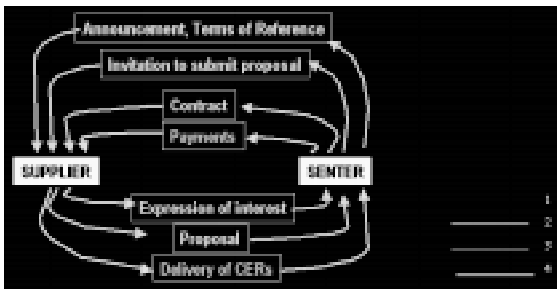
RE excluding biomass	5.5
Energy from clean & sustainability grown biomass	4.4
Energy- efficiency improvement	4.4

- Others,incl. fossil fuel switch & CH_4 recovery 3.3

10 CERUPT PROCEDURE

- Procurement guidelines
  - SENTER (tendering authority) buys CERs
    - Public procurement
    - Terms of contract
- Relevant aspects
  - Two stage procedures
  - Expression of interest, proposal
  - Selection & contract award criteria
  - No negotiation
  - Price by competitive bidding

11 CARBON CREDITS PROCEDURE



12 RESULTS SELECTION CERUPT PHASE 2001

- Received 80 expression of interest
  - 90 Mio CERs
  - Project in 27 countries
- Selected : 26 expression of interest
  - 32 Mio CERs
  - Average price of 4.7 per CER
- Project in 13 countries
  - El Salvador (1) Costa Rica (4) Panama (3) Jamaica (1) Peru (1) Bolivia (1) Brazil (2) **India (6)** Indonesia (2) China (2) Nigeria (1) Kenya (1) & Uganda (1)

13 PROPOSALS FROM INDIA

- Wind – 3 (Enercon in Karnataka, Suzlon in TN, Vestas in TN)
- Biomass – 2 (Kalpataru in Rajasthan, Ind-Barath in Maharashtra)
- Wind-Biomass Hybrid – 1 (Vestas in TN)

14 SUZLON/SG PROJECT UNDER CERUPT

- Project size 15 MWe
- Location Sankaneri, TN
- Type Grid connected Wind EnergyProject
- Technology 1.25 MW sized wind turbine
- PLF 28-30%
- CERs supply 340,000 by 2012
- Period of delivery 2004 onwards

15 MAJOR ISSUES IN RE

- Considering a market cost of $5 per CER
  - Seller takes the Kyoto Risk
  - Transaction costs reduces substantially beyond a 10 MW grid connected/stand alone project
  - Transaction costs does not behave the same for de-centralised energy systems (viz. SPV)
  - Transaction costs has an inverse relation with monitoring points & geographical boundary of the project size

16 ADVANTAGE OF BUNDLING & REDUCTION OF TRANSACTION COSTS

A Case Study

17 ABOUT THE PROJECT

- SUZLON/SG through TERI submitted a PIN to GTZ- CDM India office
- GTZ selected "grid connected wind farm project" in Tamil Nadu
- Project development & implementation by Suzlon Energy as a turn-key contractor
  - Suzlon manufactures wind turbines, does site development, implements & maintains the wind farm project
- Project owners would be a mix of process industries in the state of Tamil Nadu

18 PROJECT SPECIFICATION SHEET

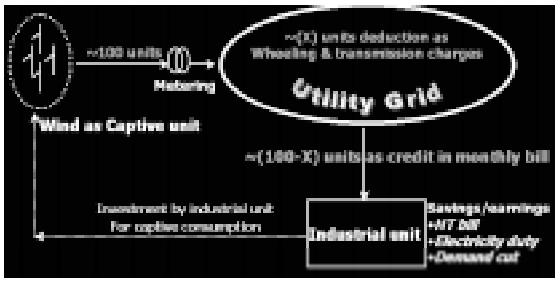
Sector	Renewable Energy
Project	Wind Farm (Grid connected)
Project proponent	SENERGYGLOBAL (CER Asset Creation & Holding Company)

Location	Irrukandarai, Radhapuram Taluk Tirunelveli District, Tamil Nadu
Site features	Barren land, no agricultural activity, industrially backward
End use of power	Wheeling to industrial units of process industries

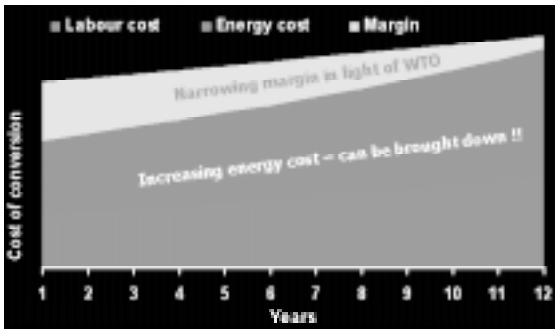
19 PROCESS INDUSTRIES & WIND POWER

- Energy cost is always a major expenditure –
  - Ranging from as low as 25% to as high as 40-45%
- Competition (both domestic & global) has led to freezing of cost of the final produce (viz. cloth, cement, chemicals etc.)
- Wind power is one of the logical answer to these problems
  - Power plant uses wind (which is free) as fuel
  - Long term freezing of cost of power

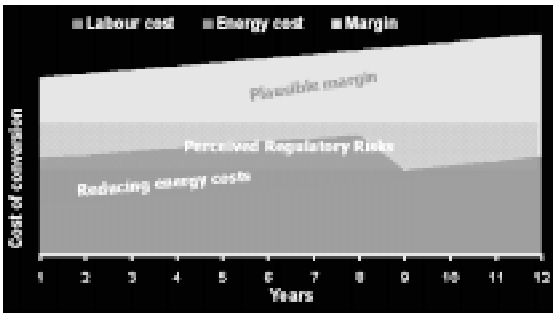
20 THE PROCESS : HOW IT HAPPENS ?



21 IMPACT OF RISING ENERGY PRICE ON PROCESS INDUSTRIES (VIZ. TEXTILES)



22 BENEFITS TO THE TEXTILE INDUSTRY THROUGH WIND ENERGY



23 TECHNOLOGY FEATURES

- Project size
  - 300 MW (planned), with plausible upscale to larger size
- Wind turbine size
  - 1.25 MW (planned), with plausible upscaling to 2 MW
- Features
  - Low wind regime wind turbine, high PLF
  - RIM (resin infused mould) technology incorporated in the blade
    - The latest technology leading to savings of materials (approx. 30%)
    - Better aerodynamic features leading to higher performance

24 PRESENT STATUS OF THE PROJECT

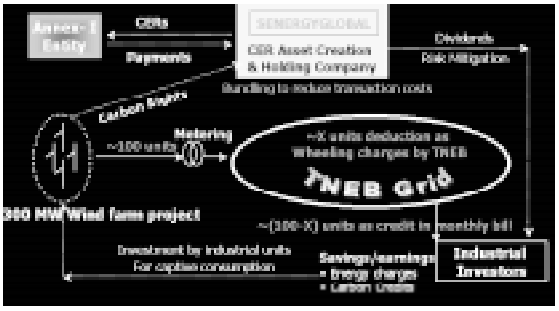
- Wind farm site operational since August, 2002
  - Wind farm installation has reached approximately 120 MW
  - Extensive Wind data monitoring at five different locations
- Target for 2003-04 is pegged at 150 MW
- All statutory clearance has been obtained
  - Clearance in India is mainly for grid inter-connection
  - Local village bodies are having no-objection to the said activity, rather they are benefited (directly/indirectly)
- Project would have a mix of self-financing/ IREDA/banks etc.
  - Suzlon also facilitates funding based on internal due diligence
  - Suzlon provides O&M of the project
  - Major owners of the project include viz.

Ramco Industries, Ever Ready, Amar Jyoti, Velaithal Spinning Mills etc.

25 DETAILS OF THE PROJECT

Project cost per MW	Rs 46 Mio ~US$1 Mio
Total project cost (300 MW)	Rs 13.8 Bio ~ US$300 Mio
Projected PLF (average)	28-30%
(against all India average of 20%, & TN average of 25%)	
Average wind speed	7-7.5 m/s
O&M (including insurance) cost	1.7-2%
Cost of generation (in Rs/kWh)	Rs 2.5-2.9/ kWh
Levelised annualised (disc. at 12%)	5.4-6.3 US cents/kWh
Esti. E. Gene. (300 MW) per annum	840 Million Units
Estimated CERs from the project *(Southern Region Baseline)*	600,000 p.a.

26 PROJECT STRUCTURING FOR CER ASSETS



27 CHALLENGES…

Additionality

- Technology & Project additionality
  - Wind turbine sizes have gone to MW size from kW size
  - Wind park model (unique with higher infrastructure cost)
- Electricity & Regulatory related additionality
  - Risks associated with volatility of the power sector
  - No unbundling of electricity board in Tamil Nadu
  - Rules & Regulations, new structures are yet to be formed
  - Investments in power generation is going to be very high risk venture
- Issues wrt to buy-back rates (PPA), wheeling charges etc.
- Financial additonality

IRR change : 3-6 % (substantial change)
RoE change : 5-9 % (substantial change)

When you are describing
A shape or sound or tint
Don't state the matter plainly
But put it in a hint;
And learn to look at all things
With a sort of mental squint
Lewis Carroll

28 THE ADVANTAGES OF BUNDLING

- SUZLON has contracted all its wind farm projects to bundle under SENERGY GLOBAL
- SENERGY GLOBAL to act as a trading repository of CERs in India
  - Sell onward to Annex I countries (government/private companies)
  - Buy CERs from any seller from India
  - Bundle projects to lower the transaction costs

29 THE ROLE OF FINANCIAL INSTITUTIONS

- Packaging projects
  - Development of project pipelines
  - Portfolio generation
- Financing projects
  - Project finance
  - Venture capital
  - Special mutual funds
  - Corporate finance
  - Lending
- Bringing in expertise in checking the viability of project proposal – due diligence
- Insurance

30 DOS AND DON'T

- Don't get lured by fly-by night consultants/ brokers of VERs/carbon off-sets
  - Baseline & Validation report is a must
- Don't think of undertaking a project for a size of less than 7-8 MW (high transaction cost)
- Don't try to get the benefits in haste, it would spoil the deemed revenue generation for years to come

Abstract qualities begin
with capitals always:
the True, the Good, the CDM, the Beautiful -
those are the things that pay
with apologies to **Lewis Carroll**

DEVELOPING AND FINANCING CDM PROJECTS IN THE EASTERN REGION

ABHIJIT CHATTERJEE
Consultant, Winrock International India

ABHIJIT CHATERJEE is a consultant working in the area of climate change mitigation. He has over 5 years of work experience in this field. He holds a Master's from Delhi School of Economics and has worked with Development Alternatives and Winrock International India. He explained about the situation of renewable energy in the eastern region and potential of CDM projects from this region and raised several issues of financing of such projects.

1 CONTENTS

- Potential CDM Projects in Eastern India
- The Emerging Market for Emissions Reductions
- CDM Financing Options
- Capitalizing on the CDM
- Conclusion

2 CDM PROJECTS IN EASTERN INDIA

- Grid Based Renewable Energy (RE) Projects
  - high carbon intensity in West Bengal
  - medium to high carbon intensity in overall Eastern grid
  - very low (almost zero) carbon in NE grid
  - Priority areas micro-hydel, biomass and SPV
- Off Grid RE projects
  - replaces diesel / kerosene in all cases
  - high potential for Sunderbans, Orissa, Bihar and NE
  - decentralized energy a desirable option
- Energy Efficiency (EE) Projects
  - jute, sponge iron, brick kilns, cardamom, SMEs and so on
  - option of replacing / retrofitting old, worn-out SEB plants
  - lack of an enabling investment environment a deterrent
  - scoping study on EE / SME potential in East needed
- Forestry Sector (LULUCF) Projects
  - potential exists for afforestation and reforestation projects
  - formation of rules at the EB level a critical necessity
  - plantations need to be preserved through social forestry
- Looking Eastwards……
  - potential in MW Scale biomass and hydro projects
  - cogeneration in Parboiled Rice Mills a clear possibility
  - community based energy systems hold key to success
  - opportunities exist in transport & waste to energy sectors
  - sectors for energy efficiency projects need to be identified
  - focus to shift from RE to EE, LULUCF & WTE
  - range of small (solar lantern) to very large (EE) deals
  - need to concert efforts into assessing CDM potential
- Emerging Market for Emission Reductions
  - "CDM? Is anything happening on CDM? I have been to so many workshops on CDM, and everywhere people are just talking. Nothing seems to be moving on the ground" – A tired project developer
  - "More than 75 ER transactions have already been done in India itself since 2003" – A not-so-tired speaker
  - "India, as indeed the whole world, is yet to register the first CDM project" – A speaker, possibly in the same event

WHO IS RIGHT, AND WHO IS NOT?

3 THE EMERGING MARKETS FOR CERS

- Where no trade has yet been registered.....
- Led by Multilateral & Annex I Government
- price around $4.00 to $6.00 per CER
- high project transaction costs (PCF says it is $175k - $250k)
- validation, M&V, CDM EB certification a must, average time > 2 years
- CDM design a must at the planning stage
- existing projects may not qualify for CER
- viable for larger scale CDM projects (> 500,000 ER in 10 yrs)
- future: micro-scale projects for *demonstration* **(CDCF)**
- Government initiative led by Netherlands, EU etc
- rates expected to go up soon as KP comes into force
- market works through tenders and announces, some brokerage deals

4 THE EMERGING MARKETS FOR VERS

- "**early action credits**"
- prices vary, but generally are lower than in CER market
- non-additional projects find easier entry point in VER deals
- project transaction costs lower, DoE not always mandatory
- validation & M&V necessary, no certification
- trading through brokerage firms, average time around 6 months
- most offsets sold on year to year (current vintage) basis
- mid sized existing projects (15,000 < ver < 50,000) best suited
- market is volatile, uncertain and high on risk
- so far has recorded maximum number of trades
- will the market die after EB rules are clear? **Not likely**.

5 THE EMERGING RETAIL MARKET

- not related to the Kyoto compliance regime
- transaction costs are very low
- major driver is awareness and environmental protection
- projects still need to be validated by independent agency
- prices can be as high as USD 13 per ERU
- small to very small volumes can be traded (< 100 ERU)
- value exists for ERUs that score high on SD scale
- small scale community linked projects are a natural choice

6 CDM FINANCING – ISSUES AND OPTIONS

- Understanding Carbon Finance
  - financing options are becoming more & more dynamic
  - project shall determine the market: CER-VER-Ret
  - ER flows **usually** raise returns by 2% - 3%
  - timing of the sale very important for project
  - design of the emission contract a key issue
  - seller to negotiate terms: access to info required
  - level playing field expected as market matures
- Structuring the Deal: Options
  - Important that the buyer features in the financing process
  - Equity: investor receives financial return as well as CERs
  - Grant: contribution in return for rights to CERs as produced
  - Loan with repayment in form of CERs
  - ER Purchase Agreement (to trade ERs as they are verified)
  - buyer providing corporate guarantees for loans
  - Again, contracting is a key step
  - strength of project and seller can determine sale outcome
- What the CDM Cannot Do
  - The CDM *cannot be a magic solution* to the financing barriers of RE / EE projects
  - The CDM Investor is not looking for sustainable development, he simply wants a cheap source of carbon offsets
  - He is by and large not willing to put in grant money for a R&D project
  - Transaction costs are not going to vanish, even

in the long run

- So the CDM *cannot* bring about a sea change to the way business is done in developing countries
- Projects with advanced technology & state-of-the-art equipment could benefit from better rates of return (IRR up by 3% to 5%) - *original role of the CDM*
- At the present rates of $ 5 per CER, CDM could help advanced RE / EE projects tide over their high capital costs
- CDM Investors can bring in additional equity, concessional rupee loans, technical expertise
- CDM can promote local sustainable development
- CDM could provide a spread to domestic FIs (IREDA etc) and lower their investment costs

7 CAPITALIZING ON THE CDM

■ Project Ideas from Eastern India: EXAMPLE

Bundle of Rice Husk Gasifiers as one CDM project

■ **Observations**

- RHG technology is proven, project not additional
- Project size does not allow it to access CER market
- VER and/or Retail market can be accessed
- Expected net average revenue of $1.5 to $2.00 per ER
- Community benefits need to be highlighted
- Project Ideas from Eastern India: EXAMPLE

Micro-hydel projects in Himalayan Bengal, Sikkim and NE

■ **Observations**

- project can be locally additional
- Project size does not allow it to access CER market
- Project possesses high SD potential
- Ideal for retail, project can also be sourced to CDCF
- Expected net average revenue of $5 to $7.00 per ER
- Typically, ER flows shall compensate for interest liability

■ Project Ideas from Eastern India: EXAMPLE

12 MW Rice Husk Cogeneration Project for Heat & Power

■ **Observations**

- CHP in Rice Production is considered additional
- Project size shall allow it to access CER market
- The grid could be the GHG Emissions baseline
- CDM funds to reduce technology risk
- Carbon funds to build up escrow account
- Replicability of project very high
- Local SD benefits: power for villages, employment, etc

■ Project Ideas from Eastern India: EXAMPLE

Poultry Litter to Power Generation Projects

- Eastern India has several poultry farms / Hatcheries
- at small scale (digester), medium scale (methanation)
- large scale (> 4 MW) - combustion and methanation

■ **Observations**

- projects could have high ER through methane route
- significant community benefits
- financial benefit to entrepreneurs
- benefits from ER sales is an add-on
- decentralized energy saves T&D losses

■ Observations

- The CDM has the ability to bring in cash flows from either carbon credit sales and/or foreign investment, which is a major plus
- Eastern India has potential in developing small-scale CDM in renewables (biomass, micro-hydel, solar PV)
- Future prospects look very bright if there is policy support
- However, there is a limit to what the CDM can do to the financial viability of the project, or the RE sector as a whole
- There are significant transaction costs involved in developing CDM projects, which are lower in VER or retail deals
- A whole host of institutions are required to provide support services to CDM projects - business for some, costs for others

Panel Discussion on "CDM Opportunities and Barriers for States"

Hirak Ghosh
Ex-Secretary of Environment Department, Govt. of West Bengal (Chair)

S. P. Gon Choudhary
Director, West Bengal Renewable Energy Development Agency

Subir Nathak
MD, Market Dynamics Ltd.

Hirak Ghosh served the Govt. of West Bengal as Secretary of Department of Environment till recently. He also held the position of Chairman of West Bengal Pollution Control Board. He has been a key figure in policymaking at the state level in West Bengal.

S.P. Gon Choudhary is Director of the West Bengal Renewable Energy Development Agency (WBREDA). He is a leading specialist in renewable energy technology systems in India and a recipient of Ashden Award (Green Oscar) for sustainable energy in 2003.

Subir Nathak is Managing Director of Market Dynamics Pvt. Ltd. He holds an MBA from the Indian Institute of Management, Ahmedabad. He has served as International Consultant on Renewable Energy to Govt. of Bangladesh. He is currently the Renewable Energy Advisor To Sahara India Parivar, a large Indian private sector group, and also served as advisor and Project Manager on Implementation and preparation of DPR on bundling of small-scale CDM projects and carbon credits for Govt. of Canada.

Summary

Discussions in the panel session were led by Mr Hirak Ghosh, former Environment Secretary of Govt. of West Bengal. Mr. Ghosh was joined by Mr S.P. Gon Choudhary, Director of West Bengal Renewable Energy Development Agency (WBREDA) and Mr. Subir Nathak, Managing Director of Market Dynamics Ltd. Mr. Ghosh made the opening remarks pointing to the need of understanding of various issues in the process of successful implementation of CDM projects and appreciating the initiative under which this workshop was held. Mr. Gon Choudhary raised the issues relating to the opportunities and barriers to implementation of renewable energy projects in the region, especially in West Bengal. He pointed to the fact that these projects have immense potential towards the development of certain areas like Sunderbans, which lack supply from the grid, as well as other areas. He also highlighted the achievements of WBREDA and recent setting up of a special cell within WBREDA for CDM projects under which one of the key activities currently being undertaken is that of information dissemination. He also informed about the group efforts of entrepreneurs of West Bengal in attracting investments for their projects citing the example of formation of a Green Power Consortium by rice mill owners. Mr. Nathak summarized the discussions held during the workshop and added that good learning was generated and that a large number of questions that the participants had, were addressed in the workshop.

State Level Capacity Building Workshop on Clean Development Mechanism (CDM)

March 23-24, 2004
Gokul Dwarka Hall, Hotel Taj Ummed Palace, Ahmedabad

PROGRAM

DAY 1: March 23, 2004

Time	Agenda	Speakers
10:00 – 10:45	**Inaugural Session**	**Welcome Address & Introduction**: Mr. Somnath Bhattacharjee, *Vice President, WII* **Inaugural Address**: Sh. K. V. Bhanujan, *Chairman, Gujarat Pollution Control Board* **Special Address:** Mr. Shinichi Iioka, *CDM Program Manager, Climate Policy Project, IGES (read out in absentia)* **Vote of Thanks:** Dr. Ashish Rana, *Senior Program Officer, WII*
10.45 – 11.00	**Tea Break**	
11.00 – 12.30	**Technical Session 1:** Clean Development Mechanism (CDM) – An Overview **Chair**: Mr. A C Shroff, *Managing Director, Excel Industries*	**Expectations of participants from the workshop** **Introduction to Climate Change and Development Issues:** Prof. P R Shukla, *IIM Ahmedabad* **Climate change convention and Kyoto Mechansims:** Dr. Ashish Rana, *Senior Program Officer, WII* **Discussions**
12:30 – 13:30	**Lunch**	
13:30 – 15:30	**Technical Session 2:** GHG Market **Chair**: Mr. Somnath Bhattacharjee, *Vice President, WII*	**GHG Market & India's Perspective**: Dr. Ajay Mathur, *President, Senergy Global* **Legal issues in CDM projects**: Ms. Amee Yagnik, *Advocate, Gujarat High Court* **Discussions**
15:30 – 15:45	**Tea Break**	
15:45 – 17:00	**Technical Session 3:** CDM & Sustainable Development **Chair**: Dr. Ajay Mathur, *President, Senergy Global*	**CDM and Biomethanation:** Mr. Siddhartha Yadav, *Consultant, Ministry of Environment and Forests* **CDM Benefits from Waste Utilization:** Mr. A. C. Shroff, *MD, Excel Industries Ltd*. **Discussions**

contd...

DAY 2: March 24, 2004

Time	Agenda	Speakers
09:30 – 10:45	**Technical Session 4:** CDM Project Development **Chair**: Prof A.N.Mathur, *Dean, College of Technology and Engg., Udaipur*	**CDM Project Cycle:** Ms. Aditi Dass, *Senior Program Officer, WII* **Case Study – Biofuels:** Mr. Jai Uppal, *Advisor, WII* **Discussions**
10:45 – 11:00	**Tea Break**	
11:00 – 13:00	**Technical Session 4 continued:** CDM Project Development **Chair**: Sh. K.V. Doshi, *Dy. Director, Gujarat Energy Development Agency*	**Case Study – Cogeneration:** Mr. Dhirendra Kumar, *Program Officer, WII* **Case Study – Gasifier**: Mr. Manoj Gohil, *Executive Director, Agrocel Industries* **Case Study – Solar Dryer**: Prof. N. S. Rathore, *Head, Renewable Energy Dept., College of Tech. And Engg., Udaipur* **Discussions**
13:00 – 13:45	**Lunch**	
13:45 – 15:00	**Technical Session 5: Financing Issues** **Chair**: Mr. A T Kusre, *GM, ICICI Bank*	**Carbon Finance & CER Purchase**: Mr Chintan Shah, *GM, Senergy Global* **Financing of Renewable Energy Projects in India**: Mr. Pradip Modi, *P.K. Modi & Associates, Chartered Accountants* **Discussions**
15:00 – 15:45	**Panel Session**	**Panel Discussion on "Opportunities and Barriers for States"**: Sh. Vijay Ranchal, *India Development and Environment Agency* Sh. K.V. Doshi, *Dy. Director, Gujarat Energy Development Agency* Mr. Sandeep Dave, *Director, Neptune Automation Pvt. Ltd.* **Feedback by participants** **Closing Remarks**: WII
15:45 – 16:00	**Tea Break & Wrap-up**	

PRESENTATIONS

Technical Session 1
Clean Development Mechanism (CDM) – An Overview

Chairperson

A.C. Shroff

Managing Director, Excel Industries

■ Introduction to Climate Change and Development Issues

P.R. Shukla

Professor, IIM Ahmedabad

■ CDM – Climate Change Convention, Kyoto Protocol and Issues of Additionality

Ashish Rana

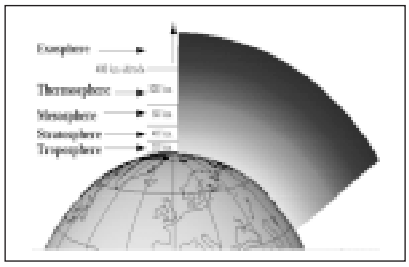
Senior Program Officer, Winrock International India

INTRODUCTION TO CLIMATE CHANGE AND DEVELOPMENT ISSUES

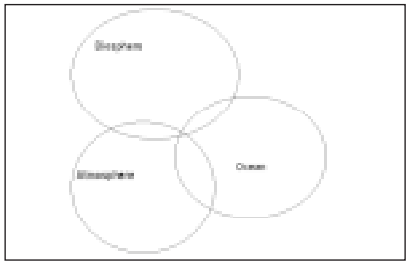
P.R. SHUKLA
Professor, IIM Ahmedabad

P. R. SHUKLA is a Professor in the Public Systems Group at Indian Institute of Management, Ahmedabad. He holds a Ph.D. from Stanford University. He has worked on numerous research and consulting assignments for Indian and international organizations. He is a lead author of several Intergovernmental Panel on Climate Change (IPCC) reports and has co-authored ten books and numerous publications in international journals. He gave an extensive overview of the problem of human-induced climate change and what India could do about it. He touched upon all the aspects and issues concerning CDM projects.

