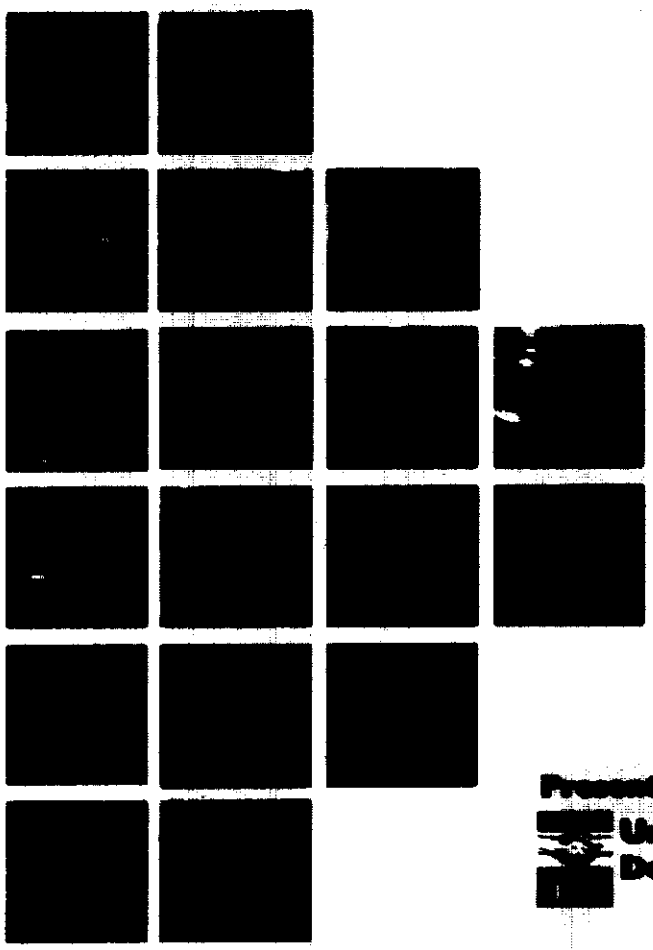
PN-AC4-769

CLIN 5: SENIOR POLICY LEVEL ROUNDTABLES

Subtask 5.D: *Completion of at Least Three Sector-Specific Roundtables*



Prepared for:

United States Agency for International Development / India Mission

Greenhouse Gas Pollution Prevention Project - Climate Change Supplement

Implemented by:

The Global Environment Team
The Louis Berger Group, Inc.

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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

SUMMARY OF THREE SECTOR-SPECIFIC ROUNDTABLES

"Integrating Climate Change Mitigation Strategies into Economic Development Activities"

Senior policy level roundtables are one of the tools designed into the GEP-CCS project for fostering dialogue, understanding key issues and developing long-term sustainable solutions to Indian's climate change challenges among diverse stakeholders. The ultimate goals of these roundtables are to: enhance the understanding of stakeholder groups about their roles in climate change; broaden perspectives on the role of clean energy or other technologies in reducing GHG emissions; and develop recommendations on policy initiatives and strategies for climate change mitigation. By collectively identifying appropriate financial instruments, technology and policy-oriented approaches to address climate change, these stakeholders can have a significant positive impact on mitigating India's contribution to global climate change and in so doing, reduce potential long-term impacts on India's economic and social development.

As the implementing contractor of GEP-CCS, the Louis Berger Groups Inc (LBG) is tasked with conducting a total of five roundtables. To date, GEP-CCS, along with several of its associated partner organizations, has conducted roundtables in the utility, industry, renewable, and urban solid waste sectors. A fifth multi-sector roundtable is planned for 2002 that would bring together the four sectors noted above and/or other key Indian stakeholders to identify cross-sectoral issues and strategies for climate change mitigation.

In May 2001, in collaboration with the Confederation of Indian Industries (CII), GEP-CCS conducted the first roundtable in the utility sector. The focus was on discussing appropriate clean energy technologies for power generation and transmission and distribution. Through this process, a comprehensive, prioritized list of technology approaches was developed that has been communicated to key Government of India (GOI) ministries and decision makers. The report on this roundtable was submitted by LBG to USAID under separate cover.

This report summarizes the three "sector-specific" roundtables conducted in the industry, renewable energy, and municipal solid waste sectors, respectively. The first of these was held in August 2001 in collaboration with the Federation of Indian Chambers of Commerce of Industry (FICCI). Individuals and industry associations from energy intensive and high emissions emitting sectors including cement, metals (steel and aluminum) pulp/paper and fertilizers were brought together to discuss opportunities and barriers in adopting clean energy technologies, and through so doing, reduce energy consumption and GHG emissions. The renewable sector roundtable was also conducted in August 2001 in partnership with Development Alternatives (DA), a partner organization to the GEP-CCS project. The primary purpose was to identify issues that that constrain more wide scale adoption of renewable energy technologies and to identify a few key actions needed to help overcome the obstacles. Then in December 2001, GEP-CCS and the Financial Institutions Reform Expansion Project (FIRE) of USAID, along with the Ministry of Urban Development (MOUD), co-organized a major national level workshop on municipal solid waste management. GEP-CCS's role focused on drawing linkages between municipal solid waste

(MSW) management and climate change (methane emissions). GEP-CCS also provided key inputs on technology approaches for MSW treatment both in international and Indian contexts.

Each roundtable was designed to result in the development of a basic action plan that would define key steps and identify institutions to take voluntary responsibility for moving initiatives forward. In this way, climate change mitigation actions would become more readily incorporated into economic development planning strategies of the GOI and of interests in the respective sectors. Furthermore, non-sector specific stakeholders such as financial institutions would better understand options and opportunities for supporting sector activities that are climate change friendly.

The following section of this report contains summaries of each of the roundtable proceedings and outcomes. For each roundtable, GEP-CCS' partner institution (FICCI, DA and FIRE) has produced full reports of the proceedings. Reports for the industry and renewable roundtables are included in Appendicies A and B respectively. The proceedings for the urban solid waste roundtable will be completed within two to three weeks. It will be submitted to USAID under separate cover.

INDUSTRIAL SECTOR ROUNDTABLE

Indian industry is a key sectoral focus of the GEP-CCS project. The industrial sector generates a larger percentage of GHG emissions than any other. Therefore, reducing emissions from this sector is key to any strategy for addressing climate change mitigation. For the most part, Indian industry has not been systematically or substantively informed about its role in global climate change or about if and how climate change issues could or should influence industrial development policy, operations, or financial or social welfare decisions.

Richard Edwards addresses the Roundtable participants: Seated from L to R are Mr. Dilip Biswas, Chairman of the CPCB; Hon. Suresh Prabhu, Minister of Power, and Mr. Chirayu R Amin, President of FICCI

On August 3, 2001, in association with FICCI, a roundtable entitled the *"Capitalizing on Opportunities and Overcoming Constraints – A Roundtable on Clean Energy Technology in Industry"* was held in Delhi. Stakeholders from the energy intensive industrial sectors, including steel and aluminum, pulp and paper, cement, and fertilizers, were brought together firstly as a means of disseminating information on the links between industry performance and climate change, and secondly to foster dialogue on technology approaches that have GHG emissions reduction benefits

Currently, there are no tangible Indian regulatory drivers that motivate industry to specifically address climate change mitigation. The flexibility mechanisms under the Kyoto Protocol have the potential to motivate industry response to climate change mitigation. However, that potential may not be a realistic, short-term financial incentive, as it has not yet matured to the extent that economic benefits might accrue to industry interests. Therefore, the focus of the roundtable was on identifying barriers to implementing clean energy technologies that improve a company's bottom line while also providing climate change benefits. Actions for removing such barriers could then be defined. Furthermore, it was intended that participants identify cases where the uptake of technology was successful and share those successes as a means of replicating them.

Break-Out Group in deliberations

Approximately 100 participants were in attendance at the beginning of the daylong event. The bulk were representatives of specific industry associations and industries. Participants from the GOI, financial institutions, NGOs, independent consultants and technology providers, and research organizations also attended. The roundtable served as a forum for these interests to interact, network and explore partnering opportunities. The proceedings of the roundtable are included in this document as Appendix A.

Mr. Suresh Prabhu, Union Minister for Power, gave the inaugural address. He endorsed the introduction of clean technologies as a key tool for mitigating GHG emissions. Mr. Prabhu felt that these technologies could move industry towards achieving a zero emissions goal in the near future. Mr. Chirayu R Amin, President of FICCI, encouraged the adoption of cleaner technologies as a vehicle to address environmental issues including climate change and noted that these measures will also enhance international competitiveness of India's industrial exports. Mr. Anil Malhotra, Vice President, ICICI, discussed his organization's programs aimed at facilitating finance for clean energy projects. Mr. Richard Edwards, Director of USAID's Office of Environment, Energy and Enterprise reviewed USAID's programs and initiatives in the industry and power sectors. He emphasized the need for power sector reforms as an important initiative. Mr. Ram Babu of Price Waterhouse Coopers noted the need for the systematic adoption of full cost accounting as it gives value to heretofore unaccounted for social and environmental benefits of clean energy technologies.

In the afternoon, working groups for each industrial sector were organized to facilitate discussion on technology barriers and opportunities and on possible actions needed to overcome the barriers in their respective sectors. Brief summaries of the deliberations are as follows:

Fertilizers

The major barrier facing the industry today is the lack of a long-term pricing policy. The fluctuating fertilizers market has created a perception of significant risk in the minds of financial institutions. This has slowed investment in new, cleaner technologies. A long-term pricing policy would enable the sector to pursue longer-term investments, as a stable pricing policy would reduce risk perception for the sector. The attendees discussed ways of bridging the technology gap via enhanced R&D through in-country research laboratories. It was agreed that good technology exists, but that lack of finance is the largest constraint to its adoption.

Cement

The Cement working group concluded that the GOI should consider a range of incentive programs for the utilization of blended cements. The production of these cements is less energy intensive and result in less demand for energy from the largely coal fired electricity supply. In turn, cement plants could consider natural gas as an alternative to coal. The group also discussed that the grinding of raw materials could be introduced, via an energy efficient technology.

Steel and Aluminum

Deliberations in this group focused on technologies for reducing energy demand. Transition to the use of non-consumable anodes was seen as a key energy reduction approach and hence, a climate change beneficial technology. The group also discussed the hot metal/electric arc furnace as a process to reduce power consumption.

Pulp and Paper

A range of technology applications such as black liquor treatment, chemical recovery, alternative methods of bleaching and the use of organic waste were discussed. These technologies would allow for higher efficiency and strengthen overall operations. Raw materials and other organic

waste were discussed as viable alternatives for fuel for power generation. In addition, alternative methods and chemicals for bleaching could be considered.

After the break out groups completed their deliberations, they were reassembled to report their findings and to identify recommendations for action that would be beneficial to the entire sector.

Key recommendations, have been organized by thematic areas:

Financial Instruments
- Introduction of tax exemptions and custom duties for clean energy technologies.
- Standards for evaluating clean energy technologies.
- Enhanced ESCO and venture capital role in financing technologies.
- Development of new standards for financing project, that are outside of the conventional framework.
- Necessary funding for demonstration projects.
- In-country financing is needed to enhance projects competitiveness internationally

Policy-Oriented Tools
- Development of a long-term national fuel policy.
- Ensuring state-level economic return on surplus cogeneration power.
- Developing a national mechanism to certify emissions for future trading.
- Lift state-level restrictions on the captive power stations.

Technology Constraints
- Incentives for utilizing waste gases.
- Bridging technology gaps in enhanced energy efficiency.

Information Outreach Enhancement
- Interagency collaboration on appropriate technological advances.
- Focused information dissemination by USAID and FICCI.
- Additional information on climate change issues, mechanisms and financial incentives that could benefit industry.

RENEWABLE ENERGY SECTOR ROUNDTABLE

As renewable energy projects are innately GHG mitigating relative to the use of fossil fuel for generating power, GEP-CCS has an inherent interest in promoting project development in this sector. In order to support this interest, a roundtable was organized on August 17, 2001 in New Delhi entitled, *"Renewable Energy for Sustainable Development: Opportunities, Barriers and Solutions"*. The Roundtable was implemented by the Climate Change Center at DA with strategic guidance from GEP-CCS. The goals of the roundtable were to increase the understanding of the linkages between renewable energy projects and climate change mitigation, inform stakeholders about developments in international climate change mitigation negotiations and mechanisms that might provide incentives for renewables project development, and to explore opportunities and constraints for facilitating project facilitating project development. The latter led to the development of an action plan for overcoming key constraints.

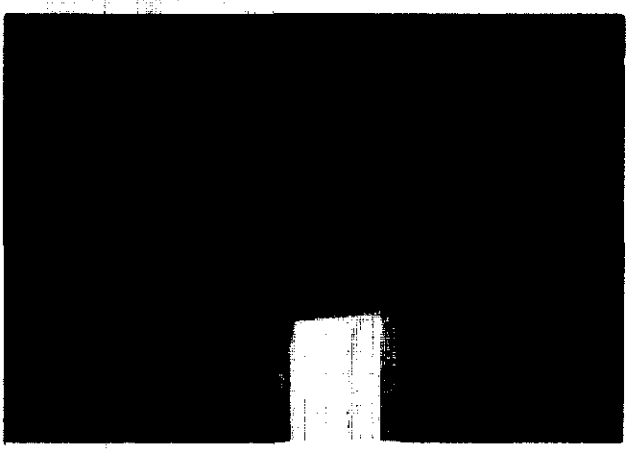
Participants listening to remarks during the inaugural session

Diverse interests attended the event. These included representatives from MNES and other GOI agencies including IREDA, financial institutions, project developers, NGOs, technology providers, and researchers. Approximately 50 participants attended. Dr. Ashok Khosla, President of DA, opened the roundtable by stressing the necessity of focusing roundtable deliberations on *"what should be done"*. He noted that to the extent possible, the action plan to be drafted should help form a foundation for accelerating beneficial renewable energy policies, financial instruments, and capacity building approaches to enhance the adoption of these technologies.

In the inaugural address, A. K. Mangotra, Jt. Secretary of MNES, described India's achievements in promoting renewable energy. He also discussed MNES programs and policies that are intended to accelerate renewable energy project development into the future. Mr. Mangotra emphasized the importance of developing consensus among a broad range of stakeholders in order to build momentum for focused action on policy and project development and implementation programs. The roundtable proceedings, prepared by DA, are included in this report as Appendix B.

LBG worked with DA to design and structure the roundtable so it was participant driven. The entire afternoon was dedicated to eliciting information and opinions from participants through a series of breakout group activities and subsequent consolidation of ideas and consensus building. Experts from DA facilitated these activities. In the first activity, participants identified four broad areas in which opportunities and constraints can be grouped: technology, finance, policy, and social and institutional issues. Break out groups were formed for both the technology issue and the finance issue. Two individual groups took up the combined topic of policy/institutional/social issues. Each group deliberated on its topic and subsequently reported its findings back to the entire group. Issues within each topic were prioritized through a participant voting process.

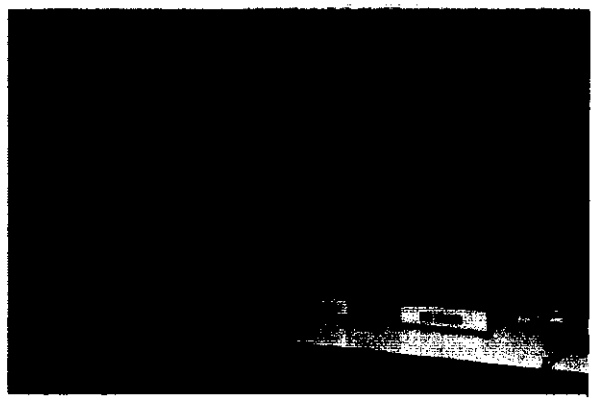
The major barrier collectively voiced by all the groups was the absence of a well-defined, comprehensive GOI policy for the renewable energy sector that would promote solutions to the diverse barriers identified. Participants also prioritized the development of an easily accessible web- based database on Indian and international renewable energy technologies and case studies. The database would include detailed financial and technology information that improves project development potential through widespread understanding among project stakeholders on related policy, costs and revenues, risks. The third finding was that full-cost accounting should be adopted by financial institutions and policy makers as the basis for evaluating the merits of renewable energy projects. The participants felt that the social and other sustainable development benefits of renewable energy projects are not being captured in standard project risk and finance evaluations. Hence, they look less attractive to investors than traditional fossil fuel based energy generation projects.



Break-out groups generated key inputs to the Roundtable discussions and outcomes

An action plan for addressing these issues was developed. Please refer to page eight of Appendix B for that plan. Over time, LBG will be following up with the stakeholders responsible for implementing the actions to assess progress made.

URBAN SOLID WASTE MANAGEMENT ROUNDTABLE



Inaugural session speakers from L to R included: Ron Sissem, GEP-CCS; Mr. Banarjee, Jt. Sec., MOUD; Mr. Ram, Principle Sec., MOUD; Mr. A. Stein, Dir. USAID RUDO; Mr. N. Bhattacharjee, Program Manager USAID RUDO, and Mr. Lee Baker, FIRE(D).

On December 19-20, 2001 in Delhi, GEP-CCS co-coordinated a roundtable entitled, *"National Workshop on Solid Waste Management: Facilitating Urban Local Body Initiatives to Meet MOEF Objectives: What Needs to be Done?"* GEP-CCS helped coordinate and sponsor this event as part of its task to address climate change mitigation in the urban municipal solid waste management sector.

Originally, GEP-CCS was tasked to conduct a roundtable for the urban sector that addressed both transportation and municipal solid waste. However, in consultation with USAID/India, the urban sector roundtable scope was narrowed to address methane emissions from solid waste. This decision was based on two primary motivations. First, recent legal and legislative mandates for improved municipal solid waste management handed down by the Supreme Court of India and the Ministry of Environment and Forests have put immediate pressure on municipalities to develop improved solid waste management strategies and programs that include consideration of methane abatement. Programs must be implemented according to a very challenging, tight timeframe. Municipalities are urgently seeking assistance that will enable them to meet these deadlines. GEP-CCS can be of immediate service to the sector by providing TA in a timeframe that helps municipalities fill information and strategic planning gaps. Second, GEP-CCS seeks to maximize the impact of its activities by combining efforts with other USAID/India projects/programs wherever possible. GEP-CCS's planned December timeframe for conducting a solid waste focused roundtable was largely coincident with USAID's Financial Institutions Reform and Expansion Project (FIRE) plans for conducting a national workshop on solid waste management. Hence, FIRE and GEP-CCS collaborated to design and implement one major national workshop that met the objectives of both projects.

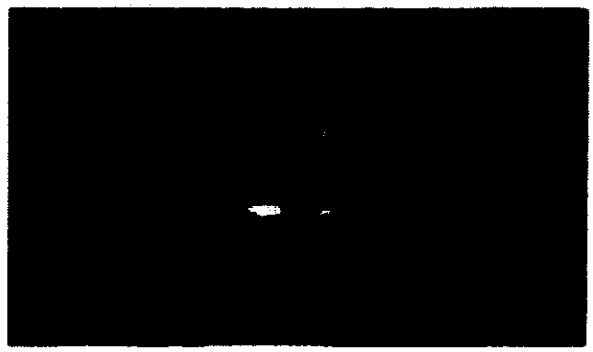
Roundtable Planning and Content

While GEP-CCS and FIRE have differing programmatic goals, facilitating improved solid waste management practices is an objective that is common to both. GEP-CCS seeks to improve stakeholder understanding of the linkage between climate change and solid waste management and to provide technical assistance to municipalities for developing projects that mitigate methane emissions from solid waste. FIRE, among other objectives, seeks to assist municipalities with financing urban infrastructure projects and programs by developing innovative infrastructure financing tools and promoting private sector participation in the delivery of urban services and infrastructure improvements, including solid waste.

GEP-CCS worked with FIRE to craft a workshop agenda that would foster dialogue across both of the respective project objectives. The workshop content was informed by GEP-CCS's prior

experience in the sector gained through a Training Needs Assessment (TNA) conducted early in 2001 and by preliminary outcomes of a series of three, two-day trainings for urban solid waste managers and officials entitled, "Tools for Improved Solid Waste Management and Treatment" conducted from December 10-19, 2001. Content was also largely influenced by FIRE's extensive experience and understanding of the financial and technical constraints to improved delivery of municipal solid waste management services in India. GEP-CCS's goal of developing models of methane abatement from municipal solid waste (MSW) and fostering the replication of those models across India is largely predicated on the fiscal capacity and health of municipalities. Therefore, FIRE's efforts to improve that capacity are a catalyst for facilitating the ability of municipalities to implement climate change mitigation projects.

FIRE's longstanding relationship with the GOI Ministry of Urban Development (MOUD) also helps to leverage GEP-CCS impact. The MOUD is the nodal ministry for managing urban affairs and development at the GOI level. GEP-CCS's and FIRE's collaborative effort to more firmly link MSW management and climate change places this issue more squarely in the policymaking "sights" of the MOUD.



Mr. Greg Wikler, part of the GEP-CCS team, presented on technology options for municipal solid waste treatment.

The workshop was broken into several major sessions: 1) Setting the Tone – an overview of the MOEF Guidelines and their requirements for municipalities; 2) Responsibilities of Urban Local Bodies (municipalities) – presentation of case studies from three municipalities and a presentation by Mr. Greg Wikler of the GEP-CCS Team on options for MSW treatment including those that mitigate methane emissions; 3) Private Sector Participation – Risks and Opportunities; 4) Financing Solid Waste Projects; 5) Break Out Groups and Dialogue – two sessions designed to identify key action items needed as a basis for a MOUD supported action plan for improved SWM; and 6) Identifying Potential State Support – an effort to create linkages between states and their municipalities for improved support in MSW management practices. The workshop agenda is included in this report as Appendix C. The FIRE project is currently assembling a proceedings report that will be supplied to USAID under separate cover.

Session five was designed as the platform for moving forward on a strategy in the urban MSW management sector that could open up opportunities and support initiatives for implementing improved SWM strategies, including methane mitigation.

Participants and Resource People

Approximately 190 people confirmed to attend the workshop. It is estimated that about 140 were present for the opening plenary. As several participants noted, the workshop was the largest and most comprehensive of its kind ever put together with a focus on improved solid waste management. Stakeholders included: GOI representatives such as Mr. Koshal Ram, Secretary MOUD; Mr. Banarjee, Jt. Sec. MOUD; Mr. Mangotra, Jt. Sec. Ministry of Non-Conventional Energy Sources (MNES), Mrs. Indrani Chandra Shekharan, MOEF; Central and State Pollution Control Boards; State Ministries of Urban Development; Municipal Commissioners and MSW

engineers; financial institutions such as HUDCO, IDFC and ICICI; private sector MSW project developers, promoters and technology providers; NGOs; USAID and other bilateral and multi-lateral program representatives, etc.

