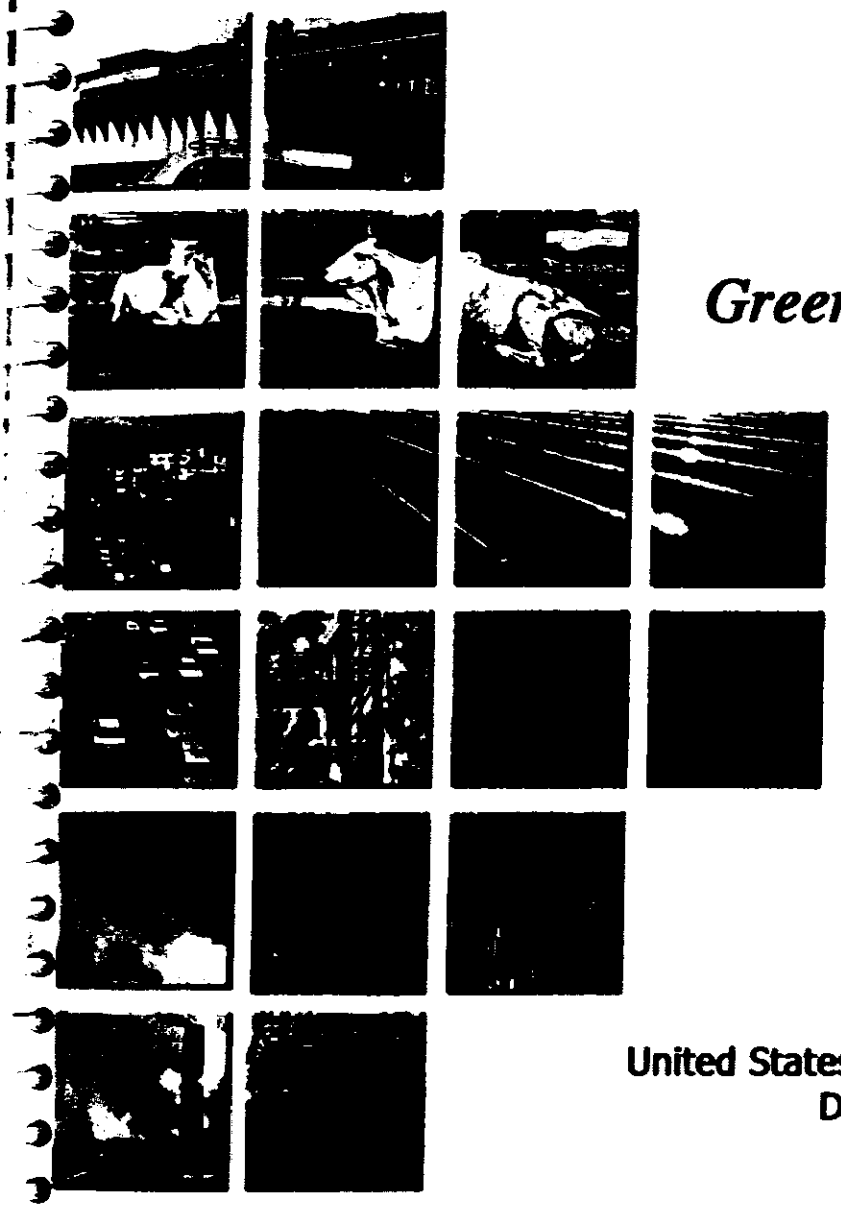
PN-ACY-738

CLIN 2E : Institutional Strengthening of Financial Sector : Final Training for Financial Institutions



Greenhouse Gas Pollution Prevention Project— Climate Change Supplement

A Program of the:
United States Agency for International Development/India Mission

Implemented by:
The Louis Berger Group, Inc.

Global Environment Team

THE Louis Berger Group, INC.
2300 N Street, NW
Washington, DC 20037 USA

The Louis Berger Group, Inc.
Contract No. 386-C-00-00-00058-00
Sandeep Tandon, CTO

b

TABLE OF CONTENTS

Executive Summary 2
GEP-CCS Project Background 3
Needs Assessment for Training Task – november, 2000 4
First Training program – Bangalore, India April, 2001 6
Organizational Preparations for this Training 8
Training Team 8
Proceedings at the Training Program 11
  Who attended 11
Business Plan Group Case Studies 12
Outcomes of the training program 14
Conclusions 14
Appendices 16
  Appendix I: List of Participants 17
  Appendix II: Business Plan Exercise 20
  Appendix III: Complete Program Book 24

EXECUTIVE SUMMARY

The Louis Berger Group, Inc. (LBG) is implementing the Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS) for USAID-India. GEP-CCS is a four-year effort, begun in April 2000, to help create awareness of climate change issues among industry, government, financial institutions, project developers and research institutions. Contract line item (CLIN) 2 calls for "Institutional Strengthening of the financial Sector". Within that CLIN, task 2C requires training for "...banking professionals with certificates given." Pursuant to this requirement, LBG led the development of and conducted an extensive 5-day training course to targeted Indian Financial Institutions (IFIs) between April 16-20th, 2001, at the Dominion in Bangalore, India. A follow-up training was then scheduled for the following year, April 23-24, 2002, at the Taj Mumbai Hotel, Mumbai, India. This second training completed the CLIN 2 training requirements. This report relays some of the key findings and observations from this second training.

While relying on some of the same training materials as in the previous year, the second training program was more streamlined and built towards a case study exercise performed by the trainee class. One of the recommendations from the earlier training was that the 5-day training session was overly long, and that the training should be compacted. Pursuant to that request, and under approval by USAID, this training was limited to two days.

The training was structured into six primary sessions:

- Current Trends in Climate Change Negotiations
- Traditional and Conventional Finance for Clean Energy Technologies
- Emissions Markets and Trading
- Clean Energy Project Development from Macro View
- Clean Energy Project Development – Specific Structuring Elements
- Clean Energy Perspective from a Financial Advisory Institution

Thirty-one attendees, representing 20 different institutions participated in the training. Evaluations were received from just under half of these participants, with the ratings provided as good to excellent.

GEP-CCS Project Background

The Greenhouse Gas Pollution Prevention Project (GEP) was launched by USAID-India in 1995 to reduce the volume of emissions of greenhouse gases by increasing efficiency in coal fired power plants (efficient coal conversion or ECC) and encouraging use of biomass fuels in power generation (alternative bagasse co-generation or ABC).

A Project Agreement Amendment to GEP was signed between the Government of India and USAID/India on September 8, 1999 to launch the Climate Change Supplement (CCS). The GEP-CCS expands the ongoing ECC and ABC activities by adding two new components "Fostering Climate Change Initiatives for Sustainable Development" and "Linking Urban Development and Climate Change". The new set of activities will encourage technical cooperation between U.S. and Indian institutions. It will also build local institutional capacity to design and implement projects that reduce GHG emissions.

The Louis Berger Group is implementing these new components and aims to increase awareness about of Global Climate Change (GCC) issues amongst major Indian stakeholders such as industry, government decision makers, the research community and the financial sector.

A major activity within the "Fostering Climate Change Initiatives for Sustainable Development" component calls for "Institutional Strengthening of Financial Sector." Under this activity, LBG proposed to establish a dialogue with the Indian financial community to (a) understand the current knowledge of the GCC impact on financial aspects of projects (b) disseminate information on international technology trends in GCC (c) identify gaps that hinder GHG mitigation project development; and, (d) conduct training on GHG mitigation financing and project development.

Over the course of the GEP-CCS project, LBG will conduct at least two capacity building training courses to a targeted audience of Indian Financial representatives.

NEEDS ASSESSMENT FOR TRAINING TASK – NOVEMBER, 2000

One of the preliminary tasks within CLIN 2 was to assess the existing in-country lending practices relating to GHG mitigation projects, and to gauge the knowledge among IFIs about the topic of certified emissions reduction trading. Therefore, a Training Needs Assessment (TNA) of IFIs was conducted by LBG from November 6-11, 2000, with support of financial experts from NATSOURCE LLC, New York City, and Global Financial Solutions, Germantown, Maryland. A final TNA report, with training recommendations and draft training curriculum was submitted to USAID-India on November 29, 2000.

LBG's approach to the TNA focused on identifying major gaps in IFI awareness of existing debt/equity sources of finance for GHG mitigation projects, as well as the opportunities from the newly emerging area of certified emissions reduction trading.

Three broad findings emerged through the meetings:

GHG emission mitigation is not presently addressed within banking lending criteria, and basic environmental risk is assessed on a preliminary level

The majority of IFIs indicated that their sole environmental criterion is whether the loan applicant is considered compliant by the relevant Government of India regulatory authority. As one interviewee described it, their environmental review procedures are "binary" at best, with firms receiving a "0" or "1" with respect to environmental compliance. Although environmental audits are performed, this information is not taken into account during the lending decisions.

Though IFIs expressed some cautious skepticism about the concept of GHG emissions trading, they were keenly interested in the concept and wanted to learn more about the process.

The majority of the IFIs were aware of the potential of trading certified GHG emissions reductions, but they had detailed questions about the process and likelihood of the market. There was special interest in the role of key actors in a transaction, such as auditors, engineering firms and brokers. A couple of institutions identified "east/west" concerns, in that developed countries would be allowed to continue emitting GHG, while the developing countries would be reducing their emissions.

The IFIs were very receptive to GHG training and had specific recommendations on the structure of the training and the most suitable timeframe for conducting training.

The IFIs were almost unanimous in recommending that the IFI training be provided on at least two levels. First, a basic overview presented to CEO level representatives, followed by a separate 3-4 day intensive training provided to the project appraisal staff. Additionally, the timeframe most often recommended was April-May, 2001, to coincide with the end of the fourth financial quarter.

FIRST TRAINING PROGRAM – BANGALORE, INDIA APRIL, 2001

The first training installment, an intensive 5-day training course, was conducted by the Louis Berger Group, Inc. on April 16-20th, 2001 at the Dominion in Bangalore, India. Over 18 IFS were represented at the training.

The training was structured into three modules that covered (1) international sources of debt/equity for clean energy projects, (2) how certified emissions reductions are brokered, and; (3) project baseline assessments, monitoring and verification, risk mitigation and other financial considerations within clean energy project development.

LBG retained the services of three leading consulting firms in this field: Econergy International Corporation (Project Structuring); Natsource, LLC (Emissions Markets and Trading); and Global Financial Solutions (Traditional and Conventional Finance).

The following issues/recommendations were highlighted in the previous FI training conducted by LBG in Bangalore, April, 2001. We identify in this list the specific actions that were taken to address these issues for this year's training course:

Issue 1: *Reducing the Length of Training*

Action: The training was compressed to two days.

Issue 2: *Editing Back the Traditional Lending Module (I)*

Action: The Traditional and Conventional Finance session was compressed into a single 1-hour session.

Issue 3: *Re-ordering the Sequence of Modules*

Action: The training sessions were re-ordered, with the Clean Energy Project Structuring session coming at the end so as to provide a logical synthesis of the earlier sessions.

Issue 4: *Unnecessary Overlap Between Modules II [CEP Project Development] and III [Emissions Markets and Trading]*

Action: The training was re-designed and overlaps between the Emissions Trading and Clean Energy Project Development were eliminated in large part.

Issue 5: *No Project Developer Case Studies Involving Successful Sales of GHG reductions.*

Action: In the business plan case study exercise, the trainees were provided with background on 10 projects prepared through the GEP-CCS project. Two of those cases have been approved by Government of India and submitted to an international carbon tender.

Issue 6: *More Preparation on the Interactive Exercises*

Action: During planning of the business plan exercise, three hours was allotted for the trainees. This, however, proved insufficient, and this must be taken into account for any future training activities.

Issue 7: *More Central Location for Training*

Action: The training was moved to Mumbai and held at the well-known Taj Mumbai.

Issue 8: *Inclusion of More Background Material on Greenhouse Gas Mitigation*

Action: In the short time-frame of this training, there was insufficient opportunity to give the attendees an extensive overview of key GHG mitigation concepts. However, reading material was provided to the participants to enable additional study.

Issue 9: *More Indian Case Studies Included in Modules*

Action: The business plan exercise review was re-designed to look at 10 actual projects that had been submitted through the GEP-CCS project development process. These were "real cases," several of which have achieved financial closure.

Issue 10: *Computer Lab Infrastructure Was Inadequate*

Action: Five computers were provided to the attendees in order to complete their business plan exercise assignment.

Issue 11: Both Mid-week Field Trip and Social Event Were Well Received

Action: As this was only a two-day session, field trip was not possible. However, attendees had ample opportunity to interact during the lunch, coffee and tea breaks that provided them with opportunity to network with their financial institution colleagues, as well as the LBG training team.

ORGANIZATIONAL PREPARATIONS FOR THIS TRAINING

As noted in the previous section, recommendations received in the April 2001 training indicated that the trainees considered the 5-day program too long. Therefore, LBG condensed the training into a two-day format – providing more of a general overview of the key concepts.

Also, training location was another key issue for the past trainees. Therefore, Mumbai was selected as the location, and the training facilities of the Taj Mumbai were retained.

The LBG India office contacted over 80 different IFIs covering commercial banks, development banks, venture capital funds, insurance companies, training institutions and industry associations involved in project identification and funding. Considering the nature of this GEP-CCS activity being Train-the-Trainers, contacts were made essentially with the staff training colleges and HRD divisions of banks and financial institutions. LBG received 31 firm confirmations from participants. Besides these, there were several last minute confirmations and ultimately, 36 banking officials participated in the Symposium. The list of participants and confirmations etc is enclosed in **Appendix I**.

Besides the main training sessions and presentations, GEP-CCS had also envisaged inviting the representatives of Government of India to provide their perspective and plan. Although they expressed interest in interacting with bankers, as the Parliament Session was in progress, it was not possible for MOEF to depute one of their officials for the Symposium.

TRAINING TEAM

The Louis Berger Group, Inc. tapped in-house resources to conduct the majority of this training:

Session I: *Current Trends in Climate Change Negotiation*
Presenter: Mr. Ron Sissem, GEP-CCS, Chief of Party, LBG

Mr. Sissem has 17 years of interdisciplinary technical and management experience in environmental planning and management both in international and domestic contexts. He currently is the Chief-of-Party of the Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS) being implemented by the Louis Berger Group, Inc. under USAID/India. His most recent management experiences have been with USAID and IFC/World Bank in the areas of climate change and small and medium sized enterprise (SME) business development programs. His prior work with UNDP focused on fusing natural resource management with economic development needs to facilitate biodiversity conservation. His international experience includes work in the following countries: Japan, Mongolia, Malaysia, Bosnia and Herzegovina and India. Mr. Sissem has a graduate degree in Environmental Planning from the University of North Carolina at Chapel Hill. His undergraduate degree was in Environmental Science and in Physical Geography from the University of California at Santa Barbara.

Session II: *Traditional and Conventional Finance for Clean Energy Technologies*
Presenter: Mr. Rodrigo Carvajal, Senior Program Advisor, LBG

Mr. Carvajal is an international economist with over sixteen years of experience in international trade, finance, and private sector development, with particular emphasis on designing and implementing technical assistance programs aimed at strengthening the international competitive positions of both private and public sector enterprises. Mr. Carvajal has been associated with the Louis Berger Group, Inc. for over ten years. Currently he serves as the Trade and Investment Advisor for the company under its contract with the US-Asia Environmental Partnership (US-AEP). In this capacity, he provides technical assistance in the areas of trade and investment promotion in relation to this environmental initiative that covers 11 countries throughout Asia. Prior to joining the Berger Group, Mr. Carvajal held senior level positions with the Foreign Commercial Service of the U.S. Department of Commerce, and with the Foreign Trade Services Division of Inchcape, PLC. He holds a Bachelor's Degree in International Affairs and Economics from the American University, and a Master's Degree from The University of Pennsylvania.

Module III: *Emissions Markets & Trading*
Presenter: Mr. Ted Yoder, Manager Trade Finance Unit, LBG

Ted Yoder is Manager of Louis Berger Group's new Trade Finance Unit. In that capacity he works with US financial institutions to finance overseas buyers of US clean energy and environmental equipment. Within the past year, the TFU has built a portfolio of over US$6 million covering projects in S. Korea and Philippines. Before joining LBG, Mr. Yoder managed a US Government trade matching service. Prior to this, he worked for the Commercial Environmental Group of Booz, Allen and Hamilton, Inc. Mr. Yoder holds a Masters Degree in International Commerce and Policy from George Mason University, Virginia. Through his coursework he also received a joint certificate from George Mason & St. Peters College/Oxford University for completing international coursework on "Trade in the Digital Age". Mr. Yoder has an undergraduate degree in Biology from Goshen College, Indiana.

Session IV: Clean Energy Project Development from a Macro View
Presenter: Mr. Vinay Deodhar, Project Finance Specialist for GEP-CCS, LBG

Mr. Deodhar has over 19 years of experience in project development and financial structuring and has managed project implementation in the Chemical industry. Mr. Deodhar worked in the premier financial institution, ICICI Ltd., for over 12 years on energy and environment projects. Mr. Deodhar looks after Project Development and Finance activities in the LBG New Delhi, India office. He holds a graduate degree in Chemical Engineering from the Indian Institute of Technology, Mumbai and a Master's in Operations and Finance Management from Mumbai University.

Session V: *Clean Energy Project Development – Specific Structuring Elements*
Presenter: Mr. Vinay Deodhar

Session VI: *Clean Energy Perspective from a Financial Advisory Institution*
Presenter: Mr. Balawant Joshi, Head Regulatory & Transition Practice, ICRA Advisory Services

Mr. Joshi is a Mechanical Engineer with extensive experience with electrical utilities such as Tata Power. In his position as Head Regulatory & Transition Practice, Mr. Joshi is responsible for advising various Indian state government and electric power regulators in defining policies especially for encouraging efficient distribution of power. ICRA is a long-term participant in GEP-CCS programs.

PROCEEDINGS AT THE TRAINING PROGRAM

The main objective of the symposium was to provide financial sector officials a perspective on: recent trends and developments in climate change regime; methodologies for assessing GHG reduction potential of clean energy technologies; structuring of clean energy projects to position them for possible financing through market based instruments; risk analysis and possible mitigation mechanisms; and clean energy technologies and their GHG reduction potential. Other objectives were to enhance the technical capacity of the officials to be able to advise industrial clients in ways to improve the technical-economic feasibility of projects, thereby reducing investment risk.

The two-day program was structured to be interactive and participative, including relevant Indian and international case studies, the sharing of pertinent experiences by participants, and group assignments in the development of business plans and project structuring.

Who attended

20 different institutions were represented at the training, an increase of 2 from the previous years training:

Banks/FIs

- Small Industries Development Bank of India
- United Western Bank, Ltd.
- Bank of Baroda
- Power Finance Corporation
- IREDA
- The Saraswat Cooperative Bank
- Infrastructure Development Finance Corporation
- UTI Bank
- Infrastructure Development Corporation (Karnataka) Ltd.
- State Bank Institute of Rural Development
- Housing & Urban Development Corporation Ltd. (HUDCO)
- ICICI
- SICOM Limited
- State Bank Staff College

Business Associations

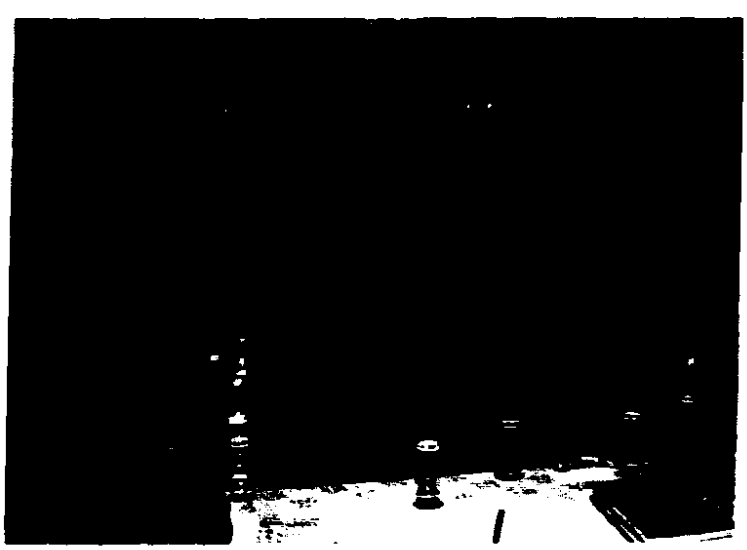
- Loss Prevention Association of India, Ltd.
- Indo-American Chamber of Commerce
- FICCI
- Indian Banks Association

Other Organizations

- Nexant
- US-Asia Environmental Partnership

Group Discussing the Project DPR

Training Program in Session



Presentation by Groups

BUSINESS PLAN GROUP CASE STUDIES

In the first training, the attendees participated in an exercise where they created "mock" clean energy project business plans. While this was well-received by the attendees, it could have been enhanced with additional discussion about actual project data. Therefore, for this training, LBG created an exercise where trainees reviewed the ten Detailed Project Report (DPR) worksheets that were presented to USAID under CLIN 3.

In the exercise, the trainees were divided into five groups, and each group was provided 2 DPR worksheets that had been sanitized of specific company names and contact information. The assignment was to review the worksheets and prepare a brief oral presentation for the rest of the trainees. Additionally, each group was asked to "score" the proposed project on the basis of ten specific criteria:

- Key Personnel Business Experience
- Coherency of Business Plan
- Proven Nature of Technology
- Credit Status of State Electricity Board
- Project Developer "Clean Energy" Experience
- Status of Power Purchase Agreement
- Dependability of Fuel Supply
- IRR/NPV and Cost Competitiveness
- Potential Revenue from Carbon Offsets
- Project Risk Factors

Results

The trainees were diligent participants in this exercise, and presented a broad spectrum of perspectives on the projects. The following chart shows the "scoring" determined by the attendees for the 10 GEP-CCS DPRs.

Total Possible Score = 70 N.C.= Not completed by training time[1]

Project Name	Technology	Tons CO2e Avoided /annum	Scoring
Polyene Films	Solar PV	20,000	N.C.
Coastal Agro	4 MW Co-gen	23,000	52
Globe Cogen	45 MW Co-gen	150,000	50
Kakatiya	6 MW Poultry Litter	35,000	N.C.
Venkatesh	110 MW waste heat based Cogen	440,000	40
Ambuthirtha	2x10 MW Hydro	75,000	N.C.
Bhoruka	2x2.5 MW Hydro	13,000	50
RR Bioenergies	12 MW Biomass IGCC	97,000	N.C.
Lucknow	5 MW MSW Biomethanation	192,000	49
Market Dynamics	Rural PV-Biomass briquetting	16,000	31

[1] Ironically, on the Day 2, many of the participants underwent hardships in reaching the venue on account of a flash strike by the taxicabs which were protesting against a Mumbai High Court ruling mandating the conversion of diesel taxies into CNG mode. Therefore, the start of second day training was delayed by almost one hour.

OUTCOMES OF THE TRAINING PROGRAM

Overall Observations of the Participants:

Approximately half of the trainees (15) submitted evaluations. 43% rated their overall program impression as Excellent, with 57% rating Good. The CEP Project Development: Macro View session received the highest ratings with 57% indicating Excellent. The next highest rating was CEP Project Development: Structuring Elements, which had a 47% Excellent rating.

The re-designed business plan exercise was well received, with over half of those submitting evaluations indicating an excellent rating.

The business plan case study exercise was well received.

Specific Comments on Areas of Improvement

Five of the respondents recommended extending the training by a day to 3 days.

A significant number of the participants submitting evaluations indicated that the training was too compressed and could have been extended for an additional day. One comment stated, "...due to paucity of time not much interaction could take place." Another stated that the training could be extended an additional day "...for discussing some more projects."

The session on Traditional and Conventional Finance received mixed evaluations, likely because these FIs are quite conversant in traditional financing tools such as export credit agency insurance and guarantees, multi-lateral development bank loans and leasing.

CONCLUSIONS

The Louis Berger Group responded to nearly all of the key recommendations from the previous training. Logistically, the training was shortened to accommodate busy financial institution schedules and held in Mumbai, a central location for the Indian banking community. Programmatically, the sessions were compressed and re-ordered to present a more logical sequence for the trainees, building upon traditional finance theories, then covering the existing carbon finance opportunities and, finally, synthesizing these together through two sessions on Clean Energy Project Development. Finally, the case study exercise was improved by using "actual" Indian business plans, several of which had successfully received financial closure, or had been submitted to an international carbon tender opportunity.

Once again evaluations seemed to question the relevance of training modules on "traditional" international sources of debt and equity in clean energy project development. From comments received during the sessions, it can be conjectured that this is likely due to two factors:

First, most international debt and equity mechanisms such as export credit agency and leasing, are concepts that are not foreign in any way to the India context. India, for example has its own export credit agency, so in-depth exposure to US Ex-Im Bank programs is probably not necessary. US Ex-Im does have a unique environmental and renewable energy initiative that should be covered in some brief manner. However, going into excessive detail on insurance and guarantee programs and case studies is probably not merited.

Second, international "clean energy" equity programs such as the Renewable Energy and Energy Efficiency Fund (REEF) and concessional loan programs such as the Global Environment Facility (GEF) are probably not realistic tools for the India context. REEF is only working on its first equity position, even after being in operation now for over two years. GEF is not a project-by-project financing tool; primarily it seeks to provide incremental funding for larger impact regional activities.

In spite of the absence of a robust near-term carbon market, the attendees indicated a strong interest in the project structuring sessions. There appeared to be an acceptance that some type of external financing elements will eventually be harnessed, be they carbon market based mechanisms or specialized debt and equity structures.

APPENDICES

Appendix I: List of Participants

List of Participants at Training Symposium on Current state of Clean Energy Finance

Sr. No.	Name of Participant	Designation	Bank Address
1	D. G. Mahabal	Manager (Tech)	Bank of Baroda Risk Management Div, Central Office, Ballard Estate Mumbai 400 001
2	S. S. Khanolkar	Manager (Tech)	Bank of Baroda Risk Management Div, Central Office, Ballard Estate Mumbai 400 002
3	V. K. Sharma	DGM,	State Bank of India, State Bank Staff College, Sect. 17 Gurgaon
4	Shiv Kumar gupta	AGM	State Bank of India, State Bank Inst. Of Rural Dev. PB No.2 Lingampally, Hyderabad 500 019
5	T. Ashok Nair	Faculty Member	State Bank of India, State Bank Inst. Of Rural Dev. PB No.2 Lingampally, Hyderabad 500 020
6	G. Suneel Babu	Manager (Tech)	IDBI, IDBI Tower, WTC Complex, Cuffe Parade mumbai 400 005
7	Kishore D. Jathar	Sr. Manager, Credit	The Saraswat CoOp Bank Ltd.Sailors Building, D. N. Road, Opp Hutatma Chowk Fort Mumbai 400 001
8	P. K. Singh	Sr. Manager, Environment	Power Finance Corporation Ltd. Chandralok, 36 Janpath New Delhi 110 001
9	Ms. Anahit Engineer	Dy. Manager Credit	UTI Bank, Central Office, 131 Maker Towers F Cuffe Parade Colaba Mumbai 400 005
10	S. K. Dey	Asst. Manager (TS)	IREDA Core 4A, East Court, 1st floor, india Habitat Center, Lodhi Road, New Delhi 110 003
11	M. Rajkumar	Tech. Officer (Solar)	IREDA Core 4A, East Court, 1st floor, india Habitat Center, Lodhi Road, New Delhi 110 004
12	Dilip Patel	General Manager	SICOM Ltd. Nirmal, Nariman Point Mumbai 400 021
13	Srinivas Rao	Manager	SICOM Ltd. Nirmal, Nariman Point Mumbai 400 022
14	Sharad Bhise	Manager	SIDBI, Suryakiran Building, 1st Floor C-8 Mumbai-Pune Road, Chinchwad Pune 411 019
15	K. Vijay Kumar	Asst. Appraisal Officier, Urban Infra. Finance	HUDCO, HUDCO Bhawan, 1st Fl. India Habitat Center, Lodhi road New Delhi 110 003
16	A. K. Srivastava	Asst. Chief (Projects)	HUDCO, Western Zonal Office, Block - 12nd Floor, MMRDA Bldg Bandra Kurla Complex Mumbai 400 051
17	Vivek S. Mandalkar	Sr. Manager,	Agri Finance Cell, The United Western Bank Ltd., 172/4Ravivar Peth, Shivaji Circle, Satara 415 001
18	Abhijit Das	Manager Risk Management Services	Loss Prevention Asso.of India Ltd.,Warden House, 4th Floor, Sir P. M. Road, Mumbai 400 001
19	P. K. Mukherjee	Dy. ManagerRisk Mgt. Services	Loss Prevention Asso.of India Ltd.,Warden House, 4th Floor, Sir P. M. Road, Mumbai 400 002
20	L. Baskaran	Jr. Manager	Loss Prevention Asso.of India Ltd.,Warden House, 4th Floor, Sir P. M. Road, Mumbai 400 003
21	Ms. Jayasree Menon	Economist,	Indian Banks Association Center 1, 6th Fl., World Trade Center Cuffe Parade Mumbai 400 005
22	Girish Mahajan	Chief Manager,	ICICI Bank, ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051

23 Gaurav Singh	Asst. Manager (TS)	ICICI Bank, ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051
24 Ramanand Pulavarty	Manager	ICICI Bank, ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051
25 Joachim colaco	Project Officer	ICICI Bank, ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051
26 Zarasp Irani	Manager	ICICI Bank, ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051
27 Suyez Pinto	Manager	IDFC Ramon House, HT Parekh Marg, Backbay Reclamation Mumbai 400 020
28 Kirtan Sahoo	Manager	Environmental management, IDFC, ITC Center, 3rd Floor 760 Anna Salai Chennai 600 002
29 Sanjay Agrawal	Manager (operations)	Infrastructure Dev Corpn(Karnataka) Ltd., 118 (Old 72/4) Cunningham Road, Bangalore 560 052
30 Srishti Sinha	Information Manager	FICCI, Western Region EIC 2 Arcadia, Ground Floor 195 Nariman Point mumbai 400 021
31 Prashant Laxmeshwar	Mktg. Manager	FICCI, Western Region EIC 2 Arcadia, Ground Floor 195 Nariman Point mumbai 400 021
32 Sunil Kulkarni	Financial Consultant	Nexant 408, Dalamal Tower Nariman Point Mumbai 400 021
33 Sanjiv Tamhane	Sr. Consultant	Nexant 408, Dalamal Tower Nariman Point Mumbai 400 021
34 Suneel Parasnis	Director	USAEP, American Center 4 New Marine Lines Mumbai 400 020
35 Ms. Nutan Zarapkar	Dy. Director	USAEP, American Center 4 New Marine Lines Mumbai 400 020
36 Kamal Vora	Dy. Secy General	Indo American Chamber of Commerce, 1-C vulcanInsurance Bldg., Veer Nariman Road Churchgate, Mumbai 400 020

Appendix II: Business Plan Exercise

GHG EMISSION REDUCTION PROJECTS: ROLE OF INDIAN FINANCIAL SECTOR
A Training Symposium on the Current State of Clean Energy Project Finance

Organized by:
The Louis Berger Group, Inc / Greenhouse Pollution Prevention Project, USAID/India

April 23 – 24, 2002
Taj Mahal Hotel, Mumbai

Business Plan Exercise

Activity: Attendees will examine real clean energy business plans and assess them against general clean energy financing concepts presented in the course.

Process: On the first day of the training, attendees will be divided into groups and assigned several actual GEP-CCS business plans for review. On the second day of the training, each group should be prepared to make a presentation to the larger class on the merits and/or downsides of their particular business plans. This presentation can be presented orally from written notes, or groups may prepare short power-point overviews should they desire, but each presentation and discussion should not exceed ten minutes. The goal is to get a quick grasp of the key aspects of each business plan. At a minimum, groups will be required to complete the attached business plan "scoring sheet" for each of their business plans.

Outputs: (1) 10 minute presentation for each business plan
(1) Completed "scoring sheet" for each business plan

Goal: To discuss "actual" clean energy businesses plans, and gather different perspectives from various segments of the Indian financial sector including debt, equity, concessional lenders and risk institutions. At the end of all of the presentations, the "scored" business plans will be ranked, and attendees will be updated on the status of each of the business plans. Financial closure has been completed for several of the ten business plans used in this exercise – and the rankings will be compared against these actual results.

~~~~~~~~~~
~~~~~~~~~~

Business Plans to be Reviewed

Project A: 200 Solar PV Water Pumps in A.P.

Project B: 4 MW Rice Husk Cogeneration in A.P.

Project C: 45 MW Bagasse Based Cogeneration in Karnataka

Project D: 6 MW Poultry Litter Power Project in A.P.

Project E: 110 MW Coke Oven Cogeneration Power Plant in Tamil Nadu

Project F: 2 x 10 MW Mini-Hydel in Karnataka

Project G: 2 X 2.5 MW Run of River Mini-Hydel in Karnataka

Project H: 12 MW IGCC from Crop Biomass in A.P.

Project I: Biogas 5 MW from MSW Biomethanation in Tamil Nadu

Project J: Rural PV Lighting & Agro Waste Briquetting in West Bengal

Project: _____

Location: _____

Type of Technology and Fuel Source: _____

Installed Capacity (MW): _____

Estimated Cost (Rs): _____

SCORING TABLE (70 Points Possible)

Ranking Factor	Scoring Range	Weighting	Score
1. Key Personnel Business Experience (Mgmt. Plan)	1-5 (limited to extensive)	x 2	
2. Coherency of Finance Plan	1-5 (least to most)	x 2	
3. Type of Technology	1 - 5 (untested to proven)	x 2	
4. Credit Status of State Electricity Board (for on-grid)	1-5 (least to highest credit rating)	x 2	
5. Project Developer "Clean Energy" Experience	1–5 (least to most experienced)	x 1	
6. Status of Power Purchase Agreement	1-5 (from un-drafted to completed/signed)	x 1	
7. Dependability of Fuel Supply	1-5 (from least to most dependable)	x 1	
8. IRR/NPV: cost competitiveness vis a vis other energy tech.	1-5 (from least to highest return)	x 1	
9. Potential Future Carbon Revenues	1 to 5 (from marginal to significant revenue)	x 1	
10. Project Risk Factors	1 to 5 (high risk to few risks)	x 1	
	TOTAL SCORE		

*note, for comparison reasons, if any variable is Not Applicable, extrapolate the resulting total score against the 70 maximum (e.g. 50 out of 60 = .83…extrapolated score is .83 x 70 = 58)

Comments:

_____

_____

_____

Appendix III: Complete Program Book

GHG Emissions Reduction Projects: Role of Indian Financial Sector

A Training Symposium on the Current State of Clean Energy Project Finance

April 23-24, 2002
Taj Mahal Hotel, Mumbai

Greenhouse Gas Pollution Prevention Project-Climate Change Supplement

Implemented by:

The Louis Berger Group, Inc.
The Global Environment Team

A program of the:

United States Agency for International Development / India Mission

25

GHG EMISSION REDUCTION PROJECTS: ROLE OF INDIAN FINANCIAL SECTOR
A Training Symposium on the Current State of Clean Energy Project Finance

Organized by:
The Louis Berger Group, Inc./ Greenhouse Pollution Prevention Project,
under the auspices of USAID/India

April 23 – 24, 2002
Taj Mahal Hotel, Mumbai

Table of Contents

1. Section I : Overview & Background

2. Section II: Agenda

3. Section III: Key Symposium Presentations

   A. Current Trends in Climate Change Negotiations
      Mr. Ron Sissem, Chief of Party, LBG/GEP-CCS
   B. Traditional & Conventional Finance for Clean Energy Technologies
      Mr. Rodrigo Carvajal, Sr. Program Advisor, The Louis Berger Group, Inc.
   C. Emission Markets & Trading,
      Mr. Ted Yoder, Manager Trade Finance Unit, The Louis Berger Group, Inc.
   D. Clean Energy Project Development – Macro View,
      Mr. Vinay Deodhar, Project Finance Specialist, LBG/GEP-CCS
   E. Clean Energy Project Business Plans & Financial Structuring Exercise,
      Mr. Ted Yoder, Manager Trade Finance Unit, The Louis Berger Group, Inc.
      Mr. Rodrigo Carvajal, Sr. Program Advisor, The Louis Berger Group, Inc
   F. Clean Energy Project Development – Structuring Elements
      Mr. Vinay Deodhar, Project Finance Specialist, LBG/GEP-CCS

4. Section IV: Business Plan Review Exercise Materials

5. Annex
   A. Review and analysis of the Marrakech Accords on Climate Change
   B. U.S. Global Climate Change Policy
   C. Air Trends Special Supplement: President Bush Announces climate change policy
   D. Clean Technology Finance Resources
   E. Toolkit on Business Development in Climate Change Mitigation Projects
   F. PEW center on Global Climate Change Solution Series Report: The Emerging International Greenhouse Gas Market

SECTION I.

Overview and Background

GHG EMISSION REDUCTION PROJECTS: ROLE OF INDIAN FINANCIAL SECTOR
A Training Symposium on the Current State of Clean Energy Project Finance

Organized by:
The Louis Berger Group, Inc./ Greenhouse Pollution Prevention Project-Climate Change Supplement
under the auspices of the USAID/India Mission

April 23 – 24, 2002
Taj Mahal Hotel, Mumbai

The Louis Berger Group, Inc. is conducting a training symposium for the Indian financial sector during April 23-24, 2002 at Mumbai. This is the second such program covering the theme of financial aspects of clean energy project development and structuring, organized under the USAID/India's *Greenhouse Gas Pollution Prevention Project-Climate Change Supplement (GEP-CCS)*. The Louis Berger Group, Inc. (LBG) is managing GEP-CCS.

The GEP-CCS project aims at building the institutional capacity of industry, climate change centers, key Government of India (GOI) officials, leading Indian financial institutions (FIs), and banks. It also assists the clean energy project development process by highlighting the Greenhouse Gas (GHG) mitigation potential of the projects, and illustrating ways to promote them to possible funding sources under diverse financial mechanisms. Under the financial sector capacity building activity, LBG conducts training programs for Indian financial sector institutions to increase their awareness about the use of potential greenhouse gas reduction analysis for the evaluation of specific projects. The banking sector is a major stakeholder in financing projects and is therefore exposed to major risk if project is delayed due to environmental factors. It is, therefore, essential to equip the bank loan officers with appropriate analytical tools.

BACKGROUND

Environmental factors are gaining ever-greater importance in the implementation of industrial and infrastructure projects. It is likely that the use of environmentally benign energy/industrial technologies may become mandatory and will be beneficial to the project developers in the long run. Incorporation of GHG impact assessment in the design of clean energy projects and realizing their values can possibly become important for enhancing the viability of a project. In light of this, assessment of GHG risks and impacts associated with specific investments under consideration of the banks is pertinent to ensure project implementation on schedule and subsequent performance. Financial Institutions and banks, which are the major stakeholders in industrial projects, are susceptible to the risks emanating from the environmental impact of project activities in general. The financial sector stands to benefit in the longer run, by clearly identifying risks that may impact the performance of assets in their portfolio. A loan officer also plays an important advisory role in enhancing the value of the project activity.

LBG conducted the first such training program for FI/Bank officers on clean energy project development and structuring in April 2001, which helped in create an awareness

among the FIs and banks about the impact of GHG emissions. Based on interactions with key FIs and banks and on experience of the first FI training, LBG has designed this training program scheduled for April 2002. The program will benefit loan/credit officials of commercial banks, financial institutions, insurance companies, non banking financial companies (NBFC), credit rating agencies, infrastructure and special purpose financing institutions, venture capital funds and bank staff training academies. The thrust of this training program, and line with GEP-CCS guidelines, is to emphasize a **training of trainers (TOT)** approach, so that there is a wider dissemination of knowledge in the entire banking sector.

OBJECTIVES

The main objective of the symposium is to provide financial sector officials a perspective on: recent trends and developments in climate change regime; methodologies for assessing GHG reduction potential of clean energy technologies; structuring of clean energy projects to position them for possible financing through market based instruments; risk analysis and possible mitigation mechanisms; and clean energy technologies and their GHG reduction potential. Other objectives are to enhance the technical capacity of the officials to be able to advise industrial clients in ways to improve the technical-economic feasibility of projects, thereby reducing investment risk.

The two-day program would be highly interactive and participative, including relevant Indian and international case studies, the sharing of pertinent experiences by participants, and group assignments in the development of business plans and project structuring. A brief program outline is attached.

ANTICIPATED OUTCOMES

The training program shall assist the bank officer to better appreciate the significance and magnitude of environmental risks of projects. They will be able to better apprise and advise the project promoters in a manner that enhances the project's value.

FOR WHOM

The training program is targeted toward financial institutions, public and private banks, insurance companies, special purpose FIs (like HUDCO, IREDA, NCDC, REC), credit rating agencies, NBFC's and venture capital funds. The target audience would be faculty members from training colleges/institutions, and middle management level appraisal officers of these organizations.

VENUE AND DATES

The program is to be held at the Taj Mahal Hotel, Mumbai during April 23-24, 2002 and participation is free of charge.

FACULTY

Project and trade finance experts on the subject from The Louis Berger Group, Inc. USA and India will conduct the training program. LBG has also invited subject experts from Indian partners of the GEP-CCS program, ICICI and from the advisory service of the renowned rating agency ICRA Ltd. to deliver key sessions. Besides these contributors, officials of industry association, CII.

Mr. Ted Yoder, Manager-Trade Finance Unit, The Louis Berger Group, Inc.

Ted Yoder is Manager of Louis Berger Group's new Trade Finance Unit. In that capacity he works with US financial institutions to finance overseas buyers of US clean energy and environmental equipment. Within the past year, the TFU has built a portfolio of over US$6 million covering projects in S. Korea and Philippines. Before joining LBG, Mr. Yoder managed a US Government trade matching service. Prior to this, he worked for the Commercial Environmental Group of Booz, Allen and Hamilton, Inc. Mr. Yoder holds a Masters Degree in International Commerce and Policy from George Mason University, Virginia. Through his coursework he also received a joint certificate from George Mason & St. Peters College/Oxford University for completing international coursework on "Trade in the Digital Age". Mr. Yoder has an undergraduate degree in Biology from Goshen College, Indiana.

Mr. Rodrigo Carvajal, Senior Program Advisor, Global Environment Team, The Louis Berger Group, Inc.

Mr. Carvajal is an international economist with over sixteen years of experience in international trade, finance, and private sector development, with particular emphasis on designing and implementing technical assistance programs aimed at strengthening the international competitive positions of both private and public sector enterprises. Mr. Carvajal has been associated with the Louis Berger Group, Inc. for over ten years. Currently he serves as the Trade and Investment Advisor for the company under its contract with the US-Asia Environmental Partnership (US-AEP). In this capacity, he provides technical assistance in the areas of trade and investment promotion in relation to this environmental initiative that covers 11 countries throughout Asia. Prior to joining the Berger Group, Mr. Carvajal held senior level positions with the Foreign Commercial Service of the U.S. Department of Commerce, and with the Foreign Trade Services Division of Inchcape, PLC. He holds a Bachelor's Degree in International Affairs and Economics from the American University, and a Master's Degree from The University of Pennsylvania.

Mr. Vinay Deodhar, Project Development Specialist, GEP-CCS Project, The Louis Berger Group, Inc.

Mr. Deodhar has over 17 years of experience in project development and financial structuring and has managed project implementation in the Chemical industry. Mr. Deodhar worked in the premier financial institution, ICICI Ltd., for over 12 years on energy and environment projects. Mr. Deodhar looks after Project Development and Finance activities in the LBG New Delhi, India office. He holds a graduate degree in Chemical Engineering from the Indian Institute of Technology, Mumbai and a Master's in Operations and Finance Management from Mumbai University.

30

SECTION II.

Agenda

GHG Emission Reduction Projects: Role of Indian Financial Sector

A Training Symposium on the Current State of Clean Energy Project Finance

Organized by:
The Louis Berger Group, Inc./ Greenhouse Pollution Prevention Project-Climate Change Supplement
under the auspices of the USAID/India Mission

April 23 – 24, 2002
Taj Mahal Hotel, Mumbai

Day 1: Tuesday, April 23, 2002

9:00 am	Registration
9:30 am	Welcome
9:35 am	**Clean Energy Finance: Relevance & Importance** • Mr. Ron Sissem, Chief of Party, LBG/GEP-CCS Project
9:45 am	**USAID Role in Clean Energy Finance** • Mr. John Smith-Sreen, Deputy Director - E^3, USAID/India Mission
9:55 am	**Innovative Finance for GHG Mitigation Projects: ICICI Perspective** • Mr. Anand Kusre, General Manager, ICICI Ltd.
10:05 am	**American Consulate General-Mumbai Clean Energy Activities** • Mr. Suneel Parasnis, Director, Office of Technology Cooperation, USAEP
10:15 am	Brief Introductions by Symposium Participants
10:30 am	**Current Trends in Climate Change Negotiations** • Mr. Ron Sissem, LBG/GEP-CCS Project A briefing session on the evolution of climate change regime. The linkage between industrial and infrastructure activities and climate change and mitigation strategies being adopted by various nations would be discussed. India's climate change position and relevance to the Indian banking sector will be highlighted.
11:00 am	Tea/Coffee Break
11:15 am	**Traditional and Conventional Finance for Clean Energy Technologies** • Mr. Rodrigo Carvajal, Senior Program Advisor, The Louis Berger Group, Inc. A run down summary of traditional finance tools and instruments and how they can be used for financing clean energy projects to mitigate climate change impacts. A summary of available international finances would be provided. This would include corporate finance, trade finance, equipment finance, export credit agencies lending.

12:15 pm **Emission Markets & Trading**

- Mr. Ted Yoder, Manager - Trade Finance Unit, The Louis Berger Group, Inc.

This session will present the key concepts of emissions trading, benefits to be derived, experiences from US Acid rain SOx /NOx trading program, role of India, types of markets, contract structures and current market trends, roles of various market players-brokers, accountants, engineers and possible roles for FIs/banks.

13:00 pm Lunch

14:00 pm **Clean Energy Project Development - Macro View**

- Mr. Vinay Deodhar, Project Finance Specialist, LBG/GEP-CCS

This session shall give banks and FIs necessary understanding of how project finance concepts could be applied to clean energy projects, and will inform them regarding the possible market based financial benefits to be derived from the sale of future carbon reductions.

14:45 pm Tea/Coffee Break

15:15 pm **Clean Energy Project Business Plans and Financial Structuring Exercise**
Facilitators: Mr. Rodrigo Carvajal, The Louis Berger Group, Inc.
Mr. Ted Yoder, The Louis Berger Group, Inc.

An overview of the Detailed Project Report (DPR) Worksheet utilized by GEP-CCS management in assessing clean energy business plans will be conducted as preparation for this group exercise. Fundamental aspects pertinent to the formulation of effective business plans will be also discussed: product/service markets targeted, competitive analysis, risk assessment, marketing considerations, pricing, financial planning, human resource issues, legal and regulatory concerns, exit strategy, etc. Specific attention will be given to the unique challenges and opportunities that these commercial undertakings pose for relevant financing entities, and to the best approaches for capitalizing on these ventures.

16:00 pm **Business Plan Review Exercise: Small Group Break-out Session**

The participants would be divided into five groups and assigned business plans to review for financing potential. Each team will prepare a power-point overview and finance-ability "score" for their two projects to report back to the larger group. All ten cases will be reviewed and discussed on the following day

33

Day 2: Wednesday, April 24, 2002

9:30 am — Review of 1st Day of Training

9:45 am — **Clean Energy Project Development - Structuring Elements**
- Mr. Vinay Deodhar, LBG/GEP-CCS Project

The session would highlight key concepts and methodologies involved in developing GHG mitigation projects, including: project boundaries/baselines, GHG reduction potential assessment, and integration with conventional project financial analysis and risk assessment. Attendees will learn basic "back-of-the-envelope" methods for quantifying baselines and carbon savings.

11:00 am — Tea/Coffee Break

11:15 am — **Clean Energy Perspective from a Financial Advisory Institution**
- Mr. Balawant Joshi, Head Regulatory & Transaction Practice, ICRA Advisory Services

Covered issues will include: the status of Indian Power sector; role of clean energy projects in reforming electric utilities; efficiency improvements in reforming sector and its GHG impact; and role of electricity regulators in States and Central Government.

12:00 pm — **Groups may reconvene to finish business plan analysis**

13:00 pm — **Luncheon Speaker** *"Clean Energy Projects: An Indian Industry Perspective"*
Mr. M. A. J. Jeyaseelan, Executive Director, Environment Information Center, Federation of Indian Chambers of Commerce and Industry (FICCI)

14:00 pm — **Begin business plan presentations**

15:00 pm — Tea/Coffee Break

15:30 pm — **Continue business plan presentations**

16:30 pm — **Panel Discussion:** ***Evaluating Business Plan Presentations***
- Mr. Ron Sissem, LBG/GEP-CCS Project
- Mr. Rodrigo Carvajal, The Louis Berger Group, Inc.
- Mr. Ted Yoder, The Louis Berger Group, Inc.
- Mr. Vinay Deodhar, LBG/GEP-CCS Project
- Mr. M. A. J. Jeyaseelan, FICCI
- Project Developer ***Invited***

17:00 pm — **Closing Words**

SECTION III.

Key Symposium Presentation

CURRENT TRENDS IN CLIMATE CHANGE NEGOTIATIONS

Mr. Ron Sissem
Chief of Party
LBG/GEP-CCS Project

Climate Change Supplement

Greenhouse Gas Pollution Prevention Project

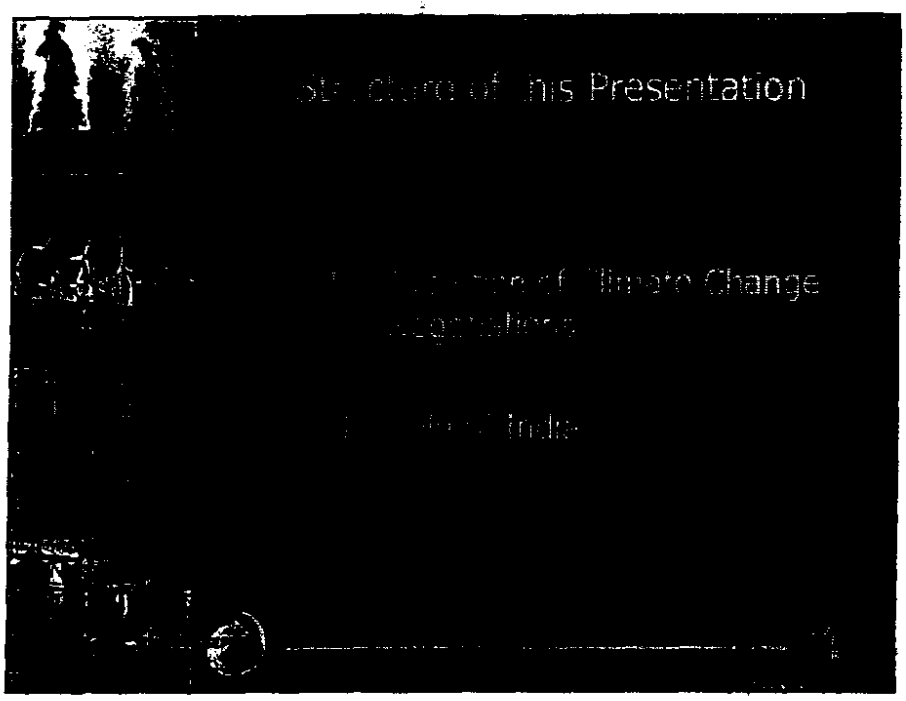
Current Trends in Climate Change Negotiations

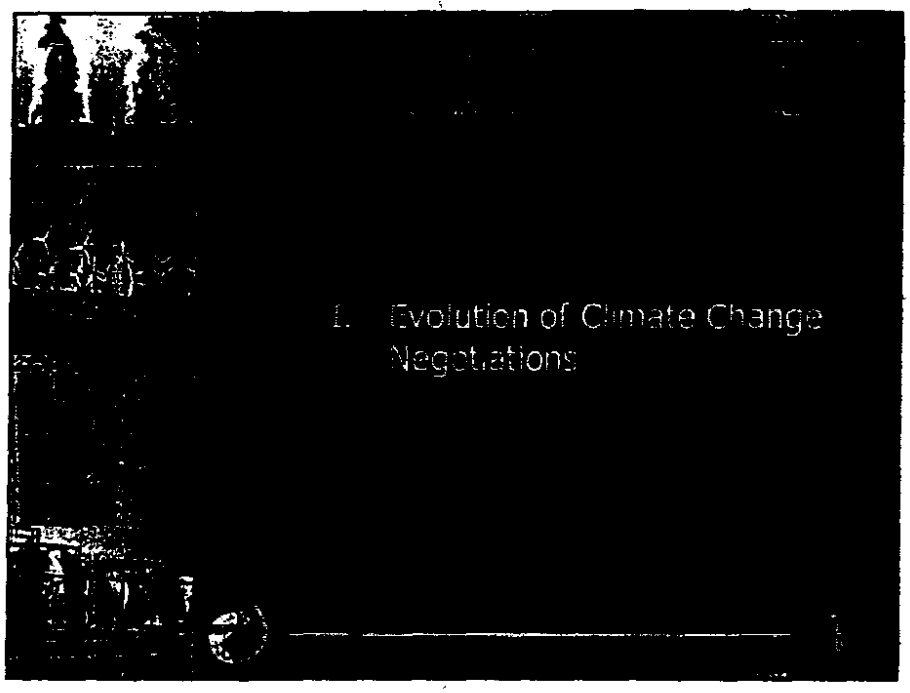
Mr. Ron Sissem
Chief of Party
LBG/GEP CCS Project

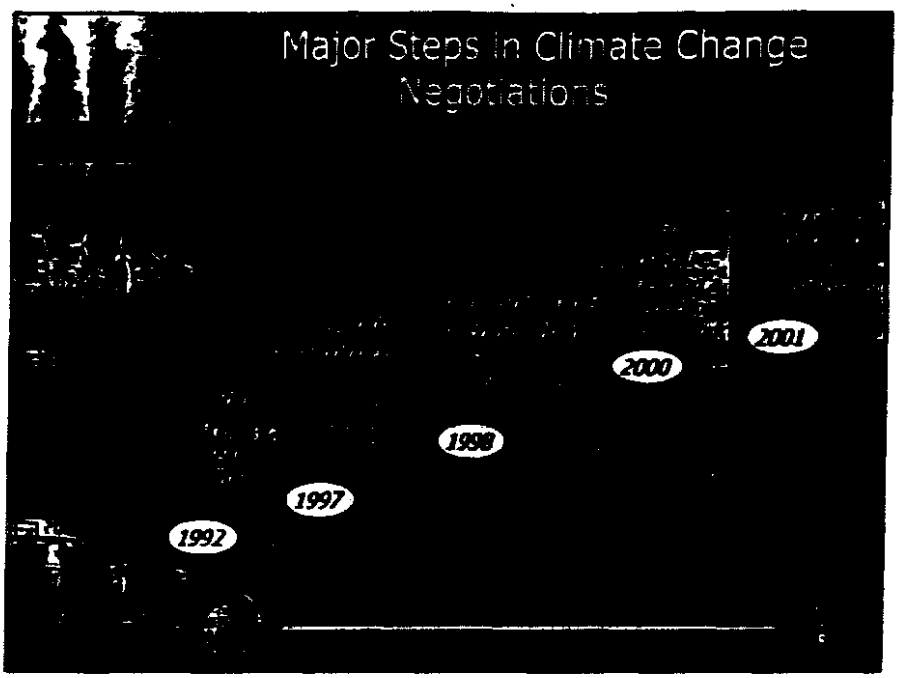
THE Louis Berger Group, INC

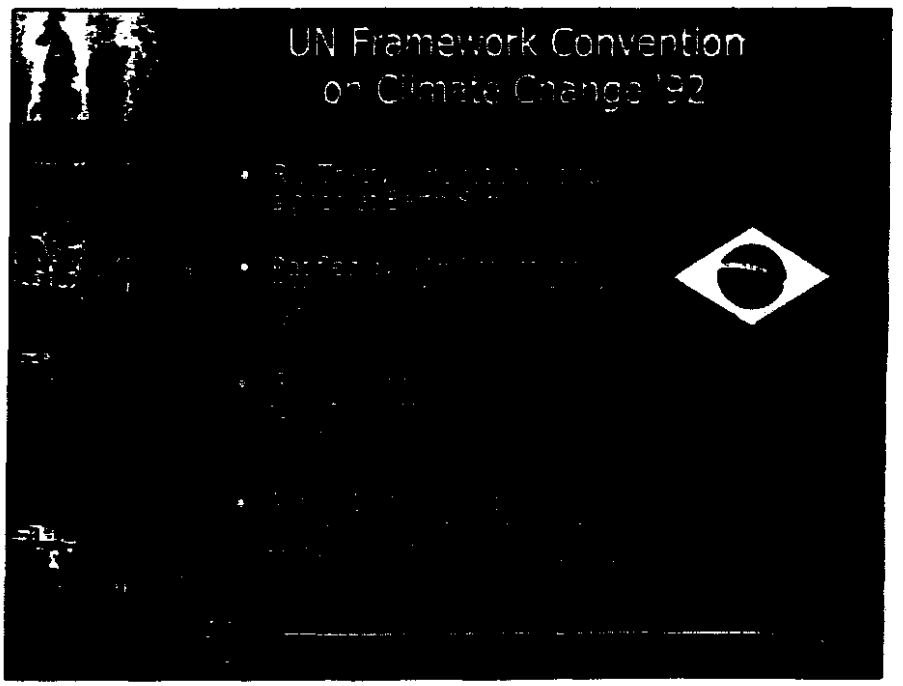
Portions of the Materials Presented are Courtesy of Natsource LLC Strategic Advisory Services Division, a GEP-CCS Project Financial Service Partner

31


Structure of This Presentation
India


1. Evolution of Climate Change Negotiations


Major Steps in Climate Change Negotiations
1992
1997
1998
2000
2001


UN Framework Convention on Climate Change '92

Kyoto Protocol '97

- [illegible] negotiated [illegible]
- [illegible] policies and [illegible]
- [illegible] compliance period (2008-2012)
- [illegible] including mechanisms defined in [illegible]
- [illegible]

Kyoto Protocol '97

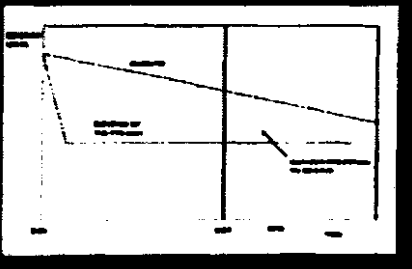
- Binding, differentiated reduction commitments for Annex B (=Annex I)

Kyoto Protocol Mechanisms:
International Emissions Trading

- Between 2 Annex B countries
- Transfers of Assigned Amount Units (AAUs) [illegible] of national caps
- No underlying reduction – simply trading

Kyoto Protocol Mechanisms:
Joint Implementation

- [illegible]
- [illegible]
- [illegible]



41

Kyoto Protocol Mechanisms:
Clean Development Mechanism

- [illegible] between [illegible] country [illegible] country
- [illegible]
- [illegible] credit[illegible]
- [illegible] Certified Emissions Reductions (CERs), which can be added to Annex B national caps

Comparing the Kyoto Mechanisms

- Trade vs. investment (projects)
- Who's involved
- CDM cost advantage: abatement costs
- CDM cost disadvantage: transaction costs, project risks

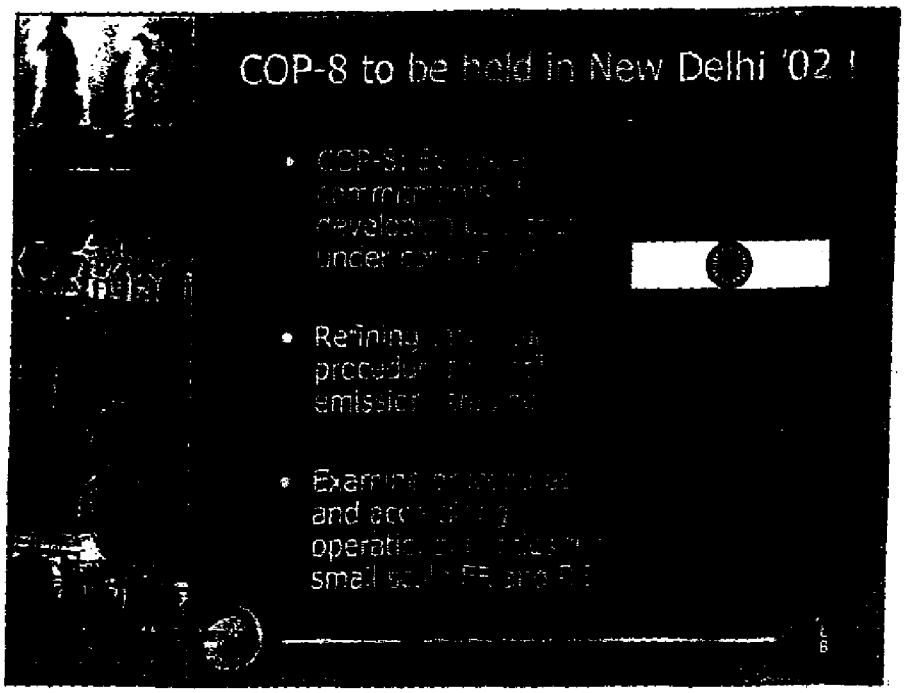
42

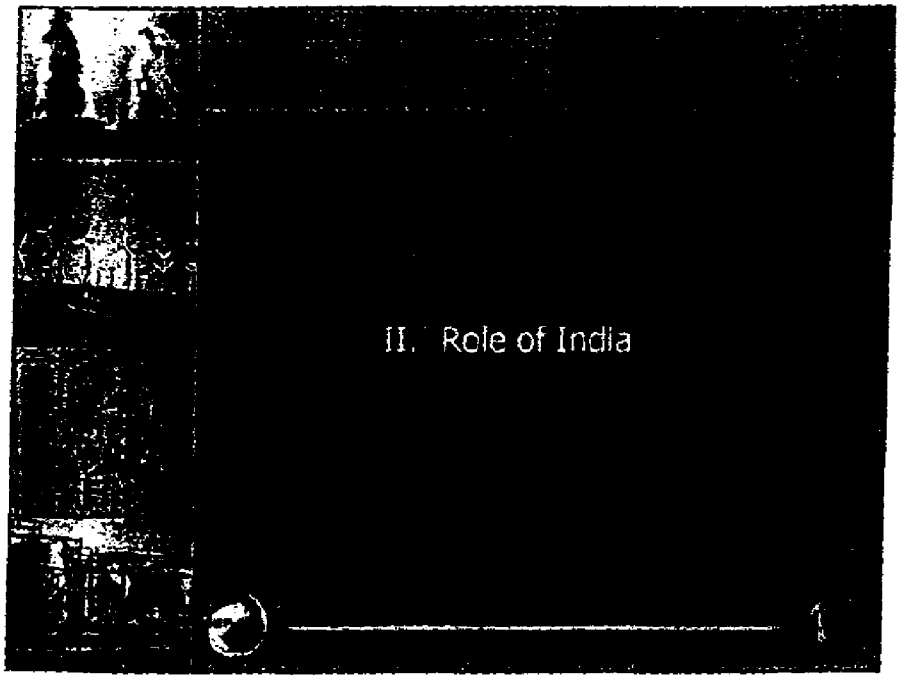
The Hague '00

- COP-6 - high expectations
- Major issues:
  - supplementarity
  - compliance
  - adaptation
  - role of sinks
  - project eligibility
  - CDM modalities (bilateral, direct)

Marrakesh '01

- COP-7: Establishing Operating rules (governing trading, JI and CDM)
- [illegible]
- [illegible]
- [illegible]


COP-8 to be held in New Delhi '02 !


II. Role of India

Government of India stance

- Sceptical through 1997
- Reappraisal in 1999
  - October 26 India Minister of External Affairs and US Secretary of Energy sign Joint Statement of Cooperation in Energy and Related Environmental Aspects (w/ Clinton Administration)
  - March 22 same Ministers sign Joint Statement on Energy and Environment with US Secretary of State affirms desirability of CDM

Burden or opportunity for India?

- Through 2012, emission reduction obligations are envisaged only for industrialized countries
- Emerging economies [illegible] US as project [illegible]
- [illegible]
- [illegible]?

45

Host benefits - country level

- [illegible] investment
- Lure clean investment
  - [illegible] reductions of local pollutants
  - [illegible] climate change
- Private sector technology transfer
- Improve energy, economic efficiency

Host benefits - developer level

- Monetize previously valueless asset (emissions reductions), enhancing project economics
- Forward sales can reduce up-front financing costs

46

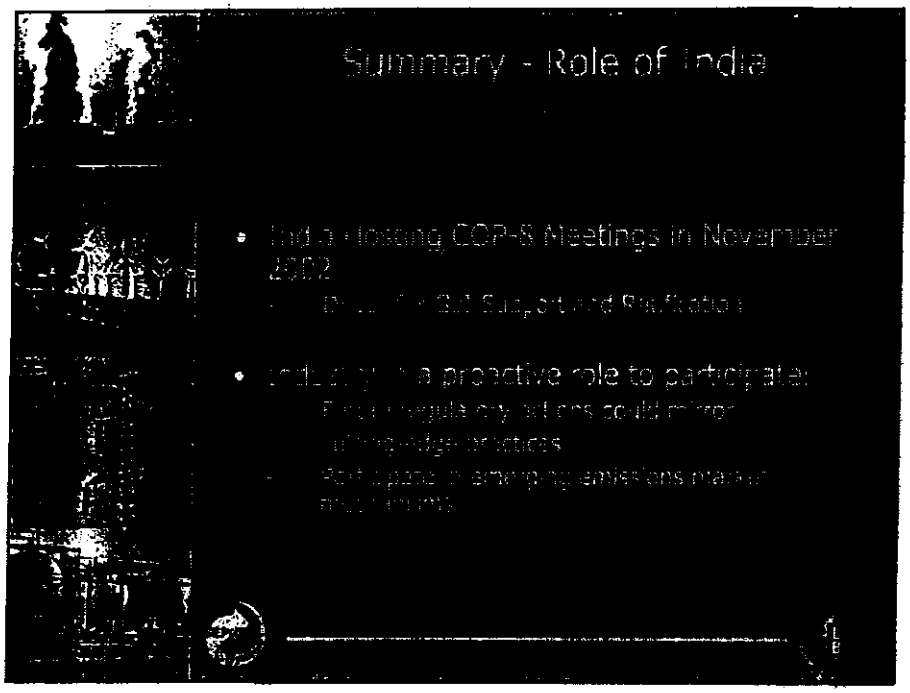
Downside?

- Emerging economy projects would substitute not add to, some OECD domestic emissions reductions
- "Paper" reductions could diminish global climate change efforts

Summary - Negotiations

- International negotiations move in fits and starts
- [illegible]
- [illegible]
- [illegible]

87


Summary - Role of India
India Hosting COP-8 Meetings in November 2002
a proactive role to participate:

68

TRADITIONAL AND CONVENTIONAL FINANCE FOR CLEAN ENERGY TECHNOLOGIES

Mr. Rodrigo Carvajal
Senior Program Adviser
The Louis Berger Group, Inc.