1 THE EARTH'S ATMOSPHERE



2 THE GLOBAL CLIMATE SYSTEMS AND INTERACTIONS

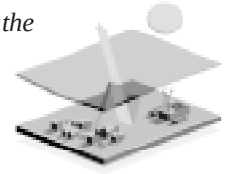


3 THE NATURAL GREENHOUSE EFFECT

Solar Radiation passes through the clear atmosphere
Most of the radiation is absorbed by earths surface and warms it

4 THE NATURAL GREENHOUSE EFFECT

Most radiation is absorbed by the earths surface and
Infrared radiation is emitted back into the upper atmosphere

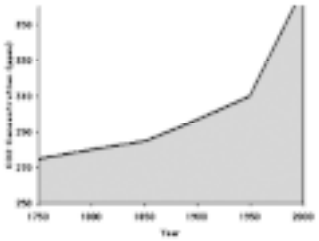


5 THE NATURAL GREENHOUSE EFFECT

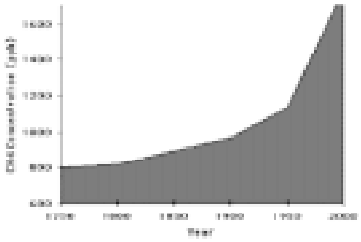
Some of the infrared radiation passes through the atmosphere and some is absorbed and re-emitted in all directions by greenhouse gas molecules
The effect of this is to warm the earths surface and the lower atmosphere

- Earth's Climate has remained relatively stable during last 10000 years
- Modern society has evolved and adapted to the climate variability
- Present society faces potentially rapid changes because of human activities that alter the atmospheric composition and change the earth's radiation balance
- Human activities lead to generation of certain gases through - Combustion of fuel
  - Land use changes
  - Agricultural practices
  - Various industrial processes
- The gases are
  - Carbon dioxide
  - methane
  - nitrous oxide
  - CFC
  - Ozone

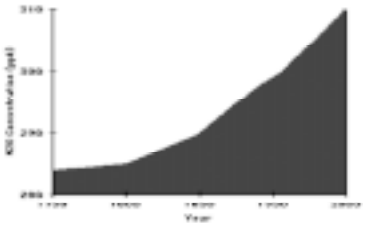
Called Greenhouse gases



CO_2 Increased from 280ppm in 1750 to 368 ppm in 2000.
2/3rd of this increase during last 20 years (since 1980) due to fossil fuel burning. Rate of increase 0.4 % per year over past 2 decades (since 1980)



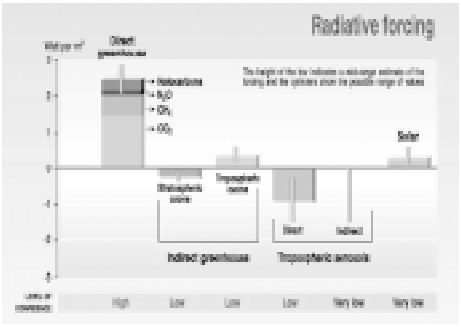
Methane increased by 2.5 times since 1750 from 700-1750 ppb



Nitrous oxide increased by 16 % from 270 ppb in 1750 to 316 ppb in 2000

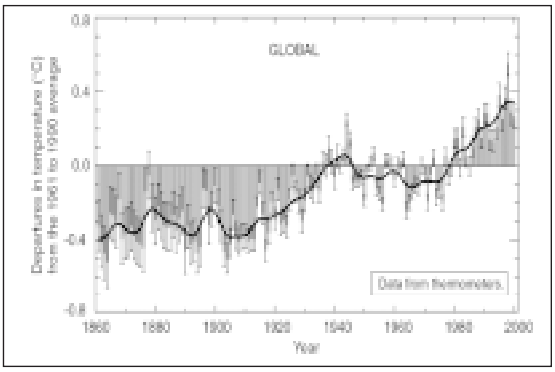
6 Enhanced Green House Gas Effect

- Increasing concentrations of the greenhouse gases and other trace gases have *changed the radiative forcing* of the atmosphere leading to a net warming

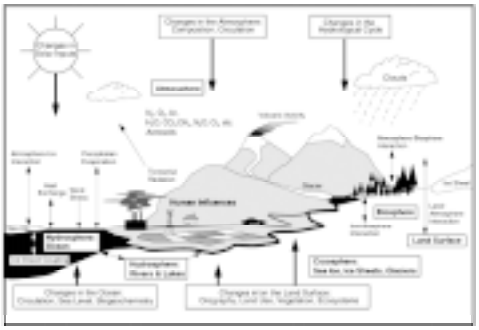


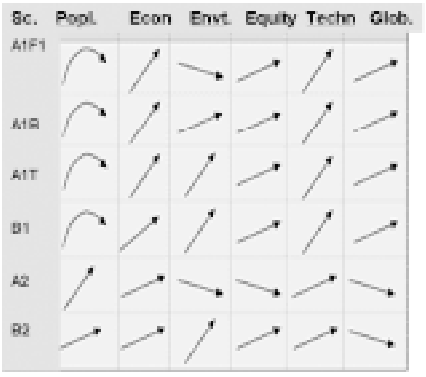
7 Evidences of Climate Change

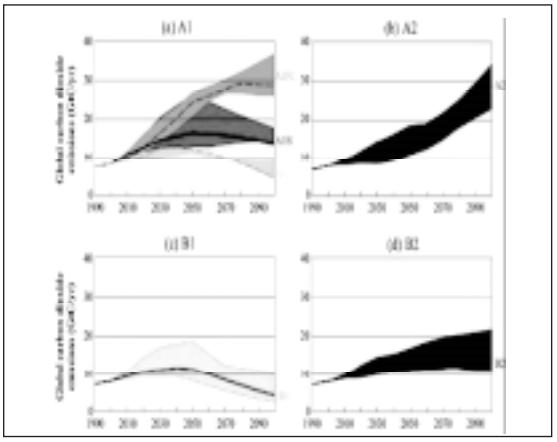
- *Global av. surface temperature has increased by 0.4*°C to 0.8°C over the 20th Century
- No set pattern in change in global precipitation in 20th century, however,
- Global av. Sea level has risen between 0.1 - 0.2m per decade during 20th century



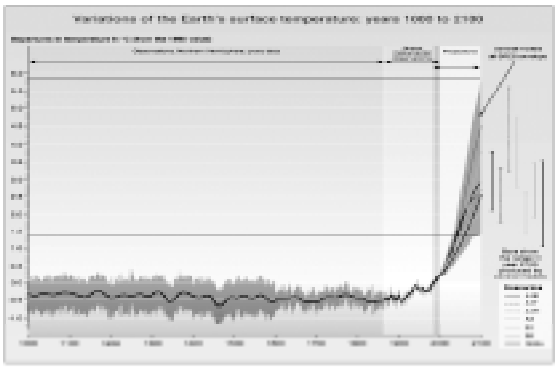
8 The climate human interaction



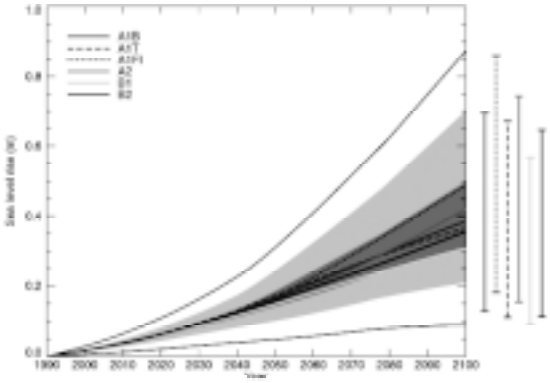




9 TEMPERATURE CHANGES AT DIFFERENT FUTURE CO_2 CONCENTRATIONS



12 GLOBAL AVERAGE SEA LEVEL RISE SCENARIOS



This change will be rapid and will ride over natural climate variability

10 IMPACTS OF CLIMATE CHANGE

13 CLIMATE CHANGE

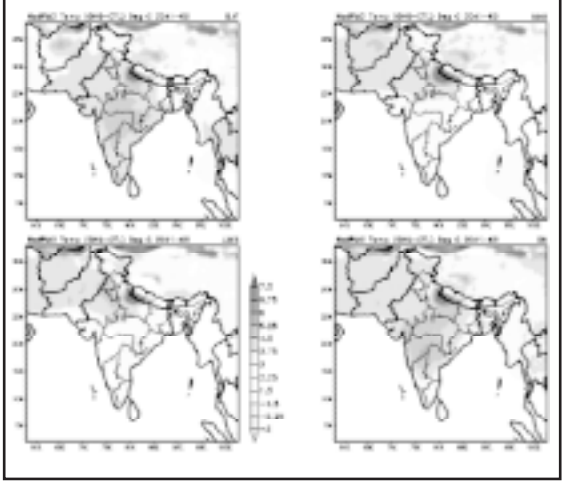
- Emerged as a
  - Global environmental issue in the last decade
  - Engaged the world's attention
  - Relates to a global common atmosphere
  - Scientifically complex climate systems – sub system air / ocean
  - Politically contentious, acquired north-south dimension
- And above all
  - Climate affects us all
  - Change will impact our activities in various economic sectors and ultimately
  - Economic growth and development

11 PROJECTED CLIMATE CHANGE FOR INDIA

South of 25^0C: increase by 2-4•‹C

Northern region: Exceeding 4•‹C

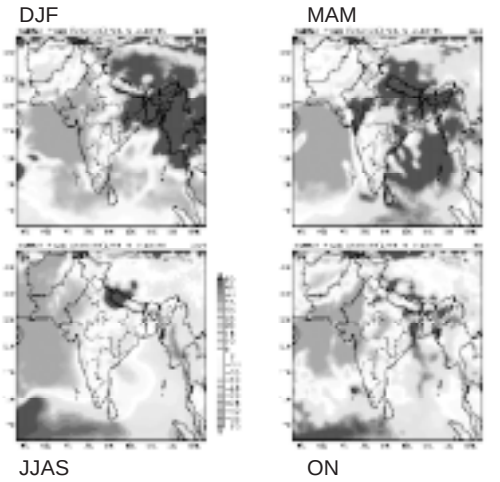
Projected temperatures



14 Projected climate change on India

- Overall precipitation will remain the same with regional variations
- Decrease in number of rainy days over a major part of the country
- Decrease is more in western and central part (by more than 15 days)
- Near foothills of Himalayas and in northeast the number of rainy days may increase by 5-10 days

Projected temperatures



15 Kyoto Protocol

- *The* Kyoto Protocol is an addendum to the United Nations Framework Convention on Climate Change (UNFCCC or the Convention) that was adopted in December 1997.
- The Kyoto Protocol represents a potentially binding international treaty that stipulates actions to be taken by nations to combat global climate change. Six specific greenhouse gases are regulated under the Kyoto Protocol.
  - Carbon dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous oxide (N_2O)
  - Hydrofluorocarbons (HFCs)
  - Perfluorocarbons (PFCs)
  - Sulphur hexafluoride (SF_6)

16 The reduction Commitments under the Kyoto Protocol

- *Most industrialized (Annex B) countries are to reduce their* collective emissions of greenhouse gases by an average of 5.2% by the commitment period of 2008 to 2012,
- While developing nations (non-Annex B) are not subject to emissions reduction caps.
- The deadline for signing the Kyoto Protocol was March 1999, and by this time it had received 84 signatures. The Kyoto Protocol shall enter into force when a minimum of 55 parties that account for at least 55 % of the Annex I carbon dioxide emissions in 1990 have ratified

The emission reduction targets (with respect to 1990 levels) taken on by developed countries under the Kyoto Protocol are:

Switzerland, Central & East European states, European Union	- 8%
United States	-7%
Canada, Hungary, Japan, Poland	-6%
New Zealand, Russia, Ukraine	0%
Norway	+1%
Australia	+8%
Iceland	+10%

17 Kyoto Protocol Flexibility Mechanisms

- To assist developed states in meeting their emissions reduction targets, the Kyoto Protocol defines
  - a schedule for emissions reduction activities and
  - advocates adoption of international emissions trading as a primary tool for greenhouse gas emission reduction.
- Emissions trading can occur between and among combinations of Annex I nations as well as between Annex I and non-Annex I nations.
- The Kyoto Protocol describes the following mechanisms for emissions trading:
  - International Emissions Trading (IET),
  - Joint Implementation (JI) —— targets Annex I Countries
  - the Clean Development Mechanism (CDM) ——targets non-Annex I Countries

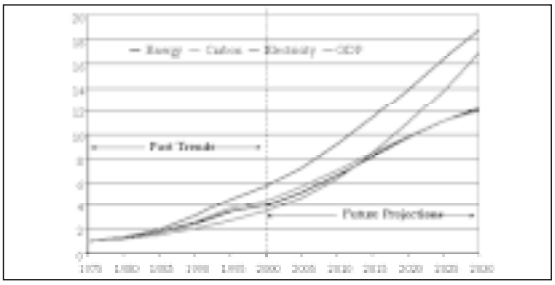
18 Carbon Market: Size and Price

- OECD: Annual Mitigation Target (2008-2012)
  1.5 - 1.8 Billion $TCO_2Eq.$
- Hot Air
  0.7 - 1 Billion $TCO_2Eq.$
- Marginal Mitigation Cost (in Year 2010)

Domestic Action	US $/$TCO_2$ Eq.
• Japan Alone	127
• W. Europe Alone	36
• Annex I Trading	4 - 8
• An I Trade +CDM	3 - 6

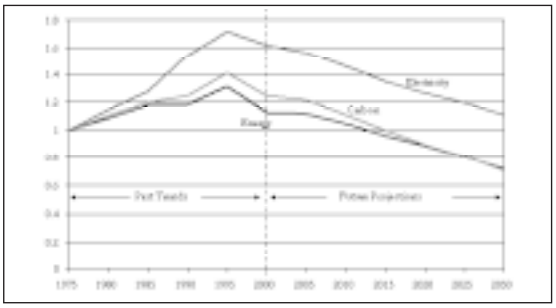
19 Energy, Carbon, Electricity and GDP

(History and Projections for Reference Scenario)

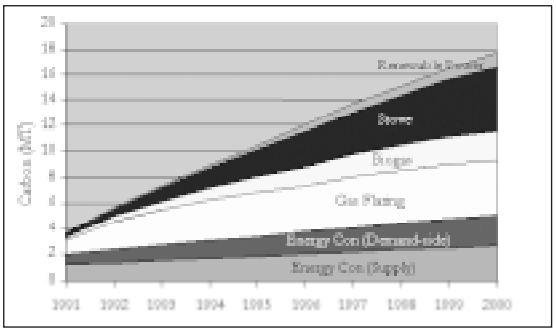


20 GDP intensities of Energy, Electricity and Carbon

(Reference Scenario)

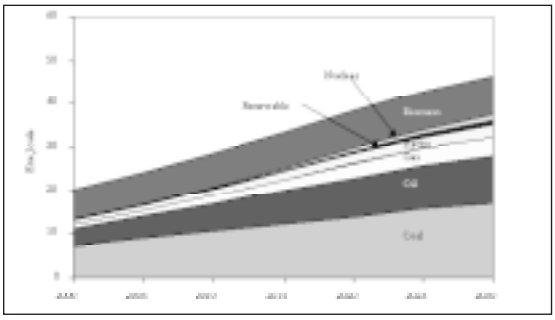


21 Carbon Mitigation in Past Decade?



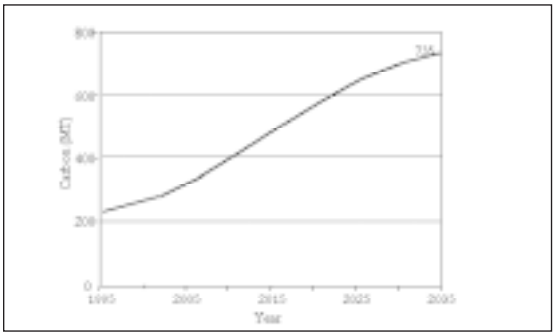
22 Future Energy Demand for India

(Base Scenario)

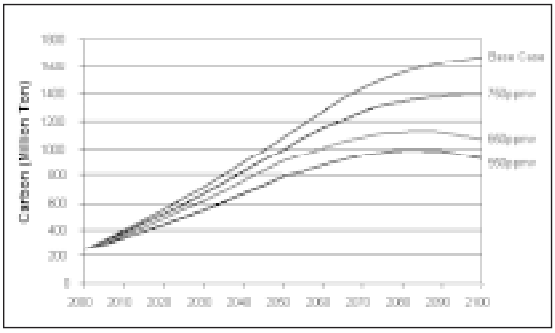


23 Carbon Emissions for India

(Base Scenario)



24 Global Carbon Mitigation Scenarios (2000 - 2100)



25 Global Carbon Price

(under different Post-Kyoto Scenarios)

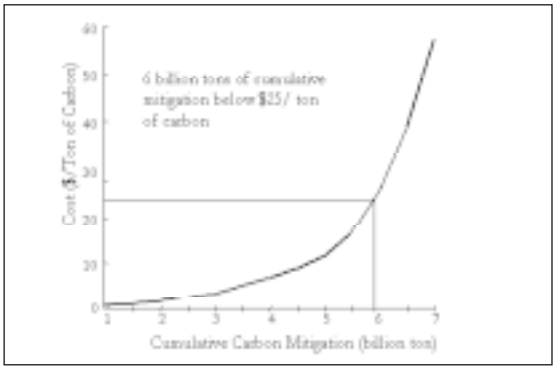
Stabilization Target	Kyoto Period (2000-2012)	Post-Kyoto Regime	
		2012-2030	2030-2100
750 ppmv	$5-8/ton	$8-18/ ton	$18-65/ton
650 ppmv	$5-10/ton	$10-24/ton	$24-88/ton
550 ppmv	$5-14/ton	$14-35/ton	$35-120/ton

26 Carbon Mitigation for India
(under different Post-Kyoto Scenarios)

(Cumulative: in Million Ton)

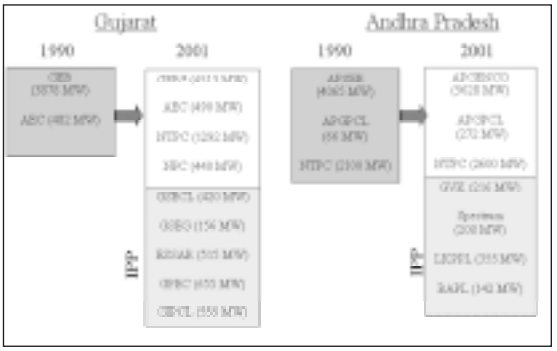
Stabilization Target	Kyoto Period 2000-2012	Medium Term 2000-2030	Long Term 2000-2100
750 ppmv	138 (3%)	743 (5%)	11334 (11%)
650 ppmv	301 (7%)	1555 (11%)	23666 (23%)
550 ppmv	449 (10%)	2503 (17%)	33284 (32%)

27 Carbon Mitigation Supply Curve for India (2005-2035)

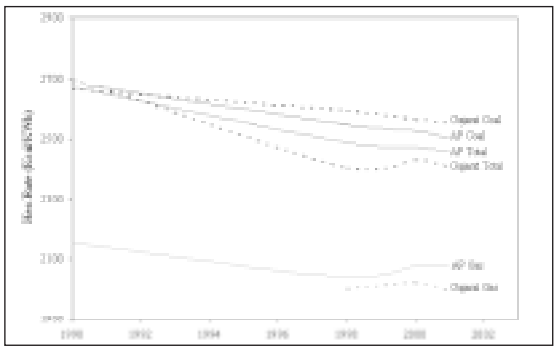


28 Baseline for Power Projects
(Results from IIMA-Stanford Study)

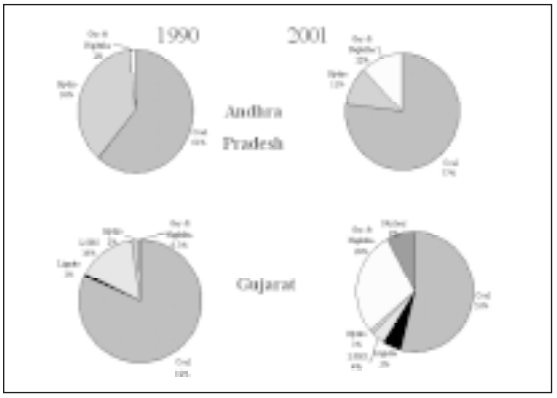
29 Shifts in Generation in Gujarat & AP



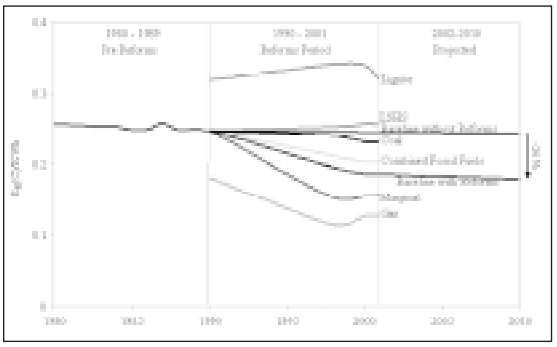
30 Energy Efficiency of Generation in AP & Gujarat



31 Generation Mix (GWh) in AP & Gujarat



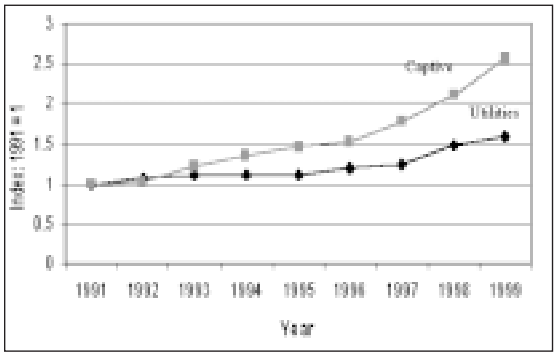
32 Carbon Baseline: Gujarat



33 Complexities, Uncertainties and Risks of Operating in CDM Market

- Key issues:
  - Baselines (Complexities)
  - Market Risks (Uncertainties - Market Size, Price)
  - Future Climate Regime (Uncertainties - Scientific, Political)
  - Legal Risks

34 Added Baseline Complexities Post-reform Power Capacity Addition in Gujarat



35 Market Uncertainties

36 Market Uncertainties: Size and Price

- OECD: Annual Mitigation Target (2008-2012)
  1.5 - 1.8 Billion TCO_2Eq.
- Hot Air
  0.7 - 1 Billion TCO_2Eq.
- Marginal Mitigation Cost (in Year 2010)

Domestic Action	US $/$TCO_2$ Eq.
• Japan Alone	127
• W. Europe Alone	36
• Annex I Trading	4 - 8
• An I Trade +CDM	3 - 6

37 Uncertainties of Future Climate Regime

- Global and Long-term nature of Climate Change problem
- Scientific Uncertainties and Controversies
- Large Number of Players
- Divergent Perspectives
- *Need for Cooperation (Leakage, Competitiveness)*

38 Issues and Concerns for CDM Implementation

39 Operational Issues and Concerns

- Transaction Costs (How to Minimize?)
- Subsidies (What would happen to existing subsidies?)
- Portfolio versus Isolated Projects (How to Coordinate?)
- Fast Track (What to put on fast track?)
- Shifting Baseline
- Share of CER Market (What market share to target?)
- Fragmented Market (How to operate in the fragmented carbon market?)
- CER Contracts and Laws (How CER contracts be structures between participants?)
- Legal Risks (What risks the host country laws would pose?)

