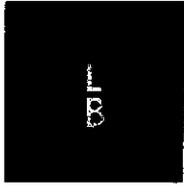


FN-ACV-748



**United States Agency for International Development
Greenhouse Gas Pollution Prevention Project
Climate Change Supplement
(GEP-CCS)**

Communication and Information Outreach

**Task 4.C
U.S. FORUM MEETING REPORT
MAY 14 -15, 2001**

By:

**The Louis Berger Group, Inc.
C-6/7, Safdarjung Development Area
New Delhi 110 016**

May 30, 2001

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THE Louis Berger Group, INC.

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

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List of Acronyms

CII	Confederation of Indian Industry
DA	Development Alternatives
EPRI	Electric Power Research Institute
GEP-CCS	Greenhouse Gas Pollution Prevention Project -- Climate Change Supplement
GOI	Government of India
IEM	Institute for Environmental Management
IGIDR	Indira Gandhi Institute for Development Research
IIEC/CERF	International Institute for Energy Conservation / Civil Engineering Research Foundation
IIM	Indian Institute of Management
IIT	Indian Institute of Technology
LBG	The Louis Berger Group, Inc.
MSE	Madras School of Economics
NIAS	National Institute of Advanced Studies
TERI	Tata Energy Research Institute
USAID	United States Agency for International Development
WRI	World Resources Institute

Executive Summary

"Bringing Ideas into Action" – Anthony Janetos, World Resources Institute

On May 14 -15, 2001 The Louis Berger Group, Inc. *Greenhouse Gas Pollution Prevention Project – Climate Change Supplement*, in association with the World Resources Institute – Climate, Energy and Pollution Programs, held a U.S. Research Forum at the WRI "Zero Emissions" facilities. This event was conducted as part of LBG/GEP's continuing implementation of the GEP-CCS project, particularly the project's targeted research component. The purpose of this component is to produce a set of framing papers on key climate change issues in India. The U.S. Forum is the follow-up to an Indian Research Forum held in India in January 2001. Taken together, the two Forums are intended to define key research issues in climate change in India and to develop teams of U.S./Indian researchers who together, would work to produce high impact research results.

The U.S. Forum was attended by two sets of researchers. The first was composed of six Indian researchers who, as part of the Indian Forum, were identified as lead authors on the main research topics defined at that Forum. The leader of the Indian delegation was Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research (IGIDR). The second set was comprised of U.S. researchers. These researchers were selected by LBG using input from the Indian researchers where possible. The U.S. researchers belong to organizations or institutions recognized for their leading technical or research strengths in the climate change topics on which the research framing papers are focused. WRI was selected as the host of the event due to the institution's internationally recognized work in climate change research. The table on the following page contains a summary of the research topics and the India/U.S. research teams that will produce the framing paper for each topic. A list of the participants in the U.S. Forum can be found in Appendix A.

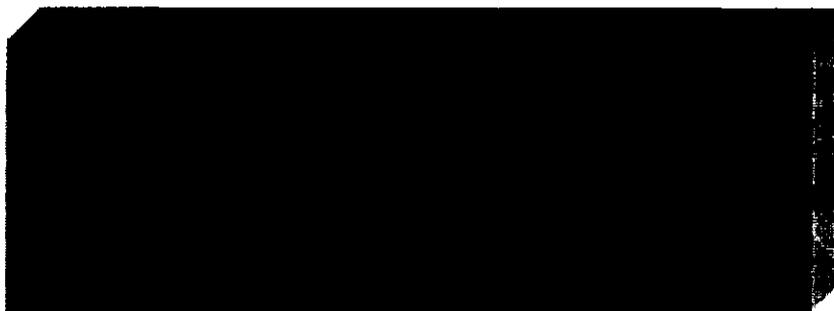
LBG/GEP designed the Forum agenda in consultation with WRI to achieve several key outcomes: maximum interaction between Indian and U.S. researchers, understanding between U.S and Indian researchers of value added that each team member could provide for the research effort, and development of an action plan by each team that sets the framework for cooperation to produce the framing papers. These outcomes were achieved and culminated with research partners solidifying their collaboration through cooperative preparation of research action plan. LBG then closed the Forum by defining target milestones for completing draft framing papers and for subsequent peer review and final paper preparation and production. The Forum agenda is included in this report as Appendix B.

List of research topics and the India/U.S. research teams

Vulnerability	India's Vulnerability to Climate Change of Adaptation: An Overview	Kirit Parikh <i>IGIDR</i> Anand Patwardhan <i>IIT-B</i>	Bonnie Biagini <i>World Resources Institute</i>
Mitigation	GHG Mitigation Options for Selected Sectors		
	• Transportation	Jyoti Parikh <i>IGIDR</i>	Madeline Castanza <i>IIEC/CERF</i>
	• Waste	Jyoti Parikh <i>IGIDR</i>	Don Augenstein <i>Institute of Environmental Management</i>
	• Power Sector	Amit Kumar Garg <i>IIM-A</i>	Steve Gehl <i>EPRI</i>
	• Building Materials and Construction Sector	Jyoti Parikh <i>IGIDR</i>	Will Kirksey <i>IIEC/CERF</i>
Carbon Neutral Development	Assessment of the role of carbon neutral technologies in India's Power Sector	Dilip Ahuja <i>Nat. Inst. Of Advanced Studies</i>	Dick Bratcher <i>EPRI</i>
Macro Economic	Linkages between Growth and GHG Emissions	Manoj Panda <i>IGIDR</i>	Kevin Baumert <i>World Resources Institute</i>