Climate Change Supplement

Greenhouse Gas Pollution Prevention Project

"Conventional Finance for Clean Energy Technologies"

Mr. Rod Carvajal
Senior Program Adviser
The Louis Berger Group, Inc

THE Louis Berger Group, INC

LB

Portions of the Material Presented are Courtesy of
Global Financial Solutions, LLC
a GEP-OCS Financial Services Partner

Structure of this Presentation

I. Resources for Financing Clean Energy Technologies

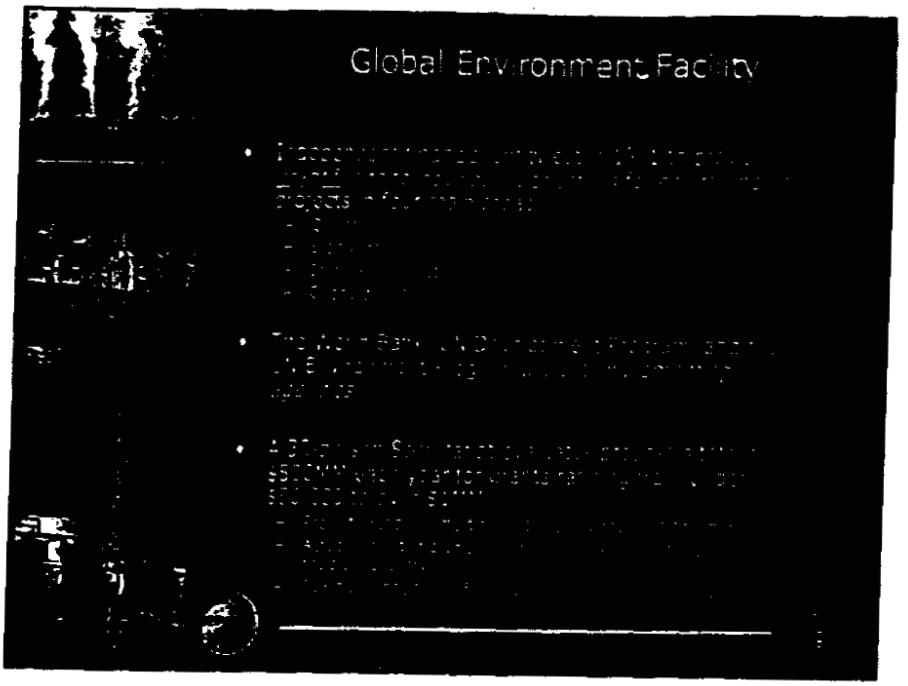
II. Export Credit Agencies, Focus on the Export-Import Bank of the United States (Ex-Im)

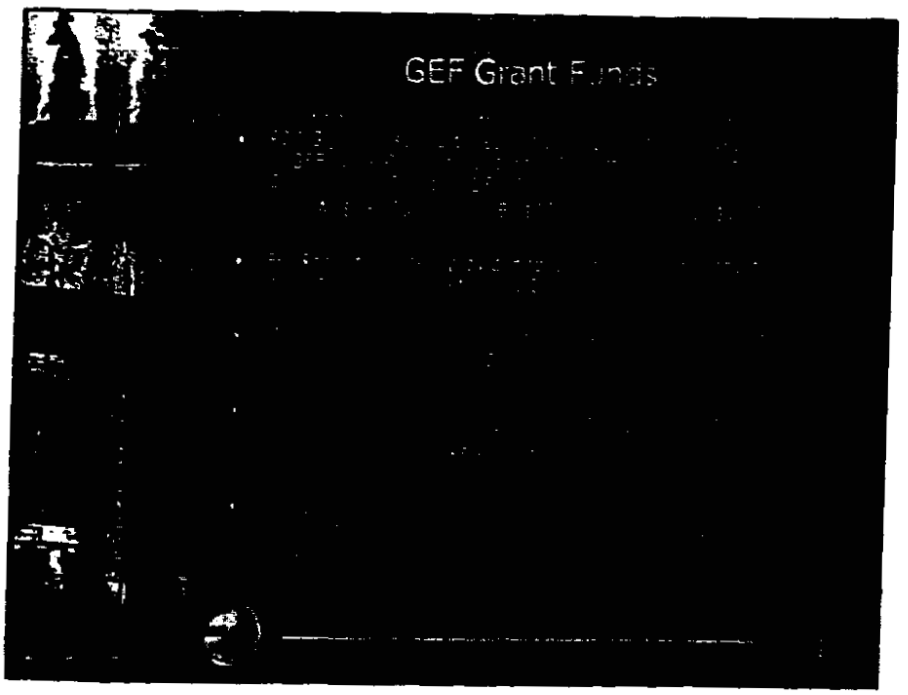
III. Leasing and other Mechanisms/Approaches to Financing Clean Energy Technologies

I. Resources for Financing Clean Energy Technologies

BEST AVAILABLE COPY

51





BEST AVAILABLE COPY

GEF Climate Change Projects

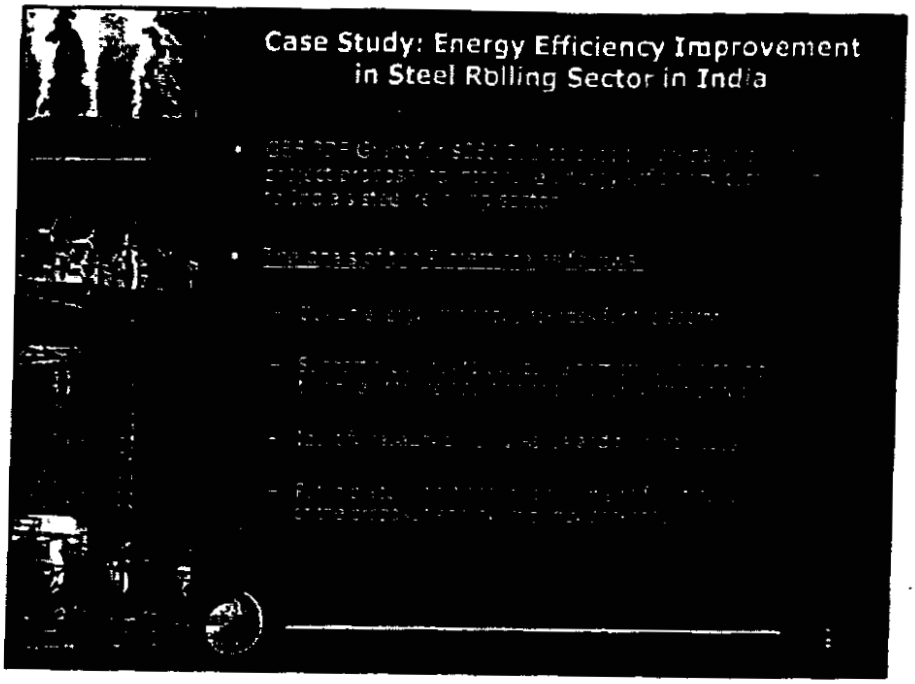
- [illegible]
- 2) [illegible] by removing barriers and reducing implementation costs;
- 3) reducing the incremental costs of low greenhouse gas emitting energy technologies; and
- 4) [illegible] development of sustainable transport.
- From 1991 to [illegible], GEF allocated [illegible] million to 227 climate change projects, [illegible] activities [illegible] by more than [illegible] million co-financing.
- From 1991 to 2000, GEF has supported 11 climate change projects in India with total projects grants of $109,900,000.

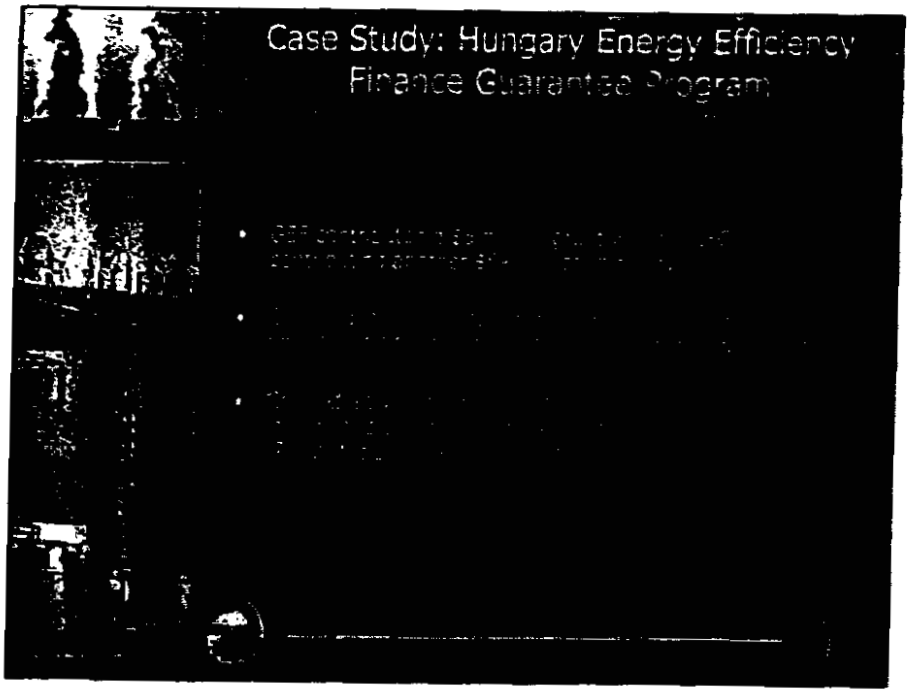
Examples of Eligible Climate Change Projects

- Programs to promote efficient energy production, distribution, consumption
- Programs to improve demand-side planning for electricity
- Technical training for renewable and high efficiency technologies
- Programs to promote on- and off-grid photovoltaic installations
- Programs to reduce market barriers to adoption of energy efficiency

BEST AVAILABLE COPY

53





BEST AVAILABLE COPY

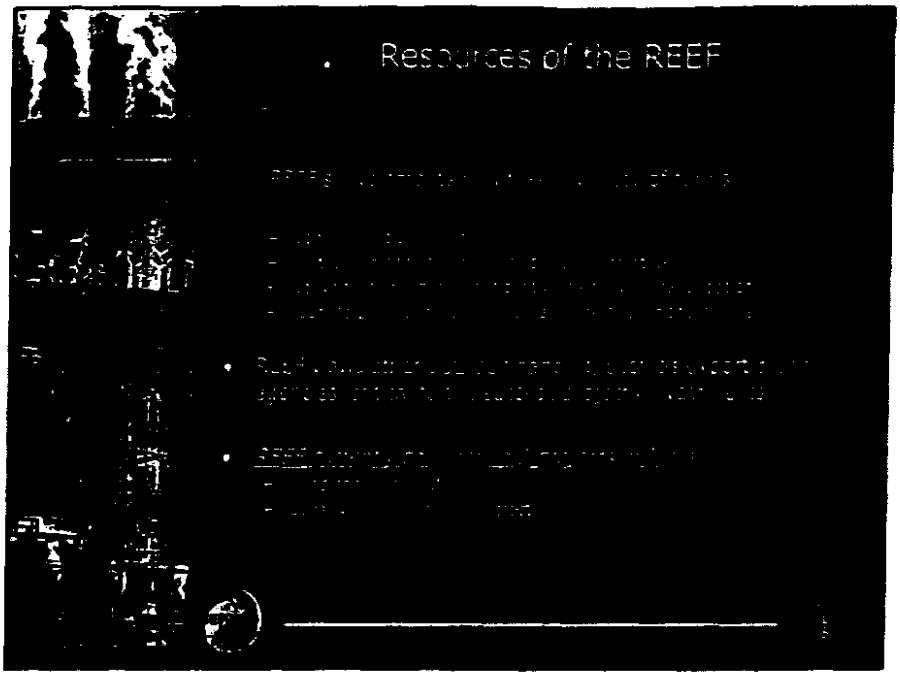
Case Study: Hungary Energy Efficiency Finance Guarantee Program

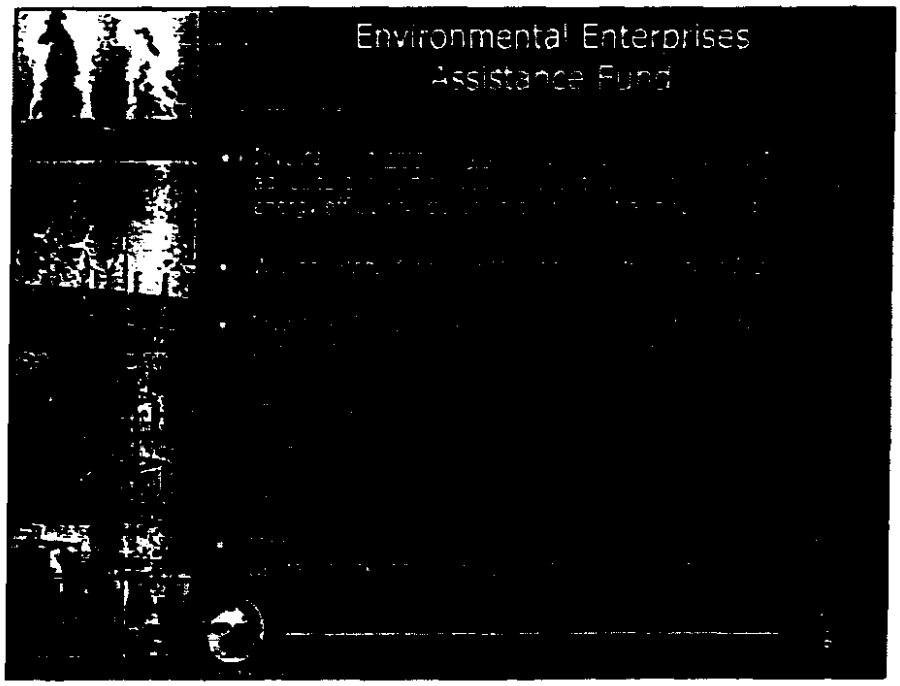
- [illegible]
- [illegible]

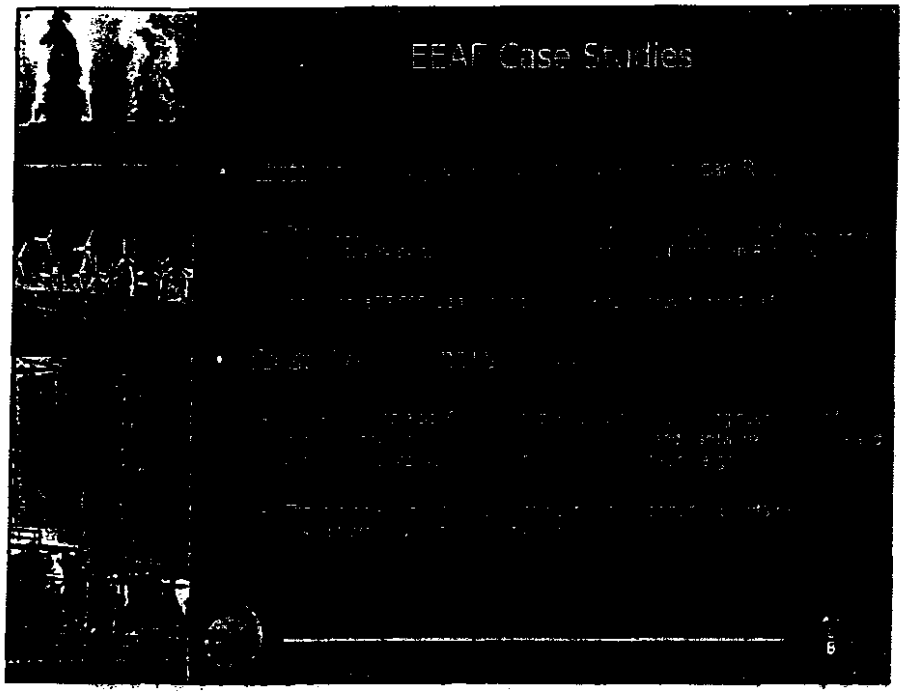
Renewable Energy and Energy-Efficiency Fund (REEF)

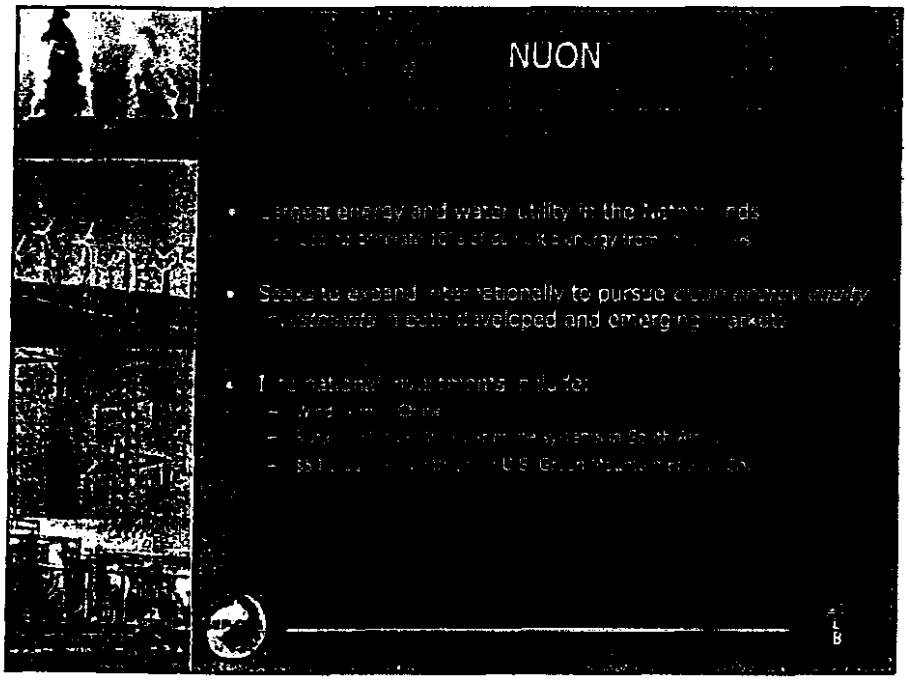
- [illegible] in February 2000 by the IFC to invest in [illegible] projects in emerging markets.
- REEF [illegible] equity investments in projects ranging [illegible] from U.S. [illegible] to $100,000,000.
  - [illegible] investment [illegible]
  - REEF [illegible] equity [illegible]
- REEF focuses on projects that are commercially [illegible] viable with strong ownership and management structure.
  - REEF [illegible]
- REEF will invest in profitable, commercially viable private [illegible] projects in sectors that include:
  - [illegible]
  - [illegible]

55

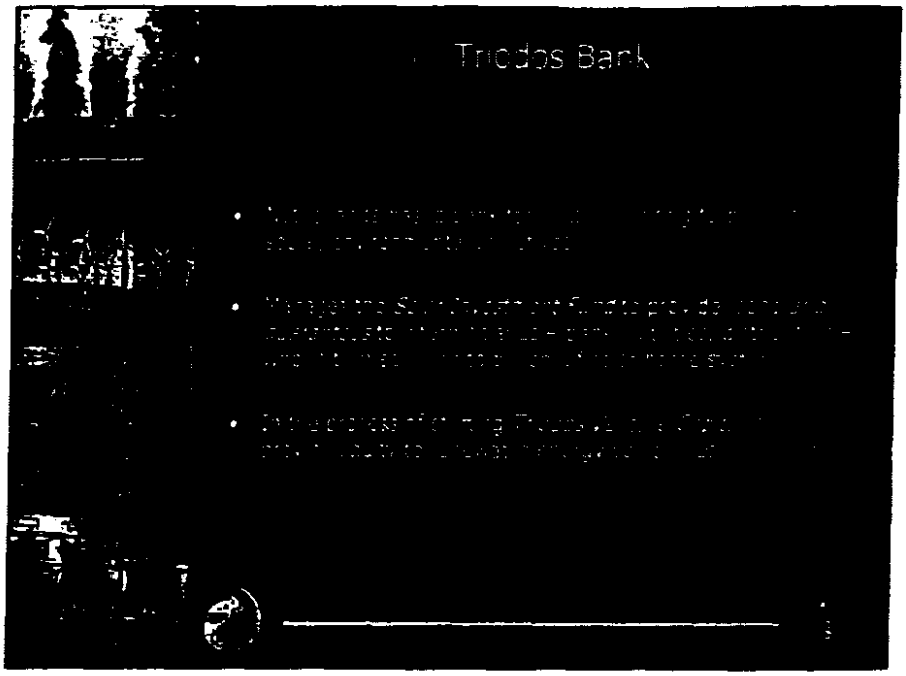

Resources of the REEF

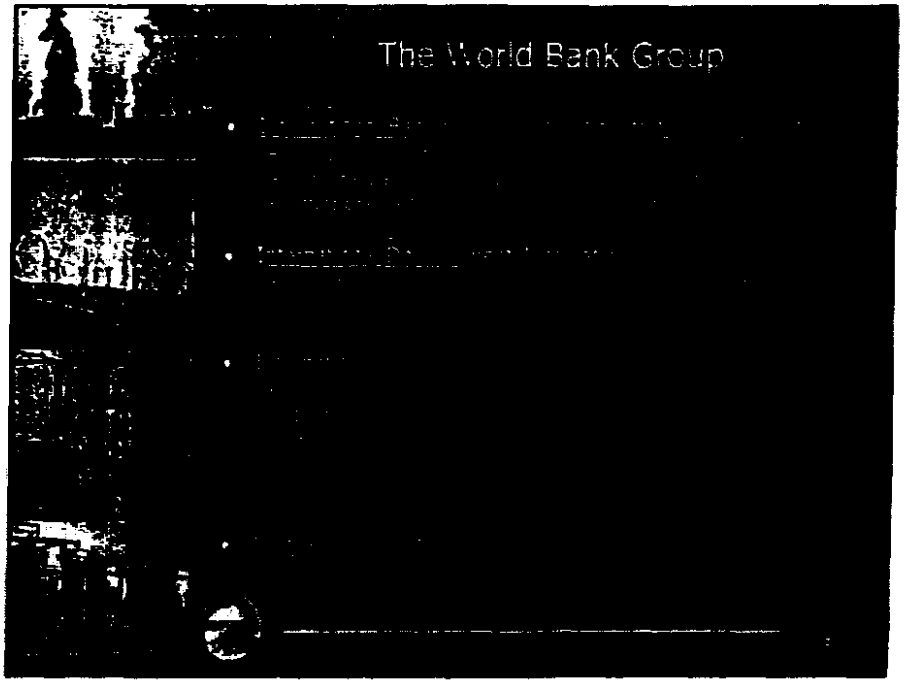

Environmental Enterprises
Assistance Fund

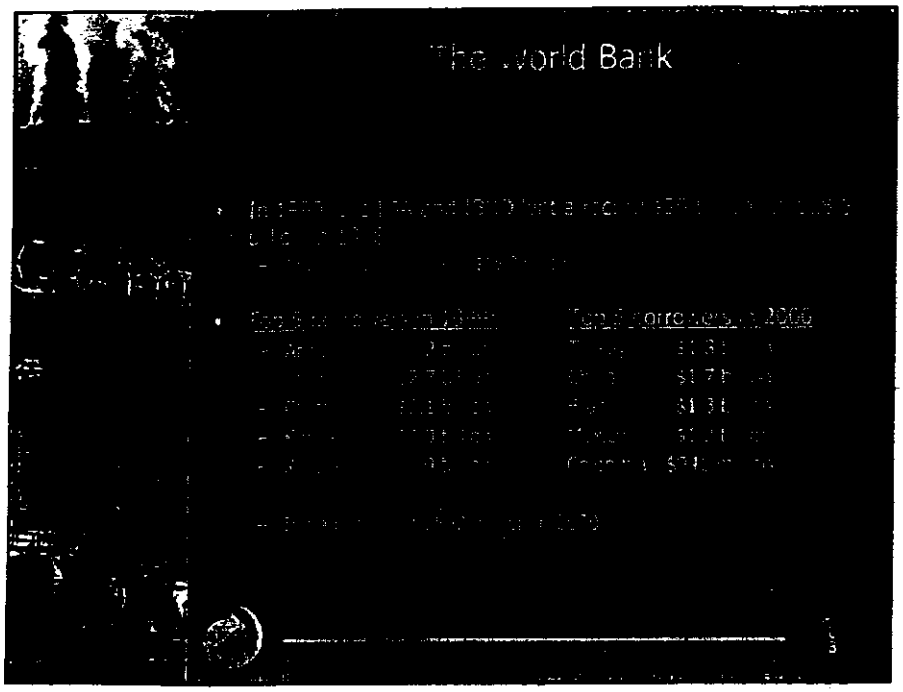


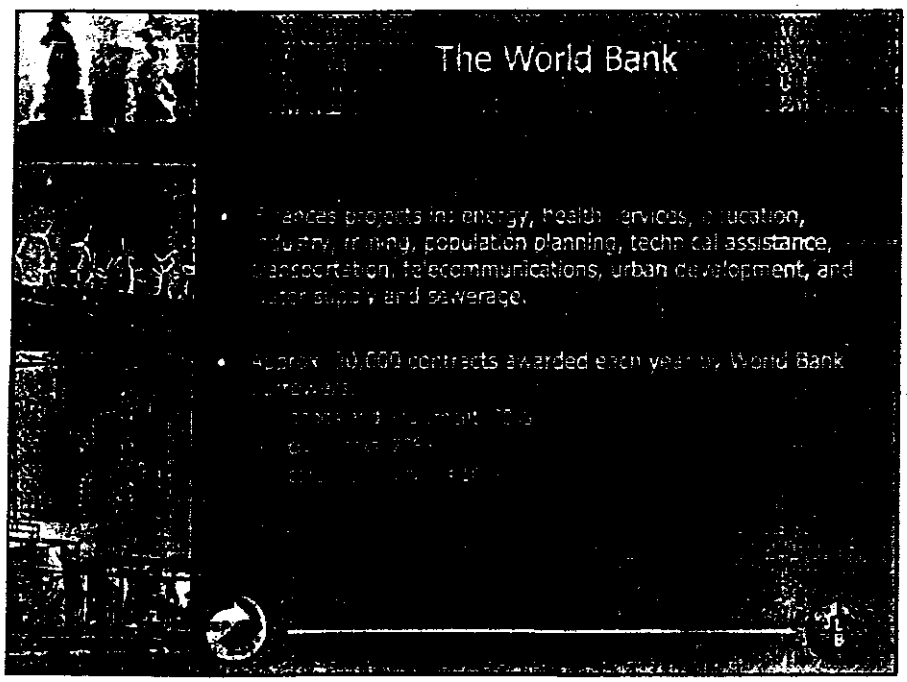


57

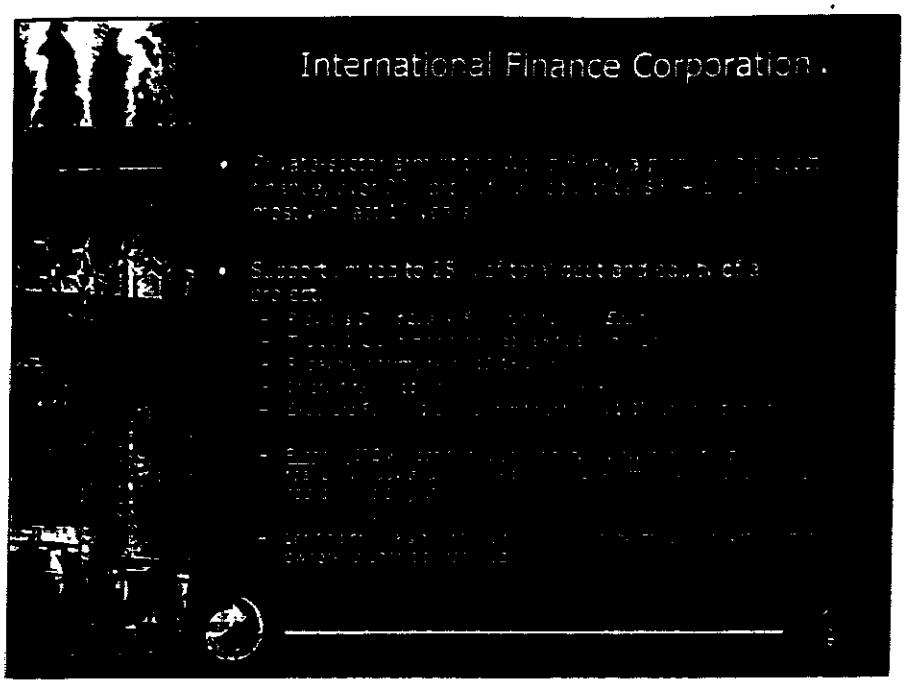

Triodos Bank

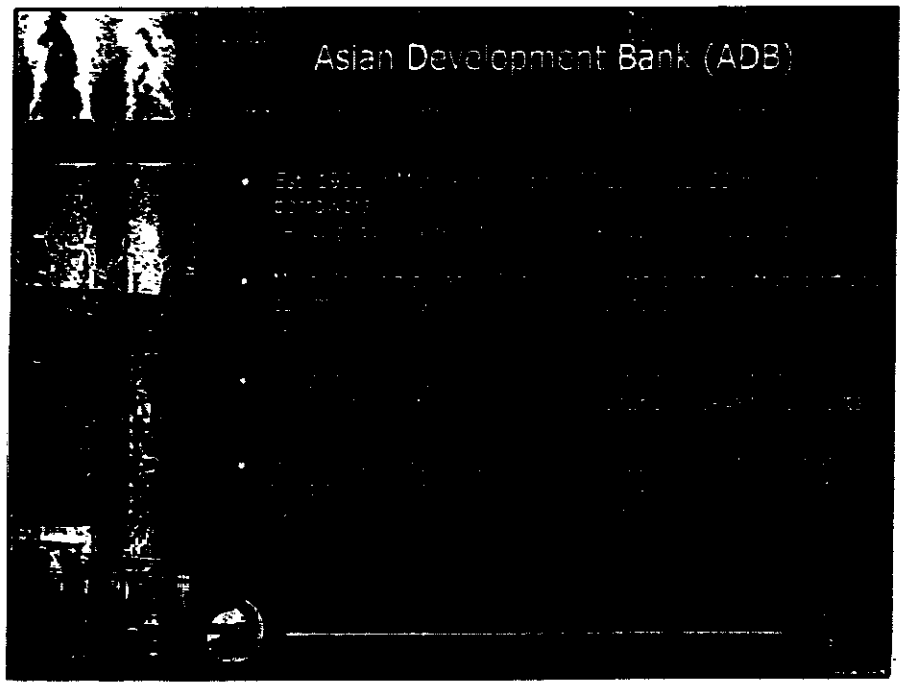

The World Bank Group


The World Bank


The World Bank
Finances projects in energy, health services, education, industry, mining, population planning, technical assistance, transportation, telecommunications, urban development, and water supply and sewerage.
Approx. 40,000 contracts awarded each year by World Bank borrowers.

59


International Finance Corporation

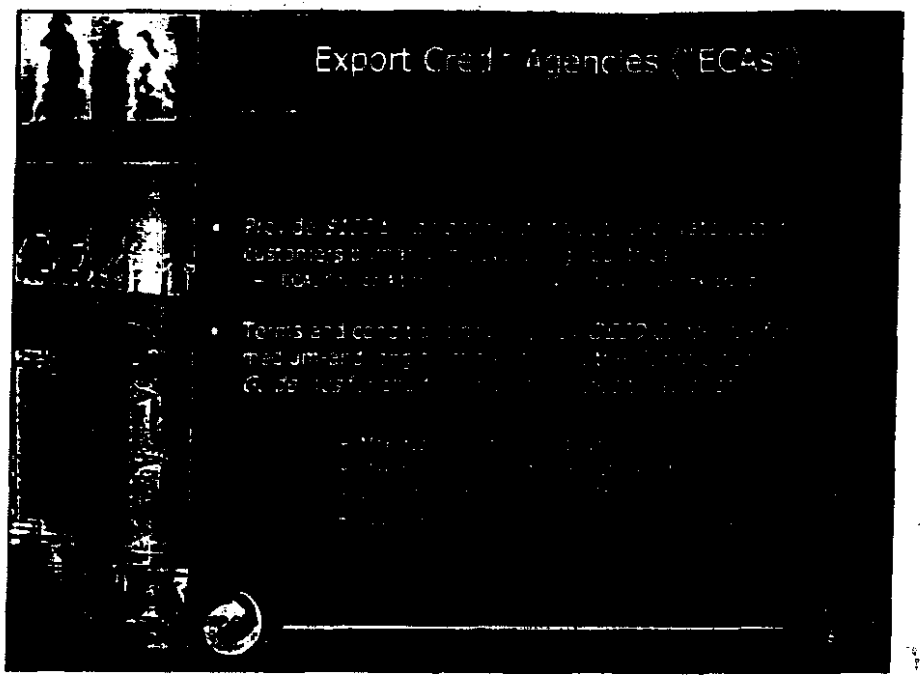

Asian Development Bank (ADB)

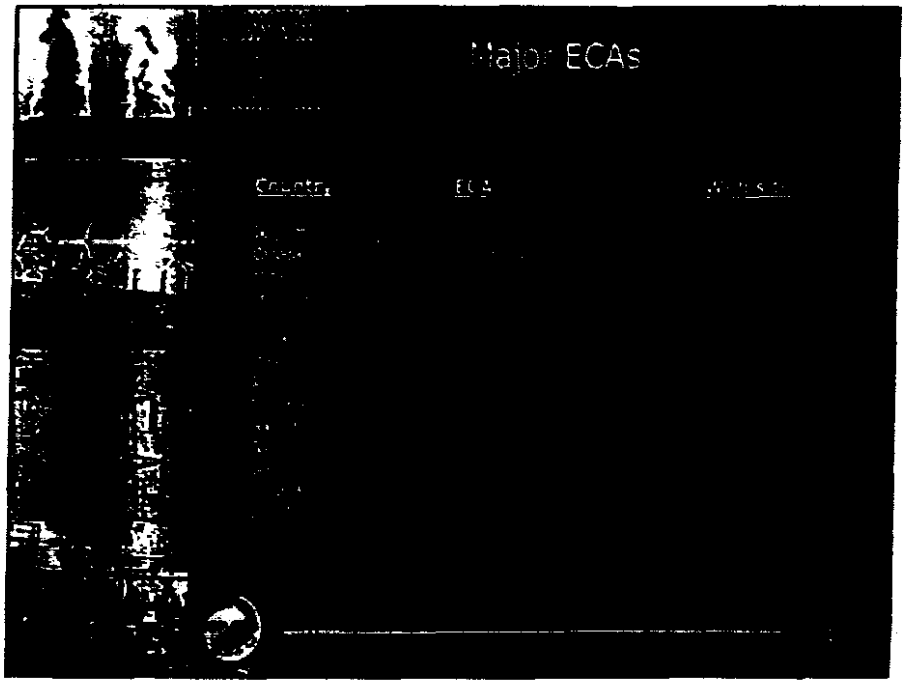
ADB Program Resources

- [illegible]
- [illegible] Group
- Guarantees are available only for [illegible] exports
- Co-financing is similar to IFC's "B" loan, [illegible] banks get "umbrella" protection from ADB's *preferred creditor status*, but NOT an art. [illegible] guarantee

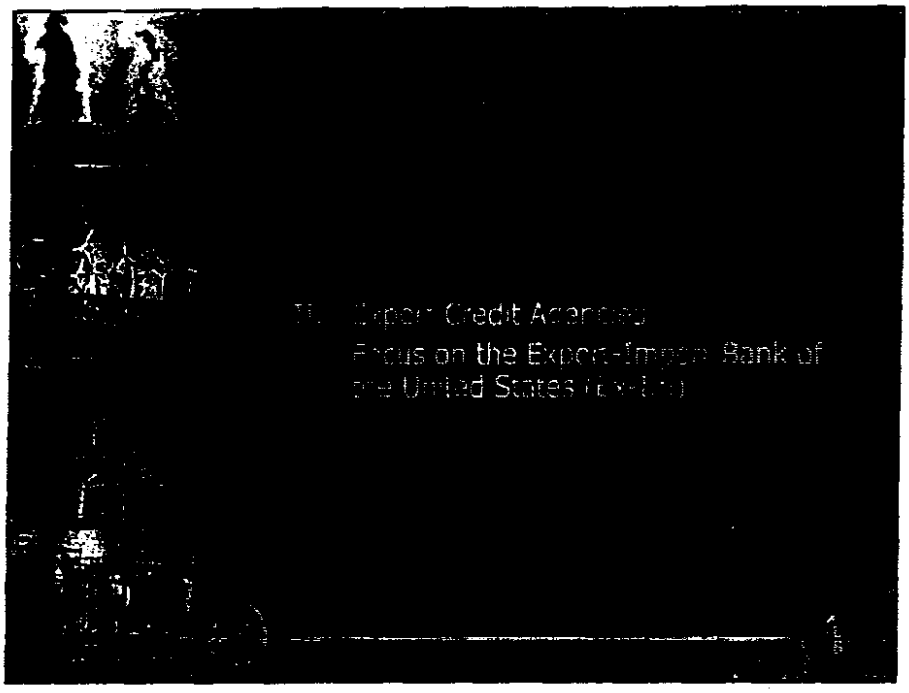
Export Credit Agencies ("ECAs")

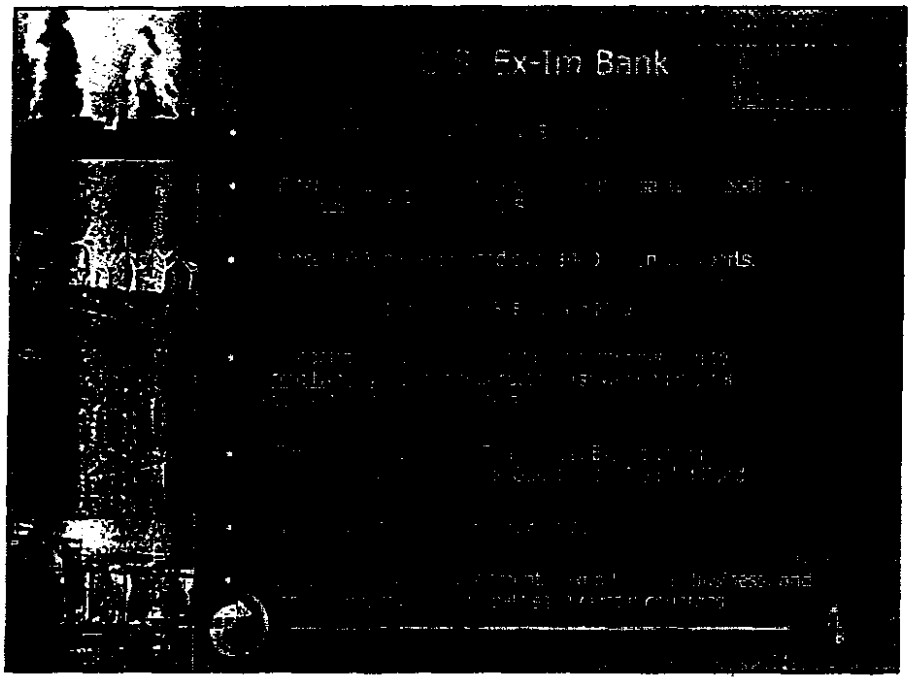
- Agencies of national governments created to provide financing of their country's exports.
- Most industrialized countries, many emerging markets have ECAs.
- Provide financing in the form of direct loans, loan guarantees, export credit insurance, and "tied aid."





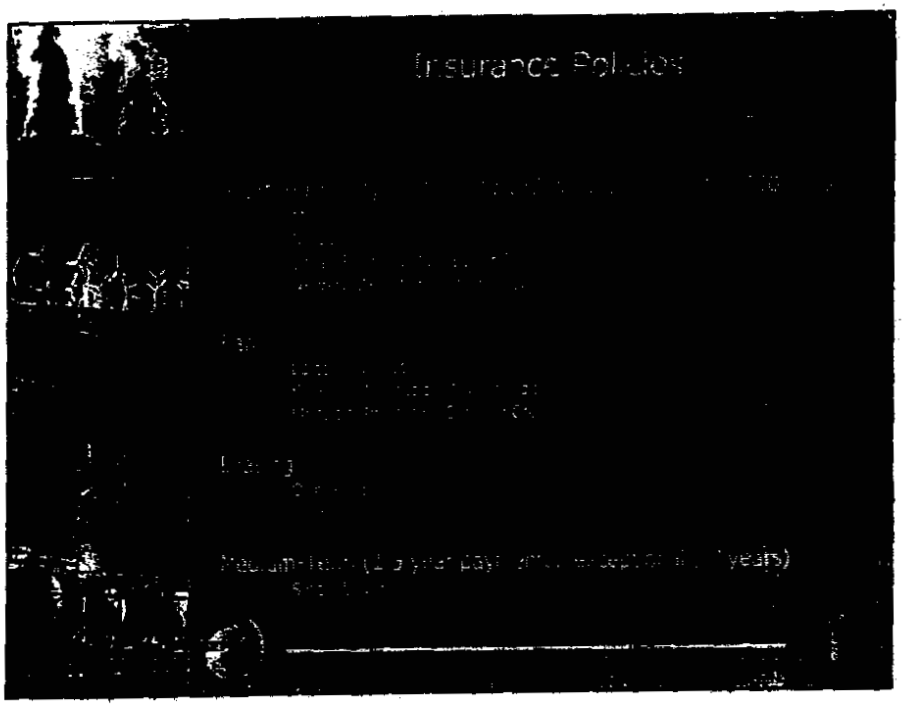
BEST AVAILABLE COPY

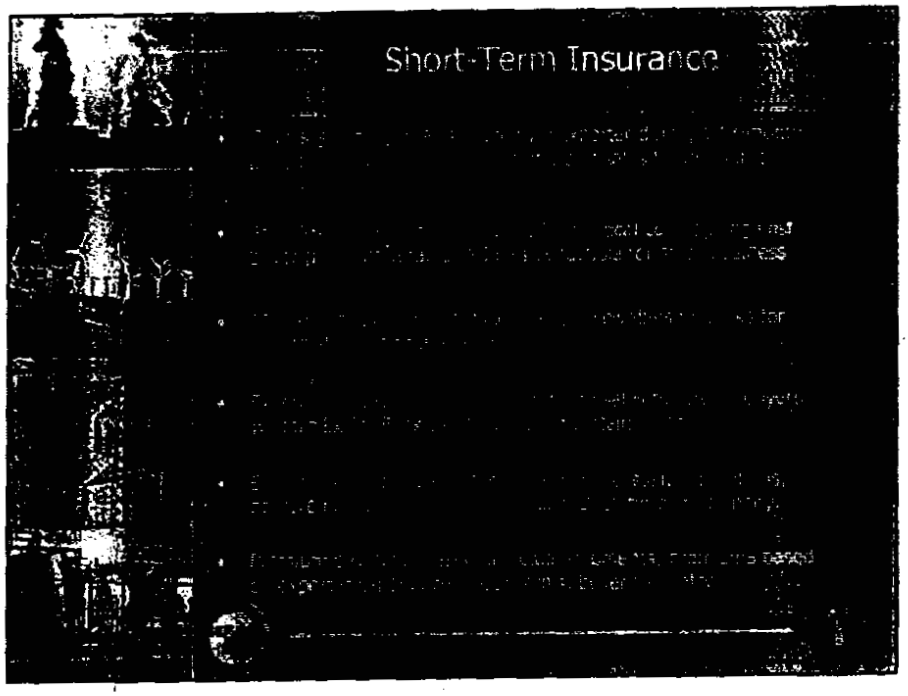

Export Credit Agencies
Focus on the Export-Import Bank of
the United States (Ex-Im)


Ex-Im Bank

Environmental Exports Program

Export Credit Insurance





65

Case Study: Kyocera Solar

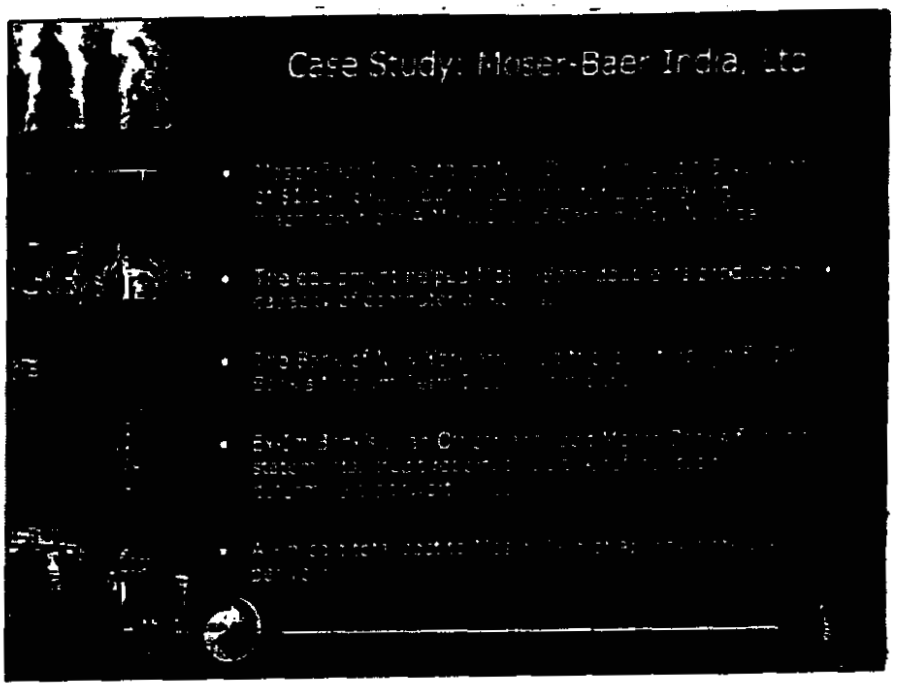
Short-Term Credit Process

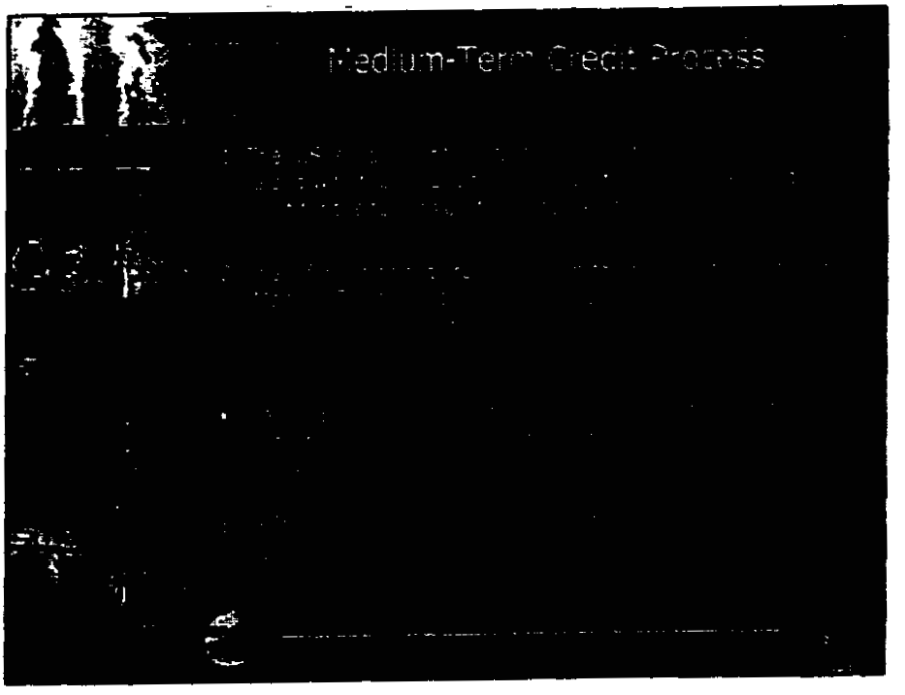
Short-Term Credit Standards

Medium-Term Credit Insurance

BEST AVAILABLE COPY

67





BEST AVAILABLE COPY

6

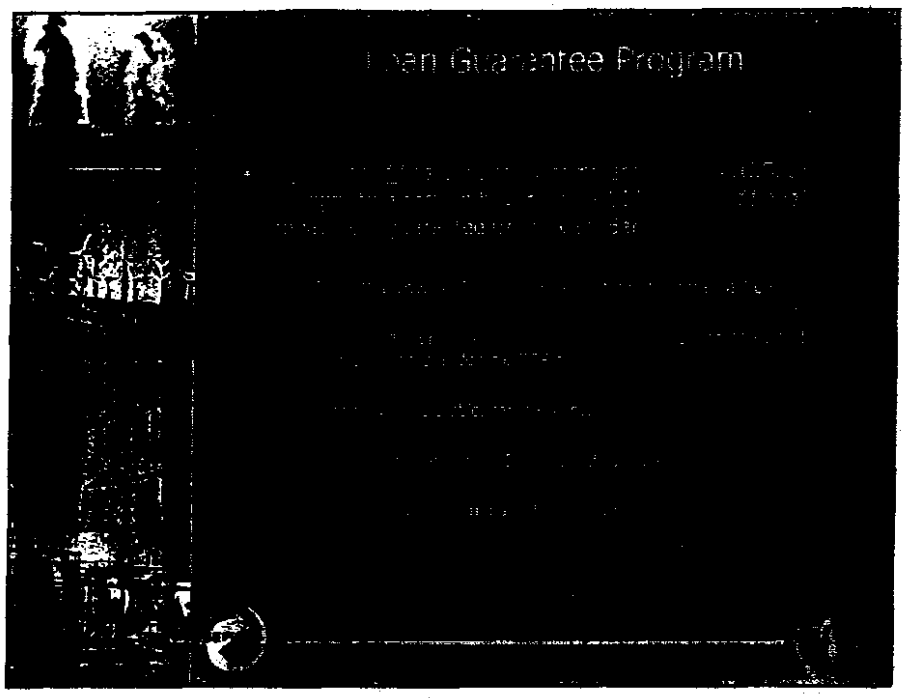
Medium Term Credit Standards

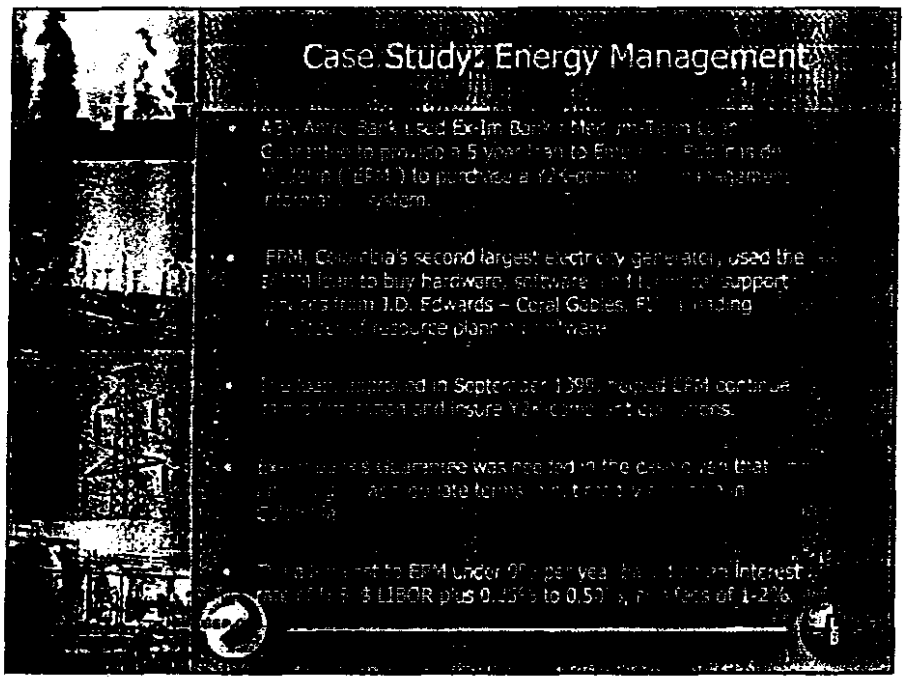
Finance Lease Insurance

Case Study: Lease Insurance

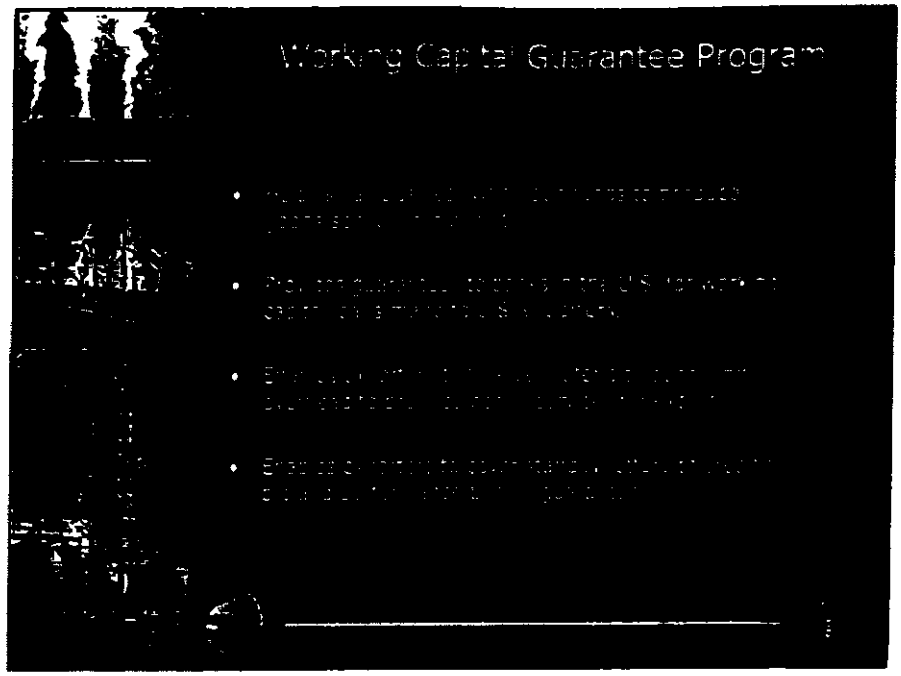
Direct Loan Program

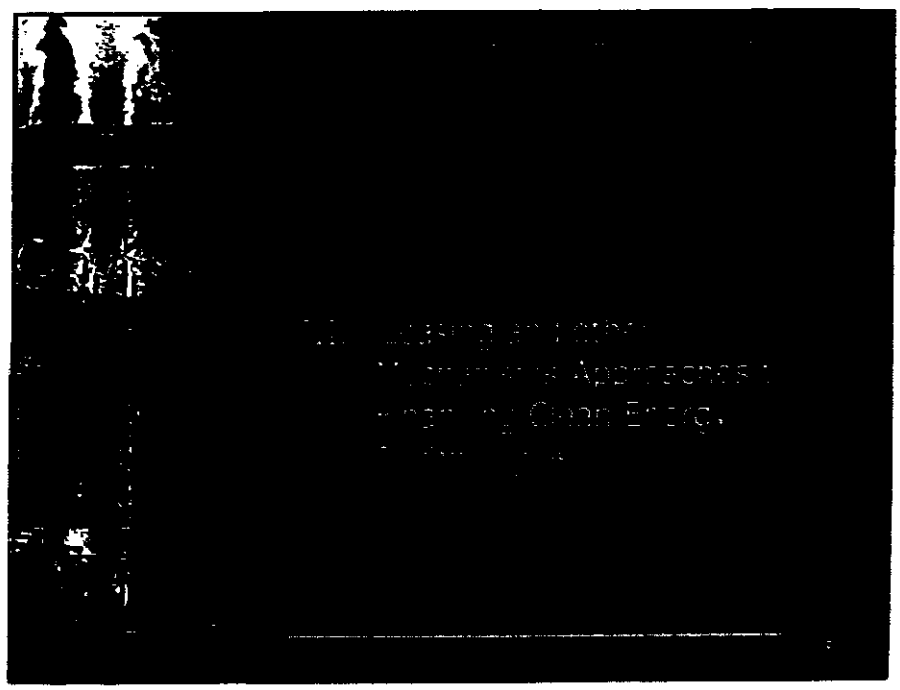
BEST AVAILABLE COPY

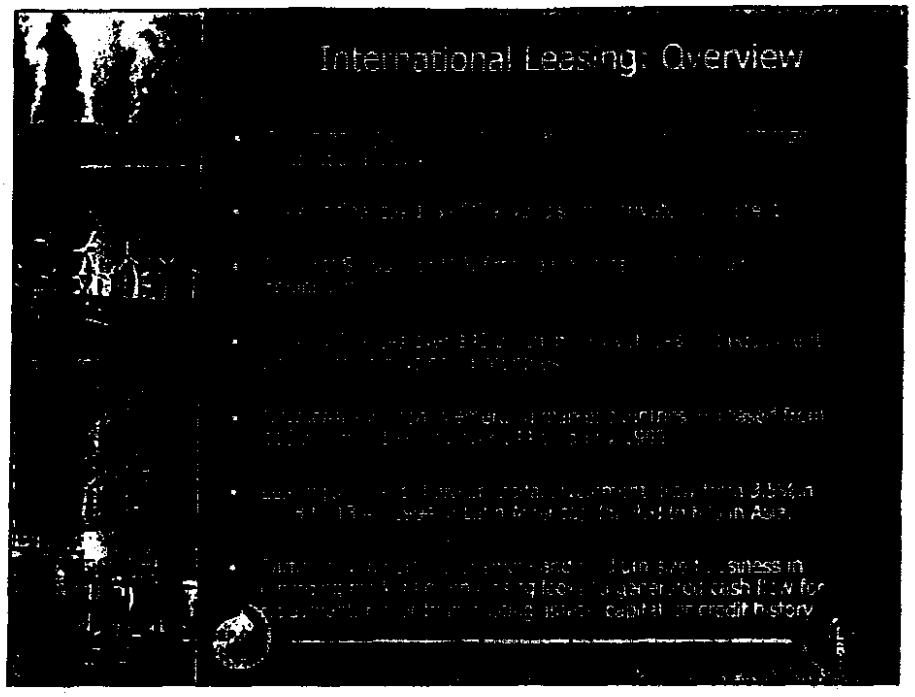

Loan Guarantee Program

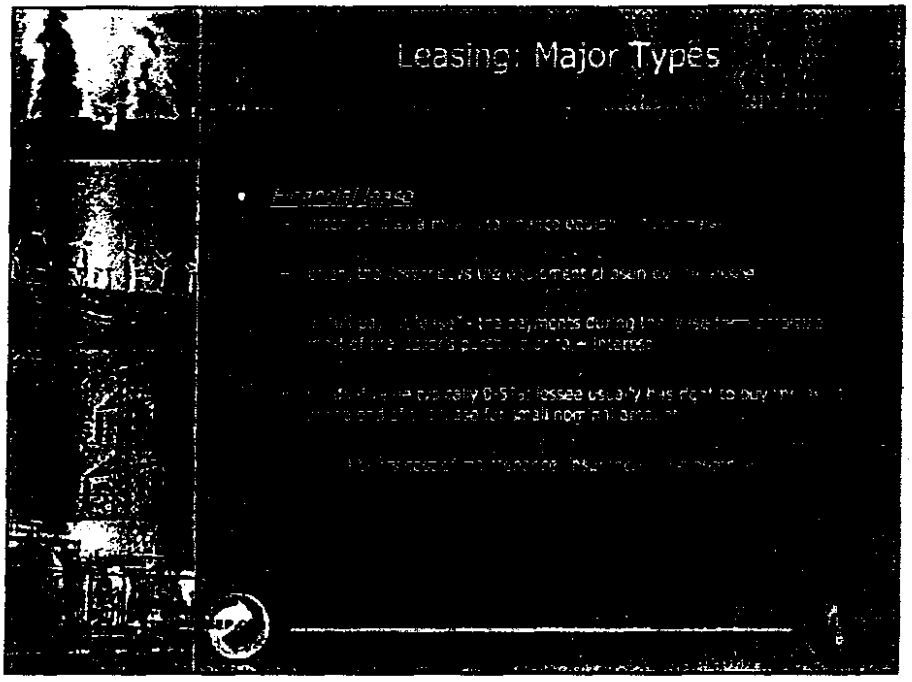

Case Study: Energy Management
ABN AMRO Bank used Ex-Im Bank's Medium-Term Loan Guarantee to provide a 5 year loan to Empresas Publicas de Medellin (EPM) to purchase a Y2K-compliant energy management information system.
EPM, Colombia's second largest electricity generator, used the EPM loan to buy hardware, software and support services from J.D. Edwards – Coral Gables, FL including enterprise resource planning software.
The loan approved in September 1999 helped EPM continue its efforts to reach and insure Y2K compliant operations.
The loan guarantee was needed in the case of EPM that [illegible] appropriate terms [illegible] in Colombia.
The loan extended to EPM under 90 days was at a floating interest rate of 6 LIBOR plus 0.45% to 0.50%, plus fees of 1-2%.

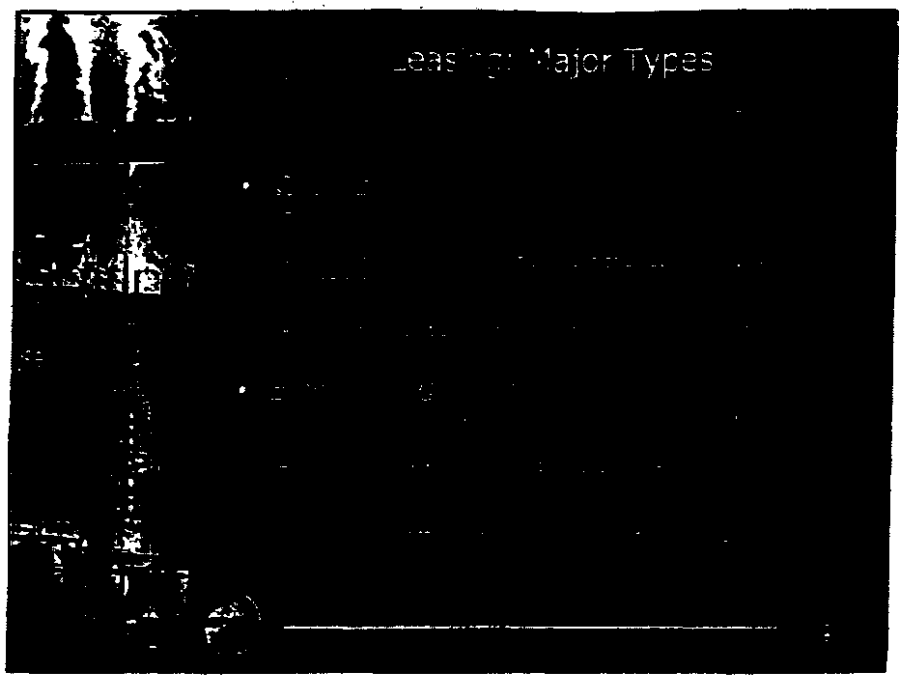
7/

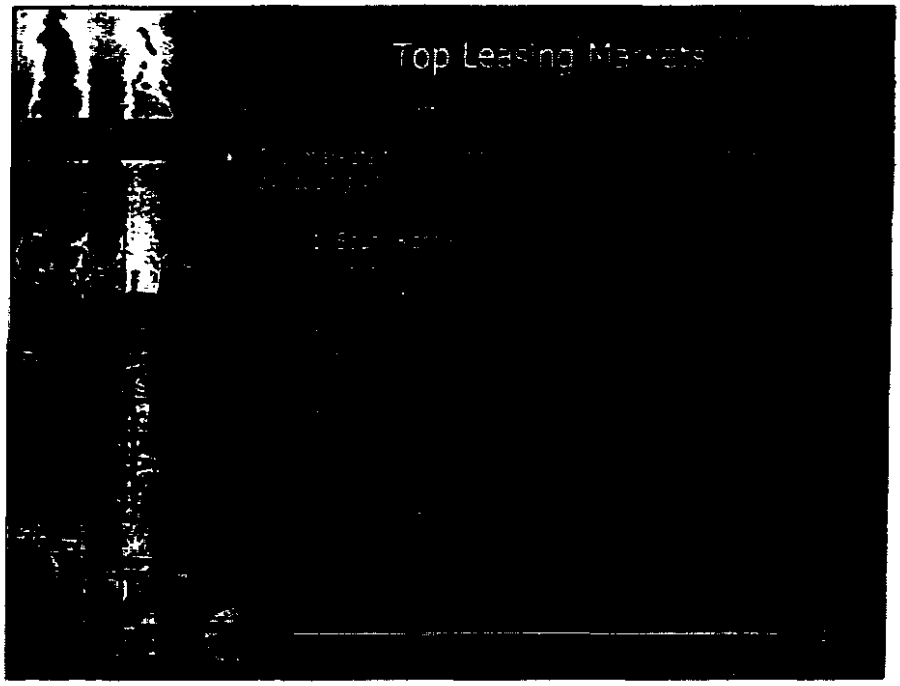

Working Capital Guarantee Program




International Leasing: Overview


Leasing: Major Types


Leasing: Major Types


Top Leasing Markets

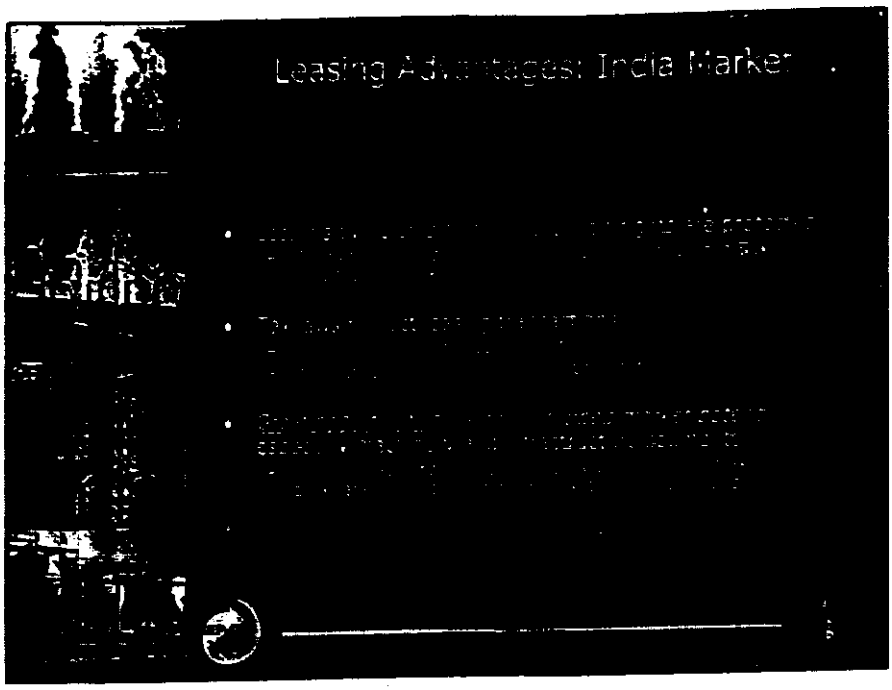
India Leasing Market Overview

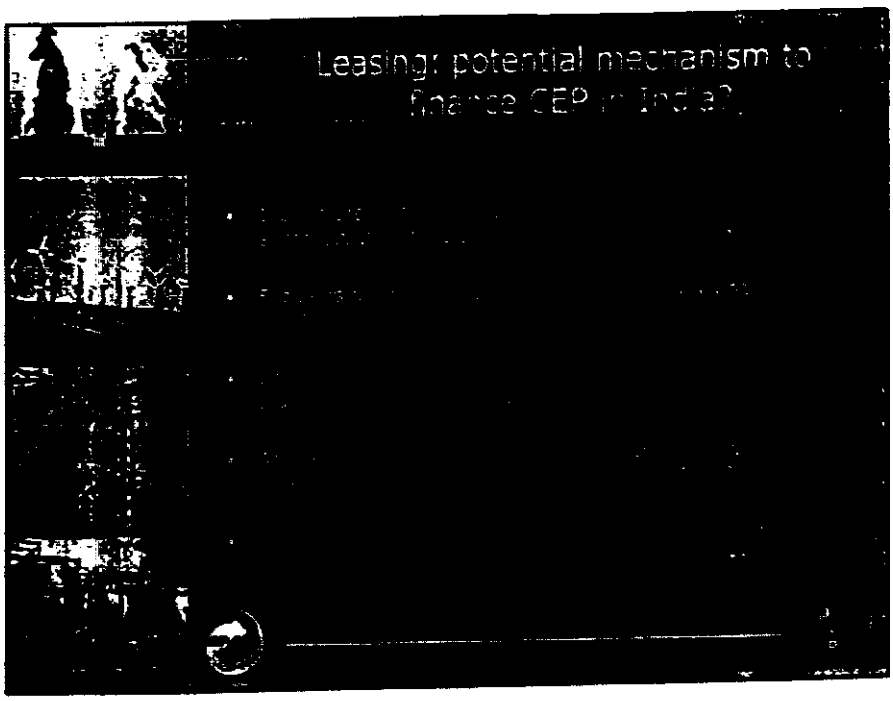
- [illegible]
- Leasing [illegible] for plant and equipment [illegible]
- [illegible] market became [illegible] in 1993 with the entrance of ICICI and IFCI funding [illegible]
- [illegible] companies assisted [illegible] by [illegible] banks and financial institutions

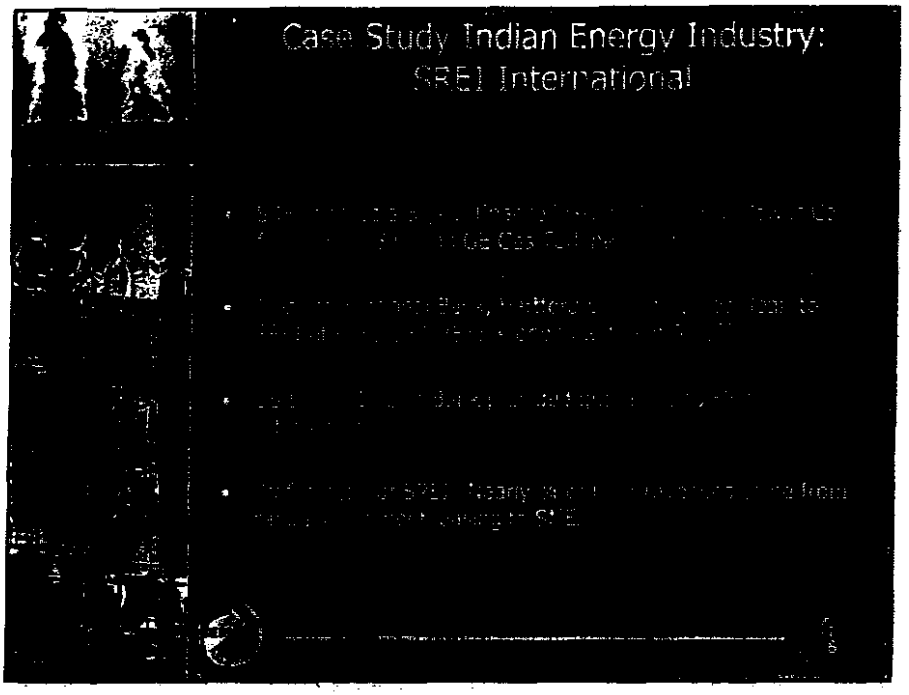
India Leasing Market Overview

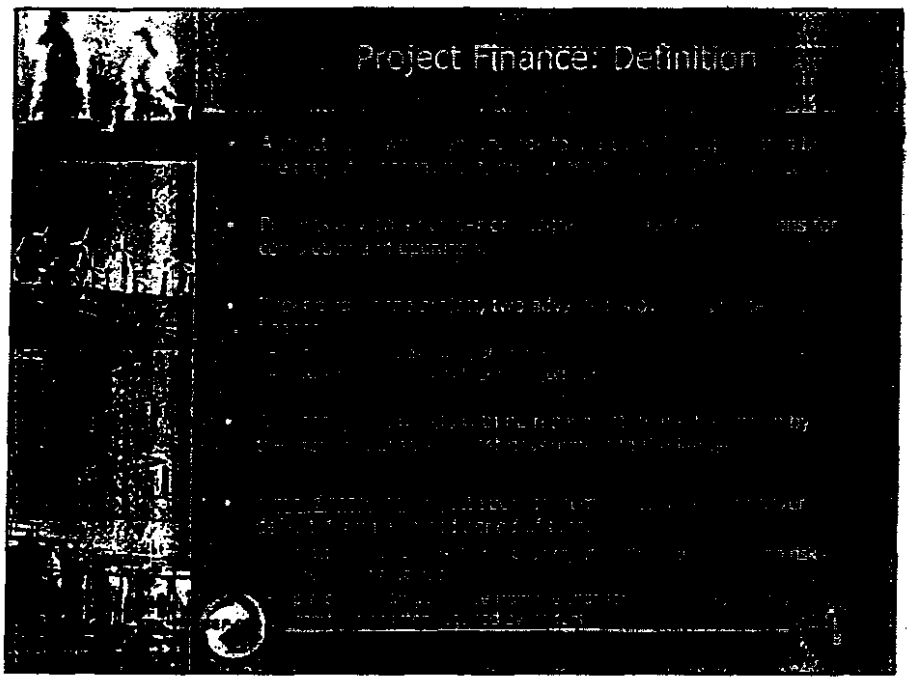
- In 1991 RBI allowed banks to offer leasing facilities directly.
- So far, banks are not big players in India's [illegible] market [illegible] other markets [illegible]
- With [illegible] liberalization increasing [illegible] foreign [illegible] banks are interested in India's [illegible]

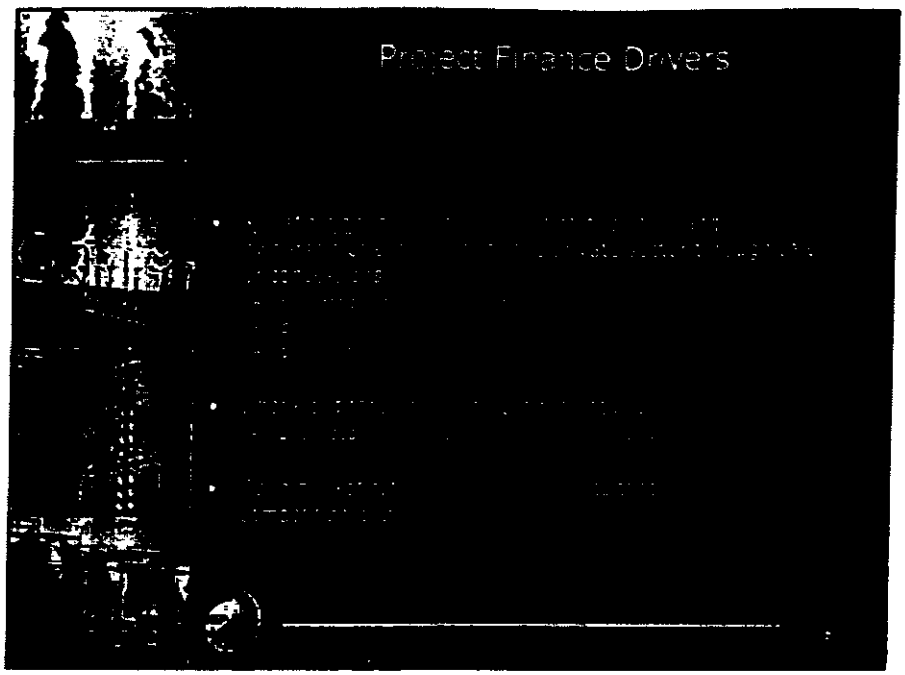
75

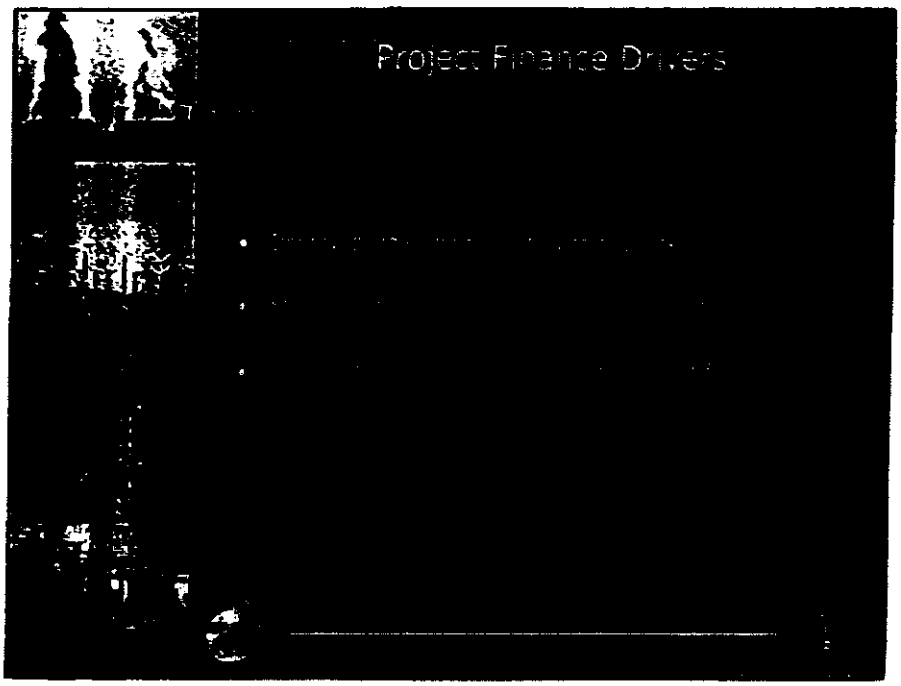

Leasing Advantages: India Market

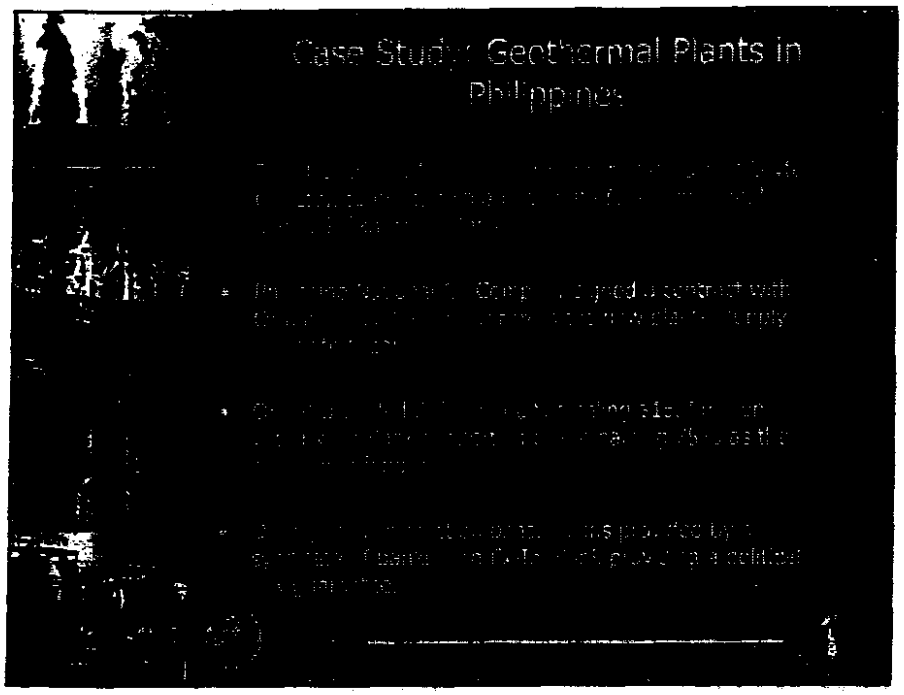

Leasing: potential mechanism to
finance CEP in India?