40 Strategic Issues and Concerns

- Linking with CDM with National Development Priorities
- Integrated Projects (Can integrated projects such as infrastructure be considered?)
- Programs (Can programs like energy efficiency be included?)
- Soft versus Hard Projects (How can soft projects be included?)
- Multi-country projects (e.g. Gas Pipeline passing through several countries)
- Reforms and Institutional Developments
- Post-Kyoto Regime
- Mitigation and the Long-term Competitiveness of Indian Industry

CDM – Climate Change Convention, Kyoto Protocol and Issues of Additionality

Ashish Rana
Senior Program Officer, Winrock International India

ASHISH RANA is a Senior Program Officer in Climate Change Program at Winrock International India. He holds a PhD from the Indian Institute of Management, Ahmedabad. He has worked extensively on integrated assessment models for energy and climate policy analyses while focusing on macroeconomic modeling and applications for developing countries. His chief interests are in the field of climate change mitigation and adaptation, particularly on technological choices and economic impacts. He is one of the authors in the IPCC Third Assessment Report and IPCC Special Report on Carbon Dioxide Capture and Sequestration. He gave an overview of the climate change convention and key rules of the Kyoto Protocol.

1 Outline of presentation

- Convention timeline
- Protocol rules
- Kyoto mechanisms
- Additionality

2 Convention Timeline – Initial years

1979 First World Climate Conference (WCC)

1988 IPCC established

1990 IPCC and second WCC call for global treaty on climate change.
September, United Nations General Assembly negotiations on a framework convention

1991 First meeting of the Intergovernmental Negotiating Committee (INC)

1992 May, INC adopts UNFCCC text
June, Convention opened for signature at Earth Summit

1994 March, Convention enters into force

3 Convention Timeline – Last decade

1995 March and April, COP 1 (Berlin, Germany)

1997 December, COP 3 (Kyoto, Japan)
Kyoto Protocol adopted

1998 November, COP 4 (Buenos Aires, Argentina)
Buenos Aires Plan of Action

2000 November, COP 6 (The Hague, Netherlands)
Talks based on the Plan break down

2001 April, IPCC Third Assessment Report
July, COP 6 resumes (Bonn, Germany)
Bonn Agreements
Oct. and Nov. COP 7 (Marrakesh, Morocco)
Marrakesh Accords

2002 August and September World Summit on Sustainable Development
November, COP 8 (New Delhi, India); Delhi Declaration

2003 December, COP 9 (Milan, Italy)

2004 December, COP 10 (Buenos Aires, Argentina)

4 Kyoto Protocol

- Rules focus on
  - Commitments
  - Implementation
  - Minimizing impacts on developing countries
  - Accounting, reporting and review
  - Compliance

5 General rules

- Improve quality of emissions data
- National mitigation & adaptation programs
- Promote environment friendly technology transfer
- Cooperation in scientific research and international climate observation networks
- Support education, training, public awareness & capacity building initiatives

6 COMMITMENTS

- Aggregate reduction of at least 5% from 1990 levels by 2008-2012.
- Individual targets for all Annex-I countries
- 6 GHGs in one basket, GWP weighted
- *EITs – Base year 1990 or 1995 for HFCs, PFCs, SF_6*
- Use of LULUCF for sinks permitted

7 EMISSION TARGETS

- Average over 'First Commitment Period'
- Early action: 'demonstrable progress'
- Carry over
  - Difference in targets allowed to carry over beyond 2012
  - Credits earned from sinks not allowed
  - Credits from JI/CDM: 2.5% of assigned amount

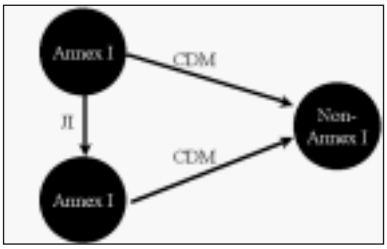
8 POLICIES AND MEASURES

- Suggested actions
  - Enhancing energy efficiency
  - Promoting renewable energy
  - Favouring sustainable agriculture
  - Methane recovery through waste management
  - Sinks
  - Market reforms
  - Transport sector emissions
- Use of SBSTA for enhancing effectiveness

9 KYOTO MECHANISMS

- Flexibility mechanisms
  - Joint Implementation
  - Clean Development Mechanism
  - Emissions Trading
- Designed to boost cost-effectiveness
- Supplemental to domestic action

10 KYOTO MECHANISMS



11 JOINT IMPLEMENTATION

- Additional Emission Reductions or removals
- Projects starting from 2000, ERUs can be issued only after 2008
- Track I: Host country fully meets all eligible requirements
- Track II: Host country does not fully meet all eligible requirements

12 EMISSION TRADING

- Annex I acquire Assigned Amount Units
  - CERs from CDM projects
  - ERUs from JI projects
  - RMUs from sink activities
- Hold 'Commitment Period Reserve': 90% of AAUs

13 CLEAN DEVELOPMENT MECHANISM

"Real, measurable and long-term climate benefits in form of ERs or Removals that are additional"

- Generate investment in developing countries
- Enhance environment friendly tech. transfer
- Promote Sustainable Development
- Additionality: Finance, Tech. Transfer
- No diversion of ODA

14 CLEAN DEVELOPMENT MECHANISM

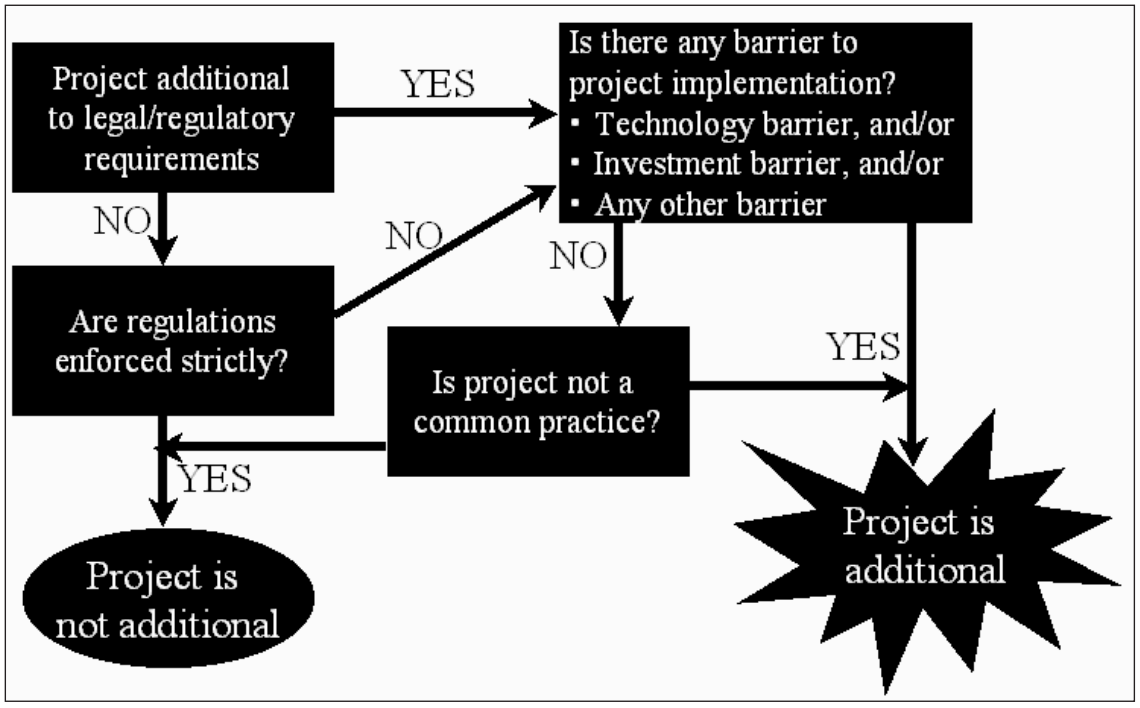
- CERs to accrue from project from 2000
- CDM – Executive Board overseeing practical arrangements
  - Defines procedures for accepting projects and encouraging the development of Small Scale Projects (esp. in Renewable Energy, Energy Efficiency)
- Appropriate, transparent, conservative baselines
- Rigorous monitoring plan to collect accurate emissions data

15 MINIMIZING IMPACTS

- Removing subsidies for environment friendly technologies
- Develop carbon capture & storage technologies, advance fossil fuel technologies
- Capacity building to improve efficiency
- Diversify economies that rely heavily on fossil-fuel production or commerce

16 ADDITIONALITY

- To ensure that Emission Reduction due to BAU measures in developing countries should not be credited under CDM
- Baseline determination
  - Scenario that reasonably represents the anthropogenic emissions by sources of GHG that would occur in the absence of the proposed project activity
- Project Design Document requires "Brief explanation of how emissions are to be reduced by the proposed project, including why the emission reductions would not occur in the absence of the proposed project activity"
- Necessary Condition
  - The emissions from the proposed project are less than the baseline emissions
- Sufficient Condition
  - The proposed CDM project is not a baseline scenario project and hence would not have been implemented in absence of CDM



Technical Session 2
Financing Issues

Chairperson

Somnath Bhattacharjee
Vice President, WII

GHG Market and India's Perspective

Ajay Mathur
President, Senergy Global

Emission Reductions: Linking International and National Legal Regimes

Amee Yajnik
Advocate, Gujarat High Court

GHG Market and India's Perspective

Ajay Mathur
President, Senergy Global

AJAY MATHUR is President of Senergy Global, the first Indian company dealing exclusively in CER asset creation and trading. He is a well-known expert on CDM and headed the Climate Change Team at the World Bank till December 2003. He has over 20 years of experience working in all aspects of energy projects. He talked about the nature and size of the carbon emissions-reduction market and the present status and future expected trends of CDM transactions.

1 Overview

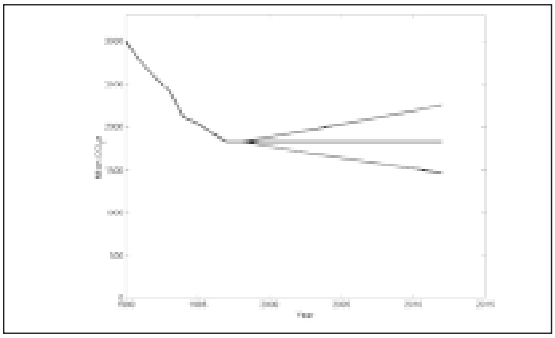
- The Global Market for Emission Reductions
  - Global Demand for ERs
  - ER Markets
  - Price and Volume Trends
- CDM Project Experience
  - Global Supply
  - Trends in Technological Choices
- Indian supply of CDM Projects
- Challenges

2 The Global Market for Emission Reductions

- 39 Developed Countries and Economies in transition:
  - Agreed to "differentiated" and binding emission limitations
  - Reduction of greenhouse gases by 5.2 % below 1990 levels in the commitment period 2008-2012 (~2800 - 4800 $MtCO_2$, including US)
- OECD countries are unlikely to meet their commitments under Kyoto Protocol and emission will exceed their commitments:
  - North America by 21% to 30% , but US has decided not to ratify
  - Pacific OECD by 19% to 29%
  - Western Europe by 16% to 27%
- The marginal cost of domestic abatement will drive the demand for external GHG credits.

3 Demand for Emission Reductions without the US

- Gross Annual Demand between 2008 & 2012 — 1400-2400 $MtCO_2e$
- Credit for Sinks — app 330 $MtCO_2e$
- Net demand for ERs — 1000-2000 $MtCO_2e$
- There is emerging consensus that 700-800 $MtCO_2e$ would be sourced through the flexibility mechanisms: CDM, JI, IET
- Split would depend on prices and policies



4 Emissions Trading with Russia can alone meet all the projected Demand

Source: PointCarbon

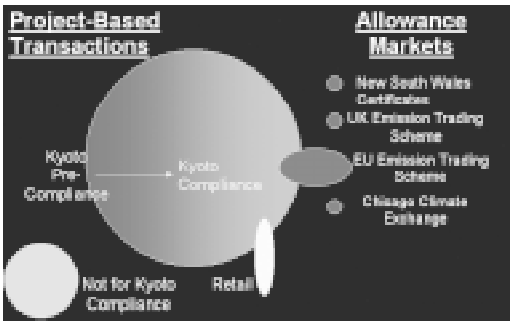
- Total "hot air" availability is about 2000-3200 $MtCO_2e$
- Strong political opinion against large purchases of cheap hot air
- Volume largely depends on deal with Russia

5 Demand for CDM Emission Reductions

Country	Total planned CER purchase, 1st Kyoto commitment period (2008-12)
Austria	20-30 $MtCO_2e$ (JI&CDM)
Canada	50 $MtCO_2e$ (CDM, JI and ET)
Denmark	6.25$MtCO_2e$, but » Î 120 million to be invested in JI/CDM -2007
EU	400-600$MtCO_2e$
But depends	on linking directive
Italy	At least 60$MtCO_2e$ (JI&CDM)
Japan	At least 95$MtCO_2e$ (JI&CDM)
Netherlands	67$MtCO_2e$

Estimated demand would be in the 200-300 $MtCO_2e$ range

6 Multiple Carbon Markets are Emerging

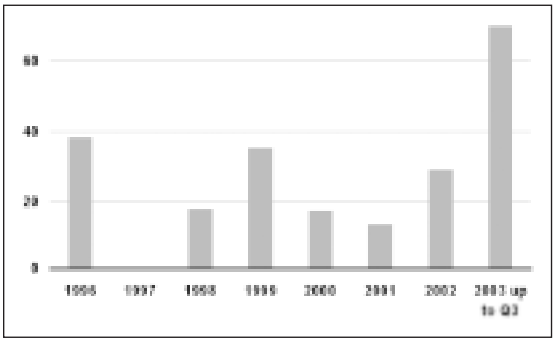


7 Key Figures

- Based on assessment by the World Bank's Carbon Finance Team
- Project-based transactions account for more than 96% of volume traded (2003)
- Key numbers:
  - **70 million tCO_2e** traded in 2003 (vintages up to 2012)
  - **2.5 times** more than 2002
  - ~ **220 million** tCO_2e traded since 1996
  - On average, projects generate 70% more emission reductions (post-2012 in general)

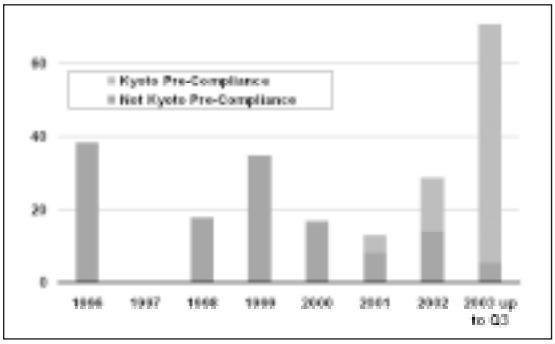
8 Carbon Market Growing

Volume traded in project-based transactions, million tCO_2e



9 Main Driver: Compliance

Volume traded in project-based transactions, million tCO_2e



10 Structure of Current Transactions

- Prior to the Marrakesh Accords (Nov.2001)
  - Options represented up to 43% of annual volume
  - Spot or 2-3 forward purchases
- Since 2002, most transactions include
  - Forward purchase of vintages 5-10 years ahead
  - Payment on delivery
  - Can be complemented by options on further vintages or additional volume

11 Still no Standard Contract

- Commodity purchase model vs. investment in underlying project
- Tender model vs. one-by-one negotiation
- **Distribution of risks** between buyer and seller. For example, what if….

- the project underperforms, delivers less/no ERs?
- ERs are in fine not registered under CDM or JI?
- market value of carbon changes?
- the Kyoto Protocol does not enter into force?

■ Hence liability provisions, insurance, etc.

12 PRICES

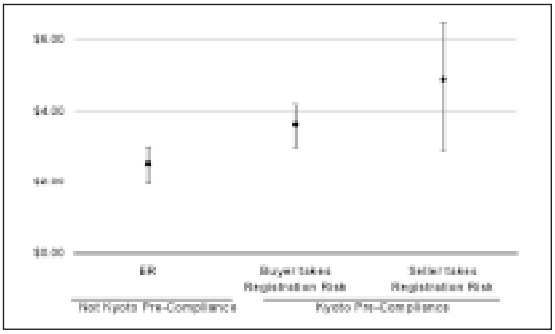
■ Price only **one among many features** of purchase contracts

■ Especially important in current context with **no standard commodity or standard contract**

■ **Limited price data**: on 2/3 of overall volume purchased in 2003, but only on 1/3 of volume purchased by private sector

13 PRICES IN 2003

(in U.S.$ per metric tonne of CO_2e)



14 KEY PRICE DETERMINANTS

■ Delivery of VERs vs. Issued CERs
- Who bears the methodological and issuance risk
- Who bears the Kyoto Protocol Entry into force risk

■ Other determinants
- Creditworthiness of project sponsor
- Viability of underlying project, and liabilities of seller in case it underperforms
- ER vintage: pre or post 2012
- Cost of validation and potential certification
- Host country support
- Additional environment and social benefits

15 TOTAL MARKET VALUE

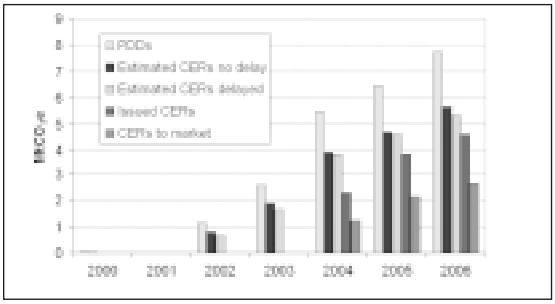
■ Market in 2003: ***200 - 300 million U.S.$*** (between 300 and 650 million U.S.$ since 1996)

■ World Bank Carbon Funds experience is that carbon finance is between 1:6 and 1:8 of total project cost

■ Carbon finance "leverage" in 2003: between ***1.2 and 2.4 billion U.S.$***

■ ER purchase agreements denominated in strong currency can help bring financing to the underlying project

16 CERS INTO THE MARKET



Who's selling?

■ 90% of volume now contracted in JI or CDM Countries

■ Latin & Central America remains dominant

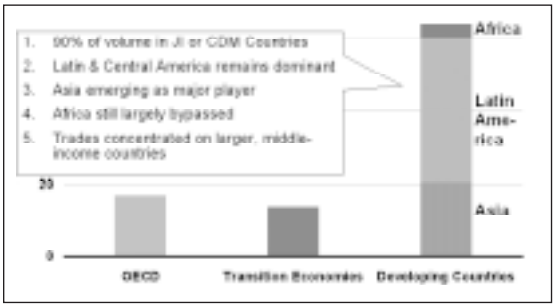
■ Asia emerging as major player

■ Africa still largely bypassed

■ Trades tend to concentrate on larger, middle-income countries

17 LOCATION OF PROJECTS

In million tCO_2e sold from 2002 to Q3 2003



18 WHO'S BUYING?

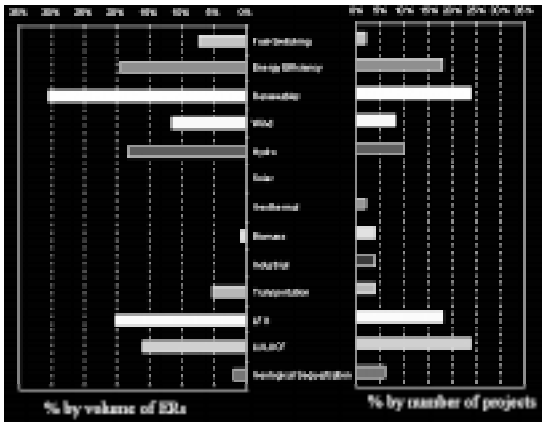
■ Government of the Netherlands single biggest buyer (30% of purchases in 2002-2003)

■ Japanese public and private entities emerging as major purchasers

■ Public sector still dominates, but private sector

now represents over 40% CDM volume (virtually none of JI)

19 Technology Distribution (2001-02)



20 Impact of Carbon Finance on Project

Assuming a revenue stream based on emission Reduction (at US$ 3/TCO_2e) the change in internal rate of return (IRR) of projects:

Technology	DIRR
Energy Eff.-District Heating	2- 4
Wind	0.9-1.3
Hydro	1.2-2.6
Bagasse	0.5-3.5
Biomass with methane kick	Up to 5.0
Municipal Solid Waste with methane kick	>5.0

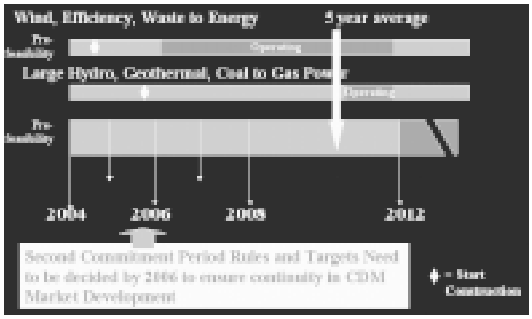
21 Where are the Indian CDM Projects Expected to Develop

- Energy Efficiency
  - *Power sector: clean coal technologies; coal washing; Fuel switching*
  - *Industrial sector: Iron & Steel; Paper; Cement; Caustic Soda; Aluminium*
  - *Commercial & Domestic Buildings: Appliances; Lighting*
- Renewable Energy
  - *Power generation: Biomass; Wind; Hydro; Bagasse cogen; Solar*
  - *Agriculture sector: PV and wind Pumps; Biomass gasifiers*
  - *Households: Cookstoves; Biogas, PV lighting*
- Transport
  - *Mass rapid transport*
  - *CNG Fuel*

22 Where does CDM seem to make the largest difference ?

- Landfill Gas
- Construction sector – brick making; cement blends
- Biomethanation – domestic and industrial biogas

23 Time is Running Out



24 Challenges

- Additionality is difficult to demonstrate in most energy efficiency and renewable energy options
- Baselines are difficult to estimate because of data scarcity
- Monitoring can be expensive for most projects, especially small projects
- Reliability and predictability of new technologies continues to be a challenge
- A formal risk mitigation strategy is essential in order to obtain attractive ER prices

EMISSION REDUCTIONS: LINKING INTERNATIONAL AND NATIONAL LEGAL REGIMES

AMEE YAJNIK
Advocate, Gujarat High Court

AMEE YAJNIK is an Advocate at the Gujarat High Court. She has a Master's of Science of Law from Stanford University and is also pursuing the doctoral degree from the same university. She has a special interest in the field of energy and environmental law and has delivered lectures on the subject at various international and national conferences and workshops. She also has a Master's degree in Ecology and Environment. She is also a guest faculty at several leading institutes like Lal Bahadur Shastri National Academy for Administration, Mussoorie, Institute of Company Secretaries of India, Ahmedabad, and IIM, Ahmedabad. She drew attention to the legal and contractual issues that could emerge as bottlenecks when it comes to realization of the CERs.

1 PRESENTATION AGENDA

- Ownership of Atmosphere (Property Rights)
- Ownership of ERs and legal process of transfer
- Would specific law be needed in India/Non-Annex I?
- Contract Risks
- How to make the contracts robust to ensure tradable rights?

2 OWNERSHIP OF ATMOSPHERE: THE PROPERTY RIGHTS ISSUES

- Atmosphere is global common property
- Atmosphere is a scarce resource
- Utilization of the resource is skewed
- Property regime defined by KP has limitations
  - "Grandfathering" is used for assigned amount (AA) allocation
  - Whether AA is an "entitlement"?
  - Whether the AA allocation under KP distort future rights regime?
- Long-term emissions regime issues
  - "Convergence" of AA rights allocation (e.g. per capita entitlements)
  - "No harm" principle for developing counties will continue

3 OWNERSHIP OF ERS AND LEGAL PROCESS OF TRANSFER

- ER has international legal origin under KP.
- ER is a product of a CDM/JI Project.
- If Project is "legal" in domestic jurisdiction and ERs are "certified" and "verified" by authorized agents, then ERs are legal commodities
- Ownership of ERs is with the Project Stakeholders
- Distribution of ERs is a contract among stakeholders
- Rules pertaining to export of a legal commodity in a country are applicable for transfer to an international agent

4 WOULD SPECIFIC LAW BE NEEDED IN INDIA/NON-ANNEX I?

ERs are new commodities, but not different. Therefore present laws/ rules are applicable and adequate.