Three international experts contributed to the deliberations. The GEP-CCS Team included Mr. Greg Wikler, Vice-President of Global Energy Partners and Mr. John Benemann, an internationally recognized expert on anaerobic waste treatment processes. Mr. Wikler presented an overview of options for MSW treatment including methane abatement strategies. Mr. Benemann brought his expertise on biomethanation and landfill methane abatement strategies as well as experience/lessons learned from having been a lead trainer in GEP-CCS's prior MSW training programs noted previously. The presentation prepared by Mr. Wikler for the workshop is included in this report as Appendix C. Mr. Benemann's core presentation made during the above noted trainings is also included as it gives insight into the inputs he gave during the workshop. Ms. Sandra Cointreau, an internationally recognized expert on the design and implementation of municipality solid waste management programs also attended through the support of the FIRE project. All three experts also served as panelists for several of the sessions.

In a related but separate activity, GEP-CCS also utilized Mr. Wikler's and Mr. Benemann's expertise to further inculcate the linkage between MSW management and climate change with key national level policy makers. During the week of December 17-21, the GEP-CCS Team met individually with the Chief Secretary and Chief Scientist - Central Pollution Control Board, HUDCO, the Chairman of the MOEF Technical Advisory Group on Waste to Energy Technologies, Dr. Motsara of the Ministry of Agriculture, and a nine-member team from MNES led by Mr. Mangotra, Jt. Secretary. The goal was to provide expert advice and create dialogue on the efficacy of waste to energy technology options as opportunities for mitigating methane emissions from MSW. The meetings helped to build partnerships with these interests and have created a foundation for collaboration on implementing GEP-CCS activities in the solid waste management sector.

Overview of Deliberations

This section includes a brief summary of the highlights of each Workshop session along with qualitative assessments of stakeholder interest and issues of concerns.

Setting the Tone

Chaired by Mr. Dilip Biswas, Chairman of the Central Pollution Control Board, this session focused on a review of the MOEF Guidelines that act as the drivers for municipalities to improve their solid waste management, treatment and disposal practices. Mr. P.U. Asnani from the US Asian Environmental Partnership Program led the session with a very thorough presentation on the key basic model MSW collection, segregation, handling, and transport practices that municipalities can implement a very low cost. He also identified the types of partnerships that municipalities can and should foster with regulatory bodies and most importantly, the private sector, to ensure that the first steps towards compliance with MOEF rules are implemented.

Participant comments centered clarification of the MOEF Guideline requirements and the timeframes for compliance. Many felt that the timeframes are unreasonable given lack of technical expertise and financial resources for implementation. It appeared that the greatest value in the

presentation was in generating a shared stakeholder understanding of what is required and of those elements of the guidelines that can be undertaken by municipalities under their current technically and financially constrained situations.

Responsibilities of Urban Local Bodies

Dr. Meera Mehta, Senior Financial Specialist, Water and Sanitation Program chaired the session. Mr. Ashok Dalwai, Municipal Commissioner Bangalore; Mr. D Jagannadha Rao, Additional Commissioner Hyderabad; and Mr. Ajit Kumar Jain, Additional Commissioner Mumbai presented case studies on the more progressive MSW management programs that have been undertaken by each. Institutional development, finance, community cooperation, technical support, etc. that were required to implement better MSW management practices were highlighted. While each municipality has taken a slightly different approach owing to their unique problems and circumstances, the underlying message was that municipalities could take concrete actions to begin to address MSW management challenges. However, all three presenters noted that the timeframes in the MOEF guidelines may not be met, but that the important thing was to take initiative and show due diligence.

Mr. Wikler presented the advantages and disadvantages of various MSW treatment options ranging from composting to more advanced waste to energy technologies including biomethanation and landfill methane gas recovery. His presentation focused on the US experience with these options as a means for identifying next steps for their potential use in India. While prescriptions for India were not made per se, the inference made was that while higher technology options for waste treatment and energy recovery may prove to be viable in India from a purely technology standpoint, that the track record of the technologies is insufficient to recommend that they be pursued over the short term or until such time as objective, economically viable projects have been demonstrated. This is also true for the waste to energy options (biomethanation and landfill methane recovery and reuse) that hold the most promise for methane mitigation from MSW.

It should be noted that in numerous side discussions over the course of the workshop, participants engaged Mr. Wikler and/or Mr. Benemann for advice on their unique circumstances regarding considerations for waste to energy project proposals. Several are interested in working with GEP-CCS to develop model projects in both biomethanation and/or landfill gas recovery.

Participants had specific questions and comments on each of the models presented. Several were targeted at the institutional arrangements that were made to implement the models. Others questioned the cost – a recurring theme throughout the Workshop. Another recurring theme first voiced by municipal commission representatives during this session, was the difference in capacities between large cities and moderate to smaller cities for implementing improved MSW practices. Several noted that technical and financial capacity building is needed in most of the municipalities that must answer to the MOEF Guideline requirements.

Private Sector Participation: Risks and Opportunities

Five private sector MSW project practitioners/project developers gave overviews of their respective projects as a method of highlighting opportunities and constraints to the success of private sector participation. Ms. Landine Leurent of Onyx Asia Holdings presented on her company's implementation of a contract with Chennai for waste collection and transport. This appears to be

the only private sector case study in India for provision of such services. She described the services provided along with the contract mechanisms employed for the services. Mr. K.S.V. McNair of Excel Industries and Mr. Dinesh Tandon of Mahindra and Mahindra spoke on their respective company experience in composting projects. To date, composting is the only proven waste treatment option that may have application across a range of current municipal MSW situations in India. Both presenters identified the constraints each faces in ensuring such projects are financially sustainable and outlined the roles that municipalities need to play to invite private sector participation.

Of particular interest were the waste to energy project case studies presented by G.V. Ramakrishna of SELCO on its pelletization project in Hyderabad and by Mr. Suhas Bhand of CICON on its biomethanation project in Nagpur. Both highlighted the sensitivity of the technical and financial issues that could affect the success of each project. Again, focus was placed on the role of municipalities in facilitating private sector MSW project development and the conditions that need to be created to enhance the viability of such projects.

Participant comments were varied. However, common themes included the following: 1) perceptions by municipal officials that private sector MSW treatment project developers should pay a municipality for its solid waste rather than view private sector projects as a means for relieving a municipality of a liability and a cost; 2) concern that municipalities need to generate revenue through tipping fees and user fees in order to support private sector participation; 3) lack of recognition that even with private sector participation, municipalities still face risks if composting or waste to energy projects fail; and most clearly, 4) uncertainty over how to evaluate the viability of waste to compost or waste to energy projects (including biomethanation and landfill gas) from a financial or technical perspective.

Financing Solid Waste Projects (Day Two)

Chaired by Mr. V. Suresh, Chairman of HUDCO this session was intended to provide stakeholders an overview of key opportunities and constraints in generating financing MSW management and treatment projects and programs. Mr. Suresh presented a synopsis of HUDCO's activity to date in funding such projects. He noted that activity has not been extensive owing to a lack of an incentive for municipalities to identify and implement projects and in turn, lack of a market for HUDCO to serve. A number of the key financial considerations HUDCO uses to evaluate projects were noted as compared, in general, with the typical characteristics of MSW projects and their promoters. A representative for Ms. Jayalaxmi of IDFC presented a case study on the financial evolution and analysis of the Lucknow biomethanation project. His presentation was excellent in terms of summarizing the key risks and risk mitigating factors a financial institution considers for such projects. Interesting to note was his inclusion of environment and social risks as a factor in the financial analysis. Mr. Shekar Damle of ICICI gave an overview of similar risk consideration issues and his outlook for ICICI's interest in financing MSW management projects.
This session prompted significant discussion questions from the participants. General comments noted that municipalities are not practiced in dealing with private sector financial institutions or in preparing projects. Because their experience with private sector participation is also low, municipalities don't have a clear idea of the risks they face by inviting private sector participation or how to work with financial institutions to facilitate MSW projects. As lack of financial resources is the most common constraint sighted for developing MSW projects, including those that may hold climate change mitigation potential, most participants noted a need for capacity

building in how to interface with financial institutions and the private sector to implement needed projects.

Another recurring theme is the fact that to date, few if any municipalities have been able to institute mechanisms to collect user fees or tipping fees for MSW collection, transport, disposal or treatment. As these sources of revenue are critical for financial sustainability of most MSW projects, including biomethanation and landfill gas recovery, failure to establish the fiscal discipline and legislative authority for generating such revenue is a major constraint.

Breakout Groups and Dialogue

As noted previously, the chief goals of the Workshop were to facilitate dialogue among key stakeholders and through this, develop a set of key issues for enhancing MSW management that could form the basis of an action plan. The breakout group and dialogue activities were designed to accomplish the latter.

The participants were divided into four groups and asked to identify and rank priority issues and actions needed. Each group was assigned one of the following topics: storage, collection and transportation; processing and disposal options; financing and capacity building. A moderator led the open group discussion. Discussions in each group were lively, with nearly all participants contributing to the outcomes.

After the deliberations, the workshop participants reconvened to present their findings. A copy of the findings is included in Appendix C. Each group's presentation was followed by a brief question and answer session.

Outcomes

The workshop was a tremendous success. Part of the success owes to the opportunity created for all of the key sector stakeholders to deliberate on a full range of issues and to exchange ideas and opinions. Key decision makers at the GOI level had the opportunity to share and receive information from practitioners in the field and vise-versa – a prerequisite for informed decision making at both levels.

From the GEP-CCS perspective, information and ideas shared at the workshop will help inform how GEP-CCS can target its remaining technical assistance in the sector to best meet the priority needs of municipal managers. Several core technical assistance needs that could be within the scope of GEP-CCS can be identified:

- Sanitary landfill siting and design requirements (including methane gas mitigation)
- Guidance for developing professional tenders for MSW projects that mitigate methane emissions (i.e. technical specifications, costing, management options, finance options, operational parameters, etc.).
- Assistance with analyzing and evaluating bids made by the private sector for biomethanation or sanitary landfill projects.

The workshop also helped build GEP-CCS visibility and awareness of its mission in the MSW community. In addition, more extensive relationships with key GOI, state and municipal officials were created. These will be extremely beneficial in developing collaborative strategies for GEP-CCS activities and to leverage the resources and outreach capability of these interests. And as noted previously, the numerous side discussions between the GEP-CCS team and various stakeholders helped to identify potential municipalities with which GEP-CCS might partner in developing a demonstration project in methane mitigation.

Next Steps

Several actions are now needed to capitalize on the momentum gained through the workshop. Over the next one to two months, several actions are planned:

- GEP-CCS is in the process of identifying a project design that meets its mandate to provide technical assistance to one or more municipalities in mitigating methane from MSW.

- In conversations with a number of key GOI stakeholders including MNES, MOEF, MOUD, HUDCO and the CPCB, GEP-CCS proposed that a small focus group be formed to identify how best to move forward. GEP-CCS would vet its project design with the group and identify how to leverage the resources of each respective stakeholder to add value to the technical assistance impact. All have agreed on this concept.

- In closing the workshop, Jt. Secretary Banerjee recommended that simple guidelines be developed for municipalities to help guide their MSW management actions. He identified four primary areas that the guidelines should cover: 1) technology options for MSW treatment; 2) policy guidance on user charges and cost recovery for MSW services; 3) private sector participation; and 4) small sanitary landfills and cost recovery. GEP-CCS is now discussing with the FIRE project if and how best to help meet the intent of Mr. Banerjee's recommendation. It may well be that GEP-CCS, through its project design process, can help develop guidelines or case studies for technology options or small sanitary landfills in an effort to meet two of the needs identified by Mr. Banerjee.

SECTOR SPECIFIC ROUNDTABLES AND GEP-CCS PROGRAMMATIC DIRECTION

The sector specific roundtables have enabled GEP-CCS and the sector stakeholders to identify initiatives for incorporating climate change beneficial actions into economic development activities. Going forward, GEP-CCS will be looking for opportunities to help develop these strategies and/or work with the relevant stakeholders to push these initiatives forward. GEP-CCS may be able to tailor its remaining activities for this purpose. Where flexibility for new programmatic initiatives exists, GEP-CCS will work with USAID to identify similar opportunities.

APPENDIX A

INDUSTRIAL ROUNDTABLE PROCEEDINGS

information to the participants about developing clean energy technology projects and the funding options available as these subjects were of common relevance to all the target sectors.

- Break out sessions were designed to facilitate interactive discussion among the identified representatives, technology organizations and financial institutions for identifying the specific opportunities and barriers in each of the target sectors.

Round Table Highlights

Perspectives brought out at the Plenary Sessions

The Round Table commenced with the inaugural address by the Union Minister for Power, Mr. Suresh Prabhu, who made a emphatic statement in favour of introducing cleaner technologies to reduce the impact of Greenhouse Gas emissions. He stressed the need for not only lowering emissions but progressively moving towards zero emissions wherever possible.

Reiterating the fact that energy and transportation sectors were the prime sources of greenhouse gases. Mr. Prabhu underscored the need for changing the profile of electricity generation in the country with emphasis on Hydro power and the use of renewable sources for power generation. He also made case for introducing Special Purpose Vehicles for promoting the adoption of Clean Energy Technologies (Extracts of the inaugural address of Mr. Suresh Prabhu is given at Annexure I).

Mr Richard Edwards, Director, Office of Energy, Environment and Enterprise, USAID highlighted the need to address both the economic and regulatory barriers that impede the adoption of Clean Energy Technologies. While industry should aim at enhancing the marginal cost competitiveness of clean energy options by focusing on cost reduction and accessing low cost funds, the policy framework should be designed to reduce business risks regulatory enforcement.

Mr Chirayu R Amin, President, FICCI in his welcome address exhorted the participants to adopt clean energy technologies keeping in view the long term interests of the environment and also with an eye on improving the international competitiveness of products manufactured.

Mr D K Biswas emphasized the need for synergising the initiatives taken by industry, policy makers, Government and technology institutions. He recommended that these should be forums that facilitate frequent and continuous interactions between all the stakeholders of the clean energy technology projects.

Mr Anil Malhotra, Vice President, ICICI stressed the need for Clean Energy Demonstration Projects posed for funding should be innovative and preferably first of its kind in the country. These demonstration projects should also clearly aim at bridging technology gaps and result in substantial environmental improvement so as to qualify for softer funding windows.

Dr Ram Babu, Director, Global Environmental Services Division, Price Waterhouse Coopers stressed the need for the Clean Energy Technology Projects to be made

Opportunities for Engineering Consultants

Engineering Consultants have a great opportunity to assist project developers and financial institutions in establishing the feasibility of clean energy projects as well as in making definite waste estimates (DCE).

Clean Energy Technology opportunities specific to the Fertiliser Industry

Use of bio-fertilisers

Chemical fertilisers could be replaced by bio-fertilisers to reduce hydrocarbon use and to increase nitrogen supply.

Use of better Fuels

Cleaner fuels like natural gas, naptha, furnace oil will enhance energy efficiency and reduce greenhouse gas emissions.

Use of new energy saving devices

The use of new energy saving devices like Combustion air pre-heater, efficient Co2 removal system, Pre-reformer to reduce s/c ratio, Co-generation systems Would make fertilizer production more efficient.

Use of better technology

Better technologies could be adopted in areas such as low-pressure ammonia synthesis, urea utilization efficiency etc.

Clean Energy Technology opportunities specific to the Cement Industry

Manufacture of blended cements

Production of blended cements will reduce clinker consumption which will in turn reduce coal consumption and enhance energy efficiency.

Use of Natural gas

Cement plants can use natural gas in place of coal as fuel.

Grinding of raw material by energy efficient technologies

Grinding of raw material such as lime-stone, clinker etc. by energy efficient technology will reduce consumption of electrical energy.

Use of municipal solid combustible waste

Increased scale of operations

In order to improve the energy efficiency of paper mills as well as their economic viability, there is a potential opportunity for enhancing the scale of operations.

Use of organic waste

Utilisation of organic waste for value added products like polyols and polymethane (wood/paper coatings and adhesives). Bio-conversion of cellulosic waste by solid state fermentation can also be done.

Technology for chemical recovery

Technology for chemical recovery for straw and bagasse based mills is available. All mills producing bleached pulp up to capacity of 50 tonnes per day or above should adopt chemical recovery in order to generate energy as well as mitigate pollutants.

Alternative methods of bleaching

Alternative methods of bleaching like bio-bleaching etc. can result in cleaner production.

Use of agricultural residue

Much of raw material for the paper industry is imported where as all agricultural residue such as bagasse i.e. rice straw, jute etc. which are considered as the best raw material for the Paper Industry are burnt. Use of agricultural residues could make paper mills cleaner and more viable.

Broadening of fuel base

Paper mills could also use wood wastes like bark, dust, fines and sludge etc. to reduce the consumption of fuels.

[redacted]

Barriers to utilizing clean energy projects across the focus sectors of the Round Table

Lack of a nation wide Natural Gas Grid

Natural gas is emerging as a preferred clean fuel for many industries. However, its availability is inadequate and the pipeline network do not serve all parts of the country.

The absence of mechanisms required for certifying greenhouse gas reductions hinders development of projects that would be clearly eligible for trading as and when carbon trading does commence with the approval of the Government.

Lack of incentives for power generation using waste gases

A number of industries have the option to generate power using waste gases. This option is not being fully utilized mainly because of the high costs of such generation. Lack of adequate incentives for cogeneration prevents industry from utilizing these opportunities.

Restrictions on setting up captive power stations

Some of the State Governments like Madhya Pradesh, Gujrat, Maharashtra and Haryana do not permit Cement plants to have their own captive power stations. Such restrictions should be removed to enable the industries to implement clean energy options in power generation.

Lack of a liberal approach in assessing the financial health of the company

Funding of clean energy technology projects becomes difficult once the financial institutions use conventional yardsticks to assess the financial health of the applicant.

Need for better interaction between various agencies

There are no institutional mechanisms to promote regular and structured interaction between technology institutions, Government and industry in the area of clean energy technologies. Lack of such mechanisms hinders the faster utilisation of new technology opportunities.

Information dissemination

Information relating to clean energy technology project opportunities are scattered. Industries find it difficult to locate all the relevant information in one place.

Funding of demonstration projects

There is a lack in funding available for clean energy demonstration projects. Industry therefore finds it difficult to test new technologies.

No clear mechanism for carbon trading

Industrial units also lack an understanding of the variety of carbon markets that are emerging the world over. Lack of information and training opportunities continues to limit industry understanding of clean energy opportunities.

Barriers to utilizing clean energy projects specific to Steel and Aluminium Industries

Technology gaps in use of non-consumable anodes

Technology gaps exist in the area of non-consumable anodes.

Lack of incentives

There are no incentives available for co-generation of energy through waste gases.

Lack of a nodal agency

There is no single nodal agency for dissemination of information on various fronts related to energy efficiency.

Absence of proper bench-marking where non clean technologies are cheaper

There are no reliable mechanisms for bench marking clean energy technologies applicable to steel and aluminium industries.

Barriers to utilizing clean energy projects specific to the Pulp and Paper Industry

Use of bagasse for Power generation

Encouraging use of bagasse for energy generation endangers its availability for the paper industry.

Lack of incentives for power saving schemes

The Government does not provide any incentives to the industry for power saving. This makes the attitude of the industry indifferent.

De-forestation

For wood based pulp mills, scarcity of raw materials particularly forest based raw materials is preventing these mills from stepping up their capabilities to economically viable size.

Size of Equipment

For small capacities plants, the major problem is supply of right size of equipments as the costs are proportionately high.

Lack of low cost demonstrated technologies

Many of the low cost technologies available for clean energy projects are not tested and tried through demonstration projects. This reduces the level of confidence of paper mills in adopting these technologies. Often such

State Governments like Madhya Pradesh, Gujrat, Maharashtra and Haryana need to permit the Industry to have their own captive power stations. This will enable the industries to implement clean energy options in power generation.

High steam parameters for improvement in power generation

Improvement in power generation can be achieved by high steam parameters. High-pressure steam gives better results in terms of efficiency as well as power generation.

Attractive Funding Options

Various financial institutions can bring out special schemes and incentives for implementation of clean energy projects. Also the rates of interest could be low.

Developed countries to finance clean technologies

Developed countries need to take initiative in financing clean technologies which can be used by industries in developing countries

Energy Audits

Energy audits can be conducted to assess energy consumption and reduce any form of wastage. This will enable optimisation of process parameters for efficient use of energy.

Solutions to Barriers in utilizing clean energy projects in the Fertiliser Industry

Formulation of a long-term fertiliser pricing policy

A clear long-term fertiliser pricing policy needs to be formulated. This will attract investment in the fertiliser sector from the financial institutions and lending agencies. This will encourage the industry to initiate more and more clean energy technology based projects.

Chemical fertilizers can be replaced by bio-fertilisers for supply of nitrogen.

Bio-fertilisers like slow release urea will help prevent loss of uncoated prills thereby saving energy and valuable feed stock like gas, naptha etc. The Government should support R&D in bio-technology in this area.

In-house R&D facilities of various organizations can be used

Organisations like PDIL, EIL etc. can offer their in-house R&D facilities to bridge technology gaps in the fertiliser industry. Bio-technology should be introduced in the area of effluent treatment plants.

ACTION PLAN

Government

- Natural gas is emerging as a preferred clean fuel for many industries.However, its availability is inadequate. Efforts should be made to increase the supply of Natural gas. Government should also provide a nation wide gas grid. FICCI and Industry Associations will follow up with the Government.

- The Government should formulate a clear-cut National fuel and feed stock policy taking into account domestic production and possible imports.

- Better fuels like naptha, furnace oil should be made available.

- Tripura gas should be exploited.

- To facilitate cogeneration as well as generation of power from non conventional energy sources, sale of power generated from such projects should be allowed to be given permission for banking wheeling and selling with third parties, other than SEBs.

- Government should urgently create mechanisms required for certifying greenhouse gas reductions projects. This will enable industry to design projects that would be clearly eligible for trading as and when the trading does commence with the approval of the Government.

- A number of industries have the option to generate power using waste gases. This option is not being fully utilized mainly because of the high costs of such generation.

- Government should provide incentives to industries for doing so. Tax incentives like exemptions from excise and customs duties must be extended to clean energy technology projects to make them economically attractive.

- There needs to be a clear long-term fertiliser pricing policy, lack of which makes clean energy technology projects investment in the fertiliser sector unattractive for financial institutions.

- Surplus power generated from cogeneration systems should be treated at par with the power generated from non-conventional sources such as wind power.

State Electricity Boards

- State Electricity Boards should buy power from the cogeneration projects at remunerative prices.

- Grinding of raw material such as lime-stone, clinker etc. by energy efficient technology will reduce consumption of electrical energy.