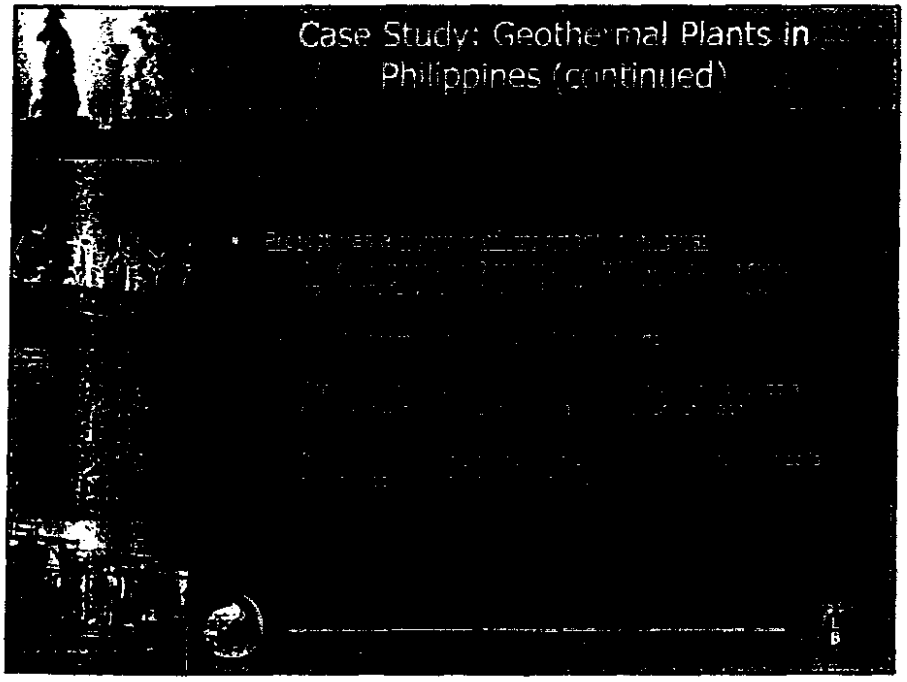

Case Study Indian Energy Industry:
SREI International


Project Finance: Definition


Project Finance Drivers


Project Finance Drivers


Case Study: Geothermal Plants in Philippines


Case Study: Geothermal Plants in Philippines (continued)

Financing Projects in Challenging Markets Necessitates Creativity

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Structured Finance Summary

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

EMISSIONS MARKETS AND TRADING

Mr. Ted Yoder
Manager-Trade Finance Unit
The Louis Berger Group, Inc.

Climate Change Supplement

Greenhouse Gas Pollution Prevention Project

Emissions Markets and Trading Prospects for Carbon Revenue

Mr. Ted Yoder
Manager-Trade Finance Unit
The Louis Berger Group, Inc

THE Louis Berger Group, INC.

L
B

Portions of this presentation are courtesy of Natsource LLC Strategic Advisory Group, a GEP-CCS Financial Services Partner

Emissions Trading Fundamentals
Outline

I. Benefits of trading in theory
Practical results: US SO2

II. US SO2 in depth: description and analysis

III. Looking forward

I. Benefits of trading in theory
Practical results: US SO2

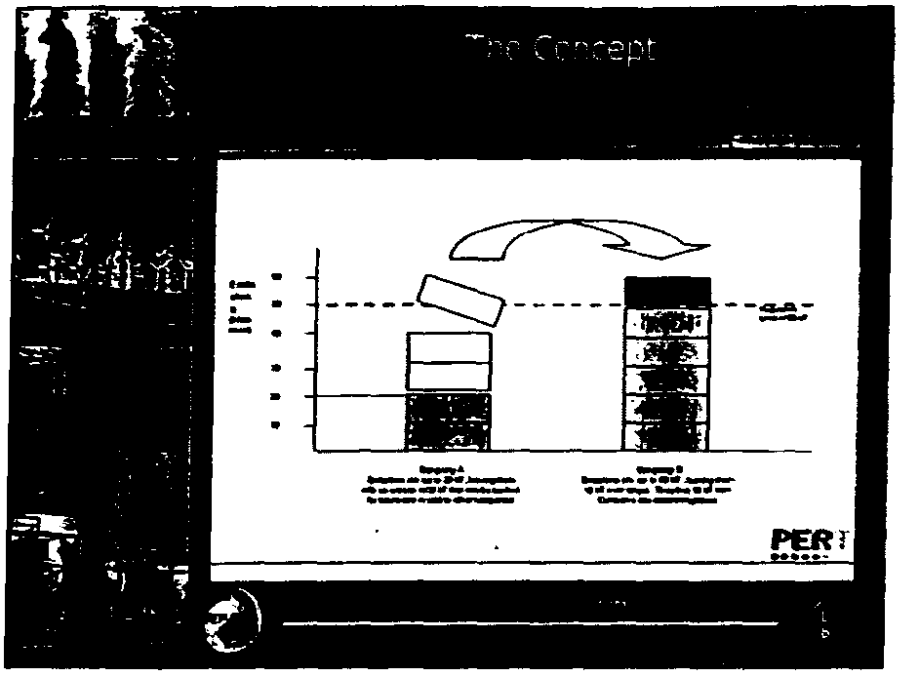
83

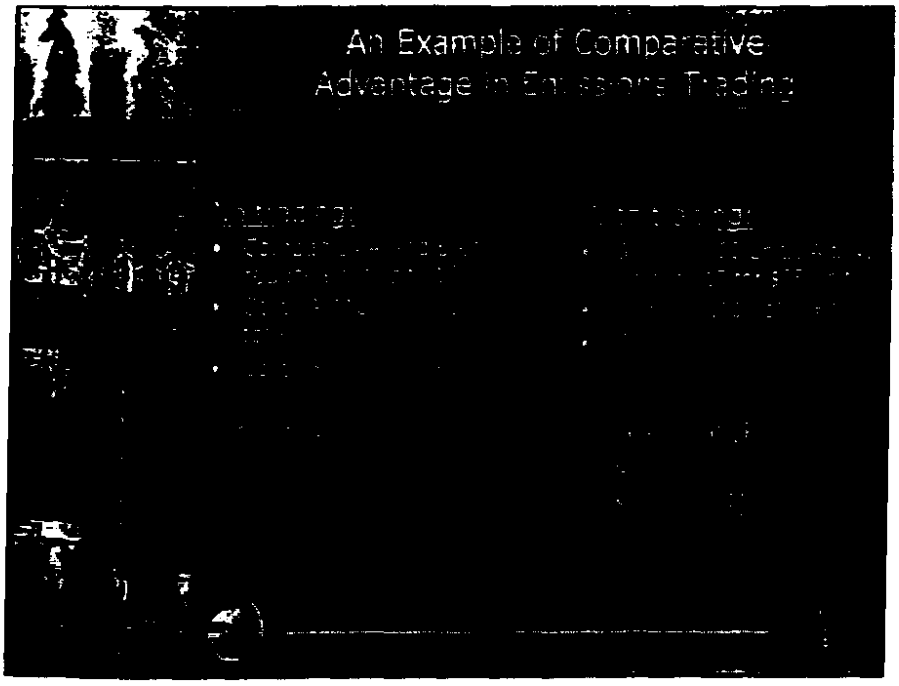
Environmental Regulations: the old way

- Command and control
  - specific technology
  - specific source
  - specific time
- Costly, inflexible

Emissions Trading Benefits

- Takes advantage of differences in sources' marginal abatement costs to achieve


The Concept
PER


An Example of Comparative
Advantage in Emissions Trading

Environmental Regulation: the New Way

- Emissions trading gives sources flexibility to choose
  - how to comply
  - when to comply
  - where to comply

Practical results: US SO2

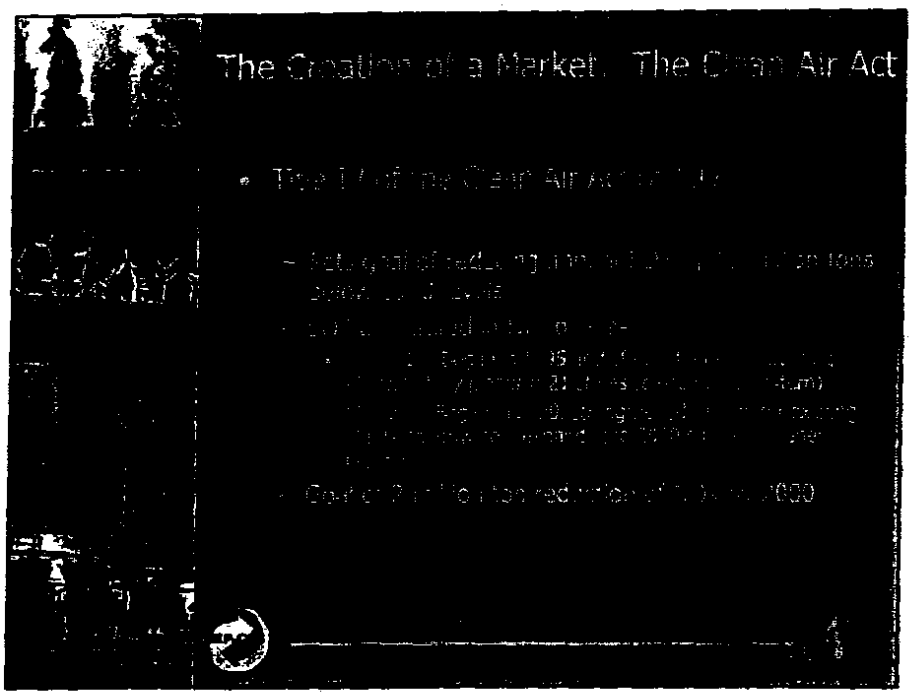
86

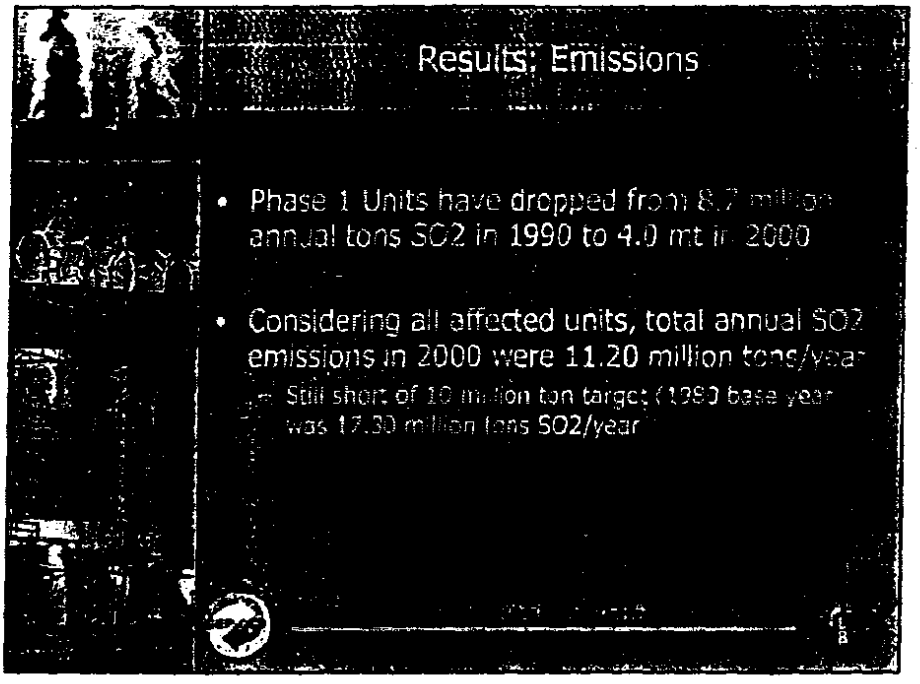
In Practice: US SO2 basics

- Affects electric generators at >25MW
- Achieves cap through allowances
  - 1 allowance = 1 ton SO2 emitted per year
- Allowance trading (cap-and-trade) market

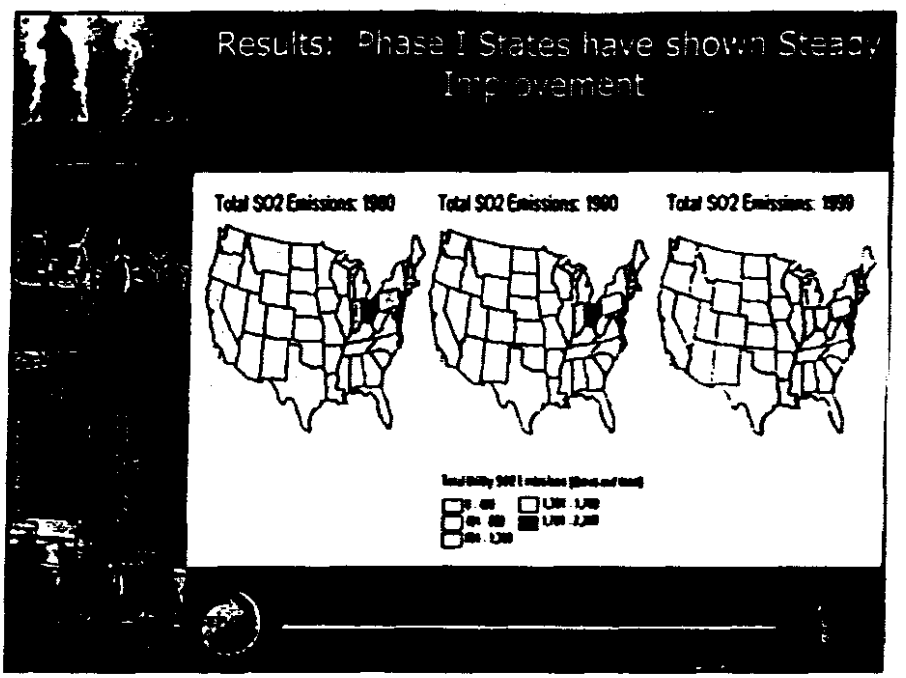
In Practice: US SO2 basics

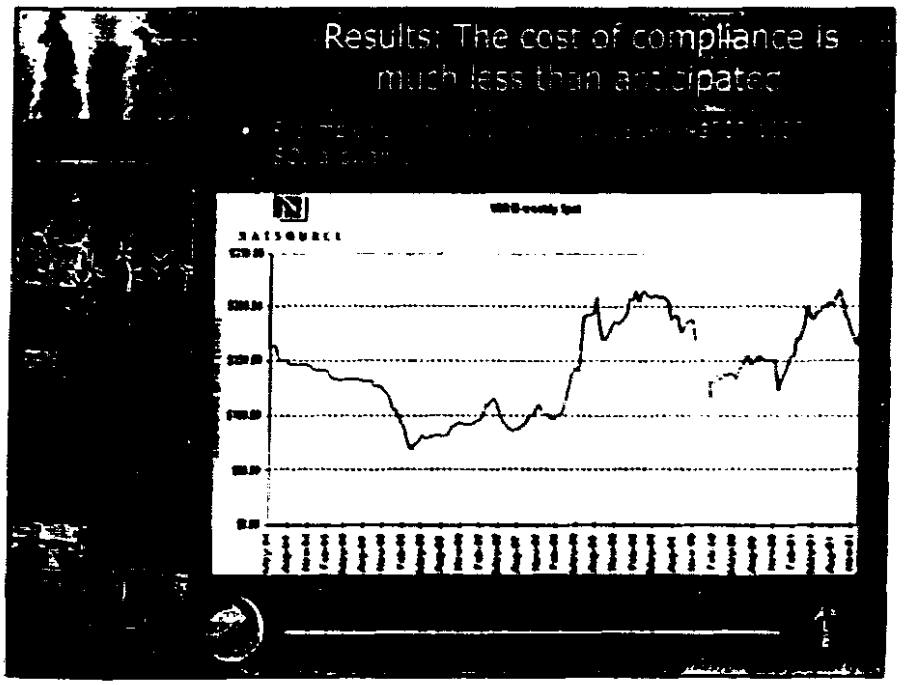
- Phase II [illegible] at [illegible] allowances
- [illegible]
- [illegible]

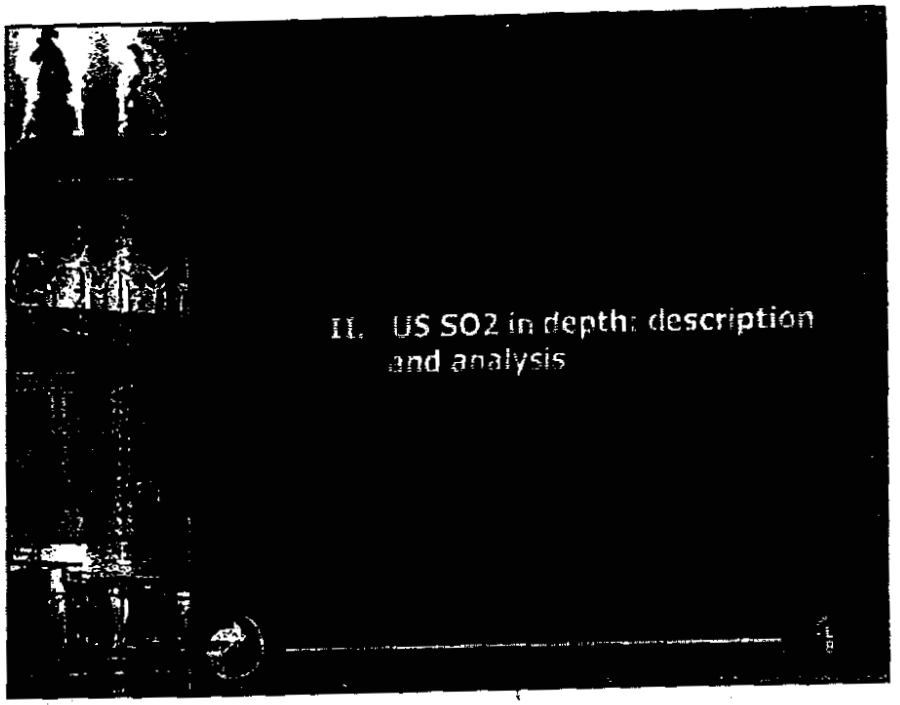

The Creation of a Market: The Clean Air Act

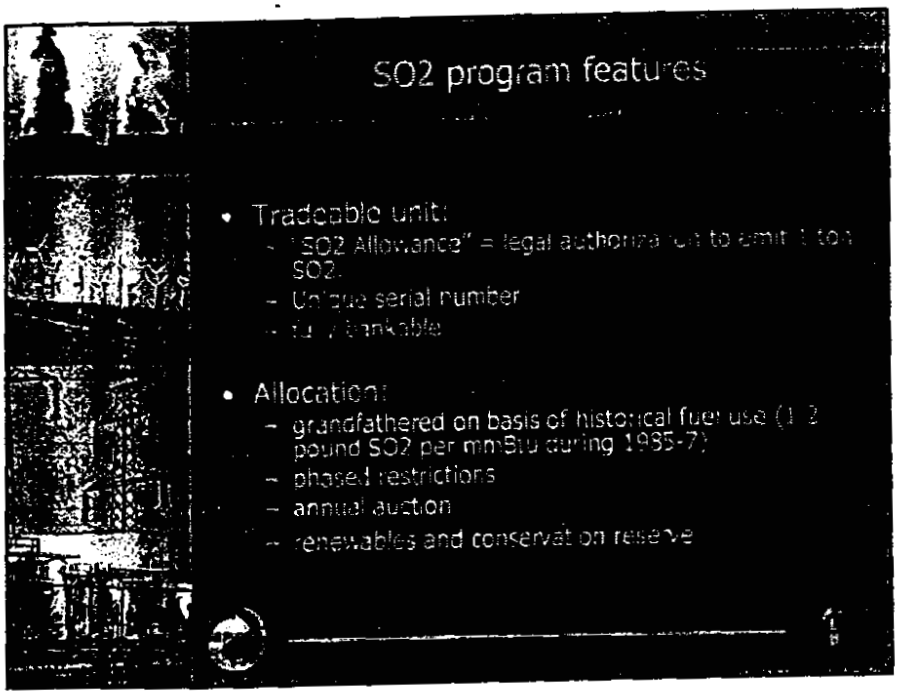

Results: Emissions
Phase 1 Units have dropped from 8.7 million annual tons SO2 in 1990 to 4.0 mt in 2000
Considering all affected units, total annual SO2 emissions in 2000 were 11.20 million tons/year
Still short of 10 million ton target; (1990 base year was 17.30 million tons SO2/year

88


Results: Phase I States have shown Steady Improvement
Total SO2 Emissions: 1980
Total SO2 Emissions: 1990
Total SO2 Emissions: 1999


Results: The cost of compliance is much less than anticipated


II. US SO2 in depth: description and analysis

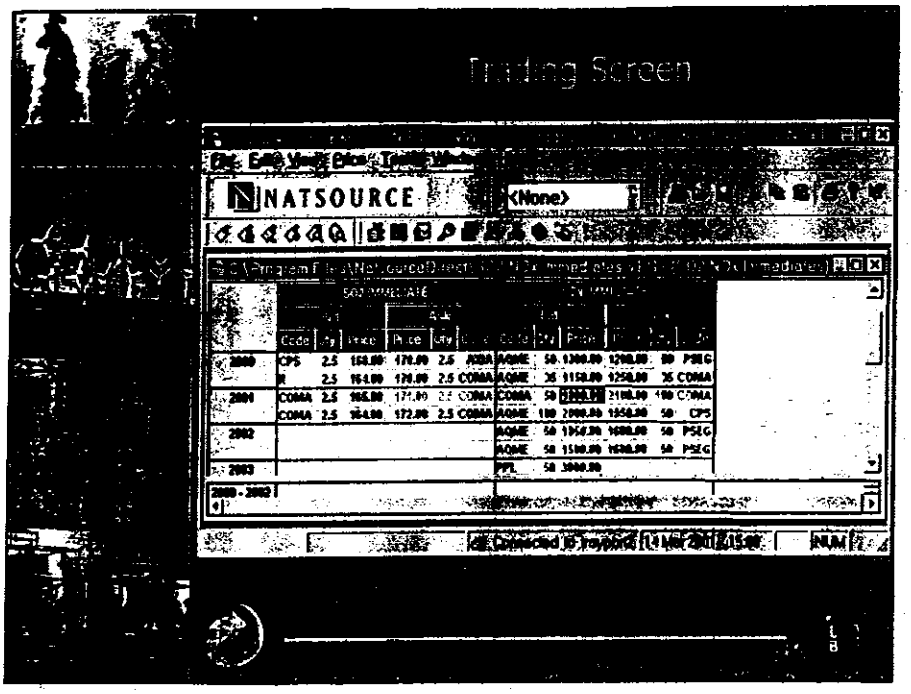

SO2 program features
• Tradeable units
– "SO2 Allowance" = legal authorization to emit 1 ton SO2
– Unique serial number
– fully bankable
• Allocations
– grandfathered on basis of historical fuel use (1.2 pound SO2 per mmBtu during 1985-7)
– phased restrictions
– annual auction
– renewables and conservation reserve

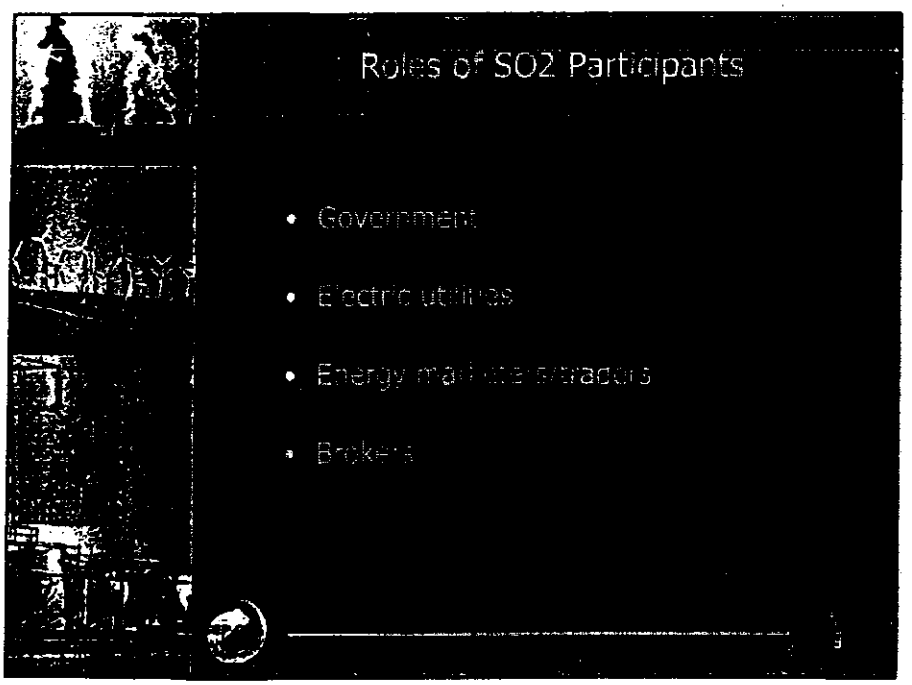
SO2 Program Elements (continued)

- Emissions monitoring
  - Mandatory Continuous Emissions Monitoring (CEM) required under CAA
  - Sulfur dioxide
- Permit accounting
  - Allowance Tracking System (ATS) records holdings, transfers
  - Sulfur dioxide

Trade Mechanics

- Tradable permit program (allowance trading)
- Accounting for emission reduction credits
- Banking
- Offsets
- Emissions cap


Trading Screen
NATSOURCE
<None>


Roles of SO2 Participants
• Government
• Electric utilities
• Energy marketers/traders
• Brokers

92

SO2 Market Drivers

- Cost Basis Drivers
  - [illegible]
  - [illegible]
- Regulatory, Industry Restructuring Drivers
  - [illegible]
  - [illegible]
  - [illegible]

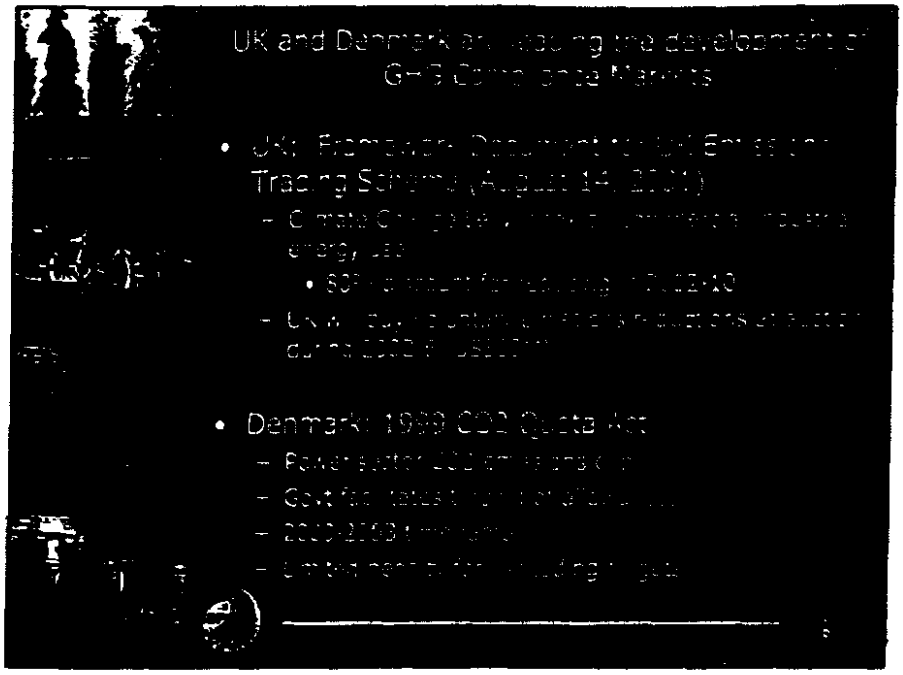
SO2 significance

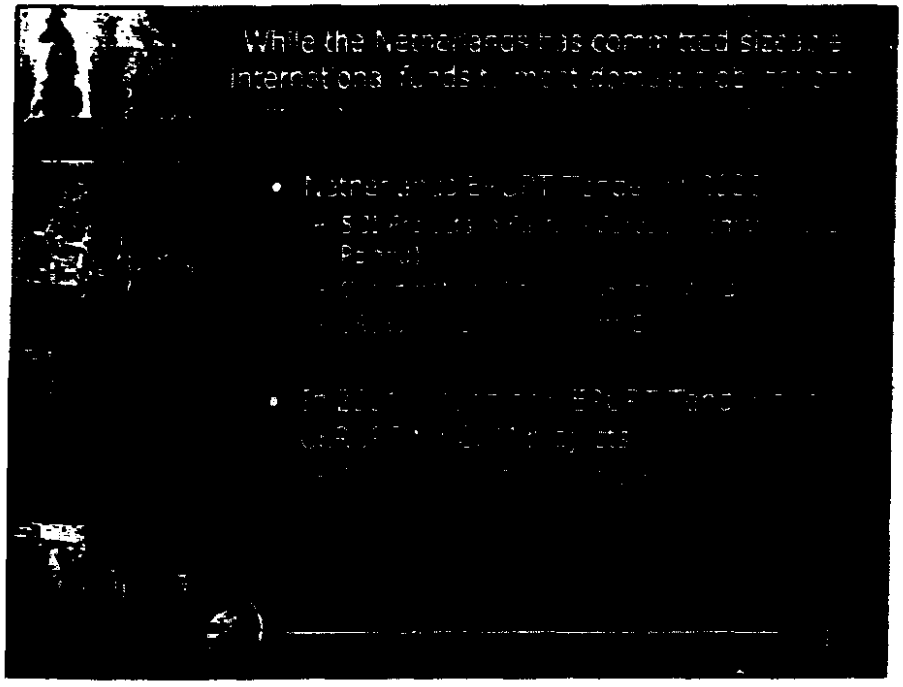
- [illegible]
- [illegible]
- [illegible]

III. Looking forward

Lessons for successful GHG market design

- Well-defined commodity, so participants know what they're getting
- Simplicity so participants know how to get involved
- Effective monitoring for environmental integrity
- Strong penalties to deter non-compliance
- Minimize interference to let market find cheap environmental solutions


UK and Denmark
GHG
Trading Scheme
Denmark: 1999 CO2 Quota Act


While the Netherlands has committed sizable
Period

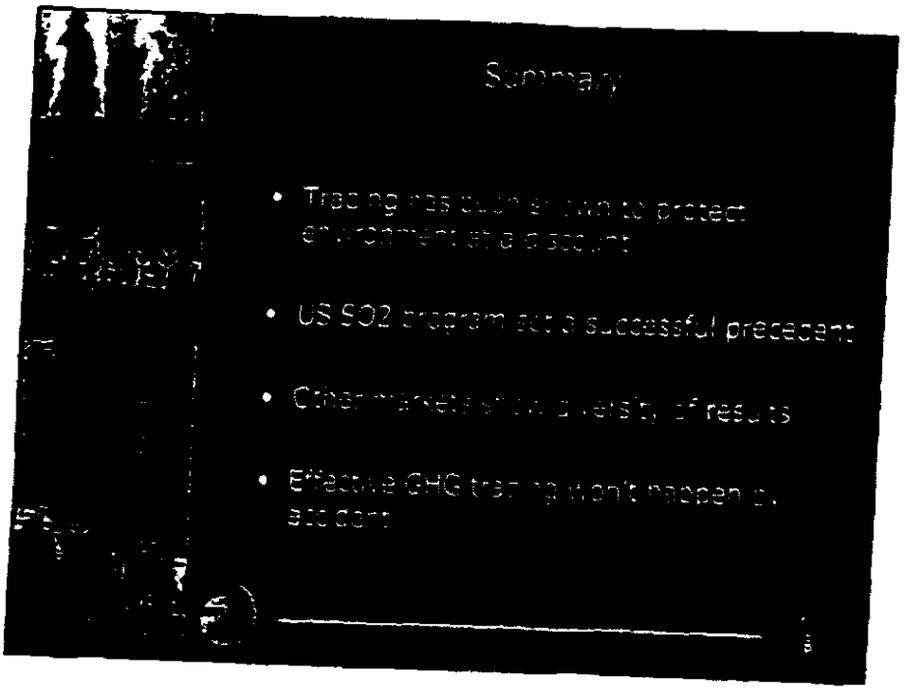
95

Will GHG replicate successes?

- Measurement and baselining [illegible] complex
  - [illegible] small projects [illegible] countries
  - Higher costs for verification and [illegible] for relative [illegible] market (USD1[illegible] [illegible])
  - [illegible] "[illegible]"
- The dramatic effects of Acid Rain DROVE the SO2 market – GHG effects much more controversial

Will GHG replicate successes?

- Multilateral negotiations slow to provide guidance
- Differences in domestic systems (e.g. UK and Denmark) could complicate the global market
- International law hard to enforce


Summary
• US SO2 program set a successful precedent
• Effective GHG trading won't happen by accident

CLEAN ENERGY PROJECT DEVELOPMENT – MACRO VIEW

Mr. Vinay Deodhar
Project Development Specialist
LBG/GEP-CCS Project

98

Greenhouse Gas Pollution Prevention Project

Clean Energy Project Development – Macro View

Mr. Vinay Deosher
Project Development Specialist
LBG/GEP-CCS Project

The Louis Berger Group, Inc.

LB

Portions of this Material is Presented
[illegible] Greenhouse Gas Pollution Prevention Project
[illegible] GEP-CCS Project
[illegible]

Project Finance Defined

- [illegible] dependent on [illegible] generated by the project
- Project assets serve as [illegible]
- [illegible] limited recourse to the promoters books off balance sheet finance
- Ideal for large infrastructure projects Need proper legal and regulatory framework

Drivers for Project Finance

- Liberalised markets and asset reform process
- Stable legal and regulatory framework; suitable political and economic environment
- Need for basic infrastructure with capital scarcity
- Ideal for Emerging Market Economies

Project Finance for Clean Energy

Carbon Market Background

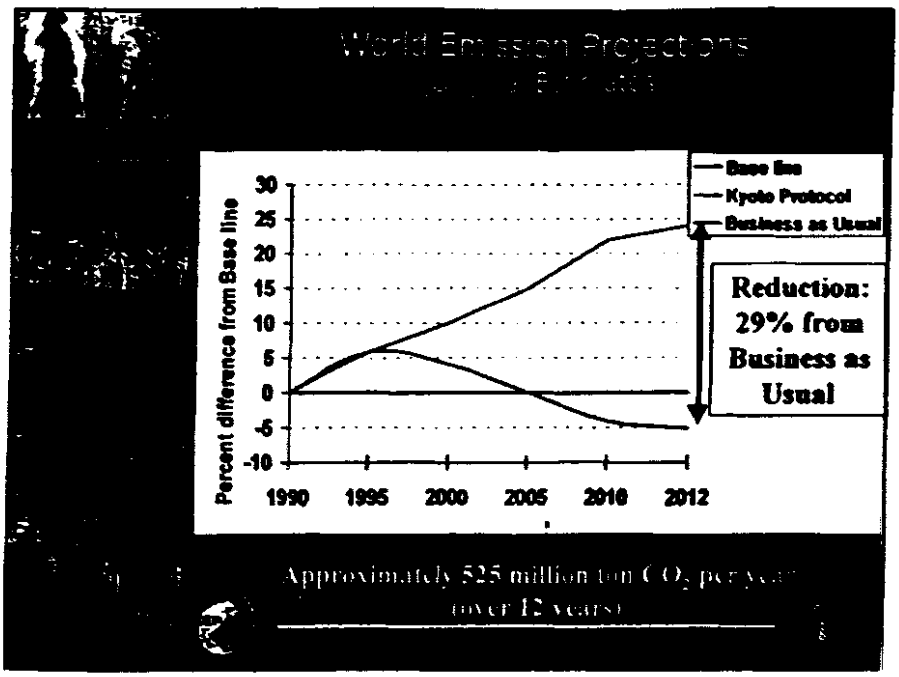
The Emerging International Market

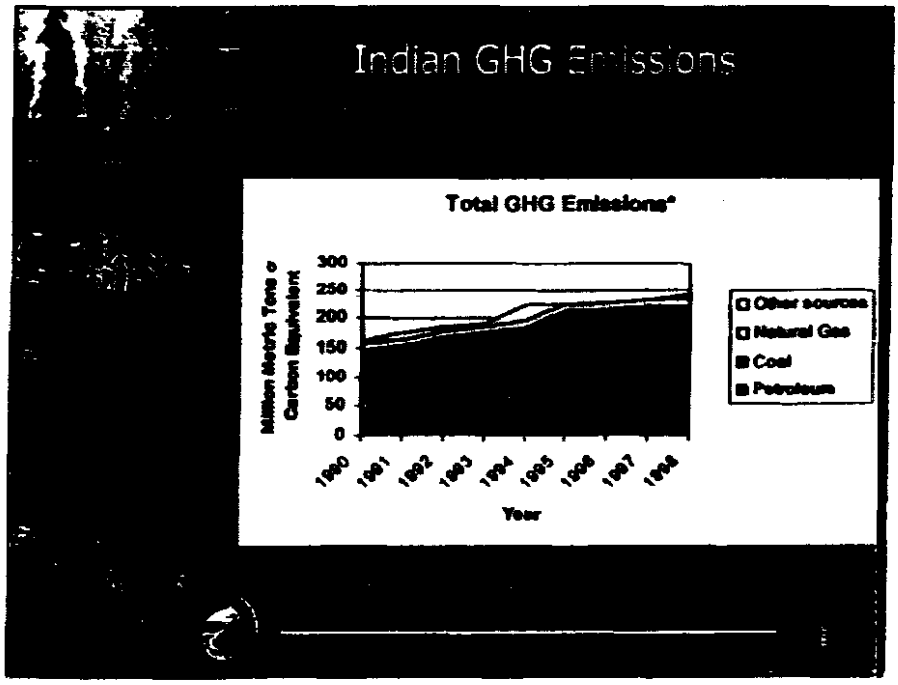
- Market Size and Scope
- Suppliers of Emissions Reductions
  - International Carbon Brokers
  - Clean Exchanges and destination [illegible]
  - Projects
- Demand Signals
  - Private Sector [illegible]
  - [illegible] cap and trade programs
- Emerging Trends

Sources of Supply for GHG Reductions

- Emission Reduction Commitments under UNFCCC
- Voluntary targets by corporations, states and countries
- Market Drivers
- Price Signals

102


World Emission Projections
Percent difference from Base line
30
25
20
15
10
5
0
-5
-10
1990
1995
2000
2005
2010
2012
Base line
Kyoto Protocol
Business as Usual
Reduction: 29% from Business as Usual
Approximately 525 million ton CO_2 per year
(over 12 years)


Indian GHG Emissions
Total GHG Emissions*
Million Metric Tons of Carbon Equivalent
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
Year
Other sources
Natural Gas
Coal
Petroleum

103

Present Drivers for the GHG Reduction Markets

- Caps agreed by Annex I nations
  - EU = 92% of 1990 level
  - UK = 92% of 1990 level
  - Japan = 94% of 1990 level
  - Canada = 94% of 1990 level
- Carbon Purchasers
  - World Bank Prototype Carbon Fund
  - [Oregon] Climate Trust
  - Dutch Government's ERU [illegible] IPC
  - Private Sector Trading Programs

Greenhouse Gas Prices by Commodity Type, Vintage

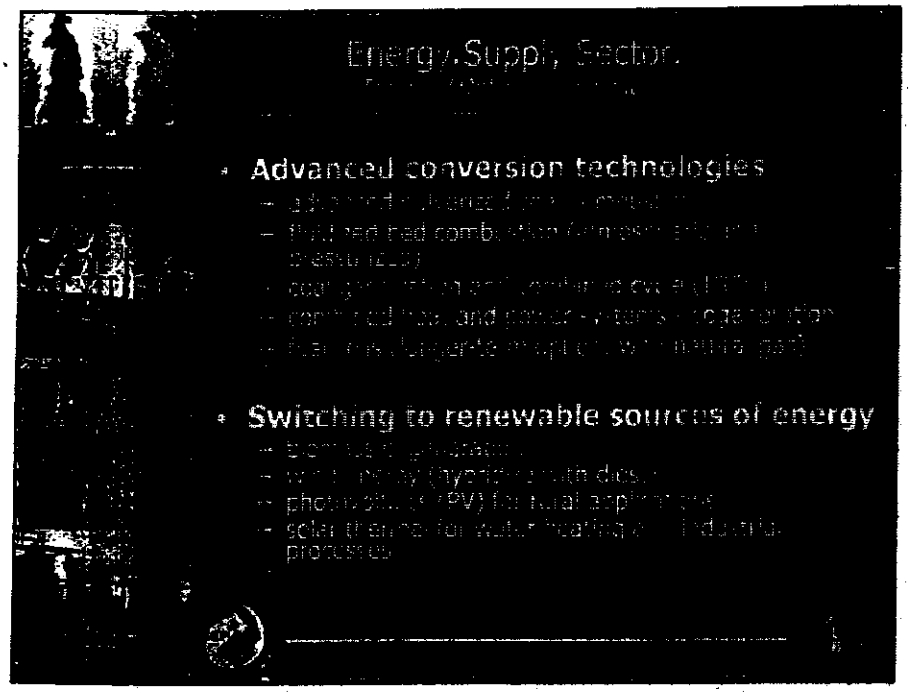
Commodity	Vintage	Price
VERs (Pre-Kyoto)		
Annex B VERs	1991-2007	[illegible]
Annex B VERs	2008-2012	[illegible]
CDM VERs	2000-2001	[illegible]
Dutch ERUs	2008-2012	[illegible]
Compliance Tools		
Danish allowances	2001	[illegible]
Danish allowances – Bid/Offer	2002	[illegible]
UK allowances – Bid/Offer	2002	[illegible]

Sectors Hosting CEPs

Energy Supply Sector

- More efficient consumption of fossil fuels in power plants

7


Energy Supply Sector
Advanced conversion technologies
Switching to renewable sources of energy

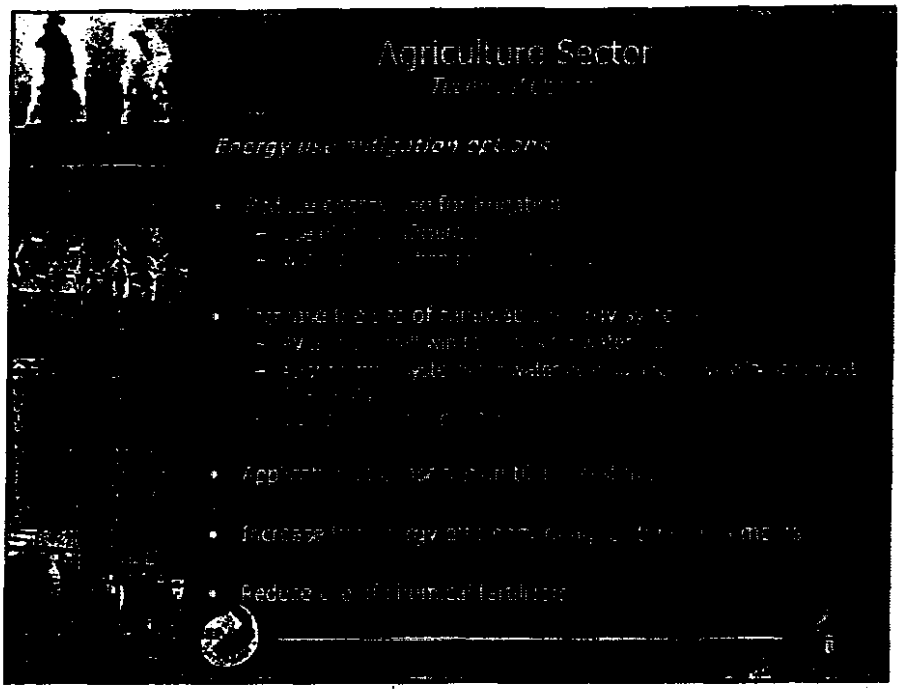
Industrial Sector
Technical Options
Development and application of more efficient technologies and processes
Fuel switching
Cogeneration
Process improvements
Material substitution, recycling and reuse

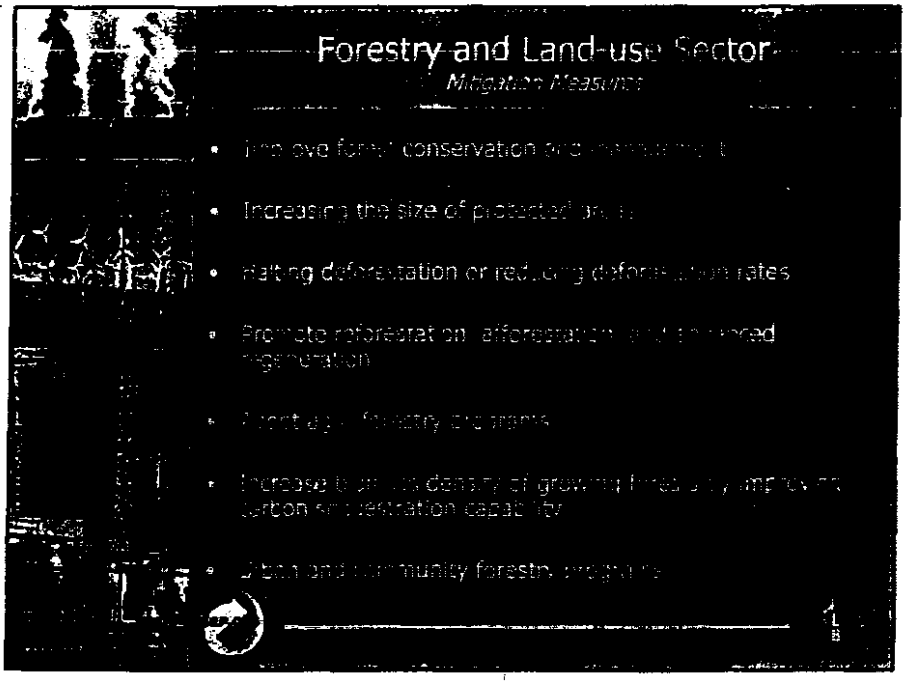
Transport Sector

- Energy Efficiency Improvements for Vehicles
- Alternative Fuel Sources
- Infrastructure and System Changes
- Transport Demand Management

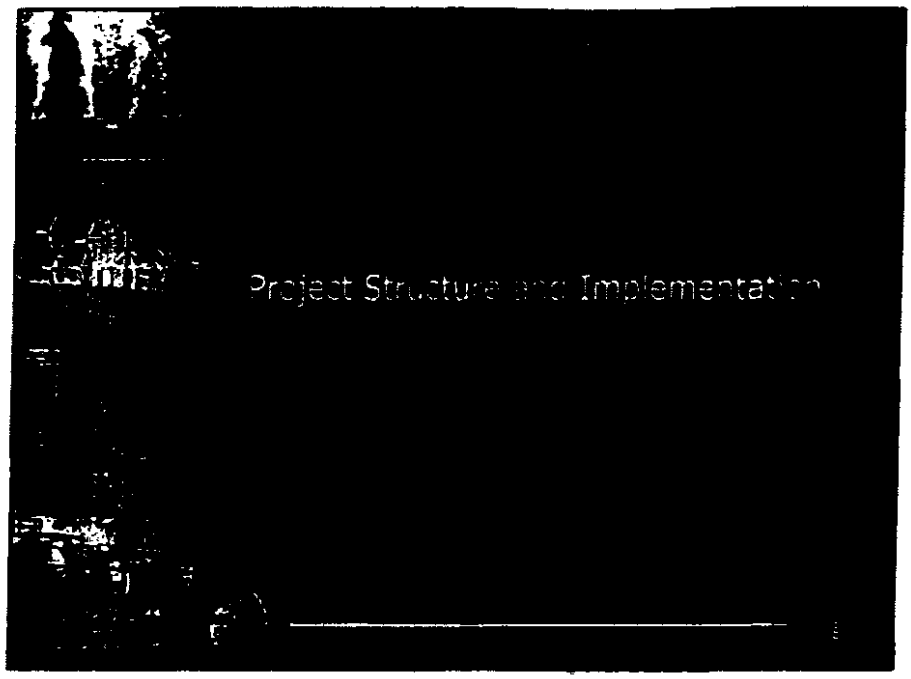
Buildings

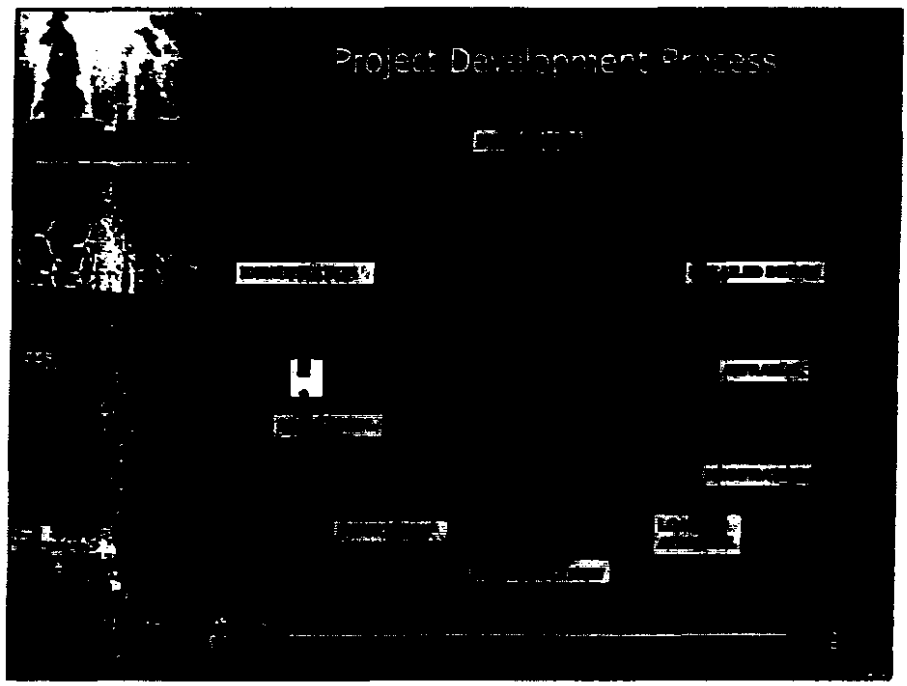
- Building Equipment


Agriculture Sector
Energy use mitigation options


Forestry and Land-use Sector
Mitigation Measures
Increasing the size of protected areas
Halting deforestation or reducing deforestation rates
Promote reforestation, afforestation and assisted regeneration

108


Project Structure and Implementation


Project Development Process

Project Identification

- Develop [illegible] inventory of GHG [illegible] and sinks
- Project the growth of GHG "Base line" scenario
- Identify the activities that are responsible for generation GHG emissions
- Identify the possible GHG abatement activities
- Identify [illegible] CCMPs with a "Least-cost" strategy

Process of Selection of an Investment Project

Idea Generation | Initial Screening | [illegible] | [illegible]

- Project Ideas Compete for consideration
- Management decision based on PFR
- DPR caters to outside stakeholders – Strategic Investors, Lenders and serves basis for Information Memorandum

110

Project Preparation and Design

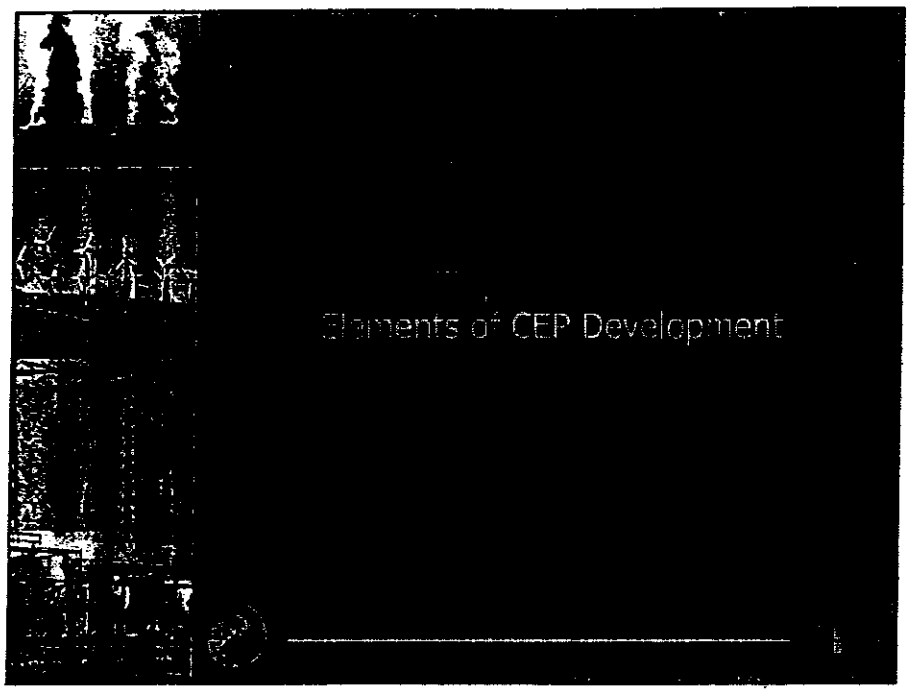
- Pre-feasibility Assessment
  - [illegible]
  - [illegible]
  - [illegible]
- Feasibility Study
  - [illegible]
  - [illegible]
  - [illegible]
  - [illegible]

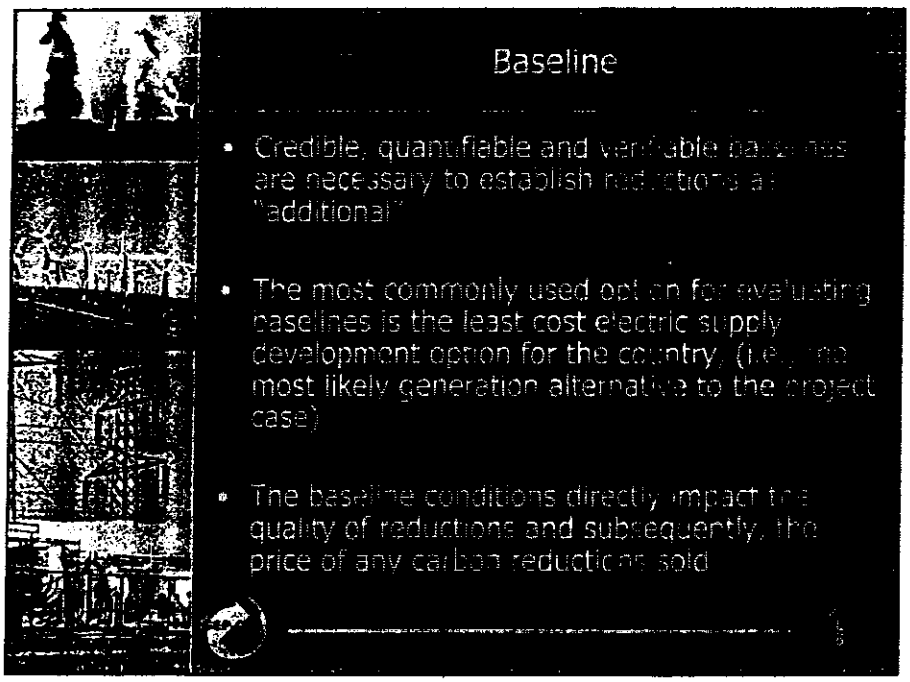
Function of the Project Report

- [illegible]

Idea Generation

- [illegible]
- [illegible]
- [illegible]
- [illegible]


Elements of CEP Development


Baseline
• Credible, quantifiable and verifiable baselines are necessary to establish reductions as "additional"
• The most commonly used option for evaluating baselines is the least cost electric supply development option for the country, (i.e., the most likely generation alternative to the project case)
• The baseline conditions directly impact the quality of reductions and subsequently, the price of any carbon reductions sold

112

Baseline Options

Example project:

- Baseline 1:
- Baseline 2:
- Baseline 3:

Baseline Definition

Key Actors/Stakeholders

- Executive Board
- National Planning Agency
- Sectoral Planning Agencies
- Project Developers
- Project Investors
- ER Buyers

Proposed CEP

Technical/Economic/Financial

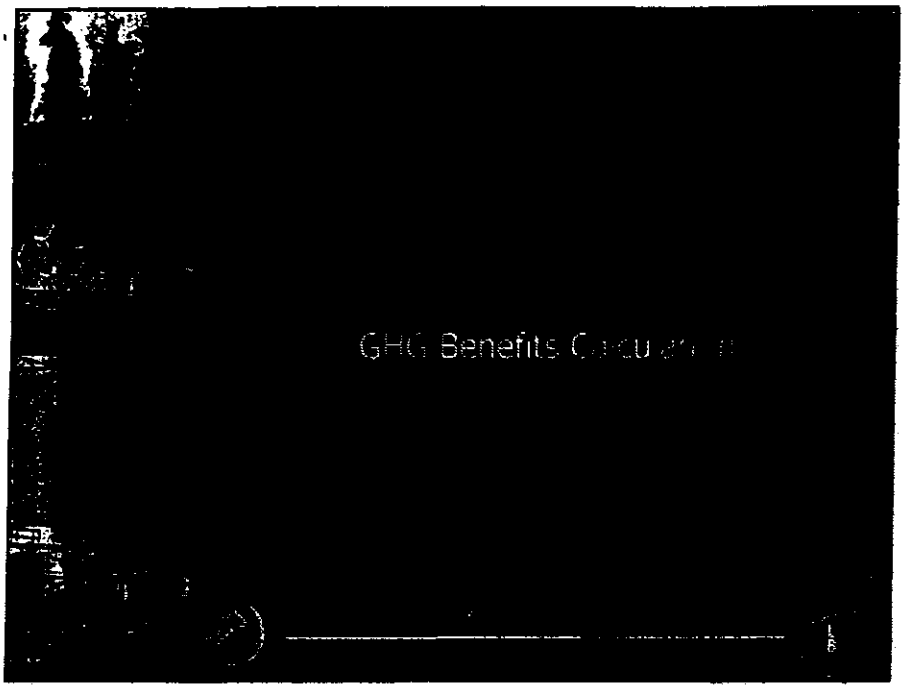
Baseline Definition

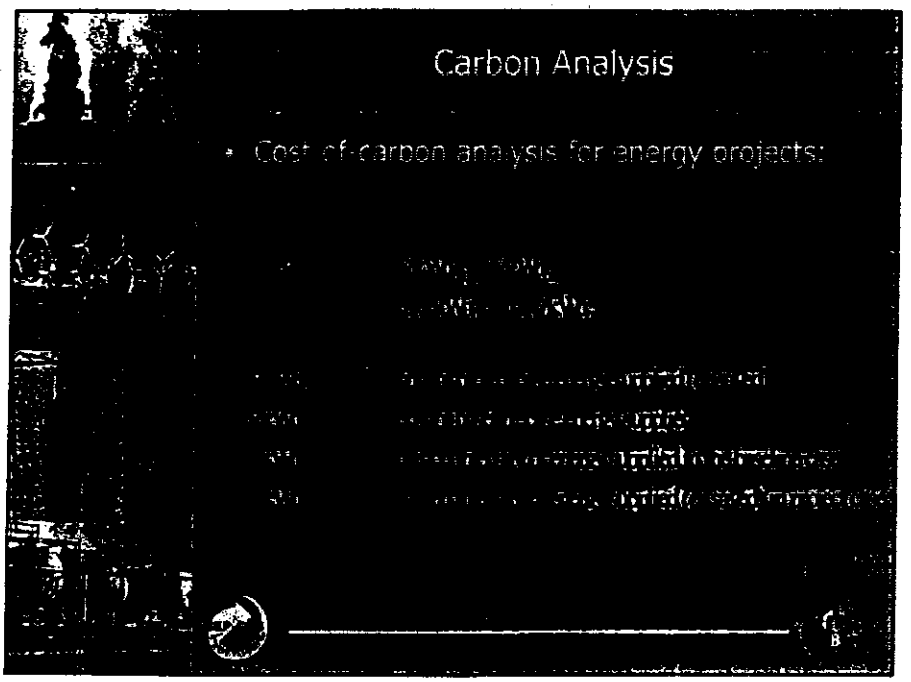
Project Validation

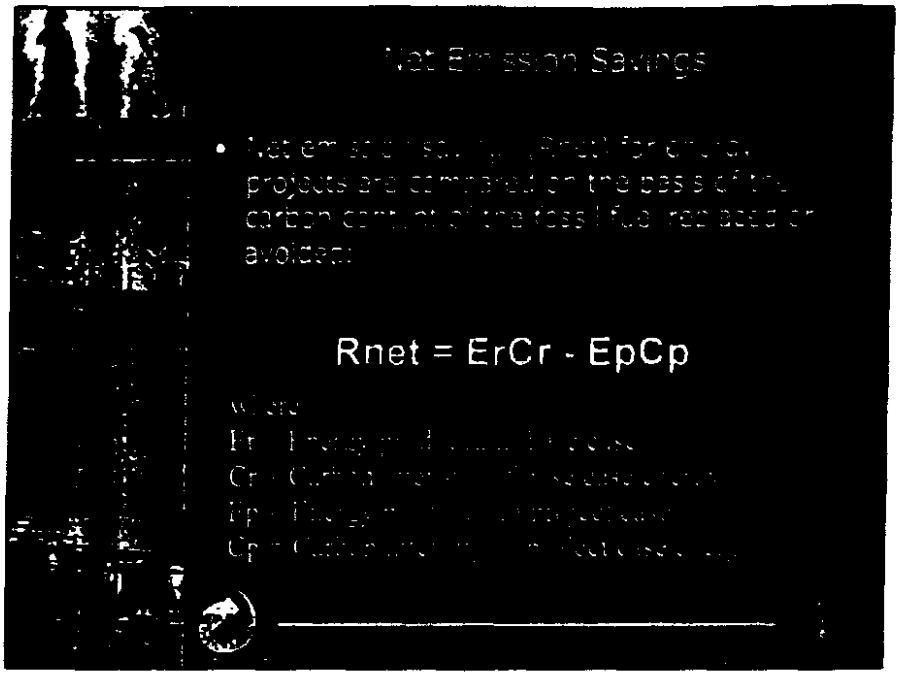
Relevant Issues

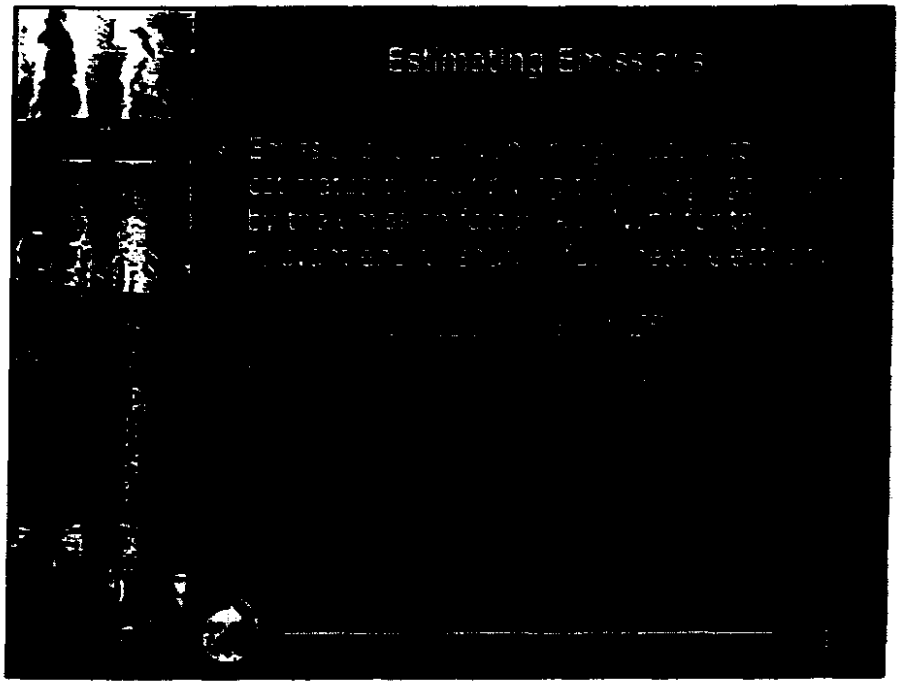
- Emissions additionality
- Financial additionality
- Baseline definition approach
  - -Project specific
  - -Technology matrix
  - -Benchmarks

13


GHG Benefits Calculation


Carbon Analysis
• Cost-of-carbon analysis for energy projects:





115

Cost of Emission Reductions

- Costs of avoided emissions can be calculated by comparing the marginal emission rate and MCOE of an emission reduction option against a baseline.