- State/ Central Government Laws/ rules
- Project clearances (e.g. for DPC phase I, there were 28 clearances pre-closing and 14 post-closing)
- Project Contracts/ Agreements (Complex Structure)

However existing structure is complex and has high transaction costs.

For ERs, new rules may have to be added. Question is whether these be handled within existing machinery or a new institution is needed (e.g. independent CDM authority)

5 Contract Risks

Country risks associated with Project in general are applicable

- Legal Risks
- Regulatory Risks
- Political and Social Risks
- Administrative / Bureaucratic Risks
- Missing dimensions of rule of law

6 DPC: Project Agreements Structure

7 Additional Legal Risk for ERs

Country risks associated with Project in general are applicable ERs bring additional risks:

- Baseline
  - Dynamic Baseline
  - Altered Operating Conditions (AEC Case study)
- ER Price

8 AEC Case

- Ahmedabad Electricity Company (AEC), a coal based power company, started a 200 MW gas based plant in1997
  - In 2000, gas supply dried up (weak-contract, gas monopoly)
  - Shifted to oil as a fuel in 2000
  - Recent oil price rise has inflated electricity generation cost
  - AEC is unable to get the higher electricity price from GERC
  - Since past 2 months, AEC gas/oil plant is inoperative
- Risk is transferred from weak gas contract and electricity price regulation
- What happens to ERs if this was a CDM project?

9 How to make the contracts robust to ensure tradable rights?

- Clauses for dispute resolution
  - Clear ER Ownership definition (legal entitlement)
  - International arbitration (high transaction costs/ more confidence)
  - Host country dispute settlement (low cost/ low confidence due to weak legal regime/ delays)
- Size of project matters
  - Large project can have international arbitration
  - For Small projects, robust host country mechanism would help

10 Conclusions

- Project operates within the domestic jurisdiction, therefore all the dynamics of the domestic regime will influence ERs
- Domestic legal regimes need to establish explicit laws/ rules/ institutions/ authorities to recognize ERs legally.
- International regime needs to take into account the diversity of domestic legal systems
- Harmonization of international and domestic legal regimes apart, the near-term the effectiveness of ERs and ER transactions can best be achieved by overcoming barriers by contracting and arbitration processes

Technical Session 3
CDM & Sustainable Development

Chairperson

Ajay Mathur
President, Senergy Global

CDM and Biomethanation

Siddhartha Yadav
Consultant, Ministry of Environment and Forests

CDM Benefits from Waste Utilization

A.C. Shroff
MD, Excel Industries Ltd.

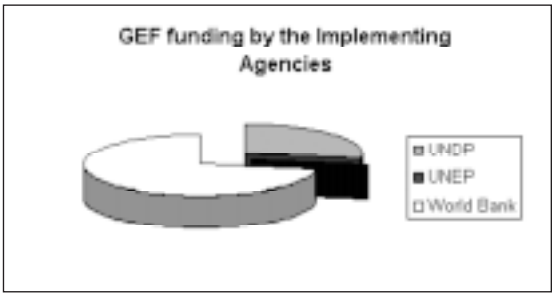
CDM AND BIOMETHANATION

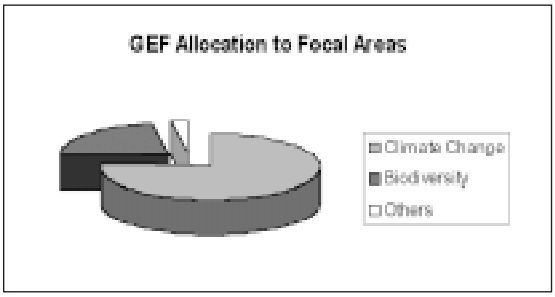
SIDDHARTHA YADAV
Consultant, Ministry of Environment and Forests

SIDDHARTHA YADAV works as a consultant with the Ministry of Environment and Forests, Govt. of India. He is an expert in CDM and has been involved in a national study on High Rate Biomethantion Projects sponsored by UNDP. He has several years of experience working with government agencies including the Central Pollution Control Board of India. He explained about UNDP/ GEF project of High Rate Biomethanation implemented by the Ministry of Environment and Forests, Govt. of India, under which 16 sub-projects are set up across the nation as demonstration projects. He also explained about the development of National Master Plan for Biomethanation and the potential to frame those projects under CDM.

1 CONTEXT

- United Nations Development Programme (UNDP)/Government of India GEF portfolio





UNDP	US $50.9m	36%
UNEP & Others	US $17.86m	13%
World bank	US $72.4m	51%
Total	US$141.53m	

Climate Change	US $107.748 m	64.16%
Biodiversity	US $28.725 m	35.28%
Others	US $ 3.37m	0.56%

Total GEF funding in Climate Change sector (ongoing projects) US $107.74 m

2 CLIMATE CHANGE-BIOMETHANATION GEF INITIATIVES

- Development of High Rate Biomethanation processes as a means of Reducing GHG Emissions
- Selected Options for Stabilizing Greenhouse Gas Emissions for Sustainable Development
- Carbon Emissions Reduction through Biomass Energy – SUTRA (Sustainable Transformation for Rural Areas)
- Removal of Barriers to Biomass Power Generation in India (under approval)
- Technology Transfer Networks (UNEP-TTN)

3 UNDP/GEF PROJECT ON HIGH RATE BIOMETHANATION

- Setting up 16 Demonstration sub-projects
- Preparation of National Master plan
- Trainings/Workshops/Information Dissemination

4 STRATEGY

- Built upon the experiences of the ongoing GEF projects
- Scaling up the ongoing UNDP/GEF project 'Development of High Rate Biomethanation Process as a means of reducing GHG Emissions'
- National Biomethanation Master Plan under UNDP/GEF project - Final stages of preparation
- Learning from the project cycle to be used to

determine Individual , Institutional and Systemic capacity requirements in Biomethanation projects for CDM

- Making biomethanation technology an attractive option for private, public and multiple financing sources
- Achieving multiple benefits
  - Reducing GHG
  - Improvement of Air and Water Quality at local level
  - Access to valuable new source of energy by local communities
  - Enhancement of Quality of Life for rural women-substitute firewood
  - Overall sustainability of benefits

5 Activities

- Identification of stakeholders for Biomethanation CDM projects
- Assess capacity for undertaking CDM project cycle
- Assess CDM potential of the projects implemented with UNDP/GEF support
- Review developments at CDM EB, Subsidiary Bodies, COP in terms of modalities and procedures - draw linkages to Biomethanation Master Plan
- Define CDM prospects for Biomethanation projects
- Information dissemination and exchange of information and experiences with non-Annex I parties

6 MoEF/UNDP TTF Project 'CDM and Biomethanation'

- Pipeline CDM projects – India is the leader followed by Brazil and Costa Rica
- The estimated amount of CERs from India CDM portfolio is about 38 million CERs
- Indian portfolio - 32.2% share of the global market
- National Draft Masterplan -2700 MW waste to energy generation projects by 2017
- Resource requirements, strategic activities and key issues – under review

7 Issues

- Targets and Financial Allocation
  - Timeframes for achieving the targets
  - Financial resources as subsidies to specific project types- issue of additionality
  - Risks and Barriers
  - National Bomethanation Masterplan is likely to identify the risks and barriers to Biomethanation projects in India; definition may be referred in justifying the additionality through barrier removal in prospective CDM projects
- Baselines
  - Explicit acknowledgement of rules and notifications for management of Urban and Industrial waste management will simplify baseline setting for prospective Biomethanation projects

8 Capacity Building Needs and Strategies

- Low availability of data on biomethanation projects and low awareness about successful projects
- Lack of business models constraining the adoption of commercial biomethanation projects
- Lack of recognition of societal/ environmental benefits arising from the sustainable waste management by biomethanation
- Awareness on carbon trading and societal benefits is generic; economic and financial benefits are poorly understood

9 Capacity Building Needs

- **Advocacy and Support Organisations** like CII, FICCI etc.- may play the role of bundling organisations. Considerable capacity Building efforts on CDM modalities and procedures, methodological issues, markets etc. may be required
- **Financial Institutions-** possess relatively high level of awareness and understanding of CDM but require better understanding of scientific and technological risk & understanding of CDM modalities and procedures

- **Local Bodies and Municipalities-** lack understanding of CDM modalities & procedures- require awareness on advantages of CDM, P-P-P models
- **NGO's , project promoters, R& D Institutions, State Level nodal agencies, Technical consultants-** play a key role – require understanding and awareness of CDM modalities and procedures, markets and bundling organisational roles

10 POTENTIAL FOR BIOMETHANATION CDM PROJECTS

Sector	Potential (million tonnes CO_2/year)
Municipal Solid waste	1648.28
Municipal Liquid Waste	288.6
Pulp & paper	6.37
Starch & Food products	2.88
Total	1946.14

Estimated CDM potential from Biomethanation in India - 1946.14 million tonnes CO_2/year

Maximum potential exists in Urban Waste Sector (84% Solid Waste, 15% Liquid Waste)

Assuming that credits will be available during the period when compliance is below 50%

CDM Benefits from Waste Utilization

A.C. Shroff
MD, Excel Industries Ltd.

A. C. SHROFF is an industrialist and a social worker. He is Managing Director of Excel Industries Ltd. and a Board Member of Excel Cropcare Ltd. He is also a Trustee of Vivekanand Research and Training Institute, a local NGO involved in rural development work for more than 30 years. He is also a Trustee of Kachh Navnirman Abhiyaan, a federation of NGOs working in Kachh area after the devastating earthquake of 2001. He has been appointed as co-chair of Environment Committee of Federation of Indian Chambers of Commerce and Industry (FICCI). He spoke about his experience in setting up projects for waste utilization towards sustainable development and also tapping the potential benefits of CDM through such projects.

1 Municipal Solid Waste Management Landfill Gas Emission & Climate Change

- Most of the waste we generate ends up in landfills, where it decomposes and produces landfill gas.
- Landfill gas contributes to local smog and present health and safety hazards.
- Landfill gas is approximately 50 percent methane, a potent greenhouse gas that contributes to global climate change.

2 Municipal Solid Waste Management Impact of Urbanisation

Transition from Natures' Nutrients Flow of Circular Loop to Liner-One Way Nutrients Flow

- The chemical fertilizer revived the fertility of nutrient depleted farmland. Cities could expand, and food could be imported from great distances, without concern for returning urban garbage and sewage to farmlands.
- Thus, garbage and sewage became waste products to be discarded, rather than soil builders to be reused.
- But reliance on linear flows instead of the traditional organic "loop" comes at a price that is paid at both ends.

Today, the price for breaking organic loops is a diverse set of problems,

- from pollution and poor soil health caused by excessive dependence on fertilizer
- to difficulty in disposing of nutrient-laden urban wastes cleanly.
- Many regions of the globe are now over fertilized.
- Drinking water in several countries is contaminated with fertiliser run off
- Species diversity is reduced in some land-based ecosystems by excess application of Nitrogen.
- The quality of organic matter declines, and plant diseases become more prevalent, in soils dependent on manufactured fertilizers.
- Aquatic life in rivers, lakes, and bays suffocates as blooms of algae fatten on Nitrogen and phosphorus that have leached and eroded from these soils.
- In short, a host of new problems arise once the circular flow of nutrients (essential for plant growth) and organic matter (essential for soil health) is disrupted and made into a linear flow.

3 Municipal Solid Waste in India

- Indian Population is about 1000 Million.
- MSW generation ranges from 200gms per capita per day in small towns to about 500gm per capita per day in large cities.
- MSW generation is estimated at 73 million ton per year at minimum generation rate.
- Out of this, 40 millions tons per annum is generated in Class – I cities (having population over 100,000)

4 MSW* Composition Qualitative Estimates

**Municipal Solid Waste*

Typical analysis of MSW in Indian cities ~

- 31% to 56% Compostable / Combustible Waste Material
- 40% to 54% Inert Material such as construction debris, stone, sand
- less than 10% Recyclable such as paper, plastic, glass, metal
- 22% to 42% Moisture contents
- Calorific value ~ 800 Kcal/kg to 1140 Kcal/kg

5 MSW* Impact on Climate Change Qualitative Estimates

**Municipal Solid Waste*

- 40 millions ton MSW generated per annum in Class-I cities ends up in landfills, where it decomposes & produce landfill methane & other harmful gas.
- Assuming dry Organic Component weight @ 30% of MSW, one ton of MSW will emits approximately 101kg of Methane at Landfill Site.
- Estimated 4 million ton of CH_4 emission per annum could be avoided if 40 million tons of MSW generated by Class-I cities pass through Composting Process.
- In addition,8 million tons of compost can be produced for Biomass Production on 1.6 million hectares of degraded barren land to promote Carbon Sequestration and produce feed stock Biomass for Bio-Energy generation.

6 Statutory Compliance

Municipal Solid Waste Rule 2000

- Govt.of India, has enforced Municipal Solid Waste (Handling & Management) Rules 2000 for Scientific & Eco-friendly disposal of MSW in Class-I Cities of India.
- All Urban Local Body (ULB) have to adopt a Scientific & Eco-friendly Solid Waste Disposal Method from Jan.2004. MSW Rule compliance requires:
- Segregation of Bio-degradable & Non-Bio-Degradable MSW
- Sanitation of MSW
- Composting of Organic fraction of MSW
- Recycling of Non-bio-degradable MSW
- Sanitary Landfill for Inert & residual MSW

7 Municipal Solid Waste Management Present Scenario

- ULB presently provides following services through SWM Dept ~
- Road Sweeping
- Collection of MSW from Community Bins
- Transport of MSW to Notified site
- Open Dumping of MSW at Notified site

8 Eco-friendly Disposal Option

- Composting Process option for Compostable / Combustible Waste
- Sanitary Landfill option for Inert Material such as construction debris, stone, sand generation.
- Reuse & Recycling option for Recyclable such as paper, plastic, glass, metal

9 Cost-effective Disposal Options

- It is observed during last one decade that Composting Process is more practical and relevant for the Agrarian Indian Economy especially with Non-segregated nature of Municipal Solid Waste in India.
- Compost can be produced from MSW for Biomass Production on degraded barren land to promote Carbon Sequestration and produce feed stock Biomass for Bio-Energy generation.

10 Oppourtunities in India

- 70% of Indian Population depends on Agriculture & Allied Activities for their Livelihood.
- Synthetic Fertilizer Consumption in the year 2001- 02 was about 17.36 million ton.
- Synthetic Fertilizer usage efficiency optimization ideally requires equal quantity of Organic Manure (50:50 basis)
- Estimated need for compost for balance use of fertilisers is 8.68 million tons per annum based on fertiliser consumption estimates for 2001- 02.
- Linkage of MSW Composting & Agriculture assume Clean Development Mechanism oppourtunities ~

- Reduction in Methane Emission
- Produce Compost
- Produce Biomass in Solid or Non-edible oil
- Promote Carbon Sequestration
- Make available feed stock for Bio-Energy generation.
- Rejuvenated land provides sustainable frame work for Reverse Migration of people from Urban cities to Rural Villages.

11 Project Economics

- 18250 TPA MSW Project
- Capital Investment Rs. 22 Millions
- Annual Revenue Exp. of Rs. 6 Millions.
- 3650 tons of Compost per annum
- Rejuvenate 700 hectares of degraded barren land for sustainable production of Biomass as source of Renewable source of Energy.
- Composting Process is viable for any Nation on this planet under tropical climate zone.

12 Excel Solid Waste Management Project Capability

- 14 plants in India using Excel Process Technology
- Installed capacities to handle over 1 million ton of MSW per annum
- Technical Staff for Monitoring & Review.
- Executed Asia Development Bank funded project and Pre-qualified for ADB funded Project in India & Srilanka

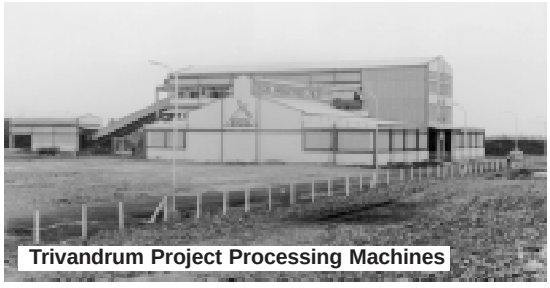
13 Compost use in Agriculture Impact on Climate Change

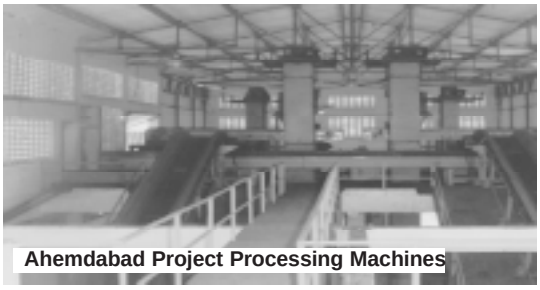
- Carbon Sequestration*

In the UN Framework Convention on Climate Change, the signatory countries of the Kyoto Protocol agreed to include carbon sequestration (agricultural sinks) as an option for mitigating GHGs. Agriculture both absorbs and emits large amounts of carbon dioxide (CO_2). Fertilizer applications increase the amount of dry matter produced by a crop and, thus, increase the net carbon fixed in soils as organic matter when crop residues are returned to the soil. Nitrogen helps to stabilize carbon in soil organic matter: a kilogram of nitrogen is required for every 10 to 12 kilograms of carbon sequestered. The building-up of soil organic matter stocks, and the subsequent increase in soil carbon, can be enhanced using advanced farming practices such as conservation tillage (reduced tillage or no-till), cover crops and improved crop rotations.*source:www.fertilizer.org/ifa International Fertilizer Industry Association ~Position Paper on Greenhouse Gas Emission and Carbon Sequestration.

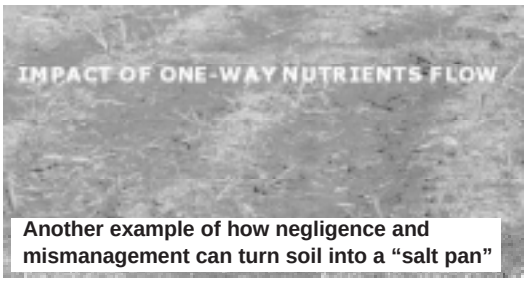

Trivandrum Project Arial View


Ahmedabad Project


Trivandrum Project Processing Machines


Ahemdabad Project Processing Machines

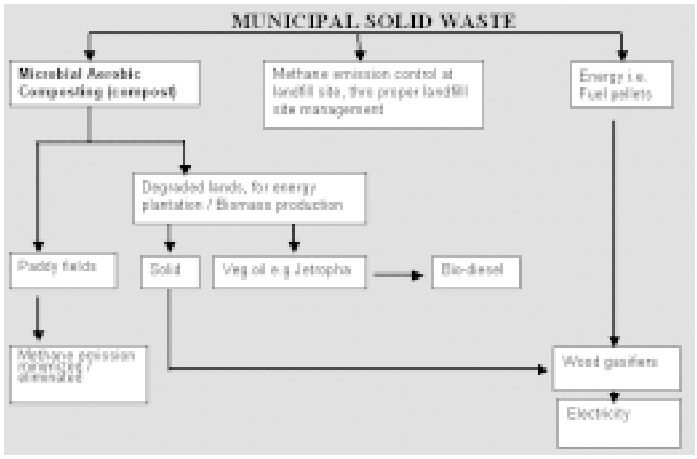
14 End Product Performance



Another example of how negligence and mismanagement can turn soil into a "salt pan"

See the magic of Celrich. The land has produced a good initial crop growth…. The farmer was very happy to see the dense green cover on his barren land….

15 Pathways to Sustainable Development MSW > Compost > Biomass > Bio-Energy



16 Compost use in Agriculture Impact on Climate Change

- Increases nutrients use efficiency and diminishes nitrogen leaching minimize N_2O emission.
- Carbon stored in soils is generally more than double that stored in the vegetation that these soils support.(102 MT per hectare versus 17 to 47 MT per hectares)
- Almost half of the soil carbon is stored in top 30 cms of soil profile, the depth most accessible to rooting system of annual crop & pasture.
- Improved soil organic matter content increase carbon sequestration capacity and thus help reduce agriculture-induced GHG emissions.

Source: www.wri.org/wr2000/agro_carbon.html Web Site of World Resources Institute

17 Key Issues

- The baseline precept for organic matter management is that in a fully sustainable world, all organic flows must be recycled.
- Appreciation of contribution of organic matter

to sustainable urban living will require a diverse set of policies affecting the individuals, municipalities, and industries that produce organic waste and the farmers that use it.

- As a starting point, organic material can be turned away from traditional disposal sites using taxes or legal restrictions
- Viable recycling options are necessary to ensure that material is actually reused. Such options are best governed by the principle that organic wastes should be segregated from other wastes.
- High cost of inventory ~ MSW generation is round the year whereas demand for compost by farming community is seasonal.
- Marketing Cost & Middleman Profit adds to price Farming Sector is unorganized and therefore marketing of compost essential needs chain of middleman to reach end user.
- High Cost of Transportation ~ Production unit needs to be in urban city for proximity to MSW generation whereas farmers are located away in rural areas.
- Thus the ex-factory sale price of compost (loose) at Rs.2000 per ton becomes Rs.4000 per ton when it reaches at farmers fields.

18 EXCEL ~ AHMEDABAD COMPOST PLANT

- Installed Capacity: 182500 TPA MSW

500TPA x 365 days = 182500 TPA MSW

- Compost Production Capacity: 25000 TPA Compost

100TPA x 250 days = 25000 TPA Compost

- Estimated Methane Emission Reduction: 18250 TPA

182500 TPA MSW @ 100kg per ton = 18250 TPA

- Estimated GHG Reduction CO_2 equivalent: 383250 TPA

18250 TPA CH_4 x 21 times = 383250 TPA

- Estimated GHG Reduction CO_2 equivalent: 383250 TPA

18250 TPA CH_4 x 21 times = 383250 TPA

- Estimated CER certificates Value = Rs.51.73 million/annum

383250 TPA @ US $ 3 per ton x Rs.45 = Rs.51.73 million/annum

- Compost Production Cost: Rs. 60.25 million/ annum

18250 TPA MSW @ Rs.330 per ton = Rs. 60.25 million/annum

- Compost Plants in India are being operated at below break-even volume as the price at which the average farmer can afford to buy compost needs govt subsidy support.

19 LOOKING FORWARD FOR GOVT. SUPPORT

- MoEF, Govt. of India has notified Municipal Solid Waste (Handling & Management) Rule 2000.
  - MSW Rule has made mandatory for all state govt. to adopt suitable biological process to stabilize Organic fraction of MSW.
  - State Govt. has initiated process towards mandatory segregation of Waste thro legislation & motivation
  - State Govt. has initiated process towards inviting proposals for Waste to Compost and/ or Energy Projects.
- Indian City Compost Producers Association formed to mobilise Govt. Support.
- In order to make available compost to average farmers at affordable price ~
  - Capital Investment Subsidy proposed @ 30% to reduce incidence of Interest & Depreciation on cost of production.
  - Compost sale subsidy proposed @ Rs.1000 to 1200 per ton of Compost.
  - Freight subsidy proposed @ Rs.300 per ton of Compost.
  - Exemption from Excise & Sales taxes on Plant & Equipment for Composting & Sale of Compost.
  - Tax holiday for 20 years
- In order to operate Compost Plant at full installed capacity it is necessary tap institutional market and promote use of compost as ~
  - Soil Amendment for Biomass Production on degraded land
  - Soil Enrichment for Urban Landscaping by ULB
  - Soil Enrichment for Social Forestry by MoEF

- Balance use of fertiliser for averting soil degradation & Water Bodies Pollution

20 WAY FORWARD.....

- There is logic, documentation & financial prudence to promote mandatory use of compost under govt. schemes such as ~
  - Wasteland Rehabilitation and Biomass Production
  - Promotion of Renewable Source of Bio-Energy
  - Salinity Ingress Control
  - Soil & Water Conservation
  - Organic Farming for Sustainable Agriculture
  - Combating Desertification
  - Community Forest Management
  - Integrated Watershed Management
- With these demand, Composting Units can sale compost at Rs.1500 to Rs. 2000 per ton ex-factory loose round the year.
- Thus the present installed capacity will run to its full utilisation as well as invite private sector participation for Composting Activity.