- Municipal solid combustible waste can be used in cement manufacture. Also burning of such waste should be done in a kiln. Co-firing of such fuels will have lesser impact on GHG if burnt in an incinerator.

- Retrofit technologies in various branches of Cement manufacture: 5/6 stage pre-heaters, low pressure cyclones, high efficiency classifiers, vertical roller mills, roller press, variable speed drives, expert control systems should be encouraged.

- Non-consumable anodes should be used in Aluminium smelters will reduce power consumption and CO_2 emission.

- Hot metal use in EAF through Cupola route should be used to reduce power consumption.

- ECOTECH technology should be used for Electric Art Furnace (EAF) for reduced power consumption.

- Smelting reduction processes should be used for hot metal production. Wastes should be utilised in plant, mines and non-coking coal. There should be Co-generation of energy through utilisation of waste gases like BF etc.

- Technology for chemical recovery for straw and bagasse based mills is available. All mills producing bleached pulp up to capacity of 50 tonnes per day or above should adopt chemical recovery in order to generate energy as well as mitigate pollutants.

- Alternative methods of bleaching like bio-bleaching etc must be encouraged.

- Fuel base needs to be broadened and should include wood wastes like bark, dust, fines and sludge etc. This will reduce usage of wood as a fuel.

- Industry units need to be more transparent with their accounting practises and balance sheets, lack of which creates a barrier for financial institutions to provide funding.

- Alternatively biomass like mustard stalk, cotton stalk, rice straw, rice husk, cane trashes etc. should be used for fuel for power generation. Biomass is an eco friendly source of power generation for decentralised agro paper mills. Its use for cogeneration of power in these mills must be encouraged.

- Black liquor bio-methanation should only be for lower capacity pulp mills. A pilot test should be done in India using Indian raw materials.

Annexure I

Address of Mr Suresh Prabhu, Hon'ble Minister of Power

Speaking at the Roundtable on Clean Energy Technologies organised by the Federation of Indian Chambers of Commerce and Industry, USAID and Louis Berger Group, the Union Minister of Power, Shri Suresh Prabhu disclosed that the Energy Conservation Bill will be passed in the current monsoon session of Parliament. He congratulated FICCI and USAID for organising a Roundtable on this topical subject. While expressing concern over global climate change and the need to reduce greenhouse gas emissions, he laid emphasis on significant steps that need to be taken to tackle this problem. He said that changing climates affect our GDP growth, affect the coastal population and gradually the entire population and the ecosystem. Global warming causes drastic changes in climatic conditions that leads to loss of crop and reduction in GDP growth. It has a negative impact on overall economic growth and well being of our future generations. Therefore, we need to address this issue with seriousness. He said this Roundtable organised by FICCI is very timely and significant.

He said we have to resort to clean technologies to reduce GHG emissions. Technologies should not only aim at just reducing emissions, but at achieving zero emission levels. The transport sector is one of the largest of GHG emissions. We must reduce consumption of fossil fuels. The government has taken some steps to reduce pollution from this sector. Clean technologies must be implemented in this sector.

The energy sector is another large source of emissions. We must change the profile of electricity generation in the country. GOI has decided, that from the 12th Plan onwards, 20% of incremental power generation from nuclear sources, 20% from renewables and atleast 35% (medium term) from hydro sources. A plan is underway. and will be made public soon. All power plants in the country will be required to comply with ISO 14000.

He said it has already been decided to set up a special purpose vehicle that will take care of environmental issues on a stand-alone basis. The society for special purpose vehicle has already been registered. While one addresses supply side issues, demand side management must also be addressed to achieve least cost economies.

The ecosystem is a unified system, so we need to take global action to address global problems. Cooperation of the international community is very important. For implementing clean energy technologies, there should be no geographical barriers. Movement of clean technologies should take place without much limitation. India not being an Annex I under Kyoto Protocol, we are not required to comply with emission reduction targets. Despite that, the GOI is taking several concrete steps on its own towards tackling environmental problems.

clean technologies in Indian industry. They are economic barriers resulting from marginal cost competitiveness of clean energy options compared to traditional technologies and lack of clear policies on incentives for investment. Indian industry is now much more aware of the benefits of environmental management systems and adopting these cleaner technologies. Firms are adopting cleaner production technologies to reduce operating costs, better access to certain types of financing, reduce business risks from regulatory enforcement and stronger competitive position especially for those engaged in international trade.

Mr Chirayu R Amin, President, FICCI, in his welcome address said that the current negotiations on global warming and the clean development mechanism that aimed at creating a market for carbon emissions are not sailing smooth. While some countries are reluctant to accept mandatory obligations for emission reduction, there are others who have made voluntary commitments on their own. There are contentious issues in this area too. He was optimistic that the continuing dialogues would certainly result in more realistic frameworks that would take into account the ground level realities. Clean energy technologies are an integral part of our energy strategy and is vital to build the country's energy security he added.

Mr Ron Sissem Chief of Party, Green House Gas Pollution Prevention Project of USAID while making his presentation said that clean energy technologies improve Energy supply stability, Energy quality, Reduce emissions and improve efficiency.

- ADB funded energy efficiency studies in 6 industrial sectors (1996-1999)
- Interactive website on energy efficiency related issues (www.energyefficiency-cii.com)

Currently executing 4 programmes

- Trade in Environmental Services & Technologies (TEST)
- Energy Conservation & Commercialisation (ECO)
- Greenhouse Gas Pollution Prevention (GEP)
- Technology Development & Commercialization (TDC)

Earlier implemented

- PACER
- EESP

Projects

- ICICI supports demonstration projects and activities creating awareness.
- The demonstration projects should:
  - Be innovative
  - Bridge technology gaps
  - Be first of its kind in India
  - Have a significant environmental impact
  - Be in line with USAID's strategic objectives

Discussion Theme III - Implementing Clean Energy Technology projects in Industry – success stories and failures.

Mr Shyam Bang, Executive Director, Vam Organics Ltd. observed :

- Biogas is a viable non-conventional energy source. Industries having potential for biogas are : Distilleries, Breweries, Dairies, Starch, Paper, Food Processing Fish, Chicken, Meet processing, Slaughter House etc.

- Performance of Biogas Plant :

  COD reduction : 65-70%
  Methane Content in Biogas : 53-58%
  Calorific Value of Biogas : 4500-4600 Kcal/Nm3
  Biogas produced per : 0.53 - 0.56 NM3kg of COD destroyed

- Bio-gas Production at VOCL

  Total alcohol production per year : 89100 KL
  Effluent generation per year : 1.15 million m3/yr
  Biogas produced per year : 5.2.1 million Nm3
  Equivalent coal in terms of energy : 63000 MT
  Value of energy (considering coal price of Rs 1750 /t): Rs 110 million/yr

  Total Investment : Rs 120 million
  Operation Cost : Rs 30 million

- The GHG environmental benefits are quite clear to the financing side. There are many more environmental windows that can be cashed.

Secondary Steel Making

A number of technological improvements over the last three decades have resulted in progressively reducing levels of specific energy consumption in secondary steel making processes. Indeed there has been improvement in all the important operating indices. Improved energy efficiency has resulted in lower overall carbon emissions - directly and indirectly due to reduced electrical energy consumption. Several energy efficient technologies have been applied in secondary steel making. The scope for improving energy efficiency in the secondary steel sector in India is enormous.

ALUMINIUM INDUSTRY

Aluminium is the second largest of the metallurgical industries. Though highly energy intensive, it is also highly recyclable, and in the long run, could reduce pollutants significantly. Secondary aluminium production consumes much less energy than production from ore- 10-20 gigajoules per ton (GJ/t) compared to 164 GJ/t consumed in primary aluminium production. Nearly 83 percent of aluminium industry's energy requirements is met by electricity (including transmission and distribution losses). A preponderant part of the total energy consumed in primary aluminium production is consumed during the electrolytic reduction of alumina (63 percent of all energy consumed in aluminium production). The basic process of electrolytic reduction called Hall-Heroult process, which is universally used for primary production of aluminium, is highly energy intensive, and fundamental changes in this process have not been commercialized yet. This process uses about 0.42 tonnes of petroleum coke per tonne of aluminium metal produced, which is close to the theoretical minimum of 0.34 tonne per tonne of aluminium metal. There is little scope for significant reduction in carbon consumption in the process.

A number of general technologies can contribute to increased energy efficiency. These are computer control of processes or major energy using processes, waste heat recovery, and use of adjustable speed drives. About 85 percent of U.S. aluminium industry establishments have reported using one or more of these measures for energy saving.

In the secondary aluminium sector the largest part of energy is used in smelting. The possibilities of energy saving are greatest in this area.

B. Background paper : Clean Energy Technologies In Cement Manufacture

This Background paper covers the following topics :

- *Significance of Clean Technologies*
- Overview of Cement Industry
- Energy Use in Cement Industry including coal and power.
- GHG Emissions from Cement Industry
- Clean Technologies for Co_2 reduction in Cement related activities
- Issues for Adoption of Cogeneration Technologies in India which include Technology Transfer, Technology Absorption, Adoption of Cogeneration Technology, Technical/Technological Barriers, Financial barriers, Institutional Barriers

- Identifying project opportunities with appropriate details for modification of existing plants to make them cleaner or energy efficient.

- Arriving at a recommended list of technologies for the benefit of industry for considering their implementation in new projects or while modernising existing plants.

The Complete document as prepared and circulated gives insight of various technologies and also details of success stories after implementations of some or more of the defined measures.

D. Background paper : Bankable Energy Efficient and Cleaner Production Technologies in the Fertiliser Industry

Fertilizer is generally defined as any material, organic or inorganic natural or synthetic or Bio based which supplies one or more of the chemical or biological elements required for the plant growth. The fertilisers are also, therefore divided under Chemical or Bilogical categories. In the present context, only chemical fertilisers are being considered.

The primary nutrients which fertilisers supply, are Nitrogen , Phosphorous & Potassium. Their concentration in fertiliser is expressed as percentage of total available Nitrogen (N) or Phosphate (P_2O_5) or Soluble Potash (K_2O).

Fertiliser being a nutrient, its requirement is increasing in field of food grains and other crops from our limited land resources. The fertilizer nutrient requirement is, therefore split in three categories as under:-

- Phosphatic - 27%
- Potassic - 11%
- Nitrogeneous - 62%

In the case of nitrogenous fertilisers, the presence of Nitrogen is in the Ammonical form, Nitrate form (or a combination thereof) or an Amide form. Ammonical form of Nitrogen is contained in fertilizer like Ammonium Sulphate, Ammonium Chloride etc. Nitrogen is contained in fertilizer like Ammonium Nitrate, Calcium Ammonium Nitrate etc. The amide Nitrogen is contained in Urea.

Since the indigenous raw materials are available mainly for Nitrogen, Government policy has been to achieve maximum degree of self sufficiency in the production of Nitrogenous fertilisers based on utilisation of indigenous raw materials, leaving only marginal quantities to be imported.

The Fertiliser Industry offers most exciting, challenging and rewarding opportunities for adopting Bankable Energy Efficient and Cleaner Production Technologies.

As most of these plants are in core sector, the technology has to be leading towards Energy Conservation and improving performance efficiency. The focus in the Fertiliser industry is therefore on:-

- Energy Efficiency

Annexure V

Organizational Preparation

- FICCI and LBG together organised this round table.
- Initial discussions were held with industry associations specific to the targeted sectors for their inputs.
- Targeted participants were identified from all over India, which included plant level managers. The round table had representation from the industry, technology institutes, consultants, policy makers, financial institutions and project developers.
- Letters briefing the targeted participants about the Round-table were mailed.
- Consultants were identified and hired to prepare background note on each sector.
- As per the programme, moderators and rapporteurs were identified and briefed about their role in the Round table.
- Follow ups were done for confirmation of participants.
- Backdrops, Stationery, conference kits and other conference material were arranged for.
- Conference hall, lunch and tea arrangements were made.

APPENDIX B

RENEWABLE ENERGY ROUNDTABLE PROCEEDINGS

The Greenhouse Gas Pollution Prevention-Climate Change Supplement
A USAID/India Project

PROCEEDINGS OF THE ROUNDTABLE ON

RENEWABLE ENERGY FOR SUSTAINABLE DEVELOPMENT:

OPPORTUNITIES, BARRIERS AND SOLUTIONS

August 17, 2001, New Delhi

Organised by

Climate Change Centre
Development Alternatives

PREFACE

It is with great pleasure that the **Climate Change Centre, Development Alternatives** brings out the proceedings of our Roundtable on **Renewable Energy for Sustainable Development: Opportunities, Barriers and Solutions** which it organised at India Habitat Centre, New Delhi on 17th August 2001. The objective of this Round Table was to stimulate constructive dialogue, identify the stakeholders and their roles and responsibilities and work towards an enabling environment for promotion of renewable energy in India. Promotion of renewable energy becomes important in view of its significance as a means to decentralised rural energy, a sources of clean energy and an effective response to the challenge of climate change.

The Roundtable brought together around 70 participants, covering different stakeholders' groups like representatives of Government of India, International Development Agencies, Financial Institutions, Renewable Energy Project Developers, Academic Institutions, Consultants, Non-Government Organizations and Community representatives etc. The organisers were very cautious that this meeting should address to the crux of the problems related to renewable energy development in India. The participants analysed in a participatory manner the opportunities and barriers facing the renewable energy sector in India in technical, financial, policy-institution and social context and worked out a set of recommendations and an action plan for an enabling environment for renewable energy development in India.

The participants felt a sense of involvement and committed themselves to contribute in realising the recommendations into results. We hope that a joint and concerted effort will result into well directed activity towards the development of renewable energy sector and fulfilling the target set by the Ministry of Non-conventional Energy Sources that by the year 2012 renewables contribute 10% to total grid capacity. This will be an important landmark from the climate change point of view as well.

This document contains a summary of the proceedings, a background note on barriers in renewable energy development in India, the presentations by different resource persons and the outcomes of various sessions.

CONTENTS

OBJECTIVE OF THE ROUND TABLE

The objective of the Roundtable was to provide an opportunity to different stakeholders i.e. the concerned ministry of Government of India, International Development Agencies, Financial Institutions, Renewable Energy Project Developers, Academic Institutions, Consultants, Non-Government Organizations and Community representatives etc. to discuss:

- The enormous opportunities lying in the field of renewable energy and how to tap it
- Barriers in large-scale renewable energy development in India
- Creating an enabling environment for renewable energy development in India
- Various stakeholders in the renewable energy sector and their roles and responsibilities in ensuring large-scale renewable energy development

The roundtable was structured in such a manner that inputs from all the stakeholder groups are acquired and the recommendations are not biased toward a particular stakeholder group. The recommendations that emerged during the Roundtable serve the interest of all the stakeholders' groups. These recommendations were discussed and analysed by the participants to develop a concrete and time-bound road map for large-scale promotion of renewable energy and thus sustainable development of the country.

ORGANISATIONAL PREPARATIONS

The Climate Change Centre, Development Alternatives organised the Roundtable on "Renewable Energy for Sustainable Development: Opportunities, Barriers and Solutions" at India Habitat Centre, New Delhi on 17th August 2001 as a part of 'The Greenhouse Gas Pollution Prevention Project-Climate Change supplement (GEP-CCS)' a project of the USAID/India. The Louis Berger Group Inc. is implementing the project; Development Alternatives is a major partner in this.

As a Climate Change Centre, Development Alternatives is facilitating renewable energy entrepreneurs in taking up renewable energy projects and exploring funding opportunities for these projects from environmentally targeted sources. Because of Development Alternatives' strong understanding of the renewable energy issues, its long presence in the renewable energy sector and its access and goodwill among the stakeholders, Development Alternatives chose to organise the Roundtable on renewable energy issues, out of a total of five Rondtables proposed to be organised under the GEP-CCS project.

The organisational preparations for the Roundtable involved the following issues:

- Objectives of organising the Roundtable
- Preparing a tentative agenda
- Identifying the list of participants
- Identifying the resource persons
- Contacting the participants and the resource persons
- Finalising logistics
- Preparing a *Background Note* and other background materials for the participants

The organisers were very cautious that the meeting is structured in a participatory manner and all the stakeholders' groups are represented. Keeping this in view, there was more emphasis on working group exercises rather than on presentations by the resources persons. Only a few presentations were allowed in order to set the stage for the day.

Shri. A. K. Mangotra, Jt. Secretary, MNES, in his inaugural address described the significant achievements in renewable energy sector in India. He emphasised on the efforts required to fulfill the gap between the planned renewable energy development (10% of the total grid energy) and current status (3% of the total grid energy). In India 80,000 villages are required to be electrified. He proposed that electrification in 18,000 villages that are not accessible should to be done through renewable energy. He appreciated Development Alternatives' role in providing an enabling environment towards promotion of renewable energy in India for sustainable development. He emphasised the need of capacity building among different stakeholders in renewable energy sector and a level playing field. He also talked about the developments in COP 6- II towards CDM and its impacts on renewable energy development.

Technical Sessions I: Identification of Opportunities & Barriers - Stakeholders' Experiences

The objective of this session was to identify the opportunities and barriers facing the renewable energy sector. The session consisted of two activities - i) a series of presentations by the renewable practitioners and ii) a working group exercise to identify the opportunities and barriers. Dr. Khosla introduced the moderators Mr. S. Patara and Dr. Aditi Haldar, who ware to take care of the participatory process of identifying the issues and their solutions.

Dr. Ashok Khosla brought to the fore a few issues facing the renewable energy industry in order to set the stage for this session. He talked about the experience of DESI Power project towards commercialization of renewable energy. He stressed on commercial viability of the renewable energy technologies. According to him the energy policies should have commitment for renewable energy development e.g. state electricity boards should provide for third party purchase of power generated. He pointed out that nothing actually happened on ground till now despite government's top priority in rural energy sector. He mentioned that various subsidies prevailing in energy sector at times result in decelerating renewable energy development.

Mr. K. Sudhakar, Director, M/s R R Bioenergy Ltd., presented the experience of his organization in developing Bio-mass Gassification project based on IGCC technology. The project has taken into consideration all possible issues like resource availability, socio-economic viability etc. He also described the greater social impact of the project in the area (West Godavari District of Andhra Pradesh). Despite all the positive factors in the project he is facing a number of constraints since there is no capacity available in the country to evaluate the innovations in the technology. The very innovative technology also poses lack of confidence among the investors. Issues like constant devaluation of rupees etc. also pose a challenge.

Mr. Subir Nathak, Managing Director, Market Dynamics Pvt. Ltd., shared his experience on mainstreaming renewable energy. The organisation is active in the Solar PV and Solar thermal sector and is facing considerable problems as this sector has not really come up with economically viable technologies compared to conventional energy and other renewable energy technologies. He referred to the targeted contribution of renewable energy in total energy generation. Some of the barriers that his project faced are lack of infrastructure and training, lack of awareness and old mind-set of people.

A lot of opportunities exist for renewable energy development in the country but despite serious government efforts and inputs, renewable energy development could not be realised on a large-scale. The participants shared the barriers faced by their groups; these could be clubbed into technological, financial and policy-institutional and social categories.

- ***Technological barriers***
  - Lack of established technologies
  - Low conversion efficiency leading to high costs
  - Lack of maintenance, service qualities and reliability
  - Lack of proper documentation of projects

- ***Financial barriers***
  - Lack of availability of sufficient funds
  - Difficult access to government programmes and financing agencies
  - Price distortions between conventional and renewable energy

- ***Policy - Institutional & Social barriers***
  - Inconsistent SEB policies
  - Intervention of government on procurement of international funds
  - Lack of evaluation mechanism of new technologies with regulatory authorities
  - Lack of good privatisation policy
  - Lack of commitment from government and developers
  - Lack of robust infrastructure to sustain products, operation and maintenance
  - Multiplicity of decision making agencies in Central, State and Local levels
  - Attitude and mindset of people – no beneficiary participation in planning and designing

Technical Sessions II : Recommendations for Promotion of Renewable Energy in India

During this session, the participants were divided into following working groups on a random basis :

WG I - Technology
WG II - Finance
WG III - Policy, Institutional & Social – I
WG II - Policy, Institutional & Social – II

The working groups deliberated among themselves to find the solutions to the barriers that were identified in the technical session – I. The solutions identified by the working groups were presented to the plenary. Annexure contains the detailed list of solutions. The list being a very exhaustive one, it was thought appropriate to pick up the most important and the most urgent ones to develop an action plan for them. The participants expressed their opinion through a voting exercise on identifying the issues that should be dealt with immediately. Following issues emerged as ones requiring immediate attention:

1. A Comprehensive National Renewable Energy Policy
2. Availability of Data-base of Technologies with a Nodal Agency which is easily accessible
3. Full-cost Accounting including environmental & social costs

DR. ASHOK KHOSLA

President, Development Alternatives

Dr. Ashok Khosla emphasized that this Roundtable should not be like several other business as usual meetings on renewable energy issues. He mentioned that it would be useful to discuss 'what should be done' by Government, Non Governmental Organizations (NGOs), Project Developers & other stakeholders to accelerate the promotion of renewable energy in India by removing barriers and finding cost-effective solutions to the issues. He briefed about the framework of the Roundtable and said that the meeting would be successful if at the end of the day the participants have identified a definite plan of action and have worked towards its follow-up.

MR. RON SISSEM

Chief of Party, The Louis Berger Group Inc.

Mr. Ron Sissem, Chief of Party, The Louis Berger Group Inc. (LBG), in his welcome note stressed on the practitioners' participation to make the event successful. He mentioned that in the GEP-CCS project, emphasis is on energy as the key sector for GHG emission mitigation. The project is aimed at delivering information and technical assistance to diversify stakeholders' activity for mitigation of GHG emission. (Detailed presentation is available in Annexure – II)

MR. RICHARD EDWARDS

Director, Energy Environment & Ecology
United States Agency for International Development

Mr. Richard Edwards stressed on the benefits of the renewable energy to fulfill the energy requirements of the rural masses, its contribution in enterprise development & livelihood creation in rural areas and its significance in GHG emission reductions and sustainable development of the country. He, however, emphasised that renewable energy development would require a good business model. He also discussed the fundamental issues facing the power sector and maintained that renewables being decentralized systems help in rural development. He appreciated Development Alternatives' effort in this direction and gave a brief outline of USAID future focus like promotion of mini/micro-hydel and biomass based power generation.