Where:

CAE = [illegible] avoided emissions

EC_A = [illegible] for option A

EC_B = [illegible] for baseline option B

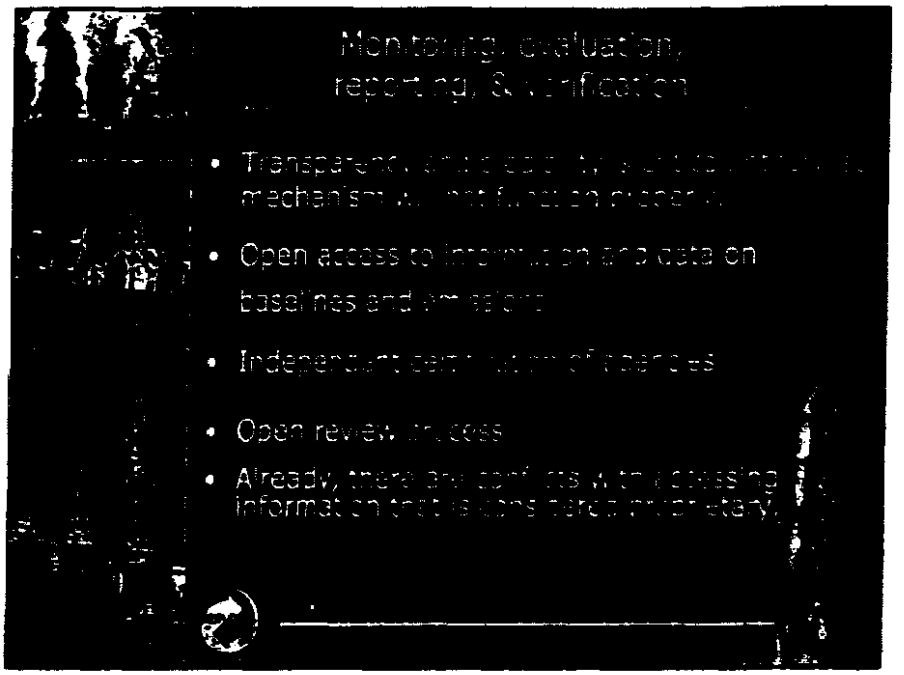
EF_A = [illegible] on A

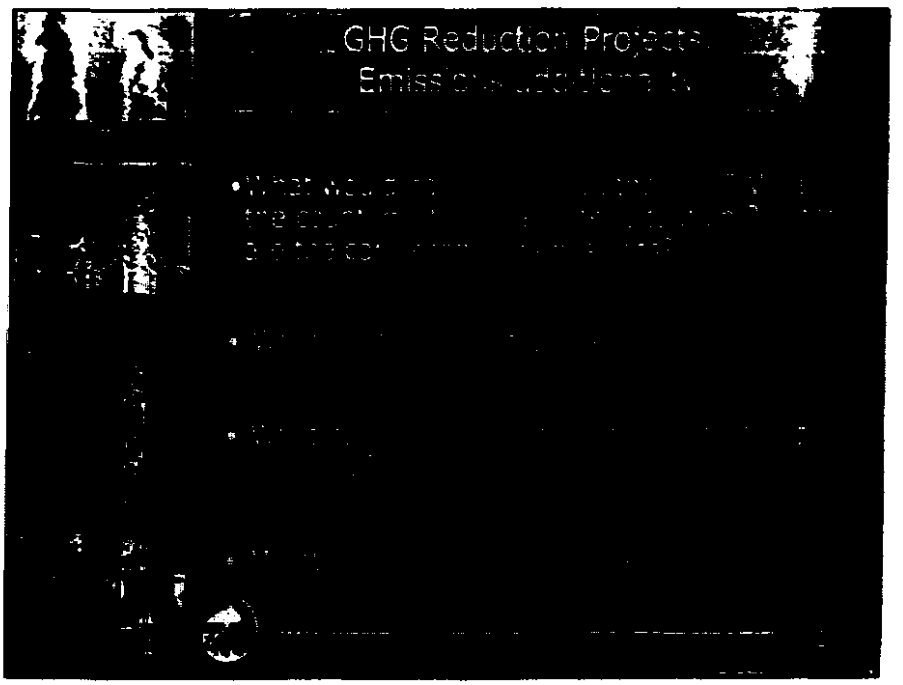
EF_B = [illegible]

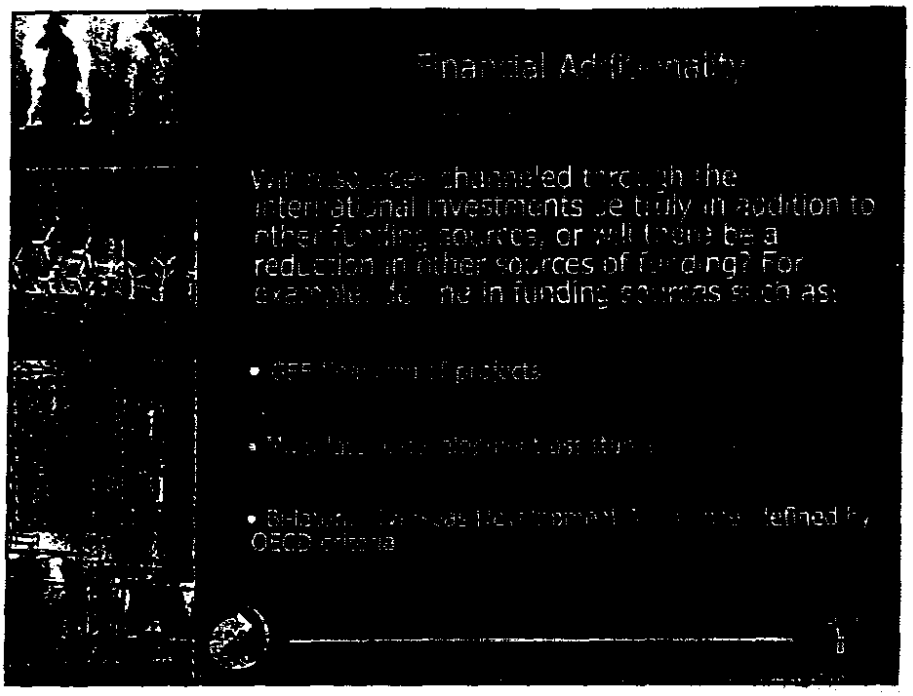
Reduction Quality Evaluation

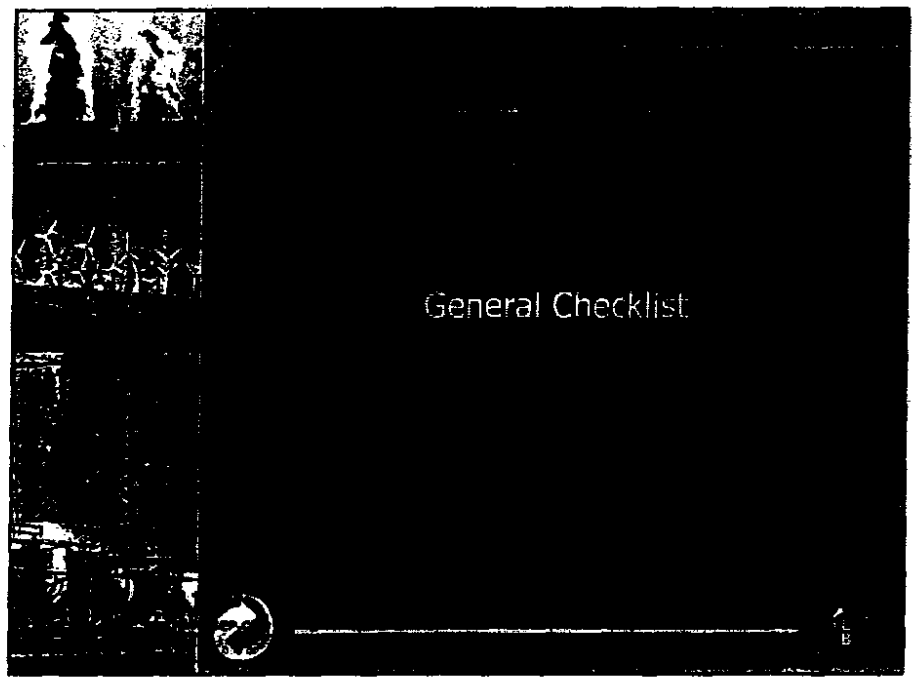
- Evaluate reductions based on:
  - **Leakage**: loss of benefits due to market feedback and indirect effects
  - **Permanence**: Confirmation that the project will continue to provide reductions throughout the proposed lifetime of the project
  - **Verifiability**: Are the reductions [illegible] monitored and verified?

116


Monitoring, evaluation,
reporting, & verification
• Open access to information and data on
baselines and emissions
• Independent certification of baselines
• Open review process


GHG Reduction Projects
Emissions Accounting


Financial Additionality
Will resources channeled through the international investments be truly in addition to other funding sources, or will there be a reduction in other sources of funding? For example, decline in funding sources such as:
• GEF funding of projects
• Multilateral development banks
• Bilateral Official Development Assistance defined by OECD criteria


General Checklist

118

Three major elements:

- **Policy:** What is the [illegible] regulatory environment for CCMPs in the [illegible] and how does this impact [illegible] the sale of carbon reductions?
- **Commercial:** Do the financial arrangements of the project stand up to financial institutions' expectations (with [illegible] the sale of reductions)?
- **Environmental:** A key element of CCMPs is confirming that the project is actually producing an environmental benefit that would not have occurred under normal market conditions

Environmental Element "Most Crucial"

- [illegible]
- [illegible]

Environmental Element (cont'd)

- [illegible] issues concerning the parameters [illegible] boundaries for the project's system [illegible] vis-à-vis GHG emissions?
- [illegible] Monitoring & Verification Protocol [illegible] been developed to re-calculate annual GHG emissions reductions?
- [illegible] party certification body [illegible] independently verify results of MVP reports? If so, are the costs included in the price for sale of the carbon reductions?

Tea Break –

We will continue tomorrow with detailed project structuring discussion

CLEAN ENERGY PROJECT BUSINESS PLANS AND FINANCIAL STRUCTURING EXERCISE

Mr. Rodrigo Carvajal
The Louis Berger Group, Inc.

Mr. Ted Yoder
The Louis Berger Group, Inc.

Climate Change Supplement

Greenhouse Gas Pollution Prevention Project

"Clean Energy Project Business Plans and Financial Structuring Exercise"

Mr. Rod Carvajal
Mr. Ted Yoder
The Louis Berger Group, Inc.

Objective of this Training Component

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Key Elements of Business Plans Utilized in CEP

[illegible]

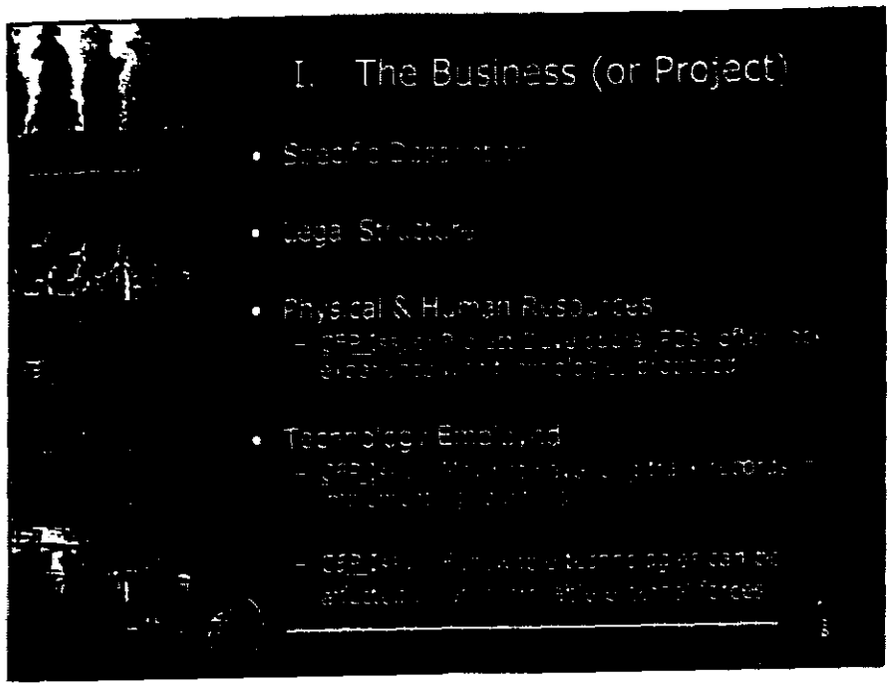
- [illegible] Standard Business Planning Approach
- Address and Adhere to CEP Informational Requirements
  [illegible] Feasibility Analysis and [illegible]
- Address Nuances Specifically Related to CEP Development and Financing

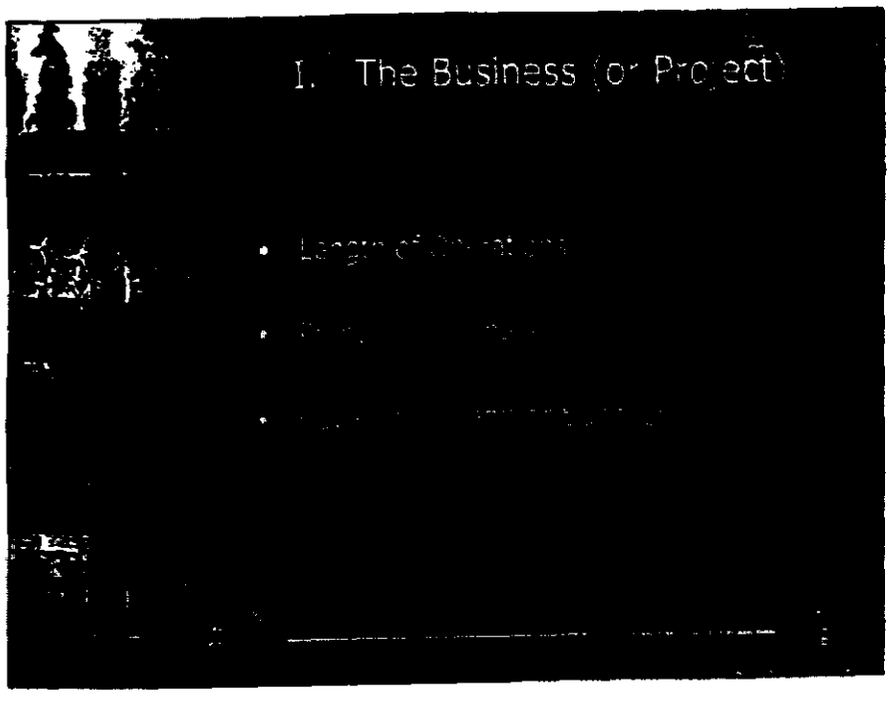
Key Elements of Business Plans Utilized in CEP

Major Categories:

- ✓ The Business
- ✓ The Market
- ✓ The Competition
- ✓ Pricing
- ✓ Marketing Plan
- ✓ Management
- ✓ Implementation Plan
- ✓ Proposed Financing
- ✓ Financial Plan

123


I. The Business (or Project)
Legal Structure
Physical & Human Resources
Technology Employed


I. The Business (or Project)

124

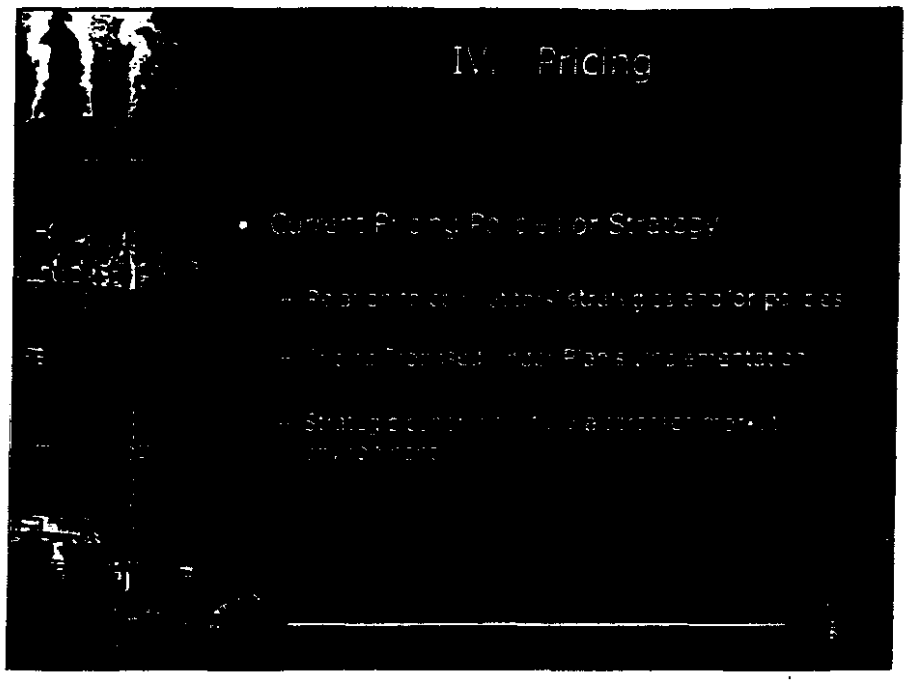
II. The Market

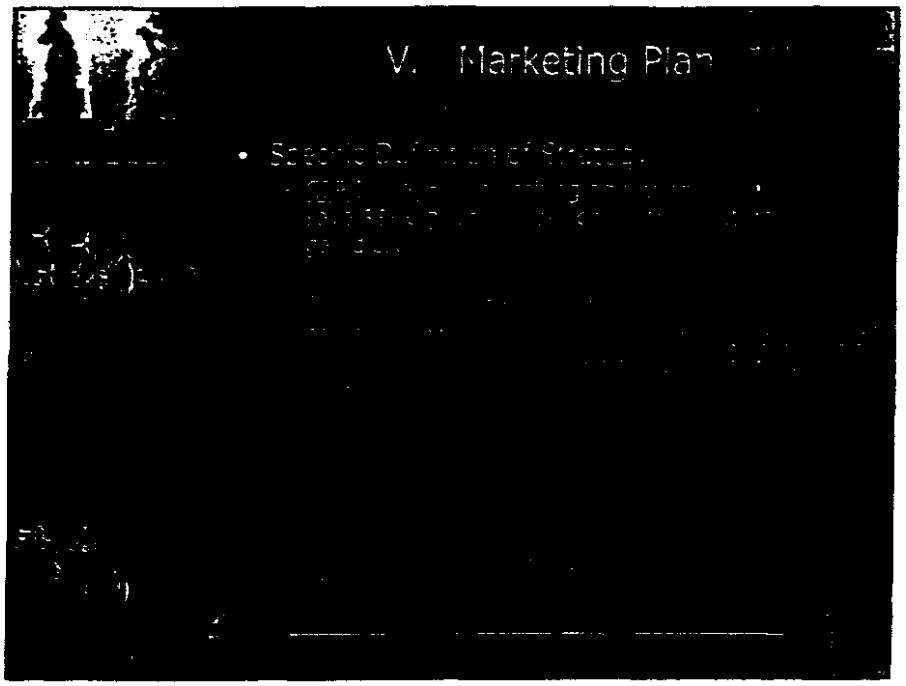
- Scope of Market
- Geographic & Demographic Dimensions
- Competitive Relative Positioning
- Supply Chain & Dynamics
- Regulatory Aspects

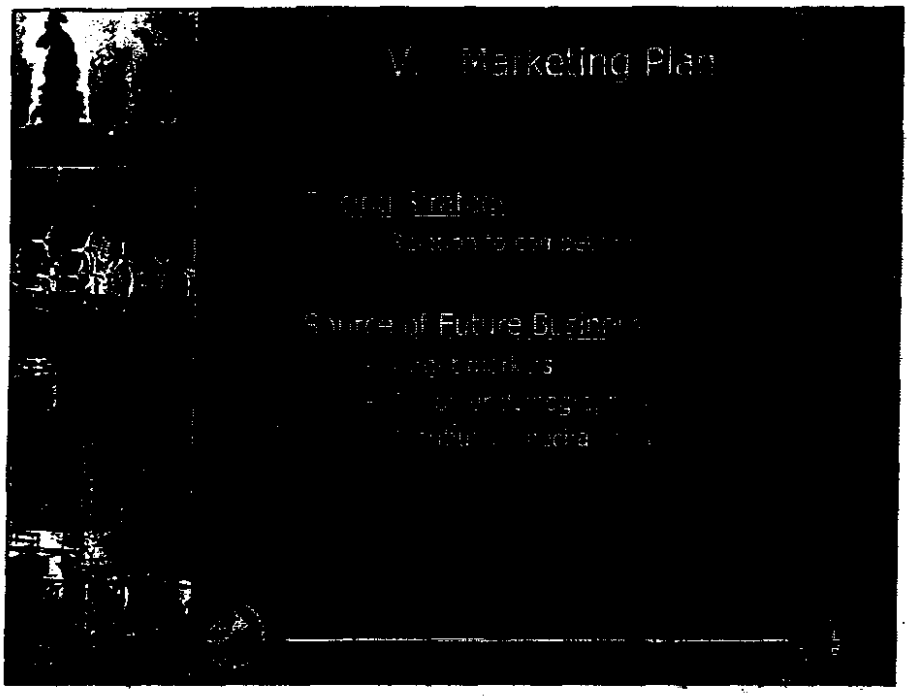
III. The Competition

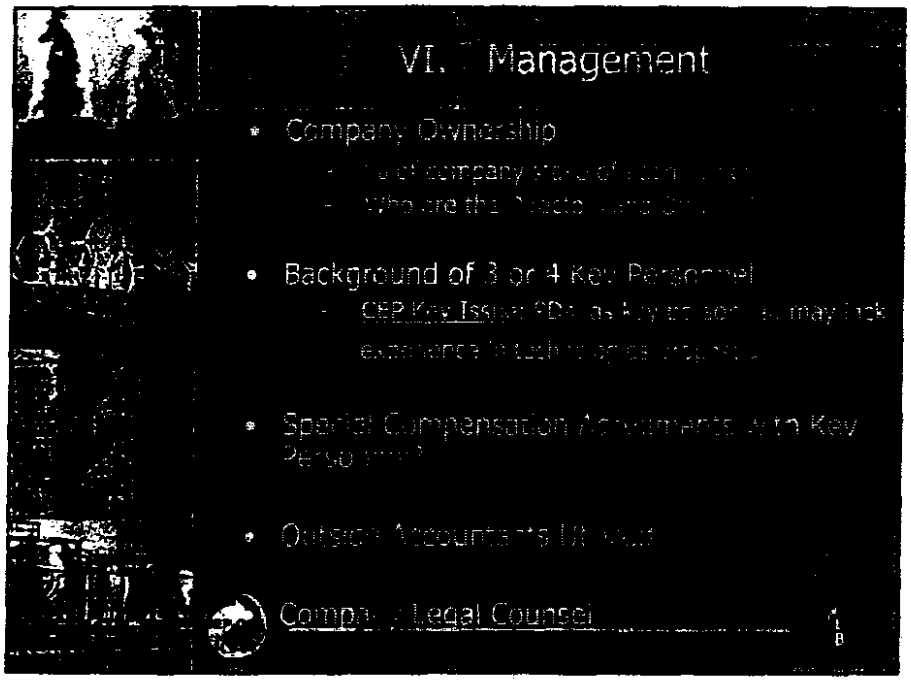
- Qualitative Description of Competition
  - Strategic aspects
    - CRP ISSUE: Competition for fuel supply, e.g. hydro vs. agricultural use of water
- Quantitative Description of Competition
  - Relative market shares
  - Number of firms
  - Identification of firms & associated customer base
- Product Differentiation (Market Niche Definition)

125


IV. Pricing


V. Marketing Plan


V. Marketing Plan
Source of Future Business

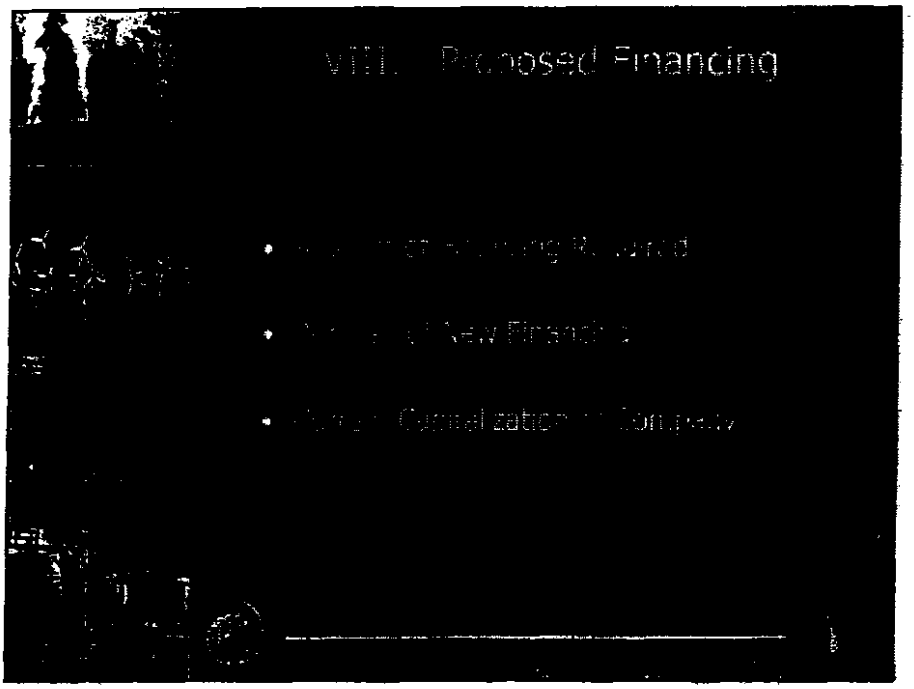

VI. Management
Company Ownership
Background of 3 or 4 Key Personnel
Company Legal Counsel

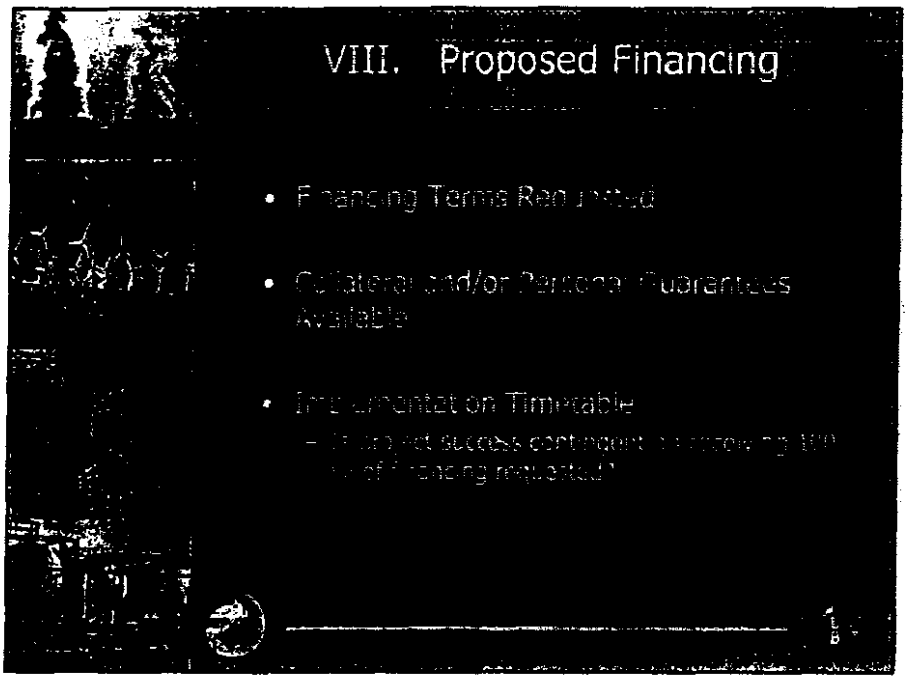
VII. Implementation Plan

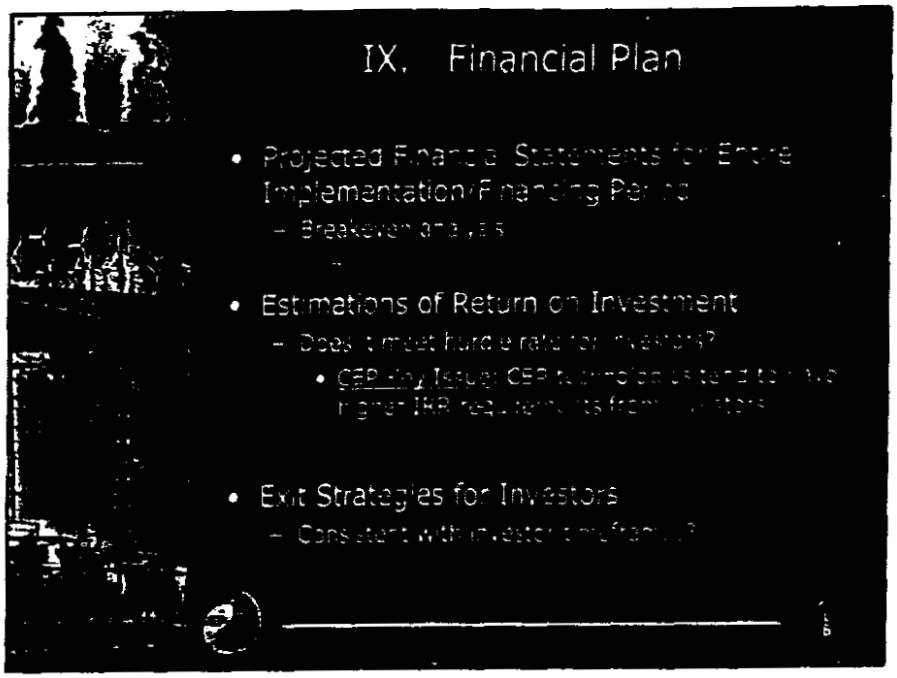
- [illegible] Consistent with Overall Plan
- Explains How Company Will Expand Operations Under New Financing
  - [illegible]
- Defines Pertinent Risks and How They Will Be Handled

VII. Implementation Plan

- Defines Pertinent Risks and How They Will Be Handled, Cont.
  - [illegible]


VIII. Proposed Financing


VIII. Proposed Financing
Financing Terms Required
Collateral and/or Personal Guarantees Available
Implementation Timetable


IX. Financial Plan
• Projected Financial Statements for Entire Implementation/Financing Period
– Breakeven analysis
• Estimations of Return on Investment
– Does it meet hurdle rate for investors?
• CEP Key Issue: CEP is unfortunately tend to have higher IRR requirements from investors
• Exit Strategies for Investors
– Consistent with investor timeframe?

130

CLEAN ENERGY PROJECT DEVELOPMENT – STRUCTURING ELEMENT

Mr. Vinay Deodhar
Project Development Specialist
LBG/GEP-CCS Project

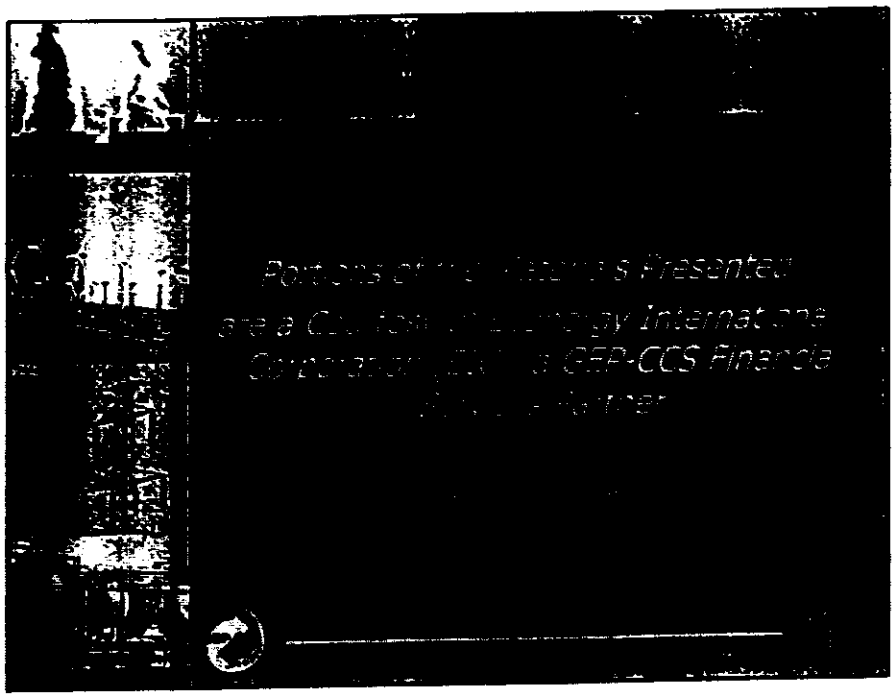
Climate Change Supplement

Greenhouse Gas Pollution Prevention Project

Clean Energy Project Development – Structuring Elements

Mr. Vinay Deodhar
Project Development Specialist
The Louis Berger Group, Inc.

The Louis Berger Group, INC



132

Outline

- Elements of a GHG mitigation project
- Transparent results + GHG mitigation specific
- Differentiation of Climate Change Mitigation Project (CMP) and Business as Usual Scenario thru [illegible] applying approximation methods and establishing its emission intensity,
- Explaining the "Additionality" (environmental, financial, technological & social)
- Valuing Carbon Offsets, [illegible] settlement over baselines and incorporating it in project financial [illegible] enable decision making
- Explained in the context of a human project cycle

Why Carbon Finance?

- Provide additional revenue sources only available to climate change projects
- Sector is underdeveloped with many potential low-cost, quick return projects
- Generation of carbon premium
- Project fits the regulatory framework [illegible] carbon trading

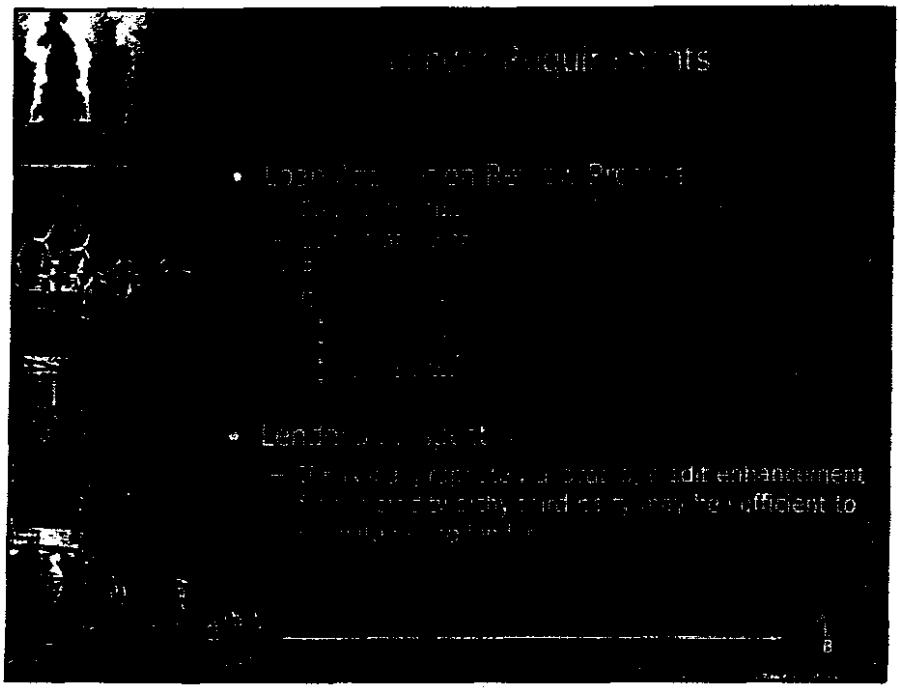
Carbon Revenue Stream

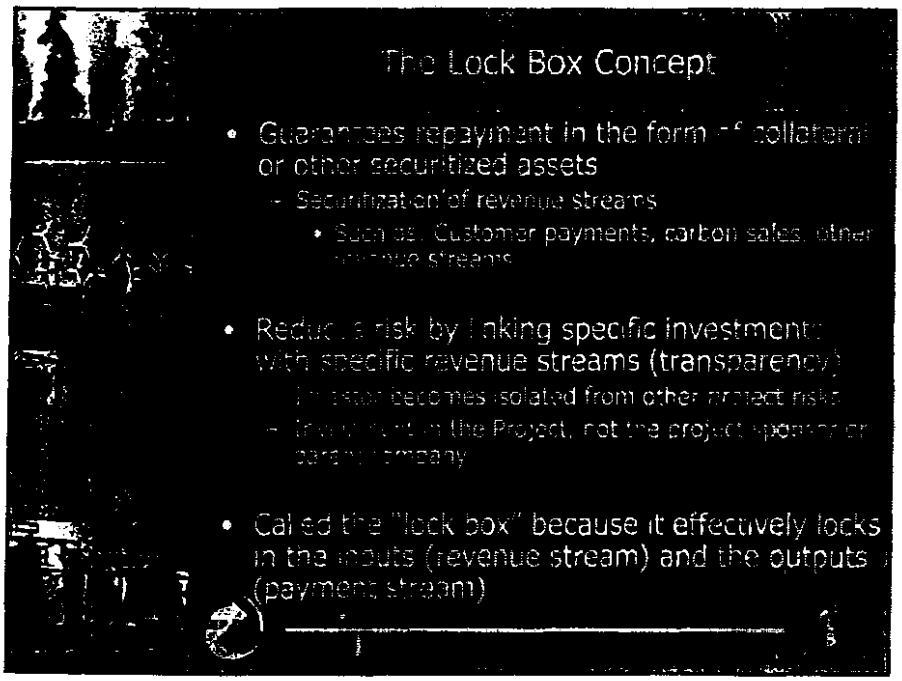
- Non-recourse financing means recourse to cash flows as primary security
- Any cash flow can be a security
- Carbon sales can help meet financial gap

CEP Project Analysis

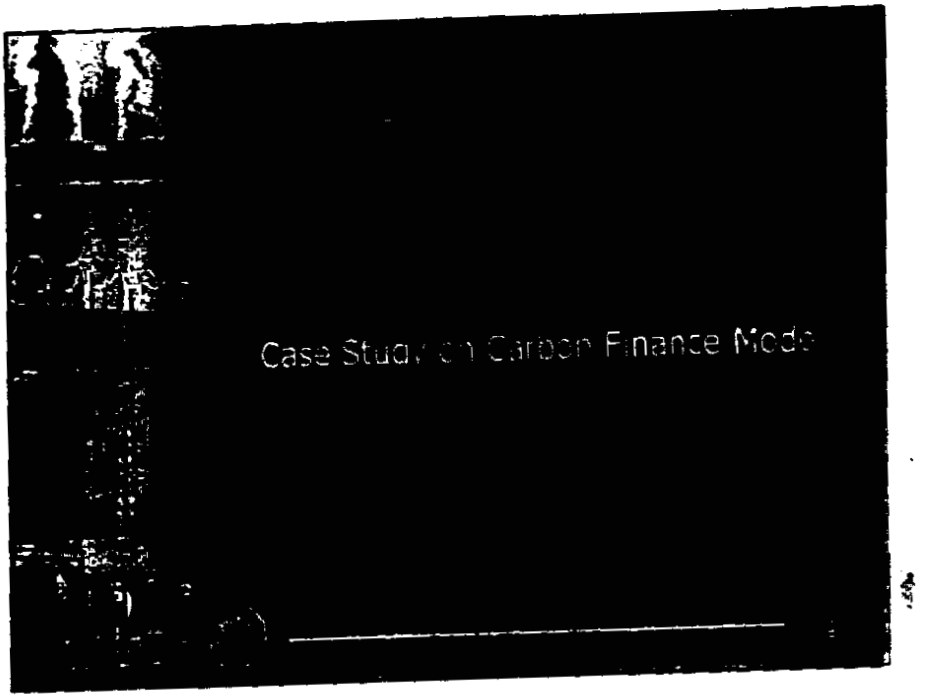
- CEP investments may appear risky to the lender, due to lack of information and resulting uncertainty.

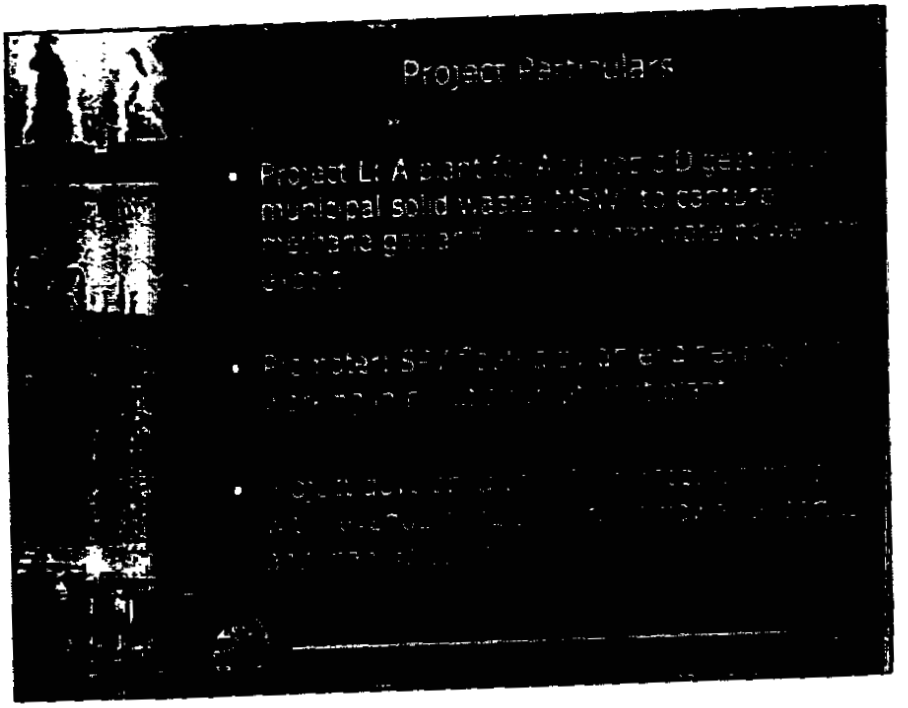
134




The Lock Box Concept
• Guarantees repayment in the form of collateral or other securitized assets
– Securitization of revenue streams
• Such as: Customer payments, carbon sales, other revenue streams
• Reduces risk by linking specific investments with specific revenue streams (transparency)
– Investor becomes isolated from other project risks
– Investment in the Project, not the project sponsor or parent company
• Called the "lock box" because it effectively locks in the inputs (revenue stream) and the outputs (payment stream)

135


Case Study on Carbon Finance Mode


Project Particulars
• Project L: A plant for
municipal solid waste (MSW) to
methane gas
• Project
• Project

Needs Prior to GHG Analysis

[illegible]

Steps in Project Analysis

1. Review the Check-list to see if carbon finance is right for the project
2. Review the project to insure that: a) it can be realistically implemented, b) reduces GHG emissions, and c) can assist India in achieving sustainable development
3. Choose a business model: the traditional corporation vs. the special purpose vehicle
4. Valuing of the project
5. Complete a basic projected Income Statement for the project
6. Estimate the discount or hurdle rate
7. Calculate the Net Present Value
8. Calculate the Levelized Cost of the Project

Steps in Project Analysis

9. Identify Project Risk Factors
10. Distinguish between qualitative and quantitative risk
11. Develop a Risk Matrix
12. Decide the appropriate level of Debt the project
13. Decide the company's investment hurdle rate (or Cost of Capital)
14. Recalculate the project's net present value (NPV)
15. Decide the appropriate level of Debt for the project
16. Decide the best risk mitigation procedures for the project

Nature of GHG Mitigation

- Project L leads to reduction [illegible] biodegradation of [illegible] 300 TPD municipal solid waste, which otherwise [illegible] emitted from dumps.
- [illegible]
- [illegible]

[illegible]

138

GOI Perspective

- [illegible] demanded as a [illegible] to energy [illegible] by MNES. GOI approval is imminent
- [illegible] not amount [illegible] of Official [illegible] Assistance [illegible]
- Project involves a sustainable and environmentally "additional" activity and could also provide cleaner work for the unorganized "rag pickers"

Thus the project exhibits...

- Environmental Additionality – Better than business as usual scenario
- Technological Additionality – Advanced technology is being provided [illegible] Additionality – Need for additional funding to sustain GHG mitigation [illegible] the diversion of ODA
- Social Additionality – through improving the health and hygiene in the city and also providing additional employment

139

Hence We may proceed with further analysis...

- Baseline Analysis
- GHG Mitigation Potential Estimation
- Monitoring & Verification System
- Valuation and Integration into Financial Analysis
- Risk Assessment & Mitigation

What is a Baseline?

- It represents the emissions that would occur in the absence of a GHG mitigation project
- Integration [illegible]
- Baseline [illegible]
- The [illegible] project [illegible]

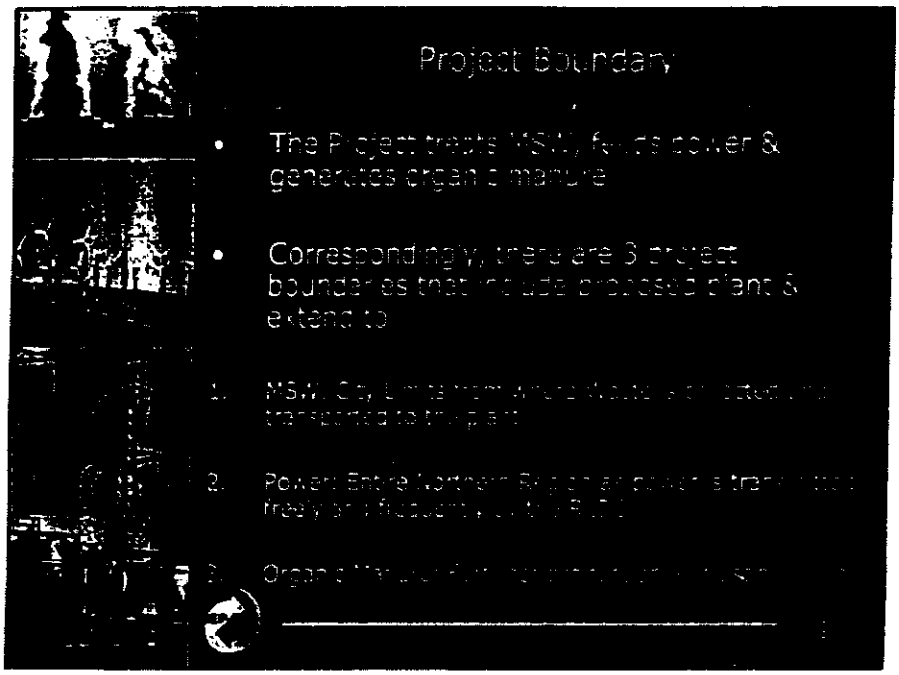
Steps in Establishing Baseline

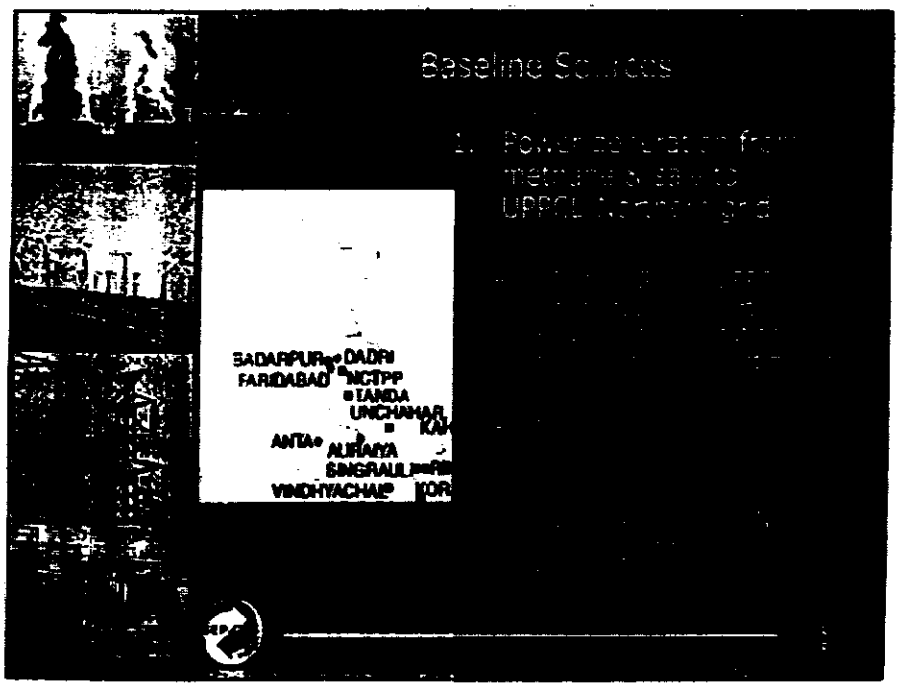
1. Define project boundary
2. Identify the appropriate baseline source
3. Gather required data
4. Calculate baseline carbon emission rate
5. Calculate emission reductions

GHG Reduction Objectives of the Case Project

- Clear Technology Nature
  - [illegible] best technology [illegible] treatment and methane abatement
  - GHG abatement on three counts
- SD Objectives/Aspects
  - Direct and indirect employment potential for local population
  - [illegible] work only component for unorganized [illegible] ragpickers/recyclers
  - [illegible] in health & hygiene
- Host Country Objectives
  - Meets objectives of MOEF SWM Rules 2000
  - [illegible] Technology Demonstration Project of MNES

141


Project Boundary
The Project treats MSW, feeds power & generates organic manure
Correspondingly, there are 3 project boundaries that include proposed plant & extend to


Baseline Sources
1. Power generation from methane in landfills UPPCL Northern grid
SADARPUR
DADRI
FARIDABAD
NCTPP
TANDA
UNCHAHAR
ANTA
AURAIYA
SINGRAULI
VINDHYACHAL

142

Baseline Sources

2. Methane capture
   - Current Practices in India are: Open dumping of MSW
   - No segregation of bio degradable and inert material
   - Organic matter putrefies in the dumps. Generated methane escapes into atmosphere
   - Thus, Business as usual is No recovery of methane from degrading urban solid waste

Baseline Sources

3. Organic Manure
   - Chemical fertilizers like urea, ammonia, potash and DAP, SSP are business as usual. However, only a small fraction of these is absorbed by the plants.
   - Organic manure would provide a valuable supplement to chemicals N P K
   - Sludge release by MSW generated organic manure may be suitable to plantations, like tea
   - Large use of energy in chemical fertilizer manufacture

143

Data Collection Sources

1. Electric Power Sector

- CEA statistics
- Planning Commission [illegible] Reports of [illegible] SEBs and EDs
- Reports of National Council of [illegible] Board of Irrigation & Power [illegible]
- Report of World Bank
- Meetings with state and [illegible]

Data Collection Sources

2. Methane Capture from [illegible]

- [illegible]
- [illegible]
- [illegible]

Data Collection Sources

- Organic Fertilizer Manufacture
  - [illegible] of Fertilizers
  - [illegible] Fertilizer Institute Association
  - [illegible] Utilization
  - [illegible] LBNL [illegible] on [illegible] manufacture
  - Data [illegible] organic manure from [illegible]

Electric Power Capacity

[illegible]	[illegible]	[illegible]	2001	[illegible]	2000	[illegible]	2001	[illegible]
[illegible]	4542	75	4102	73	[illegible]	79	[illegible]	75
[illegible]	1533	25	1533	27	[illegible]	21	[illegible]	25
[illegible]	6075	[illegible]	5635	100	14882	100	15285	100

145

Electric Power Generation

	2000		2001		2010		2001	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	52656	[illegible]
[illegible]	6232	[illegible]	6241	[illegible]	[illegible]	[illegible]	12067	[illegible]
Total	24356	100	24765	100	62607	100	64593	100

Revelations!!

- Although the Thermal:Hydal capacity mix improved towards Hydal both in UPSEB and NRLDC from 2000 to 2001, the actual generation mix tilted towards [illegible]
- UP Purchases [illegible] each year, 99.5% [illegible] which comprises [illegible] and 5-[illegible] Hydal
- The [illegible]

146

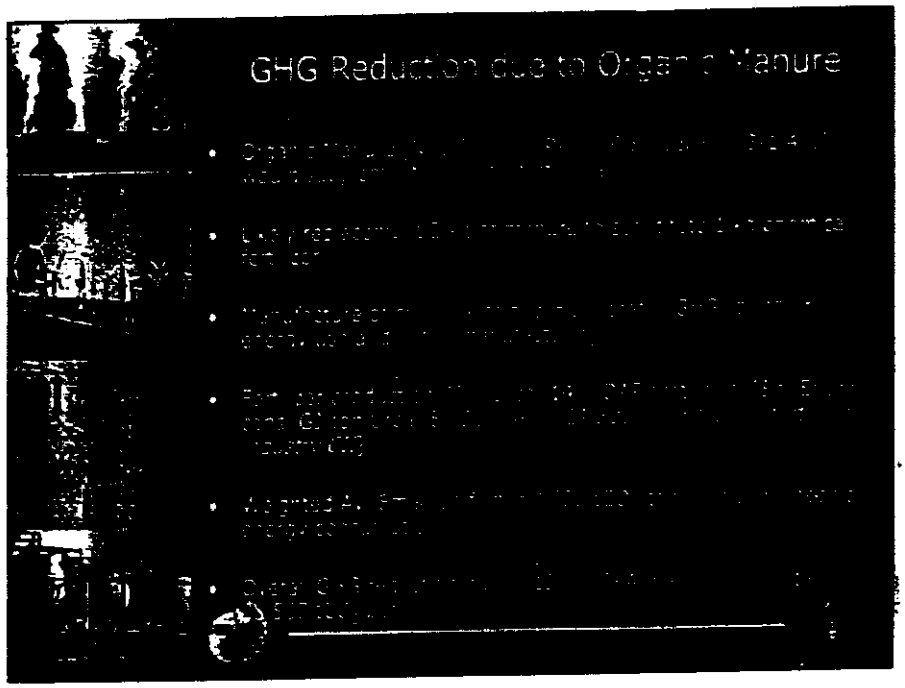
GHG Reduction from Sale of Power

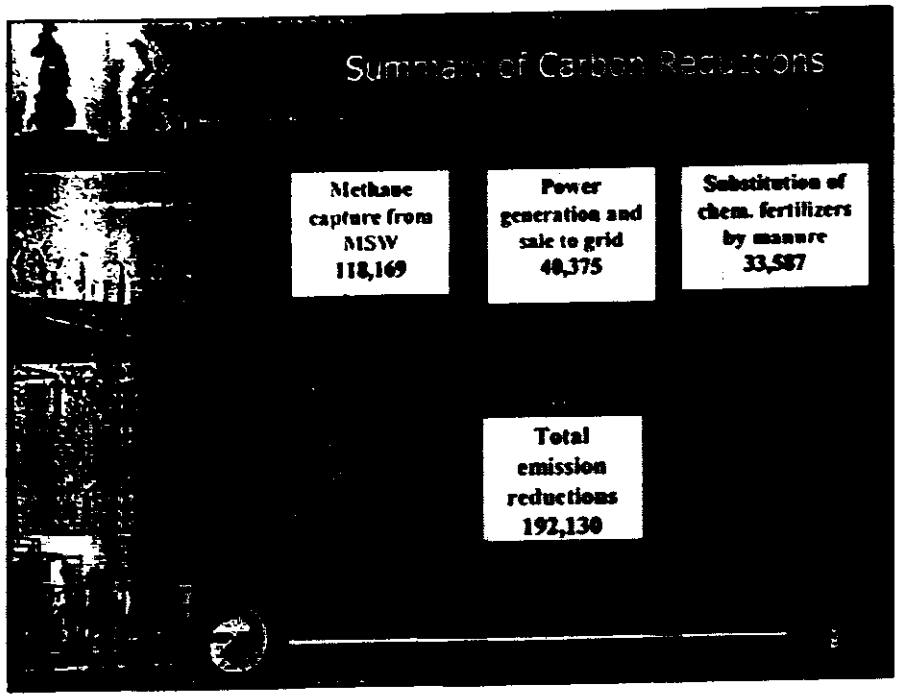
- [illegible] capacity of Central [illegible] Plus (mainly [illegible]) 82% coal, 18% gas
  [illegible]
  [illegible] efficiency [illegible] during [illegible]
  [illegible]
- [illegible] considerations, the weighted average emission factor for power replaced by proposed GHG [illegible] project should be 21.5 tCO2/TJ [illegible] 0.2841 tCO2/MWh
- Thus, the power supplied by 5.1 MW project @ 84% availability leads to reduction of 10,375 Tons of CO_2 per annum

Methane avoided from MSW Dumping

- Proposed plant is expected to lead to faster digestion of biodegradable matter and recover maximum amount of methane
- Methane left over in the manure (only a small fraction) [illegible] contribute to GHG abatement
- [illegible] reduction of GHG from this stream = methane captured in process
- [illegible] captured in the proposed project is 5,627 tons [illegible]
- Consequent CO2 emission reduction = 118,169 tCO_2 per [illegible]

147


GHG Reduction due to Organic Manure


Summary of Carbon Reductions
Methane capture from MSW 118,169
Power generation and sale to grid 40,375
Substitution of chem. fertilizers by manure 33,587
Total emission reductions 192,130

145

Monitoring & Verification

- In developing a baseline, projections are made about future parameters
- M&V is the process of measuring these parameters, for updating the emission reduction calculations
- The baseline emission rate and actual emission reductions must be measured and recorded so as to document and quantify project's performance

M&V Plan

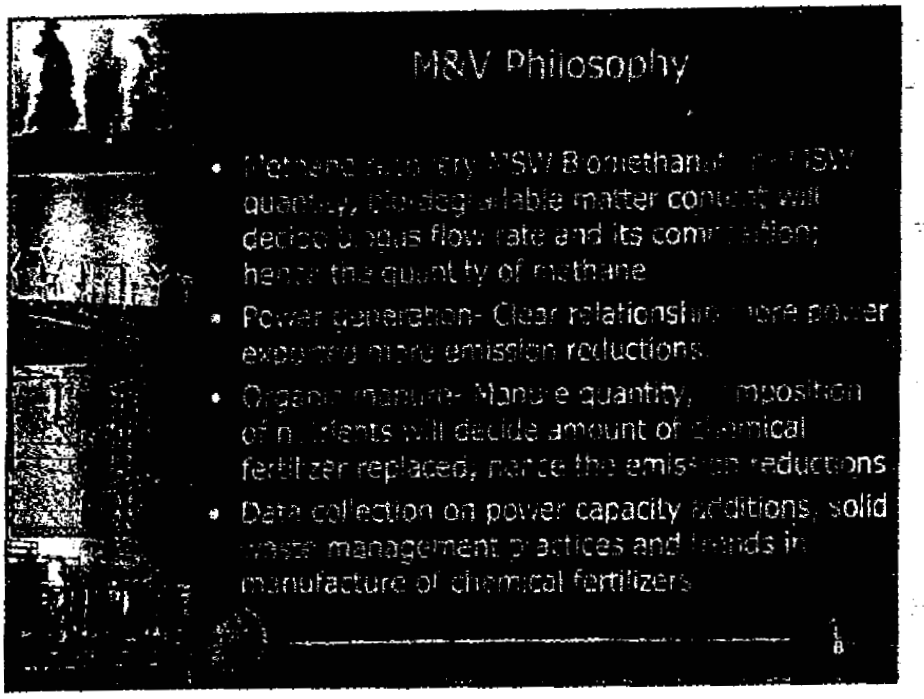
- M&V plan must be prepared and validated during the design stage to ensure consistency in the indicators to be used throughout the project
- Technically credible M&V plans are considered an essential part of a carbon offset project plan

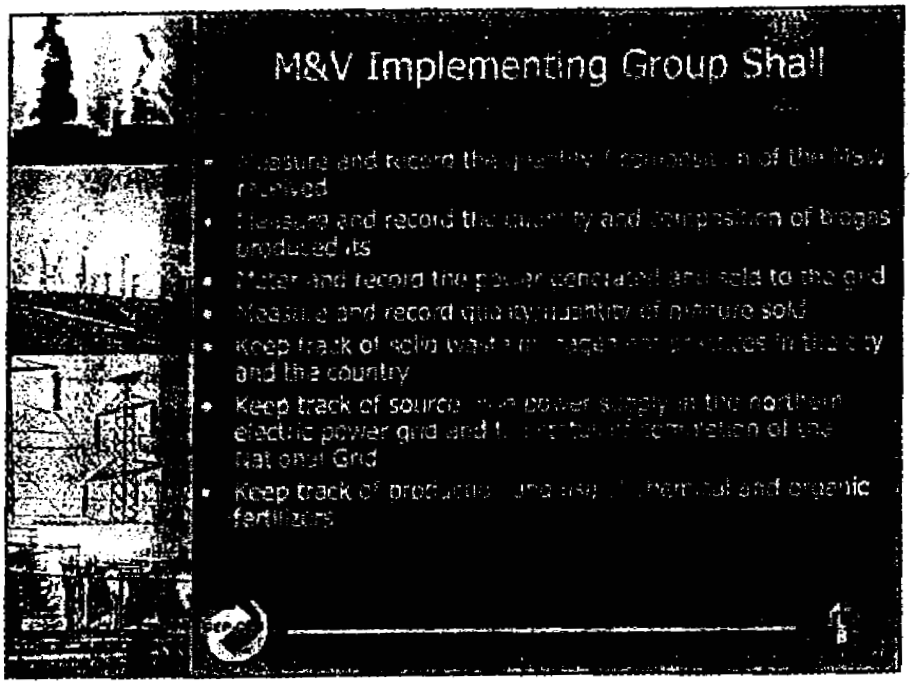
Essential elements of an M&V Plan

- Identify a person/group to manage the M&V process
- Gather information from similar projects on M&V protocols, consult with experts
- Review and assess the M&V design
- Identify technological requirements and technical skills for M&V
- Identify cost of instituting the M&V protocol
- Initiate M&V at appropriate time

M&V Protocol

- M&V system– An interdepartmental group with representatives of production, maintenance, quality control, finance and [illegible] for implementation
- A required [illegible] relating to M&V [illegible] [illegible]


M&V Philosophy
Methane emissions from MSW: Biomethanation of the MSW quantity, biodegradable matter content will decide biogas flow rate and its composition; hence the quantity of methane
Power generation- Clear relationship: more power exported more emission reductions.
Organic manure- Manure quantity, composition of nutrients will decide amount of chemical fertilizer replaced, hence the emission reductions
Data collection on power capacity additions, solid waste management practices and trends in manufacture of chemical fertilizers


M&V Implementing Group Shall
Measure and record the quantity / composition of the MSW received
Measure and record the quantity and composition of biogas produced its
Meter and record the power generated and sold to the grid
Measure and record quality/quantity of manure sold
Keep track of solid waste management practices in the city and the country
Keep track of source wise power supply in the northern electric power grid and the contribution of generation of the National Grid
Keep track of production and sale of chemical and organic fertilizers

M&V Hardware needs

- MSW- Weighing scale, laboratory apparatus for quality check, gas volume & composition
- Power- Export and meter [illegible]
- Manure- Bag weighing machines, laboratory apparatus for quality check
- MIS system to monitor emissions reductions

Almost all the equipment is necessary for any operational project MIS and [illegible] costs

M&V System Cost Estimates*

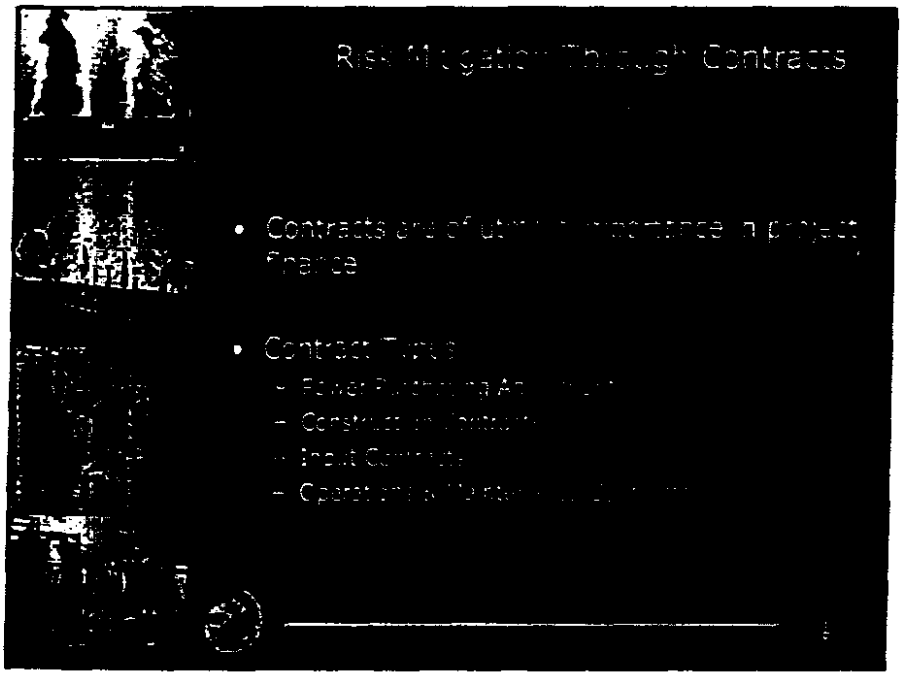
Item	Estimated cost Rs Million	Equivalent s (Rs. 48 US s

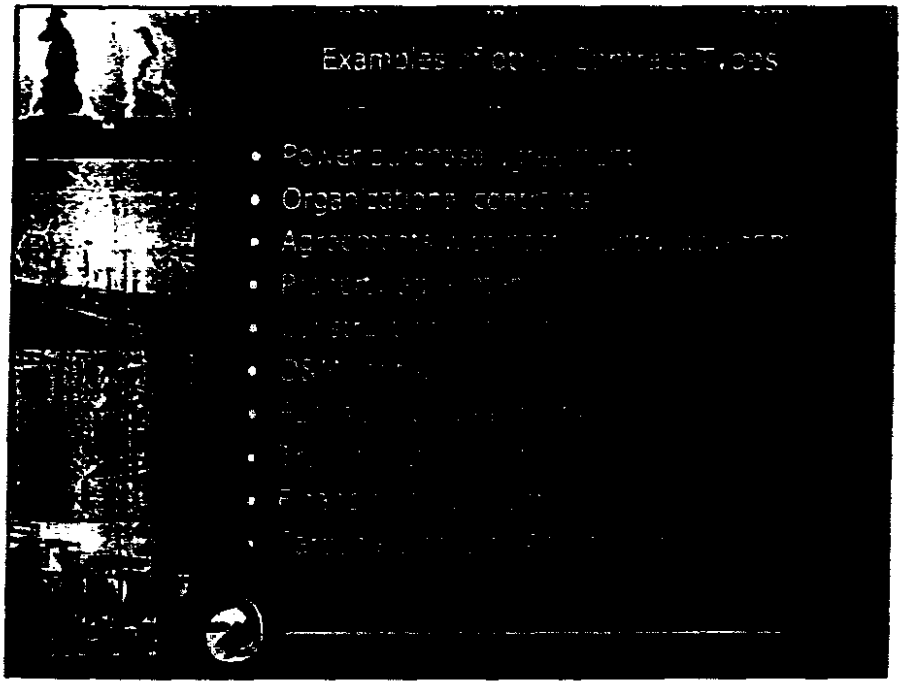
Risks Facing Project Developers

- The [illegible]
- Project [illegible]
- The [illegible]

Mitigating Risk
Lender's Perspective

- Attempts to structure financing that provides:
  - All costs before construction completion are without recourse to the lender
  - Contractor satisfies performance requirements
  - Recourse to other creditworthy participants
  - Long-term, predictable revenue [illegible] that covers operating costs and debt [illegible]
  - Revenue streams in an easily convertible currency
  - Proper incentives under the operating agreement to ensure maximum revenue and minimum costs, while complying with environmental laws

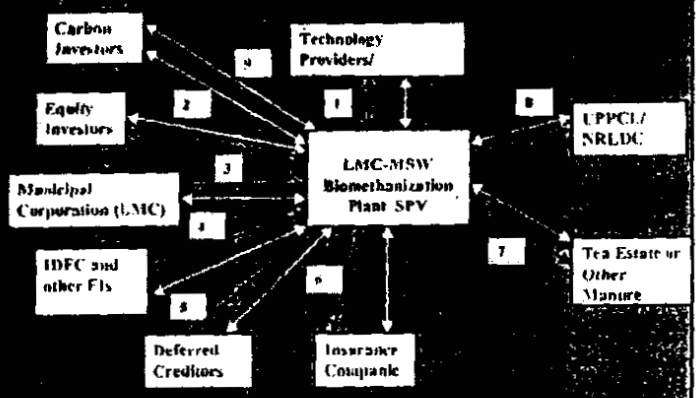

Risk Mitigation Through Contracts
• Contracts are of utmost importance in project finance
• Contract Types
– Construction Contracts
– Input Contracts

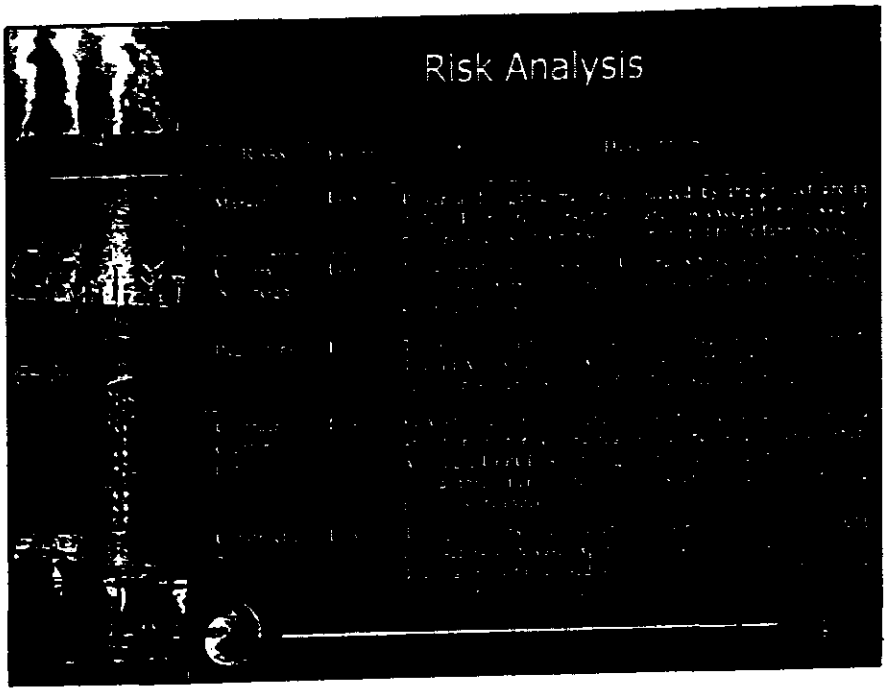

Examples of other Contract Types
• Power purchase agreements
• Organization contracts
• Agreements with government authorities
• Project support
• Insurance
• O&M contracts
• Supply contracts
• Tax
• Financial
• Technical

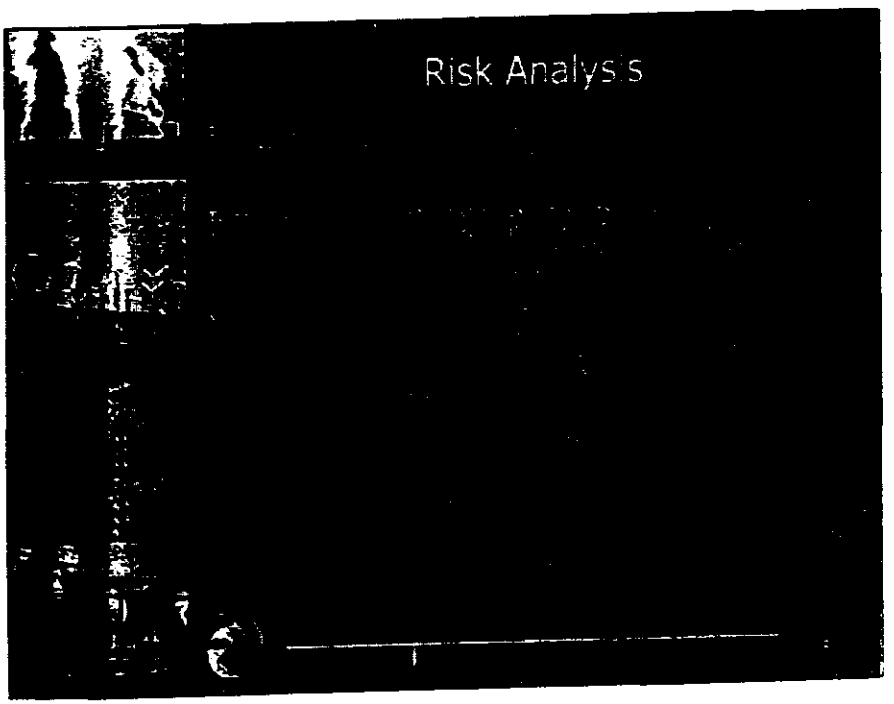
Contractual Risk Mitigation Structure

Sr. No.	Service/ performance	Agreement	Transaction	Annual Transactions
[illegible]	[illegible]	EPC contract/ Tech [illegible]	Purchase of Equipment/ Tech	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Garbage [illegible] Agreement	[illegible] of garbage of [illegible] quality	
[illegible]	[illegible]	[illegible]	Provide Loan	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] credit on [illegible] equipment cost	[illegible]
[illegible]	[illegible]	Policy [illegible]	[illegible] and other risk	[illegible]
[illegible]	[illegible]	Manure Purchase Agreement	Sale of manure power	Payment for manure
[illegible]	[illegible]	Power Purchase Agreement	Sale of	Payment of Power tariff
[illegible]	[illegible]	Carbon Other Purchase Agreement	[illegible] Investment	[illegible]

Contractual Risk Mitigation Structure




Risk Analysis


Risk Analysis

Integration of Emission Revenues with Project Financials

- Pricing the emission reductions
  - Using recent benchmarks
  - By [illegible] of services provided
- Integrate the "new" revenue stream and related costs in the profitability analysis of the project
- Run sensitivity analysis with different pricing scenarios

Pricing of Emission reductions

- Two possible approaches for pricing in non-established markets
  1. **[Cost of Production between project and a similar project with traditional technology] / tons of emission reductions**
  2. **Total amount required to make the project IRR cross the Hurdle rate/tons of emission reductions**
- **Proposed project provides heterogeneous services that cannot be provided by traditional technology**
  - Better to select Second Approach

Results

- IRR on Equity with [illegible] price of [illegible] at Rs. 2,200 - and power tariff as specified in PPA- 22.85% and a hurdle rate of 25%
- Price of emission reductions from recent sales is $ 3 per ton CO2e
- At this price Project IRR [illegible]
- Reasons for higher IRR – MNES tariff & [illegible] and relative higher price of [illegible]

Sensitivity Analysis

- IRR is sensitive to [illegible] price [illegible]
- MNES [illegible]
- MNES [illegible]
- [illegible] 20.85 %

Sensitivity Analysis Results

Conditions & constant Manure price Rs/Ton	IRR without Emission Reductions	IRR with Emission Reductions
MNES grant & Tariff 2200	22.65%	27.12%
MNES grant & Tariff 1500	20.19%	24.63%
W/o MNES grant, UPERC Tariff, 2200	18.19%	22.80%
W/o MNES grant, UPERC Tariff, 1500	16.09%	20.86%

Carbon Transaction: Options

- Simple Payment Plan
  - (50% Upfront, 50% pay as you go)
- Performance Model
  - Carbon contract (formula, verification protocol)
- Options Model
  - Call Options on Carbon

Performance Contract Model

- Greater protection from project risk through positive and negative incentives
- Increased attractiveness of projects not yet undertaken
- Energy efficiency contracts follow this model already

SECTION IV.

