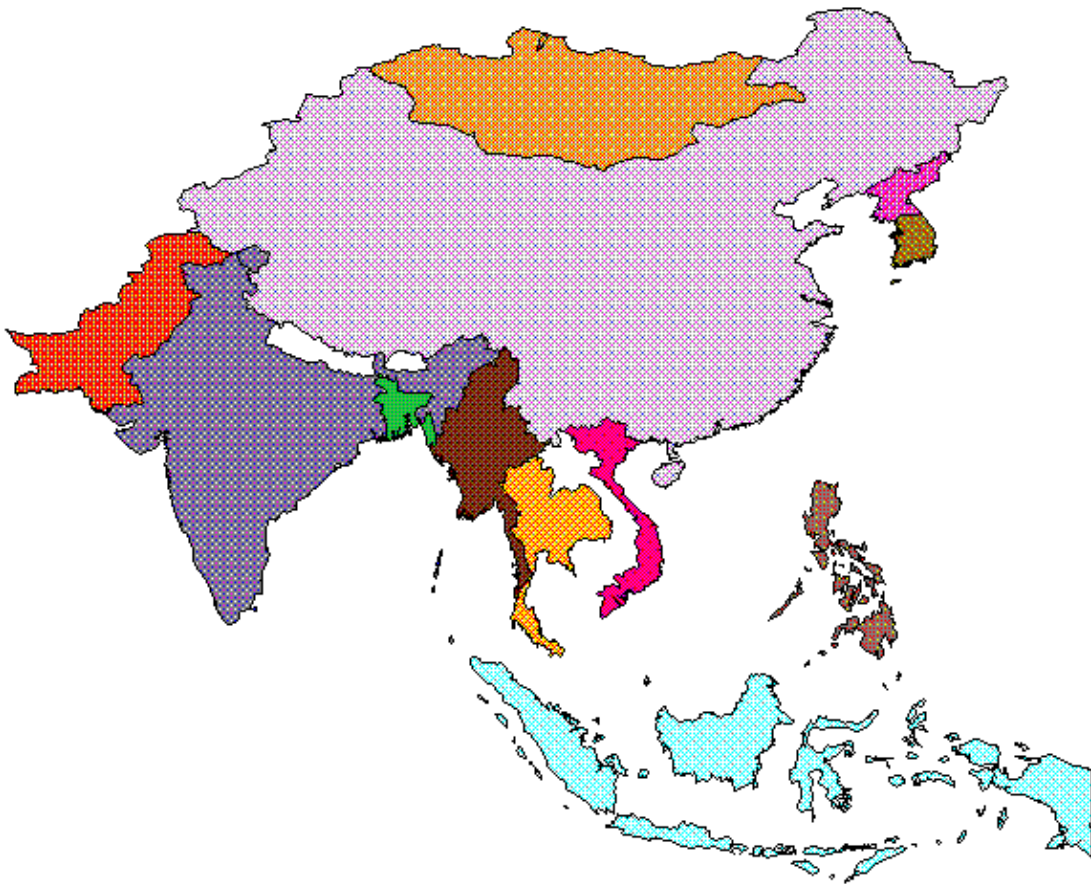


**REPORT OF
THE SECOND NATIONAL WORKSHOP
ON
BANGLADESH ALGAS STUDY**

OUTPUT B4



JULY 1997

Bangladesh Centre for Advanced Studies (BCAS)
in association with
**Bangladesh University of Engineering and Technology (BUET),
Bangladesh Institute for Development Studies (BIDS), and
Bangladesh Unnayan Parishad (BUP)**

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Introduction: Bangladesh ALGAS Second National Workshop was held on 10th May 1997 in Dhaka Sheraton Hotel, Shahbagh, Dhaka. The workshop was organised by Bangladesh Center for Advanced Studies (BCAS) in association with the Department of Environment (DOE). The main objectives of the workshop was the *Prioritisation of GHG Mitigation Options*. The workshop was inaugurated by Mr. Ahbab Ahmed, Secretary, Ministry of Environment and Forest, Government of Bangladesh. It was attended by 77 participants who represented many government and non-government institutions.

The workshop consisted with an inaugural session, two technical sessions and a concluding session. After the formal inaugural session presentations were made on the possible GHG mitigation options considered for Bangladesh, merits and demerits of each of the options considered and other relevant information. The sensitisation was followed by a prioritisation activity where the technical participants were asked to put value judgement on different priority areas/options. The session was followed by a concluding session.