Background

The Louis Berger Group Inc. is implementing the *Greenhouse Gas Pollution Prevention Project-Climate Change Supplement* for the U.S. Agency for International Development. A major goal of GEP-CCS is to improve the understanding of climate change issues among key stakeholders in India that have significant potential to help shift India's current path of high intensity GHG emissions to a path of lower GHG generation. The Project includes a number of outreach activities designed to generate awareness among stakeholders and to generate information that can be used for awareness building. To implement the latter, GEP-CCS is promoting the development of "framing" papers on critical climate change issues in India. The papers are being prepared by eminent Indian researchers who will act as the lead authors. The work is being supplemented or reinforced by U.S. partner researchers. The papers will address the economic, social and environmental implications of climate change in India and also address technologies and approaches for mitigating the growth of GHG emissions in India. The papers will be used as informational inputs to the awareness building process mentioned above and be made available for wide review and discussion among diverse climate change interests.



The framing paper development process was initiated on January 22, 2001 when LBG, in association with the Indira Gandhi Institute for Development Research (IGIDR), held an Indian Research Forum. The Forum was attended by many of India's leading climate change researchers from a variety of institutions, as well as other interests such as NGOs and Government of India representatives. The objective of the Forum was to identify, discuss, and ultimately select critical topics of research that address key potential impacts of climate change in India and that would identify approaches for mitigating those impacts. In addition, lead Indian authors for those research topics were selected based on the consensus of working groups set up during the Forum. Please refer back to the table in the Executive Summary, which lists the research topics. The participants at the Indian Forum agreed that under the leadership of a lead researcher, each framing paper would be drafted by a research team, with several researchers providing technical contributions to the final product.

The next phase in the framing paper development process was designed as a U.S. Research Forum. The objective of the U.S. Forum would be to partner the identified Indian lead authors with prominent U.S. researchers and institutions recognized for their research or practical technical understanding of climate change issues. As noted above, the purpose of the U.S. side participation is to supplement the work of the Indian researchers by providing an international perspective and supporting it with information or research approach ideas that would strengthen the framing papers.

The LBG/GEP team in collaboration with the lead Indian researchers where possible selected the following U.S. institutions to participate in the U.S. Forum as partners to the Indian researchers:

- **World Resources Institute (WRI)**
- **International Institute of Energy Conservation /
Civil Engineering Research Foundation (IIEC/CERF)**
- **Electric Power Research Institute (EPRI)**
- **Institute of Environmental Management (IEM)**

Due to its prominence in climate change research, WRI was selected to host the U.S. Forum. WRI provided an excellent facility and prominent WRI climate change staff participated in and helped facilitate the event.

Objectives

The objectives of the U.S. Research Forum were clearly articulated in consensus with the Indian researchers:

- To refine the specific key themes and parameters of the research topics.
- To facilitate partnerships with reputable U.S. researchers and institutions conducting climate change research or related technical work.
- To finalize action plans for each team that define the contents and steps for developing the research papers.

These objectives were met during the Forum. The key outcome was the production of draft action plans by each research team. These set the framework for the scope of research, the target stakeholder audiences, the roles and responsibilities of the Indian and U.S. researchers, key information gaps that need to be addressed and other fundamental information. The worksheets used as a basis for generating inputs to the action plans are included in Appendix C.

Proceedings of the U.S. Forum

The Forum was a one and a half day event. The first day was designed to frame the purpose of the event, identify the necessary outcomes, enable the researchers to meet each other and enable all researchers to present an overview of their climate change research interests and expertise. Each presentation was followed by group discussion that prompted clarification of issues and a sharing of ideas. The presentations enabled the researchers to identify common areas of interest, new or different research approaches and enhanced understanding of scope of work that each researcher had in mind for the framing papers.

The second day was designed to put the Indian and U.S. research partners together to hammer out a research action plan. The teams broke out to spend the morning discussing the scope of the framing papers and a host of other issues that enabled them to define the inputs to action plans for conducting the research.

Day One: Introductory Session

Mr. Ron Sisseem, Chief of Party, LBG/GEP-CCS program, facilitated the commencement of the U.S. Research Forum by welcoming all of the participants and by presenting an overview of the GEP-CCS project. Goals of the Forum were also articulated. Ms. Virginia Gorsevski from the USAID Environment Center welcomed the participants, reviewed USAID's programs in climate change and encouraged the participants to utilize USAID's resources to assist with their research efforts.

Anthony Janetos, Senior Vice President and Chief of Programs at WRI then provided an overview of WRI's programs and encouraged the participants to transform their research into applied approaches for addressing climate change.

Day One: Presentations

After the ceremonial remarks and formal introductions, the U.S. and Indian researchers began formal presentations of their work and areas of interest. This was done on a topic-by-topic basis. Summaries of the presentations are as follows:

Vulnerability

Dr. Kirit Parikh of IGIDR and Dr. Anand Patwardhan of IIT-B emphasized a need to focus on climate change trends and variability. As such, assessment techniques are

needed to measure vulnerability in the Indian context. They noted that the variability of climate would have a severe impact on the Indian agriculture sector and could produce catastrophic and frequent storm events and flooding, changing crop patterns, loss of livelihoods from fisheries and farming, and significant impacts on the Indian population, especially the poor.

Mr. Anthony Janetos presented a comprehensive overview of the conducted U.S. National Climate Change Assessment. Mr. Janetos provided a snapshot of changing weather patterns and perceived impacts on ecosystems created by climate change in the U.S. He noted the science and assumptions behind the study, but focused most on the process by which it was conducted. This enabled his Indian counterparts to understand how they might embark on a similar comprehensive vulnerability assessment. Much time was spent on discussing the public participation, transparency and peer review process for the Assessment.