21 WHAT EXCEL CAN OFFER?

- Pre-feasibility Study
- Detailed Project Report
- Process Design Engineering
- Tendering Process, Contractor & Vendor Selection
- Training O&M Contractor
- Project Management Consultancy

Technical Session 4
CDM & Sustainable Development

Chairperson

A.N.Mathur

Dean, College of Technology and Engineering,
Maharana Pratap University of Agriculture and Technology Udaipur, Rajasthan

CDM Project Cycle

Aditi Dass

Senior Program Officer, Winrock International India

Biofuels - A Global Overview, Benefits and Potential CDM Opportunities

Jai Uppal

Advisor - Renewable Energy, Winrock International India

CDM Project Cycle

Aditi Dass
Senior Program Officer, Winrock International India

ADITI DASS is working at Winrock International India, Climate Change Unit. She has been working on global and local environmental issues for over 10 years in research/ academic institutions, private organizations, NGOs and the government, focusing extensively on urban transport, energy and environmental aspects & policies and climate change issues. She was with the Asian Institute of Technology (AIT) Bangkok, prior to joining WII. She holds a master's degree in Planning (with specialization in transportation planning). In her presentation, she covered the CDM project cycle.

1 Outline

- Overview – Climate Change
- What is CDM
- CDM Eligibility Criteria
- CDM Project Cycle
- Typical Renewable Energy CDM Projects submitted to UNFCCC
- CDM activities at Winrock International India

2 World Response to Climate Change

- UNFCC signed at Rio in 1992
- Parties to Convention meet every year to review the progress on implementation - Conference of Parties (COP)
- Kyoto Protocol - Signed at Kyoto, Japan in 1997 (COP-3) - Reduction of emissions by developed countries

3 Clean Development Mechanism (CDM)

- Adopted in Kyoto in COP-3, 1997
- Two main purposes
  - Assist Annex I Parties in achieving compliance with their quantified emission reduction commitments under the protocol
  - To assist developing country parties in achieving sustainable development
- Rules agreed
  - Projects starting in 2000 & later are eligible to earn CERs
  - Should lead to real, measurable and long term GHG reductions which are additional to any that would occur in absence of the CDM project

4 CDM Project: Steps Involved

- Project Identification
- Project Idea Note (PIN)
- Government Endorsement
- Project Development
- Validation
- Registration
- Monitoring
- Verification
- Certification
- Issuance of CERs

5 Eligibility Criteria

- Additionality
- Project should not be a baseline case (BAU)
- Reduction in emissions that are additional to any that would occur in the absence of the certified project activity (Article 12.5c)
- Meets host country sustainable development criteria
- Project activity initiated after Jan 01 2000
- Special provisions for small-scale CDM projects

6 Eligible Sectors

- Energy/Renewable Energy
- Industrial Process
- Waste
- Forestry
- Nuclear Energy - Discouraged

7 Eligible Projects

- Energy
  - Renewables - Wind; Solar; biomass; hydro; geothermal
  - Power Generation - Combined Cycle turbines; distributive networks; clean coal technology
  - Fuel Switching - Natural gas; methane; biomass and biogas; hydrogen
  - Cogeneration - Sugarcane; chemical byproducts
- Household
  - Conservation - Lighting, solar water heaters, efficient equipment
- Industry
  - Efficiency - Boilers; motors; lighting
  - Cogeneration - chemical; paper; metallurgy; oil refining
  - Retrofits
  - Production process
  - Waste Fuel Recovery - Including Landfills
- Transportation
  - Alternative Fuel Vehicles
  - Mass transit systems

8 GOI Approval Criteria

- Purpose – two fold
- Eligibility
- Additionality (Emission, Financial & Technical)
- Sustainable Development Indicators
- Social, Economic, Environmental & Technological well-being
- Baseline
- Transparent methodology, system boundaries, project lifetime
- Financial Indicators
- Flow of additional investment, IRR with & without CERs, MoU/agreements with stakeholders, Funding available etc
- Technological Feasibility – New / Improved / Innovative
- Risk Analysis – Carbon Risk / Country Risk / Regulatory Risk
- Credentials

9 Project Development

- Project Design Document
  - Baseline Design
  - Monitoring and Verification Protocol
  - Local Stakeholder Consultations
- Identification / Negotiation with Buyer of ERs
  - Unilateral CDM
- Finalization of Contracts – signing of the ERPA

10 Validation Designated Operational Entity (DOE)

- A DOE under the CDM:
  - is either a domestic legal entity or an international organization accredited/ designated by EB
  - Validates and subsequently requests EB for registration
  - Until today, the CDM EB has not accredited and recommended for designation of any Indian entity.
  - EB is in the process of considering applications which are regionally distributed

11 CDM Project Registration

- Registration is the formal acceptance by EB of a validated project as a CDM project activity
- Registration is the prerequisite for verification, certification and issuance of CERs
- Process: DOE shall
  - Submit CDM Project Activity Registration Form alongwith
    - CDM-PDD
    - Approval of host party
  - Pay Registration Fee
- The Registration
  - Registration by EB shall be deemed final 8 weeks after the date of receipt of request for registration unless there is a request for review

12 Registration Fees

Average tonnes of CO_2 equivalent reductions/year over the crediting period (estimated/approved)	US $ (*)
< = 15,000	5,000
>15,000 and < = 50,000	10,000
>50,000 and < = 100,000	15,000
> 100,000 and < = 200,000	20,000
> 200,000	30,000

13 Monitoring and Verification Designated Operational Entity (DOE)

- A DOE under the CDM:
  - Verifies emission reductions
  - Certifies and
  - Requests EB for issuance of CERs
- For Small Scale CDM Projects, the DoE agency entrusted with the task of validating the project can execute the Monitoring Plan and Project Verification

14 Certification and Issuance of CERs

- Certification by the CDM Executive Board on the basis of verification report
- This is followed by the issuance of the CERs to the project applicant entity/ies
- This step is repeated after every round of submission of verification report

15 CDM – Operational Management

- Conference of Parties (COP)
  - Overall guiding body
    - Designation of operational entities
    - Guidance on rules and procedures
    - Geographically equitable distribution
- Executive Board (EB)
  - Management of CDM
    - Reviewing, suggesting and detailing modalities and procedures for CDM
    - Frame criteria for developing and selecting projects
    - Appoint operational entities to validate projects
    - Verify and certify CERs generated through an approved project
    - Maintain the registry for CDM projects and related information
- Designated Operational Entities
  - Implementation
    - Validation
    - Verification
    - Certification

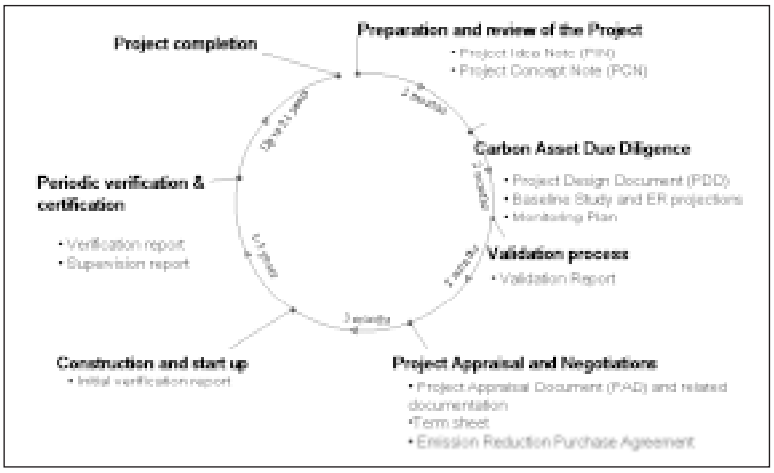
16 CDM Terminology

- Project Host
  - Entity in the developing country that promotes the project
    - Can propose the project either individually or in partnership with a developed country party entity
    - The project host and developed country entity could either be a private entity, a public sector entity or a government organization.
- Participating Country
  - Country participating in the CDM
    - Should have ratified Kyoto Protocol
- CDM Authority
  - Authority in the participating country
    - To be designated by the participating country
- Measurable Reductions
  - Monitoring
    - Any proposed project should have built into it a monitoring plan that would provide information for estimating emission reductions during the course of project operations

17 Small-scale projects

- Categories:
  - Renewable Energy Project activities with a maximum output capacity equivalent of up to 15 MW
  - Energy Efficiency improvement project activities which reduce energy consumption, on the supply and /or demand side by up to equivalent of 15 GWh/annum
  - Other project activity that both reduce anthropogenic emissions by sources and that directly emits less than 15 kilotonnes of CO_2 equivalent annually.

18 CDM Project Cycle - The Documentation



19 Small-Scale Project Guidelines

A simplified Baseline Methodology can be used if project participants are able to demonstrate that the project activity would not otherwise be implemented due to existence of one or more of the following barriers:

- Investment barrier
- Technology Barrier
- Barrier due to prevailing practice
- Other barriers
  - institutional barrier or limited information
  - organization capacity
  - capacity to absorb new technology
  - financial or managerial resources

20 Some Examples of Renewable Energy Projects submitted to UNFCCC

- TA Sugars co-generation and fuel switch project - capacity augmentation component – Tamil Nadu, 4 Plants, Capacity: 6MW-13MW (WII)
- 18 MW Biomass Power Project in Tamilnadu, India
- Colombia: Jepirachi Windpower Project – Uribia Region, Colombia, Capacity: 19.5 MW
- El Gallo Hydroelectric Project – Guerrero Region, Mexico, Capacity: 30 MW
- A.T. Biopower rice husk power project - Pichit province, North of Bangkok, Capacity: 22MW
- Wigton wind farm project – Jamaica, Capacity: 20.7 MW

21 Present Scenario

- India, Brazil, China, Costa Rica and Philippines are market leaders in supplying CDM projects.
- Market dominated by gas capture / removal of biomethanation projects, renewable energy projects and fuel switch projects.
- About 15 Indian projects have entered the CDM project cycle.
- Indian projects represent approximately 30% of the global CDM market
- Not a single project yet registered by EB

22 Climate Change Unit Winrock International India

- Policy Support
  - Indian National Communications on CC
- CDM Facilitation Services for Buyers and Sellers
- Capacity Building though workshops/Conferences
- Vulnerability and Adaptation Issues

23 CDM Project Pipeline

- Prototype Carbon Fund
  - Cogeneration
  - Waste to Energy
- Baselines for small-scale RE projects
  - Wind - CERUPT
- Rabo India Finance
  - Wind, Cement
- UNDP - GEF
  - Biomethanation

24 CDM Projects at WII

- Cogeneration
  - TA Sugars
- Waste to Energy
  - EDL India (14.85 MW at Chennai)
- Wind
  - Vestas RRB India (14.45 MW)
- Biomethanation
  - 6 (paper and pulp, tannery, MSW)

25 CDM Project on Wind 14.45 MW Wind Power Project

- Project Developer: Vestas RRB India Ltd.
- Buyer: Senter International, The Hague
- Location: Rameswaram, Tamil Nadu, India
- Project Details:
  - Small Scale (Type I D) project category (as per decision 17/CP.7, paragraph 6 (c) (i) of the UNFCCC)
  - 17 Nos. Vestas type V52-850 kW Wind Electric Generators (WEG)
  - produce 41.18 million kWh of 'green' power per year
  - first CER delivery proposed in January 2006 for year 2005
  - Weighted average emissions of current generation mix (2003): 0.79 kg CO_2 equ/kWh.
  - Annual power generation: 41.18 million kWh
  - Annual emission reduction: 32.49 thousand tonnes of CO_2/year
  - Total projected emission reduction: 324.9 thousands tons CO_2 for the credit period of 10 years (2005-2014)
  - The project lifetime is 20 years and the crediting period agreed between the developer and the financier is fixed crediting period for 10 years
- Project Additionality:
  - Since the project do not intend to access government financial incentives and funds, this can qualify as additional.
  - Project cost of generating electricity from wind is higher than that for the least cost option of coal. The annualized cost of power generation for a 100 MW coal plant Rs 2.21 per kWh, whereas the cost of electricity production from the proposed project is Rs 2.70 per kWh.
  - Power generation mix in Tamil Nadu is mostly thermal (86%) due to higher capacity utilization of thermal plants resulting in substantial GHG emission. Whereas, the wind project will lead to zero GHG emission thereby proving additionality.
  - advanced Vestas type V52-850 kW WEG technology is used instead of 225/250 KW – technical additionality.

Biofuels - A Global Overview, Benefits and Potential CDM Opportunities

Jai Uppal
Advisor - Renewable Energy, Winrock International India

JAI UPPAL specializes in biomass research and utilization in industry and as a transport fuel. In his 30 years of experience, he has worked in the areas of design and fabrication of process plants and equipment, joint ventures, project conceptualization, diversification, and project financing and implementation. Mr Uppal is a Fellow of the Institution of Engineers and Past Chairman of the Indian Institute of Chemical Engineers (Northern Regional Centre). He holds a bachelor's degree in Chemical Engineering from the Institute of Technology, Banaras Hindu University, and a master's in Chemical Engineering from the University of Michigan. He is working at Winrock International India as Adviser, Renewable Energy. He explained about energy from bio-fuels and potential of bio-fuel plantation projects for CDM.

1 WII - Biofuels Activities:

- Publication of Biofuels India (earlier Ethanol Newsletter)
- Launched India Ethanol Coalition - Feb 2000
- Conducted study tours to Brazil & USA
- Organised visit by Brazilian & USA Delegation to visit India
- Conducted Annual Seminars on Ethanol/Biofuels
- Organised Roundtable With UNDP on Ethanol
- Reports such as Techno –Commercial, Feasibility, Detailed Project & Policy etc. (Funding of Ethanol Projects for IREDA)
- Advisory/consultancy services including setting of Projects in Ethanol,TBO Plantations, Biodiesel, Biomass, Bioenergy and other renewable fuels (GMR Ltd, Dr Vikhe Patil SSK Ltd)
- Promotion of Projects such as Biodiesel Project of Naturol etc.
- Energy Efficiency studies, water utilization, pollution control

2 Biofuels - Introduction

- Liquid Biofuels:
- Ethanol
- Biodiesel/Straight vegetable oils
- Fuels derived from pyrolysis of biomass.
- At present first two are major biofuels

3 Global Overview

- Long term operational experience:
  - Up to EP 25 no problems in Brazil only Engine tuning
  - +E25-100 requires engine modification and significant reduction in mileage
  - Up to ED 15 with hydrated alcohol & emulsifier no problems in trials in buses in Australia and Sweden.
  - B20 no problems, no engine modifications in Europe, USA etc.
  - B100 no problems widely used in Europe but USA standards do not permit above B20.
  - Warranty issue yet to be addressed in USA

4 Global Overview - Ethanol

- Consumption of Ethanol in Brazil + 11 bill L per year (20-25% blend and neat - 100%)
- Consumption of Ethanol in USA - 10 bill L per year (mainly 10% blend but +85% also)
- Canada – 200 mill L,
- France – 120 mill L (ETBE),
- Spain – 100 mill L
- Sweden – 60 Mill L, Poland etc

5 Global Overview - Biodiesel

- German Capacity + 1 mill Tonnes (1.25 bill L per year) Consumption - +600 mill L

- France Capacity +500 mill Tonnes
- Italy, Belgium, Austria, Sweden
- Australia, Malaysia, Indonesia
- Africa – Mali, Zambia, Kenya etc.
- Brazil

6 Indian Ethanol Experience

- India had a flourishing sugar industry & its byproduct, molasses, was used for manufacture of potable alcohol, animal feed etc or was discharged in water stream causing acute pollution problems.
- The Indian Ethanol Program started during World War II - there was a shortage of petrol (gasoline) & 'Power Alcohol' was encouraged by the British.
- A large number of new units were set up in the mid 40s to manufacture Ethanol using Azeotropic distillation - particularly in the state of Uttar Pradesh.
- The program died after WW II because of cheap availability of petrol and probably because oil companies were not interested in blending.
- These units converted to potable alcohol and/or supply of alcohol for various applications including Alcohol based chemical (ABC) units which came up in the 60s.
- The 'Oil Shock' of mid 70s saw a revival of interest in Ethanol. Successful trials in 1979 - IOC/IIP on 15 cars found Ethanol (10% & 20% blends) suitable
- Large number of Univs. conducted engine trials.
- Since 1977 - 6 technical committees & 4 study groups have examined this issue – no action !
- 1986 onwards R&D demonstration projects supported by Ministry of Non Conventional Energy Sources.
- Ethanol/methanol (3%)diesel in buses & successful field trials with E5/10 blends using 93vehicles, in Delhi (93-95). 1.8 million kms without operational problems & comparable efficiency.
- Support for the program gained momentum from mid 1990s
- Power Alcohol Committee of Secretaries GOI was set up in 1997.
- WII - The India Ethanol Coalition (Feb 2000) during first Ethanol Seminar in 2000, Roundtable Meeting (with UNDP)in July 2001 & yearly Conference thereafter. 2003 named "Biofuels – Progress, Policies & Prospects.
- Qtly Ethanol Newsletter since July 2001 named Biofuels India Newsletter (March 2003) –only one of its kind.

7 Indian Policy Initiatives

- Finally (April 2001) 3 successful Pilot Projects using E5 – 2 Maharashtra & 1 UP – mixing at oil depots and supply to nearly 300 petrol pumps with supply from U.P. – 1500km
- Announcement of December 10, 2001
  - Policy announced to blend 5% ethanol with petrol
  - Inter Ministerial Task Force constituted
  - Rs 4 Cr.(US$ 1 Mill.) for R&D on Ethanol diesel blends
  - Amend Sugar Development Act for financing Ethanol
- Announcement of March 20, 2002
  - A Technical Committee Report - Ethanol most appropriate oxygenate for India
- Auto fuel Policy of August 2002
- " The development of technologies for producing ethanol and bio-fuels from different renewable sources can play a major role in commercialization of bio-fuels vehicle in the country, which should be encouraged by providing R&D & other support through suitable fiscal incentive."
- September 13, 2002 Notification making 5% Ethanol blending in gasoline mandatory in 9 States (Sugar producing States)& 4 UTs by January1, 2003 - a notice period of just 3.5 months.
- Amendment to the Sugar Development Fund to enable access to fund for producing Ethanol from Alcohol at interest rate of 6% - 2002.
- Budget of Feb 2002 -Excise duty concession of Rs 0.75 per litre (detaxation of green Fuels) passed by parliament but not notified.
- Reduced to Rs 0.30/L after nearly 6/7 months valid till Feb 28, 2003

- Budget of Feb 2003 -Excise duty concession of Rs 0.30 per litre valid till Feb 29, 2004

8 Present Status

- Nearly 300 units with total installed Alcohol capacity is 3.2 billion L with 40% to 45% utilization before Ethanol was introduced. Main use of alcohol was Potable and ABC. The health of independent alcohol units was not good.
- Substantial Progress made - nearly 750 mill L Ethanol capacity built up in little more than one year after notification.

9 Ethanol Potential

- Positive Picture: Production of 300 mill T sugarcane, 20 mill T sugar, 350 MW power to grid, 3 bill L of Alcohol & 500 mill L of Ethanol capacity despite problems - draught, Politics, Red tape & ongoing efforts of detractors !
- Sugar cane from 4 mill Hctr – just 4% of cultivated land.
- Sugar Production record – 3 to 4 mill T excess – This year may be a different year - draught
- Glut in sugar prices & Mills running at a loss!
- Excess sugar can be used to produce 3 billion L of Ethanol for India & world market.

10 Petroleum & Transport Status

- Indian Scenario:
  - Petroleum Products/crude oil Consumption 100 mill T & growing at 5 -7%
  - Import component 2/3rd & domestic crude oil production stagnating for the last 15 years except Natural gas
  - Gasoline consumption 8 million T & growing at +7%
  - Diesel consumption 40 million T growing at <5%
  - Vehicle population about 50 mill growing at + 7%
  - Sales of two-wheelers – about 75% of vehicles.
  - Petroleum sector largely Govt controlled, Auto in Pvt. Sector

11 Biofuels Benefits

- Decentralized form of energy
- Enhance Rural Employment & rural development
- Provide energy security
- Reduce vulnerability to oil supply disruptions
- Potential for use of wastelands and combating desertification & greening of landmass
- Additional benefits of BD:
  - Low in sulfur content and high in lubricity
  - Ultra Low sulfur diesel is poor in lubricity thus biodiesel provides unique synergy as a blend.
  - Degraded lands and low rainfall regions can be used to grow TBOs plantations & provide rural employment
  - Reduces net CO_2 emissions by 78.45% compared to petro-diesel
  - 3.24 units of energy yield for every unit of energy used in production of Biodiesel
  - Polycyclic aromatic Hydrocarbon (PAH) reduced to the extent of 75% to 85%
  - Use of B100 in urban buses reduces life cycle emissions of PM by 32%, CO by 35% and SOx by 8% compared to petro-diesel
  - Overall ozone forming potential of BD is 50% less than PD
  - High flash point & good caloric value
  - High Cetane Number
  - Readily Biodegradable
- Major technical issues :
  - Shelf life
  - Compatible elastomer required
  - Possible corrosion problems
  - Disposal of glycerol

12 Table for reduction of Emissions

Emission	B100	B20
Carbon Monoxide	-47%	-12%
Hydrocarbon	-67%	-20%
Particulates	-48%	-12%
Nitrogen Oxides	+10%	+2%
Air toxics	-60%-90%	-12%-20%

13 Ethanol Benefits

- Additional benefits of Ethanol:
  - Uses molasses which is readily available & waste by product of sugar production
  - Diversifies the Sugar industry as there is an huge excess of sugar production in the country leading to a glut.
  - Potential of use of sugar cane, sweet sorghum, rotten and damaged grain.
  - Improves Octane Number
  - Replaces harmful Oxygenates such as MTBE
  - High Oxygen content – half the quantity required when compared to MTBE.

14 Ethanol – Issues

- Technical issues:
  - Increases RVP of blend
  - Has lower Calorific value – 3% less theoretical energy content (almost same as MTBE) for E10 but practically no change in 'mileage' up to 10%
  - Precautions required to be taken to avoid ingress of water to avoid phase separation.
  - Imaginary problems: cold start, vapour lock, pick up of moisture from atmosphere, corrosion, aldehydes.

15 Reduction of Emissions

Emissions	For E10-E100
Carbon monoxide	-10%-40%
HC	-5%-17%
SO_2	Up to –80%
CO_2	50 to 100%
Lead	Eliminated
NO_x	+1%

16 Biofuels Potential in India

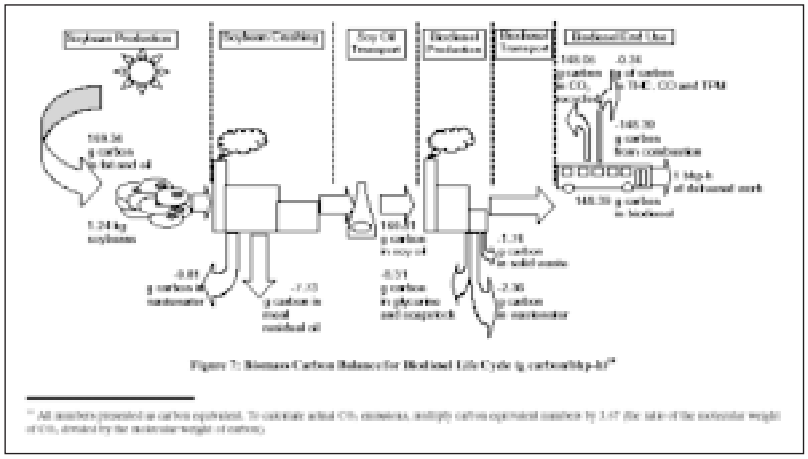
The future of biofuels industry is bright with a huge potential that can be tapped by 2012:

- Ethanol:
  - 4 mill tonnes per year of excess sugar can be used to produce 3 bill L of Ethanol for India
  - India has more than 40 mill tonnes of grain stocks. 4 mill tonnes of grains can produce 1.5 bill L of Ethanol per year.
  - Sugar occupies less than 4% cultivable land
  - Once Biomass to Ethanol is commercialized it can become a source of almost limitless source of Biofuels.
  - Ethanol with a consumption of 4000 million litres can have a retail turn over of Rs 140,000 million per year
  - Export Potential of 3 to 4 bill L.
  - Total Potential of Ethanol – 10 bill. L
- BIODIESEL:
  - 8 to12 mill Ha of degraded lands can provide Biodiesel for 20% blend (12 mill Tonnes per year).
  - Biodiesel with a potential consumption of 15000 million litres can have a retail turn over of more than Rs 330, 000 million per year.
  - It can provide huge rural employment potential of 40 to 50 million families and transform the rural economy

17 Life Cycle Overview- Biodiesel & Petrodiesel

- Life Cycle Consumption of petroleum reduced by 95% if Biodiesel is used in buses.
- "Biodiesel yields 3.2 units of fuel product energy for every unit of fossil energy consumed in its life cycle."
- "Biodiesel reduces net CO_2 emissions by 78.45% compared to petroleum diesel"
- Biodiesel in urban busses reduces life cycle emissions of total PM by 32%, CO by 35%, Sox by 8% compared to petroleum diesel but increases NOx life cycle emissions by 13.35%
- Major BD Life Cycle operations include:
- Production of seeds, Transportation of seeds, Oil extraction,conversion to BD, Transportation of BD, Use in bus
- Major PD Life Cycle operations includes:
- extraction from wells,Transportation, Refining, Transportation of diesel, Use in bus
- Same Geographical Boundaries
- Same Time Frame
- Same basis – Engine & bus parameters
- Assumptions

18 Life Cycle Overview- Biodiesel & Petrodiesel



- Total Life Cycle Fossil CO_2 (gm per BHP-Hr) :
- Petro Diesel – 633.28
- Biodiesel – 136.45
- We therefore get a net reduction of 78.45% reduction of CO_2 emissions in BD as compared to PD in life cycle.
- We can therefore use this for calculations for Buses using 100% BD and proportionate reduction for various blends after estimating replacement of Petro-diesel by biodiesel.