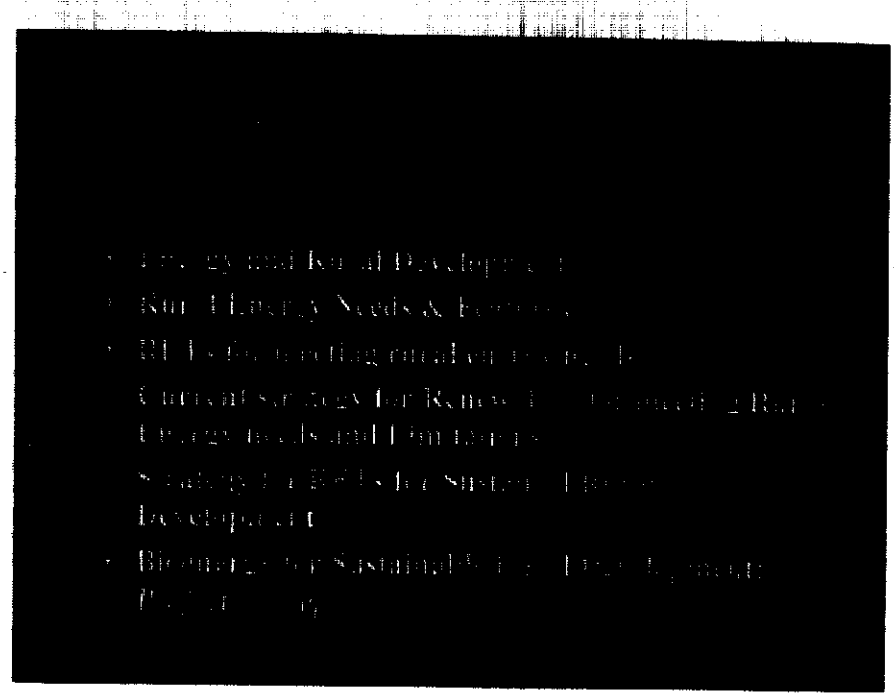
KEYNOTE ADDRESS

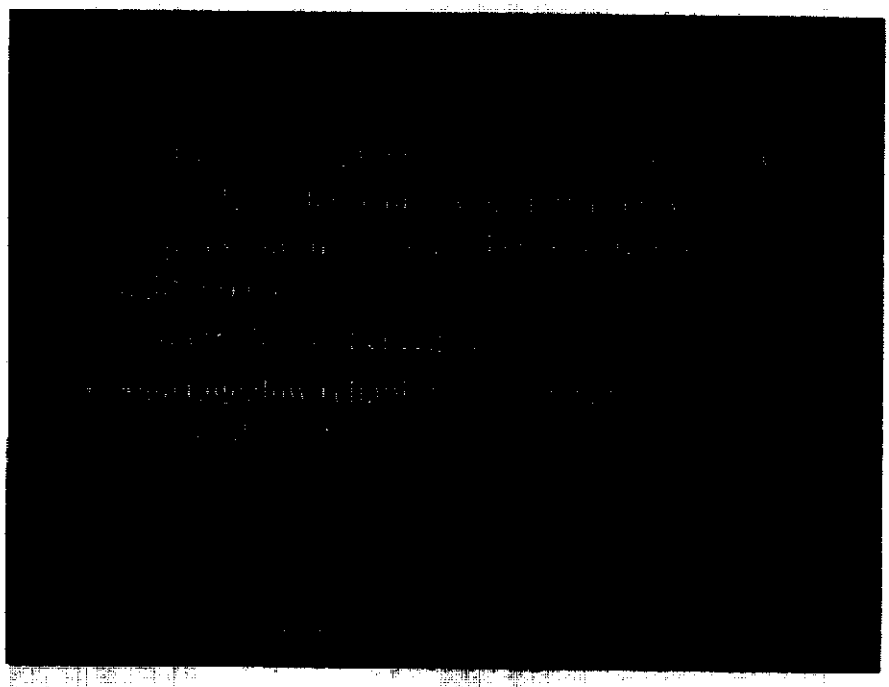
by

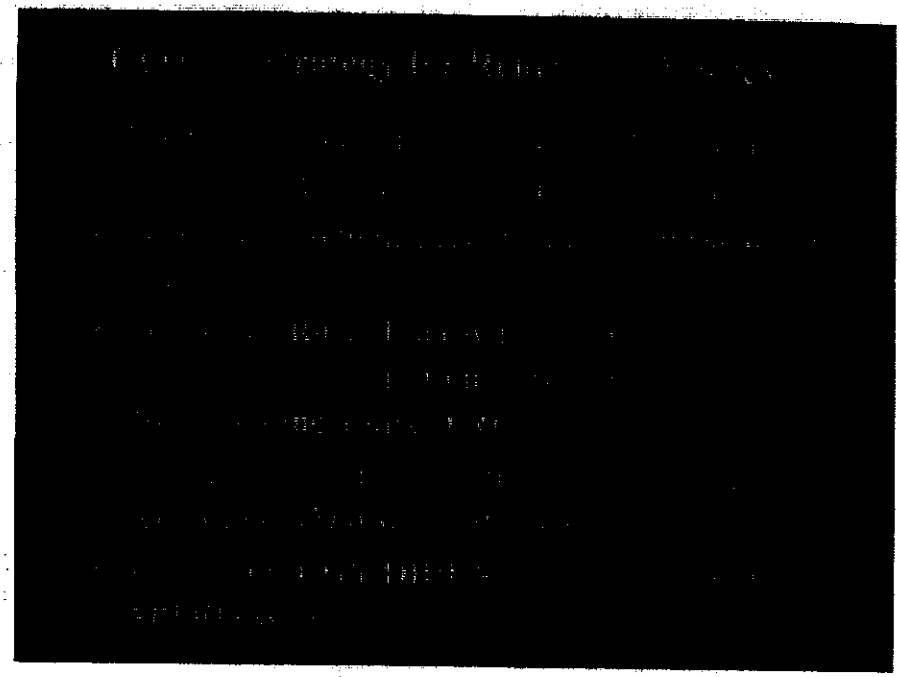
DR. N. H. RAVINDRANATH,

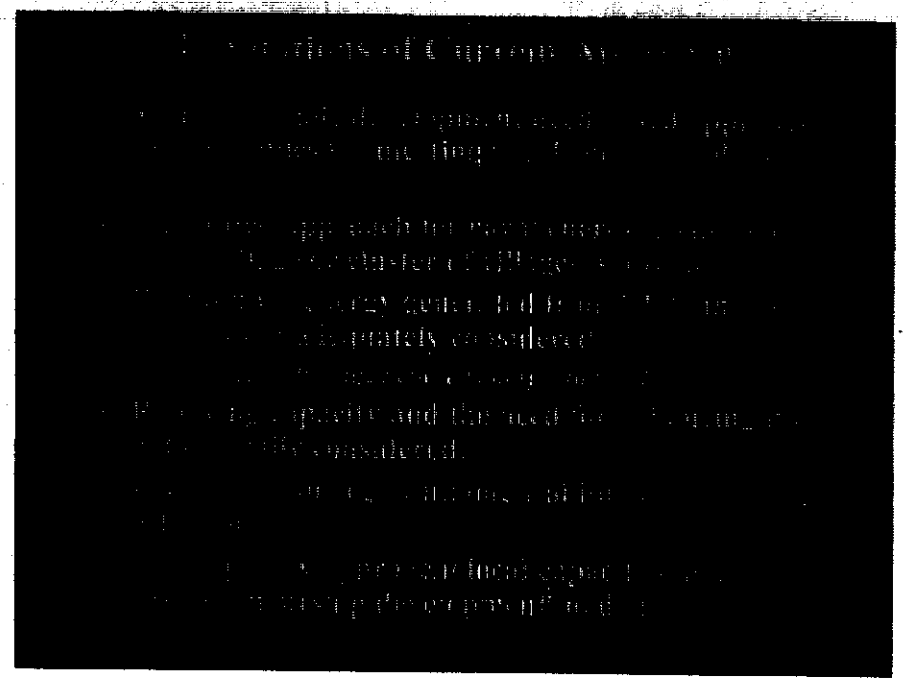
Professor

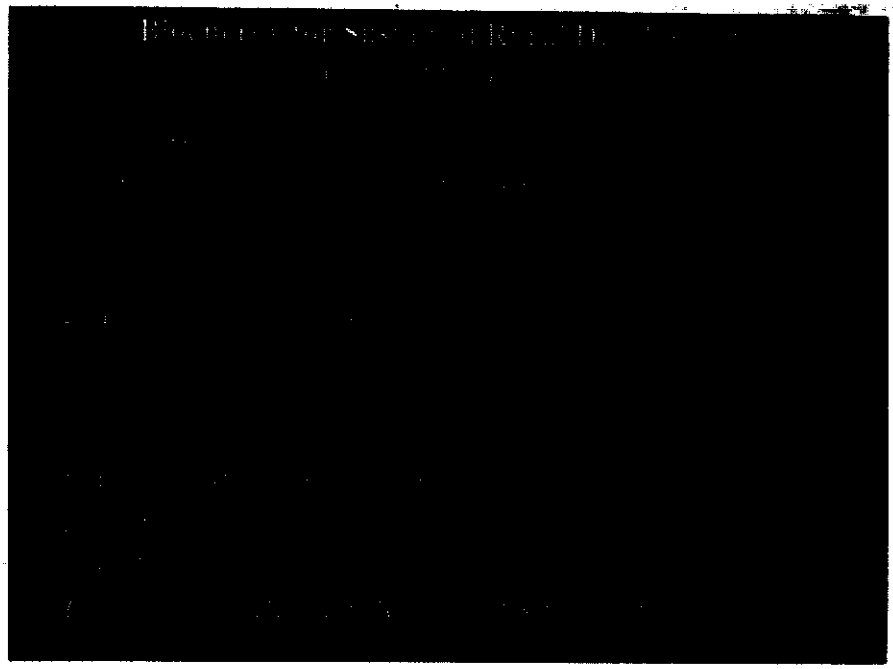
Indian Institute of Science
Bangalore

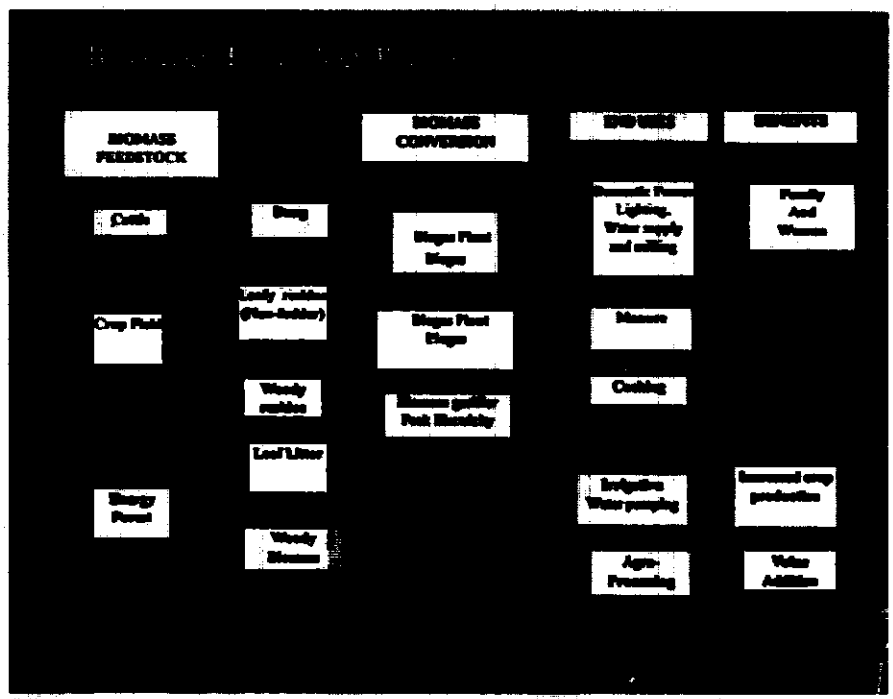


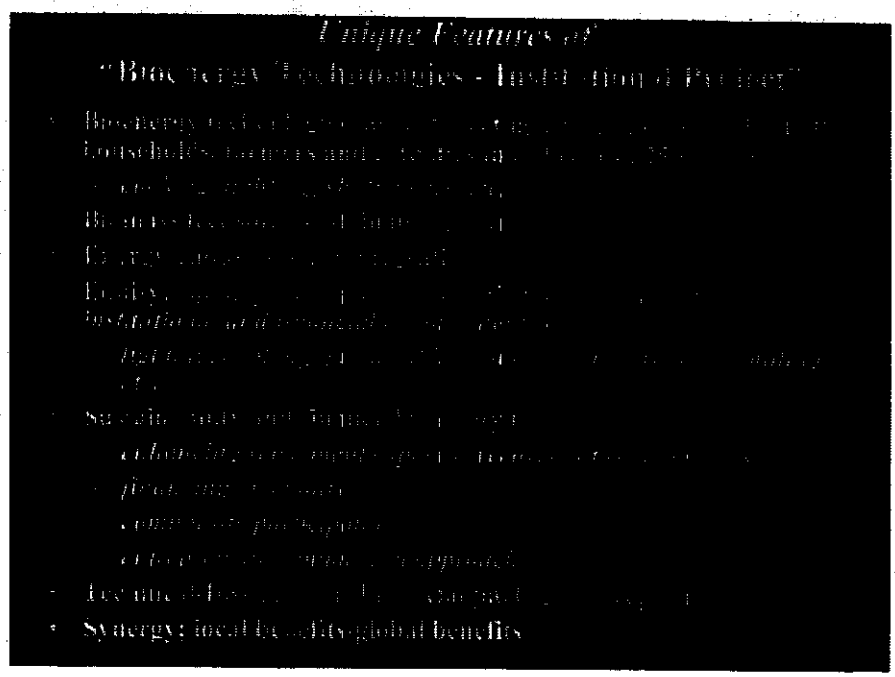









BIOMASS FEEDSTOCK
BIOMASS CONVERSION
Cattle
Crop Post
Sheep Post
Dung
Leaf Litter
Lighting, Water supply and milling
Cooking
Irrigation, Water pumping
Agro-Processing
Poultry And Worms
Value Addition


Unique Features of
"Biotechnology Technologies - Investment Projects"

OPPORTUNITIES AND BARRIERS IN RENEWABLE ENERGY PROMOTION

The objective of this session was to identify the opportunities and barriers facing the renewable energy sector. The session consisted of two activities – i) a series of presentations by the renewable practitioners and ii) a working group exercise to identify the opportunities and barriers. Dr. Khosla introduced the moderators Mr. S. Patara and Dr. Aditi Haldar, who ware to take care of the participatory process of identifying the issues and their solutions.

Dr. Ashok Khosla brought to the fore a few issues facing the renewable energy industry in order to set the stage for this session. He talked about the experience of DESI Power project towards commercialization of renewable energy. He stressed on commercial viability of the renewable energy technologies. According to him the energy policies should have commitment for renewable energy development e.g. state electricity boards should provide for third party purchase of power generated. He pointed out that nothing actually happened on ground till now despite government's top priority in rural energy sector. He mentioned that various subsidies prevailing in energy sector at times result in decelerating renewable energy development.

PRESENTATION

by

MR. K. SUDHAKAR

Director

R. R. Bio Energies Limited
Secunderabad

Bio-mass based Power Generation through Integrated Gasification Combined Cycle (IGCC) Technology A tool to change the socio-economic scenario of rural India

Objective of the Company

V1

Project: Salient Features

The project uses only Coconut Leaves, Oil Palm Leaves, Oil Palm Bunches etc. as fuel

Farmers are finding it difficult [illegible] their farms.

[illegible] project organises [illegible] pays the farmers money for [illegible]

[illegible] 6,000 farmers will get [illegible] additional income every year.

[illegible] transportation and handling of [illegible] provides downstream employment to [illegible] people.

RR Bio Energies

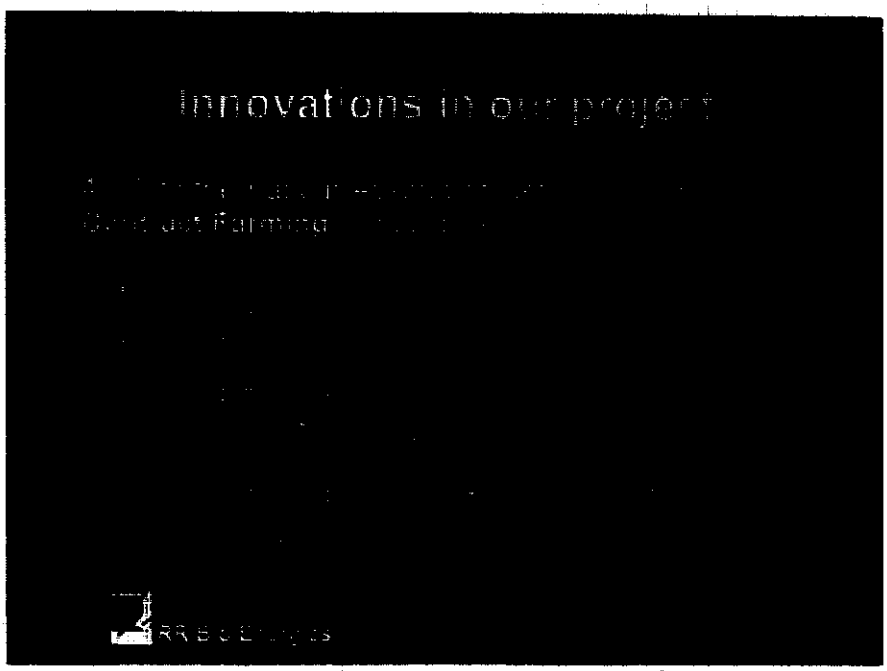
Project Salient Features

Cold Storage Facility

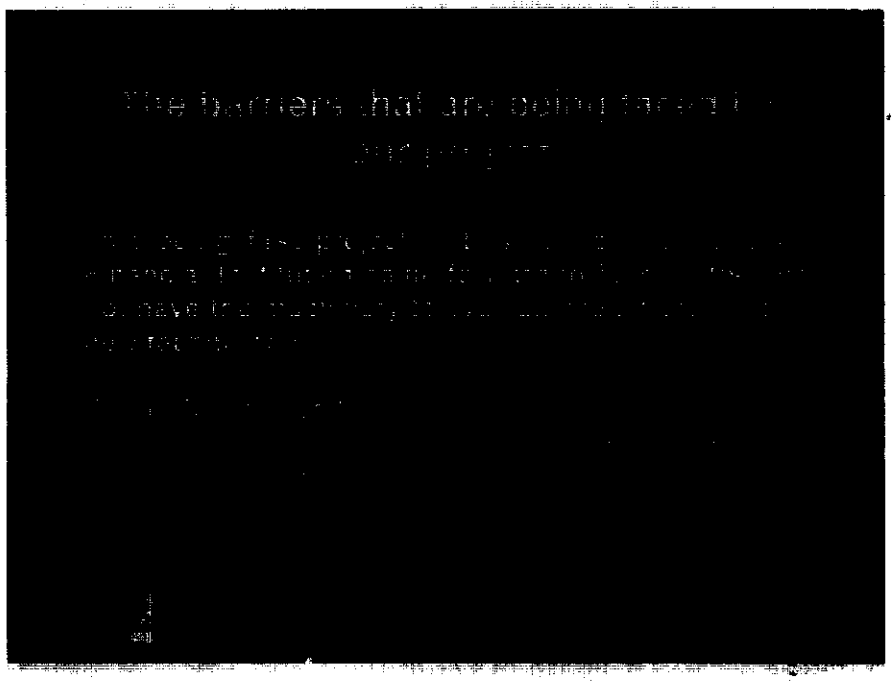
After successful implementation [illegible] project [illegible] storage facility will be created [illegible] Vapour Absorption Refrigeration System (VARS) technology which [illegible]