Linking GHG Emissions with Growth

Dr. Manoj Panda, IGIDR, summarized his assessment of the impact of climate change on Indian economic growth. He emphasized that there are very direct links between climate change impacts and adverse impacts on economic activity. Basic assessments of impacts in various economic development sectors were presented. He too noted that economic impacts on the poor needed to be considered and could be the root of social upheaval. Dr. Panda discussed possible ways of modeling economic impacts, but acknowledged a need to round out the range of modeling approaches that may have the most applicability in India.

Mr. Kevin Baumert, WRI, presented an economic impact assessment model that recognizes that approaches for achieving and measuring cleaner growth should not focus on GDP measures, but rather on the intensity with which an economy utilizes energy, and ultimately its production of carbon emissions. He described the parameters of the model and its possible application to the Indian climate change scenario.

Assessment of the Role of Carbon Neutral Technologies

Dr. Dilip Ahuja, NIAS, discussed that it was imperative that India examine the various roles that renewable energy technology can play in India for mitigating GHG emissions. In order to provide substantive direction to Indian policy makers and project developers, he suggested that the research approach should focus on quantifying the carbon mitigating impact of these technologies along with their relative economic opportunity costs. The role of renewables in helping off-set India's power supply-demand deficit was also discussed as were basic strategies for promoting distributed power generation using

renewable technologies. Generation of a prioritized list of technologies based on cost, applicability and opportunities and constraints for their implementation was proposed.

Mr. Dick Bratcher, EPRI, discussed the need to create a mindset for a gradual transition to cleaner power generation technologies. A gradual transition will allow for the deliberate and efficient, least cost design and development of appropriate cleaner energy technologies. He described EPRI programs for technology development and the relative perspective of the electric utility sector on the technology development and commercialization process. He agreed that a ranking of technologies for application in India could be a useful product and noted that EPRI has substantial resources to support such an activity.

Mitigation in Selected Sectors

Transportation

Dr. Jyoti Parikh, IGIDR, provided an overview of the current emissions statistics from New Delhi and Mumbai that are directly contributed by the transport sector as a proxy for identifying carbon dioxide emissions from the sector. She described growth trends in India's most populous metropolises and painted a very serious picture of the projected growth in GHG emissions based on those trends. She discussed potential GHG mitigation options for the urban transport sector including alternative fuels (CNG, LNG, fuel cell, ethanol) and alternative technologies (four stroke two wheelers, hybrid electric vehicles) that need to be investigated and incorporated into policy and regulatory approaches to transportation sector planning.

Ms. Madeline Castanza, IIEC/CERF, framed experience in the U.S. and developing countries that drive changes in the transportation sector. These include congestion and air pollution and their attendant health costs and community impacts. She noted an absence of a "golden key" solution to transportation impacts in the U.S. or other international contexts. Rather, solutions generally consist of a blend technologies, fuels and transport guidelines. Successful strategies have focused on improving efficiency of existing systems, and promoting integrated transport planning and sustainable transport. Integrated solutions do have a GHG mitigation benefit and may substantially reduce impacts on economic growth and public health and welfare.

Waste

Dr. Jyoti Parikh, IGIDR, discussed the current context for solid waste management (SWM) in India and its implications for converting waste to energy or developing methane capture and reuse projects. She described the characteristics of typical solid waste streams and noted their implications for adopting GHG mitigation approaches in the solid waste sector. She also noted population behavior that adds to the GHG emissions problem such as the common practice of burning solid waste during cooler

months and that increasing local community health problems are motivating Indian communities to act on poor MSW practices.

Mr. Don Augenstein, IEM, described the evolution of U.S. experience in landfill practices and technologies over the past 50 years as well as the drivers behind the improvement of practices and technologies. The focus was on landfill practices that affect the potential for methane recovery and reuse. Various technologies for methane recovery and reuse as an energy source were described as were the economic, social and environmental benefits of such technologies.

Power

Dr. Amit Kumar Garg, IIM, provided an overview of the Indian power sector. Dr. Garg discussed that the key concerns within the power sector currently are the demand-supply deficit and the inefficiencies in power generation and transmission and distribution. A menu of technology options were presented that could be relevant to the current Indian situation, with particular attention focused on IGCC, and PFBC. Dr. Garg presented an outline of assistance he could use from U.S. counterparts on new, innovative technologies and on American case studies that could be used to strengthen arguments for implementation of cleaner energy technologies in India.

Mr. Steve Gehl, EPRI, provided an overview of the EPRI Electricity Technology Roadmap. The Roadmap is EPRI's (and a host of other utility sector interest's) vision of a process of technology development and sector actions needed over the next 50 years. Strategies for the sector revolve around five objectives: 1) meet the global sustainability challenge; 2) resolve the energy/carbon conflict; 3) accelerate economic growth and productivity; 4) enable the digital economy; and 5) strengthen the power delivery infrastructure. He noted that the Roadmap can serve as a model for the Indian power sector on how to plan for technology change and innovation and offered the full range of EPRI power sector technology expertise to Dr. Garg.