Business Plan Review Exercise Materials

GHG EMISSION REDUCTION PROJECTS: ROLE OF INDIAN FINANCIAL SECTOR
A Training Symposium on the Current State of Clean Energy Project Finance

Organized by:
The Louis Berger Group, Inc./ Greenhouse Pollution Prevention Project, USAID/India

April 23 – 24, 2002
Taj Mahal Hotel, Mumbai

Business Plan Exercise

Activity: Attendees will examine real clean energy business plans and assess them against general clean energy financing concepts presented in the course.

Process: On the first day of the training, attendees will be divided into groups and assigned several actual GEP-CCS business plans for review. On the second day of the training, each group should be prepared to make a presentation to the larger class on the merits and/or downsides of their particular business plans. This presentation can be presented orally from written notes, or groups may prepare short power-point overviews should they desire, but each presentation and discussion should not exceed ten minutes. The goal is to get a quick grasp of the key aspects of each business plan. At a minimum, groups will be required to complete the attached business plan "scoring sheet" for each of their business plans.

Outputs: (1) 10 minute presentation for each business plan
(1) Completed "scoring sheet" for each business plan

Goal: To discuss "actual" clean energy businesses plans, and gather different perspectives from various segments of the Indian financial sector including debt, equity, concessional lenders and risk institutions. At the end of all of the presentations, the "scored" business plans will be ranked, and attendees will be updated on the status of each of the business plans. Financial closure has been completed for several of the ten business plans used in this exercise – and the rankings will be compared against these actual results.

~~~~~~~~~~
~~~~~~~~~~

Business Plans to be Reviewed

Project A: 200 Solar PV Water Pumps in A.P.

Project B: 4 MW Rice Husk Cogeneration in A.P.

Project C: 45 MW Bagasse Based Cogeneration in Karnataka

Project D: 6 MW Poultry Litter Power Project in A.P.

Project E: 110 MW Coke Oven Cogeneration Power Plant in Tamil Nadu

Project F: 2 x 10 MW Mini-Hydel in Karnataka

Project G: 2 X 2.5 MW Run of River Mini-Hydel in Karnataka

Project H: 12 MW IGCC from Crop Biomass in A.P.

Project I: Biogas 5 MW from MSW Biomethanation in Tamil Nadu

Project J: Rural PV Lighting & Agro Waste Briquetting in West Bengal

163

Project: _____

Location: _____

Type of Technology and Fuel Source: _____

Installed Capacity (MW): _____

Estimated Cost (Rs): _____

SCORING TABLE (70 Points Possible)

Ranking Factor	Scoring Range	Weighting	Score
1. Key Personnel Business Experience (Mgmt. Plan)	1-5 (limited to extensive)	x 2	
2. Coherency of Finance Plan	1-5 (least to most)	x 2	
3. Type of Technology	1 - 5 (untested to proven)	x 2	
4. Credit Status of State Electricity Board (for on-grid)	1-5 (least to highest credit rating)	x 2	
5. Project Developer "Clean Energy" Experience	1–5 (least to most experienced)	x 1	
6. Status of Power Purchase Agreement	1-5 (from un-drafted to completed/signed)	x 1	
7. Dependability of Fuel Supply	1-5 (from least to most dependable)	x 1	
8. IRR/NPV: cost competitiveness vis a vis other energy tech.	1-5 (from least to highest return)	x 1	
9. Potential Future Carbon Revenues	1 to 5 (from marginal to significant revenue)	x 1	
10. Project Risk Factors	1 to 5 (high risk to few risks)	x 1	
	TOTAL SCORE		

*note, for comparison reasons, if any variable is Not Applicable, extrapolate the resulting total score against the 70 maximum (e.g. 50 out of 60 = .83…extrapolated score is .83 x 70 = 58)

Comments:

_____

_____

_____

_____

_____

_____

164

Project: _____

Location: _____

Type of Technology and Fuel Source: _____

Installed Capacity (MW): _____

Estimated Cost (Rs): _____

SCORING TABLE (70 Points Possible)

Ranking Factor	Scoring Range	Weighting	Score
1. Key Personnel Business Experience (Mgmt. Plan)	1-5 (limited to extensive)	x 2	
2. Coherency of Finance Plan	1-5 (least to most)	x 2	
3. Type of Technology	1 - 5 (untested to proven)	x 2	
4. Credit Status of State Electricity Board	1-5 (least to highest credit rating)	x 2	
5. Project Developer "Clean Energy" Experience	1–5 (least to most experienced)	x 1	
6. Status of Power Purchase Agreement	1-5 (from un-drafted to completed/signed)	x 1	
7. Dependability of Fuel Supply	1-5 (from least to most dependable)	x 1	
8. IRR/NPV: cost competitiveness vis a vis other energy tech.	1-5 (from least to highest return)	x 1	
9. Potential Future Carbon Revenues	1 to 5 (from marginal to significant revenue)	x 1	
10. Project Risk Factors	1 to 5 (high risk to few risks)	x 1	
	TOTAL SCORE		

*note, for comparison reasons, if any variable is Not Applicable, extrapolate the resulting total score against the 70 maximum (e.g. 50 out of 60 = .83...extrapolated score is .83 x 70 = 58)

Comments:

_____
_____
_____
_____
_____
_____

Project: _____

Location: _____

Type of Technology and Fuel Source: _____

Installed Capacity (MW): _____

Estimated Cost (Rs): _____

SCORING TABLE (70 Points Possible)

Ranking Factor	Scoring Range	Weighting	Score
1. Key Personnel Business Experience (Mgmt. Plan)	1-5 (limited to extensive)	x 2	
2. Coherency of Finance Plan	1-5 (least to most)	x 2	
3. Type of Technology	1 - 5 (untested to proven)	x 2	
4. Credit Status of State Electricity Board	1-5 (least to highest credit rating)	x 2	
5. Project Developer "Clean Energy" Experience	1–5 (least to most experienced)	x 1	
6. Status of Power Purchase Agreement	1-5 (from un-drafted to completed/signed)	x 1	
7. Dependability of Fuel Supply	1-5 (from least to most dependable)	x 1	
8. IRR/NPV: cost competitiveness vis a vis other energy tech.	1-5 (from least to highest return)	x 1	
9. Potential Future Carbon Revenues	1 to 5 (from marginal to significant revenue)	x 1	
10. Project Risk Factors	1 to 5 (high risk to few risks)	x 1	
	TOTAL SCORE		

*note, for comparison reasons, if any variable is Not Applicable, extrapolate the resulting total score against the 70 maximum (e.g. 50 out of 60 = .83...extrapolated score is .83 x 70 = 58)

Comments:

_____
_____
_____
_____
_____
_____

ANNEX A.

Review and Analysis of the
Marrakesh Accords on Climate Change

NATSOURCE
EMISSIONS BROKERAGE DESK
AirTrends
Special Supplement
DECEMBER [illegible] 2001
VOLUME [illegible] ISSUE [illegible]
SUPPLEMENT

MICHAEL [illegible]
RICHARD [illegible]
DIRECTOR
PHONE: 212-232-5305
FAX: 212-232-5353

Marrakesh Accords on Climate Change

Review and Analysis

Four years after the adoption of the Kyoto Protocol, international climate change negotiators meeting in Marrakesh, Morocco reached agreement on November 10 on a wide-ranging set of rules for implementation of the Protocol. The decisions by the 7th Conference of the Parties to the UN Framework Convention on Climate Change (known as COP-7) elaborate upon the breakthrough political agreement reached in Bonn, Germany last July. By finalizing the rules for implementation of Kyoto, the Marrakesh Accords open the way for countries to pursue ratification of the Protocol and for it to enter into force.

The negotiations in Marrakesh once again proved exceedingly difficult, as delegations attempting to flesh out the Bonn Agreement into legal language remained divided along historical lines on key issues, such as the type of compliance regime required to provide backbone to the Protocol's emissions targets and trading mechanisms. Russia's assertive demand to increase its forest management limit further complicated the talks. In the final hours, the Parties found necessary compromises on these contentious issues, reaching agreement on a broad package of decisions. Key elements of the Marrakesh Accords for the greenhouse gas (GHG) emissions trading market include:

- Operating rules for international emissions trading and the other two Kyoto "flexibility mechanisms", the Clean Development Mechanism (CDM) and joint implementation (JI).
- A compliance regime that lays out the consequences for failing to meet emissions targets but postpones the question of whether these consequences will be legally binding until the Protocol enters into force.
- Criteria for a Party's eligibility to participate in the mechanisms.
- Establishment of the CDM's Executive Board.
- Creation of a new "Removal Unit (RMU)" for carbon sequestered through land use, land use change and forestry activities in Annex I (developed) countries.
- Full fungibility (interchangeability) of credits or allowances generated under all three flexibility mechanisms and

168

RMUs.

- Developing countries are allowed to unilaterally undertake CDM projects and sell the resulting credits to developed countries.
- Banking of surplus emissions credits into future commitment periods is allowed – unlimited in the case of AAUs, but with restrictions on CDM and JI credits to 2.5% of a country's assigned amount. RMUs may not be banked.
- Additionally, a late and exceptional concession granted Russia's demand to nearly double its ceiling for credits (to 33 MMT) from domestic forest management activities from that prescribed in the Bonn Agreement.

These provisions, along with robust emissions reporting, monitoring and review requirements, are expected to significantly enhance development of a global emissions market. The Marrakesh Accords effectively complete the work under the Buenos Aires Plan of Action to put flesh on the bones of the Kyoto Protocol. It thus sets the stage for the Protocol to enter into force and create a global trading system that will channel investment flows toward economically-efficient opportunities to reduce and sequester GHG emissions. The ratification decisions of Japan and Russia continue to be critical to the entry into force of the Protocol; in the days immediately following the conclusion of the Marrakesh Accords, both countries indicated their satisfaction with the Accords and expressed intent to pursue ratification. Ratification by 55 countries representing 55% of industrialized country emissions will be required for the Protocol to enter into force.

Over 160 nations agreed to the Marrakesh Accords, with the one standout being the United States. The U.S., while present in Marrakesh, did not actively participate in negotiations on the Kyoto Protocol, continuing to insist that it has no intention of joining the Protocol and instead will develop its own policies to address climate change.

Key Elements of the Marrakesh Accords

Compliance

During the negotiations, a great deal of attention and energy was focused on several inter-related issues pertaining to compliance and eligibility rules for use of the flexibility mechanisms (international emissions trading, Joint Implementation, and the Clean Development Mechanism). Probably the most carefully-watched issue at Marrakesh was the question of whether the consequences for non-compliance with Kyoto Protocol emissions limitations would be legally binding on Parties as a matter of international law. Another key set of compliance issues was the specific procedures for non-compliance determinations, and the structure, functions and rules for the Compliance Committee.

Just before the high-level negotiations began on November 7, Parties achieved an important agreement on much of the language setting forth the roles of the facilitative and enforcement branches of the Compliance Committee, the procedures for determining non-compliance, and the consequences of non-compliance. However, decisions on the legal nature of these consequences, and the conditions under which eligibility to use the mechanisms could be denied, proved much more difficult to achieve.

Ultimately, Parties agreed that the decision on the legally binding nature of the consequences of non-compliance would be left to the first meeting of the Parties following the Kyoto Protocol's entry into force (known as the first COP/MOP in the singular language of the negotiations), and that a formal amendment to the Protocol would need to be adopted. This outcome was forced by Japan's and Russia's continuing opposition to legally-binding non-compliance consequences – a position that frustrated many Parties, given their desire for procedures designed to ensure that non-compliance would have real consequences for Parties. As part of the last-hour compromise, the link between compliance with emissions limitations and eligibility to use the mechanisms was also deferred to the first meeting of the Parties to the Protocol. The rationale for this deci-

sion was that denial of eligibility to use the mechanisms would be binding in its nature and, like the legally binding question, could only be taken up by Parties to the Protocol in an amendment. The compromise also effectively postponed a final decision on what constitutes failure to meet sinks reporting requirements, and whether such a failure could trigger suspension of use of the mechanisms. Details of these decisions follow.

Consequences of non-compliance

As provided in the Bonn Agreement, the Marrakesh Accords' annex on procedures and mechanisms relating to compliance establishes final language requiring countries that fail to meet emissions targets to restore deficit tons in the next commitment period at a rate of 1.3 to 1 (i.e., a country must make up its deficit, plus 30%). Countries that are in non-compliance must also prepare a compliance action plan. The final compromise eliminated the possibility that the enforcement branch of the Compliance Committee (see description below) could consider additional consequences of non-compliance, such as financial penalties. Lastly, countries that fail to meet eligibility requirements for use of the mechanisms (see below) will be suspended from using the mechanisms.

Compliance Committee

The annex on procedures and mechanisms relating to compliance under the Protocol ("the annex") creates a Compliance Committee, consisting of a facilitative and an enforcement branch. The annex was adopted, but with the understanding that it must be approved by the COP/MOP through an amendment to the Protocol.

The facilitative branch will promote compliance by providing advice and facilitation to Parties regarding compliance with their emissions limitations, and their inventory and reporting requirements. The facilitative branch will be responsible for reviewing Parties' submissions demonstrating that their use of the mechanisms is "supplemental" to domestic action, and that they are complying with article 3.14 of the Protocol (i.e., that they are striving to minimize adverse social, environmental and economic impacts on developing country Parties). The assignment of these responsibilities to the facilitative branch instead of the enforcement branch reflected Parties' decision not to make eligibility for use of the mechanisms contingent on meeting reporting requirements on supplementarity and article 3.14.

The enforcement branch is charged with determining whether a Party is in compliance with its emissions limitation, and with applying the consequences of non-compliance described above. The enforcement branch is also responsible for 1) determining compliance with the Kyoto Protocol's methodological and reporting requirements for emissions and sinks; 2) determining compliance with eligibility requirements to use the mechanisms (which are discussed below); and 3) making necessary adjustments to emissions and sinks inventories, and to the accounting database for assigned amounts.

Link between compliance and eligibility to use the flexible mechanisms

Under the procedures and mechanisms for compliance which were adopted in Marrakesh, Parties that do not comply with their emissions limitations will be suspended from making transfers under Article 17 of the Protocol. Significantly, the procedures and mechanisms on compliance were adopted, but with the understanding that the COP/MOP-1 would need to adopt these procedures and mechanisms through an amendment to the Protocol, along with any decision on the legally-binding nature of the consequences of non-compliance.

Other eligibility requirements for use of the mechanisms include: 1) being a Party to the Protocol; 2) the establishment of an emissions registry; 3) the establishment of an emissions and sinks inventory system; 4) submission of the most recent required inventory

Link between sinks reporting and eligibility to use the flexible mechanisms

A proposal by the G-77 and China at Marrakesh to link sinks reporting to eligibility to use the mechanisms became an important part of compliance discussions due to its important compliance implica-

tions. In particular, if Russia failed to meet its sinks reporting requirements, and was therefore ineligible to sell AAUs, Japan, whose stringent emissions target forces it to rely on tons purchased overseas, could be in grave danger of non-compliance, or would be forced to purchase AAUs at a much higher price in the absence of Russian tons. Ultimately, Parties postponed a final decision on this issue by requesting that the Subsidiary Body for Scientific and Technological Advice develop criteria for determining failure to adequately or accurately report removal by sinks from activities under Article 3.3 and 3.4 of the Protocol, and recommend a decision on this topic to the COP/MOP for approval.

Flexibility Mechanisms

The lengthy and complex agreement on mechanisms resolves several outstanding issues in a favorable way for the efficiency of carbon markets. These and other new outcomes in the Marrakesh Accords are described below.

General Issues

- **Fungibility:** Emissions credits earned under emissions trading (assigned allowance units, or AAUs), the CDM (certified emissions reductions, or CERs) and JI (emissions reduction units, or ERUs) and domestic sinks activities (emissions removal units, RMUs) are interchangeable ("fungible") for compliance purposes. Transfer of AAUs, CERs, ERUs and RMUs within and among Annex B Parties (i.e., industrialized countries with emissions targets under the Protocol) is unrestricted. Companies that invest in CDM or JI projects would thus be able to trade credits from these projects on the emissions market, an important provision to enhance liquidity in the emissions marketplace.

- **Banking of Credits:** The Marrakesh Accords allow for "banking" (or carry-over into the next commitment period) of excess emissions reductions, with variations in the ability to bank different types of units. There are no restrictions on the ability of Parties to bank allowances issued by Annex I countries (AAUs) that have not been used for compliance within a commitment period. Banking of CERs (credits generated from the CDM) and ERUs (from JI) is restricted to 2.5% of a Party's assigned amount. The carry-over of RMUs between commitment periods is prohibited.

Table 1: Guide to Emissions Units
Examining the transfer and banking potential of the various tradeable emissions units established by the Kyoto Protocol and the Marrakesh Accords.

Unit	Mechanism	Limits of Transfer	Bankability
AAU (Assigned Amount Unit)	Allocated at the national level, based on an Annex I countries reduction commitment under Annex B of the KP	Unlimited transfer within and between Annex B countries; fungible with ERUs, CERs and RMUs	Unlimited banking
CER (Certified Emission Reduction Unit)	Clean Development Mechanism	Unlimited transfer within and between Annex B countries; fungible with ERUs, AAUs and RMUs; CERs acquired from sinks activities are limited to 1% of base year emissions multiplied by 5.	Banking limited to 2.5% of a Party's initial assigned amount in Annex B
ERU (Emission Reduction Unit)	Joint Implementation Projects	Unlimited transfer within and between Annex B countries; fungible with CERs, AAUs and RMUs	Banking limited to 2.5% of a Party's initial assigned amount in Annex B
RMU (Removal Unit)	Sequestration credits generated in Annex I countries	Unlimited transfer within and between Annex B countries; fungible with ERUs, CERs and AAUs	Cannot be banked towards future commitment periods

International Emissions Trading

- **Supplementarity / Commitment Period Reserve:** As agreed in Bonn, there is no quantitative limit on the extent to which a Party can rely on the flexibility mechanisms for compliance with emissions targets, though domestic action is to constitute a significant element of Parties' efforts. COP-7 agreed that Parties "shall" report on supplementarity but that this requirement would not determine eligibility for participation in the mechanisms. To protect against the risk of Parties overselling, the Marrakesh Accords

preserve the Bonn agreement that requires each Annex B Party to retain a commitment period reserve of 90 percent of its assigned amount of allowable reductions of five times its most recently reviewed emissions inventory, whichever is lower. Parties falling below this amount will not be able to sell emissions units any longer, but will be able to buy in order to meet the reserve level. Once back above the reserve level, Parties would be eligible to engage in selling again.

While the outcome on supplementarity is favorable for relatively unfettered access to the Kyoto mechanisms, the commitment period reserve may shrink the potential supply of credits from countries that are likely to have considerable surplus credits to sell, such as Russia. This potential constraint on supply may have several effects: it will likely have upward price impacts, and it will ensure that there will be a greater geographic distribution of emissions reduction sources than might otherwise be the case. By restricting the amount of emissions units which Annex B countries may sell through the trading system, it also may enhance investment flows into the CDM market.

The commitment period reserve may also complicate emissions trading because international transactions will need to be verified by the UNFCCC transaction log to ensure that they do not violate the reserve restriction.

- A Party may authorize legal entities to participate in emissions trading. Parties will be liable for the fulfillment of the obligations of the legal entities it has authorized.

- Emissions trading may begin with the entry of the Kyoto commitment period in 2008.

Clean Development Mechanism (CDM)

- **CDM Executive Board:** The establishment of the CDM Executive Board with a mandate to establish rules for baseline methodologies, emissions monitoring and verification procedures; develop project approval procedures; and accredit operating entities will give an important boost to the fast start potential of the CDM. The Executive Board is also tasked with determining modalities and procedures for small-scale energy efficiency and renewable energy projects, and with accrediting operational entities, by COP-8 next year.

The 10-member Board, which will be chaired by John Ashe of Antigua & Barbuda, is composed of one member from each of the five UN regional groups, two from Annex I countries, two from Non-Annex I countries, and one from a small island developing country (the same composition as that assigned to the Compliance Committee branches). Decisions are too be taken by consensus when possible, and by a three-fourths majority when not, including a "double majority" among both the Annex I and non-Annex I members.

Table 2. Members of the CDM Executive Board

Group	Member	Alternate
Africa	John Shaibu Kilani, *South Africa*	Ndiaye Cheikh-Sylla, *Senegal*
Asia	Mohammed Reza Salamat, *Iran*	Chow Kok Kee, *Malaysia*
Eastern Europe	Oleg Pluzhnikov, *Russia*	Marina Shvangiradze, *Georg*
GRULAC	Luiz Gylvan Meira Filho, *Brazil*	Eduardo Sanhueza, *Chile*
WEOG	Jean-Jacques Becker, *France*	Martin Enderlin, *Switzerland*
AOSIS	John W. Ashe*, *Antigua and Barbuda*	Tuiloma Neroni Slade, *Samo*
Non Annex I Party	Franz Tattenbach Capra, *Costa Rica* Adbelhay Zerouali, *Morocco*	Abdulmuhsen Al-Sunaid, *Sa* Xuedu Lu, *China*
Annex I Party	Sozaburo Okamatsu, *Japan*	Suchma Gera, *Canada*

* Executive Board Chairperson

- **Unilateral CDM:** Developing coun-

NATSOURCE
EMISSIONS BROKERAGE DESK
Airtrends
Special Supplement
DECEMBER 11, 2001
VOLUME 4, ISSUE 11
SUPPLEMENT

CONTACTS
MICHAEL [illegible]
RICHARD R[illegible]
DIRECTOR
PHONE: 212-[illegible]-5300
FAX: 212-2[illegible]-5353

Marrakesh Accords on Climate Change

Review and Analysis

Four years after the adoption of the Kyoto Protocol, international climate change negotiators meeting in Marrakesh, Morocco reached agreement on November 10 on a wide-ranging set of rules for implementation of the Protocol. The decisions by the 7th Conference of the Parties to the UN Framework Convention on Climate Change (known as COP-7) elaborate upon the breakthrough political agreement reached in Bonn, Germany last July. By finalizing the rules for implementation of Kyoto, the Marrakesh Accords open the way for countries to pursue ratification of the Protocol and for it to enter into force.

The negotiations in Marrakesh once again proved exceedingly difficult, as delegations attempting to flesh out the Bonn Agreement into legal language remained divided along historical lines on key issues, such as the type of compliance regime required to provide backbone to the Protocol's emissions targets and trading mechanisms. Russia's assertive demand to increase its forest management limit further complicated the talks. In the final hours, the Parties found necessary compromises on these contentious issues, reaching agreement on a broad package of decisions. Key elements of the Marrakesh Accords for the greenhouse gas (GHG) emissions trading market include:

- Operating rules for international emissions trading and the other two Kyoto "flexibility mechanisms", the Clean Development Mechanism (CDM) and joint implementation (JI).
- A compliance regime that lays out the consequences for failing to meet emissions targets but postpones the question of whether these consequences will be legally binding until the Protocol enters into force.
- Criteria for a Party's eligibility to participate in the mechanisms.
- Establishment of the CDM's Executive Board.
- Creation of a new "Removal Unit (RMU)" for carbon sequestered through land use, land use change and forestry activities in Annex I (developed) countries.
- Full fungibility (interchangeability) of credits or allowances generated under all three flexibility mechanisms and

RMUs.

- Developing countries are allowed to unilaterally undertake CDM projects and sell the resulting credits to developed countries.
- Banking of surplus emissions credits into future commitment periods is allowed – unlimited in the case of AAUs, but with restrictions on CDM and JI credits to 2.5% of a country's assigned amount. RMUs may not be banked.
- Additionally, a late and exceptional concession granted Russia's demand to nearly double its ceiling for credits (to 33 MMT) from domestic forest management activities from that prescribed in the Bonn Agreement.

These provisions, along with robust emissions reporting, monitoring and review requirements, are expected to significantly enhance development of a global emissions market. The Marrakesh Accords effectively complete the work under the Buenos Aires Plan of Action to put flesh on the bones of the Kyoto Protocol. It thus sets the stage for the Protocol to enter into force and create a global trading system that will channel investment flows toward economically-efficient opportunities to reduce and sequester GHG emissions. The ratification decisions of Japan and Russia continue to be critical to the entry into force of the Protocol; in the days immediately following the conclusion of the Marrakesh Accords, both countries indicated their satisfaction with the Accords and expressed intent to pursue ratification. Ratification by 55 countries representing 55% of industrialized country emissions will be required for the Protocol to enter into force.

Over 160 nations agreed to the Marrakesh Accords, with the one standout being the United States. The U.S., while present in Marrakesh, did not actively participate in negotiations on the Kyoto Protocol, continuing to insist that it has no intention of joining the Protocol and instead will develop its own policies to address climate change.

Key Elements of the Marrakesh Accords

Compliance

During the negotiations, a great deal of attention and energy was focused on several inter-related issues pertaining to compliance and eligibility rules for use of the flexibility mechanisms (international emissions trading, Joint Implementation, and the Clean Development Mechanism). Probably the most carefully-watched issue at Marrakesh was the question of whether the consequences for non-compliance with Kyoto Protocol emissions limitations would be legally binding on Parties as a matter of international law. Another key set of compliance issues was the specific procedures for non-compliance determinations, and the structure, functions and rules for the Compliance Committee.

Just before the high-level negotiations began on November 7, Parties achieved an important agreement on much of the language setting forth the roles of the facilitative and enforcement branches of the Compliance Committee, the procedures for determining non-compliance, and the consequences of non-compliance. However, decisions on the legal nature of these consequences, and the conditions under which eligibility to use the mechanisms could be denied, proved much more difficult to achieve.

Ultimately, Parties agreed that the decision on the legally binding nature of the consequences of non-compliance would be left to the first meeting of the Parties following the Kyoto Protocol's entry into force (known as the first COP/MOP in the singular language of the negotiations), and that a formal amendment to the Protocol would need to be adopted. This outcome was forced by Japan's and Russia's continuing opposition to legally-binding non-compliance consequences – a position that frustrated many Parties, given their desire for procedures designed to ensure that non-compliance would have real consequences for Parties. As part of the last-hour compromise, the link between compliance with emissions limitations and eligibility to use the mechanisms was also deferred to the first meeting of the Parties to the Protocol. The rationale for this deci-

sion was that denial of eligibility to use the mechanisms would be binding in its nature and, like the legally binding question, could only be taken up by Parties to the Protocol in an amendment. The compromise also effectively postponed a final decision on what constitutes failure to meet sinks reporting requirements, and whether such a failure could trigger suspension of use of the mechanisms. Details of these decisions follow.

Consequences of non-compliance

As provided in the Bonn Agreement, the Marrakesh Accords' annex on procedures and mechanisms relating to compliance establishes final language requiring countries that fail to meet emissions targets to restore deficit tons in the next commitment period at a rate of 1.3 to 1 (i.e., a country must make up its deficit, plus 30%). Countries that are in non-compliance must also prepare a compliance action plan. The final compromise eliminated the possibility that the enforcement branch of the Compliance Committee (see description below) could consider additional consequences of non-compliance, such as financial penalties. Lastly, countries that fail to meet eligibility requirements for use of the mechanisms (see below) will be suspended from using the mechanisms.

Compliance Committee

The annex on procedures and mechanisms relating to compliance under the Protocol ("the annex") creates a Compliance Committee, consisting of a facilitative and an enforcement branch. The annex was adopted, but with the understanding that it must be approved by the COP/MOP through an amendment to the Protocol.

The facilitative branch will promote compliance by providing advice and facilitation to Parties regarding compliance with their emissions limitations, and their inventory and reporting requirements. The facilitative branch will be responsible for reviewing Parties' submissions demonstrating that their use of the mechanisms is "supplemental" to domestic action, and that they are complying with article 3.14 of the Protocol (i.e., that they are striving to minimize adverse social, environmental and economic impacts on developing country Parties). The assignment of these responsibilities to the facilitative branch instead of the enforcement branch reflected Parties' decision not to make eligibility for use of the mechanisms contingent on meeting reporting requirements on supplementarity and article 3.14.

The enforcement branch is charged with determining whether a Party is in compliance with its emissions limitation, and with applying the consequences of non-compliance described above. The enforcement branch is also responsible for 1) determining compliance with the Kyoto Protocol's methodological and reporting requirements for emissions and sinks; 2) determining compliance with eligibility requirements to use the mechanisms (which are discussed below); and 3) making necessary adjustments to emissions and sinks inventories, and to the accounting database for assigned amounts.

Link between compliance and eligibility to use the flexible mechanisms

Under the procedures and mechanisms for compliance which were adopted in Marrakesh, Parties that do not comply with their emissions limitations will be suspended from making transfers under Article 17 of the Protocol. Significantly, the procedures and mechanisms on compliance were adopted, but with the understanding that the COP/MOP-1 would need to adopt these procedures and mechanisms through an amendment to the Protocol, along with any decision on the legally-binding nature of the consequences of non-compliance.

Other eligibility requirements for use of the mechanisms include: 1) being a Party to the Protocol; 2) the establishment of an emissions registry; 3) the establishment of an emissions and sinks inventory system; 4) submission of the most recent required inventory.

Link between sinks reporting and eligibility to use the flexible mechanisms

A proposal by the G-77 and China at Marrakesh to link sinks reporting to eligibility to use the mechanisms became an important part of compliance discussions due to its important compliance implica-

tions. In particular, if Russia failed to meet its sinks reporting requirements, and was therefore ineligible to sell AAUs, Japan, whose stringent emissions target forces it to rely on tons purchased overseas, could be in grave danger of non-compliance, or would be forced to purchase AAUs at a much higher price in the absence of Russian tons. Ultimately, Parties postponed a final decision on this issue by requesting that the Subsidiary Body for Scientific and Technological Advice develop criteria for determining failure to adequately or accurately report removal by sinks from activities under Article 3.3 and 3.4 of the Protocol, and recommend a decision on this topic to the COP/MOP for approval.

Flexibility Mechanisms

The lengthy and complex agreement on mechanisms resolves several outstanding issues in a favorable way for the efficiency of carbon markets. These and other new outcomes in the Marrakesh Accords are described below.

General Issues

- **Fungibility:** Emissions credits earned under emissions trading (assigned allowance units, or AAUs), the CDM (certified emissions reductions, or CERs) and JI (emissions reduction units, or ERUs) and domestic sinks activities (emissions removal units, RMUs) are interchangeable ("fungible") for compliance purposes. Transfer of AAUs, CERs, ERUs and RMUs within and among Annex B Parties (i.e., industrialized countries with emissions targets under the Protocol) is unrestricted. Companies that invest in CDM or JI projects would thus be able to trade credits from these projects on the emissions market, an important provision to enhance liquidity in the emissions marketplace.

- **Banking of Credits:** The Marrakesh Accords allow for "banking" (or carry-over into the next commitment period) of excess emissions reductions, with variations in the ability to bank different types of units. There are no restrictions on the ability of Parties to bank allowances issued by Annex I countries (AAUs) that have not been used for compliance within a commitment period. Banking of CERs (credits generated from the CDM) and ERUs (from JI) is restricted to 2.5% of a Party's assigned amount. The carry-over of RMUs between commitment periods is prohibited.

Table 1: Guide to Emissions Units

Examining the transfer and banking potential of the various tradeable emissions units established by the Kyoto Protocol and the Marrakesh Accords.

Unit	Mechanism	Limits of Transfer	Bankability
AAU (Assigned Amount Unit)	Allocated at the national level, based on an Annex I countries reduction commitment under Annex B of the KP	Unlimited transfer within and between Annex B countries; fungible with ERUs, CERs and RMUs	Unlimited banking
CER (Certified Emission Reduction Unit)	Clean Development Mechanism	Unlimited transfer within and between Annex B countries; fungible with ERUs, AAUs and RMUs; CERs acquired from sinks activities are limited to 1% of base year emissions multiplied by 5.	Banking limited to 2.5% of a Party's initial assigned amount in Annex B
ERU (Emission Reduction Unit)	Joint Implementation Projects	Unlimited transfer within and between Annex B countries; fungible with CERs, AAUs and RMUs	Banking limited to 2.5% of a Party's initial assigned amount in Annex B
RMU (Removal Unit)	Sequestration credits generated in Annex I countries	Unlimited transfer within and between Annex B countries; fungible with ERUs, CERs and AAUs	Cannot be banked towards future commitment periods

International Emissions Trading

- **Supplementarity / Commitment Period Reserve:** As agreed in Bonn, there is no quantitative limit on the extent to which a Party can rely on the flexibility mechanisms for compliance with emissions targets, though domestic action is to constitute a significant element of Parties' efforts. COP-7 agreed that Parties "shall" report on supplementarity but that this requirement would not determine eligibility for participation in the mechanisms. To protect against the risk of Parties overselling, the Marrakesh Accords

preserve the Bonn agreement that requires each Annex B Party to retain a commitment period reserve of 90 percent of its assigned amount of allowable reductions of five times its most recently reviewed emissions inventory, whichever is lower. Parties falling below this amount will not be able to sell emissions units any longer, but will be able to buy in order to meet the reserve level. Once back above the reserve level, Parties would be eligible to engage in selling again.

While the outcome on supplementarity is favorable for relatively unfettered access to the Kyoto mechanisms, the commitment period reserve may shrink the potential supply of credits from countries that are likely to have considerable surplus credits to sell, such as Russia. This potential constraint on supply may have several effects: it will likely have upward price impacts, and it will ensure that there will be a greater geographic distribution of emissions reduction sources than might otherwise be the case. By restricting the amount of emissions units which Annex B countries may sell through the trading system, it also may enhance investment flows into the CDM market.

The commitment period reserve may also complicate emissions trading because international transactions will need to be verified by the UNFCCC transaction log to ensure that they do not violate the reserve restriction.

- A Party may authorize legal entities to participate in emissions trading. Parties will be liable for the fulfillment of the obligations of the legal entities it has authorized.

- Emissions trading may begin with the entry of the Kyoto commitment period in 2008.

Clean Development Mechanism (CDM)

- **CDM Executive Board:** The establishment of the CDM Executive Board with a mandate to establish rules for baseline methodologies, emissions monitoring and verification procedures; develop project approval procedures; and accredit operating entities will give an important boost to the fast start potential of the CDM. The Executive Board is also tasked with determining modalities and procedures for small-scale energy efficiency and renewable energy projects, and with accrediting operational entities, by COP-8 next year.

The 10-member Board, which will be chaired by John Ashe of Antigua & Barbuda, is composed of one member from each of the five UN regional groups, two from Annex I countries, two from Non-Annex I countries, and one from a small island developing country (the same composition as that assigned to the Compliance Committee branches). Decisions are too be taken by consensus when possible, and by a three-fourths majority when not, including a "double majority" among both the Annex I and non-Annex I members.

Table 2. Members of the CDM Executive Board

Group	Member	Alternate
Africa	John Shaibu Kilani, *South Africa*	Ndiaye Cheikh-Sylla, *Senegal*
Asia	Mohammed Reza Salamat, *Iran*	Chow Kok Kee, *Malaysia*
Eastern Europe	Oleg Pluzhnikov, *Russia*	Marina Shvangiradze, *Georg*
GRULAC	Luiz Gylvan Meira Filho, *Brazil*	Eduardo Sanhueza, *Chile*
WEOG	Jean-Jacques Becker, *France*	Martin Enderlin, *Switzerland*
AOSIS	John W. Ashe*, *Antigua and Barbuda*	Tuiloma Neroni Slade, *Samo*
Non Annex I Party	Franz Tattenbach Capra, *Costa Rica* Adbelhay Zerouali, *Morocco*	Abdulmohsen Al-Sunaid, *Sa* Xuedu Lu, *China*
Annex I Party	Szczburn Okramotes, *Japan*	Suchova Gera, *Canada*

* Executive Board Chairperson

- **Unilateral CDM:** Developing coun-

tries will be allowed to unilaterally undertake CDM projects that can generate credits. These CDM credits can then be marketed internationally to countries that need them for compliance with emissions targets. This, in combination with the fungibility outcome, is an important measure to create fluidity and efficiency in the global carbon market.

- **CDM Adaptation Fund Fee:** A fee of 2% of the CDM proceeds will be placed on CDM projects to support the new adaptation fund to assist developing countries most vulnerable to the adverse effects of climate change. CDM projects in least developed countries will be exempt from this fee. A separate fee to cover administrative expenses of the CDM will be determined later by the COP/MOP.

- CDM projects that started during or after year 2000 can generate CERs retroactively from year 2000, but must be registered with the Executive Board by 2005. New CDM projects must register with the EB before beginning to generate credits.

Joint Implementation (JI)

- **A JI Supervisory Committee is established.** Its powers will include the authority to verify ERUs in cases where a host Party falls out of compliance with eligibility requirements for international emissions trading (see below), but is still eligible for JI. The Committee will be composed of three members from Parties in Annex I with economies in transition, three members of Annex I not referred to above, three members from non-Annex I, and one member representing small island developing states.

- **Second Track for Joint Implementation:** Because emissions from JI projects in Annex I countries are accounted for under the national targets of these countries, JI projects have less stringent criteria for emissions baselines, monitoring and verification. However, in the case of an Annex I country which fails to meet monitoring and reporting requirements or its emissions targets, a second track will be established for joint implementation projects in that country that will use a project cycle similar to that for CDM projects, reflecting the fact that the project's emissions are no longer accounted for under the country's achievement of its target.

- Joint implementation projects can begin generating credits with the start of the Kyoto commitment period in 2008, though JI projects can have started anytime after the year 2000.

Even following the key political decisions reached in the Bonn Agreement last July, Parties had been faced with an extremely complex set of legal texts on the Kyoto mechanisms, representing the enormous diversity of views and interests among the Parties on the underlying concepts of emissions trading. These decisions at COP-7 cut through that proliferation of proposals and legal texts to provide a sound framework for the establishment of the Kyoto mechanisms. The Accords give additional impetus and confidence to the ongoing development of emissions markets in various countries, and it provides the thrust necessary to get the CDM off to the "fast start" that was originally envisioned to begin in year 2000. While the CDM Executive Board still has considerable work to do in developing methodologies for baselines and verification of CDM projects, the Marrakesh Accords give considerable certainty for investors to start CDM projects.

Sinks

The Bonn Agreement defined eligible activities that sequester carbon from the atmosphere through soils and vegetation ("carbon sinks"). Eligible sinks activities in Annex I countries include forest management, cropland management, grazing land management and revegetation. Afforestation and refor-

estation are allowable sinks activities under the CDM, but are limited to 1% of base year emissions multiplied by five. In addition, the Marrakesh Accords include the following new provisions regarding sinks:

- The newly created emissions **Removal Units (RMUs)** to represent carbon sequestered through domestic sinks activities can be used towards a country's emissions reduction commitment within the compliance period that the reductions are generated. RMUs cannot be banked for future compliance, therefore restricting their life on the emissions market. From the market's perspective, this is likely to enhance the use of RMUs for compliance in the first period, making AAUs the preferred tool for banking.

- **Russian Sinks Exception:** Immediately following the Bonn Agreement in July, Russian negotiators had signaled their dissatisfaction with the 17.6 million metric ton CO2e ceiling for credits for forest management activities contained in Appendix Z to the Bonn Agreement (the Appendix contains a specified ceiling for each Annex I Party's activities under Article 3.4 for the first commitment period). After intense bargaining in Marrakesh, Parties granted an exceptional last-hour concession to Russia's demand, and expanded the Russian ceiling to 33 million tons. This increase in Russian sinks capability, adding to an already high reserve of emissions from slowed economic activity in the 1990s, could bolster Russia's ability to meet a large portion of the global GHG emissions reduction supply. However, Russia still faces challenges in completing acceptable inventories of sinks and emissions that are prerequisites to trading.

- The eligibility of **sinks activities under the CDM** is limited to afforestation and reforestation activities, up to a ceiling of one percent of base year emissions multiplied by 5.

As agreed in Bonn, in addition to the forest management activities covered in Article 3.4 of the Protocol, Annex B countries will have unlimited use of credits from sinks activities under Article 3.3 of the Kyoto Protocol to meet their emissions targets.

Other Decisions

Assistance to Developing Countries: As agreed at COP 6.5 in Bonn, three new funds were formally established in the Marrakesh Accords to provide assistance to developing countries. The adaptation fund, to be financed by a share of the CDM proceeds, will provide assistance to developing countries most vulnerable to the adverse effects of climate change. In addition, a special climate change fund and a separate fund for least developed countries will provide assistance for capacity building, technology transfer and other needs. There are no mandatory obligations for countries to contribute to these funds, however, so they are reliant on voluntary contributions. An enhanced framework to stimulate the transfer of environmentally-sound technologies was agreed to, and a consultative group of experts on technology transfer was elected in Marrakesh to provide guidance to this framework.

Kazakhstan and Turkey: COP-7 noted Kazakhstan's commitment to take on a quantified emissions target under Annex B of the Kyoto Protocol, and agreed to allow Turkey to remain in Annex I of the Convention but be removed from the financial obligations of Annex II, meaning that Turkey will be in a position to take on a quantified emissions target by at least the second commitment period.

Looking Forward: The Conference agreed to consider a process at COP-8 to evaluate commitments by developing countries under the Convention, an unprecedented move that could open the way toward discussion of emissions targets for developing countries. COP-7 also agreed upon a Marrakesh Ministerial Declaration to next September's World

Summit on Sustainable Development in Johannesburg, South Africa. Following the conference, a number of countries, including Japan, expressed their intent to seek ratification by the time of the World Summit on Sustainable Development in September, 2002. Finally, the conference agreed that COP-8 would be held in October-November of 2002; India has expressed interest in hosting that conference.

Business Outlook

For the business community, perhaps the delegates' most significant accomplishment is the work completed on the technical procedures governing the cornerstone flexibility mechanisms of CDM, JI and International Emissions Trading. Building on the successes of Bonn, the delegates managed to agree on the detailed text that provides the operating rules for international trading, address party eligibility for participation in the mechanisms, and outline the nature and scope of a compliance regime. Importantly, the Marrakesh decisions successfully avoided any of the potential landmines proposed by some delegations that could have severely inhibited attempts to create an efficient emissions market.

These steps, together with recent national and regional guidance on the development of emission reduction regimes and trading schemes, mean that the policy infrastructure for the global carbon market is starting to take shape. To date over 40 countries have ratified Kyoto. A number of Annex I countries have climate change mitigation legislation in place and some, like Denmark, the UK and Sweden have gone so far as implement emissions trading schemes. Though Marrakesh does not provide the specific sovereign legislation necessary to govern corporate response, it does provide the guidance that national governments need to seek ratification of the Kyoto Protocol and draft implementing regulations.

The prospect of entry into force of Kyoto, which received a significant boost in Marrakesh, is expected to provide important policy signals to allow the world business community to take the lead in meeting emission reductions goals. Policy processes at the national level are likely to pick up speed as countries move to ratify and plan to implement Kyoto. Though companies with assets in the U.S. may face a less certain regulatory future, it is possible for businesses in other major industrialized countries to start planning for a GHG-regulated economy, especially as national systems come into greater focus.

A full copy of the 245-page Marrakesh Accords can be accessed at www.unfccc.int.

ANNEX B.

U.S. Global Climate Change Policy: *A New Approach*

February 14, 2002

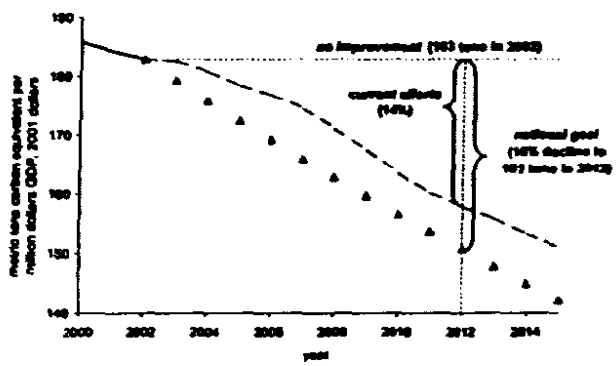
U.S. Global Climate Change Policy
A New Approach

The President announced today a new approach for meeting the long-term challenge of climate change. Specifically, the President's plan will:

Reduce the Greenhouse Gas Intensity of the U.S. Economy by 18 Percent in the Next Ten Years. Greenhouse gas intensity measures the ratio of greenhouse gas (GHG) emissions to economic output. This new approach focuses on reducing the growth of GHG emissions, while sustaining the economic growth needed to finance investment in new, clean energy technologies. It sets America on a path to slow the growth of greenhouse gas emissions, and – as the science justifies – to stop and then reverse that growth.

The United States will lower its rate of emissions from an estimated 183 metric tons per million dollars of GDP in 2002, to 151 metric tons per million dollars of GDP in 2012. We will achieve these reductions through a combination of current and new efforts. Meeting this commitment will prevent over 500 million metric tons of greenhouse gases from entering the atmosphere over the next ten years – the equivalent of taking 70 million cars off the road. This goal is comparable to the average progress that nations participating in the Kyoto Protocol are required to achieve.

Reduce GHG Emission Intensity 18% Over the Next Decade



Substantially Improve the Emission Reduction Registry. The President directed the Secretary of Energy, in consultation with the Secretary of Commerce, Secretary of Agriculture, and the Administrator of the Environmental Protection Agency, to propose improvements to the current voluntary emission reduction registration program under section 1605(b) of the 1992 Energy Policy Act within 120 days. These improvements will enhance measurement accuracy, reliability and verifiability, working with and taking into account emerging domestic and international approaches.

Protect and Provide Transferable Credits for Emissions Reduction. The President directed the Secretary of Energy to recommend reforms to ensure that businesses and individuals that register reductions are not penalized under a future climate policy, and to give transferable credits to companies that can show real emissions reductions.

Review Progress Toward Goal and Take Additional Action if Necessary. If, in 2012, we find that we are not on track toward meeting our goal, and sound science justifies further policy action, the United States will respond with additional measures that may include a broad, market-based program as well as additional incentives and voluntary measures designed to accelerate technology development and deployment.

Increased Support for America's Commitment to Climate Science and Technology. The President's budget includes $4.5 billion for climate change programs in 2003, a $700 million increase over FY'02 – notable given America's focus on security issues in the President's new budget proposal. Key elements of this effort include:

- ✓ The Climate Change Research Initiative. The U.S. will spend $1.7 billion in FY'03 for basic research on climate change, $40 million of which is dedicated to leverage other funding to address major gaps in understanding the carbon cycle and the role of black soot.

- ✓ The National Climate Change Technology Initiative. The U.S. will spend $1.3 billion on climate change technologies, of which $40 million will be spent on development and deployment of advanced energy and sequestration technologies critical to long-term emission reduction.

Implement a Comprehensive Range of New and Expanded Policies, including:

- ✓ Business Challenges: The President challenged American business and industry to develop new agreements with the Administration to reduce greenhouse gas emissions, building upon successful aluminum and semiconductor agreements.

- ✓ Enhanced Activities in the Transport, Manufacturing and Agricultural Sectors: The plan includes $4.6 billion in tax incentives over five years to spur investments in renewable energy, hybrid and fuel cell vehicles, co-generation and landfill gas. The President also supports including expanded sequestration elements in the Farm Bill.

New and Expanded International Policies Designed to Complement Our Domestic Programs:

- ✓ Triple Funding for "Debt-for-Nature" Tropical Forest Conservation Programs to $40 million. Under the Tropical Forest Conservation Act, developing countries agree to protect their tropical forests from logging, protecting biodiversity, avoiding emissions, and preserving the substantial carbon sequestration services they provide. Under the Bush Administration "debt-for-nature" swaps have been negotiated with Belize, El Salvador, and Thailand.

- ✓ Fully Fund the Global Environment Facility (GEF). The President's plan calls for $178 million in FY03 for the GEF, the chief multilateral climate change assistance funding mechanism – an increase of more than $77 million.

- ✓ Bilateral Assistance. The President's climate plan calls for $155 million for the United States Agency for International Development, which will continue to be a major source of climate technology assistance to developing countries.

- ✓ Investing $25 Million in Climate Observation Systems in Developing Countries. In response to the National Academy of Sciences' recommendation for better observation systems, the President has allocated $25 million and challenged other developed nations to match the U.S. commitment.

183

ANNEX C.

BEST AVAILABLE

Air Trends Special Supplement: President Bush Announces Climate Change Policy

BEST AVAILABLE

NATSOURCE
EMISSIONS BROKERAGE DESK
Airtrends
Special Supplement

CONTACTS
MICHAEL
RICHARD R
DIRK F
PHONE: 212-232-5001
FAX: 212-232-5353

President Bush Announces Climate Change Policy

On February 14th, President Bush announced his administration's long-awaited climate change policy. At the core of the policy is a voluntary goal to reduce the greenhouse gas (GHG) intensity of the U.S. economy by 18% by 2012. Under the plan, the current GHG intensity level—183 metric tons of carbon equivalent (mtce) emissions per million dollars of GDP in 2002—would be reduced to 151 mtce per million dollars of GDP in 2012. By setting a voluntary goal defined in terms of GHG intensity, rather than absolute emissions levels, the plan allows the U.S. to demonstrate progress against a metric through voluntary actions. At the same time, the plan reflects the administration's view that mandatory emissions caps, such as those enshrined in the Kyoto Protocol, would unduly constrain economic growth.

This analysis will describe the main elements of the President's climate change plan and assess the impact of the plan on U.S. GHG emissions. After reviewing key provisions in the plan, the analysis will consider the President's proposal in the context of the evolving climate policy debate in Congress, discuss international reactions to the plan, and offer some final thoughts.

(continued on page 2)

...And Multi-Pollutant Plan

The Bush Administration issued its long-awaited multi-pollutant proposal on February 14, 2002. The CLEAR SKIES initiative establishes the general framework for a proposal to reduce power plant emissions of NOx, SO_2, and mercury over the next 16 years (for this article combined regulation of NOx, SO_2 and mercury is referred to as multi-pollutant). Implementation of this initiative will require amending the Clean Air Act. This policy position is intended to give the Administration a voice in the debate over multi-pollutant legislation on Capitol Hill.

The Logic of Using a Multiple-Pollutant Approach

Electric utility companies regard the current regulatory approach as being unnecessarily costly and complex. It presents significant challenges and uncertainties particularly for coal-based power plant operators. Many, including utility officials, have concluded that there is a better way to achieve air quality goals.

Designed properly, a multi-pollutant approach would be a more efficient way to achieve economic, energy and environmental goals. Such an approach would provide regulatory certainty, continue to improve air quality, increase compliance flexibility and reduce compliance costs through market based approaches, and maintain coal-fired generation as part of the electricity supply mix. The Edison Electric Institute (EEI), the trade association of investor-owned utilities, has advocated for a multi-pollutant approach that reduces SO_2, NOx and mercury. The environmental community favors a multi-emissions approach if it would produce deep emission reductions of SO_2, NOx, mercury and CO_2

(continued on page 6)

Bush Climate Policy

(continued from page 1)

Summary and Assessment of the President's Climate Change Plan

GHG Intensity Target

In the administration's announcement, the voluntary GHG intensity target is described as a "national goal" which "sets America on a path to slow the growth of GHG emissions, and as the science justifies, to stop and then reverse that growth." The announcement directly responds to criticism from policymakers who were disappointed by President Bush's decision to withdraw from the Protocol; it states that the President recognizes America's responsibility to reduce emissions, and asserts that reversing emissions growth will eventually stabilize atmospheric concentrations of GHGs at safe levels. However, the plan emphasizes the need to protect the economy from the negative effects of overly-restrictive emissions targets before technologies have been developed that can break the link between economic growth and emissions growth.

According to the administration's estimates, achieving the GHG intensity target would reduce emissions in 2012 by 100 million mtce, or 4.5%, relative to business-as-usual emissions in that year. The plan is estimated to achieve more than 500 million mtce in reductions over the period 2002-2012. In comparison, the Clinton Administration's commitment under the Kyoto Protocol would have reduced emissions by about 300 million mtce over a shorter period, 2008-12.

Although the administration did not provide a complete explanation of its calculations, estimates of future emissions under the plan can be made based on information provided in the announcement and other data. We estimate that the administration's plan would result in U.S. GHG emissions in 2012 that are approximately 13% above 2000 levels, 31% above 1990 levels, and 41% above the U.S.' Kyoto Protocol target of 7% below 1990 levels. These figures are comparable to other estimates quoted in recent news reports.

Because the GHG intensity target ties total emissions to performance of the economy, it does not guarantee that any specific emissions reductions goal will be met. Natsource's estimates adopt the administration's assumption that U.S. GDP will increase 3% per year until 2012. If GDP grows less than 3% per year, achievement of the GHG intensity target would imply a greater amount of emission reductions (relative to business-as-usual) than estimated above. On the other hand, if GDP grows more than 3% per year, achievement of the GHG intensity target would imply fewer emission reductions.

A GHG intensity target can lead to significant emissions reductions if it is sufficiently aggressive (i.e., if it requires reductions in GHG intensity that outpace economic growth). However, the administration's goal of reducing GHG intensity by 18% by 2012 would lead to only modest reductions — an estimated 4.5% reduction from business-as-usual. GHG emissions would continue to grow at about 1% per year between 2002 and 2012, compared with about 1.4% under business-as-usual. Some observers suggest that achieving the goal will require little effort since U.S. GHG intensity has been declining during the past two decades due to improvements in energy efficiency and the shift towards less energy-intensive industries.

The administration justifies the modest reductions called for under the plan by asserting that forecasts of the average reductions required by nations implementing the Kyoto Protocol range from zero to 7%. (These figures do not refer to Annex B countries' targets under the Protocol, but rather the actual emission reductions they will achieve independent of emissions trading and sequestration activities. The average emission reduction effort in other Annex B countries would have been higher if the U.S. were participating in the Protocol, since U.S. demand would have greatly reduced the supply of low-cost allowances available to other countries in international GHG markets.) The plan also notes that because GHG intensity goals do not impede economic growth, they provide a practical basis for discussing goals with developing countries. This message, and criticism of the Kyoto Protocol in a recent Council of Economic Advisors' (CEA) report, suggest that the President may push in the future for a GHG intensity approach at the international level, perhaps as an alternative to the system of emission reduction targets embraced in the Protocol.

National Emissions Registry; Initiatives to Encourage and Track Reductions

The plan sets a 4-month deadline for a proposal from the Secretary of Energy, with input from EPA and the Departments of Commerce and Agriculture, to improve the 1992 Energy Policy Act's 1605b program. Under 1605b, companies currently register their GHG emissions and emissions reductions on a voluntary basis. Revisions to the program would be intended to give greater credibility to registered reductions by improving and standardizing measurement protocols for emission reductions and carbon sequestration, and by taking account of emerging domestic and international approaches to measurement. Reporting of emissions and emissions reductions would remain voluntary under the President's

plan.

The plan calls for the Secretary of Energy to recommend reforms that would ensure that early reductions are not penalized under future climate change policies, and that inaction is not rewarded. Significantly, it also calls for reforms that would give "transferable credits" to companies that can show "real reductions." This provision recognizes that companies will have greater incentive to implement and register cost-effective emission reductions in advance of mandatory requirements if they are certain that those reductions will be recognized under future programs. However, the provision does not specify whether emission reductions that have been implemented in the past will be eligible for recognition.

The administration notes that it will assess whether existing authority under the Energy Policy Act is adequate to implement changes to the 1605b program, or whether new legislation would be needed. Several legislative proposals to improve or replace the 1605b program have been proposed in this Congress and in previous sessions.

In the announcement, the President also states that he will encourage companies to develop voluntary GHG-reduction agreements with the administration under EPA's "Climate Leaders" program. Eleven companies are currently participating in the program.

Tax Credits and Production Credits for Renewable Energy and Cogeneration

The administration proposes to award $555 million in 2003, $4.6 billion over the next 5 years, and $7.1 billion over the next 10 years as tax credits to spur investment in solar, wind, and biomass energy sources, hybrid and fuel cell vehicles, cogeneration, and landfill gas. Many of these provisions were included in the President's FY 2003 budget request. The tax credit provisions include the following:

- A three-year extension of the current 1.7 cent-per-kWh credit for electricity from wind and biomass, an expansion of the list of eligible biomass facilities, and a 0.5 cent-per kWh credit for electricity produced from coal-fired facilities co-firing newly-eligible sources of biomass;
- A 15% tax credit for purchases of residential photovoltaic equipment (during 2002-07) or solar water heating systems (during 2002-05), up to $2000 for each type of equipment;
- A tax credit of up to $4,000 for the purchase of new hybrid (electric/fuel) vehicles and of up to $8,000 for the purchase of fuel cell vehicles between 2002 and 2007;
- A 10% tax credit for investments in combined heat and power systems between 2002 and 2006;
- A tax credit of approximately 1 cent-per-kWh f energy produced from methane from landfills regulated f methane emissions. The credit would be 1.5 cents-per-kWh f unregulated landfills, and would apply to energy produced fro new facilities through 2010.

Transportation Sector Initiatives

In addition to citing the administration's recently announce "FreedomCAR" initiative, which is aimed at promoting develop ment of hydrogen-fueled vehicles, the plan announces that th Secretary of Transportation will recommend updated corporat average fuel economy (CAFE) standards. The Secretary's action must take into account a recent National Academy of Science report, which recommended allowing manufacturers to trade fue economy credits. The administration's plans on CAFE may be has tened by activity in the Senate, where increased CAFE standard are currently under consideration as part of the Democrats' com prehensive energy bill.

Agriculture & Sequestration

The plan proposes to increase funding from $1 billion to $3 billion to implement the conservation title of the Farm Bill, which would result in an additional 35.7 mmtc of sequestration annually. The Secretary of Agriculture will also recommend additional incentive measures to increase forest and agricultural GHG sequestration Related measures are currently being considered in the Farm Bill which passed the House and Senate and is now in conference committee. The Senate version of the bill contains a measure that would provide $20 million in grant funding over 5 years to agricultural producers, nonindustrial private forest owners and farmer-owned cooperatives to monitor, measure, verify and audit (using independent third parties) carbon sequestration and ghg emission reductions from eligible projects. In each of the 5 years (FY 2002 to FY 2006), $1 million would be provided to carry out farmer-owned cooperative carbon environmental trade pilot projects.

Possible Further Measures in 2012

If in 2012 the U.S. is not on track to meet the GHG intensity goal additional measures may be considered, including "a broad, market-based program" and "additional incentives and voluntary measures designed to 'accelerate technology development and deployment.

Other Provisions

The plan also calls for increased spending on climate-related science and technology, and assorted international projects geared

toward climate research, technology transfer to developing countries, and debt-for-nature swaps.

The Bush Climate Plan Differs from Current Proposals in Congress

Now that the President has announced his climate plan, a key question is how the plan will impact the evolving climate policy debate in Congress, and particularly the Senate, where a 4-pollutant bill that includes mandatory CO_2 controls for electric utilities is expected to be debated by the Environment Committee this year.

On February 5, Senator Jeffords (I-VT), the Chairman of the Senate Environment Committee, decided to postpone a committee markup of his 4-pollutant bill (the Clean Power Act, S. 556) until late March. It does not appear that the President's plan could provide the basis for building a consensus approach in the Environment Committee. After the President's announcement, Senator Jeffords criticized the plan for failing to produce real CO_2 reductions. There is an immense gap between the President's climate plan (which is voluntary and allows U.S. GHG emissions to increase to 31% over 1990 levels by 2012) and the Jeffords bill as introduced (which is mandatory and requires electric generators to reduce emissions to 1990 levels by 2007). In addition, there is also a significant gap between Senator Jeffords' proposed caps on the other 3 pollutants — SO_2, NOx and mercury — and the President's proposed caps (see separate article in this special supplement on the President's Clear Skies Initiative).

The President's climate proposal may receive greater attention and scrutiny in light of a number of climate-related proposals that have been introduced in the Senate. Senator Jeffords is expected to push for passage of a version of his 4-pollutant bill by the Environment Committee, and reportedly has sufficient votes to ensure passage. The Senate is beginning debate on the Democrats' comprehensive energy bill, which includes a mandatory GHG emissions reporting provision, as well as a provision calling for increased CAFE standards and a system for trading credits received for surpassing CAFE standards. In addition, Senator Lieberman (D-CT), last year's Democratic candidate for Vice President, announced that he is developing a cap-and-trade proposal with Senator John McCain (R-AZ), the runner-up to President Bush in last year's Republican primary. These proposals could raise the profile of climate issues in the Senate, particularly if other countries' efforts to ratify the Kyoto Protocol result in increased public support in the U.S. for more aggressive action on climate change.

On the other hand, the modest reductions called for in the President's plan could find support among Senators favoring a "go-slow" approach, particularly if there is little public pressure to take more aggressive action. That said, no major environmental organization favors the Bush plan-and without such an endorsement, it could be politically risky for Senators to support the plan. Given the distractions of an election year, combined with concerns about a sluggish economy and few legislative days remaining on the calendar, it is unlikely that the Congress will complete work on major climate change legislation this year.

International Reaction to the Bush Climate Plan Was Lukewarm

Since President Bush officially announced in June 2001 that the U.S. would not pursue ratification of the Kyoto Protocol, there has been much speculation regarding the possible shape of the administration's climate plan. There has also been concern among supporters of the Kyoto Protocol that a Bush climate plan could undermine support for the Protocol. Japanese and Russian support for ratification is particularly important, since the Protocol cannot enter into force without their ratification.

In order to enter into force, the Protocol must be ratified by at least 55 countries accounting for at least 55 percent of 1990 Annex I CO_2 emissions. With the US standing on the sidelines, ratification by the EU, Japan, and Russia would be required at a minimum to achieve entry into force. The EU is aggressively pursuing ratification of the Protocol by June 2002, in time for the World Summit on Sustainable Development in Johannesburg. However, Japan's support has been somewhat less certain, despite public pronouncements, because of the country's economic woes and its strong preference to have the U.S. participate in international GHG emission reduction efforts. Russia's intentions have also been the subject of some speculation, although many observers expect Russia to ratify in light of the significant revenue it can generate by selling emission reductions and surplus allowances.

Reactions to the President's climate plan in Europe and Japan were marked by mild praise for the President's recognition of the need to take action on climate change, disappointment with the emission increases allowed under the U.S. plan, rejection of the plan as an alternative to the Kyoto Protocol, and expressions of hope that the U.S. will eventually rejoin the Kyoto framework. Japan reaffirmed its plan to ratify the Protocol during the current session of the Diet, which ends in June, while the EU, Germany and the United Kingdom reconfirmed their intention to ratify by June 2002. Italy also recently passed a draft law to ratify the Protocol; the draft law must be approved by Parliament to enter into effect.

Japanese Prime Minister Junichiro Koizumi described the plan as a "very positive proposal", but added that Japan expected further efforts. Japanese Environment Minister Hiroshi Oki was less posi-

tive, noting that "[it's not as if we're extremely happy with it [the Bush plan]." Similarly, Germany's Environment Minister, Juergen Tritten, characterized the plan as "disappointing."

In a joint statement for the EU, Jaume Matas (the Environment Minister of Spain, which currently holds the EU Presidency) and Margot Wallstrom (Commissioner for Environment in the European Commission) contrasted the increased emissions allowed under the Bush plan with the emission reductions to be achieved by most industrialized countries. This observation was echoed in a statement by British Environment Secretary Margaret Beckett. Matas and Wallstrom noted that the new plan would not lead to stabilization of U.S. emissions at 1990 levels, a target that the U.S. is still committed to meet under the 1992 UN Framework Convention on Climate Change. Because GHG intensity has been falling in the U.S., they said that the plan foresees "little more than 'business as usual.'" They also expressed concern over the "purely voluntary nation of the actions proposed," and stated that mandatory emissions monitoring and reporting would be needed to assess whether measures under the Bush plan represent "an effort comparable to the ones under the Kyoto Protocol."

Although both Japan and Europe appeared to temper their remarks in order to leave the door open for an eventual U.S. return to the Kyoto framework, the EU was more forceful regarding the potential consideration of the U.S. plan as an alternative to the Protocol. The first sentence of the EU's statement reads, "It is clear that the proposals for U.S. action on climate change are purely domestic."