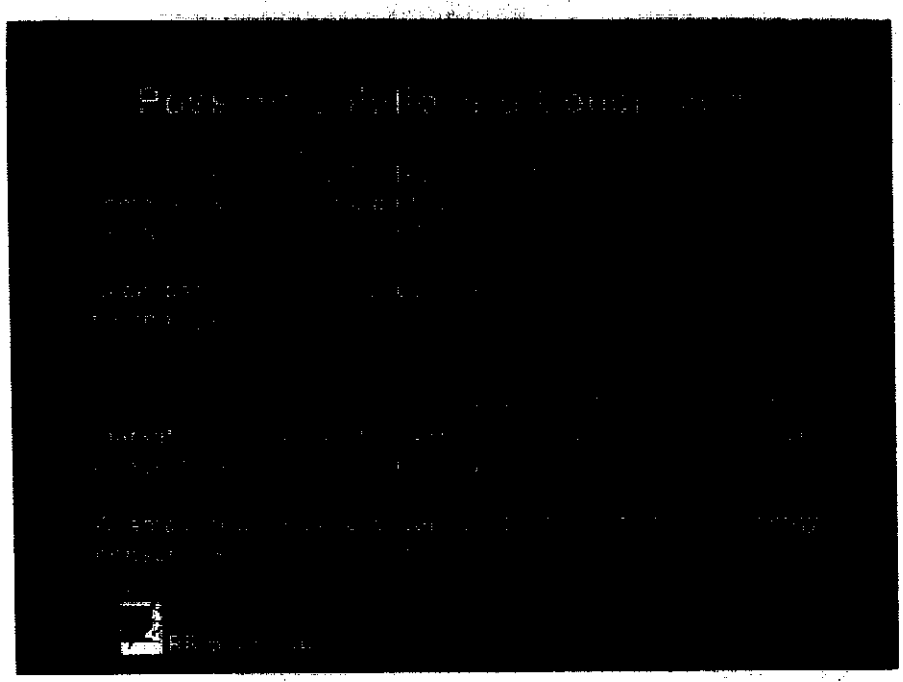
RR Bio Energies

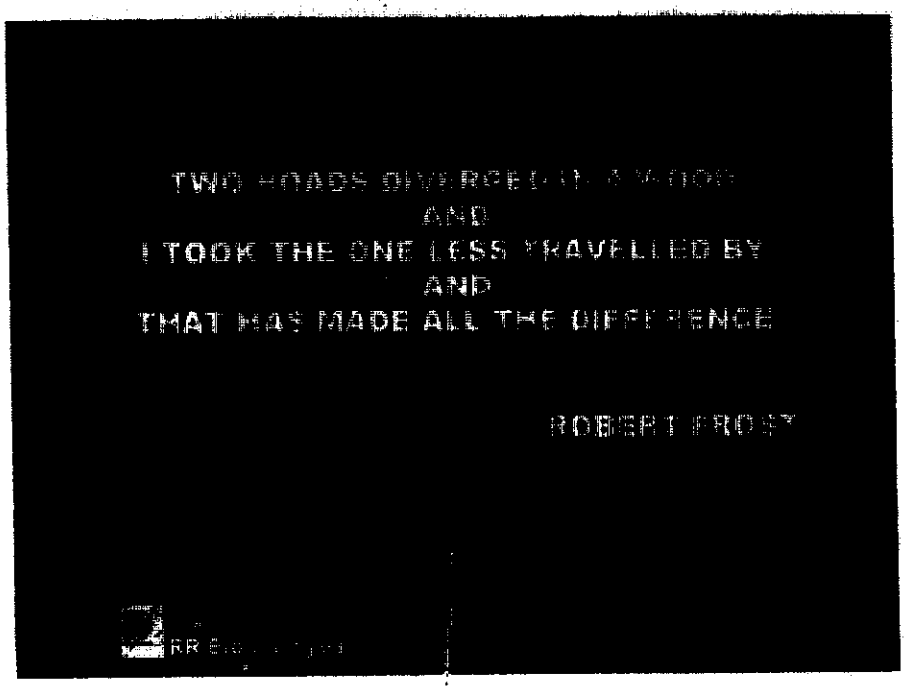
Innovations in our project



The barriers that are going to






AND
I TOOK THE ONE LESS TRAVELLED BY
AND
THAT HAS MADE ALL THE DIFFERENCE
ROBERT FROST

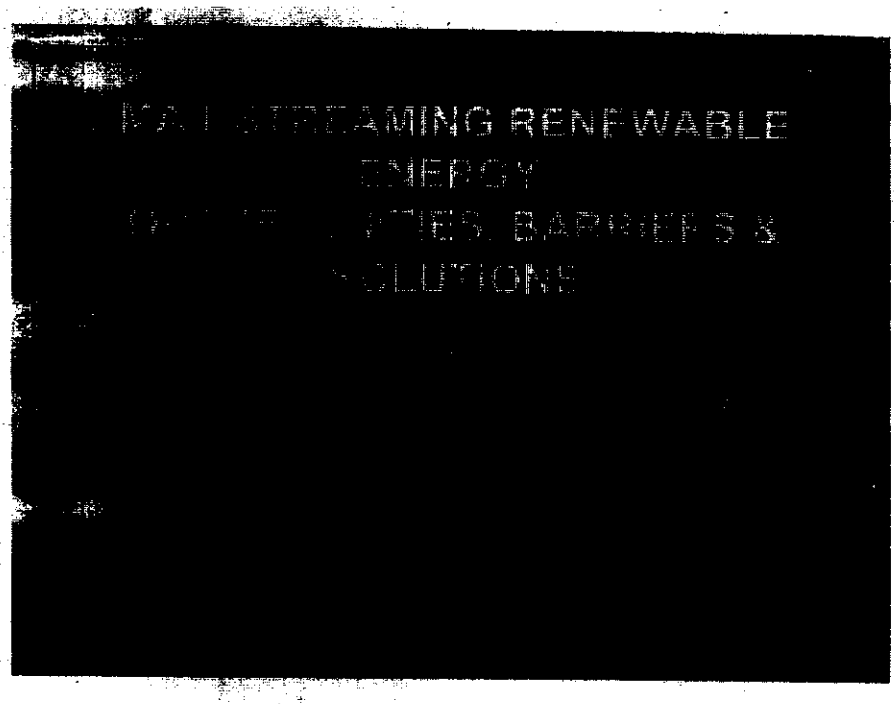
PRESENTATION

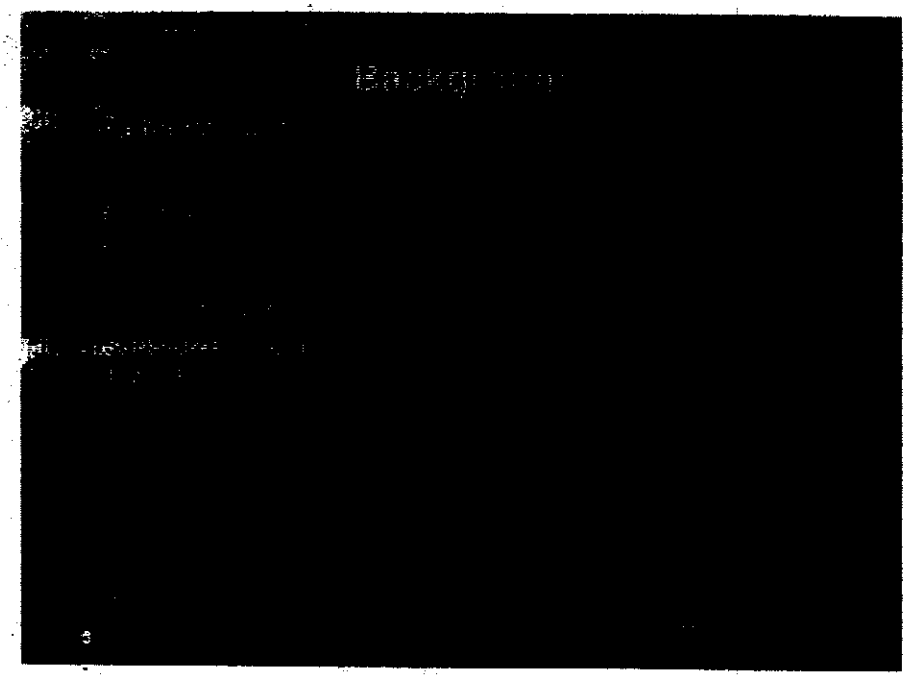
by

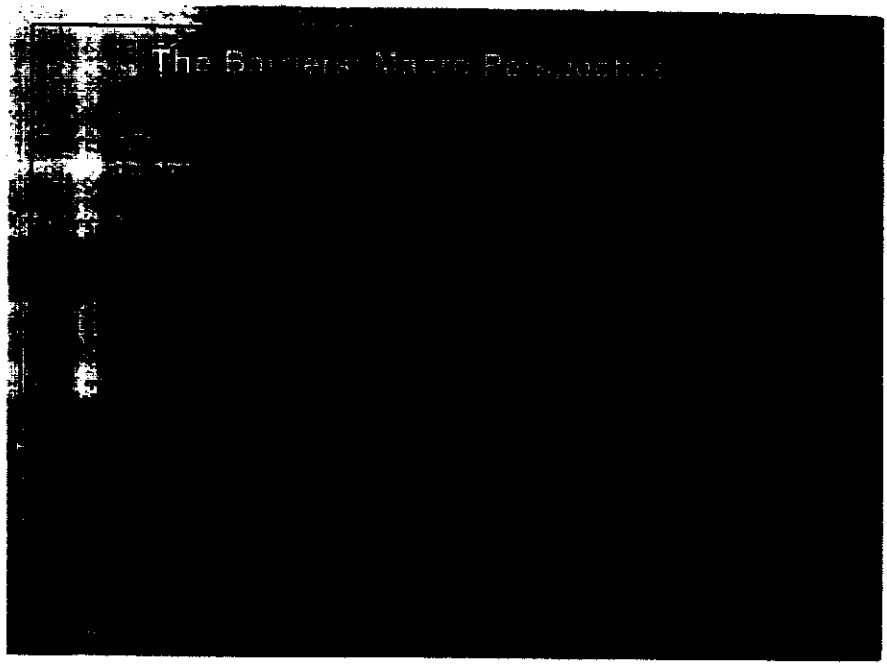
MR. SUBIR NATHAK

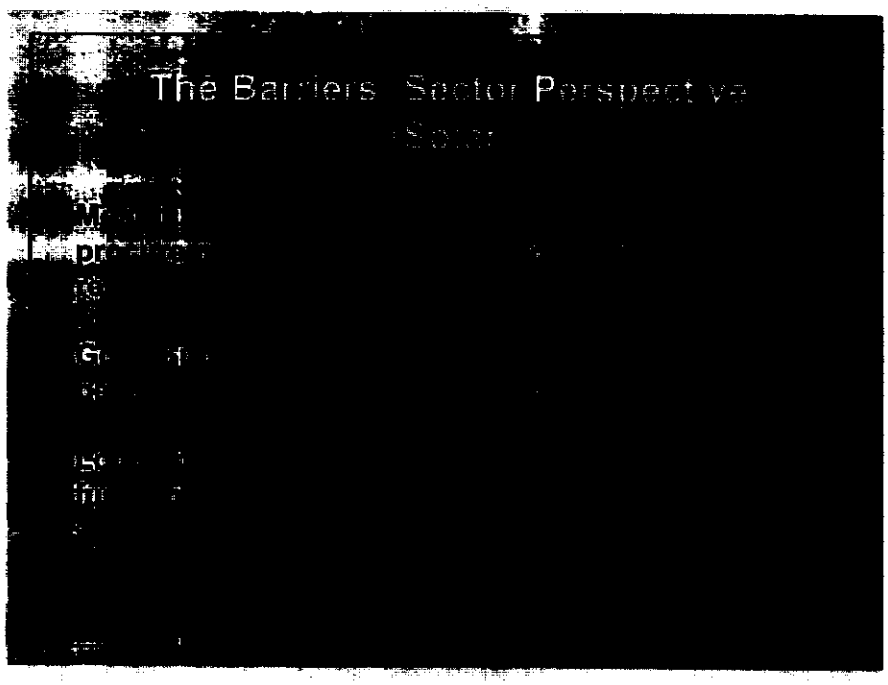
Managing Director

Market Dynamics Pvt. Ltd.
Kolkata


ENERGY






The Barriers: Sector Perspective
Solar

PRESENTATION

by

MR. V. R. VIJAY KUMAR

Director

Ravi Enteck Limited
Chennai

[redacted] Renewable Energy for Sustainable Development

[redacted]

by

RAVI ENTECK LIMITED

Chennai

[redacted]

INTRODUCTION

- **Ravi Enteck Limited is the exclusive Licensee of PRME Gasifiers in India.**
- **Ravi Enteck Limited with its experience in Renewable Energy Projects is bringing up 5.5 Mwe Biomass Power Project at Erode which will be first of its kind in India using PRMs Advanced Gasification Technology**
- **REL is looking for Potential investors to complete the Financial closure**

OPPORTUNITIES

Large Size Projects (< 30 MW)

- Large biomass-based Power Projects can be set up only with the help of sugar mills where Bagasse & Cane Trash are readily available
- Combined Cycle route using Gas Turbines will pave way for higher efficiencies
- Sugarmills are assured of their internal Power & Process Steam requirements and excess power can be sold to the User / Utility
- WITH GASIFICATION TECHNOLOGY SUGAR MILLS WILL BE MINI POWER PLANTS

OPPORTUNITIES

Technology Transfer

PRM Energy Systems, the technology suppliers of the project, is a US-based firm. The project involves transfer of technology from the US to India.

There is a high potential of the technology's adoption and replication in various sizes as has been outlined in the previous slides

BARRIERS

- State Electricity Board Policies
  - Most of the SEBs do not have a concrete Policy regarding Power Purchase
  - SEBs who have framed policies have made changes recently affecting the Project Economics drastically
  - All SEBs do not encourage Third Party Sale of Power for Biomass based Power Projects

SOLUTIONS

- All SEBs should have a long term policy and should come out with a single window clearance for Grid Tieup facilities, Power Purchase Agreements & any other clearances required.
- Govt of india should emphasize the directives given to the SEBs to fix a minimum Power purchase price considering the foreign exchange drain due to the import of fossil fuels
- Third Party Sale and Nominal Wheeling Charges for Biomass based Power Projects will attract more investors.

Sectoral Experience: Wind

Opportun...

20,000 Mw of Wind power potential can be harnessed in the country

High potential sites for wind energy are still available

Bigger machines (500 KW - 750 KW) have started coming to India

Operating costs are among the lowest in India due to low cost manpower

Barriers

Wind Energy Enthusiasm was generated by sops and killed by MAT

Policy shifts within SEBs have affected wind energy sector badly

Deafults by Existing turbine owners have put the FIs on the backfoot

Clause that Wind Turbine Generator manufacturer should obtain approval from the MNES is a requirement that is crying for a re-look

PRESENTATION

by

MR. AJAY NARAYANAN

Vice President

Infrastructure Development Finance Company Limited
Chennai

IDFC

Renewable energy projects

Opportunities, Barriers & Solutions

Ajay Narayanan

Vice President

Environment Management & Social Development Group

Decentralized Infrastructure and New Technologies Group

IDFC About IDFC

- **Set up in 1998 to**
  - **Lead private capital to commercially viable infrastructure**
- **Focus on**
  - **Project financing and facilitation**
  - **Policy advise on infrastructure**
- **Other areas**
  - **Advisory services**
  - **Initiatives to create change/reform**

IDFC Renewables in India

- 7 % of total capacity from renewables
- Significant contribution from cogeneration
- India is one of the largest markets and manufacturers of solar PV modules in the world
- In wind power generation, India ranks fifth in the world.

IDFC Financing of renewables in India

- Focus of IREDA/MNES
- Terms
  - Low interest rates
  - Payment moratorium
  - Subsidies from MNES
  - guaranteed tariff for power sale
- Issues
  - Target driven
  - Little focus on O&M
  - Lack of orientation to market

IDFC Barriers

- Disconnect between conventional rural electrification and renewable energy.
  - Multiple agencies are involved
- Price distortions
  - Environmental costs
  - Social costs
- Government is the main implementer
  - Limited leveraging of private sector service provision efficiency.
  - There are potential conflicts of interest in being regulator, service provider, project monitoring agent etc.

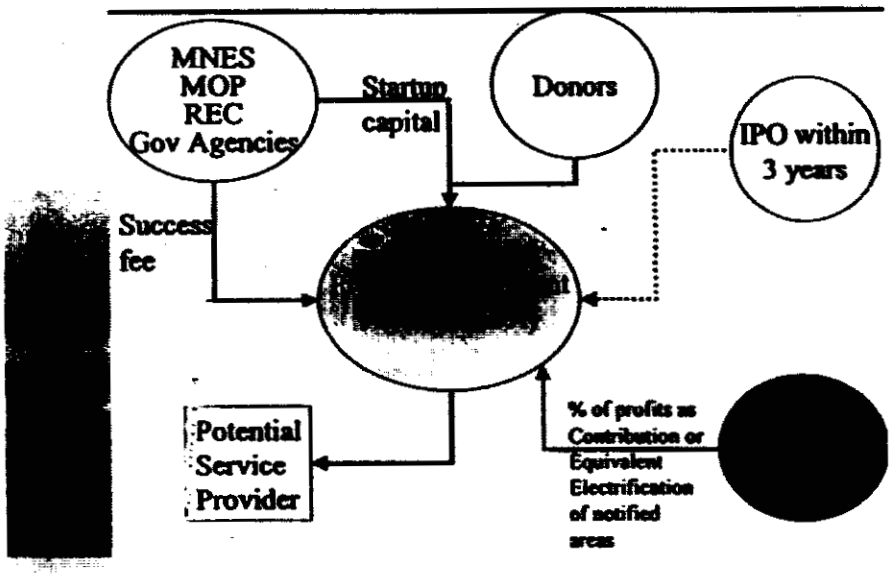
IDFC Barriers (cont.)

- High transaction cost
  - Centralized approach based on approved technologies
- Issues in implemetation
  - Focus on targets and not on service delivery
  - No incentives for local entrepreneurship in service provision;
  - One-time up front capital subsidy does not ensure operation over the anticipated life of the device;

IDFC Addressing the barriers

- **Policy (cont.)**
  - Focus on operations rather than technology/targets
  - Integrated approach to power supply
    - Approach is supply of power rather than promoting renewables
    - Environmental costs of conventional to provide subsidies for renewables
  - Government focus on regulation of service provision and setting frameworks
  - Private sector involvement in service provision
- **An option**
  - State level Project Development Agency(PDA)

IDFC PDA



IDFC

Thank You

OUT COME OF SESSION - 1

A realistic picture of the barriers faced by project developers & financial institutions emerged from these presentations. In order to receive more inputs on opportunities and barriers the question was put forward to a larger audience through a participatory exercise. The participants were divided among various stakeholder groups like

- Project Developers
- Financial Institutions
- Govt. and Public Bodies
- Non-governmental Organizations &
- International Development Agencies

The groups presented the opportunities & barriers as faced by respective groups. Some of the opportunities as identified by the participants are listed below.

Opportunities in the Renewable Energy Sector as Identified by Participants

- Sustainable economic development using local resources
- RETs for water mission, infrastructure, energy
- Appropriate technologies for community development
- Biogas to power
- Biomethanation of bagasse
- Small hydro potential – 15,000 to 20,000 MW, only 10,000 MW developed – great potential
- Growing market
- Growth in co-financing opportunities
- Growth in ancillary projects
- 18,000 villages not likely to be connected to grid
- Poor reliability of grid and inadequate voltage support
- Availability of abundant natural resources
- Clean Development Mechanism
- Decentralized energy – rural electrification
- Employment generation
- R & D opportunities (Cost effectiveness)
- Growing Interest in Innovative financing approaches in cooperation with development agencies
- Ret costs have decreased, improved technology transfers and efficiency improvement created more viable product
- Economic reforms create a more favorable environment for market based promotion of ret

A lot of opportunities exist for renewable energy development in the country but despite serious government efforts and inputs, renewable energy development could not be realized on a large-scale. The participants shared the barriers faced by their groups; these could be clubbed into technological, financial and policy-institutional and social categories as given below.

SESSIONS - II

RECOMMENDATIONS FOR PROMOTION OF RENEWABLE ENERGY IN INDIA

The objective of this session was to identify the suggested solutions to overcome the barriers, as formulated in the previous session, faced by the renewable energy sector. The session consisted of three activities – i) Formation of working groups, exercise towards finding out the solutions ii) A group discussion and voting exercise to identify the major or most important solutions. Iii) Formation of action-group to follow up with the action plan to materialise the solution points.

During this session, the participants were divided into following working groups on a random basis:

WG I - Technology

WG II - Finance

WG III - Policy, Institutional & Social – I

WG IV - Policy, Institutional & Social – II

The working groups deliberated among themselves to find the solutions to the barriers that were identified in the technical session – I. The solutions identified by the working groups were presented to the plenary as follows:

WORKING GROUP ON FINANCE

Barriers	Suggested Solutions
➢ Lack of availability of sufficient funds	• Soft funds routed through private banks (FIs) • Forex funds - set up systems • Bridge info gaps
➢ Difficult access to government programme and government financing agencies	• GoI to have facilitating role rather than a regulatory role
➢ Price distortions (subsidies and grants) that favour conventional energy	• Remove subsidies to conventional energy sector
➢ High front end costs	• Amortise over 20 years, integrate social and environmental costs • Ballooning debt repayments • Full cost accounting (include social and environmental costs)
➢ Lack of user awareness and training	• Private development finance institutions to set up a seed fund using World Bank, Multi-lateral funding agencies line of credit • MP's surrendered funds to be channeled for grant for SD
➢ High cost and lack of small scale proven technologies	• Uniform & single window appraisal • Agency to conduct T-F appraisal
➢ Lack of sustainable O & M plan	• Linking of O&M Monitoring & Verification during the debt repayment and even beyond
➢ Lack of liberal financing norms	• Liberal financing norms required for special projects that contribute to national SD priorities
➢ Lack of innovative financing mechanisms	• FIs to get geared up - appropriate policies

WORKING GROUP ON POLICY / INSTITUTION AND SOCIAL - II

Barriers	Suggested Solutions
> Power a state subject > Inconsistent SEB Policies > High risk with off-taker (SEB)	• Policies of SEBs should be consistent • More participatory - all stakeholder
> No time frame for government clearances	• Specified timeframe and accountability of the office concerned
> Lack of commitment to implement from government and developers > Lack of good privatisation policy - PPA, Leasing period, water cess, wheeling and banking, third party sales	• Enhance our awareness of officials • Targets to be set as per long term plan • Mechanism to monitor compliance
> Third party sales ?	• Policy change for permitting third party sales
> Intervention of Government on procurement of international funds	• For internationally funded project Govt. should enact as a facilitator only
> Lack of evaluation mechanism of new technologies in regulatory authority > Need mechanism for judging credit worthiness of sponsor	• Capacity building of govt. official facilitated by govt. with an expert committee
> Need deemed export for all RET	• No comments
> Need 100% depreciation for all RETs	• Penalty for non performance on annual basis
> Industries lack result oriented project development activities	• Institutional arrangement for capacity building of industries
> Lack of robust infrastructure to sustain products, O & M	• Penalty for long term (5-10yrs) non performance

ANNEXURES

RENEWABLE ENERGY DEVELOPMENT IN INDIA:

BARRIERS AND THE WAY FORWARD

BACKGROUND NOTE

By

Climate Change Centre
Development Alternatives

Prepared For

Roundtable On

Renewable Energy for Sustainable Development:
Opportunities, Barriers and Solutions

August 17, 2001, New Delhi

Renewable Energy Development in India:
Barriers and the Way Forward

Renewable Energy Programme in India

Current patterns of energy use are causing growing concern all over the world. Access to energy within and among countries is highly inequitable. Most conventional energy sources lead to high levels of pollution. Fossil fuel reserves are not only depleting rapidly but the combustion of these fuels also leads to atmospheric carbon emissions that are resulting in global warming and sea level rise. Clearly, alternative sources of energy are now urgently needed, and among these renewable energy offers major advantages. Multilateral agencies such as the World Bank, the Asian Development Bank and the Global Environment Facility are now actively seeking renewable energy projects for financing.

These developments offer significant opportunities for a country like India, which has been endowed with a great variety and abundance of renewable energy sources.

India has one of the world's largest renewable energy programmes. It seeks to (a) increase the share of renewable in the overall installed capacity of power generation, (b) meet the energy needs of rural and remote areas for a variety of applications, (c) minimise the drudgery and health hazards faced by rural women in following the age-old practice of cooking with fuel-wood collected from long distances and in traditional cookstoves which emit a lot of smoke and (d) extract energy from urban and industrial waste, besides chemical, ocean and geo-thermal sources. The underlying idea of renewable energy programme in India is not to substitute, but supplement, the conventional energy generation in meeting the basic energy needs of the community at large.

As on December 31, 2000 the contribution of renewables to total electricity generation had reached 3000 MW, representing 3 per cent of total grid capacity. However, considering the estimated potential of 100,000 MW, the achievement so far are marginal. The potential and achievements in respect of various new and renewable sources of energy (NRSE) are given in Table 1.

Table 1: NRSE POTENTIAL & ACHIEVEMENT

	Potential	Achievement (as on Dec, 2000)
Biogas Plants	120 lakh	31.28 lakh
Improved Chulhas	1,200 lakh	328.9 lakh
Wind	45,000 MW	1,267 MW
Small Hydro	15,000 MW	1,341 MW
Biomass Power/ Co-generation	19,500 MW	273 MW
Biomass Gasifiers		35 MW
Solar PV	20 MW/Sq km	47 MWp*
Waste-to-Energy	1,700 Mwe	15.15 Mwe
Solar Water Heating (Collector Area)	1400 lakh sq.m	5.5. lakh sq.m

**In additional 18 MWp SPV Products have been exported.*

(10 lakhs = 1 million)

Source: MNES Annual Report, 2000

By this time policy makers realised that for a renewable energy programme to stand on its own feet, a market based approach would be more effective than the kind of financial incentives and public investments that had been the main instruments earlier. A range of conducive policy measures was adopted to develop market linkages and promote commercialisation by involving private sector and by providing more fiscal and tax incentives. A number of other structural changes were also adopted in order to give a boost to renewable energy programmes.