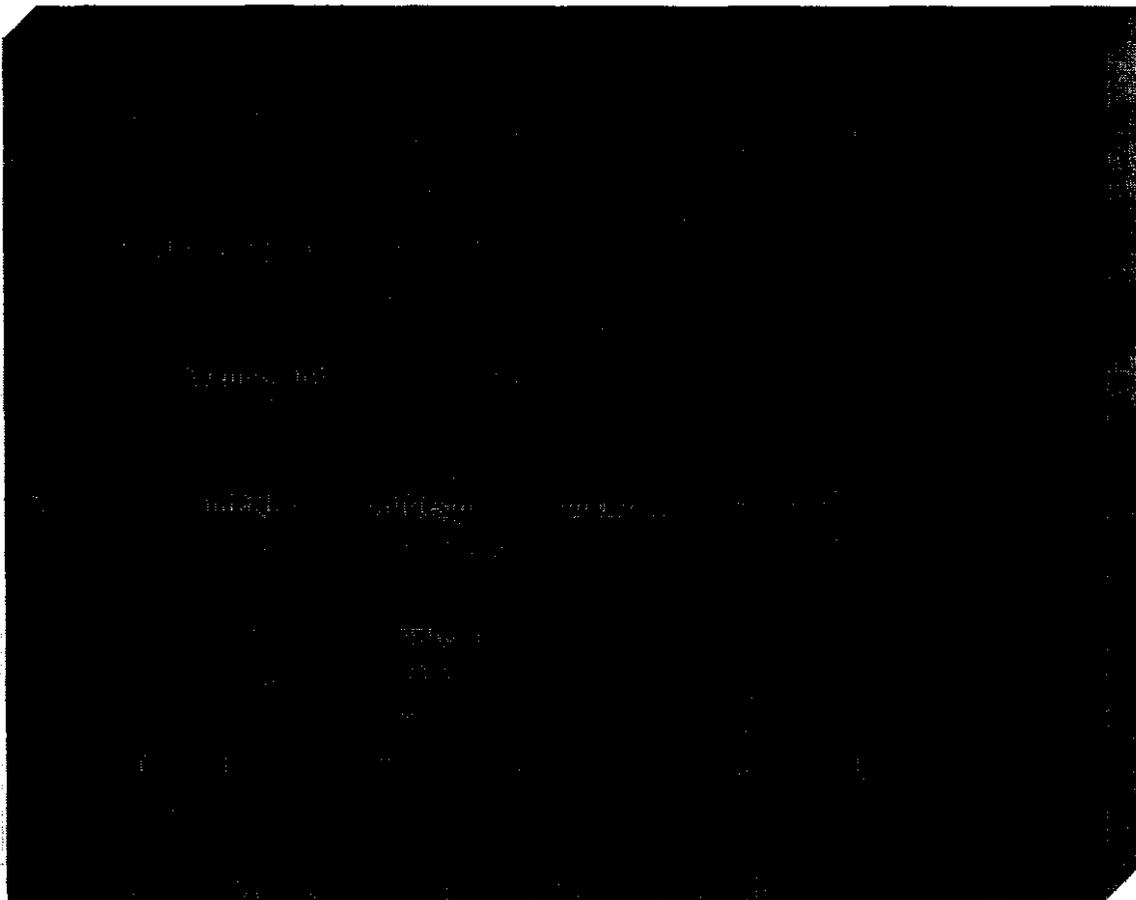
Building Materials and Construction

Dr. Jyoti Parikh, IGIDR, presented an overview of the current status of building material use and building technologies in India and of the implications of such on power use and GHG generation. She noted a significant need for technology and building material technology transfer to India to improve understanding of options in the industry for reducing GHG emissions.

Mr. Will Kirksey, IIEC/CERF, illustrated new cutting edge construction materials now in use and others that are being developed and outlined their implications for energy savings. He noted that construction materials innovation will improve productivity and could reduce building wastes (and indirectly improve energy efficiency) by at least 50%. He also noted that the dispersion of new low energy intensive materials is constricted by the lack of knowledge and performance data available to end users of such materials.

Day Two: Break Out Sessions

The Forum was organized to enable the U.S. and Indian researchers to have one-on-one sessions to plan their collaboration and actions plans. These sessions were instrumental in enabling the researchers to define the key parameters of the research papers. A worksheet was provided to each team that asked for definition of a variety of key variables needed to produce action plans. These variables are listed in the box below. The teams worked in isolation for approximately two hours to complete the worksheets and to discuss various questions and aspects of their cooperation. The consultations were very focused and productive according to the team members.



Day Two: Break Out Session Reporting and Results

After the one-on-one break out activity, the research teams were asked to present a summary of their action plans and especially the scope of their research. The following is a summary of key points for the scope of each team's research.

Vulnerability

Dr. Kirit Parikh, Indira Gandhi Institute of Development Research
Dr. Anand Patwardhan, Indian Institute of Technology – Bombay
Dr. Bonnie Biagini, World Resources Institute

- Climate change trends and projections
- Vulnerabilities and adaptation concepts and (India/US) approaches for vulnerability assessment
- Sectoral reviews of vulnerability
- Community level studies and vulnerability and adaptation
- Research and policy recommendations

Linkages Between Growth and Emissions

Dr. Manoj Panda, Indira Gandhi Institute for Development Research
Mr. Kevin Baumert, World Resources Institute

- Effects of CO2 reduction on GDP over about 20-30 years
- Examine sectoral composition of GDP
- Analyze effects on different income groups. If model permits, the exercise would involve running the models available for:
 - Base-As-Usual scenario
 - Policy scenarios with CO2 reductions by 5%, 10%, 15% and 20% from base case