The Inaugural Session: The inaugural session was chaired by Mr. Saiyid Mosharraf Husain, Director General, Department of Environment and Additional Secretary, Government of Bangladesh.

An address of welcome was made by the ALGAS Project Manager for the NCA, Mr. M. Reazuddin of the Department of Environment. In his address Mr Reazuddin explained the objectives of the workshop and gave an overview how the prioritisation activity would fit into the Bangladesh ALGAS Study. He requested the participants to give their inputs so that a national need based list of priority mitigation option could be achieved through the workshop.

Dr. Saleemul Huq, Co-ordinator, Bangladesh ALGAS Consortium presented the keynote address on Priority Areas for Greenhouse Gas Abatement in Bangladesh. In his presentation he also gave an overview on the main outputs and the current status of the project. He mentioned that mitigation activities may be conceived in two levels : Global level and National level. He gave an overview of the mitigation options considered for ALGAS Bangladesh Study and commented on how we may prioritise the options according to our national needs and capacity.

In the inaugural speech Mr. Ahmed pointed out that the impacts and devastation of the of greenhouse gas emission would be significant, especially for Bangladesh. He talked about importance of

formulating appropriate mitigation options and implementing those for the benefit of the country and the humanity.

In the concluding of the inaugural session Mr. Saiyid Mosharraf Husain, the Chairman of the session, gave his thanks to the participants and requested to contribute in the technical session.

The Technical Sessions: The second session of the MITIGATION WORKSHOP was devoted to the prioritisation of the mitigation options identified by the Bangladesh ALGAS National Technical Experts (NTEs) which has been submitted as TASKS B.1 and B.2. This session was chaired by Mr. Saiyid Mosharraf Husain, Director General of the Department of Environment. Assisting him was Dr. Saleemul Huq of BCAS, NTE team co-ordinator and Mr. M. Reazuddin, ALGAS Study Manager for the National Counterpart Agency (NCA).

The first technical session began with Dr. Ijaz Hossain, task manager for TASK B giving a presentation on Mitigation Options for Bangladesh. Dr. Hossain began with the 1990 emission inventory for all sectors (Energy, Agriculture, Forestry and Land-Use, Industrial Processes and Waste). Emission from the sub-sectors were also presented. Based on the 1990 inventory data and a set of assumptions for the economy, a projection of GHG emission was presented. This projection clearly showed the predominance of energy sector in greenhouse gas emission. The energy sector's contribution of GHG emission increases from 31% in 1990 to 81% in 2020. At the same time the agriculture sector's contribution decreases from 65% in 1990 to 15% in the year 2020. The sub-sectors which are major contributors in the year 1990 were identified. This set the background for the identification of the mitigation options.

The second part of the talk presented the areas of mitigation identified. Twelve areas were identified (list given in Appendix A) based on the following criteria.

1. Potential for abatement (total by that option)
2. National priority
3. Suitability of the technology to local conditions.

Based on the above criteria, the rationale for choosing the given area was developed. Appendix B presents the potential and rationale.

In the last part of the talk mitigation options for each identified area were presented. Each mitigation option was explained in terms of the technology involved and the potential for abatement. The presentation set the foundation for the prioritisation process which was the subject matter of second part of the second session. The objective was to use the participants to prioritise the mitigation options. This part of the session was conducted by Dr. Fasihuddin Mahtab, who is the Bangladesh ALGAS Study Advisor. The prioritisation procedure conceived was presented to the participants. This consisted of a form (see Appendix C) distributed to each participants.

The participants raised objection to the procedure mainly on the ground that they are not knowledgeable enough about each option to successfully complete the form. They expressed their unwillingness in performing numerical rating as required in the form. The participants however felt quite comfortable and keen to prioritise the areas of abatement rather than the options. Dr. Mahtab remarked that prioritisation of the actual mitigation options is best done by the NTEs who are knowledgeable about the technical, financial and other issues affecting the options. This was unanimously accepted.

In a lively discussion the participants gave their view points on some of the mitigation areas/options. The concern about the power situation in the country dominated the discussion. The high transmission and distribution losses and the low power generation efficiency were identified as an area of grave concern. The alarming situation developing in terms of the overuse of bio-mass for energy purposes was discussed and enhancement of sink through conservation of bio-mass was given high priority. The situation of the urban pollution and congestion in the transport sector was noted and urban passenger transport was given high priority.

Interestingly after the prioritisation of the areas the participants felt more comfortable with the mitigation options shown in Appendix C. At that point they were willing to numerically rate options. Thus the 49 options shown in Appendix C were prioritised by the participants.