Unfortunately, despite the efforts by the Government of India over the last three decades and involvement of private sector for a decade, renewable energy programmes have yet to become an attractive business proposition. The share of renewable energy in total power generation amounts to only 3 per cent. In view of the recent policy statement by MNES that 10 per cent of the total capacity additions up to 2012 in the power sector should be through renewables, it becomes necessary to look into the barriers in renewable energy development and suggest appropriate remedial measures.

Barriers to Renewable Energy Development in India

Barriers to the development of renewable energy in India have been identified by the practitioners like Development Alternatives, DESI Power, Tata Energy Research Institute, Central Electricity Regulatory Authority, Winrock International India, Confederation of Indian Industries. These can be discussed under following four inter-related and overlapping categories:

- Financial barriers
- Technological barriers
- Social barriers
- Institutional barriers

Financial barriers

F1. The chronic lack of financial resources for commercialisation of renewable energy technologies

F2. The higher initial investment risk in renewable energy arising from both the lack of track record of the technologies and the lack of market demand

F3. Distortions in the energy pricing policy, including highly subsidized and underpriced power tariffs that ignore large external costs such as environmental degradation and social issues.

F4. Adverse pricing policies and lack of standardisation that hamper innovation and improve upon the design and in faulty selection of beneficiaries

F5. Perception in the private sector that development of renewable energy is the responsibility of government

Technological barriers

T1. Varied viability of technologies according to location and context

T2. Seasonality and irregular availability of the primary resources for many renewable technologies require back up based on conventional sources of energy

T3. Lack of standardization in the system components and absence of long-term policy instruments leading to manufacturing, servicing and maintenance difficulties

T4. Mismatch between locally manufactured components and imported parts

T5. Absence of effective servicing and maintenance network and inadequate user training

T6. Poor co-ordination among researchers, academic institutions and private industry

Expectations from Government:

W1. Make access to electricity a constitutional human right for every citizen of India

W2. Create legal framework for decentralized power sector and use of renewables to enable such initiatives to work as full partners with the centralized sector

W3. Establish fiscal and other incentives to make decentralized power and renewable energy commercially competitive, including reduction of subsidies to centralized power sector

W4. Promote R&D, application and use of power from decentralized and renewable sources

W5. Permit generation and selling of energy from Independent Rural Power Producers (IRPPs), both to the grid and to third parties

W6. Set fair conditions for wheeling and banking of electricity by IRPPs

Expectations from Industry

W7. Accelerate innovation in renewable energy

W8. Tie up with IRPPs for local power needs

W9. Take advantage of funding available from climate change mitigation sources

Legal and Financial Framework to Promote Renewable Energy in India

Fr1. Introduce a framework so that decentralised power and energy service companies can build IRPPS without hassles

Fr2. Create a legal framework that allows generation, selling of electricity and energy services within a given area from decentralised power plants

Fr3. Create uniform ERC rules for IRPPs in all states

Fr4. Define the roles, responsibility and authority of ERCs for the decentralised sector

Fr5. Streamline the procedures for clearances and approvals with a single window system

Fr6. Review and streamline the technical, financial and regulatory conditions for grid connection of IRPPs, with reasonable wheeling charges under the prescribed technical norms

Fr7. Make it compulsory for the grid to buy power based on MNES price formula

Fr8. Impose a small national levy on fossil fuel electricity to fund clean electricity and energy services

Fr9. Make these and other funds available to commercial banks and rural development financing agencies to enable local banks to provide financing facilities for decentralised power projects

Fr10. Establish financing mechanism for providing funds to decentralised power and energy service companies and IRPPs (similar to Rural Electrification Corporation (RECs) and Power Finance Corportation (PFC) in the centralised sector)

Fr11. Provide funds and establish targets for rural commercial banks to finance and provide cash credit facilities to decentralised power and energy service companies

Fr12. Provide fiscal and tax incentives for commercial and private investments

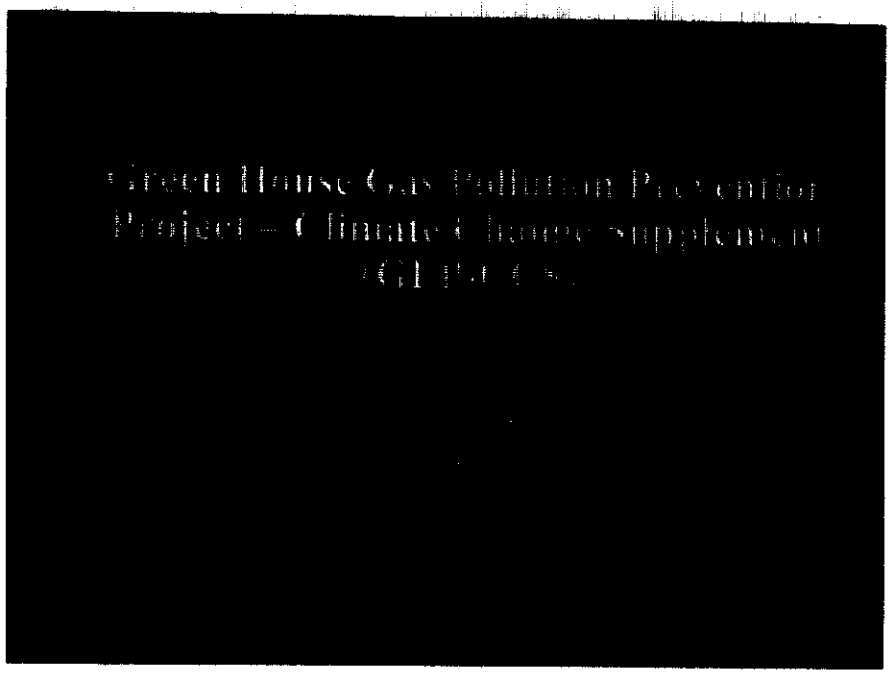
PRESENTATION

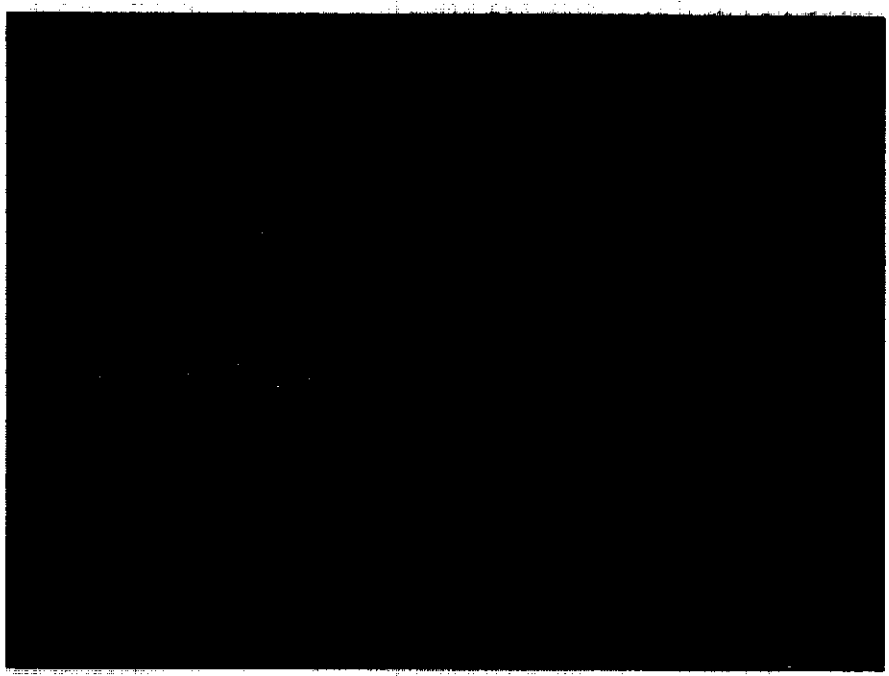
by

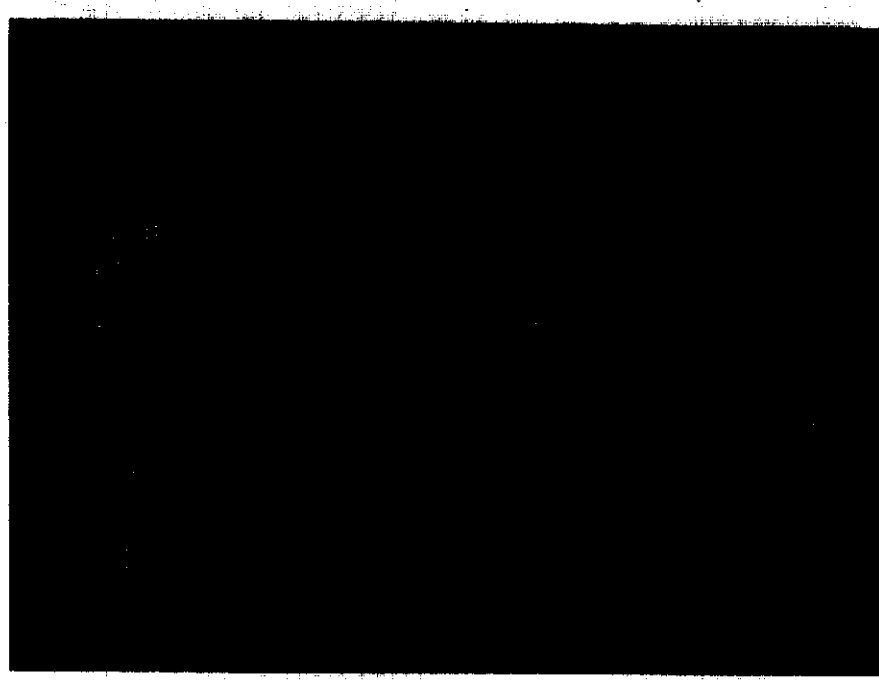
MR. RON SISSEM

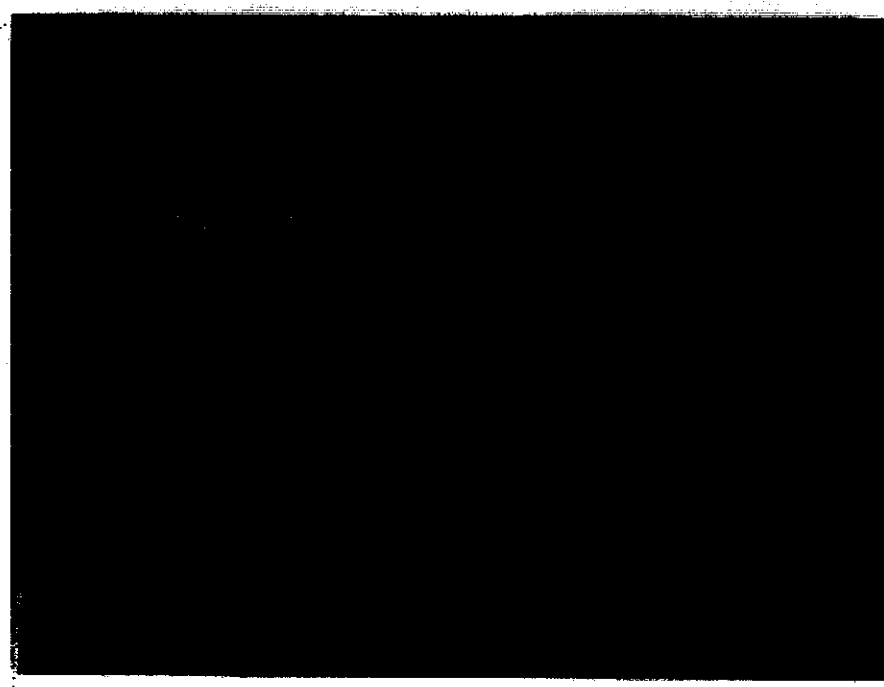
Chief of Party

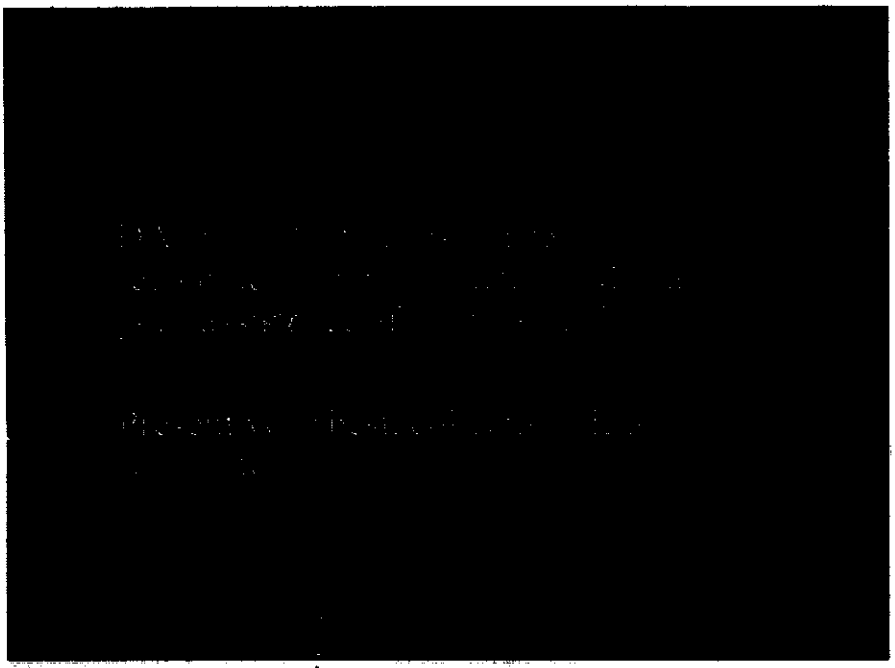
The Louis Berger Group Inc.
New Delhi











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Roundtable On

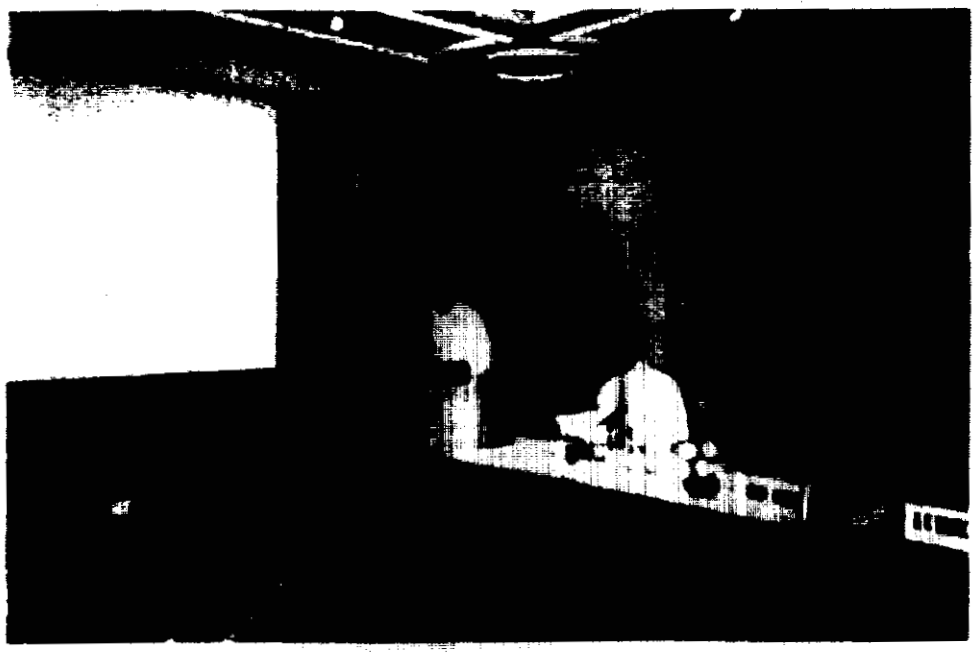
Renewable Energy for Sustainable Development: Opportunities, Barriers and Solutions

Friday, August 17, 2001
The Silver Oak, India Habitat Centre, New Delhi

PRGRAMME SCHEDULE

09.00 - 09.30	**Registration**	
09.30 - 10.15	**Inaugural Session**	
09.30 - 09.45	Welcome Addresses	Dr. Ashok Khosla, President, DA Mr. Ron Sissem, Chief of Party, LBG Mr. Richard Edwards, Dir., E^3, USAID
09.45 - 10.00	Keynote Address	Dr. N H Ravindranath, IISc.
	'Renewable Energy for Accelerated Rural Development'	
10.00 - 10.15	Keynote Address	Shri. A K Mangotra, Jt. Secretary, MNES
	'Opportunities and Barriers in Renewable Energy Development in India - An Overview'	
10.15 - 10.30	**Tea Break**	
10.30 - 13.00	**Session I: Opportunities and Barriers in Renewable Energy Promotion**	
10.30 - 11.30	Identification of Opportunities & Barriers - Stakeholders' Experiences Speakers: K Sudhakar, RR Bio Energies Ajay Narayanan, IDFC Subir Nathak, Market Dynamics R Vijaya Kumar, Ravi Enteck	
11.30 - 13.00	Opportunities and Barriers - Stakeholders' Perspectives *An Interactive Session*	
13.00 - 14.00	**Lunch**	
14.00 - 17.30	**Session II: Recommendations for Promotion of Renewable Energy in India**	
14.00 - 15.30	Working Groups: Development of Strategies to Overcome Barriers	
15.30 - 15.45	**Tea Break**	
15.45 - 16.30	Presentations by Working Groups to the Plenary	
16.30 - 17.30	Synthesising Solutions to Develop a Road Map for Large Scale Promotion of Renewable Energy	
17.30	Wrap Up	

MR. MANGOTRA REGISTERING FOR THE ROUND TABLE



DR. ASHOK KHOSLA DELIVERING THE WELCOME ADDRESS

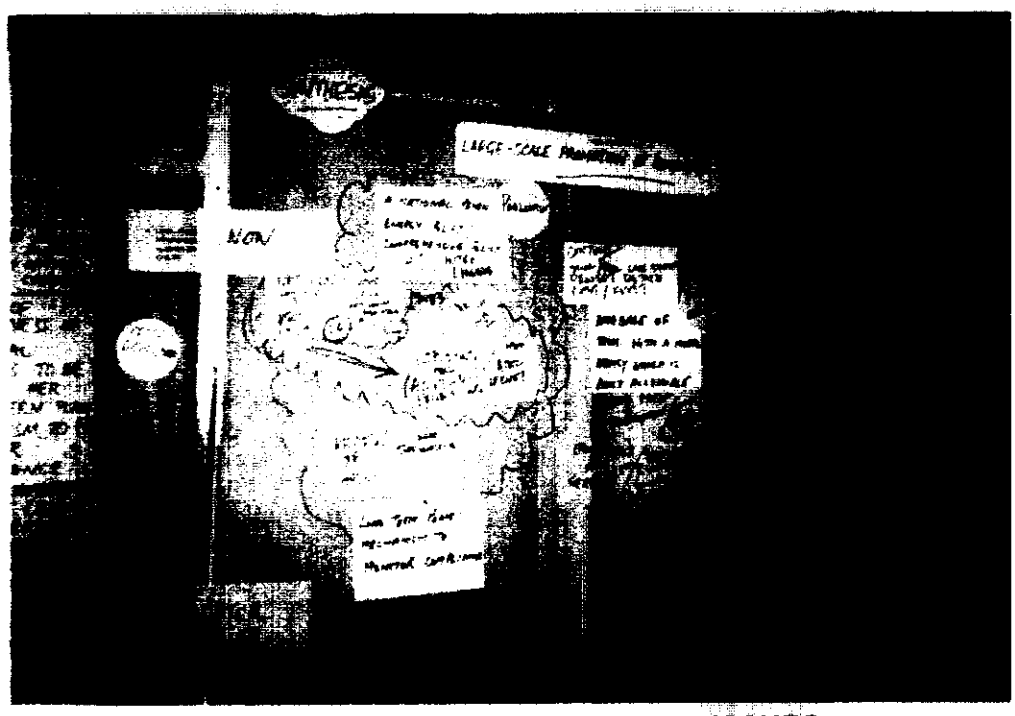
PROJECT DEVELOPERS DISCUSSING THE OPPORTUNITIES & BARRIERS

NGOs DISCUSSING THE OPPORTUNITIES & BARRIERS

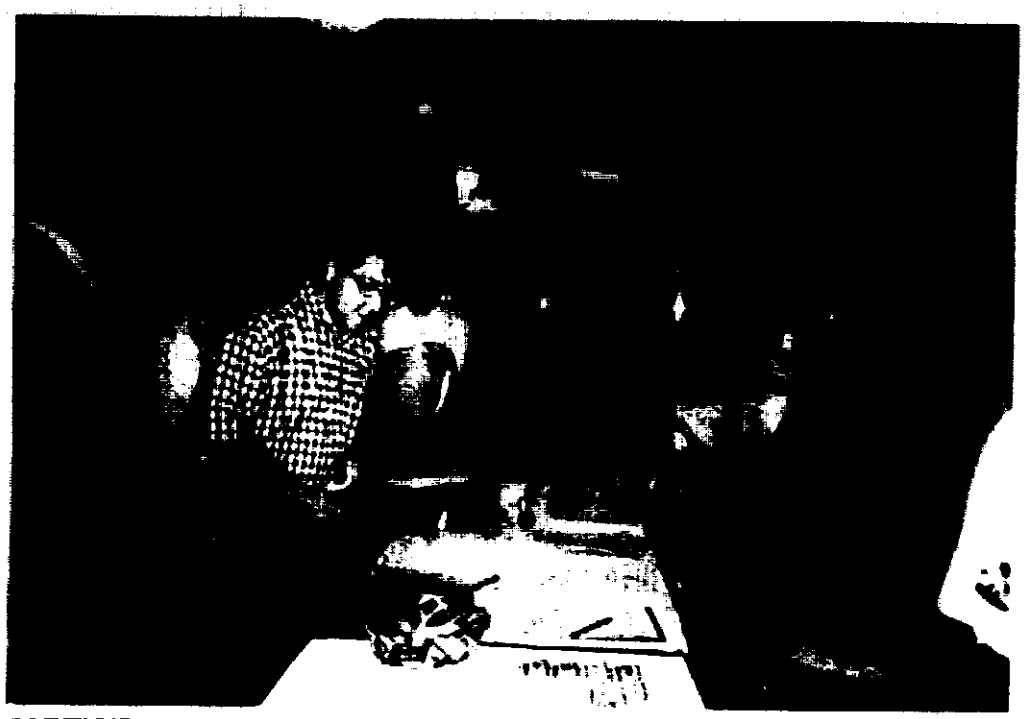
EXHAUSTED PARTICIPANTS REFRESHING THEMSELVES

MR. S PATARA MODERATING THE SESSION OF ROUND TABLE

PARTICIPANTS PRIORITISING THE RECOMENDATIONS MADE BY DIFFERENT WORKING GROUPS



PARTICIPANTS SHORTLISTED THE ISSUES THAT NEED IMMEDIATE ATTENTION



PARTICIPANTS REGISTERING THEMSELVES FOR THE ROUND TABLE

MR. RON SISSEM REGISTERING FOR THE ROUND TABLE

LIST OF PARTICIPANTS

Mr. Anil Malhotra
Vice President
ICICI Limited, ICICI Tower
Bandra-Kurla Complex, Mumbai - 400 051
Ph : 22 6531414, Fax : 22 6531268,69
Em : malhotra@icici.com