Assessment of the Role of Carbon Neutral Technologies in India

Dr. Dilip Ahuja, National Institute of Advanced Studies

Mr. Dick Bratcher, EPRI

- Description of the various technologies
- International technology implications of implementation
- Indian experience
- Cost components (capital, operating, maintenance)
- Barriers to implementation
 - costs
 - technology transfer
 - regulating environment
 - adaptation to Indian conditions

Mitigation in Selected Sectors

Transportation

Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research

Ms. Madeline Castanza, IIEC/CERF

- Possible development scenarios for transportation
- Indian transportation characteristics
 - Emissions
 - Local Pollutants
 - Finance issues
- International case studies and lessons learned for achieving GHG mitigation

Power

Dr. Amit Kumar Garg, Indian Institute of Management

Mr. Steve Gehl, EPRI

- Overview of the Indian Power Sector
- Technology Assessment with and without environmental costs
- Reference Case Results
- Mitigation Scenario Analysis
- US Experience in Carbon Mitigation and lessons for India

Waste

Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research
Mr. Don Augenstein, Institute for Environmental Management

- Status of waste management in India
- Cost and urban waste scenarios in India and implications
- Analysis of Technical Options
 - Landfills
 - Combustion
 - Gas (i. Electricity, ii. Industrial process, iii. LNG/CNG)

Building Materials and Construction

Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research
Mr. Will Kirksey, IIEC/CERF

- Current and Future materials needs
 - Impacts of conventional practice
 - Opportunities/Alternatives
- Stakeholder perspectives
- New Materials, technologies, and systems
- Implementation
 - Barriers
 - Strategies

Outcomes

As has already been noted, the desired outcomes of the U.S. Forum were achieved. Research teams have been solidified, roles and responsibilities for completing framing papers have been defined and each team has determined the scope and content of each framing paper. While a significant amount of additional communication and cooperation will be necessary among research team members, the framework and focus of their cooperation has been established as has a common vision of research needs. Momentum for the completion of draft framing papers has thus been created and an understanding of subsequent steps in the framing paper production process established.

Action Plan and Next Steps

The LBG/GEP team presented to the group the following milestones for conducting and completing research. The milestones were discussed in the context of each team's required level of effort. The Forum participants agreed that the timeframe was acceptable. The milestones for finalizing the research papers are as follows:

Immediate Steps

- **June 5, 2001** – Finalize and Sign all subcontract agreements with Indian and U.S. Researchers
- **June 30, 2001** – First Progress Report sent to LBG/GEP New Delhi and Washington D.C.
- **August 1, 2001** – Second Progress Report to LBG/GEP New Delhi and Washington D.C.
- **September 1, 2001** – All Draft Research Paper Due and Circulated to lead Authors

Future Steps

- **September 30, 2001** – Indian Lead Author Meeting and Peer Paper Review
- **October 21, 2001** – Draft Paper Revisions Completed
- **October 31, 2001** – Draft Papers launched on the FICCI website for public discussion and comment
- **November 15, 2001** – Draft Papers presented at an international conference
- **December 15, 2001** – Draft Public Comments Due
- **February 15, 2002** - Papers Finalized
- **February 15 – April 1, 2002** – Paper review by scientific editor
- **May 1, 2002** – Papers Published

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Appendix-B
Agenda for the U.S. Research Forum



Agenda for the U.S. Research Forum

World Resources Institute
 10 G Street, NE, Washington, D.C. 20002
 May 14-15, 2001

Monday, May 14, 2001

- 8:30 am Continental Breakfast
- 9:00 am Welcome and Introductions
- Mr. Ron Sisseem, Chief of Party, Greenhouse Gas Pollution Prevention Project (GEP)
The Louis Berger Group, Inc.
 - Ms. Virginia Gorsevski, Global Environment Center, Climate Change Programs
USAID Washington, D.C.
 - Ms. Julie Haines, Vice President, Global Environment Team
The Louis Berger Group, Inc.
 - Mr. Anthony Janetos, Senior Vice President and Chief Program Officer
World Resources Institute
 - Ms. Jyoti Parikh, Indian Delegation Lead
Indira Gandhi Institute of Development Research
- 9:30 am Introduction of Researchers and Background
- 10:00 am Research Topic Presentations, facilitated by Dr. Boni Biagini, World Resource Institute
- Vulnerability to Climate Change*
- Dr. Kirit Parikh, Indira Gandhi Institute for Development Research
 - Dr. Anand Patwardhan, Indian Institute of Technology
 - Mr. Anthony Janetos, World Resources Institute
 - Discussion
- 11:00-11:15 am Tea/Coffee Break

Linkages Between Growth and GHG Emissions

- Dr. Manoj Panda, Indira Gandhi Institute for Development Research
- Mr. Kevin Baumert, World Resources Institute
- Discussion

Assessment of the Role of Carbon Neutral Technologies

- Dr. Dilip Ahuja, National Institute of Advanced Studies
- Dr. Dick Bratcher, EPRI
- Discussion

1:00 pm Lunch

2:00 pm Continuation of Presentations, facilitated by Mr. Ron Sisseem, The Louis Berger Group, Inc.