The President's proposal did not directly state that it was intended to replace the Protocol, although it did note that a GHG intensity approach "is a more practical way to discuss goals with developing nations", since it would not constrain economic growth, as would absolute emissions caps. In recent remarks, Secretary of State Colin Powell touched on this theme, stating that the Bush approach is a "natural fit" with the goals of developing nations because of its "focus on economic growth." The CEA's recent Economic Report of the President hinted at the possibility of replacing "the reductions set out in the Kyoto Protocol" with "a reasonable, gradual goal." However, the CEA report does not specify whether a GHG intensity improvement target should apply to all countries, or whether different goals should be set for different countries. The administration's ambiguity on this issue likely reflects its desire to avoid being seen as interfering with other countries' ratification of the Protocol. This desire was evident in National Security Adviser Condoleeza Rice's efforts to reassure diplomats from EU countries that the plan was not seen by the administration as competing with the approach taken in the Protocol.

Reactions to the Bush plan from Australia, Canada, and the Japanese Federation of Economic Organizations (Keidanren) indicate that the Bush administration position will, nevertheless, still have some impacts on the Kyoto ratification process, even if these impacts are not likely to be fatal to its entry into force. Australian Prime Minister John Howard asserted that the Bush plan "will lead to an alternative to simply saying no to the Kyoto Protocol," suggesting that his government will align itself with the U.S. on the climate issue. On February 27, Australia and the U.S. established the "Australian/U.S. Climate Action Partnership," which will focus on such issues as emissions measurement and accounting, the development of emission reduction registries, economically efficient approaches to reduce industrial emissions, sequestration from agriculture and land management, and building capacity in developing countries. The Australian Minister for the Environment and Heritage, Dr. David Kemp, said that Australia remains committed "to working to meet its Kyoto targets," but noted Australia's concern that the Kyoto Protocol does not involve all countries. Announcement of the Australian/U.S. partnership may stoke concerns in the EU that the U.S. policy approach could undermine support for the Protocol. However, Australia's reaction to President Bush's announcement should not come as a surprise to most observers, given previous indications that Prime Minister John Howard's government is unlikely to ratify the Protocol.

Canada has been sending somewhat mixed signals in response to the Bush climate plan. Although the Prime Minister has expressed support for the Protocol, recent statements by Natural Resources Minister Herb Dhaliwal and Environment Minister David Anderson suggest that Canada may take more time to ratify than other nations due to its consultation process. Cabinet members have called for consultation with the provinces on the topic of the Protocol, and 9 of 10 provincial premiers sent a letter to the Prime Minister questioning ratification. Prime Minister Chretien's communication director recently noted that the Prime Minister has consistently said he wants Canada to receive "clean air credits" for its exports of clean natural gas to the U.S.

Summary

The issuance of President Bush's climate plan represents further evolution of U.S. domestic and international climate policy although it does not call for a significant level of reductions in the next ten years, and is voluntary. In the U.S., the plan is likely to raise the profile of climate issues in the Senate, and attract attention in discussions on the CO_2 component of 4-pollutant legislation. Internationally, the plan will provide at least a starting point for the Bush administration to reengage in climate policy discussions. In the meantime, other countries continue to push forward with their plans to ratify the Protocol.

For U.S. companies, one element of the administration's climate policy could create new incentives to reduce emissions, despite

the plan's voluntary nature. The Bush plan calls for rules that would provide "transferable credits" to companies that can show "real reductions." Inclusion of this provision suggests that the Bush administration views market mechanisms as an important tool for creating incentives to reduce GHG emissions. If the administration is able to provide companies with certainty that their emission reduction efforts will be recognized under future GHG emission reduction requirements, many firms would have significantly less reluctance to implement early reductions. A credible registry and a well-designed credit-for-early-action measure allowing for trading would motivate firms to plan for the future and, potentially, to implement cost-effective internal reductions and credit purchases in advance of mandatory requirements.

Natsource will continue monitoring reactions to the President's climate plan, new developments in the administration's implementation of the plan, and other key developments in emerging domestic and international climate policies.

Bush Administration's Multi-pollutant Plan Announced

(continued from page 1)

within at least the next decade (adding CO_2 to the roster of regulated emissions).

The Legislative Landscape

The legislative activity on reductions of power plant emissions has centered on the Senate Environment and Public Works (EPW) Committee chaired by Senator Jeffords (I, VT). In March 2001, Senator Jeffords introduced legislation (S. 556) to address emissions from power plants. S. 556 would require significant reductions in NOx, SO_2, mercury and CO_2 by January 1, 2007. Senator Smith (R, ME), the ranking minority member of the committee, also supports multi-emissions legislation, as does a majority of the committee.

The EPW Committee has held several multi-emissions hearings. Mark-up of S.556 could occur in April.

Details of CLEAR SKIES Initiative

Chart 1 lays out the details of the Administration's initiative compared to S. 556.

The CLEAR SKIES initiative has less stringent reduction levels and later deadlines than Environmental Protection Agency proposals that were previously the subject of debate within the Administration.

Several aspects of the Bush initiative deserve particular attention. The second phase deadline for reductions of all three pollutants is 2018, 12 years later than the S. 556 deadline. In addition, the West will have less stringent reductions for SO_2 and NOx than the East. The exact East/West levels are not specified. Regarding SO_2, the Administration endorsed the 510,000 ton air quality goal enshrined in an agreement of Western Regional Air Partnership (WRAP)—a collaboration between federal, tribal and state governments focused on regional haze in the Grand Canyon region—and stated that SO_2 allocations will "track" that agreement. The Administration also stated that there would be different reduction caps and separate East and West trading regions for NOx. The initiative also includes incentives for power plants that install scrubbers early in the program. Details for this early action incentive program also have not been released.

The CLEAR SKIES initiative includes a 15-ton mercury cap (two-thirds reduction from current emission levels) to be achieved by 2018, apparently with trading. However, EPA has started to develop what could be a more stringent requirement, through rulemaking. This regulatory requirement is unlikely to allow for trading and would be implemented by December 2007 under existing Clean Air Act authority. The CLEAR SKIES initiative would replace the mercury regulatory requirement.

In addition to the targets and compliance deadlines, there are many important details not addressed by the Administration's announcement:

1. Does the Administration's program replace other parts of the Clean Air Act to provide regulatory certainty?
2. How will the look-back provision (that allows the EPA Administrator to revise the reduction levels in the second phase of the program) work?
3. How will East/West reduction targets be allocated?
4. Will the mercury reduction target take into account the difficulties associated with reducing mercury in Western coals?
5. Will reductions from co-generation (combined heat and power) and industrial boilers also be required?

The Administration plans to make an announcement regarding the new source review (NSR) program very shortly. While there were no specifics announced as part of the CLEAR SKIES initiative, there are indications that significant NSR reforms are planned.

Trading

A cornerstone of the CLEAR SKIES initiative is cap and trade. The Administration estimates that a cap and trade program could result

in compliance costs savings of as much as $1 billion annually. Both S. 556 and the CLEAR SKIES initiative provide for NOx and SO2 trading. S. 556, however, would prohibit mercury trading. The environmental community is vigorously opposed to trading mercury. The Administration supports trading for all 3 pollutants, including mercury. However, there are concerns about concentrating mercury emissions in particular localities or "hot spots."

Initial Reactions

The environmental community has been critical of the CLEAR SKIES proposal. Their reaction can be characterized by the statement by Angela Ledford, Director of the organization Clear the Air, "The President's streamlining could actually allow more pollution than current law allows."

Utilities have been cautious in their remarks. For example, Edison Electric Institute welcomed the release of the Bush Administration multi-pollutant plan. However, EEI characterized the initiative as "an ambitious program that would be very challenging to meet." Generally, the CLEAR SKIES initiative has more stringent reduction levels than advocated by most (though not all) utilities. However, the date for the final reductions (2018) is later than the utility pr posals.

Prospects for Legislation

Legislation on multi-emissions in this Congress is very uncerta Chairman Jeffords likely has the votes to report "four pollutar legislation out of the Senate committee. However, action in the f Senate is not anticipated and passage of any legislation with S.55 like levels and dates is extremely unlikely. A key point to wa will be whether Senators Smith and Voinovich (R, OH) negotiate compromise with Senator Jeffords before or during mark-up of 556. As we move closer to the fall Congressional elections, H action on this issue will become more unlikely. Prospects for le islation in the next Congress can be better assessed after the ne election.

(1) All reductions are achieved through a cap and trade program exce where noted.
(2) All reductions are calculated from the current levels in the table.
(3) S. 556 does not allow mercury trading.

Chart 1. CLEAR SKIES Initiative vs. S. 556
Annual Emissions (1)

	Current Levels	CLEAR SKIES Initiative			S. 556
		2008	2010	2018	2007
NOx (Million tons)	5	2.1 (58% red. (2))	–	1.7 (67% red.)	~1.5 (70% red.)
SO2 (Million tons)	11	–	4.5 (59% red.)	3 (73% red.)	~2.2 (80% red.)
Hg (Tons)	48	–	26 (46% red.)	15 (69% red.)	~5(3) (90% red.)

ANNEX D.

Clean Technology Finance Resources

CLEAN TECHNOLOGY FINANCE RESOURCES

ORGANIZATION	CONTACTS	PHONE/FAX/EMAIL
Global Environmental Facility (GEF) – *GEF India Focal Point*	Rajeev Kher, Joint Secretary International Cooperation (IC), Ministry of Environment & Forests, Paryavaran Bhavan, CGO Complex, Lodhi Road, New Delhi 110 003	Ph: 436- 3956 Fax: 436-3956 Email: rajeevk@nic.in
Renewable Energy and Energy-Efficiency Fund (REEF)	Projects Over 7MW: Mr. Ken Locklin, 2000 L St., NW Suite 200, Washington, DC 20036	Email: klocklin@elf group. com
	Commercial Projects Under 7MW: Mr. Brooks Brown, 1655 N. Ft. Meyer Dr. Suite 520 , Arlington, VA 22909	Email: brooks@eeaf.org
	Off-grid and development projects under 7MW: Mr. Phil LaRocco, 383 Franklin Street, Bloomfield, NJ 07003	Email: phil@energyhouse.com
Environmental Enterprises Assistance Fund (EEAF)	Mr. Brooks Brown, President, 1655 N. Ft. Meyer Dr. Suite 520, Arlington, VA 22909	Email: brooks@eeaf.org
Nuon	Dr. Annemarie Goedmakers, Director Nuon Renewable Energy Business Unit, Postbus 9039, 6800 EZ, Arnhem, Netherlands	Ph: 31 (26) 377-2143 Fax: 31 (26) 377-2186
Triodos Bank	Mr. Hans Schut, Project Manager, Triodos Bank, Utrechtseweg 60 P.O. Box 55, 3700 AB Zeist, The Netherlands	Ph: 31 (30) 693-6500 Fax: 31 (30) 693-6566 Email:hans.schut@triodos.nl

The World Bank Group	1818 H Street, NW Washington, DC	Ph: (202) 473-1000 Fax: (202) 477-6391
International Finance Corporation (IFC)	2121 Pennsylvania Avenue, NW, Washington, DC 20433	Ph: (202) 473-7711 Fax: (202) 974-4384
Asian Development Bank (ADB)	6 ADB Avenue, Mandaluyong City, 0401 Metro Manila, Philippines	Ph: (632) 632 4444 Fax: (632) 636 2444
Export-Import Bank of the U.S.(EX-IM)	811 Vermont Ave., NW, Washington, DC	Ph: (202) 565-3946 Fax: (202) 565-3380

ANNEX E.

Toolkit on Baseline Development in Climate Change Mitigation Projects

Draft Toolkit for Baseline Development in Climate Change Mitigation Projects

For

Louis Berger Group Inc.
Greenhouse Gas Pollution Prevention Project [GEP]
A USAID/India Project

April, 2001

Econergy International Corporation
1925 K Street, Suite 230
Washington, DC 20006
(202) 822-4980

196

Table of Contents

TABLE OF CONTENTS I
1. INTRODUCTION 1
2. CONCEPTUAL BACKGROUND 3
3. OPERATIONALIZING BASELINE DEVELOPMENT 7
SUPPORTING MATERIALS 30

DISCLAIMER

This toolkit is not intended to substitute for engaging a qualified professional who is experienced in the development of the carbon emissions baseline of a climate change mitigation project. Establishment of a credible baseline is critical for all CCMPs. Achieving a credible baseline is extremely complicated for certain CCMPs. The quality of emissions reductions, as perceived by the marketplace, and therefore the market value of the reductions, may be severely downgraded in the absence of the involvement of a carbon baseline professional who has a proven track record of providing these specialized services.

1. Introduction

Intended applications of toolkit

This toolkit describes the essential elements and steps for baseline calculation procedures to be applied to climate change mitigation projects (CCMPs) in India in the energy generation and energy efficiency sectors. This toolkit is intended only as a road map by which the CCMP developer can gain a strong conceptual understanding of the baseline characterization that must be established for the project.

The procedures in this toolkit apply to two broad project types:

1. Alternative energy production, in which a less carbon-intensive source (renewables, natural gas, etc.) is used to generate electric or thermal energy
2. Energy efficiency, in which electric or thermal energy consumption is reduced

Both project types can displace carbon emissions from three different sources:

1. Grid-generated electricity
2. Electricity generated off the grid
3. Thermal (steam, hot water) energy generation.

Other project types, such as methane capture from various possible sources, as well as waste-to-energy projects are described in a general way here. Specific treatment of such project types is not provided, but the basic principles provided here establish the groundwork for performing baseline analysis of such projects. Further, it is anticipated that case materials based on projects under development in India may be prepared as part of the testing of this toolkit.

Linkages with the other toolkits

This Baseline Toolkit is closely linked with the M&V Toolkit and it provides necessary input to the Sustainable Development, Carbon Finance, and Marketing and Funding Toolkits. The Baseline Toolkit develops the procedures for determining the baseline carbon emission rate and quantifying the emission reductions resulting from the CCMP. The M&V Toolkit identifies the parameters that must be monitored to update the baseline calculations and determine the actual CCMP performance, which will allow the quantification of actual emission reductions. The M&V Toolkit presents the procedures for this quantification, which are those included in the Baseline Toolkit. In developing the baseline, there is risk that the baseline does not accurately predict the actual emission reductions that will occur. M&V addresses this risk, assuring that the buyer of carbon credits gets what they pay for.

The Baseline Toolkit provides necessary input to the other three toolkits by quantifying the emission reductions resulting from a CCMP. This provides a yardstick with which to assess the project's environmental sustainability, as discussed in the Sustainable

198

Development Toolkit. It also determines the quantity of carbon credits that can be traded, which is a necessary prerequisite to the Carbon Finance Toolkit and the Marketing and Funding Toolkit.

199

2. Conceptual Background

Definition and importance of a baseline

CCMPs implemented in India will produce reductions in greenhouse gas emissions compared to what would otherwise occur. The baseline represents the emissions that would occur in the absence of the CCMP. The difference between the CCMP case and the baseline defines the value of the carbon reduction. Internationally accepted standards demand that selected CCMPs have a credible, quantifiable and verifiable baseline of emissions, from which reductions can be measured and verified. The definition of the baseline is inherently counter-factual (it will be replaced by the proposed CCMP) and therefore somewhat uncertain. Nevertheless, the establishment of the baseline is the key step in determining the extent to which a CCMP satisfies the requirement of additionality under the Clean Development Mechanism (CDM) or other carbon-reduction trading regime provided under the Kyoto Protocol to the UN FCCC.

In the absence of a standard baseline set by regulatory authorities, for example a technology standard, baselines must determined on a project-specific basis that is reasonable and verifiable. The first step for identifying a project-specific baseline is to determine the "system boundaries" within which the GHG emissions are calculated. The systems boundary, for example, might be all electricity generated in a regional grid system into which a renewable energy project feeds, as opposed to the entire national grid. Individual CCMPs inherently displace the emissions of different sources, depending on the type of project and its location in the country. As a result, the system boundary must be carefully chosen to ensure that the baseline accurately characterizes the emission reductions from the CCMP.

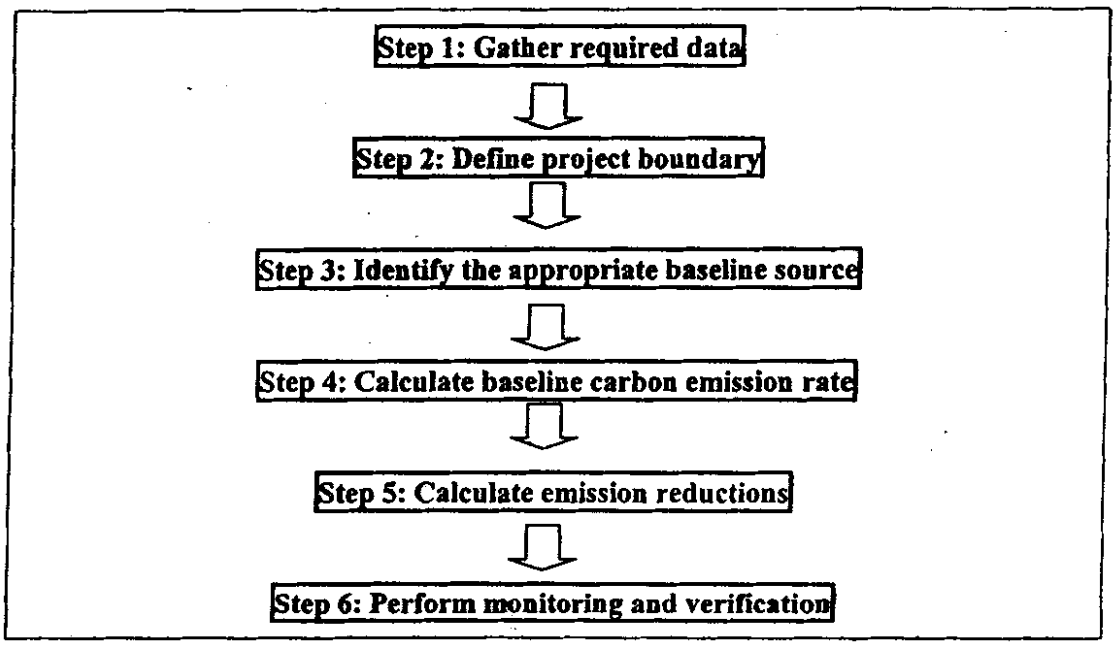
For energy sector projects considered here, net emission reductions for CCMPs are calculated on the basis of the carbon content of the fossil fuel replaced. Thus, the principal elements that determine the amount of reductions include:

1. The baseline carbon emission rate
2. The project's energy production rate (for generation projects) or reduction in energy consumption (for efficiency projects)
3. The project emissions (if any)

These elements must be quantified and measured in order to accurately calculate a CCMP's emission reductions. The general steps required for baseline development are illustrated in Figure 1.

200

Figure 1: Critical Path Diagram for Baseline Development



Risk assessment and mitigation

The baseline is subject to the risk of being adjusted or even rejected at some later date if it is not well-designed and documented. If possible, an authoritative third party should validate the baseline. A baseline that does not hold according to initial expectations over a specified period of time can undermine delivery of the projected Certified Emission Reductions (CERs), the tradable units under the CDM. Both the buyer and the seller of the CERs could as a result suffer from any unexpected a shift in the baseline. In the worst scenario, the seller could be prevented from realizing expected revenues from the sale of CERs, while the buyer may find that fewer or none of his previously anticipated CER purchases will be fulfilled. At a minimum, shifts in the baseline can change the relative price and value of the CERs. The higher the quality of the baseline, the lower the overall risk to all the parties to the project.

Risks to the baseline must therefore be identified and mitigated early. If it is not possible to mitigate all the identified risks to a project baseline, the parties to the project could instead agree to a more conservative figure for any related transactions or recorded reductions. In this context, the perceived risks to the baseline can determine the "quality" of the CERs sold by the project. The lower the perceived risk to the baseline, the higher the CER quality. In order to maximize the quality of the CERs, and thus their value, it is in the interest of the seller to engage a well-qualified and experienced expert to quantify the original CCMP baseline. Similarly, it is in the interest of the buyer to engage a well-

201

qualified and experienced M&V agent to verify the actual amount of CERs produced by the project. Verified or validated CERs will be perceived by the market as having high quality.

Training required for baseline development

For energy sector projects, baseline preparation must typically be performed by individuals with formal training in engineering or the physical sciences. Project baseline assessment requires an understanding of the combustion process, for example, and evaluation of the carbon content of electricity from the grid and the operation of the electric system in the region where the project is located. Economists with training or experience in the field of energy economics, and specifically utility and power system economics, should be able to perform the analysis required.

Technical analysts contributing to the baseline determination must perform calculation-intensive tasks. Proficiency with electronic spreadsheets and a high level of comfort in processing numerical data are required. Completion of a workshop providing training for CCMP baseline development is highly recommended.

Static and dynamic baselines

Because of the general rule that the more predictable baselines are, the more valuable are the associated CERs measured against it, static baselines are generally preferable to dynamic baselines. Consider the fact that long-term planning and investor decision-making benefits from stability and consistency in project variables, including baselines for calculating CERs.

At the same time, however, the environmental impact of a given project may be improved through intentional and foreseen shifts in the baseline. If a baseline is periodically reviewed and adjusted to meet developments in technology that have become mainstream, for example, the associated CERs of projects are contributing more marginal reductions of GHG emissions to the atmosphere. With greater assurance of the marginal environmental benefit, the project may also become more valuable to regulatory authorities, for example.

Baselines that "step down" over time, for example, increases the marginal benefit to the environment of any GHG reductions achieved. The gradually falling baseline can reflect advances in technology, general knowledge and management, as well as overall economic development, which are likely to lead to an overall improvement energy sector performance. The improved performance of the "business as usual" scenarios going into the future is captured in a stepped or decreasing baseline.

For projects with longer project lives, dynamic baselines are therefore generally more credible and robust that static baselines. Projects with life cycles or associated CER sales contracts of less than five years may be a reasonable limit for use of a fixed baseline. Projects with longer life-cycles and associated CER calculations could have gradually

202

falling or stepped baselines that reflect, for example, changes (reductions) in the carbon intensity of electricity generation as a whole in India.

Regardless of what type of baseline is adopted, one of the most important characteristics is that it be predictable. Unexpected changes in the baseline, just like unexpected changes in interest rates or other economic variables, create undue risk and uncertainty in the project and deter buyer of CERs and other investors motivated by climate change objectives.

Benchmarking

Benchmarking of certain kinds of technology can serve as a simplified baseline for any subsequent projects in that sector, including CCMPs. For example, the associated reductions of energy projects can be measured against a best or least-cost technology benchmark such as combined-cycle natural gas power generation systems. Any subsequent projects that exceed the emissions of that benchmark on a per unit based (i.e. tons of CO_2 per kwh), would have to mitigate their emissions, and other projects that performed better than the benchmark would receive credits for their activity which they could then sell or trade.

International policy development

It is important for project developers, business representatives, government policymakers and other interested parties to understand that the international policy context is still uncertain, and that national policies can help define the direction and shape of international rules. The Kyoto Protocol requires emission reductions generated by the CDM to be real, measurable, and additional to what would have happened in the absence of certified project activities (KP §12.5), but these terms are not defined nor is it clear how these requirements should be implemented. Clarification of these issues is the focus of the on-going negotiations of the Conference of the Parties (COP). Given the lack of definition at present, project developers must rely on existing tools employed to date and invent new ones in assessing environmental additionality, whether designing project-specific and multi-project baselines.

The basic requirement for additionality under the CDM is that reductions are "additional to any that would occur in the absence of the certified project activity." Since non-Annex I countries have not yet taken on any reduction commitments, one can assume that no special efforts to reduce emissions would be made in the absence of the CDM. However, the prospect of gaining CDM credit for any and all measures that reduce emissions could create an incentive for policies that unnecessarily encourage emissions, so that even obvious or trivial measures might be claimed for CDM credit.

Thus, from the policy perspective, the absence of project activity is generally considered to be "business as usual," i.e. neither special measures to reduce emissions nor any measures to increase emissions. Specifically, with regard to energy policy, this means development of energy resources to minimize costs, without climate-related

203

requirements. Although it is widely recognized that energy services can be provided at minimum cost by including end-use efficiency measures with supply resources in integrated resource planning (IRP), such measures are still not in the mainstream of energy planning and development.[1] The restructuring and privatization of the energy sector that is underway in many developing and restructuring economies are only accentuating this situation.

Thus, "business as usual" can be summarized as least-cost energy-supply development, without special regard for climate protection. This policy criterion helps to define the baseline activities "that would occur in the absence of the certified project activity." Based on this *policy criterion*, a consistent *economic criterion* is that the baseline represents least-cost development under "business as usual" financial conditions. However, the baseline economic criterion relates directly to financial decision-making practices in the host country, and the energy technology choices that are favored as a result of this "business as usual" financial thinking and sector investment planning.

3. Operationalizing Baseline Development

This section begins with a self-evaluation checklist for project developers. Next, the section discusses several general principles of baseline development. Finally, the section provides detailed procedures for the development of a baseline. The specific procedures depend on the type of project, so the procedures are detailed for selected project types. The application of these procedures to non-energy CCMPs is also discussed in this section.

Checklist

The following checklist is designed to help project developers determine where they stand in taking the steps necessary prior to proceeding with baseline development.

1. Has a CCMP been identified and defined?
2. Does your organization have the training necessary to develop a credible baseline? (see "Training required for baseline development" section above)
3. Has the project boundary been accurately defined? (see "Project boundary delineation" section below)
4. Do you possess the data required to perform the baseline calculations? (see "Data requirements" section below)
5. Are these data of sufficient quality? (see "Criteria for data quality" section below)

Principles of baseline development

[1] See Swisher et al, 1997, which also contains detailed explanations and examples of the utility planning concepts mentioned here.

204

In order to proceed with the quantification of the baseline scenario for CCMPs, we need to specify the basic principles, or decision rules, by which the baseline scenario will be defined. Once we have stated these principles, we can define the analysis required to identify the baseline generation sources. Then we can determine the corresponding baseline carbon emission rate against which the CCMPs should be compared to determine net emission reductions. Finally, we will need to consider the updating of these estimates in the future, as an input to the monitoring and verification (M&V) plan.

Project boundary delineation

The delineation of project boundaries is an important step in the development of a credible project baseline. The project boundary identifies the systems and emissions sources that are affected by a CCMP. Typically, this boundary includes the project site plus the sources whose emissions will be displaced by the CCMP.

Indirect emission impacts can result from project construction, transportation of materials and fuel (at least in the baseline), and other upstream or downstream activities. The CCMP's effects should be carefully evaluated to identify any such emissions sources so that they may be included in the project boundary.

Criteria for data quality

Data quality is crucial to the construction of a defensible and robust emissions baseline. This is especially true in the context of creating a baseline that incorporates anticipated changes in emissions levels, or, in the case of benchmarks for specific sectors, credible arrangements for updating the benchmarks. It is generally easier to obtain credible data for fuel switching projects, where the data sources are typically the project developer itself or its client – which may easily be protected by a confidentiality agreement covering sensitive information – as well as independently verifiable measurements of the carbon content of fuels. However, it is generally much more difficult to obtain quality data on electricity production since the required information (total generation, fuel consumption, dispatch ordering for individual plants, etc.) is often controlled by state-owned utilities concerned about divulging such information or private companies that consider the data commercially sensitive. Access to such current data on a regular basis may be beyond the capabilities of any given project developer, requiring cooperation with government and sector organizations.

Data quality directly affects the credibility of the baseline emissions analysis and thus, the quality of the CERs produced by a CCMP. The data that form the basis for the definition of CCMP baseline emissions must be acquired from a credible source. For an electricity-generating CCMP that displaces grid electricity, these data must ultimately be attributable to the organization having ownership of the baseline equipment (such as the electric utility) or the organization having regulatory oversight authority over the baseline equipment (such as the electricity regulatory board).

205

For example, for a CCMP that affects the efficiency of on-site energy-generating equipment, such as a wood waste-fired cogeneration project, baseline data must be derived from a site survey during which the baseline energy equipment is audited and any necessary measurements are made. Similarly, end-use energy efficiency CCMP requires baseline data that are acquired during a site survey that includes an audit of the baseline equipment that will be affected by the CCMP. Such an audit involves making specific measurements that are required to quantify the energy savings attributable to the efficiency CCMP. Emissions baselines for end-use efficiency projects often also require analysis of off-site equipment, such as the case in which the energy efficiency project reduces the amount of grid-supplied electricity consumed by the host facility. In this case, the emissions intensity of the electricity generating equipment supplying the grid must be quantified in order to establish the CERs attributable to the energy efficiency project.

Baseline development procedures

This section presents the calculation procedures used to quantify emission reductions from selected alternative energy generation and energy efficiency CCMPs. These calculations will depend on the source from which emission reductions are displaced. As such, three procedures are presented, each for a different CCMP type:

- Baseline Procedure 1: CCMPs that displace grid-generated electricity
- Baseline Procedure 2: CCMPs that displace off-grid electricity
- Baseline Procedure 3: CCMPs that displace thermal energy generation

A fourth procedure is presented specifically for CCMPs that generate electricity or thermal energy by burning methane recovered from, for example, a landfill or agriculture project. These methane recovery projects reduce greenhouse gas emissions in two ways. First, they reduce carbon dioxide emissions by displacing electricity or thermal generation from some baseline source. These carbon emission reductions are quantified using Baseline Procedure 1, 2, or 3, as appropriate. Secondly, methane recovery projects reduce the emissions of methane (a greenhouse gas) by burning the methane in a generator. These methane emission reductions are quantified using Baseline Procedure 4.

- Baseline Procedure 4: Methane recovery CCMPs

Finally, the application of these procedures to non-energy CCMPs is also discussed.

Baseline Procedure 1: CCMPs that displace grid-generated electricity

Step 1: Gather required data

This section lists the data required to calculate the emission reductions from a CCMP that displaces grid-generated electricity. See Steps 2 to 5 for further description of these data. From each generating source in the electric grid affected by the CCMP project, the following information is required (both current and projected future data). This is required for existing plants as well as those expected to be added in the future.

206

- Installed capacity (MW)
- Annual electricity generation (MWh/yr)
- Type of fuel used for each plant
- Plant heat rate (GJ/MWh) or plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr)
- Dispatching order, if available

The following information on the electric grid is useful if available (both current and projected future data)

- Load duration curve
- Typical daily load profile
- Projected demand growth rate (%)
- Schedule of plant additions and retirements

For the CCMP, the following information is necessary (both current and projected future data)

- Installed capacity (MW) (*generation projects only*)
- Annual electricity generation (MWh/yr) (*generation projects only*)
- Reduction in annual electricity consumption (MWh/yr) (*efficiency projects only*)
- Type of fuel used (*thermal plants only*)
- Plant heat rate (GJ/MWh) or plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr) (*thermal plants only*)
- Emissions generated by CCMP (mtC/year)

Step 2: Define project boundary
For a project that displaces grid-generated electricity, the project boundary will encompass the project site, the existing electricity generation and transmission system to which the project will be interconnected, and the future generation and transmission facilities that may be added to the existing grid.

Currently, state electricity boards (SEBs) operate electric grids that function essentially independently of one another. The country is working to link the state grids eventually, though this is not expected to happen in the near future. If a national grid were completed, a project's boundary would expand to include the existing and future electricity generation and transmission system for the entire national grid.

Because of this potential future change, special attention should be paid to the composition of the electric grid. To construct an accurate baseline, it will be critical to identify the specific generating plants that are affected by the project.

In India, most state electric systems are composed almost exclusively of thermal plants, but several states (Kerala, Himachal Pradesh, Meghalaya, Jammu & Kashmir, Orissa, and Karnataka) have significant hydro capacity. As a result of the different resource bases of

207

the different SEB grids, the marginal source(s) displaced by a particular CCMP, and thus the emission reductions of the CCMP, could be very different depending on its location.

Step 3: Identify the appropriate baseline source

To quantify emission reductions from CCMPs that displace grid-generated electricity, it is first necessary to identify the baseline generation source(s), or the source(s) that will be displaced by the CCMP. Unfortunately, there is no standard method for identifying JI or CDM project baselines. Because of the diversity of CCMP and technology types, as well as host country contexts, it is unlikely that a single method could apply to all cases. However, there has been some progress in identifying the types of methods that apply best to certain project types, and in beginning to harmonize these procedures (see Michaelowa 1999). There are several types of decision rules for determining baselines, including:

1. Direct comparison with current practice (i.e., "before and after")
2. National macroeconomic analysis
3. Microeconomic investment analysis (see World Bank 2000a)
4. Control group analysis (see World Bank 2000a)
5. Benchmarks, technology standards or matrices
6. Barrier analysis (see IEA 1997)

Of these, microeconomic or investment analysis (rule #3) is appropriate to CCMPs. Applied to power sector planning, the investment analysis approach indicates that the baseline case represents the least-cost solution. In the case of CCMPs, the application of microeconomic investment analysis is not as simple as comparing the IRR values for two alternative projects. Instead, we need to identify the generation source(s) that will be replaced or deferred as a result of the CCMPs. This requires blending the investment analysis (rule #3) approach with certain elements of benchmarks (rule #5).

The least-cost solution governs the operation, or dispatching, of the existing generation plants.[2] Least-cost dispatching favors the operation of available generation sources with the lowest variable costs, or short-term marginal costs. Since thermal plants have significant fuel costs, their variable costs are higher than those of hydro plants. Thermal plants with expensive fuels, low efficiencies and higher maintenance costs are the most expensive plants to operate.

Thus, the baseline source(s) would be the existing source(s) that the operation of the CCMP replaces. The baseline case, of course, is not static, and time variations in the generation fuel mix must be captured in the baseline carbon emission rate. This is where a benchmark approach can be used to simplify the analysis. The simplest benchmarks for baseline emissions from electricity generation are:

1) To use the average emission rate for the entire system (i.e., total emissions divided by total sales), or

[2] Dispatch order is the order of priority in which each unit of generation capacity is selected for operation during a given time interval. A traditional economic dispatch strategy ranks supply resources by variable costs (mostly fuel) to determine dispatch order. The most expensive source operating at a given time is the marginal resource, and this varies with the system load.

208

2) To use the weighted-average marginal emission rate.

These baseline benchmarks are adequate for small generation CCMPs that do not, by themselves, cause changes to the generation expansion plan.

For CCMPs, it is clear that the appropriate benchmark for the baseline is the weighted-average marginal emission rate (method #2 above). The reason for this is simply the logic that governs dispatching in a generation system containing sources with low variable costs, such as hydro or renewables. Since these resources are almost cost-free in terms of variable cost, they should always be dispatched as much as possible. Thermal sources are dispatched only as necessary.

Thus, the marginal emissions source is the individual generating asset (emissions source) in the baseline case that would be the first to have its operation curtailed if a less expensive source (e.g., CCMP capacity) were available.[3] This is usually a thermal generating asset. This means that thermal sources are a significant component of the baseline case that CCMPs will replace in the short term. Although the total generation mix in some areas of India will still contain significant base-load hydro sources, the operation of these sources would be the same whether or not the CCMP is built. The inclusion of the emissions (zero) of these base-load hydro sources in the baseline carbon emission rate, such as by using the average emission rate benchmark, would be highly misleading.

Step 3 can be divided into two sub-steps: determining if non-thermal sources ever operate at the margin and determining which of the individual thermal sources are marginal.

Step 3, Part A: Determine if non-thermal sources are marginal

If an electric grid contains substantial non-thermal (hydro, renewable, or nuclear) capacity, there may be times of the year when non-thermal sources are able to meet the system demand without any thermal plant operation. During these times, no emission reduction results from the CCMP's output. In these cases, it is critical to determine when thermal sources are at the margin, i.e., the time when incremental production from the CCMP (with lower variable costs than thermal power) would be able to offset thermal generation.

For mostly thermal power generation systems, in which the dispatching is mostly a function of system demand at a given time, one can use the system's load duration

[3] In the utility system, the marginal generating plants are defined as those plants that are dispatched or utilized to meet peak loads only. During those times when end use consumption exceeds the generation capacity available from base-load plants at the utility, which are more or less in continual operation and therefore have plant capacity factors greater than 80 percent, intermediate and sometimes peaking plants are utilized to supplement total power supply to the grid. Marginal plants typically have plant capacity factors less than 20 percent. An exception to this rule may occur if, at times of low demand, there is sufficient output from "must-run" generation sources to more than meet the demand. Thus, no other plants would need to be dispatched to meet this demand.

209

curve.[4] The load duration curve (LDC) shows the fraction of the year that a given demand level is exceeded. One can superimpose the available generating capacity on the LDC by first applying hydro and intermittent, "must-run" sources such as wind to the load in each period.[5] Then, additional loads are met using remaining (thermal) sources, in order of ascending variable cost, until the total demand is met even in the peak period. For each period, the most expensive source that is needed is the marginal source. To account for hydro output variations, one can divide the analysis into separate wet and dry seasons; however, it can be difficult to obtain sufficient time-differentiated data to complete this analysis.

If an LDC is not available, one can use a daily load profile. As with the LDC, one can superimpose the available generating capacity on the daily load profile to determine which sources are marginal through the course of the day.

As discussed above, some SEB grids are dominated by thermal plants, and others by hydro capacity. Thus, the marginal source(s) displaced by CCMPs in India depend heavily on the location of the CCMP.

Step 3, Part B: Determine which of the thermal sources are marginal
After determining whether non-thermal sources operate at the margin, the next step is to determine which thermal sources are marginal. This is especially critical if the system contains base-load thermal plants. As with hydro sources, the operation of base-load thermal plants would be the same whether or not the CCMP is built. Thus, base-load thermal plants should not be included in calculating the weighted-average emission rate, because the CCMP would never displace generation from these sources.

The simplest way to determine which specific thermal generating plants represent marginal sources during some periods of the year is to compare the capacity factor[6] of existing plants. Typically, thermal plants that are dispatched to serve the base load have a capacity factor above 70%. To identify the marginal plants, look for plants with a lower capacity factor. Thermal plants with 40-50% capacity factors are probably dispatched as intermediate load, and these plants might be at the margin during some periods. Peak load plants can have a capacity factor as low as 10-20%, which indicates that these plants are at the margin whenever they are operating.

Note that hydro plants often have capacity factors around 50%, due to variations in rainfall and the need to store water for times of high demand or low production. However, it is unusual that hydro plants are truly at the margin, because as a low variable-cost resource they should be dispatched as much as possible, saving more expensive (in variable cost) thermal plants for dispatching at the margin.

---

[4] A utility's load duration curve is the cumulative frequency distribution of the utility's hourly demand levels, sorted by decreasing size according to the fraction of the year during which a given level is exceeded.
[5] A must-run generation source is one that cannot be dispatched, such that its output is wasted if it cannot be used to meet some simultaneous demand. Examples include wind power and run-of-the-river hydropower.
[6] The capacity factor is the ratio of the average production to the peak capacity, which can be expressed as:
Total annual production (MWh/yr) / [peak capacity (MW) * 8760 hr/yr]

Both Part A and Part B may need to be performed taking into account future changes to the electric grid. Future plant additions and retirements or future load growth may affect which sources are marginal in years to come. If information on such changes is available, the identification of the marginal sources could be repeated for each future year.

Step 4: Calculate baseline carbon emission rate

After determining which generating plants represent the baseline sources to be displaced by the CCMP, the next step is to calculate the carbon emission rate of these sources. As discussed above, the relevant baseline carbon emission rate is the weighted average of marginal emission rates for the generation plants on the margin. The baseline emissions depend on the installed generation capacity and fuel mix. To the extent that electricity is generated by fossil fuel-fired thermal power plants in the base case, the resulting carbon emissions must be accounted for on the basis of the relevant share of energy generated by each source and its carbon emission rate. Although installed capacity is an important parameter in describing the generation system and analyzing its economics, the emissions will be proportional to the total energy generated (MWh) by each source, rather than its generation capacity (MW).

Ideally, the baseline carbon emission rate should be determined on an hourly basis (8760 hours/year), to account for daily variations in loads and seasonal variations in hydroelectric and renewable output. These variations cause variations in dispatching, fuel mix and emissions. System operation can be simulated on an hourly basis using a production-cost model, in which the total demand is increased or decreased incrementally to simulate the marginal change in generation for each hour. If a production-cost model and hourly data are not available, or if the changes in generation sources are simple enough, then baseline carbon emission rate can be estimated on an annual basis.

Using an annual analysis method, the first step is to determine the annual percentage of the year when thermal sources are at the margin, which is the percentage of time that the CCMP displaces carbon emissions. This factor is determined from the analysis of an LDC or daily load profile, which is presented in Step 3. This analysis will yield the number of hours in a typical day or year that thermal power is required at the margin. Dividing by the number of hours in a day or year, respectively, will give the desired percentage.

The weighted-average marginal emission rate (expressed in metric tonnes of carbon per megawatt-hour, mtC/MWh) can then be calculated using the following equation:

Weighted-average marginal emission rate (mtC/MWh) =
% of year thermal plants at margin * Weighted-average emission rate of thermal plants (mtC/MWh) +
% of year non-thermal plants at margin * Weighted-average emission rate of non-thermal plants (mtC/MWh)

The average emission rate of non-thermal plants is typically zero. The average emission rate of thermal plants is the sum of all marginal thermal plant emissions divided by their

211

total production. Note that this calculation should include only the thermal plants that operate at the margin, which can be determined using the procedures in Step 3.

$$\text{Weighted-average emission rate of thermal plants (mtC/MWh)} = \frac{\text{Baseline emissions of marginal thermal plants (mtC/yr)}}{\text{Total generation of marginal thermal plants (MWh/yr)}}$$

To determine the baseline emissions of the marginal thermal plants, the emissions from each marginal thermal plant can be summed, as shown by the following equation:

$$\text{Baseline emissions of marginal thermal plants (mtC/yr)} = \sum_i \{\text{Total generation of plant (MWh/yr)} * \text{Emission rate (mtC/MWh) of plant}\}_{\text{marginal}}$$

The carbon emission rate of a thermal plant depends on the type of fuel combusted. The carbon content of various fuels can be found in Table 1.

Table 1: Carbon Content of Fuels

Fuel	Carbon Content (mtC/GJ)
Liquid Fuels	
Crude Oil	0.0200
Natural Gas Liquids	0.0152
Gasoline	0.0189
Jet Kerosene	0.0195
Other Kerosene	0.0196
Gas/Diesel Oil	0.0202
Residual Fuel Oil	0.0211
Liquefied Petroleum Gas	0.0172
Ethane	0.0168
Naphtha	0.02
Bitumen	0.0220
Lubricants	0.02
Petroleum Coke	0.0275
Refinery Feedstocks	0.02
Other Oil	0.02
Solid Fuels	
Anthracite	0.0268
Coking Coal	0.0258
Other Bituminous Coal	0.0258
Sub-bituminous Coal	0.0262
Lignite	0.0276
Peat	0.0289
Coke	0.0295
Gaseous Fuels	
Natural Gas	0.0153

Source: UNEP/OECD/IEA/IPCC 1995

The carbon emission rate of each plant can be determined using values from Table 1 and one of the following three equations. The information available for each plant will determine the proper equation to use.

If the plant's heat rate (expressed in gigajoules of fuel consumption per megawatt hour of electricity generation, GJ/MWh) is known, use the following equation:

$$\text{Emission rate (mtC/MWh)} = \text{Plant heat rate (GJ/MWh)} * \text{Carbon content of fuel (mtC/GJ)}$$

If the dimensionless thermal efficiency of the generation source is known, the same relationship can be expressed in these terms by converting the units as follows:

$$\text{Emission rate (mtC/MWh)} = \frac{\text{3.6 GJ/MWh [by definition]} * \text{Carbon content of fuel (mtC/GJ)}}{\text{Net thermal efficiency of plant}}$$

Finally, the emission rate can be derived directly from annual fuel consumption data, together with the corresponding annual generation data. One still needs the fuel carbon content and, if the fuel consumption data are expressed in tons rather than energy units, the heating value of the fuel.

$$\text{Emission rate (mtC/MWh)} = \frac{\text{Annual fuel consumption (GJ/yr)} * \text{Carbon content of fuel (mtC/GJ)}}{\text{Annual energy generation (MWh/yr)}}$$

To illustrate these calculations, consider the following hypothetical scenario. A renewable energy project will feed into a grid consisting of both hydro and thermal plants. Analysis of the LDC or daily load profile has determined that hydro plants are at the margin 10% of the year, thermal plants the other 90%. The marginal thermal plants consist of three generating units of varying fuel type and heat rate, as shown in Figure 2.

Figure 2

		A		B	C	D = B * C	E = A * D
Marginal Thermal Plants	**Installed Capacity (MW)**	**Generation (MWh/yr)**	**Type of Fuel**	**Plant Heat Rate (GJ/MWh)**	**Carbon Content of Fuel (mtC/GJ)**	**Carbon Emission Rate (mtC/MWh)**	**Carbon Emissions (mtC/yr)**
Plant 1	100	350,000	Nat. gas	8.0	0.0153	0.12	42,000
Plant 2	50	88,000	Diesel	12.0	0.0202	0.24	21,120
Plant 3	50	44,000	Diesel	18.0	0.0202	0.36	15,840
Total	**200**	**482,000**					**78,960**
Weighted-average emission rate of thermal plants = 78,960 / 482,000 = 0.16							

213

% of year thermal plants at margin	90%
Weighted-average marginal emission rate = (0.90) * (0.16) + (0.10) * (0) = 0.14	

The carbon emission rate for each plant is calculated using the heat rate and carbon content of fuel. The annual carbon emissions for each plant are then calculated. The total generation and total carbon emissions for all plants are used to determine the weighted-average emission rate of the thermal plants. The emission rate of the hydro plants is zero. These two emission rates, plus the percentage of time that thermal and hydro are at the margin, are then used to calculate the weighted-average marginal emission rate.

The weighted-average marginal emission rate calculated in these procedures is based on the current operating conditions of the emission sources. To the extent that conditions change in the future, the emission rate will also change. To estimate the future weighted-average marginal emission rate, these calculations should be performed using projections of future operation. A crucial aspect of this projection is whether new marginal plants will be added to the grid and whether any plants will be retired. In the hypothetical scenario in Figure 2, any new marginal plants would be added to the table as Plant 4, Plant 5, and so on, and included in the analysis. Likewise, the projected retirement of plants should be reflected in the analysis. Plant additions and retirements and load growth may require reevaluation of the percentage of time that thermal plants will be at the margin in future years. Once the future marginal generation sources are determined, the other important future information required is the projected annual generation from each plant. In addition, if upgrades are planned for any plants, these may increase their efficiency, so projected future heat rates would be used. With this projected information, the weighted-average marginal emission rate for each future year can be estimated. This is a critical step in estimating future emission reductions from the CCMP.

Step 5: Calculate emission reductions

After determining the weighted-average marginal emission rate for future years in Step 4, the calculation of net carbon emissions reductions (expressed in metric tonnes of carbon per year, mtC/year) from the CCMPs is fairly straight-forward. The emission reductions equal the emissions that would have been produced in the absence of the CCMP, which equal the generation displaced by the CCMP multiplied by the emission rate of the baseline source.

Net emission reductions (mtC/yr) = [Grid generation displaced by CCMP (MWh/yr) * Weighted-average marginal emission rate (mtC/MWh)] – Emissions generated by CCMP (mtC/year)

The emissions reductions can also be expressed in metric tonnes of carbon dioxide per year ($mtCO_2/yr$) by multiplying by ratio of the molecular weights of carbon dioxide and carbon.

Net emission reductions ($mtCO_2/yr$) = Net emission reductions (mtC/yr) * [44 $mtCO_2$ / 12 mtC]

For an alternative energy production CCMP, in which a less carbon-intensive source (renewables, natural gas, etc.) is used to generate electricity, the grid generation displaced is equal to the electricity produced by the CCMP minus any parasitic electricity use. For an energy efficiency CCMP, the grid generation displaced is equal to the reduction in electricity consumption resulting from the CCMP. To achieve the most accurate estimate of future emission reductions, both the grid generation displaced and the emission rate should reflect future projections.

The emissions generated by the CCMP depend on the type of project implemented. All aspects of the CCMP activities should be evaluated to identify and quantify any such emissions. Mechanisms that can produce such emissions are indirect fossil fuel use, non-CO_2 greenhouse gas (GHG) emissions, and land use change. Table 2 and the discussion that follows identify the possible mechanisms for and significance of these emissions.

Table 2: Potential Sources of Emissions from Electricity CCMPs

CCMP Type	Potential Sources of Emissions from CCMP
Electricity generation:	
Fossil fuel	Fossil fuel combustion
Biomass and geothermal	Release of non-CO_2 greenhouse gases
Reservoir hydro	Land-use change
Other renewable (wind, solar, run-of-the-river hydro)	Typically none
Energy efficiency	Increased fossil-fuel usage

The emissions generated by the CCMP can be significant in projects involving electricity generation using cleaner-burning fossil fuels, such as in converting a power plant from coal to natural gas or in an on-site cogeneration project. These emissions can be calculated by multiplying the carbon emission rate of the plant (mtC/MWh) by the plant's generation (MWh/yr). (Calculating emissions from a single electric generation source is discussed further in Baseline Procedure 2 below.)

The emissions generated by other types of CCMPs will typically be negligible, because the primary source of net emission reductions for CCMPs that displace grid electricity is the reduction in fossil-fuel use at thermal generating stations that can be displaced by the CCMPs. As such, detailed procedures for calculating the emissions generated by the CCMP are not presented in this toolkit. These procedures can be found in UNEP/OECD/IEA/IPCC 1995 and World Bank 1998.

Any type of electricity generation CCMP may have associated increases in fossil fuel use resulting from standby generator operation, transportation of materials or fuel, project construction, biomass fuel production and other upstream or downstream activities.

215

Electricity generation through combustion of biomass fuel produces no net carbon emissions if the biomass is produced sustainably within the project, because the carbon emissions produced during combustion are assumed to be offset by the capture of carbon as the biomass regrows. Geothermal projects also typically produce no carbon emissions. However, for both biomass and geothermal projects, one must in some cases account for the project's emissions of methane or nitrous oxide (N_2O), GHGs more potent than CO_2. After the quantity of these emissions (in metric tonnes per year) are estimated, they are converted to converted to CO_2-equivalent emissions by multiplying by the appropriate IPCC global warming potential (GWP) coefficient for 100-year time horizon from Table 3 below.[7] The result represents the emissions generated by a CCMP in terms of CO_2-equivalent, and is deducted from the project's annual CO_2 emission reductions.

Table 3: Direct Global Warming Potentials (GWP) of Selected Gases

Gas	Direct Effect for Time Horizon of 100 years
Carbon dioxide, CO_2	1
Methane, CH_4	21
Nitrous oxide, N_2O	310

Source: UNEP/OECD/IEA/IPCC 1995

Losses in terrestrial carbon storage due to land-use change at a hydro project site might be significant if, for example, forest land is inundated by a hydro reservoir. However, forestry projects designed for watershed protection could store net carbon in protected standing natural forest or accumulate net carbon storage in new biomass grown and in soil carbon. In this case, baseline carbon storage density should be estimated based on carbon stock accounting (Swisher 1994 and UNEP/OECD/IEA/IPCC 1995).

Energy efficiency projects will typically result in no carbon emissions. However, some efficiency projects, such as a lighting retrofit or an electric-to-fossil-fuel heating conversion, increase the thermal energy required for heating. The emissions from this thermal energy generation can be calculated using the procedures below for CCMPs that displace thermal energy generation.

Step 6: Perform monitoring and verification

Using the methods described in this document, and by making projections of future conditions, we can estimate the future carbon emission reductions that will result from the CCMP. The projections used may or may not prove to be accurate, as the specific details of the baseline sources or the CCMP might change or new sources might be added.

[7] The Global Warming Potential (GWP) allows one to express all GHGs on a comparable basis. The strength of all other GHGs is compared to that of CO_2, which is assigned a value of "1".

216

Therefore, it is necessary to plan to revise the emission reductions calculations in the future, using the same methods, procedures and assumptions from this document, but updating the specific input values. The recommended methods for carrying out this updating process and their role in the M&V process are explained in the M&V toolkit.

Baseline Procedure 2: CCMPs that displace off-grid electricity

Step 1: Gather required data
This section lists the data required to calculate the emission reductions from a CCMP that displaces electricity generated off the grid. See Steps 2 to 5 for further description of these data. From the generating source(s) affected by the CCMP project, the following information is required (both current and projected future data).

- Installed capacity (MW)
- Annual electricity generation (MWh/yr)
- Type of fuel used for each plant
- Plant heat rate (GJ/MWh) or plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr)

For the CCMP, the following information is necessary (both current and projected future data)

- Installed capacity (MW) (*generation projects only*)
- Annual electricity generation (MWh/yr) (*generation projects only*)
- Reduction in annual electricity consumption (MWh/yr) (*efficiency projects only*)
- Type of fuel used (*thermal plants only*)
- Plant heat rate (GJ/MWh) or plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr) (*thermal plants only*)
- Emissions generated by CCMP (mtC/year)

Step 2: Define project boundary
For a CCMP that displaces electricity generated off the grid, just as with a grid electricity project, the project boundary will encompass the project site, and the electricity generation and transmission system to which the project will be interconnected. However, with the off-grid CCMP, this electricity system will typically consist of only one or a few generation sources.

Step 3: Identify the appropriate baseline source
Because there are only one or a few generation sources in a CCMP displacing off-grid electricity, the baseline source is easy to identify. It is simply the source whose output the CCMP will displace.

217

Step 4: Calculate baseline carbon emission rate

The next step is to calculate the carbon emission rate of the baseline generation source. For an off-grid project, this is a brief exercise. This procedure outlined below applies if there is only one generation source displaced by the CCMP. If there are multiple sources, the carbon emission rate can be calculated by dividing the total carbon emissions (mtC/yr) of all sources by the total generation (MWh/yr). The total carbon emissions are the sum for each plant of the plant's emission rate (mtC/MWh, calculated below) multiplied by the total generation of the plant (MWh/yr).

The carbon emission rate of the generation source can be calculated using the carbon content of the fuel combusted (from Table 1 in Baseline Procedure 1) and one of the following three equations. The information available for each plant will determine the proper equation to use.

If the plant's heat rate (expressed in gigajoules of fuel consumption per megawatt hour of electricity generation, GJ/MWh) is known, use the following equation:

$$\text{Baseline emission rate (mtC/MWh)} = \text{Plant heat rate (GJ/MWh)} * \text{Carbon content of fuel (mtC/GJ)}$$

If the dimensionless thermal efficiency of the generation source is known, the same relationship can be expressed in these terms by converting the units as follows:

$$\text{Baseline emission rate (mtC/MWh)} = \frac{\text{3.6 GJ/MWh [by definition]} * \text{Carbon content of fuel (mtC/GJ)}}{\text{Net thermal efficiency of plant}}$$

Finally, the emission rate can be derived directly from annual fuel consumption data, together with the corresponding annual generation data. One still needs the fuel carbon content and, if the fuel consumption data are expressed in tons rather than energy units, the heating value of the fuel.

$$\text{Baseline emission rate (mtC/MWh)} = \frac{\text{Annual fuel consumption (GJ/yr)} * \text{Carbon content of fuel (mtC/GJ)}}{\text{Annual energy generation (MWh/yr)}}$$

Step 5: Calculate emission reductions

After determining the baseline emission rate in Step 4, the calculation of net carbon emissions reductions (expressed in metric tonnes of carbon per year, mtC/year) from the CCMPs is fairly straight-forward. The emission reductions equal the emissions that would have been produced in the absence of the CCMP, which equal the generation displaced by the CCMP multiplied by the emission rate of the baseline source.

$$\text{Net emission reductions (mtC/yr)} = [\text{Generation displaced by CCMP (MWh/yr)} * \text{Baseline emission rate (mtC/MWh)}] - \text{Emissions generated by CCMP (mtC/year)}$$

218

The emissions reductions can also be expressed in metric tonnes of carbon dioxide per year ($mtCO_2/yr$) by multiplying by ratio of the molecular weights of carbon dioxide and carbon.

Net emission reductions ($mtCO_2/yr$) = Net emission reductions (mtC/yr) * [44 $mtCO_2$ / 12 mtC]

For an alternative energy production CCMP, in which a less carbon-intensive source (renewables, natural gas, etc.) is used to generate electricity, the generation displaced is equal to the electricity produced by the CCMP minus any parasitic electricity use. For an energy efficiency CCMP, the generation displaced is equal to the reduction in electricity consumption resulting from the CCMP. To achieve the most accurate estimate of future emission reductions, both the generation displaced and the emission rate should reflect future projections.

The emissions generated by the CCMP depend on the type of project implemented. All aspects of the CCMP activities should be evaluated to identify and quantify any such emissions. Mechanisms that can produce such emissions are indirect fossil fuel use, non-CO_2 greenhouse gas (GHG) emissions, and land use change. Table 2 in Baseline Procedure 1 and the following discussion identify the possible mechanisms for and significance of these emissions.

The emissions generated by the CCMP can be significant in projects involving electricity generation using cleaner-burning fossil fuels, such as in converting a power plant from coal to natural gas or in an on-site cogeneration project. These emissions can be calculated by multiplying the carbon emission rate of the plant (mtC/MWh) by the plant's generation (MWh/yr). (Calculating emissions from a single electric generation source is discussed further in this Baseline Procedure 2.)

The emissions generated by other types of CCMPs will typically be negligible, because the primary source of net emission reductions for CCMPs that displace off-grid electricity is the reduction in fossil-fuel use at thermal generating stations that can be displaced by the CCMPs. As such, detailed procedures for calculating the emissions generated by the CCMP are not presented in this toolkit. These procedures can be found in UNEP/OECD/IEA/IPCC 1995 and World Bank 1998.

Any type of electricity generation CCMP may have associated increases in fossil fuel use resulting from standby generator operation, transportation of materials or fuel, project construction, biomass fuel production and other upstream or downstream activities.

Electricity generation through combustion of biomass fuel produces no net carbon emissions if the biomass is produced sustainably within the project, because the carbon emissions produced during combustion are assumed to be offset by the capture of carbon as the biomass regrows. Geothermal projects also typically produce no carbon emissions. However, for both biomass and geothermal projects, one must in some cases account for the project's emissions of methane or nitrous oxide (N2O), GHGs more potent than CO_2.

219

After the quantity of these emissions (in metric tonnes per year) are estimated, they are converted to converted to CO_2-equivalent emissions by multiplying by the appropriate IPCC global warming potential (GWP) coefficient for 100-year time horizon from Table 3 in Baseline Procedure 1. The result represents the emissions generated by a CCMP in terms of CO_2-equivalent, and is deducted from the project's annual CO_2 emission reductions.

Losses in terrestrial carbon storage due to land-use change at a hydro project site might be significant if, for example, forest land is inundated by a hydro reservoir. However, forestry projects designed for watershed protection could store net carbon in protected standing natural forest or accumulate net carbon storage in new biomass grown and in soil carbon. In this case, baseline carbon storage density should be estimated based on carbon stock accounting (Swisher 1994 and UNEP/OECD/IEA/IPCC 1995).

Energy efficiency projects will typically result in no carbon emissions. However, some efficiency projects, such as a lighting retrofit or an electric-to-fossil-fuel heating conversion, increase the thermal energy required for heating. The emissions from this thermal energy generation can be calculated using the procedures below for CCMPs that displace thermal energy generation.

Step 6: Perform monitoring and verification
Using the methods described in this document, and by making projections of future conditions, we can estimate the future carbon emission reductions that will result from the CCMP. The projections used may or may not prove to be accurate, as the specific details of the baseline sources or the CCMP might change or new sources might be added.

Therefore, it is necessary to plan to revise the emission reductions calculations in the future, using the same methods, procedures and assumptions from this document, but updating the specific input values. The recommended methods for carrying out this updating process and their role in the M&V process are explained in the M&V toolkit.

Baseline Procedure 3: CCMPs that displace thermal energy generation

Step 1: Gather required data
This section lists the data required to calculate the emission reductions from a CCMP that displaces thermal energy generation. See Steps 2 to 5 for further description of these data. From the generating source(s) affected by the CCMP project, the following information is required (both current and projected future data).

- Annual thermal generation (GJ/yr)
- Type of fuel used for each plant
- Plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr)

For the CCMP, the following information is necessary (both current and projected future data)

220

- Annual thermal generation (GJ/yr) (*generation projects only*)
- Reduction in annual thermal energy consumption (GJ/yr) (*efficiency projects only*)
- Type of fuel used (*generation projects only*)
- Plant net thermal efficiency (%) or plant annual fuel consumption (GJ/yr) (*generation projects only*)
- Emissions generated by CCMP (mtC/year)

Step 2: Define project boundary
For a project that displaces thermal energy generation, the project boundary is typically compact. In these cases, the boundary includes the project site and the equipment that generates the thermal energy.

Step 3: Identify the appropriate baseline source
Because there are only one or a few generation sources in a CCMP displacing thermal energy generation, the baseline source is easy to identify. It is simply the source whose output the CCMP will displace.

Step 4: Calculate baseline carbon emission rate
The next step is to calculate the carbon emission rate of the baseline generation source. For a thermal project, this is a brief exercise. This procedure outlined below applies if there is only one generation source displaced by the CCMP. If there are multiple sources, the carbon emission rate can be calculated by dividing the total carbon emissions (mtC/yr) of all sources by the total generation (GJ/yr). The total carbon emissions are the sum for each plant of the plant's emission rate (mtC/GJ, calculated below) multiplied by the total generation of the plant (GJ/yr).

The carbon emission rate of the generation source can be calculated using the carbon content of the fuel combusted (from Table 1 in Baseline Procedure 1) and one of the following two equations. The information available for each plant will determine the proper equation to use. Note that the calculated emission rate is mtC per GJ of thermal energy output, while the carbon content is mtC per GJ of fuel input.

If the dimensionless thermal efficiency of the generation source is known, use the following equation:

$$\text{Baseline emission rate (mtC/GJ)} = \frac{\text{Carbon content of fuel (mtC/GJ)}}{\text{Net thermal efficiency of plant}}$$

The emission rate can also be derived directly from annual fuel consumption data, together with the corresponding annual generation data. One still needs the fuel carbon content and, if the fuel consumption data are expressed in tons rather than energy units, the heating value of the fuel.

221

$$\text{Baseline emission rate (mtC/GJ)} = \frac{\text{Annual fuel consumption (GJ/yr)} * \text{Carbon content of fuel (mtC/GJ)}}{\text{Annual energy generation (GJ/yr)}}$$

Step 5: Calculate emission reductions

After determining the baseline emission rate in Step 4, the calculation of net carbon emissions reductions (expressed in metric tonnes of carbon per year, mtC/year) from the CCMPs is fairly straight-forward. The emission reductions equal the emissions that would have been produced in the absence of the CCMP, which equal the generation displaced by the CCMP multiplied by the emission rate of the baseline source.

Net emission reductions (mtC/yr) = [Generation displaced by CCMP (GJ/yr) * Baseline emission rate (mtC/GJ)] – Emissions generated by CCMP (mtC/year)

The emissions reductions can also be expressed in metric tonnes of carbon dioxide per year ($mtCO_2/yr$) by multiplying by ratio of the molecular weights of carbon dioxide and carbon.

Net emission reductions ($mtCO_2/yr$) = Net emission reductions (mtC/yr) * [44 $mtCO_2$ / 12 mtC]

For an alternative energy production CCMP, in which a less carbon-intensive source (renewables, natural gas, etc.) is used to generate thermal energy, the generation displaced is equal to the energy produced by the CCMP. For an energy efficiency CCMP, the generation displaced is equal to the reduction in thermal energy consumption resulting from the CCMP. To achieve the most accurate estimate of future emission reductions, both the generation displaced and the emission rate should reflect future projections.

The emissions generated by the CCMP depend on the type of project implemented. All aspects of the CCMP activities should be evaluated to identify and quantify any such emissions. Mechanisms that can produce such emissions are indirect fossil fuel use, non-CO_2 greenhouse gas (GHG) emissions, and land use change. Table 4 and the discussion that follows identify the possible mechanisms for and significance of these emissions.

Table 4: Potential Sources of Emissions from Thermal CCMPs

CCMP Type	Potential Sources of Emissions from CCMP
Thermal generation:	
Fossil fuel	Fossil fuel combustion
Biomass	Release of non-CO_2 greenhouse gases
Other renewable (solar)	Typically none
Energy efficiency	Increased fossil-fuel usage

222

The emissions generated by the CCMP can be significant in CCMPs that involve fuel switching, where cleaner burning fossil fuels are used for thermal energy generation. These can be calculated by multiplying the carbon emission rate of the plant (mtC/GJ) by the plant's generation (GJ/yr). (Calculating emissions from a thermal generation source is discussed further in this Baseline Procedure 3.)

The emissions generated by other types of CCMPs will typically be negligible, because the primary source of net emission reductions for CCMPs that thermal energy production is the reduction in fossil-fuel use at thermal generating stations that can be displaced by the CCMPs. As such, detailed procedures for calculating the emissions generated by the CCMP are not presented in this toolkit. These procedures can be found in UNEP/OECD/IEA/IPCC 1995 and World Bank 1998.

Any type of thermal generation CCMP may have associated increases in fossil fuel use resulting from standby generator operation, transportation of materials or fuel, project construction, biomass fuel production and other upstream or downstream activities.

Thermal generation through combustion of biomass fuel produces no net carbon emissions if the biomass is produced sustainably within the project, because the carbon emissions produced during combustion are assumed to be offset by the capture of carbon as the biomass regrows. Geothermal projects also typically produce no carbon emissions. However, for both biomass and geothermal projects, one must in some cases account for the project's emissions of methane or nitrous oxide (N2O), GHGs more potent than CO_2. After the quantity of these emissions (in metric tonnes per year) are estimated, they are converted to converted to CO_2-equivalent emissions by multiplying by the appropriate IPCC global warming potential (GWP) coefficient for 100-year time horizon from Table 3 in Baseline Procedure 1. The result represents the emissions generated by a CCMP in terms of CO_2-equivalent, and is deducted from the project's annual CO_2 emission reductions.

Energy efficiency projects will typically result in no carbon emissions. However, some efficiency projects reduce thermal energy consumption but increase electricity use. In addition, parasitic electricity use in thermal generation projects can result in increased emissions. The indirect emissions from increased electricity use can be calculated using the procedures in Baseline Procedure 1 for CCMPs that displace electricity generation.

Step 6: Perform monitoring and verification

Using the methods described in this document, and by making projections of future conditions, we can estimate the future carbon emission reductions that will result from the CCMP. The projections used may or may not prove to be accurate, as the specific details of the baseline sources or the CCMP might change or new sources might be added.

Therefore, it is necessary to plan to revise the emission reductions calculations in the future, using the same methods, procedures and assumptions from this document, but

223

updating the specific input values. The recommended methods for carrying out this updating process and their role in the M&V process are explained in the M&V toolkit.

Baseline Procedure 4: Methane recovery CCMPs

This procedure specifically addresses CCMPs that generate electricity or thermal energy by burning methane recovered from coal mines, landfills or agribusiness facilities.[8] Two Baseline Procedures are required for these methane recovery projects, because they reduce greenhouse gas emissions in two ways. First, they reduce carbon dioxide emissions by displacing electricity or thermal generation from some baseline source. These carbon emission reductions should be quantified using Baseline Procedure 1, 2, or 3, as appropriate. Secondly, methane recovery projects reduce the emissions of methane (a greenhouse gas) by burning the methane in a generator. This procedure, Baseline Procedure 4, is used to quantify these methane emission reductions.

Step 1: Gather required data
Data will be gathered for methane recovery CCMPs as required for either Baseline Procedure 1, 2, or 3. No additional data is required for Baseline Procedure 4. When Baseline Procedure 1, 2, or 3 is performed for the methane recovery project, the value of "Emissions generated by the CCMP" will be calculated. This value is used as an input to the calculations of this procedure.

Step 2: Define project boundary
For a methane recovery CCMP, the project boundary includes the source of methane and the generation equipment in which it is combusted.

Step 3: Identify the appropriate baseline source
The baseline source is simply the source from which the methane is recovered. This may be a landfill, agricultural land or process, or other source.

Step 4: Calculate baseline carbon emission rate
This step is not applicable to calculating methane emission reductions for methane recovery projects.

Step 5: Calculate emission reductions
The annual reduction in methane emissions is equal to the methane that is burned to generate electricity or thermal energy. When this methane is burned, it generates carbon emissions. These emissions are identified as "Emissions generated by CCMP" in Baseline Procedure 1, 2, or 3, and will be quantified when the appropriate of those procedures is conducted for the methane recovery CCMP. This

[8] Recent policy initiatives governing waste material that may be deposited in landfills in India may limit the attractiveness of landfill methane gas recovery projects. Nevertheless, there are likely to be significant opportunities for biogas production and utilization in agricultural as well as municipal settings.

226

The carbon emissions from the CCMP are expressed in metric tonnes of carbon per year (mtC/yr). This represents the carbon output of the generator. The methane input to the generator can be found by multiplying the carbon emissions generated by the CCMP (mtC/yr) by the ratio of the molecular weights of methane and carbon. In doing this, we assume that when methane (CH_4) is combusted, it is completely converted to carbon (actually CO_2) emissions.

Methane emission reductions ($mtCH_4$/yr) = Emissions generated by CCMP (mtC/year) * [16 $mtCH_4$ / 12 mtC]

These emission reductions are converted into CO_2-equivalent emissions by multiplying by the methane global warming potential (GWP) from Table 3, which is 21.

225

CO_2-equivalent emission reductions ($mtCO_2$-equiv./yr) =
Methane emission reductions ($mtCH_4$/yr) * [21 $mtCO_2$-equiv. / $mtCH_4$]

The emissions reductions can also be expressed in terms of carbon-equivalent emissions by multiplying by ratio of the molecular weights of carbon and carbon dioxide.

Carbon-equivalent reductions (mtC-equiv./yr) = CO_2-equivalent reductions ($mtCO_2$-equiv./yr)* [12 mtC / 44 $mtCO_2$]

Step 6: Perform monitoring and verification
Using the methods described in this document, and by making projections of future conditions, we can estimate the future methane emission reductions that will result from a methane-recovery CCMP. The projections used may or may not prove to be accurate, as the specific details of the baseline sources or the CCMP might change or new sources might be added.

Therefore, it is necessary to plan to revise the emission reductions calculations in the future, using the same methods, procedures and assumptions from this document, but updating the specific input values. The recommended methods for carrying out this updating process and their role in the M&V process are explained in the M&V toolkit.