Shri. A. K. Mangotra
Joint Secretary
Ministry of Non-Conventional Energy Sources
Block No. 14, CGO Complex, Lodi Road
New Delhi – 110 003
Ph : 4361027, 4360707 Extn : 2203
Fax : 4361193, 4361027, 4361152
Em : mangotra@sansad.nic.in

Mr. Anand Sarma
Haselstiege 23a
48157 Monster, Germany
Ph : 0049 (0) 251 2150402
Fax : 0049 (0) 172 5344319
Em : Mail@Sarma.ws

Dr. Ashvin Raja
Director
Polyene Film Industries Ltd.
Renewable Energy Division
A – 11 & 12, Industrial Estate, Guindy
Chennai – 600 032
Ph : 2342306 / 2342307, Fax : 044-2341470
Em : polyeneg@giasmd01.vsnl.net.in,
rajanvarada@usa.net

Mr. Ajay Narayanan
Vice President
Infrastructure Development Finance Company Ltd.
ITC Centre, 3rd Floor, 760 Anna Salai
Chennai - 600 002
Ph : 8559440/48/56 Ext. 132
Fax : 8547597
Em : ajayn@idfc.com

Ms. Ayesha Grewal
Program Officer
Winrock International India,
7 Poorvi Marg, Vasant Vihar
New Delhi – 110057
Ph : 614-2965 (O), 686-5972 (R)
Em: saroj@winrock.ernet.in

Dr. Bhaskar Natrajan
Senior Project Consultant
India Canada Environmental Facility
D-1/56, Vasant Vihar
New Delhi
Ph : 6144051, 6146074, 6146653
Fax: 6147827, 6146236, 6146078
Em : bnatarajan@delhi.icco.net

Mr. Chintan Shan
Research Associate
Renewable Energy Technology Applications
Tata Energy Research Institute,
Darbari Seth Block, Habitat Place, Lodhi Road
New Delhi - 110 003
Ph : 4682100, 4682111 (Extn. 2128),
Fax : 4682144, 4682145
Em : cnshah@teri.res.in

Mr. Dilip Singh Adhikari
Consultant
Rural Energy Group, TERI
Darbari Seth Block, Habitat Place
New Delhi – 110 003
Ph : 4682100, 4682111 Extn. 2234
Fax : 4682144, 4682145
Em : dilips@teri.res.in

Mr. Indrajit S Anand
Engineering Adviser (Energy)
DFID, British High Commission
B-28, TARA Crescent, Qutab Institutional Area
New Delhi - 110 016
Ph : 6529123 Extn. 3318
Fax: 6529296
Em : I-ANAND@dfid.gov.uk

Mr. I. M. Rehman
Fellow
TERI, Darbari Seth Block, Habitat Place
New Delhi – 110 003
Ph : 4682100, 4682111 Extn. 2234
Fax : 4682144, 4682145

Mr. John Ryan
Project Manager
Winrock International India
7 Poorvi Marg, Vasant Vihar
New Delhi – 110057
Ph : 614-2965 (O), 686-5972 (R)

Mr. John Smith Sreen
Deputy Director (Envt.)
USAID, American Embassy, Shantipath,
Chanakyapuri
New Delhi – 110 021
Ph : 4198486, 4198520, 2619813 (R),
Fax : 4198454, 4198612,
Em : jsmith-sreen@usaid.gov

Mr. K. Sudhakar
Director
R R Bio Energies Ltd., Plot 39, Lane No. 1,
Street No. 3, West Marredpally
Secunderabad – 500 026, AP
Ph : 040-7808970, 7713422, 6212348
Fax : 040-7718162
Em : rrbio@hotmail.com

Mr. P. Jayakumar
Advisor Business Development
TATA BP Solar India Ltd.
251, Nilgiri Apartments., Alakhnanda
New Delhi – 110 019
Ph : 6238316, Fax : 6267436
Em : santosh@del2.vsnl.net.in

Mr. Parimal M. Sadhphal
India Project Cordinator
Partners in Rural Development Canada-India Renewable Energy Project (CIREP), E-3/3 Vasant Vihar
New Delhi – 110 057
Ph : 6154332/4902, Fax: 6154902
Em : partnersindia@samparkonline.com

Dr. R. K. Agarwal
Scientific Officer
Aditya - The Solar Shop, Shivaji Stadium, Connaught Place
New Delhi - 110 001
Ph : 3362750

Mr. Ram Berry
Program Manager
USAID, American Embassy, Shantipath, Chanakyapuri
New Delhi – 110 021
Ph : 4198712, 2244809 (R), Fax : 4198612
Em : rberry@usaid.gov

Mr. Rahul Arora
Project Manager
Winrock International India,
7 Poorvi Marg, Vasant Vihar
New Delhi – 110057
Tel: 614-2965 (O), 686-5972 (R)

Mr. R. R. Abhyankar
Advisor
Department of Science & Industrial Research, Qutub Institutional Area
New Delhi – 110016.

Mr. Rajesh Jain
Managing Director
Enhanced WAPP Systems India Pvt. Ltd.
44E/9, Kishangarh, Vasantkunj
New Delhi - 110 070
Ph : 6123505, 6133995, 6897483, Fax : 6131911
Mobile : 9810133805
Em : wapp@del3.vsnl.net.in

Mr. Rakesh Bakshi
Managing Director
Vestas RRB India Ltd., 189, Sukhdev Vihar
New Delhi - 110 025
Ph : 91-11-6848228, 6838365
Fax : 91-11-6835160

Mr. R. K. Gupta
Managing Director
Industrial Development Services
M-1, Kanchenjunga, 18, Barakhamba Road,
New Delhi - 110 001
Ph : 3312287, 3469, 4714; 3310580,
Fax : 3316470
Em : idsindia@satyam.net.in, ids@del2.vsnl.net.in

Mr. Rameshwar Sharma
Proprietor
Surya Instruments
1666-A, Govind Puri Extn.
Ph : 6468284
New Delhi - 110 019

Mr. S. S. Garud
General Manager
Hi-Tech Engineering Pvt. Ltd.
Celcius Solar Water Heaters
1-10-68/4, Chikoti Gardens
Begumpet, Hyderabad – 500 016
Andhra Pradesh
Ph : 7762813, 7767587, 6215758,
TeleFax : 040 7730546, 7762813
Em : celciussolar@yahoo.com

Mr. S. V. R. Rao
Consultant
Winrock International India,
7 Poorvi Marg, Vasant Vihar
New Delhi – 110057
Ph : 614-2965 (O), 686-5972 (R)
Em: saroj@winrock.ernet.in

Mr. Subir Nathak
Managing Director
Market Dynamics Limited
Chatterjee International Centre
17th Floor, Flat # 2, 33A, Jawaharlal Nehru Road
Calcutta – 700 071
Ph : 226-1916/1962/3057/3563
246-9947/9962, 245-7558/4389
Fax : 033 2280014, 2492815
Em : mdindia@onebox.com, snathak@yahoo.com

Mr. Saroj Mishra
Project Officer (Biomass)
Winrock International India
7, Poorvi Marg, Vasant Vihar
New Delhi - 110 057
Ph : 6142965, Fax : 6146004
Em : saroj@winrock.ernet.in

Ms. Shakuntala D.
Director
Ministry of Non-conventional Energy Sources
Block No. 14, CGO Complex, Lodhi Road,
New Delhi – 110003.

DEVELOPMENT ALTERNATIVES (DA)
B - 32, TARA Crescent
Qutab Institutional Area
New Delhi - 110 016
Tel : 6851158, 6967938, 6565370
Fax : 6866031
Em : tara@sdalt.ernet.in

Dr. Ashok Khosla
President

Mr. George C Varughese
Vice President

Dr. Vijaya Lakshmi
Manager

Dr. Aditi Haldar
Sr. Environmental Scientist

Mr. S. Patara
Manager – Shelter Group

Mr. P. K. Bhatnagar
Advisor, DESI Power

Mr. Nishant Bhardwaj
Environmental Scientist

Mr. Satyavan Ray
Software Professional

Climate Change Centre, DA

Mr. Kalipada Chatterjee
Manager

Mr. Abhijit Chatterjee
Environmental Economist

Dr. Vivek Kumar
Environmental Scientist

Mr. Samrat Sengupta
Scientist – Energy Management

Ms. Shalini Prakash
Environmental Economist

Ms. Sonika
Stenographer

APPENDIX C

URBAN MUNICIPAL WASTE ROUNDTABLE

AGENDA
GEP-CCS TEAM PRESENTATIONS
BREAK OUT GROUP CONCLUSIONS
PROCEEDINGS (FORTHCOMING)

National Workshop on Solid Waste Management

Facilitating ULB initiatives to meet MOEF objectives: what needs to be done?

Jointly Organized by
Ministry of Urban Development and Poverty Alleviation (MOUD&PA), GOI
Financial Institutions Reform and Expansion Project, FIRE (D), USAID
Greenhouse Gas Pollution Prevention Project, GEP-CCS, USAID

December 19-20, 2001
Grand Hyatt, New Delhi

The epidemic in Surat (Gujarat) in 1994 serves as a key milestone in the development of the solid waste management sector in the country. Since then India has seen a renewed focus on improving the delivery of services. Various ministries have launched programs and high-powered committees have been formed. Increased public awareness and participation have been manifested in public interest litigations and non-government organization involvement. Supreme court issued guidelines for solid waste management and recently (2000) in accordance with Supreme Court directions, the MOUD&PA, GOI, set up a Technology Advisory Group (TAG) for improving solid waste management. The TAG includes representatives from relevant Ministries, urban local bodies, NGOs and other technical experts. In January 2000, the Central Public Health and Environmental Engineering Organization under the MOUD&PA brought out a manual on Municipal Solid Waste Management to provide guidance to urban local bodies.

In October 2000 the Ministry of Environment and Forest (MOEF) issued rules that lay out ***procedures for urban local bodies regarding waste collection, storage, segregation, transportation, processing and disposal***. The MOEF rules also set ***deadlines for cities to establish suitable waste processing and disposal facilities***. Furthermore these rules allocate the following responsibilities:

- The municipal authorities are responsible for overall ***compliance*** with the rules. The municipal authorities are to submit an annual report to the State Department of Urban Development in a prescribed format. The municipal authority/operator are also required to obtain permission from the State Pollution Control Board for setting up a waste processing and disposal facility.
- The State UD has overall responsibility for the ***enforcement*** of the provision of these rules.
- The State Pollution Control Board is responsible for ***monitoring*** compliance of the set standards. They are also to submit to the Central Pollution Control Board, an annual report with regard to the implementation of these rules.

Clearly efforts by local bodies need to be facilitated if the current momentum is to be maintained and timely compliance of the rules is to be ensured. It is within this context that the workshop has been planned. The objective of the workshop is to identify areas of support required by urban local bodies and systems required to deliver effective solid waste management services. We hope to initiate an honest dialogue amongst all stakeholders.

11:45 – 1:45	**SESSION II - ULBs TO TAKE RESPONSIBILITY**
	The responsibility of complying with the MOEF rules lies with Urban Local Bodies (ULB). However given the context of unmanaged growth and lack of technical and financial resources, it is evident that cities need to be supported in this endeavor. This session will draw upon models selected from the national portfolio, to discuss what has been done and how cities are positioned to meet these challenges. The session hopes to identify commonalities amongst some of the more successful cities, with the aim of identifying potential lessons to be learnt. Further, the MOEF rules mandate municipal authorities adopt suitable technology to make use of waste so as to minimize burden on landfill. Landfilling is to be restricted to non-biodegradable, and non-recyclable waste. This necessitates that ULBs be equipped to address important questions regarding appropriate use of technology and its costs, financing, acceptable levels of risks and issues related to decision-making power. **Chairperson** Dr. Meera Mehta, Water and Sanitation Program **Presentations** 1. *"Introducing Private Sector Participation Within the Context of City Level Planning"*, Mr. D. Jagannadha Rao, Additional Commissioner, Hyderabad Municipal Corporation 2. *"Critical First Steps"*, Mr. Ajit Kumar Jain, Additional Municipal Commissioner, Municipal Corporation Greater Mumbai 3. *"Weighing Options: Decision Making Issues for Waste Treatment Options"*, Mr. Greg Wikler, Waste Management Consultant, GEP 4. *"Comprehensive City Level Planning"*, Mr. Ashok Dalwai, Municipal Commissioner, Bangalore Mahanagar Pallika **Discussion open to floor** **Panelists (to support as required during floor responses)** 1. Ms. Sandra Cointreau, Waste Management Consultant, USAID 2. Dr. Sunil Pandey, Research Associate, Tata Energy Research Institute
1:45 – 2:45	**Lunch**

DAY TWO December 20, 2001	
9:30 – 11:30	**SESSION IV - FINANCING SOLID WASTE PROJECTS**
	Private financing and development of solid waste projects (collection and transportation, resource recovery, sanitary landfills) are presenting unique challenges. Size of investment vis-à-vis project development and monitoring efforts, the issue of new and viable technologies, the scarcity of technical expertise, and the absence of adequate experience in structuring deals, often conspire to present excessive delays. The session will review basic elements of current finance from the perspective of individuals who are key to making these transactions happen. **Chairperson** Mr. V. Suresh, Chairman and Managing Director, HUDCO **Presentations** 1. *"Experiences in Lending for SWM for: Equipment, Collection and Transportation, Resource Recovery (composting and WTE)"*, Mr. V. Suresh, Chairman and Managing Director, HUDCO 2. *"Contractual and Financial Issues in Lending to WTE Projects – The Case of Lucknow"*, Mr. R. Mohan, AVP, IDFC 3. *"Lending to Urban Local Bodies for SWM"*, Mr. Shekhar Damle, Dy. General Manager, ICICI 4. *"Public Private Partnership – The BATF Case Study for Comprehensive Approach to SWM"*, Ms. Kalpana Kar, Member, Bangalore Agenda Task Force **Discussion open to floor** **Panelists (to support as required during floor responses)** Ms. Sandra Cointreau, Waste Management Consultant, USAID Mr. Greg Wikler, Waste Management Consultant, GEP
11:30 – 11:45	**Tea**
11:45 – 12:45	**BREAK OUT GROUPS**
	• Organize break out sessions • Hand out a short list of questions • Each group to come back with a three (3) concerns and/or questions to put to the panel of state representatives *(Facilitator to be present in each group)*
12:45 – 1:45	**Lunch**

DECISION MAKING ISSUES FOR WASTE TREATMENT OPTIONS

Weighing the Options

National Workshop on Solid Waste Management
December 19-20, 2001
New Delhi, India

Greg Wikler
Global Energy Partners, LLC
Lafayette, California USA

MSW Treatment in India

- Findings from methane assessment conducted for five Indian cities:
  - » Waste volumes are large
  - » Practices vary widely
  - » Key issues for consideration:
    - Funding mechanisms
    - Fund access
    - Agency roles and responsibilities
    - Waste composition
    - Disposal methods
    - Landfill infrastructure
- MoEF rules governing MSW
- Several MSW technologies already under demonstration

The "Complete" List of MSW Conversion Technologies

Obsolete:

1. Open dumps/ dump burning

Thermochemical:

2. Mass burning, incineration*
3. Gasification/pyrolysis*
4. Plasma arc, molten metal
5. Densification / pelletization*

Biological - In Vessel:

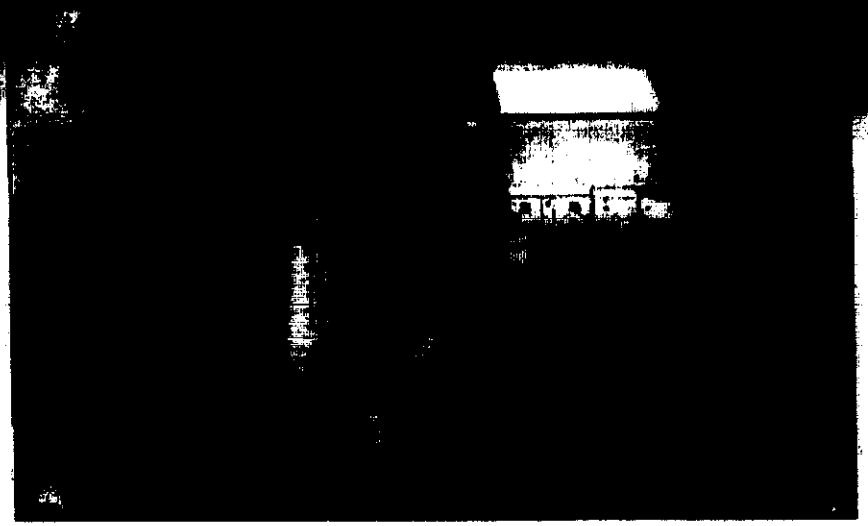
6. Anaerobic digestion* (biomethanation)
7. Waste to ethanol*

Biological - Composting

8. Aerobic composting/ vermicomposting
9. Conventional (sanitary) landfilling-no gas extraction
10. Conventional landfill with gas extraction*
11. Controlled bioreactor landfill with gas extraction*

Aerobic Composting

Through the action of aerobic (oxygen consuming) bacteria, wastes are heated to above 65°C which ultimately degrades metabolizable organics and reduces waste volumes



"Windrow" Composting Facility in the US

- » Advantages:
  - Eliminates more waste volume than any other non-thermal technology
  - Significant field experience
- » Disadvantages:
  - Requires energy for aeration or land area for turning
  - Returns more carbon to the atmosphere than any non-thermal technology

Anaerobic Digestion / Biomethanation

Organic waste is fed into a closed container where, over time, natural bacteria produce methane-rich biogas that can be used as fuel to power engines or turbines that generate electricity

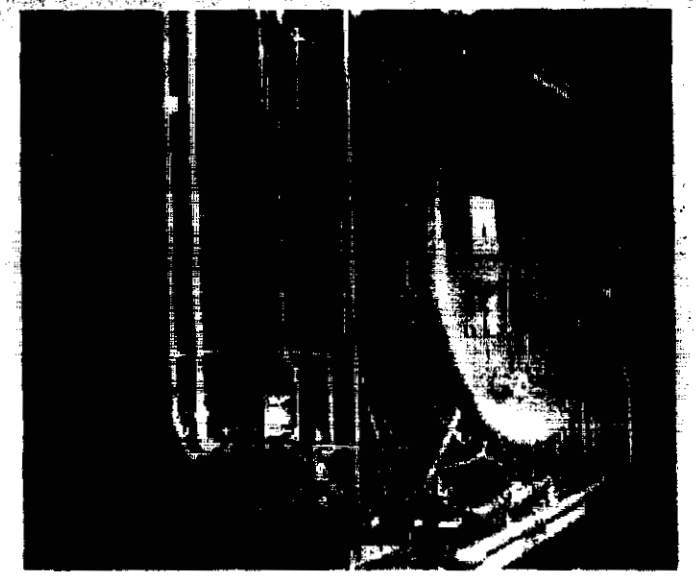
Biomethanation from Wastewater Plant in California

» Advantages:
- Can be small-scale with no external power source required
- Totally enclosed system and modular construction
- Odors and visible pollution reduced

» Disadvantages
- Highly capital intensive
- Requires high degree of biodegradable material

Densification / Pelletization

Segregating, crushing and drying of organic material from MSW into dense and solid fuel pellets that can be used as main or supplementary fuel for industrial boilers



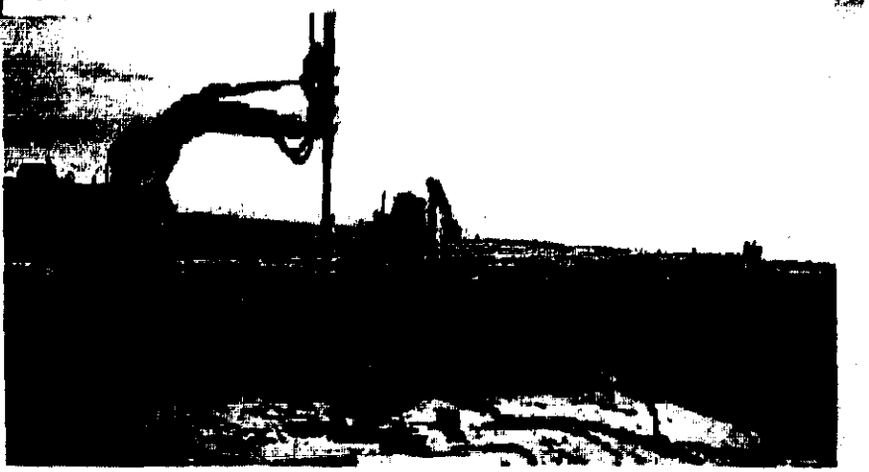
Industrial Boiler Powered by Pellets

» Advantages:
- High energy content
- Convenient for storage and transport

» Disadvantages:
- High energy consumption for crushing and drying
- Inorganic content tends to reduce effectiveness
- Only conducive during periods of lower rainfall
- May require gas cleanup to avoid air emissions

"Bioreactor" Landfill with Gas Extraction

A sanitary landfill that uses enhanced microbiological processes to transform and stabilize organic waste into high volume methane gas that can be collected and used for energy projects



Yolo County California Bioreactor

» Advantages:
  - Rapid organic waste conversion / stabilization
  - Maximum landfill gas capture for energy projects
  - More efficient use of landfill space due to rapid settlement

» Disadvantages
  - Requires high organic composition to be a cost-effective option
  - Limited technical experience

MSW-to-Energy Relevancy for India

Issues to Consider:

- Organic content of MSW is low relative to Europe/US
- Technologies are expensive and unproven
- Waste volumes not significantly reduced from these technologies
- MoEF rules may constrain cost-effective MSW-to-energy development

Recommendations:

- MSW-to-energy projects should be economically self-sufficient
- Landfill infrastructures should be modernized to accommodate MSW-to-energy technology development
- More R&D is needed for cutting-edge technologies

Demo project documentation
Annexure -7

A TRAINING FOR MUNICIPAL SOLID WASTE MANAGERS AND OFFICIALS

Chennai / Jaipur / Ahmedabad
December 10-19, 2001

John Bessonette, Ph.D.
Consultant to Global Energy Partners, LLC
Lafayette, California USA

Ph.D. in Biochemistry, Univ. of California Berkeley, 1970; Sanitary Engineering Research Laboratory, U.C. Berkeley 1974 – 1980, and 1990 – 1995. Professor, Applied Biology Georgia Institute of Technology 1981-1985.