Mitigation of GHG in Selected Sectors

Transportation

- Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research
- Ms. Madeline Castanza, International Institute for Energy Conservation/
Civil Engineering Research Foundation
- Discussion

Waste

- Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research
- Mr. Don Augenstein, Institute of Environmental Management
- Discussion

3:30-3:45 pm Tea/Coffee Break

3:45 pm **Power**

- Dr. Amit Kumar Garg, Indian Institute of Management - Ahmabadad
- Mr. Steve Gehl, EPRI
- Discussion

Building Materials and Construction

- Dr. Jyoti Parikh, Indira Gandhi Institute for Development Research
- Mr. Will Kirskey, International Institute for Energy Conservation/
Civil Engineering Research Foundation
- Discussion

5:15 pm Action Plan for Drafting Research Papers

5:30 pm Group Photo Opportunity

6:00 pm Cocktail Party, hosted by The Louis Berger Group, Inc. Global Environment Team

*Location: The Henley Park Hotel
Wilkes Room
926 Massachusetts Avenue,
Washington D.C. 20001
(202) 638-5200*

Tuesday, May 15, 2001

8:30 am Tea/Coffee

Location: Small Breakout rooms

U.S. and Indian Author One-on-One Meetings
- Finalize Scope of Work, Roles and Responsibilities
- Preparation of Joint Framing Paper

Location: Large Conference Room

10:30 am Joint U.S.-India Presentations/Discussion of the Research Framing Paper
Outlines, facilitated by Mr. Ron Sisseem, The Louis Berger Group, Inc.

- ***Vulnerability to Climate Change***
- ***Linkages Between Growth and GHG Emissions***
- ***Mitigation of GHG in Selected Sectors***
 - Transportation
 - Waste
 - Power
 - Building Materials & Construction
- ***Assessment of the Role of Carbon Neutral Technologies***

11:30 am Conclusions and Next Steps

Appendix-C
Research Paper Work Plans – One-on-One
Researcher Work Plan

Research Topic: **Vulnerability**

Indian Researchers: Dr. K. Parikh, IGIDR
Dr. A. Patwardhan, IIT-B
Dr. J. Bandopadhyay, IIM-C
Dr. K. Chatterjee, DA
Dr. K. Kumar, MSE

U.S. Researcher: Ms. Boni Biagini, World Resources Institute

I. Objectives

- A survey of the existing literature of India's vulnerability to climate variability to climate change and adaptation options.

II. Audience for Research Paper

- Indian policy-makers
- Multilateral government funding agencies
- General public

III. Key themes and issues to be examined

- Vulnerability in the context of specific key sectors:
- Specific attention to extreme climate events
- Include community-level case studies of vulnerability of adaptation

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other
- Indian Researcher will be the lead
- U.S. researcher will provide inputs in two areas, in addition to overall review and advice:
 - Methodologies and approaches for vulnerability – review of methods, tools, approaches
 - Design of comprehensive vulnerability assessment, issues of comparability, project design, lessons from other assessment, data and information needs

V. Illustrative Table of Contents

- Executive Summary
- Climate Change trends and projections
- Vulnerability and adaptation concepts and approaches for vulnerability assessment
- Sectoral reviews of vulnerability
- Community level studies of vulnerability and adaptation
- Moving towards a comprehensive assessment
- Recommendations, research and policy needs

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **May 30, 2001** – WRI to send full U.S. National Assessment regional/sector studies to Indian team
- **June 15, 2001** – First inputs from U.S. team
- **June 30, 2001** – First Progress Report to LBG
- **July 15, 2001** – First Draft for internal review by team members
- **August 1, 2001** – Second Progress Report to LBG
- **September 1, 2001** – Final Draft to LBG

Research Topic: Assessment of the Role of Carbon Neutral Technologies in India

Indian Researchers: Dr. D. Ahuja, NIAS
Dr. R. Banerjee, IIT-B
Dr. S. S. Murthy, IIT-M
Dr. V. Kumar, DA

U.S. Researcher: Mr. Dick Bratcher, EPRI

I. Objectives

- Assess the status of renewable energy technologies
- Quantify the role they can play in India over 10 years and over 20 years
- Identify barriers to their increased diffusion and ways to overcome them

II. Audience for Research Paper

- State and Central Government officials – Primary Audience
- State Electricity Boards, Regulatory Commissions and Project Developers

III. Key themes and issues to be examined

- Description (brief) of technologies
- International Experience with the technology
- Indian Experience
- Cost Components (capital, operating, maintenance)
- Barriers (including those of costs, technology transfers, regulatory environment, RD&D, adaptation to Indian conditions)
- Potential for Growth on decadal time scales

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

A.	√	√
B.	-	√
C.	√	-
D.	√	√
E.	√	√
F.	√	-

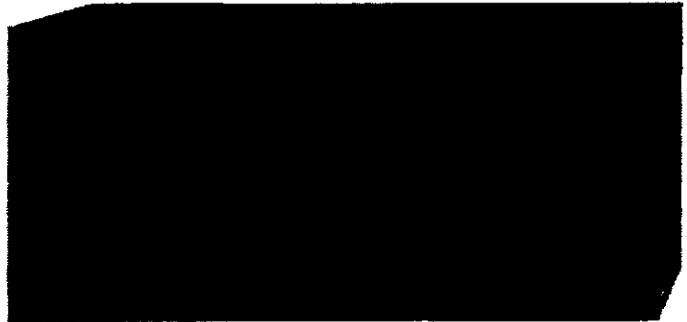
- Phase 1.** Indian Researcher will prepare the first draft
- Phase 2.** U.S. Researcher will provide initial comments
- Phase 3.** Indian Researcher will incorporate comments and revisions accordingly
- Phase 4.** U.S. Researcher will provide final review
- Phase 5.** Indian Researcher will finalize the research paper

V. Illustrative Table of Contents

- A. Executive Summary
- B. Introduction
- C. Assessment of the Individual RETs
- D. Prospective short and long-term roles for RETs in India and Recommendations