Application of procedures to non-energy CCMPs

The procedures presented above specifically address energy generation and energy efficiency CCMPs. These are by no means the only type of CCMP that a project developer may encounter. For other types of CCMPs, a project developer can construct an appropriate baseline by following the structure of the procedures presented in this toolkit. The first steps are to define the project boundary and determine the baseline emissions source, the source that would operate in the absence of the CCMP. The next step is to quantify the emissions that would occur in the baseline case and the emissions that would occur with the CCMP in place. The difference between these two case scenarios represents the emission reductions attributable to the CCMP. In performing these steps, careful evaluation of the project is necessary to accurately characterize all of the emission sources in the baseline case and the CCMP case.

This general procedure can be used to develop an appropriate baseline for any CCMP that has been carefully evaluated. For example:

- A methane flaring project, in which methane is burned rather than released directly. This reduces methane emissions, though increases carbon dioxide emissions
- A transportation project that reduces emissions from mobile sources, while perhaps increasing emissions from electricity generation or other sources
- A reforestation project that increases carbon sequestration rates

226

- A project that reduces agricultural methane emissions

In this way, the procedures presented in this toolkit can be used as conceptual tools for use in the broader field of CCMPs.

Supporting Materials

Published baseline development procedures

Michaelowa, A., 1999. "Template for baseline studies for World Bank AIJ, CDM and JI projects," Study for the World Bank Climate Change Team. Washington, D.C.

UNEP/OECD/IEA/IPCC (United Nations Environment Programme, Organisation for Economic Co-operation and Development, International Energy Agency, Intergovernmental Panel on Climate Change). 1995. *IPCC Guidelines for National GHG Inventories Volume 3: GHG Inventory Reference Manual.* IPCC: Bracknell, UK.

World Bank. 1998. *Greenhouse Gas Assessment Handbook.* Environment Department. Washington, DC.

World Bank. 2000a. "Baseline Methodologies for PCF Projects; PCF Implementation Note Number 3." Prototype Carbon Fund. Washington, D.C.

Case studies

Swisher, J.N., 1994. "Forestry and Biomass Energy Projects: Bottom-Up Comparisons of CO_2 Storage and Costs," *Biomass and Bioenergy*, vol. 6 no. 5, pp. 359-368.

World Bank. 2000b. "Latvia Baseline Study." Prototype Carbon Fund. Washington, D.C.

Reference materials

Figures, Christiana; "The Achievements of COP 6: Yes, the Achievements!"; Center for Sustainable Development in the Americas; December 2000.

International Energy Agency (IEA), 1997. Activities Implemented Jointly: Partnerships for Climate and Development, OECD, Paris.

227

ANNEX F.

Pew Center on Global Climate Change Solution Series Report:
The Emerging International Greenhouse Gas Market

BEST AVAILABLE COPY

The Emerging

PEW CENTER
Global CLIMATE CHANGE

BEST AVAILABLE COPY

The **Emerging** International Greenhouse Gas **Market**

Prepared for the Pew Center on Global Climate Change

by
Richard Rosenzweig
Matthew Varilek
Ben Feldman
Radha Kuppalli
NATSOURCE, LLC

Josef Janssen
UNIVERSITY OF ST. GALLEN

March 2002

23

Contents

Foreword *ii*

Executive Summary *iii*

I. Introduction *1*

II. Origins of Greenhouse Gas Trading *3*

A. U.S. Clean Air Act Amendments of 1990 *3*
B. The United Nations Framework Convention on Climate Change *3*
C. Project-Based Programs *4*
D. Corporate Emissions Trading Systems *6*

III. Market Characteristics *7*

A. Trader Motivations *7*
B. Key Attributes of Trades *9*
C. Roles of Service Providers *19*
D. Case Studies *21*

IV. Future Outlook *27*

A. Role of an International Agreement *27*
B. Trading Programs Under Development *28*
C. Impacts of Concurrent Policy and Market Development *32*
D. Additional Greenhouse Gas Trading Initiatives *37*
E. Potential U.S. Development of a Parallel Trading System and/or Participation in an International Agreement *39*

V. Conclusions *46*

Appendix I: Descriptions of Project-Based Programs *48*

Appendix II: Descriptions of Corporate Emissions Trading Systems *52*

Appendix III: Sample Term Sheet Offering Greenhouse Gas Reductions *53*

Appendix IV: Descriptions of Emissions Trading Systems in Massachusetts, Denmark, and the United Kingdom *56*

Endnotes *61*

Foreword *Eileen Claussen, President, Pew Center on Global Climate Change*

As businesses, policy-makers, and other stakeholders around the world have become familiar with greenhouse gas emissions trading, it has emerged as the policy of choice to address climate change. Now—with the recent agreements in Bonn and Marrakech, with new carbon trading systems in Europe, and with private sector interest and activity across many economic sectors both here and abroad—we are beginning to see the outlines of a genuine greenhouse gas market.

In this Pew Center report, authors Richard Rosenzweig, Matthew Varilek, Josef Janssen et al. describe the various public and private programs under which many early trades have occurred, the characteristics of the emerging market including the key features of early transactions, and the potential evolution of the market given the concurrent development of domestic and international climate change policy. Case studies of actual trades between four power companies—TransAlta and HEW, and PG&E and Ontario Power Generation—help illustrate leading companies' motivations for engaging in trading, as well as the challenges they have faced in the absence of clear guidelines in the nascent market.

Despite the impressive interest in greenhouse gas trading, the market that has developed thus far remains fragmented. For example, as originally proposed, the trading regimes put forth by the United Kingdom and the European Union differ in important respects: the former is voluntary and the latter is not; the former covers the full basket of six greenhouse gases while the latter is restricted to carbon dioxide. This results in higher transaction costs just as the market is getting off the ground. The challenge ahead, for business, policy-makers, and others, is to work together to help forge linkages between the emerging regimes, and ultimately to achieve convergence.

I am optimistic that we can meet this challenge. We are beginning to see the first glimmers of interest in the U.S. Congress, although the debate is expected to be long and difficult. Perhaps more encouraging are private sector efforts to build a greenhouse gas trading system, such as the Chicago Climate Exchange. Also, many companies have set up their own internal trading systems to "learn by doing," and have been eager to participate in early trades. The need for certainty, for consistency, and for a level playing field all will work to encourage a merging of regimes. Policy-makers must do their best to ensure that all systems are compatible.

The authors and the Pew Center would like to thank the companies featured in this report for sharing their experiences and perspectives, and acknowledge the members of the Center's Business Environmental Leadership Council, as well as Aldyen Donnelly of GEMCo; Erik Haites of Margaree Consultants; Richard Sandor of Environmental Financial Products, L.L.C.; and Tom Wilson of EPRI for their review and advice on a previous draft of this report.

Executive Summary

A market for greenhouse gas (GHG) emissions has begun to emerge over the past five years. This market is driven in large part by ongoing negotiations of an international global climate change treaty, which will likely impose limitations on GHG emissions. The market has been shaped by successful emissions trading programs established over the past decade, such as the sulfur dioxide (SO_2) trading program incorporated in the U.S. Clean Air Act Amendments (CAAA) of 1990.

This paper describes: (1) programs and initiatives that have provided a framework for early trades and policy development; (2) characteristics of the emerging GHG market and key features of early transactions; (3) potential evolution of the market due to ongoing concurrent domestic and international climate change policy development; and (4) potential scenarios regarding the U.S. response to climate change.

Origins

Greenhouse gas trading has its origins in the United Nations Framework Convention on Climate Change (UNFCCC). Adopted in Rio de Janeiro, Brazil, in 1992, the UNFCCC established the goal for industrialized countries to return to their 1990 GHG emissions levels by the year 2000 and a long-term objective of stabilizing atmospheric concentrations of greenhouse gases "at a level that would prevent dangerous anthropogenic interference with the climate system." In 1995, the Parties reviewed their progress and concluded that the non-binding goal would not lead to the achievement of the Convention's objective of atmospheric stabilization. In response, Parties agreed to pursue a complementary agreement that would establish quantified emissions limitations and reduction obligations for developed countries. This culminated in the negotiation of the Kyoto Protocol in December of 1997.

The process to develop rules, mechanisms, and institutions necessary to bring the Protocol into force is ongoing, including the seventh Conference of Parties (COP-7), held in Marrakech, Morocco, during November of 2001. Though significant progress was achieved there and in previous negotiations, the Protocol has not yet entered into force, and few national governments have imposed limitations on domestic GHG emissions or established trading rules. Thus, the GHG market is evolving under a loosely constructed, ad hoc framework. To date, it has evolved from a variety of mostly project-based emissions trading programs, which have been voluntary in nature and which collectively serve as precursors to formal GHG regulation. More recently, the United Kingdom and Denmark have developed national regulatory programs.

Project-Based Programs

The UNFCCC allows industrialized countries to meet their emissions reduction commitments "jointly with other Parties" through a form of project-based emissions trading. This program became known as Joint Implementation (JI). Subsequent programs have provided practical experience with key aspects of project-based emissions trading. These programs and initiatives include the U.S. government's Initiative on Joint Implementation (USIJI); the pilot phase of international project-based emissions trading known as Activities Implemented Jointly (AIJ); Ontario, Canada's multi-stakeholder Pilot Emissions Reduction Trading program (PERT); Oregon's Climate Trust; the Dutch government's Emission Reduction Unit Procurement Tender (ERUPT); and the World Bank's Prototype Carbon Fund (PCF), among others.

Each of these programs is governed by a unique set of rules. However, they exhibit some common elements that constitute a *de facto* (though non-binding) set of minimum quality criteria that govern the creation of credible emissions reductions. These common elements include: (1) establishment of a credible counterfactual emissions baseline; (2) proof of environmental additionality; (3) evidence that the reductions are surplus to existing regulatory requirements; (4) proof of permanence or durability of the reductions; (5) demonstration that the emissions-reducing project will not cause emissions to increase beyond the project's boundaries (referred to as "leakage"); (6) establishment of credible monitoring and verification procedures; and (7) proof of ownership of the reductions.

Market Characteristics

Even though few sources of GHG emissions presently confront binding emissions limitations, a growing number of companies and governments have begun to purchase reductions generated in most part by the programs described above. Few trades of GHG emissions to date have involved an exchange of emissions permits such as "allowances" or "credits," since these terms refer to government-issued commodities that only exist within the context of formal trading systems. Most GHG trades have taken place under a voluntary ad hoc framework involving a commodity defined by the trade's participants and known commonly as verified emissions reductions (VERs). These carry only the possibility, but not a guarantee, that governments will allow them to be applied against future emissions reduction requirements.

The authors estimate that approximately 65 GHG trades for quantities above 1,000 metric tons of carbon dioxide equivalent (CO_2e)[1] have occurred worldwide since 1996. This figure includes trades of reductions as well as financial derivatives based on reductions. However, the figure probably understates actual market activity because not all trades are made public, and internal corporate trades and small trades are excluded. It is important to note also that this figure refers to purchases of emissions-related commodities and excludes countless investments in projects that either purposely or incidentally reduce GHG emissions. Prices for VERs have ranged between $.60 and $3.50 per metric ton of CO_2e. Some of the price differentials between trades can be explained by differences in the features of the reductions such as their type and vintage, geographical location, and the rigor of the monitoring and verification

procedures. Other factors that affect reductions' commercial value include contractual liability provisions, seller creditworthiness, and demonstration of host country approval of the emissions-reducing project.

Two case studies provide a detailed look at actual GHG trades in this market, illustrating some of the challenges and benefits of early GHG trading as described by market participants. The first case study reviews a purchase of VERs by TransAlta, a Canadian electric utility, from HEW, a German utility. HEW generated reductions by displacing some of its fossil fuel-based generation with electricity generated by wind. The second case study examines a purchase of VERs by Ontario Power Generation, a Canadian utility, from US Gen, a subsidiary of the U.S.-based PG&E National Energy Group. US Gen created reductions by capturing and destroying methane produced at a landfill. Both case studies demonstrate that while participants benefited from these early GHG trades, the lack of clear trading rules has increased transaction costs and been a significant impediment to the development of a more robust GHG market.

National Trading Programs

Several governments have moved forward in designing domestic trading systems while international trading rules remain under development. At the national level, the United Kingdom and Denmark have each established domestic emissions trading programs. Some trading in these programs has already begun. The European Union (EU) and other countries are in various stages of domestic policy development. At the sub-national level, the state of Massachusetts, for example, will require reductions of carbon dioxide (CO_2) emissions from power plants and will allow sources to use trading as a means of compliance.

The development of these and other trading programs demonstrates that emissions trading has gained acceptance as a preferred policy instrument in the world's efforts to reduce GHG emissions. These programs will boost GHG trading activity and motivate more rapid emissions abatement than if governments had waited for the international community to conclude negotiation of the Kyoto Protocol. Already, the initiation of these programs is producing a shift in the commodity that market participants prefer to trade. Some buyers' interest is starting to shift away from VERs, whose eligibility for use as a hedge against binding emissions limitations is uncertain. Interest is beginning to shift towards government-issued permits created by the programs, which are by definition eligible for use against an emissions limitation in their jurisdiction of origin. Permits also stand a superior chance of being transferable into foreign jurisdictions for purposes of compliance.

Significant benefits have and will result from the current development of domestic trading systems. However, some adverse impacts have also resulted from the concurrent development of international and domestic climate change policy. Emissions trading systems currently in operation or under development exhibit unique features that may render them incompatible with each other. For example, the Danish and United Kingdom (UK) systems allow for trading of different gases, cover different economic sectors, and utilize different mixes of allowance and credit-based trading. To date, they have not ldeveloped rules governing interchange and mutual recognition of their tradable units with each other, which could impede or preclude beneficial cross-border transactions. There are also significant differ-

ences between each of these systems and the one being developed in the European Union. Already, the European Commission has warned that the differences in the UK and the EU systems "could create market distortions in the future."[2] Had the treaty been concluded more rapidly, the international framework would have made it easier for Parties to conform their systems leading to increased trading.

Several private-sector and nongovernmental organizations (NGOs) also have developed initiatives to help build the market and to create and take advantage of trading opportunities. They include the Partnership for Climate Action (PCA), the Emissions Market Development Group (EMDG), and the Chicago Climate Exchange (CCX).

Future Outlook

Recent international agreements negotiated at Bonn and Marrakech resolve many details concerning implementation of the Kyoto Protocol, providing greater clarity to Parties developing domestic trading programs. These agreements will increase the likelihood that future domestic climate change policy measures will be consistent with the rules of the Protocol. However, several issues still must be resolved, and, although likely, the treaty's entry into force is not yet assured. Thus, in the near future, international and domestic GHG policy will continue to develop concurrently, with the risk that incompatibilities between regional, national, and sub-national climate change policies will lead to market fragmentation and sub-optimal economic and environmental outcomes. Such fragmentation does not mean that market participants will not trade across systems. Indeed, market participants will likely devise methods of trading across jurisdictions. However, devising such structures and mechanisms will increase costs.

Prospects for a well-functioning international GHG market have greatly improved as a result of the agreements reached in international climate change negotiations during 2001. However, significant barriers remain, including the unwillingness of the United States, the world's largest emitter, to ratify the Kyoto Protocol. A qualitative analysis of several scenarios related to the United States' future climate policy response reveals that, while in the near term the lack of an emissions constraint may provide an advantage to U.S. firms against foreign competitors confronting such constraints, continued policy uncertainty may be detrimental in the longer term.

In order for the market to achieve its intended environmental and economic results, much work remains to be done. The international community must make an ultimate decision on the legal nature of Parties' compliance obligations with the Kyoto Protocol's provisions and must resolve several other key issues. Institutions governing the treaty's mechanisms must move forward expeditiously to implement the details of the Protocol. Such action will provide Parties with clear policy guidance allowing them to conform their domestic programs to international rules and to enjoy the full economic and environmental benefits of GHG emissions trading.

I. Introduction[1]

Emissions trading has emerged as a key environmental policy instrument over the past decade. The flexibility inherent in market mechanisms such as emissions trading has proven to lower the cost of achieving environmental objectives. The acid rain program of the 1990 CAAA, which authorized trading of SO_2 allowances to reduce precursors of acid deposition in the United States, has provided the most compelling empirical evidence to date of the environmental and economic benefits of emissions trading.

The results of the U.S. acid rain program, other smaller-scale experiments, and a body of economic literature served as a catalyst for the inclusion of emissions trading provisions in the Kyoto Protocol. These provisions are designed to reduce the cost of Parties' compliance with potential national emissions limitations. Despite great progress in the international climate change negotiations during 2001, rules governing these and others of the treaty's provisions have not yet been finalized. As a result, the final form of a potential regulated international GHG trading system remains uncertain. Nevertheless, an ad hoc GHG market has already begun to take shape and continues to evolve in response to new policy developments at the international, regional, national, and sub-national levels.

This paper begins by describing the origins of the GHG market and highlighting commonalities and differences among programs that have provided the architecture for pre-compliance GHG emissions trading in the absence of a binding international climate change treaty. The second section of the paper reviews and analyzes known GHG trades from 1996 to the present. This section also describes market participants' motivations and key features of early trades. The last section of the paper describes regional, national, and sub-national GHG trading systems under development and analyzes the impacts of the parallel evolution of domestic and international climate change policy. It then briefly analyzes several possible scenarios regarding the U.S. response to climate change and the consequences of this response for the GHG market, the environment, and the competitiveness of U.S. and non-U.S. firms.

Box 1

Definitions

The paper refers to several types of trading programs and tradable instruments. They are defined below in order to clarify their usage in the paper.

Trading Programs

- In a **cap-and-trade system** (i.e., allowance-based trading) the maximum level of emissions that can be released from sources is set by the control authority. This level is the cap. All sources are required to have permits (i.e., allowances) to emit. Each permit specifies exactly how much the source is allowed to emit. The permits are freely transferable; they can be bought or sold. The control authority issues exactly the number of permits needed to produce the desired emission level.[4] The largest example of this kind of system, and the most comprehensive trading program to date, is the U.S. acid rain program, in which allowances of SO_2 can be traded to comply with an emissions cap.

- Under a **baseline-and-credit system** (i.e., credit- or project-based trading) each participant is provided a baseline against which its performance is measured. If an action is taken to reduce emissions, the difference between the baseline and the actual emissions can be credited and traded.[5] The baseline established for crediting purposes can be fixed, based upon an absolute level of emissions; or dynamic, decreasing or increasing over time. The key distinction between a cap-and-trade system and a baseline-and-credit system is that in the former, regulated sources' emissions are required to achieve an emissions cap, which is a fixed quantity. Such a limit is not necessarily imposed in a baseline-and-credit system. The Clean Development Mechanism, for example, would operate as a baseline-and-credit system.

Tradable Commodities

- An **allowance** is a government-sanctioned right to emit under a cap-and-trade system.

- A **credit** is a government-recognized right to emit under a baseline-and-credit system.

- A **permit** refers to both allowances and credits. Permits are issued by governments, authorizing a specific quantity of emissions.

- Permits are referred to as **compliance tools** in this paper. Permits are distinct from verified emissions reductions, the commodity most commonly transacted in today's market.

- **Verified Emissions Reductions (VERs)** are created, in the absence of government rules, by project-based activities that are defined by the buyer and seller and verified by a third party.

II. Origins of Greenhouse Gas Trading

The development of an international GHG trading system drew from a body of economic literature on the benefits of emissions trading, the Clean Air Act Amendments of 1990, and other more limited experiments with emissions markets. This section provides an overview of the key policies and programs that have fostered the development of the GHG market.

A. U.S. Clean Air Act Amendments of 1990

The Clean Air Act and its amendments include several emissions trading provisions designed to minimize the cost of achieving air quality objectives. These programs have demonstrated that allowing emissions sources to determine how best to comply with reduction requirements achieves environmental objectives at a lower cost than other regulatory approaches. SO_2 allowance trading under Title IV of the 1990 CAAA has been the most notable emissions trading success to date. It has achieved greater environmental benefits than required by law at a lower cost than had been estimated prior to the program's implementation.[6]

The program imposed a cap on SO_2 emissions from power plants. The level of allowable emissions was reduced in two phases. Sources could comply by installing technology, switching to fuels lower in sulfur content, purchasing allowances from other sources in the program, or engaging in other activities that would reduce SO_2 emissions.

B. The United Nations Framework Convention on Climate Change

Article 4(2)(a) of the United Nations Framework Convention on Climate Change (UNFCCC) includes a provision that allows Parties to achieve their commitments to reduce emissions "jointly with other Parties" through Joint Implementation (JI) activities.[7] The UNFCCC JI provision seeks to encourage Annex I (developed) countries to participate in cooperative projects to reduce emissions of greenhouse gases in developing countries and countries with economies in transition while encouraging sustainable

development and the transfer of technology, capital, and services. The host country and investor would negotiate ownership of the reductions generated by such projects.

The JI provision of the UNFCCC represents a precursor to GHG emissions trading and, more specifically, to the two project-based mechanisms in the Kyoto Protocol. The JI provision under Article 6 of the Kyoto Protocol authorizes countries in Annex B of the Protocol (developed countries and countries with economies in transition) to engage in climate change mitigation projects to generate emissions reduction units (ERUs)[8] to meet their commitments. The Clean Development Mechanism (CDM), established by Article 12 of the Kyoto Protocol, allows developed countries to generate certified emissions reductions (CERs) by engaging in climate change mitigation projects in developing countries.[9]

C. Project-Based Programs

The current market in GHG emissions has evolved in concert with a series of project-based programs designed to gain experience and harness the power of markets to address the climate change issue cost-effectively. Over time, these programs have evolved from pilot initiatives designed to provide practical experience for market participants and governments into mechanisms for achieving voluntary commitments, hedging risk, and complying with binding emissions limits. Each of these programs is governed by a unique set of rules. However, they exhibit some common elements that constitute a *de facto* (though non-binding) set of minimum quality criteria that govern the creation of credible emissions reductions. These programs and initiatives include the U.S. government's Initiative on Joint Implementation (USIJI); the pilot phase of international project-based emissions trading known as Activities Implemented Jointly (AIJ); Ontario, Canada's multi-stakeholder Pilot Emissions Reduction Trading program (PERT); Oregon's Climate Trust; the Dutch government's Emission Reduction Unit Procurement Tender (ERUPT); and the World Bank's Prototype Carbon Fund (PCF). See Appendix I for brief descriptions of these key programs.

Common Features of Project-Based Systems

The following rules and procedures are common elements of project-based systems described in Appendix I. They provide a framework for buyers and sellers to engage in transactions.

- ***Baseline*** "Without project" emissions performance scenario (either static or dynamic).[10] Many

240

programs measure emissions reductions by comparing "with project" emissions performance against a credible counterfactual baseline.

- ***Environmental Additionality*** Linked closely to the preceding concept, environmental additionality requires that the emissions reductions achieved by the project would not have occurred in the absence of the project.

- ***Surplus*** Proof that emissions reductions were not a result of activities undertaken to comply with existing regulations. This criterion is directly linked to the establishment of baselines. To be credible, baselines should incorporate existing and planned regulatory requirements that have a direct or indirect impact on GHG emissions.

- ***Permanence*** Demonstration that the project's emissions reductions from sources or removals by sequestration will be durable over time.

- ***Leakage*** Evidence that the emissions reductions achieved at the project site do not lead to increases in emissions outside the boundaries of the project (i.e., emissions "leakage"), or that the calculation of claimed emissions reductions quantifies and accounts for leakage.

- ***Monitoring and Verification*** Opinion from a qualified third party that the proposed method for calculating emissions performance can be or has been audited to provide a credible quantitative assessment of actual project performance.

- ***Ownership*** Clear demonstration that the project proponent has a legitimate claim to ownership of reductions generated by the project and that other potential claimants are identified.

These attributes have also been used by market participants and service providers to evaluate project performance in jurisdictions where no particular project-based program has been formally adopted.

Differences in Project-Based Systems

It is important to note that, despite their similarities, project-based programs also have significant differences that lead to different project approval and crediting outcomes within different programs.

Baselines Various programs recognize different types of reference scenarios against which to measure the emissions reductions achieved by project. The use of different baselines creates divergent

quantification outcomes. For example, The Climate Trust requires the use of a dynamic baseline in which emissions are calculated against an emissions rate per unit of output instead of historical mass emissions (i.e., a static baseline). Another type of dynamic baseline is a technology benchmark, where the baseline emissions rate is reduced as technological performance improves. In the first dynamic baseline case, used by The Climate Trust, the project operator has certainty about what quantity of reductions will be achieved at any level of output. In the second technology-based case, project investors face greater uncertainty because the actual emissions rate against which reductions are credited is subject to change over time based upon the regulators' decisions regarding technological advances. In the USIJI program, several baseline techniques have been accepted. While this paper's purpose is not to critique the merits of different baseline approaches, it is important to note that the different approaches lead to different crediting levels.

Additionality The Climate Trust, for example, adopts a stringent "financial" form of additionality, requiring demonstration that the project would not occur in the absence of revenues generated by the sale of offsets. The PCF, on the other hand, applies environmental additionality, but does not require that projects' economic viability depend on revenue from the sale of emissions reductions.

Surplus PERT, for example, has accepted landfill gas (methane) emissions reductions from large U.S. landfills as surplus, even though the landfills are subject to regulations requiring the combustion of landfill gas as a means to control emissions of non-methane volatile organic compounds (VOCs). This acceptance was based on legal opinions provided to PERT which concluded that the destruction of methane from the landfill is surplus to regulation because the regulation addresses only non-methane VOCs. The PCF, on the other hand, will stop accepting reductions from a similar project in Latvia if it accedes to the European Union and becomes subject to similar landfill gas capture and flare requirements.

D. Corporate Emissions Trading Systems

In addition to formal project-based systems, individual companies have developed internal trading programs to achieve specified voluntary reduction commitments. BP and Shell have pioneered these internal systems. Although designed differently, the BP and Shell systems have provided these firms with practical GHG-trading experience and have significantly advanced the dialogue on the benefits of emissions trading. Brief descriptions of these programs are provided in Appendix II.

III. Market Characteristics

Based upon the emissions reductions generated from the programs described above, a market for GHG reductions has been emerging since the mid-1990s. Participants in this emerging market perceive several benefits from early GHG trading, but challenges associated with trading in the absence of clear rules have limited the growth of the market. This section of the paper explains why a market for GHG emissions is emerging and identifies elements of trades, trends in these elements, and the role of market service providers.

A. Trader Motivations

Among the policy instruments available to reduce GHG emissions, trading has emerged in recent years as particularly attractive to the business community. Though few GHG-emitting companies currently face binding emissions limits, public concern and the potentially large future cost of complying with such limits have persuaded many business leaders of the need to take action while minimizing costs. In traditional emissions markets, establishment of formal programs by governments has preceded trading. Section 1 of this paper identifies a variety of pilot emissions trading programs that have provided a loose policy framework for early GHG transactions prior to the establishment of trading rules. Buyers' and sellers' motivations for participating in the nascent GHG market are discussed below.

Buyers

Demonstrating Leadership Buyers believe that providing financial support for emissions-reducing activities within this emerging policy framework demonstrates leadership on an issue of public concern.

Complying With Voluntary Corporate Commitments Several companies have made voluntary commitments to reduce their GHG emissions and have utilized the market as one policy instrument to achieve these commitments. Emissions reductions need not bear any government endorsement to contribute toward achievement of companies' voluntary emissions targets.

Hedging Risk Many companies and governments believe that, despite present regulatory uncertainty, binding limitations will be imposed on GHG emissions in the future. To begin hedging risk associated with these potentially costly restrictions, some buyers participate in the market believing that current reductions are relatively inexpensive compared to likely future prices in a regulated emissions trading system. Thus, they purchase reductions hoping that governments will allow them to be used for compliance with future government emissions reduction requirements.

Learning-by-Doing Few companies possess extensive experience with emissions trading. For buyers—as well as sellers—who have not previously participated in an emissions trading program, early GHG trading provides opportunities for learning-by-doing. For example, until they prepare to engage in a trade, few companies will have conducted an analysis of internal emissions abatement options to determine at what market price they ought to be a buyer or a seller of permits. Other educational aspects of trading include exploration of how to gain approval for emissions transactions through internal risk management procedures, how to contract for emissions reductions, and how to reflect the value of GHG assets and liabilities on company balance sheets.

Informing Public Policy Practical experience accumulated through transactions can also help to inform public policy. Knowledge developed in the course of negotiating and implementing transactions helps to improve the design of trading programs under development. Firms that have engaged in transactions have a unique insight on trading that provides them with additional credibility when participating in the ongoing climate change policy development process.

Buyers in the market have included large oil and gas companies, electric utilities, and industrial firms that emit a significant volume of greenhouse gases and that anticipate future emissions limits. In particular, Canadian companies that have committed to achieve voluntary emissions reduction targets, such as Ontario Power Generation, TransAlta, Epcor, and Suncor, have purchased significant quantities of reductions to meet their commitments.[11] Additionally, the creation of Canadian exploratory trading programs such as PERT and the GHG Emission Reduction Trading Pilot (GERT) has familiarized Canadian companies with the concept of emissions trading. Similarly, the familiarity of U.S. companies with trading through participation in other emissions commodity markets may have facilitated their involvement in the GHG market.

A few European companies have participated in the GHG market, but not as many as one might expect given the European Union's support for binding emissions constraints. In light of European governments' leadership in pushing forward an international climate change treaty and the European Union's development of a trading program for its 15 member states, more European companies are likely to trade in the future.

Japanese companies, though cautious in the market's early stages, have recently demonstrated a growing interest in trading.

Sellers

Like buyers of GHG emissions reductions, sellers are interested in demonstrating leadership on the climate change issue, learning by doing, informing public policy, and shaping future trading rules.

Sellers are also motivated by the opportunity to generate a revenue stream from emissions reductions, a commodity that previously carried no value. In the future, project sponsors may also be able to lower their borrowing costs by improving the creditworthiness of projects through the additional revenue stream derived from GHG sales. These benefits can help to improve overall returns from emissions-reducing projects.

Early GHG sellers do not fit a common profile. They have ranged in size from large multinational energy companies with investment-grade credit ratings to small local landfill operators with no credit rating. In many cases, buyers have sought to acquire reductions generated within their home country. As a result, sellers have been particularly successful in countries with active buyers, such as Canada and the United States. As European demand for GHG reductions grows commensurate with its development of climate change policy, it is anticipated that additional supply will also be generated there.

B. Key Attributes of Trades

In the absence of government trading rules, GHG market participants have to define numerous attributes of their trades. Each transaction is tailored to meet the needs of the individual participants in the trade. However, participants can rely to some extent on the procedures established by the project-based programs described in Appendix I. This section identifies key attributes of GHG trades and highlights some trends in those attributes that have emerged since the first GHG transactions in 1996-1997.

Emissions Commodity

Verified Emissions Reductions Few GHG trades have involved permits, since this term refers to government-issued environmental commodities such as allowances and credits. Rather, most GHG trades have involved verified emissions reductions (VERs). They are quantified reductions that bear most or all of the characteristics described in the discussion on common elements of trading systems in Section 1. Other buyer and seller requirements may also be incorporated into VER transactions.[12] Buyers hope that governments will allow some or all of their VERs to be applied against an emissions limit, should one ultimately be adopted.

Emissions Reductions Emissions reductions (ERs) are the same as VERs except that they do not require third-party verification. However, verification adds credibility to reductions and presumably increases their likelihood of being recognized under future emissions trading rules. Thus, to hedge risk, ERs tend to be a less desirable commodity and are traded less frequently than VERs.

Compliance Tools At the time of this writing, only the United Kingdom and Denmark have established formal emissions trading programs as a component of domestic climate change policies. The units traded within these systems can be utilized for compliance with domestic emissions limitations.

Units and Gases

Almost all GHG trades of all commodity types are denominated in metric tons of CO_2e. Most, if not all, trades have involved reductions of CO_2 or methane since these gases are relatively easy to monitor and are significant contributors to climate change.

Vintage

The year in which reductions are generated, or their vintage, is a key determinant of whether they will be eligible for recognition under future trading rules. Consequently, vintage has been a key feature of GHG trades. For example, reductions undertaken prior to 1990 hold no commercial value since 1990 is most frequently used as the base year for measuring emissions performance. By contrast, reductions that will be generated from 2008-2012 tend to be desirable because those years constitute the first commitment period specified in the Kyoto Protocol. It is assumed that if other eligibility criteria are met, reductions generated during those years will earn recognition as credits that could be used to

meet Parties' emissions-reduction requirements. Reductions generated during the period 2000-2008 are also valuable because, among other reasons, national governments may establish pre-Kyoto domestic trading systems and because certified emissions reductions generated in developing countries under the CDM during this period may be used for compliance in the first commitment period of the Kyoto Protocol. (See also *Price* below).

Reductions generated between 1990 and 2000 are somewhat less desirable, though not entirely without value, since some may be usable in domestic programs that precede an international agreement, or for achieving voluntary targets.

Geographic Location

Like vintage, the geographic location of emissions-reducing projects will be a key element in determining their creditability. Moreover, unlike some other project attributes such as baseline and monitoring methodologies for which future rules are difficult to predict, location (linked with vintage) is an attribute for which policy is already clear enough to influence the value of reductions in the market.

At a general level, the first key distinction in geography is between developing and developed countries. Reductions achieved through emissions-reducing activities in non-Annex B countries between 2000 and 2008 are desirable because, under Article 12.10 of the Kyoto Protocol, they can be used for compliance in the first commitment period (2008-2012) if they meet specified criteria. In developed countries, it is presumed that only those reductions that will be generated during the first commitment period would be eligible for crediting under international trading rules and thus will hold similar commercial value. Reductions generated in developed countries prior to the first commitment period and after the baseline year 1990 are less valuable.

Canada has been a particularly common location among developed countries for emissions-reducing projects. Canadian companies have been among the most active buyers in the market, and they tend to have a preference for purchasing at least some of their reductions from local projects. Other reductions involved in early transactions have been or will be generated by a variety of projects mainly in Europe and the United States.

Only a handful of projects located in developing countries have resulted in successful emissions transactions. This is a result of several factors. First, projects located in developing countries have greater

247

perceived project risks, in addition to the policy risks inherent in GHG projects prior to the establishment of crediting rules. Also, few developing countries have established adequate institutions to review project proposals and to grant necessary host country approvals.

Ownership

Government trading rules would presumably designate the entity that is entitled to claim ownership of project-generated emissions reductions. In the absence of such rules, it is essential for potential sellers to prove their ownership of the reductions that they would transfer to a buyer.

For many projects, ownership is not in question. These include, for example, efficiency upgrades at a manufacturing facility or fuel-switching at a power plant. However, for some project types, particularly those such as renewable energy and demand-side management projects that offset or displace fossil-fuel emissions, demonstrating ownership can be challenging and has been a barrier to more frequent sales from such projects. Ownership of the reductions is potentially open to dispute because the reductions do not occur on the site of the project, but rather on the site of a fossil-fueled facility whose power was displaced. These are known as indirect emissions reductions because the reductions occur at facilities other than the one where the project has been undertaken. The possibility that the direct source of emissions would claim title to the same reductions claimed by the project developer creates potential controversy that buyers prefer to avoid.

Tradable Instrument

In most transactions, GHG market participants agree to exchange one of the emissions commodities described above. However, the authors estimate that between 25 and 50 percent of transactions to date have involved an exchange of financial derivatives such as "call options" based on VERs or other emissions commodities.

A buyer of a call option, which is simply a contract specifying certain responsibilities, acquires from a seller the right, but not the obligation, to purchase a fixed quantity of emissions at a fixed price (i.e., the "strike price") on or before a fixed date in the future (i.e., the "expiration date").[13] The buyer pays the seller of the call option to accept the corresponding responsibility to sell emissions reductions according to the agreed terms, if requested. The amount paid for the option is called the "premium."

Sellers are entitled to keep the premium even if the buyer fails to exercise the option. Call options offer buyers a relatively inexpensive way to hedge their exposure to future compliance costs.

Other derivatives include "put options," "collars," and "swaps." A put option entitles the buyer of the option the right to sell a commodity (from which the option is derived) at the strike price on or before the expiration date. The seller of the option is required to purchase the commodity at the agreed price if the buyer exercises the option. The premium is paid by the buyer to the seller at the time the initial transaction is closed.

Collars, or "fences," involve two transactions in which one party buys a call and sells a put (usually with different strike prices and the same expiration date), and the counterparty sells a call and buys a put. By setting a price floor and ceiling, each position will provide protection against market movement. Swaps are transactions in which one type of commodity is exchanged for another, rather than for cash. In emissions trading, there often are tax benefits to swaps as some tax authorities consider them to be nontaxable "like-kind exchanges."

Forward stream transactions are also possible. In this sort of transaction, a buyer acquires promised reductions of consecutive vintages. For example, a buyer might acquire rights to 10,000 tons per year during 2005-2007. In some instances, payment for such streams is provided "on delivery," meaning once rights to the reductions have been transferred to the buyer. In other instances, buyers pay now for reductions to be delivered later. This allows project developers to finance a portion of their emissions reducing projects at the present time by generating immediate revenue through the sale of future emissions reductions. However, it should be noted that seller creditworthiness and liability become important issues in any forward transaction where revenue is paid prior to receipt of the commodity in question. (These issues are discussed below.)

- *Reduction Activity*

Nuclear Power It is possible that some activities that reduce GHG emissions will not be eligible to earn GHG credits. For example, governments may be reluctant to grant credits for reductions generated by nuclear power generation. (The Parties at COP 6-bis[14] in Bonn and at COP-7 in Marrakech agreed that they should "refrain from using" ERUs and CERs "generated from nuclear facilities" to meet their commitments under the Kyoto Protocol for the first commitment period.[15])

Sequestration At the inception of the GHG market, sequestration projects were popular among buyers. Offsets from such projects were perceived as cheap to generate on a per-ton basis, and they provided an economic rationale for protecting forests, which provide additional environmental benefits. Over the past several years, uncertainty regarding sequestration's future treatment in an international agreement has diminished the commercial value of sequestration activities. However, the inclusion in the Bonn agreement and the Marrakech accords of rules regarding the acceptability of sequestration activities will likely revive these projects' attractiveness.

Renewable Energy and Demand-Side Management As indicated above, sales of reductions generated by renewable energy and demand-side management projects sometimes face ownership concerns because the reductions are indirect, meaning that they result from displacement of emissions somewhere other than the project site itself. Multiple potential claimants, such as the owner of the emitting source, technology vendors, and the entity installing the technology, might attempt to claim ownership of these reductions. In addition, quantification of these reductions can be difficult because it requires access to data on emissions resulting from generation of grid-supplied electricity, such as the emissions characteristics of the electric generating units being displaced by the renewable energy or demand-side management investments. Determining displaced emissions from such activities is particularly difficult in increasingly interconnected and restructured electricity markets that are not controlled by a single dispatch authority. Even with access to these data, potential sellers must choose whether to calculate their offset claims through comparison to a grid's annual average emissions rate per unit of energy, or to a baseline that accounts for seasonal and/or intra-day variations in emissions. Governments have not indicated what degree of detail will be adequate for certification, or if such indirect reductions can even be credited.

Fuel Switching, Production Energy Efficiency, and Fugitive Gas Capture Switching to less carbon-intensive fuels, improving the efficiency of production processes, and capturing fugitive gases from landfills, pipelines, mines, and other sources have been popular activities because they generate real, easily quantified emissions reductions as compared to other activities. Many, if not the majority, of transactions in the last two years have been generated by these activities.

Liability Provisions

In a market fraught with many uncertainties, buyers have regarded it as particularly important to specify in contracts what recourse they would have if sellers fail to fulfill their obligations. Should the

seller's project fail to generate the specified number of purchased reductions, or should the reductions be ineligible for crediting in future programs, buyers would prefer that the seller commit to deliver alternative reductions that could be used for compliance. However, few if any sellers have been willing to undertake such a strong commitment since they would be exposed to the variable and potentially high cost of producing or acquiring approved compliance tools in the market. Instead, sellers typically agree that they may supply alternative reductions or may instead return some, or all, of the sale proceeds to the buyer, possibly with a specified financial penalty. Sellers may be able to claim a higher price per metric ton of reduction in return for accepting greater liability.

Seller Creditworthiness

In transactions involving future delivery of emissions reductions, the creditworthiness of the seller has played an important role in negotiations by serving as a proxy for the sellers' ability to perform its contractual obligations. Buyers are more willing to purchase future reductions from a financially sound seller than from a smaller, less viable company. This is because a company with good credit will typically have an easier time mobilizing the resources necessary to fulfill its contractual obligations in case reductions generated by its own projects are fewer than expected, or if they fail to meet certification requirements. Many buyers in the market to date have chosen only to transact with companies of investment grade rating (~BBB) or higher.

In some cases, strong seller creditworthiness has diminished the importance of other reduction qualities such as the accuracy of the baseline, adequacy of monitoring, and demonstration of ownership. Buyers presume that if they acquire reductions for which any of these qualities are shown in the future to be inadequate, a creditworthy seller will have little difficulty acquiring substitute reductions of adequate quality.

Creditworthiness is relatively unimportant for transactions involving VERs for immediate settlement. Since the VERs would carry no guarantee of future creditability, the seller would have fulfilled its contractual obligations once the VERs are generated, verified, and delivered. In these cases there is little need for strong creditworthiness as protection against nonperformance.

Baselines and Monitoring

Buyers prefer reductions measured against a well-documented, reproducible baseline, supported by a clearly documented audit trail, and monitored with an accurate, robust methodology. However, as

indicated above, from a market perspective, the importance of these attributes is often superseded by that of creditworthiness, since this is the means by which buyers ascertain sellers' ability to fulfill contractual commitments. These commitments usually include an obligation to deliver a specified quantity of reductions that meet future certification criteria, including baseline and monitoring methodologies, whatever these may eventually be. So the particular methodologies adopted by sellers at the time of sale are less significant than their commitment to adhere to future methodologies.

Host Country Approval

Under future rules governing project approvals and emissions trading across national borders, the consent of both participating countries will be a prerequisite for official recognition of projects or individual trades. Buyers seeking to prepare for the onset of binding emissions limits have sought to obtain host country approval for trades, when possible. Most project-based systems require such approval.

Host country support has been particularly important for CDM-style projects due to the varying levels of support among developing-country governments for emissions trading and project-based investments. Because few developing country governments have yet established a CDM office with authority to approve or reject projects, acquiring explicit CDM host country approval has been difficult. For buyers motivated by voluntary commitments rather than future compliance, host country approval is unnecessary. However, host country approval will be required under the Kyoto Protocol, should it enter into force.

Volume

According to the authors' research, approximately 65 significant GHG transactions have occurred worldwide since 1996, resulting in the exchange of between 50 and 70 million metric tons of CO_2e. However, for several reasons this figure probably understates the actual level of market activity. First, this figure reflects a fairly narrow definition of "trades" that excludes strategic investments that produce emissions reductions but which may not be intended for immediate transfer to another party. Also, some companies choose not to publicize their trades, so these are not reported. Additionally, this figure excludes trades within BP's and Shell's internal trading systems. Small trades involving less than 1,000 metric tons of CO_2e are also excluded.

252

Price

Verified Emissions Reductions VERs have traded for between $.60 and $3.50 per metric ton of CO_2e since the market's first trades in 1996-1997 (see Table 1). Fluctuations in price over time are more likely attributable to differences in the features of individual transactions than to fundamental changes in supply and demand for a given commodity.

Within the category of VERs, prices are segmented by location and vintage since these are key determinants of whether reductions will be eligible for credit or usable for compliance in the future. As indicated above, developed country reductions generated during 2008-2012 and developing country reductions generated after 2000 are both expected to be eligible for credit under the Kyoto Protocol, should it enter into force. Market prices for these commodities reflect this expectation, ranging from $1.65 to $3.00 per metric ton of CO_2e. Developed country reductions generated prior to the first Kyoto commitment period and after 1990 have ranged from $.60 to $1.50 per metric ton of CO_2e. The authors are not aware of any transactions for developing country reductions generated prior to 2000.

Emissions Reductions Compared to VERs, relatively few ERs have been traded. Buyers probably prefer VERs because they anticipate that verification will be required in order to earn government-recognized permits in the future. Despite this lesser demand for ERs, they are not necessarily cheaper than VERs. Although such reductions incur no verification costs, other required qualities may raise their costs to parity with VERs. For example, ERs purchased by The Climate Trust must be "financially additional," meaning that their projects would not have been financially feasible but for the revenues generated by sale of the GHG emissions reductions. (While project developers pay $0.85 per ton of CO_2 to The Climate Trust, The Climate Trust may pay more on a per ton basis to the sponsor of the CO_2 mitigation project.) This requirement narrows the pool of potential sellers and, in so doing, excludes some that might have offered cheap reductions.

Compliance Tools In September 2001, DuPont and the Marubeni Corporation conducted the first trade to take place within a formal government program. Dupont sold 10,000 2002-vintage UK allowances to Marubeni on a forward basis. More recently, several transactions have occurred in the Danish system. In one of these, Entergy, a U.S.-based electric utility, purchased 10,000 metric tons of CO_2 from Elsam, a Danish utility.[14]

As potential market participants grow more comfortable with the UK and Danish programs, trades of compliance tools will become more common. Prices paid for compliance tools will be higher than those paid for VERs and ERs because they can be utilized for compliance with a government emissions limitation. Other bids to buy and offers to sell in domestic allowance markets suggest that prices for compliance tools will be several dollars higher than those for other commodities currently being transacted in the pre-compliance market. For example, early indications in the UK market suggest a mid-market price of approximately $7 per metric ton of CO_2e. Prices in the Danish market will be capped by a noncompliance penalty of approximately $5 per metric ton of CO_2 of excess emissions, with current bids and offers suggesting a price of about $3 to $4. Dutch ERUs must be considered VERs at this time; however, they would become compliance tools if they met JI criteria under Kyoto Protocol rules, should the Protocol enter into force. Prices of the contracted reductions from the first round of the Dutch ERUPT program are higher than other VERs because they have already received government approval. The prices are also higher because of unique contracting and procurement procedures.

Table 1

Greenhouse Gas Prices by Commodity Type, Vintage

Commodity Type	Vintage Year	Price per ton CO_2e (US$)
VERs (historic prices)		
Annex B VERs	1991-2007	$.60-$1.50
Annex B VERs	2008-2012	$1.65-$3.00
CDM VERs	2000-2001	$1.15-$3.50
Dutch ERUs	2008-2012	$4.40-$7.99
Compliance Tools		
Danish allowances	2001	$2.86-$4.17
Danish allowances – Bid/Offer	2002	$2.14-$3.60
UK allowances – Bid/Offer	2002	$5.76-$9.36

NOTE: Table updated January 22, 2002.

C. Roles of Service Providers

In addition to buyers and sellers, other entities such as brokers and auditors have played important roles in the emerging GHG market.

Brokers

Brokers maintain contacts with a broad range of market participants in order to match suitable buyers and sellers, or "counterparties." They seek to reduce transaction costs by eliminating search costs for participants to seek out counterparties directly. Beyond this traditional brokerage function, GHG brokers have played an important role in the pre-compliance market by generating new supply and demand and in educating potential market participants about the costs, benefits, and mechanics of trading. Other functions brokers play in the emerging GHG market include:

- ***Price Discovery:*** By facilitating transactions, brokers find and publicize the price at which transactions occur. In the emerging GHG market, this price is dependent on the commercial terms and size of the transaction. Price discovery is not as simple as reporting the price of a standardized commodity.

- ***Develop Transaction Structures:*** Brokers help counterparties by developing unique transaction structures that meet the individual needs of buyer and sellers.

A sample term sheet for an offer of GHG reductions is located in Appendix III.

Project Development Consultants

The role of project development consultants is similar to that of brokers, but is focused more on the supply side of the market. These consultants assist developers of GHG-reducing projects to undertake steps such as quantification and monitoring that may lead to a successful sale of reductions. They may also help to market the reductions once they have been prepared for sale.

Auditors

Engineering, accounting, certification, and consulting firms as well as environmental NGOs that provide validation (ex ante audit) and verification (ex post audit) services provide assurance that the emissions reductions meet a minimum quality standard. So far, providing this assurance has involved activities such as: (1) analyzing the plausibility of baseline assumptions; (2) ensuring the accuracy of data used to calculate baselines and actual emissions; (3) ensuring the accuracy of emissions reduction calculations; (4) ascertaining the adequacy of monitoring methodologies; and (5) assessing ancillary project benefits. However, the standards used to conduct these analyses have, to date, been determined mainly by the service providers themselves, along with the demands of buyers. Both draw on criteria of existing project-based programs.

Several NGOs and companies are currently leading projects to develop more rigorous and uniform reporting standards by which to perform verification.[17] For the most part, governments have not yet specified standards for conducting verification of reported emissions reductions. The Dutch ERUPT program and World Bank's PCF are exceptions, as they have issued specific verification criteria and recommended several firms that are qualified to assess projects' adherence to those criteria.

Financial Institutions

Financial institutions like banks and insurance companies perform basic functions such as financing and risk management. Products and services provided by these institutions may include project financing, classical insurance solutions, alternative risk transfer, derivatives, carbon investment funds, corporate equity analysis, and financial advisory services.[18] Several European financial institutions are already designing new financial products and services targeted at the needs of corporate clients that wish to take advantage of GHG emissions trading and project-based mechanisms.

Specifically, carbon investment funds are promising instruments for diversifying risks associated with investments in GHG abatement projects that aim to generate marketable emissions reductions and permits.[19] In contrast, at present there is limited scope for managing specific GHG market risks through classical insurance mechanisms due to the fact that many risks are political in nature and therefore difficult to insure.[20] In conventional project financing, it may be beneficial for both the project sponsor and the lender to take advantage of GHG emissions trading, JI, and the CDM when structuring new energy projects.[21]

D. Case Studies

The following case studies help to illustrate the conclusions summarized above by describing the terms of real GHG trades, motivations of participants, challenges encountered, and lessons learned. The case studies demonstrate exactly how and why a GHG emissions trading market is emerging. They also demonstrate the challenges of trading in the absence of clear rules. This situation has made it difficult to consummate trades, increased transaction costs, and inhibited the development of a more robust market.

TransAlta – HEW: A Hint of Things to Come

TransAlta, Canada's largest non-regulated electricity generation company and second-largest single GHG emitter, plans to reduce net emissions of greenhouse gases from its Canadian operations to zero by 2024.[22] However, it did not commit to eliminate fossil fuels from its generation portfolio. Rather, the company has sought to demonstrate that, through a combination of efficiency improvements, technology development, and emissions offset trading, this aggressive target could be met without large increases in the price of electricity.[23] In pursuing its target, TransAlta has established a reputation as one of the most active participants in the emerging market for GHG reductions. While playing this pioneering role, the company has been involved in a number of "firsts," including its purchase of reductions from a German utility, Hamburgische Electricitäts-Werke AG (HEW). This is thought to be the world's first trans-Atlantic GHG trade.

By 1999, TransAlta had already engaged in a handful of GHG emissions purchases, both on its own and as a member of the Greenhouse Emissions Management Consortium (GEMCo), a not-for-profit Canadian corporation formed by companies seeking to "demonstrate industry leadership in developing voluntary and market-based approaches to GHG emissions management."[24] Having purchased most of its reductions from projects located in North America, TransAlta decided to engage in a more challenging trade for reductions generated by a project in Europe.

At roughly the same time, Dr. Helmuth Groscurth, head of the Energy Concept Future group at HEW, the municipal utility of Hamburg, Germany, attended a conference in Stuttgart where he heard a presentation about the emergence of the market for GHG emissions reductions. Afterwards, Dr. Groscurth approached the emissions broker who had delivered the presentation to inquire whether HEW's planned

installation of wind turbines near Hamburg might be capable of generating marketable GHG reductions. Recognizing that such reductions might meet TransAlta's needs, the broker soon initiated negotiations between the two parties that culminated with the public announcement of a successful transaction in June 2000.[25] The trade took three months to complete. It did not receive formal recognition from Canadian provincial and federal governments.

TransAlta agreed to purchase a total of 24,000 metric tons of CO_2e verified emissions reductions (3,000 metric tons per year generated from 2000 through 2007). HEW would generate the reductions by displacing its own fossil-fueled generation with wind power during periods of high demand. The electricity generated by wind would allow HEW to maintain the same average level of output with reduced emissions. The companies agreed that a German standards company, TUV Management Service GmbH, would be engaged at the seller's expense to verify that the reductions had been generated as promised. HEW's first verification and monitoring report, which covers reductions generated during the year 2000, includes a description of the project's baseline and monitoring methodologies. It will be supplemented annually with an appendix containing new data for calculating the previous year's reductions. The report for 2000 has been approved by TUV.

Both companies agreed that the price of reductions was not a critical issue in their negotiations.[26] This agreement reflects the fact that both parties were motivated primarily by the desire to demonstrate publicly the viability of emissions trading and to gain experience with trading. According to Bob Page, TransAlta's vice-president of sustainable development, the deal was "part of TransAlta's ongoing commitment to reduce our net GHG emissions and lead the way in proving that market-based mechanisms such as offsets and emissions reduction trading really work."[27] Given the relatively small volume of the transaction, the amount of money involved was considered to be of secondary importance. In fact, Dr. Groscurth stated that the costs associated with completing the transaction, including fees for lawyers involved in drafting a contract and technical experts that assembled relevant data and calculated the reductions, exceeded the revenue that HEW received from the sale. Dr. Groscurth explained that these costs were particularly high since it was the company's first trade, but noted that the resulting experience has substantially reduced the costs of subsequent transactions.

For HEW, the most costly aspects of completing the trade were also the most challenging. Though there was support for the concept of emissions trading throughout the company, lawyers took significant time to ensure that the contract consummating the transaction provided HEW with adequate protection against any unforeseen outcomes. HEW also had to develop an adequate baseline methodology to calculate the project's reductions. The company had several options from which to select. In the absence of any government rules on this matter, the buyer and the verifier acted as the ultimate arbiters of the baseline's adequacy.

In TransAlta's view, one of the key factors that made the deal possible was the fact that HEW owned not only the new wind assets but also the fossil fuel units whose emissions would be displaced. According to Paul Godman, manager of sales and marketing in Transalta's GHG offset management operation, the company had reservations about purchasing reductions from renewable energy projects in which the owner of the project did not also own the fossil units, as the ownership and quantification of such reductions are often difficult to determine.[39] Mr. Godman added that HEW's strong financial standing provided assurance that it would be capable of fulfilling its obligations in the trade, which extend several years into the future.

Both companies agreed that their positive experience encouraged them to engage in other trades. After completing its sale to TransAlta, HEW purchased reductions in order to gain experience on the "buy-side" of a transaction. TransAlta has also been both a seller and a buyer and is expanding its GHG trading operation even further to develop partnerships with companies that may seek to benefit from its expertise in the market. Through its new Carbon Market Initiative, TransAlta will offer to sell a portion of reductions in its existing portfolio, which have already been subjected to the company's internal quality assessment procedures. With these and other GHG trading initiatives, both companies hope to take advantage of growing opportunities in the emerging GHG market.

PG&E—Ontario Power Generation: The Value of Third-Party Review Processes

Participation in the GHG market has been mostly voluntary to date. It is clear that market participants perceive some benefits from engaging in pre-compliance transactions. However, in the absence of clear rules governing trading, one should not overlook the practical challenges of realizing these benefits. Completing a pre-compliance GHG trade requires market participants to negotiate

not only the traditional commercial conditions of any emissions transaction, such as price, quantity, and vintage, but also a host of other issues that would not arise in a market created through formal government rules. As the following trade between Ontario Power Generation (OPG), also a member of GEMCo, and US Gen New England (US Gen), a subsidiary of the U.S.-based PG&E National Energy Group, illustrates, resolving these issues often requires a significant investment of time and effort.

OPG, a major Ontario-based electricity generator, has been a pioneer in the area of emissions trading and is one of the most active buyers and sellers in the current GHG market. OPG met its voluntary year-2000 target to stabilize net GHG emissions at 1990 levels by taking actions to improve internal energy efficiency, expanding green power initiatives, and offsetting a significant share of its GHG emissions through the purchase of CO_2e emissions reduction credits from North American and international sources.[29] According to Dave Coates, who manages OPG's GHG emissions portfolio, much of the company's activity in the GHG market has been driven by this commitment.

OPG has successfully completed trades both with and without the assistance of emissions brokers. The trade described in this case study was completed with the services of an emissions broker. In 1999, through a broker, US Gen offered to sell OPG up to one million metric tons of CO_2e emissions reductions generated by capturing and destroying methane that would otherwise be emitted from the Johnston Landfill in Rhode Island from 1998-2000.[30]

US Gen's offer appeared to meet OPG's criteria for emissions reductions. To help ensure that purchased emissions reduction credits are recognized against OPG's voluntary commitment, OPG has committed to have all of its purchases scrutinized by Ontario's PERT program (described in Appendix I). OPG sees this verification as a vital aspect of ensuring a transparent and publicly available record of all discussions relating to the creation of emissions reduction credits. Following PERT's quality assessment, the credits are registered with PERT. OPG annually reports its GHG emissions to Canada's Climate Change Voluntary Challenge and Registry (VCR) Inc. In 2001, the credits used to meet OPG's 2000 target were transferred to the VCR for retirement.

Dan Chartier, emissions marketing manager at PG&E (who negotiated the trade on US Gen's behalf), indicated that his company's main interests in conducting a GHG trade were to gain practical experience with trading and to generate revenue. PG&E has been an active participant in other emissions markets in the United States, but recognized that GHG trading would involve a unique set of challenges. In particular, navigating the PERT process turned out to be more troublesome and required more time than PG&E had expected. According to Mr. Chartier, the absence of formal operating procedures and timelines for decision-making in the PERT process caused delays. Participants in the evaluation process were free to bring up any issue relating to the PERT mandatory criteria that reductions be real, quantifiable, verifiable, surplus, and unique. However, at that time there were no formal procedures governing time limits for decision-making and no final arbiter to determine if a seller had met specific criteria.

Following the PERT process and the negotiation of the contract, the trade was eventually consummated in April 2000, roughly a year after the transaction was initiated. Both companies expressed satisfaction with completion of the trade. However, their experience demonstrates that, without clearly defined rules, the costs of conducting GHG emissions transactions may be high even in instances where the reductions themselves are attractively priced and technically credible.

The following table presents examples of actual transactions and emissions-reducing activities in the GHG market.

Table 2

Examples of Actual Transactions, Projects, and Participants in the Greenhouse Gas Market

Reduction Activity	Buyer (Buyer Country)	Seller (Project Developer or Host Country)	Date	Total Quantity (metric tons CO_2e)
Agriculture	Industrial consortium (Canada)	Insurance company (United States)	1999	2,300,000
	Electric utility (Australia)	State agency (Australia)	1998	198,018
Energy Efficiency	National government (Netherlands)	Electric utility (Romania)	2001	1,536,140
	Electric utility (Canada)	Hospital network (Canada)	1999	34,437
	Electric utility (Canada)	Electric utility (United States)	1998	10,000,000
	Environmental student group (United States)	Energy company (North America)	1998	10,000 (Other reduction activities were included in the transaction.)
Fuel Switching	Electric utility (Canada)	Electric utility (Finland)	2000	50,000
Fugitive Gas Capture and/or Use	Energy company (North America)	Energy company (Asia)	2001	460,000
	Energy company (North America)	Energy company (North America)	2000	650,000
	Electric utility developer (United States)	Landfill gas sequestration project (Canada)	2000	309,664
	Electric utility (Canada)	Landfill gas sequestration project developer (United States)	1999	2,500,000
	Energy company (North America)	Energy company (North America)	1999	260,000
	Energy company (North America)	Energy company (North America)	1999	250,000
	Electric utility (Canada)	Electric utility (Canada)	1999	80,894
	Industrial consortium developer (Canada)	Landfill gas sequestration project (Canada)	1998	210,000
	Electric utility (Canada)	Heavy equipment manufacturer (Canada)	N/A	367,500
Renewable Energy	National government (Netherlands)	Electric utility (Romania)	2001	612,631
	National government (Netherlands)	Electric utility (Poland)	2001	583,500
	Manufacturing conglomerate (Japan)	Electric utility (Australia)	2001	2,000
	National government (Canada)	Electric utility (Canada)	2000	31,104
	Electric utility (Canada)	Electric utility (Germany)	2000	24,000
	Electric utility (Canada)	Pulp and paper company (United States)	1999	89,912
	Electric utility (Canada)	Renewable energy developers (United States)	1999	75,000
	Electric utility (Canada)	Electric utility (Canada)	1999	20,000
	Industrial consortium (Canada)	Insurance company (United States)	1999	2,300,000

NOTE: Table based on Natsource research. The table presents examples of actual transactions. The names of participants involved in the trades are confidential and are withheld here. Reported volumes include transactions for emissions reductions as well as options for future purchases of emissions reductions. For further discussion of this distinction, see Section 2.B of this paper.

IV. Future Outlook

This section assesses the future direction of the GHG market. It begins by considering the role of an international climate change treaty in facilitating the development of domestic policy and the GHG market. It then briefly describes a state-level system in the United States, two national-level trading systems being developed in Europe, and a supranational program being developed by the European Union, assessing how concurrent international, national, and sub-national policymaking will affect the continued evolution of the GHG market in the near-term. Next, it examines private-sector and nongovernmental efforts designed to gain experience with trading in the context of continuing policy and regulatory uncertainty. Building on recent progress in international negotiations, the section also suggests the actions necessary to create a more robust market in the longer term. Finally, it returns to the issue of an international agreement by considering possible scenarios for U.S. participation in an international system and the implications of U.S. participation for U.S. and non-U.S. firms, the economy, and the environment.

A. Role of an International Agreement

Most countries have supported a multilateral response to global climate change for more than a decade. This is in recognition of the global nature of the problem and of the fact that unilateral adoption of national emissions limits could threaten economic competitiveness. Efforts to develop a multilateral response began in the late 1980s with preparations for a framework convention on climate change. Adopted at Rio de Janeiro in 1992, the UNFCCC established a non-binding goal for industrialized countries of returning to 1990 GHG emissions levels by the year 2000 and an objective for the world to stabilize atmospheric concentrations of greenhouse gases at a level that would prevent dangerous anthropogenic interference with the climate system. A 1995 review of Parties' progress concluded that the UNFCCC's nonbinding emissions target would not lead to achievement of the Convention's objectives. In response, Parties agreed to pursue a complementary agreement that would establish quantified emissions limitations and reduction objectives for developed countries. This culmi-

nated in the negotiation of the Kyoto Protocol in December 1997. The process to develop rules, mechanisms, and institutions to bring the Protocol into force has continued through the present, including recent negotiations in Marrakech, Morocco, in November 2001.

The Kyoto Protocol does not specify the policies and measures individual countries should implement to achieve their emissions limitation. Rather, it provides Parties the flexibility to comply with their commitments in the way they deem most appropriate to their national circumstances and policy traditions. Parties will undoubtedly implement a mix of policy instruments to achieve their commitments, including taxes, standards and regulatory measures, and voluntary agreements with industry. Many countries will also establish domestic trading systems in order to reduce the costs of achieving their emissions limitation incorporated in the Protocol. Compliance at the lowest possible cost would be realized by harmonizing domestic trading systems in order to facilitate international trades.

Several Parties have initiated their policy development processes prior to the completion of the Protocol. Their task in developing a domestic system and potentially harmonizing it with other systems has been complicated by the lack of a clear international policy framework. As a result, the programs becoming operational have important differences. Whereas some of these differences are inevitable due to each government's policymaking traditions and national circumstances, they could have been minimized if greater clarity existed at the international level. This would have fostered the development of compatible domestic systems and a market that achieves the Protocol's economic and environmental objectives at the lowest possible cost.

Disputes over the Kyoto Protocol in recent years have cast doubt on when it or another agreement would enter into force. This has significantly diminished the plausibility of the scenario described above. However, the progress made at COP-6bis and COP-7 has greatly increased the potential of achieving a clear and binding international policy framework over the longer term.

B. Trading Programs Under Development

In spite of the uncertainty that has characterized international climate change negotiations, several governments have initiated the development of domestic GHG emissions trading systems.[11] This section provides brief descriptions of a sub-national system being developed in the United States and national and regional trading

264

programs being developed in Europe. It illustrates that, in the absence of a binding international treaty with clear rules to which domestic systems could conform, trading rules in evolving domestic systems differ substantially. Detailed descriptions of the Massachusetts, Danish, and UK programs are provided in Appendix IV.

Massachusetts

Massachusetts recently became the first U.S. state to impose CO_2 emissions limits on existing fossil-fired power plants, which have historically been subject to less stringent emissions reduction requirements than new plants under the Clean Air Act. The new law imposes limits on four kinds of air emissions (SO_2, NO_X, mercury, and CO_2) from six power plants in the state. The CO_2 reduction requirement can be met either through internal actions, such as repowering from coal to natural gas, or through the purchase of offsets from emissions reduction projects. Specific rules for crediting offsets have not yet been developed, but the state has indicated that offsets will have to be real, surplus, verifiable, permanent, and enforceable in order to be creditable against the emissions reduction requirement.

Denmark

In 1999, Denmark introduced CO_2 emissions trading under the CO_2 Quota Act, which imposed a first-of-its-kind cap on power-sector CO_2 emissions. It established a total emissions quota for electricity producers of 23 million metric tons of CO_2 in 2000. The cap will be reduced by 1 million metric tons per year through 2003, when it will reach a target level of 20 million metric tons. In order to engage in transactions, market participants must notify the Danish Energy Agency (DEA) whenever they wish to transfer allowances to another participant. If an electricity producer's annual emissions exceed its holding of allowances, it is subject to a penalty of 40 Danish kroner (about U.S.$5-6) per metric ton of excess emissions. The revenue derived from penalties for noncompliance is directed toward energy-saving projects. The government set a relatively low penalty so as not to disadvantage its power sector against neighboring countries, which have not imposed similar emissions reduction requirements on their electricity producers.

United Kingdom

The United Kingdom was the first industrialized country to develop a broad-based GHG emissions trading program. The UK government published the final framework for its national trading program on

August 14, 2001. While the trading program officially begins in April 2002, forward transactions of permits have already taken place. UK entities may participate in the voluntary trading program through four paths:

(1) by signing a climate change agreement with the government, which could lead to an 80 percent discount for companies subject to a domestic energy tax known as the climate change levy (CCL);

(2) through direct entry, giving companies access to financial incentives;

(3) by generating project credits through emissions reduction activities that could be sold into the trading system; and

(4) through purely voluntary participation in the system.

The first compliance period for companies participating via direct entry will run from January 1, 2002, to December 31, 2002, with subsequent year-long compliance periods starting January 1, 2003, and running through 2006. The first two-year compliance period for companies entering via agreements began on January 1, 2002.

The UK system is complex, with distinct absolute (sources agreeing to emissions caps in exchange for the discount on the CCL) and unit (sources agreeing to rate-based emissions limitations in exchange for the discount on the CCL) sectors. The unit sector has limited ability to trade with the absolute sector, which could reduce market liquidity.

European Union

In preparation for ratification of the Kyoto Protocol and to ensure the compatibility of member states' domestic trading programs, on October 23, 2001, the European Commission issued a proposal for a directive that would establish a mandatory EU-wide CO_2 emissions trading system.[32] The directive proposes two phases for the program: a preliminary phase from 2005 to 2007 for member states to gain experience with trading, and a 2008-2012 phase mirroring the first commitment period of the Kyoto Protocol.

The EU trading program would initially cover only CO_2 emissions, which account for approximately 80 percent of the European Union's total 1999 GHG emissions. The Commission may consider the coverage of other greenhouse gases, as monitoring issues are resolved. The emitting sectors covered by the program include energy combustion installations with a rated thermal input exceeding 20 MW, oil

refineries, coke ovens, metal production and processing, and producers of cement, glass, ceramics, and paper products. These sectors account for approximately 46 percent of projected CO_2 emissions in the European Union in 2010, and include 4,000 to 5,000 installations. Inclusion of additional sectors and activities in the program may also be considered at a later date. The directive sets forth monitoring, reporting, tracking, and verification criteria for CO_2 emissions that member states would have to meet.

In the initial three years of the program, the EU directive would mandate that member states allocate allowances to affected sources on a grandfathered basis (i.e., based on historical emissions). By June 30, 2006, the Commission will review experiences with the initial allocation method and attempt to establish a harmonized allocation for the first Kyoto commitment period and beyond. In the 2005-2007 period, member states must ensure that their national allocation plans conform to (i.e., enable compliance with) the EU allocation.

The proposed EU directive would allow for unrestricted banking of allowances from one year to the next during the 2005-2007 phase and within the subsequent five-year compliance period. Member states decide whether to allow for banking between the period ending in 2007 and beginning in 2008. The proposal requires that they allow for banking from one five-year period to the next after the first five-year period.

The financial penalty for noncompliance during the 2005-2007 period would be the higher of 50 per excess ton or twice the average price during a predetermined period. For the 2008-2012 compliance period, the penalty would increase to the higher of 100 per excess ton or twice the average market price. In both compliance periods, the operator of the noncompliant installation would still be obligated after payment of the penalty to surrender an amount of allowances in the following year equal to the amount of its emissions overage.

In order to enter into force, the proposed directive must first be approved by member states' environment ministers in the European Council and then by the European Parliament. If the Parliament and Council approve the proposal, it must then be considered and approved by each of the member states' governments and implemented through national legislation.

It is unclear how the already existing UK and Danish programs would be integrated into the EU system. It appears that many elements of the Danish system, which has been approved by the European

Commission, are likely to be compatible with the EU system. However, the compliance provisions appear to be in conflict with the system envisioned by the European Union. Since it will end in 2003, it could be redesigned in a manner consistent with the EU system. By contrast, there appear to be greater tensions between the European Union and United Kingdom on the matter of compatibility. The UK system diverges from the EU system in several important ways, such as sectors and gases covered. Significantly, participation in the UK program is voluntary, while it would be mandatory in the EU program. At COP-7, the EU Environment Commissioner Margot Wallström stated, "By 2005 they (the United Kingdom) will have to adapt to our EU-wide system."[33] On November 28, 2001, an official from the European Commission warned that the incompatibility of the systems "could create market distortions in the future" and that the UK system would require modification to ensure a smooth transition to the EU program.[34]

C. Impacts of Concurrent Policy and Market Development

This section describes how the preceding policy developments at the domestic and international levels may influence GHG trading in the near future.