19 Potential Earning thru CERs

- 1 kg of Petro-diesel releases 3.2 Kg of Carbon dioxide
- The use of Biodiesel therefore gives a reduction of 2.51Kg of CO_2
- For production of 100,000 tonnes per year of BD the CO_2 reduction works out to be 251,000 tonnes.
- At a price of CER of US$ 5 per tonne of CO_2 potential earning of US$1.25 mill per year
- For 10 mill tonnes – earning potential for India by the year US$ 125 million (Rs 565 Cr.)

20 Conclusions

- The potential of Biofuels is tremendous
- The Program should go forward with clear policy from GoI and State Governments.
- Winrock is committed to promoting the Program & individual Projects by Entrepreneurs
- Winrock is ready & willing to assist you by undertaking any assignment in CDM area in Biofuels

Technical Session 4 (continued)
CDM Project Development

Chairperson

K.V. Doshi

Dy. Director, Gujarat Energy Development Agency

Sugar Cogeneration and Fuel Switch Project

Dhirendra Kumar

Program Officer, Winrock International India

Biomass Gasifier

Manoj Gohil

Executive Director, Agrocel Industries

Solar Dryer

N. S. Rathore

College of Technology & Engineering, Udaipur (Rajasthan)

SUGAR COGENERATION AND FUEL SWITCH PROJECT

DHIRENDRA KUMAR
Program Officer, Winrock International India

DHIRENDRA KUMAR is a Program Officer in Climate Change Program at Winrock International India. He has been working on global and local environmental issues for over seven years in government and non-government organizations. Dhirendra holds a master's degree in Environmental Engineering (with specialization in industrial pollution prevention and control) and bachelors in Civil Engineering. He explained the process of formulating the Project Design Document by WII in case of a sugar cogeneration plant. This PDD was submitted to the Methodology Panel of the UNFCCC.

1 PROJECT DEVELOPER

Thiru Arooran Sugars Ltd
Eldorado, 5th floor
112 Nungambakkam High Road
Chennai 600 034
Tel: 0091-44-8270636
Fax: 0091-44-8284961
e-mail: rvt@tasugars.com

2 PROJECT DESCRIPTION...

- Thiru Arooran Sugars Group (TASG) own and operate four sugar plants located at Tirumandankudi (TMK-I and TMK-II), A Chitoor, Pennadam and Kottur in the Tamil Nadu (TN) state of India
- Each plant operates cogeneration facilities which burn sugar bagasse during the sugar cane crushing season
- During off-season, only the high efficiency facilities at TMK-I and A Chitoor are operational, using coal and lignite as fuel input

Baseline Scenario

Plant	Off-season		In-season	
	Fuel	Supply to Grid	Fuel	Supply to Grid
TMK-I	Lignite/ Coal	Yes	Bagasse	Yes
TMK-II	Not Operational	No	Bagasse	Yes
A Chitoor	Lignite/ Coal	Yes	Bagasse	Yes
Kottur	Not Operational	No	Bagasse	No
Pennadam	Not Operational	No	Bagasse	No

3 CDM PROJECT ACTIVITY

- Renewable based power supply to TNEB grid
  - Cogeneration capacity augmented at three sites (TMK-II, Pennadam and Kottur) resulting in the generation of excess electricity for TNEB grid
- Fuel switch from coal/lignite to renewable biomass during the off-season operation of the cogeneration facility.

4 CDM PROJECT COMPONENTS...

- Capacity Augmentation – TMK-II, Pennadam & Kottur
  - Replacing the existing low efficiency boilers with high efficiency boilers and by installing additional turbines
  - Low efficiency boilers at Pennadam replaced with state-of-the-art high temperature, high pressure boilers (515^{0}C, 86 KSC, 100 TPH)
  - The cogeneration facilities at TMK-II, Kottur, and Pennadam (after boiler replacement) have underutilized boiler capacity
  - Excess capacity captured through the installation of additional turbines
    - TMK-II – 16 MW, 410^0 C, 42 KSC (only

for off-season)

- Pennadam - 20 MW, 510^0 C, 83 KSC (2 nos.) & 14 MW, 510^0 C, 83 KSC (1 no. – only for off-season)
- Kottur - 16.2 MW, 418^0 C, 41 KSC

Project Components	Power Generation (MW) – Baseline Scenario		Power Generation (MW) – CDM Project Scenario	
	Season	Off-season	Season	Off season
TMK-I	13.20	18.56	13.20	18.56
TMK-II	9.4	NIL	10.95	16.0
A Chitoor	13.20	18.56	13.20	18.56
Kottur	6.0	NIL	10.95	16.0
Pennadam	7.25	NIL	39.20	54.0

5 Fuel Switch – Coal/lignite-to-biomass

- Baseline Scenario - steam and electricity production at the cogeneration facilities at all four sites based on bagasse during the season and on coal/lignite during the off-season
- CDM project - the fossil fuel used during off-season replaced by locally procured agro-biomass, such as wood chips, sugarcane trash, Prosopis Julifora, and coconut and groundnut shells
- Over a 7-year period, 90% of the current consumption of coal and lignite will be gradually replaced with agro-biomass

6 CDM Project – Sustainable Development

The proposed CDM project will contribute to the sustainable development of India by

- Increasing the supply of renewable energy to the grid
- the project will add to the reliability of power supply and stabilization of the voltage, which will create business opportunities and stimulate the economic development in rural areas where the sugar plants are situated
- Reduction in particulate emissions and ash generation associated with the burning of coal, which is a dominant fuel in the Tamil Nadu generation mix
- The substitution of biomass for coal and lignite during off-season will establish a market for biomass, which is presently a zero priced resource. This will create job opportunities in the rural areas and directly benefit the local population

7 CDM Project – Additionality

- Additionality of Capacity Augmentation:
  - Technical Additionality - The project uses an advanced cogeneration technology in the form of high-pressure boilers (86 KSC, 515^{0}C) with steam turbines coupled to an alternator for the generation of power. Currently, the sugar industry in India predominantly uses low efficiency, low temperature boilers for their own power generation (32 KSC, 380^{0}C).
  - Financial Additionality - The proposed cogeneration plants are sized to produce power over and above the sugar plants' own steam and electricity needs to sell electricity to the grid. However, in the absence of subsidies, the costs for generation of electricity are significantly higher than those of other options for power generation. The cost of electricity generation at TMK - II, Kottur and Pennadam are Rs. 2.58/kWh, Rs. 3.01/kWh and Rs. 2.31.kWh respectively. The annualized costs of power generation from a 100 MW coal plant are estimated at Rs. 2.21/kWh.
  - Exceeds Regulatory Requirements - The existing boilers at all project sites fully meet the regulatory standards. The Government of India (GoI) mandates the installation of 32 KSC boilers in new cogeneration plants but does not require existing boilers to be upgraded to this standard. Thus, the refurbishment of the boilers at Pennadam is not mandated by law and clearly exceeds the legal requirements.
  - Barriers to implementation - The lack of familiarity with handling high-pressure boilers coupled with the operation of condensing and extraction multistage turbines (the existing mills mostly use backpressure turbines) is a major barrier to adoption of the proposed new technology. Furthermore, making investments

in cogeneration facility, which costs approximately Rs 35 million/MW, is an issue.

- Displacement of electricity generated from fossil fuels - The project will use bagasse to generate power for export to the TNEB. In absence of the project same power would have been supplied through the power generation mix of TNEB, resulting in CO_2 emissions. The TNEB mix generation capacity mix is 63% thermal, 22% hydro, 4% nuclear and the remainder is renewable energy based capacity. The power generation mix though is highly dominated by thermal (86%) due to higher capacity utilization of thermal plants. Therefore, zero emission bagasse based power will result in emissions from projects in the baseline, dominated by thermal power.

■ Additionality of the fuel switch:

- Substitution of coal and lignite use in the existing TMK-I and A Chitoor plants and the new cogeneration facilities at TMK-II, Pennadam and Kottur with renewable biomass will result in a reduction of CO_2 emissions through the displacement of fossil fuels.
- Due to the non-existence of a market for biomass, the collection and transportation of biomass is estimated to be more costly than the purchase of coal and lignite and hence the cost of electricity generation.

Projects	Cost of electricity Generation(Rs./kWh)	
	With Coal/Lignite	With 90% Biomass
TMK I & II	2.58	3.30
A Chitoor	2.68	3.50
Kottur	3.01	3.89
Pennadam	2.31	2.98

8 CDM Project – Emission Reduction Potential

■ The proposed CDM projects will produce 110 MW of green power during the off-season (June – December) and 34 MW during the crushing season (January – May) to be delivered to the TNEB grid.

■ Green power will reduce the air pollution and Green House Gas emissions by reducing the quantum of fossil fuel to be burned for producing the equivalent amount of power.

■ Emission reduction potential is estimated to be approximately 500 kilo tons of CO_2 per year

CDM Baseline Scenario				
	Off-season		*In-season*	
Plant	Fuel	Supply to Grid	Fuel	Supply to Grid
TMK-I	Biomass*	Yes	Bagasse	Yes
TMK-II	Biomass*	Yes	Bagasse	Yes
A Chitoor	Biomass*	Yes	Bagasse	Yes
Kottur	Biomass*	Yes	Bagasse	Yes
Pennadam	Biomass*	Yes	Bagasse	Yes

** Biomass will gradually substitute 90% of coal/ lignite over a 7 years period*

9 WII Role

■ Carbon Advisor for TASG

■ Helped TASG in designing CDM projects involving sugar cogeneration capacity augmentation and fuel switch, in line with the CDM project cycle

■ WII carried out preparation of the required documentations of

- Project Information Note (PIN)
- Baseline study
- Project Design Document (PDD)
- Monitoring and Verification Protocol (MVP)

■ Assistance during validation

■ Assistance during Emission Reduction Purchase Agreement

10 Developments

■ The proposed new methodology was submitted to the Meth Panel on September 10, 2003 and is now available on UNFCCC website for public comments (http://cdm.unfccc.int/methodologies/process)

- NM0028
- NM0035

■ The Prototype Carbon Fund (PCF) has given in-principle acceptance to procure the CO_2 reductions generated by the proposed project

BIOMASS GASIFIER

MANOJ GOHIL
Executive Director, Agrocel Industries

MANOJ GOHIL is Executive Director of Agrocel Industries Ltd, a leading company in Bhuj-Kachh area located in the western most tip of India which has successfully installed a biomass gasifier in their company for captive power consumption. He is also a trustee of Vivekanand Research and Training Institute, a local NGO involved in rural development work. He and his colleagues presented the case study on biomass gasifier that they have been using in the remote area of Kutch for several years for captive power consumption.

1 PRESENTATION BY:

- Dhaval Dave – Agrocel Industries, Kutch.
- Yogesh Jadhav – Ankur Scientific, Baroda.
- N. T. Ghelani – Transpek Industry, Baroda.

2 INTRODUCTION

- Experience gained during 2nd World War- when gasifiers were used for mobile applications-shows that suitable fuel for the operation of I.C. engine can be easily obtained by Biomass Gasification process.
- The fuel crisis in 1973 and 1979 that led steep price rise of liquid fuels. substantially.
- This has seriously affected the Economy of the world in general and under developing countries in particular.
- This has compelled the world to look for alternative fuel sources that are renewable, reliable and sustainable. Hence, renewable sources of energy like Wind, Solar and Biomass Gasification caught the attention of developed and underdeveloped nations. Use of Bio-mass in the form of wood and other agro waste like, rice husk etc. has attracted attention to provide such source of energy.
- Internal Combustion Engines are widely used in rural areas of developing countries for stationary applications like power generation and lifting of water etc.
- Using producer gas to power I.C. engines through gasifier is a convenient solution.

3 PROSOPIS JULIFLORA (GANDO BAVAL)

- Shri K.C. Shroff ex chairman of Excel Industries who is working in the area in improving Social Conditions of people in Kutch for last 25 years.
- Sufficient Quantity of Prosopis Juliflora is available in Kutch. Approximately 1.5 Lac Hectares of land is covered by this.
- Shri K.C. Shroff has tried to use this as Fodder for cattle.
- The use of Prosopis Juliflora for Generation of Power will be more gainful and on a larger scale.

4 GROWTH OF PROSOPIS JULIFLORA (GANDO BAVAL) IN KUTCH

5 WHY AGROCEL CHOSE BIOMASS GASIFICATION TECHNOLOGY?

This decision will yield multiple benefits as under:

- Create employment to local population. About 60 persons arebeing employed by Agrocel in operating their plant of 300 kW.
- In case of 1MW Plant about 150 persons will get employment.
- Gainful utilisation of Prosopis Juliflora (Gando Baval).
- Obtain power from renewable source of energy.
- The cost of Power has reduced.

- The consumption of L.D.O. has been substantially reduced.

6 Salient Features of Gasifier for Power Generation at Agrocel

- We arethankful to GEDA and MNES who have granted a subsidy of 4.5 lacs for Gasifier installation.
- Gasifier was procured from M/s Ankur Scientific Energy Technologies Pvt. Ltd. Baroda.
- Low Speed – 500 r.p.m. old marine D.G. Sets were procured from Alang Ship breaking Yard and were in use.
- These were converted for Dual Fuel Mode by Hi Tech Consultancy of Baroda.
- The Engines are operated on Dual Fuel Mode using about 30- 40 % L.D.O. and 60 - 70 % Producer Gas.
- The use of Dual Fuel mode gives flexibility of either working with Gas & L.D.O or L.D.O. alone.
- The consumption of L.D.O. has reduced from about 0.33 - 0.4 liter per kWh to 0.11 liter per kWh. There is a scope of further reducing this to about 0.08 liter per kWh.
- Daily consumption of Wood is between 4 – 5 MT.

7 Biomass as a Renewable Resource & its key advantages

- Age-old largest and most widely used fuel Source.
- This has been in use in Domestic and Industrial Units.
- Inherent & inexpensive storage in stark contrast to Solar Radiation and Wind
- Availability on demand/round-the-clock; hence ideal for captive power generation
- High capacity factor; self-contained system (without the need for a back-up)
- Wide Range of Conversion Technologies with an ability to produce Electricity, Thermal Energy as well as High Quality Fuels
- Low Capital Investments even for Power Generation
- Low cost of power generation (Rs. 3 – 4 per kWh) in Dual Fuel Mode.
- In case of 100 % Gas mode the cost would be around Rs. 2 - 2.5 per kWh.
- Wide range of power ratings (3 kW to 1000 kW or higher) with high conversion efficiencies

8 Gasification – Basic Process Chemistry

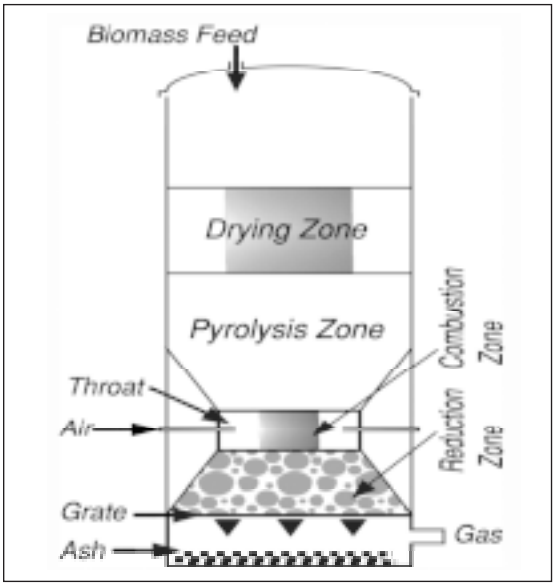
- Conversion of solid fuels into combustible gas mixture called producer gas
- Chemistry of Gasification :

Normal Combustion: $C + O_2 = CO_2$

Gasifier Condition: Hydro Carbon(Wood) + Controlled O_2 (Air) = $CO + H_2 + CH_4 + CO_2 + N_2$

- Involves partial combustion of biomass
- Full Combustion produces carbon dioxide (CO_2) and water vapour (H_2O)
- Partial combustion produces carbon monoxide (CO) and hydrogen (H_2) and some methane (CH_4) - all combustible gases, along with nitrogen (N_2) and carbon dioxide (CO_2)
- Basic four distinct processes in the Gasifier are Drying, Pyrolysis, Combustion and Reduction.
- Fuels must pass through each zone.
- Tars given off in the pyrolysis zone are broken into useful energy when they are through combustion zone.

9 Gasification - Basic Process Chemistry Schematic



10 WHY GASIFICATION ?

- Converts a traditional, low quality fuel to a modern day energy carrier i.e. combustible gas
- Such conversion occurs at relatively high efficiencies and results in total convenience and process control
- The process can be applied over a very wide range of output ratings (a few kilowatts to thousand kilowatts) with only a small variation in overall efficiency and investment
- The process is equally applicable for electricity generation and a variety of thermal applications (be it driers, ovens, furnaces, boilers etc.)
- Both initial investment as also the cost of energy/ power production are just about the lowest amongst all known alternatives

11 THE OPTIONS IN BIOMASS GASIFICATION

- Types of Gasifiers:
  - Updraught
  - Downdraught
  - Cross Draught
  - Fluidized Bed
- Feedstock Modes:

Given the current biomass specificity of the technology and the hardware, the following options are available from Ankur Scientific:

- WBG Series for Woody Biomass
- FBG series for fines like Rice Husk
- Combination Model capable of using either woody biomass or rice husk through quick change-over.

- Power Generation

Power Generation can be in two modes:

- Dual Fuel mode with about 70% energy coming from Biomass and the rest from liquid fuels
- 100% Producer Gas based systems

  Systems based totally on producer gas are a recent development with tremendous interest generated because of very low fuel cost of power generation

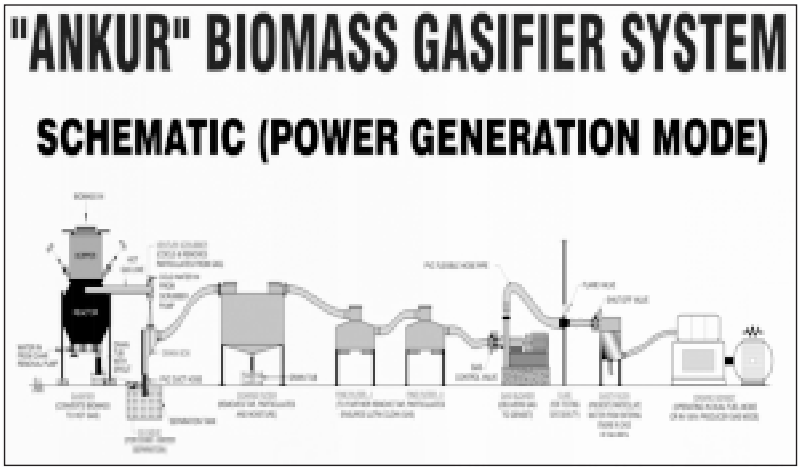
- Thermal Application

Thermal applications covering a wide range

- Flame temperature of 1200°C
- Applications requiring upto 1000°C can be totally on producer gas
- Higher temperatures through dual fuelling

12 ENVIRONMENTAL ASPECTS

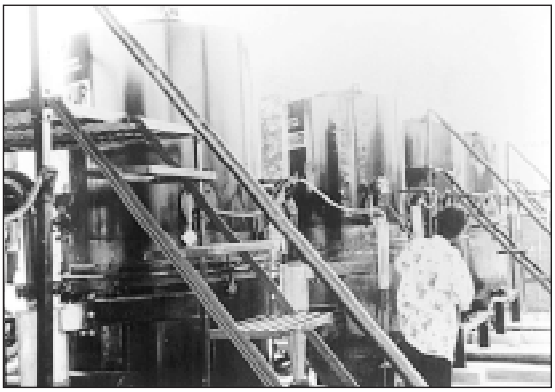
- Water-used in re-circulation mode with zero discharge.
- Air-gasifier works in suction mode and hence no gas release to atmosphere. Combustion in user equipments for both thermal and power applications is much cleaner compared to liquid fuel (because of hydrogen content)
- Small quantity of charcoal obtained from the Gasifier can be fed back into the gasifier or can be used as fuel.
- Biomass materials contain negligible sulphur and, in that respect, are better fuels (as compared to fossil fuels)



13 'ANKUR' BIOMASS BASED POWER PLANT FOR ISLAND ELECTRIFICATION

Location : Gosaba Island, Sundarbans (100 kM from Kolkata)
Capacity : 500 kW, using 5 x 100 kW AG series Gasifier
Commissioned : June 1997

HIGHLIGHTS



- Catering to about 800 households
- No disruption to date
- About 6-8 hours operation daily
- Operations managed and sustained by Rural Energy Co-operative Operated & maintained by duly trained local technicians; operating supervision for first three years by Ankur Scientific
- Tremendous boost to education, economic opportunities and social/cultural activities

Based on the success of the first , a second project installed in nearby island

14 'ANKUR' BIOMASS GASIFIER BASED POWER PACK MODEL GAS-4 FOR A COCONUT PLANTATION IN SRI LANKA

Location : At Dr. Ray Wijewardene's Coconut Plantation Sri Lanka
Capacity : Gross 4 kWe (GAS – 4)
Commissioned : 2003.

HIGHLIGHTS

- First installation of GAS-4 100% Producer Gas system.
- Start – up through battery
- Specific fuel consumption- less than 1.5 kg/kWhr
- Cost of Generation as low as 2 to 3 US cents per kWhr

15 CHLORATE INDUSTRY IN TAMIL NADU

Location : M/s Valli Chlorate, Kovilpatti
Capacity : Gross 200 kWe (GAS – 200)
Commissioned : 2003

HIGHLIGHTS

- First installation of GAS-200 in India.
- Low Start – up power
- Specific fuel consumption- less than 1.5 kg/kWhr
- Low cost of power has enabled the company to restart the production which was stopped due to increased electricity cost.

16 'ANKUR' BIOMASS GASIFIER MODEL WBG-200 COUPLED TO MICROTURBINES FOR POWER GENERATION

Location : EERC, University of North Dakota, USA
Capacity : WBG – 200 in Power Generation Mode
Commissioned : 2003

HIGHLIGHTS

- The whole gasifier system is mounted on a trailer.
- The gasifier is coupled to three turbines of 30 kW
- The order if supply of gasifier to EERC was won against stiff international competition

17 'ANKUR' BIOMASS GASIFIER COUPLED WITH SLOW SPEED MARINE ENGINE

Location : M/s Ashwin Vanaspati, Samlaya
Capacity : WBG – 400
Commissioned : 2003

HIGHLIGHTS

- Generating Power in dual fuel mode with LDO replacement of around 60 –65 %.
- Total Hours of Operation – 1740 Hrs.
- Total LDO saved during these hours- 113100 Litres

18 PARTIAL LIST OF 100% PRODUCER GAS BASED SYSTEMS

Name & Address of the Client	Gas Power Pack Model	Qty.
Lanka Transformers Ltd., 154/11, Railway Station Road, Angulana, Moratuwa, Sri Lanka	GAS-40	1 No.
Vidya Jyothi Dr.Ray Wijewardene 133, Dharmapala Mawatha, Colombo 00700, Sri Lanka	GAS-4	1 No.
Muni Seva Ashram Goraj 391 760 Tal : Vaghodia Dist : Baroda, India	GAS-40	1 No.
Valli Chlorate Co. 139, Elayarasanendal Road Kovilpatti 628 502 (Tamilnadu), India	GAS-200	1 No.
District Rural Development Agency Collectorate, Coimbatore – 641 018	GAS-9	2 Nos.