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **June 15, 2001** – U.S. side to provide information of costs international experience
- **June 30, 2001** – First Progress Report
- **July 1, 2001** – First draft of individual assessments sent to U.S.
- **July 15, 2001** – Comments due from U.S. Researcher
- **August 1, 2001** – Full draft to U.S. Researcher
- **August 15, 2001** – Comments due from U.S. Researcher
- **September 1, 2001** – Final Draft to LBG



**Research Topic: Linkages Between Growth and Emissions:
Economic Growth, Welfare and CO₂ Emissions in India**

Indian Researchers: Dr. M. Panda, IGIDR
Dr. A. Garg, IIM-A
Dr. U. Kelkar, TERI
Dr. S. Ghosh, CII

U.S. Researcher: Mr. Kevin Baumert, World Resources Institute

I. Objectives

- To analyze effects of CO₂ reduction on growth and poverty

II. Audience for Research Paper

- Policy Community in the U.S. and India
- NGOs
- Research institutions
- Media

III. Key themes and issues to be examined

- Effects of CO₂ reduction on GDP over about 20-30 years
- Examine sectoral composition of GDP
- Analyze effects on different income groups, if model permits
- The exercise would involve running models available for:
 - Base-as-usual scenario
 - Policy scenarios with CO₂ reductions by 5%, 10%, 15% and 20% from base case.

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

- Each researcher will carry out the above simulations and analyze the results of their respective models for the given scenarios
- Indian researcher will compare the results across models and make policy recommendations
- U.S. researchers will make an overall assessment of CO₂-GDP linkages based on U.S. and other country studies and comment on the Indian results

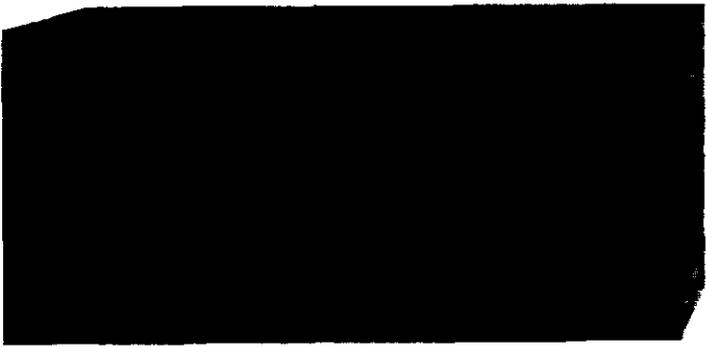
V. Illustrative Table of Contents

- A. Executive Summary
- B. Introduction
- C. Scenario Design
- D. Results from Different Models
- E. Conclusions and Policy Recommendations

Appendices: Individual Model Results

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **May 31, 2001** – Contracts with individual authors
- **June 30, 2001** – Initial reactions from authors
- **July 23, 2001** – Individual authors to give their results
- **August 23, 2001** – Comparison of results from different models
- **September 1, 2001** – Final Draft to LBG



Research Topic: Mitigation in Selected Sectors: Transportation

Indian Researchers: Dr. J. Parikh, IGIDR
Dr. S. Yedla, IGIDR

U.S. Researcher: Ms. Madeline Castanza, IIEC/CERF-South Africa

I. Objectives

- To characterize existing relationships and scenarios for urban transport emissions, local pollutants
- Identify strategies for sustainable development and climate change outcomes, and barriers to their success
- Make policy recommendations to support

II. Audience for Research Paper

- Urban Planner
- Transport Planner
- Municipal Manager
- Public Finance Specialists
- Environmental Managers

III. Key themes and issues to be examined

- Current Scenarios
 - Emissions
 - Local Pollutants
 - Development and Finance Issues
- Opportunities for mitigation, reduction and improvements
- Strategies to achieve objectives
- Barriers
- Policy Recommendations

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

Indian Researcher

The Indian researchers will conduct the majority of the synthesis research and drafting

U.S. Researcher

The U.S. researcher will review the draft research papers and will provide contributions of international examples and perspectives.

V. Illustrative Table of Contents

- A. Executive Summary
- B. Need for transportation development scenarios
- C. Transport characteristics
- D. Summary of urban case studies
- E. Best International Practices
- F. Strategies, implementation and barriers
- G. Policy Recommendations

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **June 1, 2001** – Exchange of background materials between research partners
- **June 30, 2001** – Complete collection of synthesis data for current situation and international best practices – exchange drafts
- **July 31, 2001** – Complete draft of strategies, barrier and recommendations
- **August 15, 2001** – Finalize drafts for submission to LBG
- **August 20, 2001** – Exchange executive summary draft
- **September 1, 2001** – Final Draft to LBG



Research Topic: Mitigation in Selected Sectors: Waste

Indian Researchers: Dr. J. Parikh, IGIDR
Dr. S. Yedla, IGIDR
Mr. A. Chaterejee, DA

U.S. Researcher: Mr. Don Augenstein, Institute for Environmental Management

I. Objectives

- To identify opportunities for urban waste management in the Indian context. Policy recommendations for waste-to-energy and greenhouse gas abatement.