Emissions Commodity Shift: From Voluntary to Compliance Instruments

VERs, the most commonly traded emissions commodity to date, are of limited value for companies attempting to hedge their risk from a potential future emissions limit. This is because VERs have been created in the absence of government trading rules and carry the risk that governments will not recognize them for compliance with future domestic emissions reduction requirements.

As the domestic and EU trading systems described above become operational, market participants will no longer have to define a commodity in each transaction by developing their own monitoring requirements, baseline methodologies, allowable activities types, or other characteristics of emissions reductions. Government rules will provide a framework for these activities. As a result, market participants will be able to acquire or transfer government-issued permits that conform to specific rules.

In jurisdictions that have imposed binding emissions restrictions and developed domestic trading programs, increasing numbers of buyers will elect to acquire permits rather than VERs because the former are by definition recognized for compliance with emissions reduction requirements. Firms in countries without emissions limits may also create demand for permits. Compared to VERs, permits created in

a formal program stand a higher probability of being transferable to other jurisdictions' future trading programs. Thus, foreign companies may acquire permits as a tool for risk management. For example, a German company anticipating a binding emissions limitation might purchase UK allowances in hopes that they will be recognized for compliance under a future German or pan-European trading system. Even if foreign permits ultimately cannot be used for compliance by a buyer, the acquiring party will be able to liquidate the permits within their jurisdiction of origin, so long as sources in that jurisdiction continue to face binding emissions restrictions (and assuming that the permits do not expire). Nevertheless, some buyers will continue to purchase VERs for compliance with voluntary commitments and to the extent that the lower price of VERs compensates for their less-assured status with regard to future government recognition.

Fragmentation

As the previous descriptions of emerging trading systems illustrate, in the absence of a clear international trading architecture, governments that have proceeded to develop trading programs have adopted unique programmatic elements. Differences among these elements may give rise to incompatibilities in the near-term that will likely inhibit some economically beneficial cross-border transactions. For example, the UK and Danish programs cover different gases and sectors and utilize a variety of allowance-based and credit-based approaches, posing barriers to trade between firms in these countries.

Many of the provisions in the UK program also differ from those in the European Union's draft directive. If these differences are not ultimately harmonized, GHG trading may occur mostly within several fragmented markets, each with its own unique commodity, instead of in a single international market for a homogenous GHG emissions commodity. Table 3 highlights the major design elements of these systems and also identifies the differences in design that could adversely affect market development.

Table 3

Comparison of United Kingdom, Danish, and European Union Emissions Trading Programs

	United Kingdom	Denmark	European Union
Mandatory vs. voluntary	Voluntary with financial incentive payments or climate change levy discounts	Mandatory	Mandatory
Compliance periods	Direct participants: 2002-2006; Agreement participants: 2002-2010	2001-2003	2005-2007, 2008-2012
Gases	Firms choose coverage: all six GHGs or CO_2 only	CO_2	Initially only CO_2
Sectors	Industrial sectors; electricity sector excluded	Electricity generation only	Industrial sectors and energy sector; chemical sector excluded
Allocation approach	Direct participants: grandfathering; Agreement participants: free allocations for excess reductions beyond target after compliance is demonstrated	Grandfathering	2005-2007: grandfathering; 2008-2012: to be determined
Absolute vs. relative targets	Direct participants: absolute; Agreement participants: relative or absolute	Absolute	Absolute (allows for conversion of relative to absolute)
Domestic project credits	Projects in UK are allowable except in domestic sector; sequestration not eligible although it may come under review	None	None initially, inclusion to be determined in Commission report by June 30, 2006
International project credits	None initially, will consider CDM inclusion to a certain percentage when CDM rules are finalized	None initially, will issue guidelines on JI and CDM inclusion when international rules are finalized	None initially, inclusion to be determined in Commission report by June 30, 2006
Banking	Unlimited within compliance period	Participants may bank difference between emissions and saving limit. Savings limit: 90 percent of 2001 allocation, 95 percent of 2002 allocation, 100 percent of 2003 allocation	Unlimited banking in 2005-2007 and 2008-2012; countries may allow banking of 2005-2007 allowances into 2008-2012 period
Financial penalty	Direct participants: noncompliance means ineligible for annual financial incentive payment; Agreement participants: not eligible for climate change levy discount for year of noncompliance	40 Danish Kroner/ton initially (US $5-6)	2005-2007: 50/ton or 2 times average allowance price; 2008-2012: 100/ton or 2 times average allowance price
Environmental penalty	Direct participants: for each ton of overage, 1.1 to 2 allowances deducted from next year; Agreement participants: none	None	For each ton of overage, one allowance deducted from next period
Financial incentives	$309 million over 5 years for direct participants; climate change levy 80 percent discount for agreement participants	None	None envisioned; incentives at national level could be considered impermissible "State Aid"
Safety valve (price cap)	None	None, but low penalty acts as allowance price ceiling	None (but considered in September 2001 proposal)

To take advantage of cost-saving opportunities for international trade, countries seeking to trade with each other must, at a minimum, establish rules of interchange and mutual recognition of their tradable units. This has not yet occurred between the two existing national trading systems. If ratification of the Protocol takes more time—delaying its entry into force and implementation by the Parties—and if concurrent policy-making continues, less international trading will result than if an international system had provided policy guidance to those developing domestic systems. The consequence of this reduction in trading will be increased compliance costs and potentially less investment in emissions reduction activities.

Countries may ultimately decide to amend their systems to ensure compatibility if cost-minimization is a primary objective. However, such changes would affect the positions of firms that participated in the lengthy policy development processes leading to the existing national system and presumably understood their positions within that system vis-à-vis their competitors' positions. Thus, in addition to being time-consuming, revising a system would be undesirable for some because it changes the "rules of the game," and potentially the competitive positions of affected sources.

The recent international agreements reached at Bonn and Marrakech clarify numerous details concerning implementation of the Kyoto Protocol, and reduce much of the uncertainty that has surrounded international climate change and domestic policy development during the past few years. In particular, the agreements resolved long-running debates on issues such as the imposition of a quantitative limit on the use of the mechanisms for compliance, fungibility of various international GHG units, banking rules, mechanisms governing the potential overselling of Assigned Amount Units (AAUs) (see note 8), and the treatment of sinks. Parties also determined the makeup of a CDM Executive Board, agreed to establish a JI Supervisory Committee, and partially resolved some outstanding issues related to the Protocol's compliance regime. These agreements will likely facilitate more rapid development of an international GHG market by providing clearer guidance to Parties seeking to develop domestic trading programs that will be consistent with international rules and with other domestic systems.

While the magnitude of the achievements at Bonn and Marrakech should not be understated, it cannot be assumed that the development of a seamless international GHG market is an inevitable outcome. Some key elements of the Protocol remain unresolved and require further negotiation. Some remaining issues to be addressed include the legal nature of the compliance program and operational

rules to govern the project-based mechanisms, which are to be agreed upon by the CDM Executive Board and JI Supervisory Committee. Thus, at least in the near future, international and domestic GHG policy will continue to develop concurrently, with the risk that incompatibilities between international, regional, national, and sub-national climate change policies will lead to market fragmentation and sub-optimal economic and environmental outcomes.

It is important to note that incompatibilities and fragmentation will not necessarily prevent international trades from occurring. Experience from analogous emissions markets in the United States suggests that market participants will develop transactional structures enabling them to trade across diverse systems if it is in their interest to do so. However, these trades will involve higher costs relative to those that would occur within more compatible systems.

The impacts of fragmentation on the performance of environmental commodity markets are illustrated by two emissions trading programs in the United States. The first is permanent offset trading of criteria pollutant emissions permits in the United States, authorized by Title I of the Clean Air Act. Under the new source review provisions of Title I, new or significantly modified sources of emissions located in areas that fail to meet national ambient air quality standards must acquire emissions offsets generated by shutdowns or emissions reductions from other existing sources. While the air quality standards that states must meet are established in accordance with federal law, states are provided the authority to regulate permanent offset trading.

States have developed different rules to supervise permanent offset trading. Because of these differences, little cross-border trading has occurred. This is the case even within shared airsheds that would lend themselves to regional trading with no loss of environmental quality. The result is that trading benefits are reduced as new sources are forced to acquire more costly offsets generated within their own state instead of seeking out cheaper offsets within the same airshed in neighboring states. Even where differences in trading rules do not prevent cross-border trades from occurring, those differences introduce additional complexity and increase transaction costs. Differences in national trading systems are likely to yield similar outcomes in GHG markets for the foreseeable future.

The NO_x Ozone Transport Commission (OTC) Budget Program provides another example of the impact of differences in state trading rules. This program is also authorized by Title I of the Clean Air

Act. While the program is generally regarded as a success for having achieved significant reductions of NO_X emissions at low cost, some additional cost savings are lost because of differences in the way individual states implement certain provisions of the program.[24] For example, each state in the program is allowed to choose the method and schedule by which NO_x allowances are allocated to its affected sources. While most states allocate allowances once for the entire four years of the program, a few states such as Massachusetts allocate on an annual basis. This requires some sellers to resort to "allocation-contingent" offers, meaning that the number of allowances that they would sell to a buyer is dependent on the number of allowances they receive. Potential buyers are forced to consider the risks that their counterparty might not receive its anticipated allocation or otherwise default on its obligations. This complicates comparison of competing sell offers, and occasionally obstructs trades.

D. Additional Greenhouse Gas Trading Initiatives

This section briefly describes the efforts of private-sector and nongovernmental market participants to create a GHG trading system.

Partnership for Climate Action In October 2000, the Partnership for Climate Action (PCA) was announced just prior to COP-6. It is a joint effort between the NGO Environmental Defense and Alcan, BP, DuPont, Ontario Power Generation, Pechiney, Shell, and Suncor. More recently, Entergy joined the PCA, and PEMEX has engaged in a bilateral project with Environmental Defense to manage its emissions. Each company in the PCA has committed to make GHG emissions reductions, demonstrate excellence in emissions trading, and report on their progress. With their aggregate emissions exceeding 360 million metric tons of CO_2e in 1990, the group would be the 15th largest emitter in the world if it were a country. The companies have pledged reductions of over 80 million metric tons of CO_2e, or more than 20 percent. Individual reduction targets vary, based on each company's ability to reduce emissions. While other significant NGO efforts have been developed to engage the private sector on the climate change issue, the PCA is unique in that member companies have to accept absolute emissions reduction targets and report annually on their progress.

Emissions Market Development Group Announced at COP-6 in The Hague during November 2000, the Emissions Market Development Group (EMDG) is a joint project launched by Arthur Andersen, Credit Lyonnais, Natsource, and Swiss Re in conjunction with a number of other participating companies. It is focused on

creating a "carbon repository" where firms would be able to deposit reductions they have achieved, and enhance their ability to trade the reductions in advance of the emergence of fully developed national systems.

The repository would subject reductions to a review process that values their viability for future compliance in a given country. The repository would evaluate the risks associated with reductions, their owners, and country of origin, and assign proper "exchange rates" in proportion to those risks. The repository would then issue the depositor an amount of tradable common carbon credits (CCCs) that reflect that risk-adjusted exchange rate. These CCCs would be redeemable at a future date for compliance permits in a given jurisdiction. The CCCs would be fully tradable in advance of many national systems, enabling players in the market to better manage their GHG risks. By creating a product that is more clearly defined and adjusted for risks, EMDG hopes to increase liquidity in the early trading market.

At COP-7 in Marrakech, EMDG announced that it had completed a feasibility study on its concept. While most elements of the study remain confidential to EMDG and its participants, it found that the core concepts are technically feasible, but that success hinges on further developments in market conditions. Importantly, the lack of insurance products for guaranteeing reductions for compliance is an obstacle to the creation of such an entity. Insurers believe that insurance products will become available in the near future as national GHG trading programs become operational and as market pricing information for permits becomes available. As the market matures, EMDG plans to develop some components needed by the repository, most notably a "carbon rating engine" that could assess projects' carbon value in a routine, automated way. EMDG also plans to develop a pilot portfolio of reductions that could be rated by this engine and then freely traded.

Chicago Climate Exchange In June 2001, 33 companies with assets in the midwestern United States announced the formation of the Chicago Climate Exchange (CCX). Led by Environmental Financial Products and the Kellogg Graduate School of Management at Northwestern University, under a grant from the Joyce Foundation, the group will explore the potential for a regional GHG trading exchange in order to achieve a specified level of emissions reductions. The companies have indicated in letters to the CCX that they will consider trading on the exchange if effective rules are designed. The CCX has proposed that participating companies voluntarily commit to emissions reductions and trading in all six greenhouse gases. Participants would commit to reducing their GHG emissions by 2 percent below 1999 levels during 2002 and reduce them by 1 percent annually thereafter. Credits would be given for domestic and international

emissions offset projects. The CCX hopes to have the exchange up and running by the third quarter of 2002 for participants in seven states: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin. In 2003, the CCX aims to have commitments and trading among participants in the entire United States, Mexico and Canada, and to expand the exchange to include international participants in 2004.

E. Potential U.S. Development of a Parallel Trading System and/or Participation in an International Agreement

The United States' stance on the Kyoto Protocol makes its entry into force challenging, although it appears more likely following the successful international negotiations of 2001.[m] The recent political agreements reached among 180 countries in Bonn and Marrakech on key features of the treaty revived the nearly stalled process of advancing ratification of the Protocol. The negotiations were also notable in that the United States acted only as an observer, having already expressed its opposition to the treaty.

In addition to making it more difficult to achieve the entry-into-force threshold incorporated in the Kyoto Protocol, the U.S. position raises questions about: (1) the levels of trading that will occur; (2) the environmental and economic impacts of the agreement; and (3) impacts on U.S. and non-U.S. firms.

The following section identifies and analyzes some general scenarios regarding U.S. efforts to develop a parallel system to reduce greenhouse gases and its potential participation in international efforts to address climate change. For purposes of simplicity, only a few broad scenarios and their possible impacts are presented here. Also, the authors assume for each of the following scenarios that the Kyoto Protocol will enter into force, in keeping with the stated intentions of the Parties to the Bonn and Marrakech agreements.

Scenario 1: The United States Does Not Participate in the Kyoto Protocol and Does Not Develop a Domestic Greenhouse Gas Reduction Program

In this scenario, the Protocol enters into force without U.S. participation. Parties that choose to develop domestic trading programs as an element of their domestic climate change policy will benefit from international trading rules, allowing them eventually to harmonize their systems more closely, should they choose to do so.

If the United States does not participate in international GHG markets, it is likely that compliance

costs would be far less than had been estimated by most prior analyses of the Kyoto Protocol. Lower costs would result because the largest projected buyer, the United States, would not be a market participant. Additionally, the overall volume of trading would decline without the United States. In the absence of ratifying governments imposing a constraint on use of trading for purposes of compliance with commitments, Annex B Parties would likely be able to achieve a larger share of their compliance requirements by purchasing AAUs without undertaking significant additional abatement. Consequently, the aggregateemissions abatement achieved by the Kyoto Protocol would also be diminished relative to its original formulation.[37]

It is possible that sellers will bank a portion of their AAUs for future domestic use in anticipation of increased economic activity (which may increase GHG emissions) or as an attempt to increase the market price of permits. This possibility has grown more likely as a result of Russia's supplementary allocation of tons for its sinks at COP-7, which will increase its permit supply in the first commitment period. New analysis has recently been conducted attempting to quantify the impacts of such market behavior.[38] This paper does not review the new analysis in depth or render judgment about governments' ability to engage in such strategic behavior. However, if banking does occur in countries with surplus permits, market prices would increase.

Almost all of the analyses of the Protocol without U.S. involvement arrive at similar conclusions: prices for permits and additional GHG abatement would fall. The fall in prices could be mitigated to some degree if potential sellers bank some proportion of their permits for future compliance or in attempt to raise prices.

Private Sector Impacts In this scenario, U.S.-based multinational companies with operations in other Annex B countries (predominantly energy-intensive manufacturing companies with GHG liabilities) may not enjoy the benefit of incorporating U.S. reduction opportunities into their corporate compliance strategies. Several such firms have found that cost-effective reduction opportunities exist in their U.S. operations. However, it is unlikely that reductions achieved in the United States could be used under the Protocol either to minimize their internal compliance costs by utilizing U.S. reductions in corporate reduction strategies or to generate revenue by selling those reductions to other companies.

If the United States remains outside the Protocol and does not develop a domestic GHG program, U.S.-based companies that participate in international markets, particularly those sensitive to energy

costs, might be at a competitive advantage, as they would not incur the costs associated with an emissions constraint. The magnitude of this advantage would depend upon the cost of compliance for those firms that do face an emissions constraint.

It is possible that there will be political ramifications for U.S. firms that benefit from remaining outside the Protocol. Regulated firms in other Annex B countries would likely lobby their governments to level the commercial playing field, which could entail political and trade consequences for the U.S. government and U.S. companies. In addition, U.S. companies would continue to operate under the specter of some future unspecified GHG constraint. Continuation of current policy uncertainty over the long term could increase future compliance costs by forcing firms to make complex decisions about potential capital investments without understanding future climate change policy and potential emissions reduction requirements.

Scenario 2: The United States Does Not Participate in the Kyoto Protocol but Develops a Parallel Domestic Greenhouse Gas Program

It is difficult to predict if or when the United States will require firms to control their GHG emissions. However, in recent months several members of the U.S. Congress have introduced legislation that would, among other things, require electric utilities to reduce their GHG emissions as a component of legislation that also requires reductions in conventional air pollutants. It is not clear if or when such legislation will become law. Nevertheless, it is an important signal that momentum on the climate change issue may be shifting in the United States. Additionally, the Bush Administration proposed that the United States develop a domestic climate change program while remaining outside the Kyoto Protocol.

Private Sector Impacts The U.S. power sector has relatively few low-cost options available to reduce emissions from its own assets, due in part to the long life of its facilities. Near-term emissions limits could cause premature retirement of existing capital stock, increasing the cost of electricity as new plants would have to be financed to replace high-emitting plants. Accordingly, the industry has generally been among the strongest advocates of the elements of flexibility built into the Kyoto Protocol, such as the incorporation of all six greenhouse gases into reduction targets, multi-year commitment periods, sequestration, project-based mechanisms, and international trading.

If the United States does not participate in an international agreement and develops a parallel domestic system instead, many dynamics will affect the ability of power companies and other firms to

gain access to the elements of flexibility built into the Protocol. For example, U.S. legislation might easily incorporate rules allowing firms to buy AAUs under Article 17 and other Kyoto Protocol units, or instruments created by other domestic and regional systems, for purposes of compliance with a domestic emissions limit. However, it is not clear that the Kyoto Protocol would allow purchases of AAUs by Parties outside of the Protocol. Article 17 of the Kyoto Protocol only authorizes trading among Annex B Parties.[39] Additionally, countries with domestic systems in place may attempt to take action to limit U.S. access to their compliance tools. Such purchases also raise important environmental issues that would have to be addressed, such as double counting of reductions.

There is a strong possibility that potential U.S. buyers would devise mechanisms and structures to gain access to international and other countries' domestic GHG instruments for compliance with a U.S. domestic program. They could seek to develop corporate subsidiaries for this purpose and locate them in Annex B countries or utilize market intermediaries. However, gaining access through such structures would increase costs.

The resolution of these issues will be complex and take time. This paper does not take a position on the likely outcomes of these upcoming debates. The outcomes will be driven by technical, legal, and economic issues, which are outside the scope of this analysis, while others will be driven by Parties' political considerations. It is important that such political considerations be taken into account. Recently, Michael Meacher, the UK environmental minister suggested that "U.S. multinationals will want to have a place in emissions trading to which they do not have access unless the U.S. is a member of the Protocol."[40] While Mr. Meacher does not speak for U.S. firms, it is important to note that senior political officials are beginning to think about these issues.

Gaining access to reductions generated by projects in developing countries is likely to be far less complicated for U.S. firms. Developing countries might be quite willing to sell to the United States, creating a system parallel to the CDM. Since developing countries do not have national emissions reduction obligations, such sales would not directly affect the integrity of the Kyoto Protocol's Annex B emissions caps. Allowing sales to the United States would also increase overall demand for reductions generated in developing countries, possibly increasing prices paid to sellers in those countries. Authorizing the transfer of such reductions would require provisions in U.S. law addressing such issues as their creation and transfer for compliance. However, the transaction costs involved in project-based

trading may not provide the same cost-saving opportunities as allowance-based trading. For these reasons, if U.S. domestic legislation eventually moves forward but the United States remains outside the Kyoto Protocol, utilities could be adversely affected by the increased costs associated with exclusion from some trading opportunities and with development of complex mechanisms to overcome trading barriers.

Scenario 3: The United States Becomes a Party to the Kyoto Protocol after It Enters into Force

Under this scenario, the United States could have a domestic program in place as described in Scenario 2, or it may not have developed such a program. If the United States had a program in place, it would likely require revisions to conform to international rules after it ratified the Kyoto Protocol. If the program were limited to a few sectors, an economy-wide domestic program or additional compliance measures would have to be developed in order to achieve compliance with international obligations. If a system were not in place, the United States would have to develop domestic implementing legislation to achieve its international obligations.

By delaying its participation in the Kyoto Protocol, the United States might have greater latitude to shape its terms for participation, perhaps negotiating a more permissive emissions target, for example. However, the rules and institutions governing the mechanisms would have been developed without U.S. participation, reducing the likelihood that they would be favorable to U.S. interests. In addition, if the United States becomes a Party following the first commitment period of the treaty, it is likely that compliance costs would increase for all Parties because the United States could significantly drive up demand for permits. The resulting increase in prices would be dependent on such dynamics as the level of emissions limitation agreed to by the United States, the availability of sequestration, and technological improvement. Recent studies by Richels and Manne, which assume U.S. participation in 2020, provide quantitative analyses of this scenario's impact on the price of AAUs.[41]

During the period in which the United States remained outside the agreement, competing firms in other Annex B countries would likely have gained significant experience in the international GHG market. Major emitting firms have and will continue to develop significant internal infrastructure to manage GHG emissions, likely involving diverse business units and assets. Creating such an infrastructure cannot be accomplished without significant investment in a variety of intellectual, technical, and market

resources over a lengthy period of time. Key tasks involved in developing optimal compliance strategies include understanding current emissions, projecting future emissions growth, assessing internal costs of abatement, comparing these prices to external market prices, and evaluating and implementing less GHG-intensive technologies, practices, and processes. Firms in Annex B countries and major multinational companies will develop years of experience in the GHG market and will necessarily build this infrastructure. While multinational firms facing emissions restrictions in other countries may be prepared to transfer such expertise to the United States when GHG emissions limits come into effect, U.S. firms will nevertheless have less experience than their competitors. As a result, U.S. firms would likely be disadvantaged for a period of time when competing against those that already understand the rules of the game. In addition, firms that have participated in a carbon-constrained world will likely have developed new emissions-reducing practices and technologies.

Under this scenario, U.S. firms also could continue to be affected by existing policy uncertainty, facing the difficulty of making significant capital investments without knowing what regulatory requirements they may face in the future.

BEST AVAILABLE COPY

Scenarios for United States Climate Change Policy and Potential Impacts if Kyoto Protocol Enters into Force

Scenario 1: United States Does Not Participate in the Kyoto Protocol and Does Not Develop a Domestic GHG Reduction Program	Scenario 2: United States Does Not Participate in the Kyoto Protocol But Develops a Parallel Domestic GHG Reduction Program	Scenario 3: United States Becomes a Party to the Kyoto Protocol After It Enters Into Force
• Multinational firms that have U.S. assets and are located in Annex B Parties have potentially limited options. U.S. reductions are of potentially limited value in carbon management strategy. • U.S. firms have some competitive advantage in international markets; advantage will depend upon compliance costs for Annex B Parties. • Compliance costs are reduced for Parties unless Parties with surplus AAUs bank them for future use or in an attempt to drive up prices. • Less GHG abatement. • U.S. firms face uncertainty regarding climate change policy with potentially adverse impacts.	• Multinational firms that have U.S. assets and are located in Annex B Parties have potentially limited options. U.S. reductions are of potentially limited value in carbon management strategy. • There will be potential obstacles to U.S. firms gaining access to Annex B trading market or other foreign, domestic, or regional compliance instruments. Access likely to come at some cost. • Project-based trading will likely be available. Increased demand for CDM-like projects. • Costs of domestic compliance may be higher. • Key environmental issues need to be addressed.	• After joining the Kyoto Protocol, the United States must develop a domestic GHG reduction program to comply with international obligations. • If the United States already has developed a domestic GHG reduction program prior to joining the Kyoto Protocol, it must conform the domestic program to international rules. If program is not in place, domestic implementing legislation will be required. • Non-U.S. firms will have an advantage due to their early market experience in the international system. • United States must live with existing rules of the international system. • Compliance costs likely to increase for Parties as United States drives up demand for reductions. Increase in costs depends on stringency of U.S. reduction target.

BEST AVAILABLE COPY

V. Conclusions

During the brief history of emissions trading programs, trading has typically proceeded after government requirements to reduce emissions were imposed and trading rules were developed. However, the existing emissions trading programs developed to date have not been designed to address an environmental challenge as scientifically, economically, and politically complex as global climate change. Owing in large part to this complexity, the development of comprehensive policy responses to climate change has not kept pace with the rate at which public concern over the issue has grown.

Motivated by a variety of factors including the desire to address this critical environmental challenge, respond to public concern, and shape policy, some companies and governments have already begun exploring the challenges and benefits of GHG trading prior to the existence of a formal regulatory framework. As the review of the current market in Section 2 demonstrates, this has created a unique situation in which policy development and trading is proceeding concurrently rather than sequentially, with each influencing the other. Market participants attempt to conform their trades to emerging policy, and policy-makers seek to develop trading programs in light of accumulating experience from market participants. The authors believe that this trend will continue.

Despite continuing political uncertainty surrounding the climate change issue, increased scientific understanding of climate change and growing public concern will drive more governments and businesses to seek effective ways to address this issue. The diplomatic breakthroughs achieved in Bonn and Marrakech and the recent development of a few domestic systems support the view that policy makers can overcome their differences and implement policy responses.

As environmental policy stakeholders have grown more familiar with emissions trading, it has become the policy measure of choice to address climate change. This is evidenced by the development of GHG emissions trading programs outside the United States, where most practical emissions trading experience resides. The initiation of programs in the United Kingdom and Denmark, for example, will

282

undoubtedly lead to increased trading in the near term. The EU directive will likely inspire more action by EU member states and greater harmonization among their national programs. These systems will facilitate increased trading activity and motivate investment in activities that reduce GHG emissions.

Existing domestic trading systems were developed without the benefit of clear international rules. The result is that these systems, such as those of the United Kingdom and Denmark, differ in key areas. These differences create potential impediments to cross-border trades. The UK system, and to a lesser degree, the Danish system have some important differences with the trading system currently being designed by the European Union. If domestic permits are to be transacted across national jurisdictions for the purpose of compliance, rules must be devised to allow for their interchange and fungibility. The existing systems may have to be amended to conform to EU rules and eventually, those embodied in the text of the Kyoto Protocol. In the absence of such harmonization, market participants will devise strategies to gain access to foreign GHG commodities. However, this will be a more expensive solution than if programs were initially compatible.

This suggests that at least in the near term, national and sub-national GHG markets may be fragmented, resulting in sub-optimal economic and environmental outcomes. The progress achieved in 2001 at COP-6bis and COP-7 increases the potential that a robust market will develop in the long-term. However, several key issues related to the Protocol that will affect market performance still must be addressed. For example, Parties still must address the binding nature of the Protocol's non-compliance provisions. Institutions governing the mechanisms must move forward expeditiously and Parties must harmonize their domestic systems with each other. Therefore, while the potential for harmonization with its resultant benefits is higher than it has been at any point in the past, more work needs to be done to effectuate a smoothly functioning international GHG market.

Appendix I: Descriptions of Project-Based Programs

U.S. Initiative on Joint Implementation

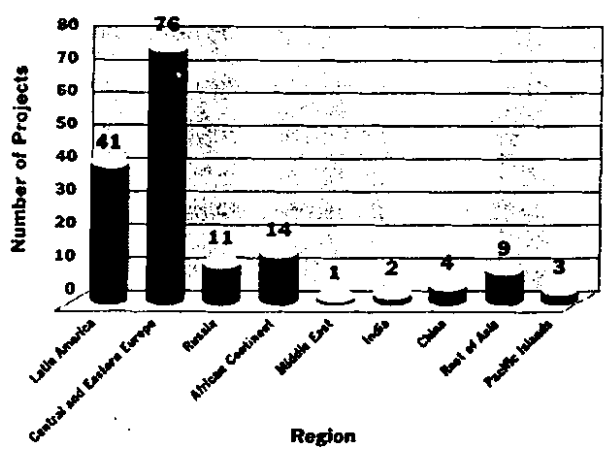
The United States was the first to initiate a JI pilot program. The USIJI was initiated under the 1993 U.S. Climate Change Action Plan (CCAP) as a pilot project to gain experience with GHG reduction projects in both developing and developed countries.[42] Its main objectives were to demonstrate the viability of project-based emissions trading (though no formal credits were granted) and to gain practical experience. USIJI differs from JI under the Kyoto Protocol. While JI under the Kyoto Protocol authorizes emissions reduction projects between Annex B countries and authorized legal entities, USIJI allowed for GHG reduction projects in both developing and developed countries. To date, the USIJI has approved 50 projects in 26 countries.[43] The projects received USIJI approval from the inception of the program in 1994 until the last round of project approvals in October 2000. The location and activity type of the USIJI projects are described in Figures 1 and 2.

Activities Implemented Jointly Pilot Phase

The AIJ program was initiated at the first Conference of the Parties (COP-1) to the UNFCCC held in Berlin in March and April of 1995.[44] The purpose of this program was to gain practical experience with JI- and CDM-like projects.[45] The pilot phase was supposed to remain in effect until 2000. An agreement reached at COP-7 in Marrakech continues the pilot phase. To date, approximately 155 AIJ projects have been undertaken in 41 countries.[46] These projects are described in Figures 1 and 2. Approximately 80 percent of all projects have involved renewable energy and energy efficiency. Project developers have claimed significant emissions reductions from these projects, though they are not required to seek verification by a third party. Nevertheless, experience generated by USIJI has helped to refine methodologies for quantifying emissions reductions from sources and removals by sequestration.

Figure 1

Regional Location of USIJI and AIJ Projects[47]



284

Pilot Emissions Reduction Trading Project

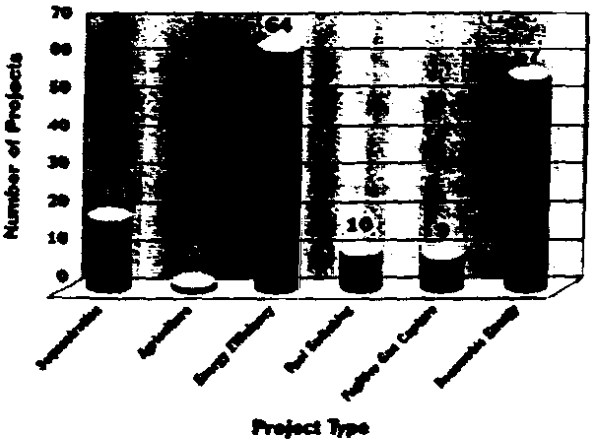
The Ontario, Canada, PERT project is a joint industry and government initiative to explore and promote emissions trading as a tool to reduce emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), and since 1997, SO_2 and GHG emissions. The PERT program is representative of pilot programs that have been developed to foster voluntary reduction activities and facilitate learning-by-doing. To date, PERT has evaluated scores of projects leading to the registration of 14.6 million metric tons of reductions of CO_2e (including CO_2, methane, and nitrous oxide (N_2O)) in the PERT registry.[48]

The Climate Trust (Oregon)

The state of Oregon requires new power plants to offset a portion of their projected CO_2 emissions as a condition of obtaining an operating permit.[49] The state requires power plant developers to offset emissions that exceed a specified rate of output (i.e., 17 percent below the most efficient combined cycle natural gas generation technology). To comply with the law, established in 1997, plant developers may choose to acquire qualifying offsets (the project path) in the market that achieve specified criteria or to pay $0.85[50] per metric ton of CO_2 (the monetary path) to The Climate Trust,[51] a state-sanctioned nonprofit entity charged with securing offsets. To date, all developers have utilized the monetary path for compliance.[52] The Climate Trust will fund five projects from its first million dollars in offset payments and is currently seeking to spend $5.5 million derived from its second round of offset payments. Table 4 summarizes four of the five projects that were procured in the first round. The fifth is a sequestration project in Ecuador whose features will be announced in early 2002. These projects anticipate avoiding, sequestering, or offsetting a total of 764,300 metric tons of CO_2 over the next 100 years.[53]

Figure 2

USIJI and AIJ Projects **by Activity**



A second round of contracts totaling $5.5 million will be awarded by The Climate Trust and Seattle City Light (Seattle, Washington) in 2002. The funds for this round are derived from payments to offset CO_2 emissions from Calpine's 450-megawatt Hermiston Power Project and Avista Corporation's 260-megawatt Coyote Springs Unit 2 power plant, both located in eastern Oregon.[54] Although all projects funded by The Climate Trust thus far have been located in the Pacific Northwest, The Climate Trust will consider offsets generated anywhere in the world.

Table 4

Projects Funded by Climate Trust First Tender"

Supplier	Volume (metric tons CO_2) of offsets	Project Description
Lummi Indian Tribe	At least 350,000 over 100 years	Preserve 1,654 acres of old-growth Pacific silver fir forest as a carbon "sink" by protecting it from industrial logging cycles.
Portland Office of Transportation	70,000 over 10 years	Internet service called CarpoolMatchNW.org that links carpoolers in a region stretching from Salem, Oregon, to Vancouver, Washington, thus reducing emissions from fuel combustion.
Klickitat County Public Utility District No. 1.	342,000 over 30 years	Cleaning and removal of CO_2 from gases released by Roosevelt Regional Landfill located in south-central Washington. Cleaned gas will fuel electric generation, offsetting higher-emitting grid-generated electricity.
Bonneville Power Administration	23,178 over 10 years	Purchase and retirement of 36,500 MWh of Bonneville Environmental Foundation Green Tags; CO_2 offsets are being separated from other environmental attributes embedded in tags and transferred to The Climate Trust.

Emission Reduction Unit Procurement Tender

The ERUPT was issued by the Dutch Ministry of Economic Affairs (MEA) in 2000. It is designed to assist the Netherlands in achieving its national emissions limit under the Kyoto Protocol through the purchase of ERUs generated from projects in Annex B countries. ERUPT projects must adhere to criteria issued by the MEA's implementing agency, Senter, which are based on potential rules for JI as outlined in Article 6 of the Kyoto Protocol.[56] The Netherlands has indicated that it aims to achieve up to half of its emissions reduction obligations through flexible mechanisms such as JI.[57]

Purchases from five projects in the first round of ERUPT involved a total of 4.2 million metric tons of CO_2e reductions, valued at total of $31 million. These projects are described in Table 5. The government has also issued two additional tenders: (1) a second round of ERUPT, and (2) a CERUPT (Certified Emission

Table 5

ERUPT Projects

Supplier	Volume (metric tons CO_2e)	Price (US$/ERU)	Country	Project Title
NV Nuon	1,536,140	7.99	Romania	Municipal Cogeneration Targoviste
NV Nuon	924,590	7.99	Romania	Municipal Cogeneration Cluj-Napoca
BTG Biomass Technology Group BV	522,320	7.92	Czech Republic	Biomass Energy Portfolio
United Power Co. (joint venture of SC Hidroelectrica SA and Harza Engineering Co. LP)	612,631	4.40	Romania	Surduc – Nehoiaşu Hydro Plant
Nuon International Projects BV	583,500	7.92	Poland	Skrobotowo Windpark

Reduction Unit Procurement Tender), which is designed to allow the government to purchase reductions generated from CDM-like projects. CERUPT aims to generate 3 million metric tons of CO_2e at anticipated prices of $2-$5 per metric ton of CO_2e. ERUPT is among the most formal programs to date because it contracts for ERUs, which will become a compliance unit if the Kyoto Protocol enters into force.

Prototype Carbon Fund

The World Bank established the PCF in 1999 to acquire high-quality project-generated emissions reductions that would potentially be eligible for international recognition under rules governing JI and the CDM. Private firms and governments invested a total of $180 million in the fund. Some believe that the World Bank's international prominence and the PCF's explicit commitment to purchase only reductions of the highest quality have made PCF procedures a *de facto* standard for project evaluation in the absence of government crediting rules. To date, the PCF has purchased reductions from three projects, which are briefly described in Table 6.[28] Private-sector and government participants involved in the PCF are listed in Table 7.

Table 6

Emissions Reduction Projects Funded by the PCF

Project Name	Cost of Reductions	Amount of Reductions	Project Description
Liepaja Solid Waste Management Project (Latvia)	N/A	255,000 million metric tons of carbon over 20-year project lifetime	Capture of methane gas from landfill, which will be used for electricity generation
West Nile Electricity Project (Uganda)	Up to US$3.9 million	2 million metric tons of CO_2 over 20-year project lifetime	Construction of two small hydropower stations, efficient diesel backup facilities, and rehabilitation of mini-grid in region
Chacabuquito Hydro Project (Chile)	At least US$3.5 million	N/A	Run-of-the-river power plant of 25 MW capacity that utilizes waters of Aconagua River

Table 7

Private sector and Government Participants in the PCF

Countries	Companies		
Canada	BP-Amoco	Gaz de France	RWE
Finland	Chubu Electric Power Co.	Kyushu Electric Power Co.	Shikoku Power Co.
Japan	Chugoku Electric Power Co.	Mitsubishi Corp.	Statoil
Netherlands	Deutsche Bank	Mitsui	Tohoku Electric Power Co.
Norway	Electrabel	Norsk Hydro	Tokyo Electric Power Co.
Sweden	Fortum	Rabo Bank	

Appendix II: Descriptions of Corporate Emissions Trading Systems

BP

In 1998, BP voluntarily committed to reduce its GHG emissions 10 percent below 1990 levels by 2010. An internal cap-and-trade system was one of the policy instruments used to achieve its corporate target. After a year of collaborative design work with the NGO Environmental Defense, BP launched a pilot phase in 1999 involving 12 of its business units located in several countries. It was the first major corporation to develop an internal GHG trading system. By 2000, after the acquisition of Amoco, Burmah Castol, and Arco, the trading system was expanded to include BP operations worldwide. In 2000, 2.7 million metric tons of CO_2e were traded at an average price of $7.60 per metric ton.[59]

Shell

Shell announced its internal cap-and-trade program in 1998 as part of a corporate commitment to reduce GHG emissions 10 percent below 1990 levels by 2002 and to exceed Kyoto Protocol emissions reduction targets through 2010. In January 2000, it instituted its Shell Tradable Emission Permit System (STEPS) program. Approximately 20 units in the company's chemicals, refining, and exploration and production businesses located in Europe, the United States, Australia, and Canada are required to participate in the program. These assets account for approximately 30 percent of corporate emissions. The company establishes caps for business units in developed countries (Annex B), but also allows business units in developing countries (non-Annex B) to generate project-based reductions and sell them into the system. This mechanism is modeled after the CDM.

Although designed differently, the BP and Shell systems have provided these firms with practical GHG-trading experience and have significantly advanced the dialogue on the benefits of emissions trading.

Appendix III: Sample Term Sheet Offering Greenhouse Gas Reductions

Offer to Sell Carbon Dioxide Equivalent Verified Emission Reductions
Proprietary and Confidential

TRADE DESCRIPTION

Our client wishes to sell a forward stream of 600,000 metric tons of carbon dioxide equivalent (CO_2e) verified emission reductions (VERs).

PRINCIPAL TERMS

Units All prices are given in USD and VER volumes in metric tons of CO_2e.

Volume As outlined below, 100,000 metric tons CO_2e VERs per year. Total = 600,000 metric tons.

Vintage The vintage year shall be defined as the period from January 1st to December 31st of specified year.

VER source The CO_2e VERs shall be generated from power plant efficiency upgrades at one of Seller's North American coal-fired electricity generating stations. The power plant upgrade(s) will involve upgrading to more efficient steam turbines and improved steam path (via improved heat exchange), which will improve the fuel efficiency of the power plant. The equipment upgrade will occur no later than the 2nd quarter of 2001.

Contract This transaction is contingent upon signature of a mutually acceptable contract. Upon confirmation of agreement to the terms outlined in this term sheet, Buyer and Seller will have 90 days to finalize and sign a mutually acceptable contract. This period may be extended only by the mutual agreement of both Buyer and Seller. If no contract has been signed within this 90-day period then the transaction is void.

Down Payment Down-payment price per metric ton of CO_2e VER as outlined in Schedule 1 below. Immediate payment of USD 187,500 to be paid within 15 business days to Seller upon execution of a mutually acceptable contract. The upfront payment is determined by summing 10 percent value of each vintage year total price per metric ton multiplied by the total volume of metric tons.

Balance price and payment The balance price represents the remaining 90 percent of the total price per metric ton of CO_2e VER. The balance payment for subsequent years will be made against delivery of the VERs according to the forward schedule below. Upon confirmation that title to the CO_2e VERs has been transferred, Buyer shall forward payment for that vintage year, by wire transfer, to Seller no later than February 15th of the subsequent vintage year.

Delivery Delivery of all rights and title to the CO_2e VERs will be made to Buyer, accompanied by a verification report, on or before the delivery date specified in Schedule 1. The verification report will confirm that the VERs are generated according to the Quality Criteria stated below.

Vintage	Volume (metric tons CO_2e VERs)	Total Price	Down Payment Price	(USD/metric ton CO_2e VER)	Delivery Date	Balance Settlement Date
2002	100,000	2.50	0.250	2.25 in 2003 USD	Jan 31, 2003	Feb 15, 2003
2003	100,000	2.75	0.275	2.475 in 2004 USD	Jan 31, 2004	Feb 15, 2004
2004	100,000	3.00	0.300	2.70 in 2005 USD	Jan 31, 2005	Feb 15, 2005
2005	100,000	3.25	0.325	2.925 in 2006 USD	Jan 31, 2006	Feb 15, 2006
2006	100,000	3.50	0.350	3.15 in 2007 USD	Jan 31, 2007	Feb 15, 2007
2007	100,000	3.75	0.375	3.375 in 2008 USD	Jan 31, 2008	Feb 15, 2008
Total	600,000	1,875,000 future USD	$187,000	1,687,500 in future USD		

QUALITY CRITERIA FOR ESTABLISHING CO_2e VERS

Seller warrants to Buyer that the CO_2e VERs shall meet the following criteria:

- ***Real:*** a reduction of actual CO_2e emissions resulting from specific and identifiable actions.
- ***Quantified:*** by transparent and replicable calculation methodology. All necessary data will be available to be verified and audited by an independent third party.
- ***Verified:*** Verification Report will be prepared for each vintage year by independent third party selected by Seller, with costs to be borne by Seller.
- ***Surplus:*** Seller warrants that VERs are in excess of any VERs that are required by existing regulatory requirements at the date of project initiation.
- ***Ownership:*** Seller warrants its ownership of the VERs in written contract with Buyer.

SALE CONDITIONS

- ***Verification Report:*** The Emission Reduction Verification Report shall be sufficiently comprehensive so as to demonstrate that the CO_2e VERs meet the Quality Criteria outlined above.

- ***Title:*** Title to the subject CO_2e VERs will be assignable at the discretion of the Buyer.

- ***Performance Warranty:*** Volume of the CO_2e VERs estimated is believed to be conservative based on engineer's modeling. If Seller fails to deliver VERs in accordance with the above volume and/or criteria in any given vintage year, Buyer's sole remedy shall be the recovery from Seller down payment funds received, plus interest thereon at 3 percent pro-rated per metric ton of undelivered VER.

- ***Project Category:*** The VERs will be selected from a portfolio from either one facility or a combination of North American facilities at the time of delivery.

COUNTER-PARTY DESCRIPTION

- Seller is a well-regarded investment grade rated Canadian company in the Energy Sector.

- If necessary, Buyer and Seller shall have a minimum of fifteen (15) business days after term sheet execution to assess their respective credit ratings and ensure credit is compliant with Buyer's and Seller's requirements.

COMMISSION

- Upon execution and delivery of a mutually agreeable written contract between counterparties, a negotiated brokerage fee is due to broker by both buyer and seller. Broker acts solely as agent in the introduction of trading counterparties. Broker is not responsible for, and is not a substitute for, your determination as to the merits of the provisions and contingencies of the transaction. Broker does not hold itself responsible for the financial condition and/or performance of either counterparty in this transaction.

CONFIDENTIALITY

All parties to this contract must mutually agree in writing as to the timing, content, and all factors relating to any public announcements regarding this transaction.

Appendix IV: Descriptions of Emissions Trading Systems in Massachusetts, Denmark, and the United Kingdom

Massachusetts

Massachusetts recently became the first U.S. state to impose CO_2 emissions limits on old fossil-fired power plants, which have historically been subject to less stringent standards than new plants under the Clean Air Act. The April 2001 law imposes limits on four kinds of air emissions (SO_2, NO_X, mercury, and CO_2) from six power plants in the state.

The six plants will be required to reduce their CO_2 emissions by 10 percent from their 1997-1999 average emissions baseline. They must then achieve an emissions rate of 1,800 lbs./MWh.[60] The affected units must meet the emissions cap by October 1, 2004, and the output-based limit by October 1, 2006. Facilities that comply through repowering are granted two additional years for compliance. This requirement can be met either through internal actions such as repowering from coal to natural gas, or through the purchase of offsets from emissions reduction projects. So far the government has issued only principles to govern the use of offsets for compliance. Specific rules for crediting of offsets have not yet been developed. At a minimum, those seeking to invest in offsite emissions reduction or sequestration projects must demonstrate to the satisfaction of the Massachusetts Department of Environmental Protection that the reductions are real, surplus, verifiable, permanent, and enforceable.

These requirements must be met before any claimed reduction generated by offsite projects can be applied toward the reduction requirement. The issues of additionality (both financial and regulatory) are still under consideration as the state establishes rules governing the use of CO_2 offsets for compliance.

The Massachusetts law is notable in that it was signed by a Republican governor in the aftermath of President Bush's decision not to develop a national program addressing CO_2 from power plants and his announcement of the United States' withdrawal from efforts to implement the Kyoto Protocol. In passing the law, the Massachusetts Legislature and Governor were responding to political pressure from environmental groups that rallied local concerns about the impacts of emissions from older coal-fired power plants. The state's inclusion of provisions for emissions trading is intended to strike a balance between environmental and economic objectives.

Denmark

In 1999, Denmark introduced CO_2 emissions trading under the CO_2 Quota Act, which imposed a first-of-its-kind cap on power sector CO_2 emissions.[61] It established a total emissions quota for electricity producers at 23 million metric tons of CO_2 in 2000. The cap will be reduced by 1 million metric tons per year through 2003, at which time the target level of 20 million metric tons is to be reached. The system covers all electricity producers operating in Denmark except producers relying entirely on renewable energy generation and those emitting less than 100,000 metric tons of CO_2 per year. Only the largest eight producers receive emissions allowances. CO_2 emissions from the small producers, which amount to 1.9 million metric tons, are accounted for in the distribution of allowances to ensure that the sum of emissions allowances plus the contribution from small producers does not exceed the total national quota.

Market participants must notify the Danish Energy Agency (DEA) whenever they wish to transfer allowances to another participant. Each year until 2003, each participant may bank the difference between its individual emissions level and its "savings limit." The savings limit for each participant is set by the government at 90 percent of the participant's allocation in 2001, 95 percent in 2002, and 100 percent in 2003. In 2001, because each participant's emissions level exceeded its savings limit, no participant banked allowances into 2002.

Emissions monitoring is based on fuel consumption data from each electricity- and heat-producing plant in Denmark. To calculate CO_2 emissions, fuel consumption is multiplied by a standard emissions factor for CO_2 content. If a power producer can substantiate that the actual CO_2 factor for the fuel used is different, this CO_2 factor will be used. CO_2 emissions are reported annually to the DEA.

If an electricity producer's annual emissions exceed its holding of allowances, it is subject to a penalty of 40 Danish kroner (about U.S.$5-6) per metric ton of excess. The government set a relatively low financial penalty in order not to place its power sector at a disadvantage vis-à-vis competitors in neighboring countries, which do not presently face similar requirements. The penalty could be increased if neighboring countries develop similar programs. The revenue from penalties is directed toward energy-saving projects.

Allowances are grandfathered to affected sources based on historical emissions during the 1994-1998 time period. Special provisions were made for combined heat and power (CHP) plants because in Denmark a large proportion (approximately 50 percent) of electricity is produced as CHP, which has already contributed to substantial CO_2 reductions. A two-step approach was chosen in which emissions allowances for CHP electricity are allocated before those for other electricity producers. Thus, CHP producers are protected from further reduction requirements in recognition of their previous efforts.

United Kingdom

On August 14, 2001, the UK government published the final framework for a national GHG trading program. The trading program begins in April 2002.[62] Although Denmark has developed a trading program that covers power-sector emissions, the United Kingdom is the first industrialized country to develop a broad-based GHG trading program that covers most of industry and all greenhouse gases.

The UK trading program will be voluntary and open to all UK organizations. There are four paths by which companies may participate in the program:

- ***Climate Change Agreement (CCA).*** Since April 2001, many companies have been subject to a new tax on industrial and commercial energy consumption, known as the climate change levy (CCL). Companies can obtain up to an 80 percent discount on their CCL liability by entering into a negotiated agreement with the government. Under this agreement, companies have to improve their energy efficiency or reduce emissions below a historic baseline to meet agreed biennial targets from 2002 through 2010. Companies may choose to adopt absolute emissions targets ("absolute sector" participants) or relative targets that are expressed in terms of energy consumed or emissions per unit of output ("unit sector" participants). Most companies have opted for output-based targets.

- ***Direct Entry.*** The government allocated £215 ($309) million over five years of the program (2002-2006), equivalent to £30 million per year after taxes, in order to encourage companies that are not subject to the CCL to take on voluntary targets. These funds will be distributed via an auction in which eligible companies will offer the government a quantity of absolute emissions reductions against a 1998-2000 baseline in return for a portion of the available monies. Successful companies will then have to deliver these emissions reductions in five equal annual amounts in order to receive their incentive payments.

- ***Project Credits.*** Any organization will be able to undertake emissions reduction projects and sell the resulting credits into the program, provided that the project's reductions are additional to emissions reductions that would have been delivered under business-as-usual conditions or other reduction obligations. Each project will have to be assessed by the government on a case-by-case basis. Rules governing this "project" sector have not yet been established.

- ***Purely Voluntary.*** Any other organizations wishing to participate can simply open an account in the registry to buy and sell allowances without having taken on a reduction target. This may include, for example, entities that do not generate emissions but nevertheless wish to engage in trading.

The UK government has negotiated 43 climate change agreements with various sectors, involving more than 4,000 companies. As of February 2002, 46 companies had registered to participate via direct entry, although it is uncertain at the time of this writing if all will participate in the auction.

Trading rules differ according to the means by which companies enter the program. Companies participating via direct entry will operate under a cap-and-trade system. They will receive their allocation in April of each compliance period. These allowances will be tradable but companies will have to hold enough allowances to meet their target in order to receive their incentive payment. In contrast, companies entering via negotiated agreements will operate under a "baseline and credit" system and will receive permits only upon demonstrating that their verified reductions exceed their agreed targets. Permits issued to each type of participant will be tradable (with some restrictions).

UK emissions permits will be denominated in metric tons of CO_2e to allow for conversion between emissions of different greenhouse gases. Each permit will exist only in electronic form and will have a unique serial number to allow for tracking. Permits not used for compliance in a given year may be carried forward or "banked" through 2007. The government may impose limitations on banking permits into 2008. Companies may choose to monitor only CO_2 or all six greenhouse gases covered by the Kyoto Protocol. This means that if a company chooses to include any non-CO_2 greenhouse gas in its commitment, it must include all six greenhouse gases.

Baseline and monitoring provisions differ according to the means by which companies enter the trading program. For companies participating via direct entry, baselines will be based on their average emissions during 1998-2000. The government will later issue protocols that describe exactly how to monitor emissions from various processes. Once companies have identified and calculated their baseline emissions, they must employ an accredited verifier to review their annual emissions performance. Companies entering the trading program via negotiated agreements with the government are subject to emissions reporting requirements to demonstrate that they have achieved the agreed-upon targets and will only be required to have their emissions data verified by an accredited verifier if they wish to sell permits in the trading program. Companies with output-based targets must also employ an accredited verifier to review their emissions and output data.

Projects can also generate tradable credits. Projects located in the United Kingdom will be allowable in any sector except the residential sector, but cannot cover emissions that are already subject to targets under the program. For the time being, sequestration projects are not eligible; however, the government will continue to review the criteria under which sequestration projects could be made eligible. UK companies may also be able to meet their domestic obligations through international trading and emissions reductions generated abroad once internationally recognized rules for crediting reductions from such projects have been established. It is likely that the number of these reductions that can be used toward compliance will be restricted. Prior to 2008, allowances from other national trading systems will only be admissible for UK compliance if formal recognition has been established between the United Kingdom's and the foreign country's government.

The first compliance period for companies participating via direct entry will run from January 1, 2002, to December 31, 2002, with subsequent year-long compliance periods starting January 1, 2003, and running through 2006. The first two-year compliance period for companies entering via agreements will run from January 1, 2002.

The government will maintain a registry containing the official record of participants' permit holdings. This record will be compared against companies' actual emissions at the end of the compliance period to ensure that they have complied with their emissions targets. A transaction log describing companies' permit transfers over the previous compliance period will be made public after the reconciliation period ends. The government has reserved the right to record and publish price information in aggregated form.

A gateway mechanism has been created to prevent net transfers of permits from the unit sector to the absolute sector in order to maintain environmental integrity. The registry will display in real time when the gateway is open, allowing transfers between the sectors. Only when there has been a net flow into the unit sector will any unit sector participant be able to transfer allowances to the absolute sector. Thus, the gateway would only open in the event that a company in the absolute sector sold permits to a company in the unit sector.

If a company that participates via direct entry exceeds its holdings of valid allowances, the government will suspend payments of its incentive money and reduce its allowance allocation for the next compliance period. A company failing to meet its overall emissions reduction target in the period 2002 to 2006 or withdrawing early from the scheme will have to return the entire financial incentive plus interest. These penalties will come into effect when allowances are first allocated in April of 2002. The government is also considering introducing legislation establishing additional financial penalties for noncompliance by these participants. However, this legislation will not be in place by the time the program starts in 2002. If a company entering via an agreement does not meet its target, the government may cancel the 80 percent CCL discount. This compliance penalty is already in effect.

Treatment of electricity generators, which produce a significant share of national emissions, is still a contentious issue. Generators are not subject to the climate change levy and are therefore not covered by CCAs. In addition, power and heat generators are excluded from the financial incentive program (except where the electricity and heat are generated and used onsite). There may be some scope for generators to gain allowances through participation in energy-saving projects. They can also participate by opening a trading account.

Endnotes

1. Carbon dioxide equivalent (CO_2e) is a measure used to compare the global warming potentials of various greenhouse gases. Global warming potential is an expression of the warming impact of a gas over a given period—usually 100 years—as compared to carbon dioxide. For example, one metric ton of methane is assumed to exert the same impact on the climate system as 21 metric tons of carbon dioxide over 100 years. For more information on global warming potential of greenhouse gases, see research conducted by the Intergovernmental Panel on Climate Change, available at www.ipcc.ch.

2. "European Union Blasts Voluntary GHG Trading." *Air Daily*. November 29, 2001.

3. The findings in this paper are based upon the authors' experience in emissions trading. Richard Rosenzweig is a managing director at Natsource LLC, an international institutional energy and environmental brokerage that facilitates physical and derivatives transactions of electricity, coal, natural gas, emissions permits, emissions reductions, and renewable energy certificates. Matthew Varilek is an emissions markets analyst at Natsource. Josef Janssen is an economist and head of emissions trading and climate policy at the Institute for Economy and the Environment at the University of St. Gallen, Switzerland.

4. Tietenberg, Tom. *Environmental and Natural Resource Economics*. 1996. New York: Harper Collins, 337.

5. Intergovernmental Panel on Climate Change. "Climate Change 2001: Mitigation." Section 10.4.4. www.ipcc.ch/pub/tar/wg3/441.htm.

6. See Ellerman, A., R. Schmalensee, P. Joskow, J. Montero, and E. Bailey. 1997. "Emissions Trading Under the U.S. Acid Rain Program: Evaluation of Compliance Costs and Allowance Market Performance." MIT Center for Energy and Environmental Policy Research; and Environmental Defense. September 2000. *From Obstacles to Opportunity: How Acid Rain Emissions Trading Is Delivering Cleaner Air*. Washington, DC: Environmental Defense.

7. See the United Nations Framework Convention on Climate Change, Article 4(2)(a), June 1992. Available at www.unfccc.org/resource/conw/index.html.

8. The four compliance units authorized by the Kyoto Protocol are emission reduction units (ERUs), certified emission reduction units (CERs), assigned amount units (AAUs), and removal units (RMUs). ERUs are generated under Article 6 of the Kyoto Protocol. ERUs would be subtracted from the host country's national emissions cap and added to that of the investor country. CERs are generated under Article 12 of the Kyoto Protocol. These credits would be added to the national emissions cap of the investor country. Annex B of the Kyoto Protocol lists permissible emissions or "assigned amounts" for countries taking on GHG reduction targets, expressed as a percentage of 1990 base year emissions. For compliance and trading purposes, Annex B Parties will denominate their assigned amounts in terms of AAUs, each equal to one metric ton of CO_2e. The notion of RMUs was created at COP-7. RMUs represent carbon sequestered through domestic sinks activities that can be used toward an Annex B country's commitment within the compliance period that the reductions are generated. RMUs will not be bankable for future compliance, thus restricting their life on the emissions market.

9. For a description of JI and CDM, see Nordhaus, Robert R., Kyle W. Danish, Richard H. Rosenzweig, and Brit Speyer Fleming. 2000. "International Emissions Trading Rules as a Compliance Tool: What Is Necessary, Effective, and Workable?" *Environmental Law Reporter*: 10837.

10. Static baselines are fixed at a permanent level, such as an entity or project's physical emissions in a given year. Dynamic baselines are emissions baselines that are linked to particular variables and may be revised upward and downward depending on project or entity characteristics such as output levels, growth rates, efficiency rates, and peer group benchmarks.

11. See case study on Ontario Power Generation and TransAlta later in this section.

12. See Section 1 above and Appendix I for definitions used in individual programs and common program elements.

13. American-style options allow the buyer to exercise an option at any time prior to the expiration date. European-style options allow the buyer to exercise an option only on the expiration date.

14. COP-6bis is the second half of the sixth Conference of Parties that started in The Hague. It took place from July 16 – July 27, 2001, in Bonn, Germany. This decision was sustained at COP-7.

15. See "The Marrakesh Accords and the Marrakesh Declaration" at www.unfccc.int/cop7/documents/accords_draft.pdf; and *Review of the Implementation of Commitments and of other Provisions of the Convention.* FCCC/CP/2001/L.7. July 24, 2001. www.unfccc.int/resource/docs/cop6secpart/l07.pdf.

16. Press release (Entergy, Elsam, and Natsource): "U.S. Utility and Danish Electricity Supplier Conduct First Trade in Danish Greenhouse Gas Allowances." December 6, 2001.

17. One of the most prominent efforts has been the GHG Protocol convened by the World Resources Institute and the World Business Council on Sustainable Development. See www.ghgprotocol.org.

18. Janssen, Josef. 2000. "Implementing the Kyoto Mechanisms: Potential Contributions by Banks and Insurance Companies." *Geneva Papers on Risk and Insurance—Issues and Practice* 24(5): 602-618.

19. Janssen, Josef. 2001. "Risk Management of Joint Implementation and Clean Development Mechanism Projects through Carbon Investment Funds." In *Instruments for Climate Policy: Limited versus Unlimited Flexibility?* Albrecht, J., M. De Clercq, and T. Verbeke, eds. Edward Elgar: Cheltenham; and Janssen, Josef. 2001. *Risk Management of Investments in Joint Implementation and Clean Development Mechanism Projects.* Ph.D. Thesis at the University of St. Gallen, Switzerland.

20. Janssen, Josef. *Risk Management of Investments in Joint Implementation and Clean Development Mechanism Projects.* Ph.D. Thesis at the University of St. Gallen, Switzerland.

21. This conclusion is derived from a pilot project conducted by the German bank LBBW in cooperation with a corporate client and the University of St. Gallen.

22. TransAlta, "TransAlta Unveils Proposal to Reduce Net Greenhouse Gas Emissions to Zero." Press Release, updated June 24, 2001. www.transalta.com.

23. TransAlta. 2000. "Beyond Kyoto: TransAlta's Blueprint for Sustainable Thermal Power Generation." www.transalta.com.

24. GEMCo. 2000. "An Introduction to GEMCo." www.gemco.org.

25. TransAlta. 2000. "TA Completes World's First Trans-Atlantic Emissions Reduction Trade." www.transalta.com.

26. Though the companies involved have chosen not to make public the exact price at which the trade occurred, they indicated that it is consistent with the range of VER prices provided in this paper.

27. TransAlta. 2000. "TA Completes World's First Trans-Atlantic Emissions Reduction Trade." www.transalta.com.

28. See discussion in Section 2.B of this paper regarding the challenges in transacting reductions derived by investing in renewable energy and demand-side management projects. For a more extensive analysis, see Cogen, J., and M. Varilek. 2000. "Promoting Renewable Energy and Demand Side Management Through Emissions Trading Program Design." Paper presented to U.S. Department of Energy workshop. October 11-13, 2000. Washington, D.C. www.rand.org/scitech/stpi/Evision/Supplement/cogen.pdf.

29. Ontario Power Generation. 2000. "Ontario Power Generation Greenhouse Gas Action Plan – 2000." www.opg.com/envComm/E_GasRep2001.pdf. The emissions reduction credits purchased included 2.3 million metric tons of CO_2 from internal energy efficiency savings.

30. PERT Registry. 2000. Credit Creation Protocol, "US Gen New England, Inc., Carbon Dioxide Emission Reductions from Johnston Landfill, Methane Capture." www.pert.org/Doc/app/JohnstonProtocol4-24-00.doc.

31. Hasselknippe, H. and G. Hølbye. 2000. "Meeting the Kyoto Protocol Commitments. Summary – Domestic Emissions Trading Schemes." Confederation of Norwegian Business and Industry.

32. European Commission. October 23, 2001. "Proposal for a Directive of the European Parliament and of the Council establishing a framework for greenhouse gas emissions trading within the European Community and amending Council Directive 96/61/EC." Brussels. europa.eu.int/comm/environment/climat/com/01581_en.pdf.

33. Jones, Matthew. "UK Emissions Trading to Go Ahead Despite EU Concerns." Reuters. November 22, 2001. See also "European Union Blasts Voluntary GHG Trading." *Air Daily*. November 29, 2001; and "EU Tells UK to Amend Its Emissions Trading Scheme." *AFX*. November 8, 2001.

34. "European Union Blasts Voluntary GHG Trading." *Air Daily*. November 29, 2001.

35. Varilek, M. 2000. "What Kyoto Can Learn from the NO_x Market." *Environmental Finance*. July-August: 20.

36. Article 25.1 of the Kyoto Protocol establishes the requirement that 55 Parties representing 55 percent of Annex B 1990 CO_2 emissions ratify the treaty in order for it to become binding international law.

37. Several analyses of the Kyoto Protocol have recently been conducted regarding the impact of the treaty with and without U.S. involvement. See Holtsmark, Bjart, and Catherine Hagem. June 2001. "From Small to Insignificant: Climate Impact of the Kyoto Protocol with and without U.S." Oslo: Center for International Climate and Environment Research. www.cicero.uio.no/media/1315.pdf; Nordhaus, William D. "Global Warming Economics." 2001. *Science*. Vol. 294, November 9: 1283; Manne, Alan S., and Richard G. Richels. "U.S. Rejection of the Kyoto Protocol: The Impact on Compliance Costs and CO_2 Emissions." 2001. Washington, D.C.: AEI-Brookings Joint Center for Regulatory Studies. October; Baron, Richard, and Martina Bosi. 2001. "Kyoto without the U.S.: Market and Policy Implications." (DRAFT) Paris: International Energy Agency; and Böhringer, Christoph. 2001. "Climate Politics from Kyoto to Bonn: From Little to Nothing?" Mannheim: Centre for European Economic Research.

38. See Manne and Richels. 2001. "U.S. Rejection of the Kyoto Protocol."

39. This legal analysis is from Robert Nordhaus and Kyle Danish, attorneys at Van Ness Feldman, August 2001 memorandum to Natsource.

40. Buchan, David. "Compromise Reached on Global Warming Treaty." 2001. *Financial Times*. November 10.

41. See Manne and Richels. 2001. "U.S. Rejection of the Kyoto Protocol."

42. William Jefferson Clinton and Albert Gore, Jr. October 1993. The Climate Change Action Plan. www.gcrio.org/USCCAP/toc.html.

43. Project descriptions can be found at the USIJI website at www.gcrio.org/usiji/projects/CurrentProjs.html and at the AIJ website at www.unfccc.int/program/aij/. These projects utilize a variety of technologies to reduce emissions, including "wind, geothermal, hydroelectric, and solar energy; coal to natural gas fuel switching; methane gas capture; biomass waste-to-energy generation; forest conservation; reforestation and sustainable land management; reduced impact logging; and energy-efficiency improvements to district heating systems and private residences." USIJI Fact Sheet, March 1999, www.gcrio.org/usiji/about/Ji_fact.pdf. Some projects have particularly large emissions reductions. For example, in Argentina, combined-cycle technology at the CAPEX power plant will result in a reduction of over 20 million metric tons of CO_2e. The recent Bioko Island project was implemented by CMS Energy, an electric utility and natural gas company based in the United States. Over a 30-year period, the company will reduce 71 million metric tons of carbon by eliminating the flaring of natural gas at its operations near Malabo, the capital of Equatorial Guinea.

44. The pilot program was established by decision 5/CP.1 of FCC/CP/1995/7/Add.1, the Report of the Conference of the Parties on Its First Session, held at Berlin from 28 March to 7 April 1995, *Part Two: Action Taken by the Conference of the Parties at Its First Session, Addendum*.

45. See Schwarze, R. 2000. "Activities Implemented Jointly: Another Look at the Facts." *Ecological Economics*. 32: 255-267; and Dixon, R., ed. 1999. *The U.N. Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned*. Kluwer: Dordrecht.

46. The Secretariat of the UNFCCC maintains a list of AIJ projects at www.unfccc.de/program/aij/aijproj.html.

47. Many USIJI projects are also AIJ projects. The projects are distributed over 14 countries in Latin America, 10 in Central and Eastern Europe, 10 on the African continent, five in Asia (besides China and India), and two in the Pacific Islands. Twenty-one projects are located in Estonia. Twenty-five projects are located in Latvia.

48. See Pilot Emission Reduction Trading Project (PERT), "PERT ERC Creations." 2001. www.pert.org/Doc/Reviews2.xls; and PERT, "Draft Rules for Emission Reduction Trading in Ontario," www.pert.org/pdf/Draft%20Rules.pdf.

49. This law originated from Oregon House Bill 3283 introduced in the 69th Oregon Legislative Assembly (1997, Regular Session). The rules for the Oregon CO_2 standard are in Oregon Administrative Rules, Chapter 345, Division 24.

50. The price was raised to $0.85 per ton (from $0.58 per ton) in September 2001. The information provided in this project summary is based upon the $0.58 per ton price.

51. The Climate Trust was formerly known as the Oregon Climate Trust.

52. Though the Oregon law allows project developers to meet their offset requirements by paying the fixed fee of $0.85 per metric ton, it does not require The Climate Trust to secure offsets at that price. In fact, The Climate Trust has paid an average of $1.50 per metric ton of CO_2 for offsets. Consequently, power plant developers' payments to The Climate Trust have not offset the total quantity of emissions for which they made a payment. Once an applicant pays The Climate Trust, liability for producing the offsets shifts from the plant developer to The Climate Trust. This has led power plant developers to rely on The Climate Trust as a fixed-cost, guaranteed means of compliance. (Information about the average price paid per ton was garnered from phone conversation with The Climate Trust. Confidentiality agreements prohibit the release of the prices paid for CO_2 offsets in individual projects.)

53. The Oregon law only allows CO_2 reductions to be used to meet the offset requirement.

54. "Over $5.5 Million to Be Awarded to Counter Climate Change," The Climate Trust Press Release, January 30, 2001. See www.climatetrust.org.

55. "The Climate Trust Awards Landmark Contract with the Lummi Indian Tribe for Storing Atmospheric Carbon," The Climate Trust Press Release, May 15, 2001; "The Climate Trust Awards Funds for Web-Based Carpool Matching," The Climate Trust Press Release, May 8, 2001; "The Climate Trust Awards Funds to Innovative Landfill Gas Project to Offset Global Warming Pollution," The Climate Trust Press Release, July 16, 2001; and "Innovating Financing of Wind Power to Cut Carbon Dioxide Levels," The Climate Trust Press Release, September 5, 2001. See www.climatetrust.org.

56. Senter can only anticipate the rules governing JI, since the Kyoto Protocol has not been finalized.

57. See Senter web site at www.senter.nl/erupt.

58. Project-related documents can be found at the PCF Document Library, www.prototypecarbonfund.org.

59. "Greenhouse Gas Emissions Trading in BP." May 2001. www.bp.com/downloads/340/ghg_emissions_trading_in_bp_may2001.pdf.

60. Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, Air Program Planning Unit. "310 CMR 7.29 Emissions Standards for Power Plants." See www.state.ma.us/dep/bwp/daqc/files/regs/729final.doc.

61. Act no. 376 of June 2,1999, Folketinget (Danish Parliament), Section 5, Subsection 4.

62. See UK Emissions Trading Scheme, www.defra.gov.uk/environment/climatechange/trading/index.htm.

300