19 Important Recent Installations and Exports

Name & Address of the Client	Gasifier Model	Mode
Ashwin Vanaspati (Gujarat)	WBG-400	Power Generation
Agrocel Industires (Gujarat)	WBG-300	Power Generation
Khaitan Chemicals and Fertilizers Ltd. (U.P.)	WBG-500	Thermal
Lloyd Insulations (Madhya Pradesh)	WBG-200	Thermal
Sai Roofings (Andhra Pradesh)	WBG-200	Thermal
Markus Dallinger, Germany	GAS-133	100% Producer Gas
NERD Centre (UNIDO Project) Sri Lanka	GAS-103	100% Producer Gas

20 Performance Evaluation

■ 300 kW D.G. Set operating on Dual fuel mode was started in Dec. 2003.

Month	Total Working Hrs. (Gasifier)	Units Generated (with/without Gasifier)	LDO Saved Ltrs.
Dec. 2003	284	72790	7296
Jan. 2004	311	89310	9844
Feb.2004	435	80100	15555
Mar. 2004 (21 Days)	457	83641	16955
Total	1487	325841	49650
Mar. 2004 (Expected)	675	123470	25029

Remarks: There were heavy Floods during Monsoon of 2003 in area around factory. Factory Operation was thrown out of Gear. During Dec. 2003, Jan. 2004, and Feb. 2004 the factory was operating only partially. The load on DG Sets was not adequate. Proper Operation of the Factory has started in March 2004.

SOLAR DRYER

N.S. RATHORE
College of Technology & Engineering
Udaipur (Rajasthan)

N. S. RATHORE is Professor and Head of Renewable Energy Department at College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan. He is a specialist in solar energy. He has also lectured at various seminars and workshops on the subject. He showed an application of solar tunnel dryer for drying of Di-basic calcium phosphate replacing the use of diesel-based dryers.

1 Di-basic calcium phosphate (DCP) is odorless mineral based inorganic compound widely used for supplementing phosphorus and calcium to animals along with feed.

M/s Phosphate India Limited, Udaipur produce feed grade DCP in their plant close to Udaipur city in Rajasthan.

Wet DCP cake having a moisture content of around 35 – 40 % is produced and dried to a moisture content of around 5% in two steps. The tray drying reduces moisture content to around 15%. Thereafter, the moisture content is reduced to around 5% in a spin-flash dryer. Both these dryers have diesel based hot air generators.

Direct cost of drying 1 MT DCP

Description	Quantity	Rate	Amount (Rs.)
Power Consumed	120 kW	Rs. 4.00 per kW	480.00
Fuel-Diesel	70 Litres	Rs. 18.00 per litre	1260.00
Labour	2	Rs. 70.00 per day	140.00
		Total	1880.00
		Say	1900.00

The main product of the M/s Phosphate India Limited, Udaipur is Di-basic Calcium Phosphate ($CaHPO_4 2H_2O$) animal feed grade, which is white powder without taste and odour having bulk density 1.00, about 99.9% of material passing through 200 mesh.

Since the product has two water molecules, it is essential that the temperature of the drying zone does not exceed 60°C.

Further, the solar tunnel dryer based on solar green house is in position to boost up temperature by 18 – 20°C, as compared to ambient.

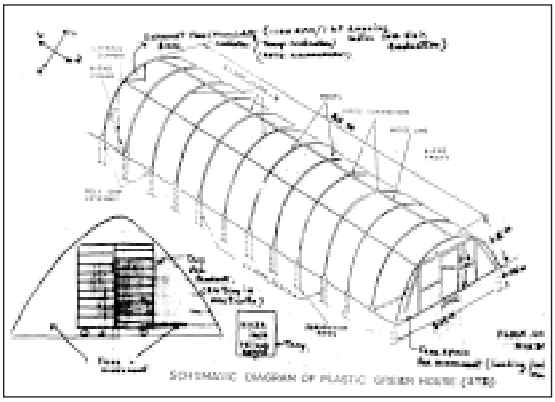
Keeping this in view for drying DCP a natural convection tunnel type solar dryer having a loading capacity of 1.5 ton per batch was designed, erected and commissioned in the factory premises and is under regular use since January, 2001.

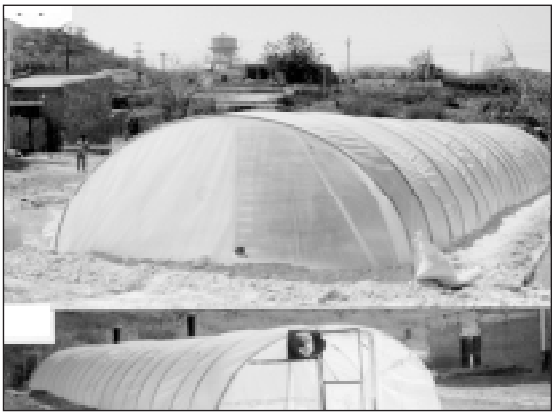
2 SOLAR CABINET DRYER:

The prototype of the solar dryer had floor area of 9.5 m x 4.5 m and capacity of around 500 kg of wet DCP per batch. It consisted of bricks and hollow cement-sand block structure, flat plate solar collector and an electrically operated exhaust fan for removing the moist air from the drying cabinet. This small system has been working at the factory site for last more than 3 year for drying wet DCP to a moisture content of around 15%.

3 SALIENT FEATURES OF THE SOLAR TUNNEL DRYER ARE AS FOLLOWS:

- It is semi-cylindrical shaped walk-in-type and has base area of 3.75 m x 21.00 m and maximum ceiling height 2.0 m.
- The metallic frame structure of the tunnel dryer has been covered with UV stabilised semi-transparent polythene sheet of 200 micron thickness.
- A gradient of 10-15° has been provided along the length of the tunnel to induce natural convection airflow.
- Cement concrete floor has been painted black for better absorption of solar radiation.
- Five-cm thick glass wool insulation has been provided to reduce heat loss through the floor.
- Black Body north wall has been provided to reduce heat loss from northern side of the tunnel.
- Inlets for fresh air have been provided along the periphery of the tunnel near ground level.
- Two chimneys of 20 cm diameter and 75 cm height have been provided on top of the curved surface to allow exhaust of hot moist air.
- Upper end of the tunnel has been provided with a door of 1.60 x 0.75 m size to facilitate loading and unloading of the material.
- An exhaust fan of 1000 m^3/h air flow rate capacity of 0.7 KW power rating has been provided on the upper end.
- The humidity sensors installed inside the tunnel automatically control ON/OFF operation of the exhaust fan to maintain relative humidity of the inside air in the range of 40-45%.
- Wet DCP is spread in thin layers of approximately 4 cm thickness in the trays of 40 x 80 cm size.
- Twenty four trays are loaded on to a trolley. Ten trolleys containing approximately 1.5 ton material are moved into the tunnel dryer in the morning for drying.





4 No Load Testing:

Under this condition the useful heat was extracted but it was not utilized.

Maximum temperature inside the solar tunnel dryer was 45°C at 14.00 hrs while the minimum temperature inside the solar tunnel dryer was 19°C at 8.00 hrs on winter day. Maximum ambient temperature on the first day was 28°C at 14.00 hrs while the minimum ambient temperature was 11°C at 8.00 hrs.

Maximum temperature inside the Solar tunnel dryer was 55.4°C at 14.00 hrs while the minimum temperature was 28°C at 8.00 hrs on summer day. The maximum ambient temperature recorded on the summer day was 36.8°C at 14.00 hrs while minimum ambient temperature was 23°C at 8.00 hrs.

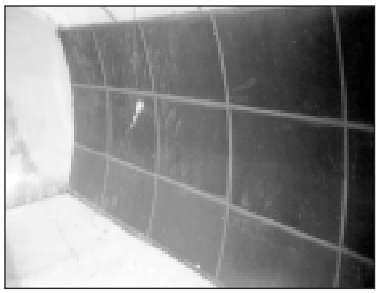
Full load testing of dryer was done for evaluating the performance in actual loaded condition. Under this condition the useful heat was extracted and utilized to remove the moisture from the DCP.

Maximum temperature inside the Solar tunnel dryer was 42.5°C at 14.00 hrs while the minimum temperature was 17°Cat 8.00 hrs during winter. Maximum ambient temperature on first day of winter seasons was 24°C at 14.00 hrs while the minimum was 11°C at 8.00 hrs.

Maximum temperature inside the solar tunnel dryer was 52.7°C at 14.00 hrs while the minimum temperature was 26°C at 8.00 hrs during summer day. The maximum ambient temperature recorded on this day was 34.7°C at 14.00 hrs and minimum ambient temperature was 22.3°C at 8.00 hrs.

5 Types of North Wall for Preventing Heat Losses from the Tunnel Dryer

- Glass wool sandwich in metallic frame.
- Thermocole inserted in metallic frame.
- Polythene sheet pad with glass wool.
- Insulation pad wrapped with tarpal.



6 Table 1: Temperature variation at different positions at no load condition (During winter) (>17°C)

Time	Temperature at various probes (°C)				
	Centre	Southern	Northern	Floor	Ambient
08.00	19.00	17.00	17.00	15.00	11.00
09.00	24.20	25.00	24.00	18.00	14.00
10.00	28.60	29.00	28.40	25.00	16.00
11.00	36.00	34.00	33.00	32.00	19.00
12.00	40.40	39.20	38.00	36.00	24.00
13.00	42.60	42.00	40.00	37.00	26.00
14.00	45.00	44.00	43.00	39.20	28.00
15.00	43.20	43.00	40.00	37.00	26.00
16.00	41.00	38.00	35.00	34.00	25.00
17.00	36.00	36.00	32.00	31.00	20.00
18.00	32.00	34.00	30.00	29.00	17.00

7 Table 2: Temperature variations at different positions at no load condition (During summer) (>19°C)

Time	Temperature at various probes (°C)				
	Centre	Southern	Northern	Floor	Ambient
08.00	28.00	25.00	28.00	27.00	23.00
09.00	37.00	35.60	34.50	34.20	26.20
10.00	37.90	36.20	34.60	34.40	27.20
11.00	42.10	40.10	39.10	39.00	29.30
12.00	46.70	46.40	42.40	40.00	30.40
13.00	47.40	45.30	44.20	42.10	32.70
14.00	55.40	51.20	49.30	48.70	36.80
15.00	53.40	49.20	48.10	48.00	33.70
16.00	49.20	48.30	47.70	46.30	30.00
17.00	44.10	44.00	43.20	41.30	28.50
18.00	40.10	39.20	38.10	38.00	28.10

8 Table 3: Temperature variations at different positions at full load condition (During winter) (>18.5°C)

Time	Temperature at various probes (°C)				
	Centre	Southern	Northern	Floor	Ambient
08.00	17.00	15.00	15.00	12.00	11.00
09.00	26.20	25.00	24.00	19.00	18.50
10.00	30.00	27.00	27.00	24.00	20.00
11.00	38.00	36.00	34.00	31.00	21.00
12.00	40.00	38.00	37.00	33.00	22.00
13.00	41.00	40.00	37.00	33.00	23.00
14.00	42.50	39.00	36.00	33.00	24.00
15.00	42.00	39.00	35.00	34.00	24.00
16.00	38.00	35.00	33.00	30.00	22.00
17.00	38.00	34.00	33.00	30.00	20.00
18.00	35.00	32.00	32.00	28.00	18.00

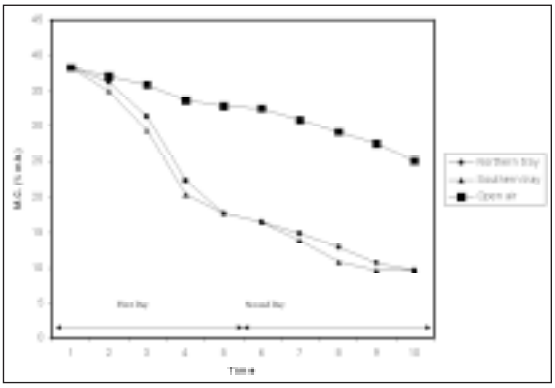
9 Table 4: Temperature variations at different positions at full load condition (During summer) (>18°C)

Time	Temperature at various probes (°C)				
	Centre	Southern	Northern	Floor	Ambient
08.00	26.00	25.00	24.00	23.00	22.30
09.00	36.80	35.20	34.10	34.00	25.20
10.00	37.40	36.30	35.30	34.70	26.90
11.00	42.00	41.70	40.70	40.60	27.30
12.00	45.90	44.30	43.90	43.00	29.50
13.00	47.00	46.30	45.10	45.00	31.90
14.00	52.70	51.90	50.30	49.70	34.70
15.00	50.00	50.00	49.30	48.30	31.30
16.00	47.10	46.30	45.20	44.30	29.70
17.00	43.20	43.00	42.30	41.70	28.30
18.00	40.00	39.20	38.00	37.00	27.30

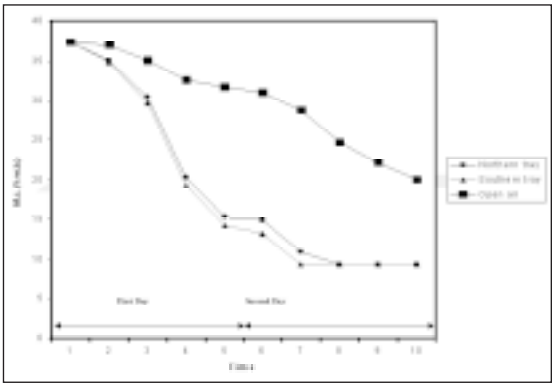
10 Table 5: Mean values of maximum and minimum temperatures for the air inside the tunnel dryer and the outside.

Mean air temperature (C)	Winter (December)		Summer (May)	
	No load	Full load	No load	Full load
Maximum				
-Inside tunnel	45.0	42.5	55.4	52.7
-Ambient	28.0	24.0	36.8	34.7
Minimum				
-Inside tunnel	19.0	17.0	28.0	26.0
-Ambient	**11.0**	**11.0**	**23.0**	**22.3**

11 Figure 1: Moisture content variation with time (% w.b. during winter)



12 Figure 2: Moisture content variation with time w.b. during winter)



13 Comparative Performance of Different types of North Wall in winter

Type of North Wall	Cost of North Wall in Rs.	No load testing		Full load testing	
		Max. temp. in side STD (°C)	Max. ambient temp. (°C)	Max. temp. in side STD (°C)	Max. ambient temp. (°C)
Glasswool sandwich in metallic cover	29,050	47.4	26.6	46.1	26.3
Insulated Pad wrapped with tarpal	20,150	46.0	25.7	44.1	26.0
Polythene sheet Pad with glasswool	17,850	44.5	25.9	41.5	25.4
Thermocole inserted in metallic frame	7,575	40.4	25.1	39.9	25.8

14 Comparative Performance of Different types of North Wall in summer

Type of North Wall	Cost of North Wall in Rs.	No load testing		Full load testing	
		Max. temp. in side STD (°C)	Max. ambient temp. (°C)	Max. temp. in side STD (°C)	Max. ambient temp. (°C)
Glasswool sandwich in metallic cover	29,050	63.1	41.6	60.0	40.0
Insulated Pad wrapped with tarpal	20,150	63.2	41.9	60.1	40.8
Polythene sheet Pad with glasswool	17,850	63.3	42.7	58.8	40.3
Thermocole inserted in metallic frame	7,575	60.4	41.1	59.8	41.1

15 Cost of construction

Cost of construction of one solar tunnel dryer of (21 x 3.75 sq.m. floor area) for drying 1.5 ton of material is approximately Rs. 50,000/-, which is as follows:

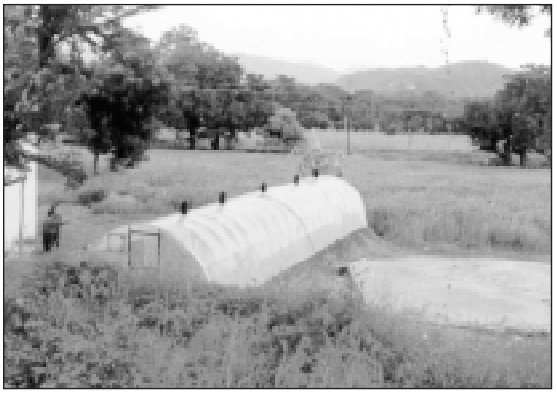
Item	Quantity	Rate	Cost (Rs.)
G.I. pipe 15 mm class B	125 m	68/-	8500/-
G.I. pipe 25 mm class A	30 m	100/-	3000/-
Exhaust fan with automatic humidity controller	One	7000/-	7000/-
Door	One	3000/-	3000/-
200 microns UV stabilized polythene sheet	40 kg (200 m^2)	150/-	6000/-
Pucca floor	75 sq. m.	100/-	75000/-
Drying Aluminium Trays cum trolly for 1.5 ton material	125 m^2	95/-	11875/-
Labour for fabrications	20 man days	100/-	2000/-
Miscellaneous (cement, nut bolt, cable, wire etc.)	–	–	1125/-
			50000/-

16 Cost of Operation/Payback Period:

The total cost of tunnel dryer has been worked out to be Rs.50,000/-. The average cost of drying one batch of DCP of 1.5 tons has been worked out to be approximately Rs.400/-. This includes interests on investment, depreciation, labour cost, cost of electricity & other running expenses. The cost of drying 1.5 tons of DCP in the diesel based tray dryer works out to Rs.1900/-. Thus there is a saving of Rs.1500/- for every batch of drying in the solar tunnel dryer. The investment on the solar tunnel dryer can be recovered in drying around 56 tons of DCP or say 75 working days.

17 The performance of Solar Dryer is summarized as under:

- The air temperature in the tunnel was higher than the outside by 10-18°C during sunshine hours.
- The moisture content of DCP under full load condition of the dryer reduced from around 38% initial value to around 9.7% final value in 16 and 12 sunshine hours during winter & summer months respectively. The corresponding values of moisture content of the DCP dried in open sun was 25.7% and 20.1%
- The moisture content of approximately 1.5 ton of wet DCP loaded in the dryer in one batch was reduced from an initial value of 38-40% to around 15% in 2 or 3 days depending upon solar insolation.



Technical Session 5
Financing Issues

Chairperson

A.T. Kusre
GM, ICICI Bank

Carbon Finance & CER Purchase

Chintan Shah
GM, Senergy Global

Financing of Renewable Energy Projects In India

P.K. Modi
P. K. Modi & Co, Chartered Accountants

CARBON FINANCE & CER PURCHASE

CHINTAN SHAH
GM, Senergy Global

CHINTAN SHAH is a General Manager at Senergy Global, which is the first Indian company in the field fo CER Asset creation and trading activities. Earlier, he was the General Manager (Strategic Planning) at Suzlon Energy Limited, a leading company in the field of wind energy generation in India. Prior to Suzlon Group, he was working with the Renewable Energy Group of TERI. His work at Senergy Global is to develop Carbon Asset instruments and products on one hand, and entering into energy trading on the other.

1 WHAT IS CARBON FINANCE ?

- Carbon finance, is nothing but an additional revenue stream emerging from a project based activity
  - Passes the various additionality tests
  - Meet all necessary compliances (viz. Kyoto Protocol)
  - Has a positive sustainable development impacts for the host country (in this case, India)
- Some exceptions, in which investor invests (equity) into the project
  - Returns as CERs

2 FOUR COMBINATIONS

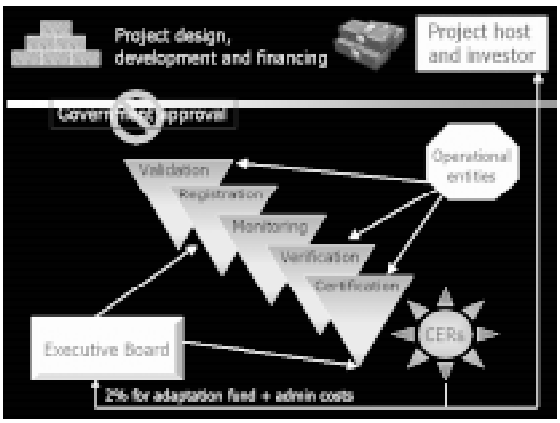
- Programmatic
  - Annex I Government to Non-Annex Government
  - Private Annex I company to Non-Annex Government
- Project based
  - Annex I Government to Private Non-Annex I Company
  - Private Annex I Company to Private Non-Annex I Company
- Programmatic
  - Annex I Government to Non-Annex Government (viz. Higher penetration of solar thermal collectors)
  - Private Annex I company to Non-Annex Government
- Project based
  - Annex I Government to Private Non-Annex I Company
  - Private Annex I Company to Private Non-Annex I Company
- Facts about CDM: Cop-6 bis & Marrakech Accord
- RE up to 15 MW are going to be benefited the most under fast-track procedures
  - Gestation period is less than 1 year, at times 3 months also
  - 15 MW project may look small on the basis of GHG emissions, but it is large enough for the RE sector
  - For, India
    - Institutional mechanisms and enabling mechanism is in place
    - Investors and financing mechanism are present
    - Full-fledged RE programme is also present

3 SIZE OF THE PROJECT ?

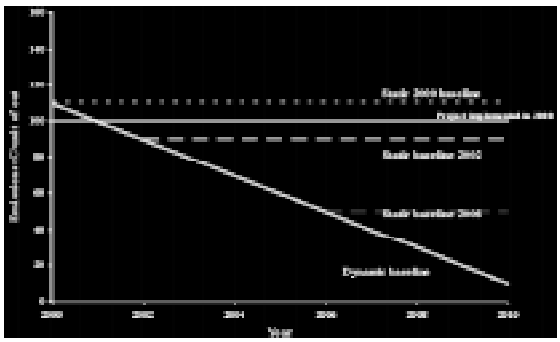
- Apart from small scale project modalities
  - Transaction costs ~ at times constant irrespective of the size of the project
  - Delivered benefit in terms of US$, € or ¥ per CER!!
- Transaction costs depends on
  - Selection of baseline (how strict) & PDD development
    - Higher the strictness higher the CER proceeds
    - Accompanied with Monitoring Protocol (strictness in baseline would lead to higher verification costs)
  - Validation & Witnessing by AOE

Finally a trade-off by fixing the optimum parameters
No Thumb Rule : It is highly project specific

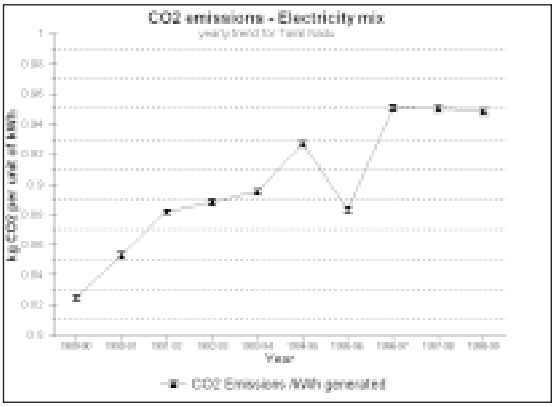
4 BASELINES



5 BASELINE



6 RE DICHOTOMY FOR CDM PROJECTS



- Grid connected RE projects (generally large in size)
  - Wind energy
  - Biomass
  - Waste to Energy
- Off-grid RE projects (generally small in size)
  - Wind and solar photovoltaic based projects
    - Lighting and other electricity based end use applications
  - Small biomass (gasification)
    - Electricity and thermal based end use applications
  - Solar thermal based projects
    - Electricity and thermal based end use applications

7 PREPARATION OF PDD

- Identification of consultants to prepare the detailed baseline document & Monitoring and Verification Protocol
  - Preparation of baseline is a very tricky issue
    - The most crucial design phase
    - Rules for small scale projects is in place
    - Has a great ramification in the amount of delivery of CERs, and also the transaction cost with respect to recurring expenditure of Verification and Certification
  - Baseline rules have been simplified, however, additionality issues still prevail for any kind of projects

8 ADDITIONALITY

- Financial additionality
  - The project is not viable on economic basis
    - Risk perceptions & mitigation
    - Cost of generation higher vis-à-vis baseline options
    - Project itself is exposed to very high operating risks

9 ANNOUNCEMENT OF FIRST CDM CDOT : CERUPT

- CERUPT stands for Carbon Emission Reduction Unit Procurement Tender
- Objective: The Netherlands to use CERs to help meet its commitment under KP
- Tender period: November 2001-January 2002
- GHG offsets: 3 Mio CERs
- Per. of purchase: 7-14 years