II. Audience for Research Paper

- Waste Managers in India
- Renewable Energy Officials / Policy-makers
- Municipal Managers
- Regulatory officials

III. Key themes and issues to be examined

- Analysis of Technical Options
 - Landfills
 - Combustion
 - Gas (LNG/CNG)
- Cost and Urban waste scenarios in India and implications
- Status of Waste Management in India

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

Indian Researcher

- Collection of Landfill characteristics
- Design, Containment, Operator Flow
- Waste Characteristics
- Cases where landfilling is an option

U.S. Researcher

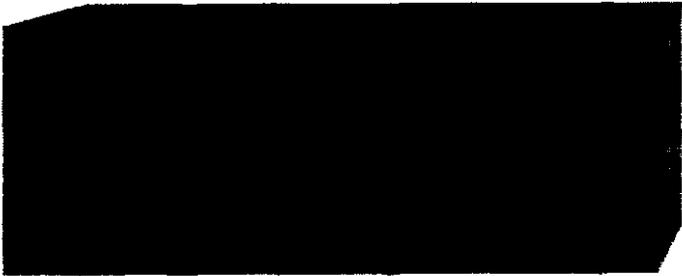
- Technology transfer
- Transfer of advanced technologies – if promising and easily integrated

V. Illustrative Table of Contents

- A. Executive Summary
- B. Urban waste Scenarios
 - Urban characteristics (amount, type)
- C. Urban Waste Study
- D. Landfill techniques
- E. Needs for India
 - necessary site characteristics
 - city list and knowledge of waste
 - policy recommendations

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **June 15, 2001** – Waste Scenarios and Characteristics
- **June 30, 2001** –
 - i) Summary of Indian
 - ii) landfill characteristics
 - iii) policy recommendations
- **August 1, 2001** – Joint Draft Paper presented to LBG.



Research Topic: **Mitigation in Selected Sectors:
Building Materials and Construction**

Indian Researchers: Dr. J. Parikh, IGIDR
Mr. A Chatterjee, DA

U.S. Researcher: Mr. Will Kirksey, IIEC/CERF Washington D.C.

I. Objectives

- To identify opportunities in the construction and building materials sectors
- Work out GHG reduction potential
- Develop recommendations for action

II. Audience for Research Paper

A broad audience is necessary for this topic due to the number of diverse decision-makers.

- Policy makers
- Architects, Engineers, constructor
- Urban Planners
- Regulatory authorities
- Building/Facility owners
- Academies
- Financial community

III. Key themes and issues to be examined

Within Indian construction scenario, examine opportunities to:

- Reduce materials
- Reduce energy intensity of materials production
- Substitute materials

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

Indian Researcher

- Construction scenario
- Current and future needs for construction materials
- Stakeholder perspectives
- New materials, technologies and systems
- Barriers and means to overcome
- Recommendations

U.S. Researcher

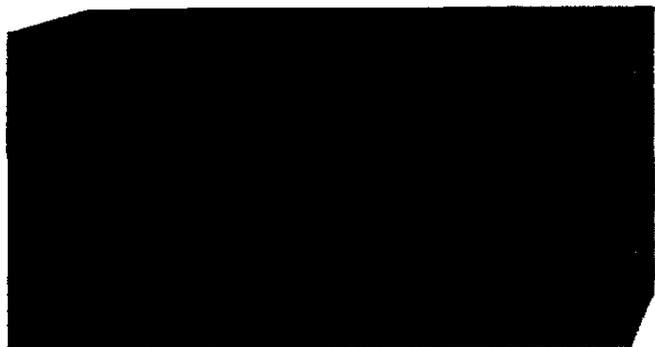
- New materials, technologies and systems
- Barriers and means to overcome
- Recommendations

V. Illustrative Table of Contents

- A. Executive Summary
- B. Construction Scenario (Introduction)
- C. Current and Future material needs
 - Impacts of conventional practice
 - Opportunities/Alternatives
- D. Stakeholder perspectives
- E. New materials, techniques, and systems
- F. Implementation
- G. Recommendation
 - Barriers
 - Strategies

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **May 25, 2001** – U.S. Background material to India
- **June 30, 2001** – India construction scenario to the U.S.
- **July 10, 2001** - U.S. Draft on new materials, techniques, and systems to India
- **August 5, 2001** – First Draft sent to U.S.
- **August 15, 2001** – Feedback to U.S.
- **August 31, 2001** – Draft completed



Research Topic: Mitigation in Selected Sectors: Power

Indian Researchers: Dr. Amit Kumar Garg, IIM
Dr. Jyoti Parikh, IGIDR

U.S. Researcher: Mr. Dick Bratcher, EPRI

I. Objectives

- To analyze carbon mitigation options for the Indian power sector under various mitigation scenarios

II. Audience for Research Paper

- Policy makers
- Research institutions
- Equipment Suppliers

III. Key themes and issues to be examined

- Overview of the Indian power sector
- Technology assessment with and without environmental cost
- Reference case results
- Mitigation scenario analysis
- U.S. Experience in carbon mitigation and lessons for India

IV. Roles and Responsibilities of U.S. and Indian Researchers

- Specifically Define Key Contributions and/or Sections to be written by each other

U.S. Researcher

- U.S. experience in carbon mitigation and lessons for India
- Information to support investment decisions: equipment supplier perspective

Indian Researcher

- All other components

V. Illustrative Table of Contents

- A. Overview of the Indian power sector
- B. Technology assessment with and without environmental cost
- C. Reference case results
- D. Mitigation scenario analysis
- E. U.S. Experience in carbon mitigation and lessons for India

VI. Intermediate Work Plan milestones to achieve the LBG/GEP-CCS defined dates:

- **June 30, 2001** – Overview of the Indian power sector
- **August 1, 2001** –
 - i) Technology assessment with and without environmental cost
 - ii) Reference case results
 - iii) U.S. Experience in carbon mitigation and lessons for India.
- **August 31, 2001** – Draft completed



Appendix-D
U.S. Research Forum Conference Papers