DON C. AUGENSTEIN, President, Institute for Environmental Management, Inc. M.S. Biochemical Engineering, MIT, 1957; Over 30 years experience in biomethanation and waste to energy conversion Principal Investigator of Yolo County Controlled Landfill Project .

RAMIN YAZDANI, Deputy Director Public Works, Yolo County, California. Background: M.S. in Civil Engineering, University of California Davis, 1988. Co-Principal Investigator of Yolo County Controlled Landfill Project. Visited five Indian cities in February 2001 for the Louis Berger Group/Global Energy Partners CLRI-GEP Project.

- "biodegradable substance" means a substance that can be degraded by micro- organisms;
- "biomethanation" means a process which entails enzymatic decomposition of the organic matter by microbial action to produce methane biogas;
- "composting" means a controlled process involving microbial decomposition of organic matter;
- "landfilling" means disposal of residual solid wastes on land in a facility designed with protective measures against pollution of ground water, surface water and air fugitive dust, wind-blown litter, bad odour, fire hazard, bird menace, pests or rodents, greenhouse gas emissions, slope instability and erosion;

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or suspended material from it;

- "pelletisation" means a process whereby pellets are prepared which are small cubes or cylindrical pieces made out of solid wastes and includes fuel pellets which are also referred as refuse derived fuel;
- "vermicomposting" is a process of using earthworms for conversion of bio-degradable wastes into compost.

NOTE: Biomethanation = anaerobic digestion. "Composting" can be either aerobic or anaerobic, and carried out in-vessel or otherwise.

Constituted by The Honorable Supreme Court of India—March 1996

MANDATORY RECOMMENDATIONS

- ALL ORGANIC/BIO-DEGRADABLE WASTES COLLECTED FROM HOUSEHOLDS, SHOPS, MARKETS, HOTELS, AND OTHER ESTABLISHMENTS SHALL FIRST BE COMPOSTED BY FOLLOWING SUITABLE METHODS OF COMPOSTING WITH OR WITHOUT POWER GENERATION AS DEEMED APPROPRIATE;
- ONLY REJECTS AND DOMESTIC HAZARDOUS SOLID WASTE SHALL BE LANDFILLED.

...tion ... of wastes so as to minimize burden on landfill... The biodegradable fraction shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.

- Landfilling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Landfilling of mixed wastes shall be avoided unless the same is found unsuitable for waste processing. Landfilling shall also be carried out for residues of waste processing facilities as well as preprocessing rejects...

100

[illegible] OF MSW IN THE U.S.

[illegible] million (27%) was recovered.
2. Main biorganic components in wastes: paper/cardboard (40%), yard (14%), food waste (7%).
3. Recovery ranges from about 5% for plastics and food wastes to 40% for paper and metals.
4. 3,300 composting programs in 1995 handled 10 million tons of yard trimmings/food wastes.
5. Some 18 mixed waste, MSW, composting operations handled some 0.5 million tons per year.
6. 112 active MSW combustion units handled 100,000 t/day design capacity (85% capacity used).

[illegible] 19 incinerators some 3,000 t/day.
8. Total MSW combusted 33.5 million tons (16% total). Power, about 400 MW (85% capacity)
9. 120 million tons disposed of in some 2500 landfills; landfills becoming fewer but larger.
10. Landfill gas recovery some 400 MW, growing rapidly (almost 1,000 MW in 2001).
11. DATA ON MSW COLLECTION/LANDFILL DISPOSAL SUSPECT: From California data on Landfill disposition, perhaps 50% or more disposal taking place than estimated

[illegible]

- U.S. COLLECTS OVER 200 MILLION TONS /YR, BEFORE RECYCLING.
- INDIA RECYCLES LARGE FRACTION OF WASTES (RAGPICKERS')
- U.S. RECYCLES, COMPOSTS, COMBUSTS SOME 70 MT/YR OF MSW
- U.S. PER CAPITA MSW COLLECTED TEN-FOLD HIGHER THAN INDIA
- HOWEVER: INDIAN STATISTICS ONLY FOR URBAN POPULATION
- PER CAPITA U.S. PRODUCES FOUR-FOLD MORE MSW THAN INDIA
- INDIA GENERATES 0.4 – 0.6 KG MSW/PERSON/DAY, 2 KG IN U.S.

[illegible]

- [illegible] INDIA [illegible]
- HIGH VARIABILITY, DUE TO GREAT HETEROGENEITY.
- NON-COMPARABLE METHODOLOGIES BETWEEN STUDIES.
- PROTOCOLS NOT DESCRIBED, SEASONAL VARIABILITIES.
- OVERALL MSW COMPOSITION DATA IS RATHER UNCERTAIN

BASIS: CANNOT DESIGN MSW-TO-ENERGY PLANTS WITH BAD DATA

ACTIONS REQUIRED:

1. WEIGHT STATIONS - KNOW HOW MUCH
2. TAKE GRAB SAMPLES, SORT, WEIGHT, DRY, TAKE AVERAGE
3. COMPARE MSW COMPOSITION BETWEEN SIMILAR CITIES
4. OPERATE SMALL DEMO/ PILOT PLANTS IF NO EXPERIENCE
5. USE TECHNOLOGIES ABLE TO USE VARIABLE WASTES.

[illegible]

1. Open dumps, Dump burning
Thermochemical:
2. Mass-burning *, Incineration
3. Gasification/pyrolysis*
4. Plasma arc, molten metal
(Not Applicable/ Not Covered).
Biological - In Vessel:
5. Anaerobic Digestion *
6. Ethanol, H2 Fermentations*
7. Aerobic Composting/ Vermicomposting
8. Conventional (sanitary) landfilling - no gas extraction
9. Sanitary landfills with gas extraction and utilization*
10. Controlled bioreactor landfills with gas extraction*

* Waste-to-Energy Technologies

[illegible]: Combustion of [illegible]

with excess air at temperatures of about 800oC, liberates heat energy, heat gases and ash. "Mass burning" recovers 65-80% of heating value as steam. Incineration recovers no energy.

» Advantages:
- Produces power (mass burning), reduces residuals to a minimum
- Relatively free of odors and odor; requires no pre-processing

» Disadvantages:
- Low heating value [illegible] MSW not suitable for energy recovery
- Toxic metals and organics tend to increased air emissions
- High capital and O&M costs, final ash disposal.

- Low heat values of Indian MSW result in low heating value of RDF
- Size reduction too expensive and separation is imperfect
- Yield of pellets is only 10-20% of MSW inputs
- Requires addition of binders and agricultural wastes.

- FROM THE REPORT OF THE TECHNICAL ADVISORY GROUP (To the Indian Supreme Court, 2000): "One plant named Eden International Ltd. has been set up in Hyderabad of 250 MT per day installed capacity in the year 1998. Fluff pellets are being made to the extent of 10% of the total waste fed. The quality of end product is still not satisfactory. It is soft and not totally dry. Binding material is required and technology needs to be further improved to make the product acceptable. Looking to the financial weakness of the first pilot plant of fuel pellets and the Hyderabad plant, the technology is not recommended at this stage."

- Gasification/pyrolysis heating of MSW with limited air (gasification) or absence of air by application of external heat (pyrolysis) generates gaseous, liquid and solid fuels
  - » Advantages:
    - Storable oil/charcoal or gaseous fuels similar to fossil fuels
    - Allows use of larger-scale power generation options (turbines)
  - » Disadvantages:
    - Low quality gaseous and liquid fuels due to tars, alkali, acids, etc. requires gas clean-up and/or leads to failure/derating/high maintenance costs of power generation plant.

- » No gasification/pyrolysis plants in the US – several failed in late 1970's and early 1980's (Andco-Torrax, Monsanto-Landgard, Union Carbide-Purox, Garrett Pyrolysis).
- » Indian Situation
- » No plants in India operational to date.
- » MSW gasification plant proposed for Chennai by Australian company, but perhaps not being pursued.
- » Proposals made for MSW gasification wildly optimistic

Conclusion: Gasification of MSW not recommended

container where natural bacteria produce methane-rich biogas usable as fuel to generate electricity or for other uses.

- » Advantages:
  - Can be small-scale, no external power source required
  - Enclosed system allows gas capture and prevents CH_4 release
  - Modular construction, reduced odors, compost by-products.
- » Disadvantages
  - Requires highly biodegradable waste, carefully segregated MSW.
  - High parasitic energy requirements, capital intensive.

- Case Studies: European Processes, Unisyn Co. (Hawaii)

bacterial populations. Is also called "[illegible]", "anaerobic digestion", "anaerobic composting" "methanogenesis", "biogasification"

- Produces "biogas", a methane / carbon dioxide mixture useful as fuel: $(C_6H_{10}O_5)$ (Starch/cellulose) + $nH_2O \rightarrow nCH_4 + nCO_2$ (+ bacteria)
- Efficiencies: from 30 to 80% of calorific value of biomass ("higher heating value") converted to fuel - lowest for MSW, highest for starch
- Time-scales: hours (sugars/starch), days (food wastes), weeks (sludges), years (MSW). Factors: temperature, nutrients, moisture, etc.

and [illegible] of composting.

Applied extensively in the treatment of sludges from municipal wastewater treatment, for food processing wastes, animal and biodegradable industrial wastes. These are "in vessel" anaerobic digestion processes.

Applications to MSW are to separately collected or segregated food waste fractions (a small fraction of total MSW) for in-vessel processes or to mixed MSW treated in large "batch" reactors (e.g. bioreactor landfills).

Biomethanation of mixed MSW requires long time periods due to unavoidable kinetic limitations in degrading particles, cellulose, etc.

[illegible]

- 2. FOUNDER/PROMOTER ([illegible]) NO PRIOR EXPERIENCE
- 3. ORIGINAL CONCEPT WAS TO DIGEST ANIMAL (DAIRY) WASTES
- 4. SEVERAL OTHER COMPONENTS: SPIRULINA, COMPOSTING ETC.
- 5. PATENTED DESIGN: PLUG-FLOW TANKS, INTERNAL SURFACES
- 6. IN EARLY 1990's SWITCHED TO FOOD WASTES ([illegible]).
- 7. COMPANY SPENT ABOUT [illegible] MILLION ([illegible]) OVER FIRST DECADE
- 8. PARENT COMPANY CEASED SUPPORT OF [illegible] IN MID-1990's
- 9. CASINO DEVELOPER BOUGHT PLANT AND CO. FOR $3.5 MILLION
- 9. BY NOW PLANT WAS PROCESSING ABOUT 35 Tons/Day FOOD WASTES

[illegible] 17

- [illegible]
- 11. PLANT NEVER CONNECTED TO GRID. ([illegible]).
- 12. ECONOMICS OF PLANT: [illegible] TIPPING FEE, COMPOST SALES.
- 13. PLANT MANAGER AND ENGINEER WERE KEY TO OPERATIONS.
- 14. NUISANCE LAWSUIT BY NEIGHBOR BECAME MAJOR PROBLEM.
- 15. DUE TO LAWSUIT [illegible] FORCED PURCHASE OTHER [illegible]. ([illegible])
- 16. LAWSUIT BALLOONED, SOME 40 LAWYERS BECAME INVOLVED
- 17. PLANT "SOLD" TO [illegible] ([illegible]).
- 18. PLANT CLOSED EARLY [illegible]: LAWSUITS, [illegible].
- 19. CURRENTLY NEW FOOD WASTE A.D. PLANT [illegible]

[illegible] 18

- ECONOMICS OF UNISYN PLANT, ACTUAL/PROJECTED

[illegible] 19

- [illegible]
- [illegible]
- "[illegible]" "[illegible]" [illegible]
- Prospects not good to get suitable source-separated food wastes for AD in India

- COSTS OF IN-VESSEL [illegible] ARE VERY HIGH
- Vendor projections cannot be independently verified, may not include all costs
- Independent studies by others suggest very high costs for such processes. ([illegible], Inc., Pacific Gas & Electric, Calif. Energy Commission)

- OVERALL ENVIRONMENTAL EFFECT IS [illegible].
- Even in Europe, A.D. of Food Wastes only handles a small fraction of MSW
- [illegible]
- Greenhouse gas emissions for In-Vessel A.D. higher than for [illegible].

CONCLUSION: In-Vessel Anaerobic Digestion not appropriate technology for India, [illegible], the U.S., Europe or Japan, [illegible].

- 3.15.4 POWER GENERATION, FUEL PELLETS AND BIO-METHANATION, ETC. (REPORT OF THE TECHNICAL ADVISORY GROUP, 2005)

- It is therefore suggested that local bodies should not experiment with any such expensive technology until after adequate experimentation and one or two successful pilot projects ... [and agencies of the] Government of India have advised them to adopt such technology or have certified that the technology is proven and can be adopted in Indian conditions.

[illegible] 21

- [illegible] Composting: [illegible] ([illegible] supplying) bacteria, oxidize wastes, produce heat, temperature rises above 60°C, wastes pasteurized, volume reduced and compost produced useful in horticulture and agriculture.

  Advantages:
  - Reduces waste volume more than other biological technologies
  - Windrow open air composting relatively low cost, simple process
- Disadvantages:
  - Requires energy for aeration or land area for windrow turning
  - Generates more CO2 than other biological technologies
  - MSW composting requires bioreactor, generates strong odors
  - Poor quality of MSW compost limits markets for such products.

[illegible] 22

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- Landfill Gas (LFG) Recovery: [illegible] designed ("sanitary") landfills where it slowly decomposes leading to landfill gas production that can be collected used as fuel for power and other applications.
  - » Advantages:
    - Low cost energy recovery due to economies of scale
    - Controlled LFG recovers high percentage of total gas potential
  - » Disadvantages
    - LFG production is slow and long-term in conventional landfills
    - Requires high volumes of waste and relatively large land areas
    - Environmental (political) opposition based on past experience
    - Indian waste will generates less LFG than U.S. waste.

[illegible] 5 years, and may double again). Potential of 5,000 to 7,000 Mwe

- Recycling / other Waste-to-Energy processes still leave major remnants of organics that requiring landfilling and that will generate LFG *in situ*.
- In U.S. 75%+ of waste is landfilled - lowest cost WE option.
- "Controlled Bioreactor Landfills" designed to maximize and accelerate LFG gas production and capture, by impermeable covers, moisture control, leachate recirculation). Case study: Yolo County "bioreactor"
- INDIA: landfilling only plausible Waste-to-Energy MSW Technology

- NEW TECHNOLOGY OF "CONTROLLED BIOREACTOR" LANDFILLS GREATLY INCREASES ENERGY RECOVERY AND REDUCES OVERALL COSTS.
- PAST PROBLEMS WITH GROUNDWATER CONTAMINATION BY LEACHATE FROM LANDFILLS HAVE BEEN RESOLVED WITH NEW LINING SYSTEMS.
- BOTH CONVENTIONAL ("SANITARY") OR CONTROLLED ("BIOREACTOR") LANDFILL DESIGNS ARE NEAR-TERM INDIAN MSW-TO-ENERGY OPTION.
- ECONOMICS OF LANDFILLS ARE APPROXIMATELY AN ORDER OF MAGNITUDE LOWER THAN ALTERNATIVES. (ECONOMICS SITE-SPECIFIC).

[illegible] RESULTING IN GAS AND LEACHATE PRODUCTION. THESE REQUIRE BASE CONTAINMENT AND CONTROL SYSTEMS AS IN LANDFILLS RECEIVING MIXED MSW, TO PREVENT GAS AND LEACHATE MIGRATION (REQUIRED).

- CONTROLLED "BIOREACTOR" LANDFILLS RESULT IN LONG-TERM STABLE REPOSITORY WHICH COULD BE RE-USED IN THE FUTURE (Landfill Mining).
- CONTROLLED "BIOREACTOR" LANDFILLS PRESENT THE BEST OPPORTUNITY FOR DEVELOPMENT OF APPROPRIATE MSW TO ENERGY PROJECTS IN INDIA.
- MERITS (SOIL, ETC.) NOT BARRIERS FOR LANDFILL ENERGY RECOVERY.
- A BIOREACTOR LANDFILL MAXIMIZES OVERALL ENERGY RECOVERY AND WASTE REDUCTION - BIOREACTOR LANDFILLS ARE COMPOSTING SYSTEMS

[illegible] the visibility due to dense smoke from burning [illegible] over a million people below elevated roadway. Such open dump problems led their banning.

- In their place "landfill" technology, essentially dumps with (daily) soil covers, starting in 1930's. Alternative was incineration of waste. Energy crisis of 1970's supported Waste-to-Energy systems (combustion, gasification, etc.).
- Experience with early landfills: Odors, Fires and Explosions. Landfill gas (LFG) found to be culprit -- can migrate far from landfill.
- Gas extraction from landfills helped LFG problem. Extraction via wells, vertical or horizontal (pipes or just gravel filled trenches). Containment: final covers of clay (however: impermeable cover creates "dry tombs" which are long-term problem).

[illegible] → Groundwater → Drinking wells contaminated.

- NEW RULES vs. 1930's: BASE LINING MANDATED. Sometimes required leak detection. Result: essentially eliminated groundwater contamination.
- TODAY: U.S. Landfills more esthetic, reduced problem. Landfill gas important renewable energy source, 1000 MW and growing rapidly
- REMAINING PROBLEMS:
  - Unpredictability/slow rollback of control of LFG recovery.
  - Limited Landfill life, public opposition to new landfill siting ("NIMBY").
  - Regulatory restrictions, such as complete enclosure ("Dry tombs")
  - Long-term management, stewardship, fate of landfill sites.

- R&D STARTED 1970's, STRONG COMMERCIAL INTEREST FOR PAST DECADE.
- CONTROL BIOLOGICAL CONDITIONS: LIQUID ADDITION, ETC. TO CONTROL METHANE GENERATION TO MAXIMUM YIELD AND STABILIZE WASTE FASTER AND ON SCHEDULE THAT IS MOST FEASIBLE
- DEMONSTRATIONS BEGUN IN CALIFORNIA, [illegible] (AUGENSTEIN, YAZDANI)
- QUESTION TO BE ANSWERED: IS THAT FEASIBLE? CAN WE CONTROL METHANE GENERATION FASTER? CAN WE MAXIMIZE ENERGY RECOVERY? STABILIZE FASTER? INCREASE LANDFILL CAPACITY? REDUCE COSTS?
- REDUCE FUGITIVE EMISSIONS TO LOWEST LEVELS POSSIBLE WITH BIOLOGICAL PROCESSES?
- Lab tests extremely encouraging in static modes ([illegible] et al. [illegible], Barlaz [illegible], many others. Initial project at Mountain View Calif. in 1980s also encouraging.

- INDIA NEEDS:
  - Fewer but larger SANITARY LANDFILLS (if needed, farther from major cities)
  - Deeper waste deposition for longer-term waste placement and lower costs.
  - Economies of scale for waste management operations
  - Sanitary Landfills, with daily cover, compaction, leachate management
  - LANDFILL GAS RECOVERY SYSTEMS with [illegible] if possible
  - Base lining to prevent leachate migration and water table contamination.
  - Drainage systems, leachage treatment,
  - Long-term maintenance until stabilization is satisfactory ([illegible] bioreactor landfills for complete stabilization, reducing long-term costs)

be difficult/costly or does large rubble prevent it? Need representative samples to get good statistics)

2. How much waste is really present. Gate waste changes: volume x density
3. How much moisture in waste? Dry at 105oC. Gate and landfilled waste.
4. Test for biological inhibition of methane generation. Are there problems?
5. Determine carbon/organics content with large samples (gate & landfilled)
6. Permeability tests: Liquid and gas as deemed appropriate/necessary
7. Toxic or energy-equipment deleterious gas components present?
8. Assess flood management conditions at landfill site
9. Measure recoverable gas rate before installing energy equipment

- 2. Use less permeable cover soil - clay or such*
- 3. Impermeable base layer (geomembrane or clay)
- 4. Better waste compaction during fill (increases capacity of landfill, reduces settlement)
- 5. Recover gas with wells and also near-surface permeable layers (shredded tires, etc.) and vacuum
- 6. Managed liquid addition*

*for maximizing and speeding-up LFG recovery

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- Group I: Storage, Collection & Transportation
- Group II:Processing & Disposal Options
- Group III:
- Group IV: Financing & Capacity Building

- **Source storage.**
  - Introduce storage at source (household level) by way of motivational efforts and involvement of local communities; and
  - Identify people who can organise local community participation, mohalla samitti, etc. to motivate & monitor source storage.
- **Primary collection.** Appropriate primary collection systems by
  - introducing house to house collection of waste by ULB;
  - organising local communities;
  - contracting out to private operators with an element of user charges.

- Simple transfer stations to be provided in cities where landfill sites are beyond 15 kms.

Street sweeping.

- Street sweeping to be carried out on a daily basis on all streets; and
- Scheduled weekly offs to be provided to the conservancy workers on rotational basis.

Legal Issues.

- Appropriate penal provisions to be incorporated in ULB Acts with powers to local authorities to levy fines; and
- Protection to officials under the Atrocities Act.

- Technology packaging integrated- centralised- economy of scale based
- Technology packaging meeting environmental norms
- Economic viability
- Adaptability
- Localised sustainability

- Need for differential technology & standards approach for < 350 TPD and > 350 TPD generating areas;
- 6 months grace period for upgradation of existing landfill sites including leachate management;
- Open dumping must stop immediately through the PCBs;
- Sanitary Landfills a must; and
- Site selection based on 1991 guidelines of the MoEF, otherwise meant for hazardous waste and waste catchment and residual disposal basis.

Financial Viability

- Professionalize Financial Mgt.
- Double entry accounting, improved budgeting systems and auditing;
- Improved MIS with focus on billing and collection;
- Separate municipal budget for SWM and identify actual cost of the service;
- Gradually move towards full cost recovery;
- Fees on Solid waste service:
  - Option 1: Single user charge
  - Option 2: Collection & transportation- fully recovered, and disposal- support from general revenues; and
- Improve efficiency of the system

State

- Strategic Planning;
- Preparation of guidelines for technology, finance and PSP;
- Facilitate availability of suitable sites for solid waste treatment & disposal;
- Set up a core group for hand holding support to ULBs;
- Devolve additional finances, tied to SWM;
- Evolve regulatory mechanism for PSPs;
- Harmonise Labour Laws to facilitate PSP;
- Document & Disseminate success stories; and
- Facilitate setting up of jointly owned facilities.