Eligible projects & Price per CER

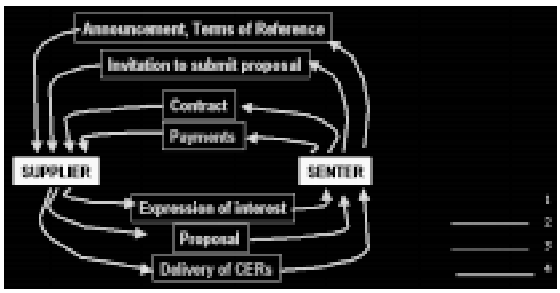
RE excluding biomass	5.5
Energy from clean & sustainability grown biomass	4.4
Energy- efficiency improvement	4.4

- Others,incl. fossil fuel switch & CH_4 recovery 3.3

10 CERUPT PROCEDURE

- Procurement guidelines
  - SENTER (tendering authority) buys CERs
    - Public procurement
    - Terms of contract
- Relevant aspects
  - Two stage procedures
  - Expression of interest, proposal
  - Selection & contract award criteria
  - No negotiation
  - Price by competitive bidding

11 CARBON CREDITS PROCEDURE



12 RESULTS SELECTION CERUPT PHASE 2001

- Received 80 expression of interest
  - 90 Mio CERs
  - Project in 27 countries
- Selected : 26 expression of interest
  - 32 Mio CERs
  - Average price of Euro 4.7 per CER
- Project in 13 countries
  - El Salvador (1) Costa Rica (4) Panama (3) Jamaica (1) Peru (1) Bolivia (1) Brazil (2) **India (6)** Indonesia (2) China (2) Nigeria (1) Kenya (1) & Uganda (1)

13 PROPOSALS FROM INDIA

- Wind – 3 (Enercon in Karnataka, Suzlon in TN, Vestas in TN)
- Biomass – 2 (Kalpataru in Rajasthan, Ind-Barath in Maharashtra)
- Wind-Biomass Hybrid – 1 (Vestas in TN)

14 SUZLON/SG PROJECT UNDER CERUPT

- Project size 15 MWe
- Location Sankaneri, TN
- Type Grid connected Wind EnergyProject
- Technology 1.25 MW sized wind turbine
- PLF 28-30%
- CERs supply 340,000 by 2012
- Period of delivery 2004 onwards

15 MAJOR ISSUES IN RE

- Considering a market cost of $5 per CER
  - Seller takes the Kyoto Risk
  - Transaction costs reduces substantially beyond a 10 MW grid connected/stand alone project
  - Transaction costs does not behave the same for de-centralised energy systems (viz. SPV)
  - Transaction costs has an inverse relation with monitoring points & geographical boundary of the project size

16 ADVANTAGE OF BUNDLING & REDUCTION OF TRANSACTION COSTS

A Case Study

17 ABOUT THE PROJECT

- SUZLON/SG through TERI submitted a PIN to GTZ- CDM India office
- GTZ selected "grid connected wind farm project" in Tamil Nadu
- Project development & implementation by Suzlon Energy as a turn-key contractor
  - Suzlon manufactures wind turbines, does site development, implements & maintains the wind farm project
- Project owners would be a mix of process industries in the state of Tamil Nadu

18 PROJECT SPECIFICATION SHEET

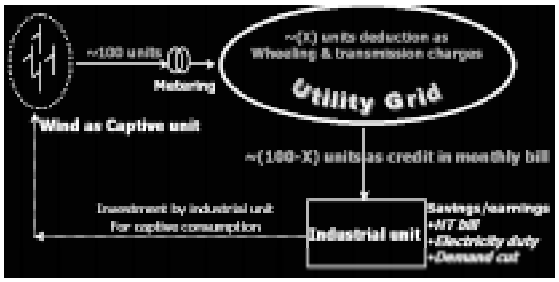
Sector	Renewable Energy
Project	Wind Farm (Grid connected)
Project proponent	SENERGYGLOBAL (CER Asset Creation & Holding Company)

Location	Irrukandarai, Radhapuram Taluk Tirunelveli District, Tamil Nadu
Site features	Barren land, no agricultural activity, industrially backward
End use of power	Wheeling to industrial units of process industries

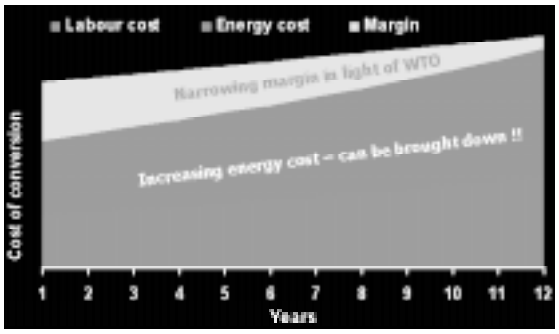
19 PROCESS INDUSTRIES & WIND POWER

- Energy cost is always a major expenditure –
  - Ranging from as low as 25% to as high as 40-45%
- Competition (both domestic & global) has led to freezing of cost of the final produce (viz. cloth, cement, chemicals etc.)
- Wind power is one of the logical answer to these problems
  - Power plant uses wind (which is free) as fuel
  - Long term freezing of cost of power

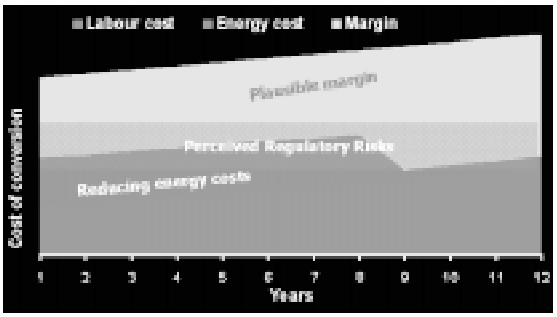
20 THE PROCESS : HOW IT HAPPENS ?



21 IMPACT OF RISING ENERGY PRICE ON PROCESS INDUSTRIES (VIZ. TEXTILES)



22 BENEFITS TO THE TEXTILE INDUSTRY THROUGH WIND ENERGY



23 TECHNOLOGY FEATURES

- Project size
  - 300 MW (planned), with plausible upscale to larger size
- Wind turbine size
  - 1.25 MW (planned), with plausible upscaling to 2 MW
- Features
  - Low wind regime wind turbine, high PLF
  - RIM (resin infused mould) technology incorporated in the blade
    - The latest technology leading to savings of materials (approx. 30%)
    - Better aerodynamic features leading to higher performance

24 PRESENT STATUS OF THE PROJECT

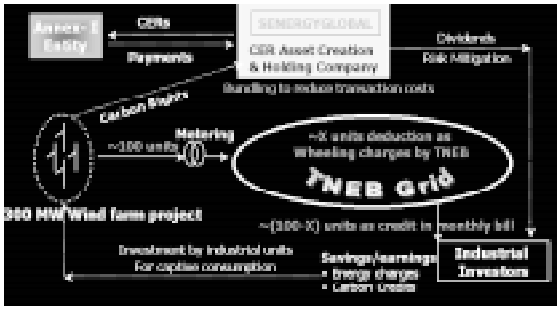
- Wind farm site operational since August, 2002
  - Wind farm installation has reached approximately 120 MW
  - Extensive Wind data monitoring at five different locations
- Target for 2003-04 is pegged at 150 MW
- All statutory clearance has been obtained
  - Clearance in India is mainly for grid inter-connection
  - Local village bodies are having no-objection to the said activity, rather they are benefited (directly/indirectly)
- Project would have a mix of self-financing/ IREDA/banks etc.
  - Suzlon also facilitates funding based on internal due diligence
  - Suzlon provides O&M of the project
  - Major owners of the project include viz.

Ramco Industries, Ever Ready, Amar Jyoti, Velaithal Spinning Mills etc.

25 DETAILS OF THE PROJECT

Project cost per MW	Rs 46 Mio ~US$1 Mio
Total project cost (300 MW)	Rs 13.8 Bio ~ US$300 Mio
Projected PLF (average)	28-30%
(against all India average of 20%, & TN average of 25%)	
Average wind speed	7-7.5 m/s
O&M (including insurance) cost	1.7-2%
Cost of generation (in Rs/kWh)	Rs 2.5-2.9/ kWh
Levelised annualised (disc. at 12%)	5.4-6.3 US cents/kWh
Esti. E. Gene. (300 MW) per annum	840 Million Units
Estimated CERs from the project *(Southern Region Baseline)*	600,000 p.a.

26 PROJECT STRUCTURING FOR CER ASSETS



27 CHALLENGES…

Additionality

- Technology & Project additionality
  - Wind turbine sizes have gone to MW size from kW size
  - Wind park model (unique with higher infrastructure cost)
- Electricity & Regulatory related additionality
  - Risks associated with volatility of the power sector
  - No unbundling of electricity board in Tamil Nadu
  - Rules & Regulations, new structures are yet to be formed
  - Investments in power generation is going to be very high risk venture
- Issues wrt to buy-back rates (PPA), wheeling charges etc.
- Financial additonality

IRR change : 3-6 % (substantial change)
RoE change : 5-9 % (substantial change)

When you are describing
A shape or sound or tint
Don't state the matter plainly
But put it in a hint;
And learn to look at all things
With a sort of mental squint
Lewis Carroll

28 THE ADVANTAGES OF BUNDLING

- SUZLON has contracted all its wind farm projects to bundle under SENERGY GLOBAL
- SENERGY GLOBAL to act as a trading repository of CERs in India
  - Sell onward to Annex I countries (government/private companies)
  - Buy CERs from any seller from India
  - Bundle projects to lower the transaction costs

29 THE ROLE OF FINANCIAL INSTITUTIONS

- Packaging projects
  - Development of project pipelines
  - Portfolio generation
- Financing projects
  - Project finance
  - Venture capital
  - Special mutual funds
  - Corporate finance
  - Lending
- Bringing in expertise in checking the viability of project proposal – due diligence
- Insurance

30 DOS AND DON'T

- Don't get lured by fly-by night consultants/ brokers of VERs/carbon off-sets
  - Baseline & Validation report is a must
- Don't think of undertaking a project for a size of less than 7-8 MW (high transaction cost)
- Don't try to get the benefits in haste, it would spoil the deemed revenue generation for years to come

Abstract qualities begin
with capitals always:
the True, the Good, the CDM, the Beautiful -
those are the things that pay
with apologies to **Lewis Carroll**

Financing of Renewable Energy Projects In India

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Pradip Modi is a practicing Chartered Accountant based in Ahmedabad and is a finance consultant to project developers of wind power projects. He has written many articles on International Finance Flows and International Trade and Tariff at various national and international conferences. He held the position of Convenor of Professional Development Committee of Chartered Accountants Association of Ahmedabad. He shared his experience of financing of a wind energy project and also showed details of financial calculation for a typical project.

1 An Overview of Energy Sector in India

- Electricity is a concurrent subject in list 3 of Schedule VII of the Constitution of India.
- Elasticity Ratio to GDP is 1.25 in 10th Plan

2 Demand and Supply by 2012:

The all India installed capacity of electricity power generation is 104917.50 MW as on 31-3-2002.The details of generation method is as under:

It is targeted to generate another 1,00,000 MW by 2012 with the help of approximately investment of Rs.8,00,000 crores. There is a need for electrifying 80000 villages .As on 31-3-2002 55% of urban areas and 69 % of Rural areas are yet to be electrified.

(Source :MNES 2002 Report)

3 Distinction Between Conventional Energy Generation and Non Conventional Energy Generation

- Conventional energy – Thermal, Hydel, Nuclear
- Non-conventional energy – Wind, Solar, Bio-mass

- **Kyoto Protocol**

An international agreement, reached in 1997 in Kyoto, Japan, which extends the commitments of the United Nations Framework Convention on Climate Change. In particular, it sets targets for future emissions by each developed country

4 Global Players vis-à-vis Indian Players in Non-Conventional Energy Generation

- Global Wind Energy Players
  - Enercon GMBH
  - GE Wind Energy
  - Dewind GMBH
  - Nordex Energy GMBH
  - RE Power Systems AG
  - Vestas Wind Systems A/s
- Indian Wind Energy Players
  - Suzlon Energy Limited
  - Enercon
  - NEPC India Limited
  - Vestas RRB Limited
- Global Solar Energy Players
  - Amonix USA
  - Shell Solar
  - BP Solar
  - Pilkington

5 Global Outlook of Wind Energy Generation

(Source : EWEA May 2003)

S.No	Country	MW end 2002
1.	Germany	11,968
2.	Spain	5,043
3.	USA	4,674
4.	Denmark	2,880
5.	India	1,702

6 Ambitious Targets of Government of India for Non-Conventional Energy Generation

Wind Power scenario in India		
State	Gross Potential (MW)	Installed Capacity (MW) (as on 30/06/03)
Andhra Pradesh	8275	92.60
Gujarat	9675	173.10
Karnataka	6620	124.30
Kerala	875	2.00
Madhy Pradesh	5500	22.60
Maharashtra	3650	401.20
Rajasthan	5400	60.70
Tamil Nadu	3050	990.30
West Bengal	450	1.10
Others	1700	1.60
Total	45195	1869.50

7 Environmental Assessment

Saving of Coal and Saving of Atmosphere from Pollution with Wind Power Generation (as on end of August 2003)	
Item	Saving
Coal	5,077,600 TONS
Sulphur di-oxide	82,510
Nitrogen Oxide	57,120
Carbon di-oxide	12,694,000
Particulates	6,820

8 Financing of Projects in India – An Overview

Financial Institutions

- IREDA
- Power Finance Corporation

Gist of Terms of Finance

- IREDA
  - Interest Rate ranging between 11.0 to 11.5% in wind Power projects
  - Maximum moratorium period one year
  - Maximum finance 100% of eligible equipment or 70% of the total project cost.
  - A rebate 0.5% on interest rate will be given for timely payment of loan.
  - The minimum capacity for eligible wind turbine is 225KW.
  - Financing is available against manufacturing of equipments also together with market development assistance.
  - Finance also available for mini/small hydro projects for moratorium period of maximum three years at the interest rate 12%
- Power Finance Corporation
  - Interest rate ranging between 8.5% to 10.25%
  - The Central sector and State sector borrowers also can avail term finance for T&D, all types of non conventional projects as well as computerisation of communication and data compilation.
  - Term loan can be availed by equipment manufacturer also who is having minimum AAA rating of State / Central sector.

9 Indian Wind Mill Industry – SWOT Analysis

- Strengths
  - Large wind potential sites in the country.
  - Raw material is available at NIL cost and inexhaustible.
  - Proven and easy to adapt technology
  - Non- polluting green power
  - Availability of skilled labour at cheap cost
  - Wind monitoring study undertaken by the Government (MNES)
  - Government's active encouragement and

support by way of tax, duty benefits and capital subsidies.

- Dedicated ministry for development of non-conventional energy sources (MNES)
- Electricity is the largest traded commodity on earth.
- With locally available natural resources of power, extraction and transmission cost is minimal
- Low gestation period
- Wind power industry has achieved CAGR of 40 % in the last 5 years.

■ Weakness

- High capital cost
- Low speed of indigenization.
- Lack of availability of quality spares, domestically
- Depreciation of rupee since the components are not entirely indigenized
- Differential Government Policies and procedures for non conventional energy generation amongst various states in India.
- Lack of grid availability and grid drop

■ Benefits / Opportunities

- Continuation of economic reform policy by the Government and the proposed implementation of power sector reforms
- Government targets to achieve 10 % of the total installed capacities through renewable energy projects by the year 2010 which is about 12000 MW out of which wind is the only major resource available
- 350 Million people still depend on firewood for energy
- Increasing heavy demand for electricity in rural areas
- Rural development which is on the priority agenda of the Government
- Ever increasing the demand and prices
- Low average levelised cost of production per KWH comparative to conventional projects
- Depleting reserves of fossil fuels
- Global / National awareness and movement against pollution and in favour of green power
- 70 % - 80% of the global public disapproved nuclear fuel through international opinion poll

■ Government Incentives

Central

- 80% depreciation benefit under I. T. Act (This allows companies with taxable profits to plan for tax shelter)
- Income Tax exemption for power income for 10 consecutive assessment years.
- Excise & Sales tax exemption on Wind Mill equipments and components.
- Income earned from Debentures and Bonds issued by power generating companies are totally exempted from tax.
- Wind Turbines have just been included among the items eligible for the 5% concessional funding out of the 'Textile Up-gradation Fund'

State

- Wheeling and Banking of Power :
- Wheeling of power allows the power generated by wind mills at one place to be used at another place by the same Company or group Companies.
- Banking of power allows power generated to be claimed for use later. Both Wheeling and Banking have a typical advantage in the Indian context of power shortage as the amount of energy wheeled or banked can be claimed at the load shedding / power shortage period, allowing manufacturing to continue uninterrupted.
- Power Purchase Agreement (PPA) for unlimited period.

Risk

- Evacuation of Power
- Poor Grid Connectivity
- Surplus generation through conventional projects
- Reliability on the continuation of Government incentives and subsidies
- Unpredictable Government policies
- Vagaries of nature

10 Impact of New Electricity Act, 2003

Recently, Parliament has passed the new Electricity Act. This Act will compel the state electricity boards to buy certain percentage of power (to be fixed)

produced by renewable sources. This would help generation of electricity from Renewable sources of energy like wind, solar, hydro, biomass.

11 A – Case Study

Project Assumptions	
Capacity of Wind Turbine Generators	225kw each
Number of WTG	8
Location of project	Tamil Nadu
Cost of Each Wind Turbine	Rs.103 lacs
Total Cost of Project	Rs. 20.65 crores
Loan Component @ 70%	Rs. 14.85 crores
Power generation units/p.a. per WTG	550000
Electrical Energy Purchase rate by TNEB per unit	Rs 2.70 fixed
Rate of int on term Loan	10.00% Per annum
Tenure of loan (years) inclusive of six months moratorium for principal	8 years
Dep rate as per Co. Act - SLM	5.28%
Operation and Maintenance	
1st Year	Free
2nd Year to 8th Year	Rs 0.53 lacs per WTG
Insurance - Fire and Allied Perils	Rs 18,000 per crore
Insurance - Machinery Breakdown	Rs 55,000 per crore
Income Tax	Tax holiday for 10 years

12 DSCR

DSCR – Cash + Tax benefit

Particulars	Projections for the year (Rs in crores)							
	1	2	3	4	5	6	7	8
Opening Cash Balance	0.00	2.69	3.05	3.13	3.22	3.37	3.80	3.91
Add : Net Profit	0.40	0.29	0.37	0.45	0.55	0.61	0.69	0.77
Add: Depreciation	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Add : Interest	0.53	0.50	0.43	0.34	0.26	0.18	0.10	0.03
Add : Tax benefit on Income Tax Depreciation @ 35.070%	2.27	0.46	0.09	0.02	0.00	0.00	0.00	0.00
Total Cash Available	**3.62**	**4.36**	**4.36**	**4.36**	**4.43**	**4.68**	**5.01**	**5.12**
Term loan interest	0.53	0.50	0.42	0.34	0.26	0.18	0.10	0.02
Term loan repayment	0.40	0.80	0.80	0.80	0.80	0.80	0.80	0.74
Total Obligation	**0.93**	**1.30**	**1.22**	**1.14**	**1.06**	**0.98**	**0.90**	**0.76**
closing Balance	2.69	3.05	3.13	3.22	3.37	3.80	3.91	4.36
DSCR	3.89	3.35	3.57	3.82	4.16	4.67	5.54	6.74
Average DSCR	4.31							

DSCR on Cash Basis

Particulars	Projections for the year (Rs in crores)							
	1	2	3	4	5	6	7	8
Opening Cash Balance	0.00	0.42	0.33	0.22	0.29	0.54	0.17	1.08
Add : Net Profit	0.40	0.29	0.37	0.45	0.55	0.61	0.69	0.77
Add: Depreciation	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Add : Interest	0.53	0.50	0.43	0.34	0.26	0.18	0.10	0.03
Total Cash Available	**1.35**	**1.63**	**1.54**	**1.43**	**1.49**	**1.75**	**1.38**	**2.30**
Term loan interest	0.53	0.50	0.42	0.34	0.26	0.18	0.10	0.02
Term loan repayment	0.40	0.80	0.80	0.80	0.80	0.80	0.80	0.74
Total Obligation	**0.93**	**1.30**	**1.22**	**1.14**	**1.06**	**0.98**	**0.90**	**0.76**
closing balance	0.42	0.33	0.32	0.29	0.43	0.77	1.08	1.54
DSCR	1.47	1.25	1.26	1.26	1.41	1.79	2.53	3.01
Average DSCR	1.65							

13 Projected Profitability

Particulars Income	Projections for the year (All Figures in Rs. Crores)							
	1	2	3	4	5	6	7	8
Sale of Power								
Units Generated	4950000	4950000	4950000	4950000	4950000	4950000	4950000	4950000
Sale price per unit	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Total Sale of Electricity	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
Expenses								
Operation & Maintenance	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Machinery Break-down insurance	0.00	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Insurance - Fire and Allied Perils	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Interest	0.50	0.50	0.42	0.34	0.26	0.18	0.10	0.02
Depreciation	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Total expenses (6 to 9)	0.94	1.05	0.97	0.89	0.81	0.73	0.65	0.57
Profit before tax	0.40	0.29	0.37	0.45	0.53	0.61	0.69	0.77
Tax provision	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit After Tax	0.40	0.29	0.37	0.45	0.53	0.61	0.69	0.77
Net Cash Surplus	0.82	0.71	0.79	0.87	0.95	1.03	1.11	1.19
Add : Opening Balance	0.00	0.42	0.33	0.32	0.39	0.54	0.77	1.08
Repayment of Bank	0.40	0.80	0.80	0.80	0.80	0.80	0.80	0.74
total Repayments	0.40	0.80	0.80	0.80	0.80	0.80	0.80	0.74
Closing Balance	0.42	0.33	0.32	0.39	0.54	0.77	1.08	1.53

14 SUGGESTIONS

- Uniform state policy for all non-conventional energy projects.
- Commercial Banks should take a positive and long term view towards this industry
- IREDA to look at these projects from a Development Banker's view.
- The Third Party Sale of Electricity Generated must be allowed.

Panel Discussion on "Opportunities and Barriers for States"

Vijay Ranchal
India Development and Environment Agency

K.V. Doshi
Dy. Director, Gujarat Energy Development Agency

Sandeep Dave
Director, Neptune Automation Pvt. Ltd.

VIJAY RANCHAL has served as Additional Secretary in the Department of Energy and Petrochemicals in Govt. of Gujarat until 2002. He is now a senior advisor to India Development and Environment Agency, a private initiative for new investment promotion based in Ahmedabad.

K. V. DOSHI is Deputy Director at Gujarat Energy Development Agency (GEDA). He is a Chemical Engineer with post-graduation in Industrial Management from Indian Institute of Science, Bangalore. He has more than 20 years of work experience in the field of energy conservation and renewable energy. Almost 10 years of his working life have been devoted to promotion of renewable energy while working in GEDA.

SANDEEP DAVE has more than 10 years of experience in the area of energy and has worked as consultant with leading consulting firms in India. He is currently working as a Director with Neptune Automation Ltd., a private sector company based near Ahmedabad.

Summary

Discussions in the panel session were led by Mr. Vijay Ranchal, former Additional Secretary, Department of Energy and Petrochemicals, Govt. of Gujarat. Mr. Ranchal was joined by Mr K.V. Doshi, Deputy Director of Gujarat Energy Development Agency and Mr. Sandeep Dave, Director of Neptune Automation Ltd. In his opening remarks, Mr. Ranchal said that although the renewable energy program in India is one of the largest in the world, it is still inadequate to meet the energy needs of the vast population which is still not covered by modern energy services. He said he was hopeful with the CDM potential of these Renewable Energy projects and it was for the entrepreneurs to understand and make the most of such opportunities. Mr. Doshi shared his experience of promoting renewable energy in the region. He said that Gujarat is still behind other states in terms of tapping the potential of biomass-based power generation. He also shared his idea of bundling of several small biomass-based power projects in Gujarat under the umbrella of GEDA to avail of CDM benefits, which could become a model for other such initiatives. Mr. Dave, who is presently involved in flyash utilization project, was optimistic about the potential of CDM benefits for several kinds of projects including renewable energy, energy efficiency, waste utilization and so on. He however advocated a cautious approach since many uncertainties are still unresolved.

Annexes

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