Each of the participant was given a list of 49 mitigation options to put value judgement in a relative scale. Against each option boxes were provided to indicate the following

1. National Priority (score between 1 and 10, 1 for low, 10 for high)
2. Social Acceptability (score between 1 and 10, 1 for low, 10 for high)
3. Barriers (Low, Medium or High)

Participants were asked to rate each option in terms of the above three criteria. The participants then proceeded on to prioritise the areas for abatement identified based on potential and priority as provided in the presentation of Dr. Hossain.

The results were analysed in a Excel spreadsheet. First the options were evaluated only on the basis of "National Priority". Second these were analysed on the basis of "Social Acceptability" and finally the "Barriers" to each option was analysed. Following the analysis based on individual criteria, the effect of criteria 1 and 2 taken together was analysed. Lastly all three items were taken together to evaluate each option. To perform this exercise the barriers had to be quantified. The following scheme was used

Low - 2

Medium - 5

High - 8

Barriers were considered as negative quantity since each of the barrier restrict possibility of implementing the relevant option. Therefore, its value was subtracted from the total of the other two. Thus if someone had rated a mitigation option as 5 for "National Priority", 6 for "Social Acceptability" and Low for "Barriers" then the overall rating was 9 (5+6-2). The results of the prioritisation is given below.

The third part of second session was the concluding session presided by the Dr. Shamsuzzaman Majumder, Additional Secretary, Ministry of Industry. In this session the proceedings of the entire workshop were summarised and discussed. The secretary remarked that the constraints of each mitigation option must be carefully analysed. He gave several examples where options which look good in paper, do not work in practice. He also stressed the need to consult the latest database on technology. The fact that technology is moving very fast will cause mitigation option to change.

Before closing the session the chairman solicited the impression the younger participants especially from the DOE. They remarked that they were enthralled by the information presented and felt somewhat more comfortable with the FCCC process.

Results of the prioritisation: The results of the prioritisation process is presented in the following tables in five different ways: (a) based on National Priority only; (b) based on Social Acceptability only; (c) based on both National Priority and Social Acceptability; (d) based on Barriers; and (e) based on overall rating considering national priority, social acceptability and barriers together.

The following tables show the top ten mitigation options identified by the workshop participants. The mitigation options listed below received maximum ratings in the respective criterion. However, the listing does not show any particular order.

Table-1: Top ten Mitigation Options on the basis of National Priority

1. T1 Vehicle maintenance
2. T2 Road Improvement
3. T3 Better Traffic Management
4. T5 Integrated Urban Development
5. T8 Two Stroke to Four Stroke Engine
6. T10 Vehicles converted to Compressed Natural Gas (CNG)
7. R10 Improved Bio-mass Cooking stove
8. R11 Metering Natural Gas
9. I7 Brick-making
10. ES1 Combined Cycle

Table-2: Top ten Mitigation Options on the basis of Social Acceptance

1. T1 Vehicle maintenance
2. T2 Road Improvement
3. T3 Better Traffic Management

4. T4 Improved Telecommunications
5. T5 Integrated Urban Development
6. T8 Two Stroke to Four Stroke Engine
7. T10 Vehicles converted to Compressed Natural Gas (CNG)
8. R5 Improved Kerosene Lamps
9. R10 Improved Bio-mass Cooking stove
10. I3 Efficient Boilers

Table-3: Top ten Mitigation Options on the basis of National Priority and Social Acceptance

1. T1 Vehicle maintenance
2. T2 Road Improvement
3. T4 Improved Telecommunications
4. T5 Integrated Urban Development
5. T8 Two Stroke to Four Stroke Engine
6. T10 Vehicles converted to CNG
7. R10 Improved Bio-mass Cooking stove
8. R11 Metering Natural Gas
9. I3 Efficient Boilers
10. ES1 Combined Cycle

Table-4: Top ten Mitigation Options on the basis of Barriers

1. T1 Vehicle maintenance
2. T2 Road Improvement
3. T3 Better Traffic Management
5. T8 Two Stroke to Four Stroke Engine
6. T9 Three Wheelers converted to Compressed Natural Gas (CNG)
7. T10 Vehicles converted to Compressed Natural Gas (CNG)
8. R11 Metering Natural Gas
9. A2 Efficient Motors
10. I3 Efficient Boilers

Table-5: Top ten Mitigation Options on the basis of Grand Score (considering all criteria)

1. T1 Vehicle maintenance
2. T2 Road Improvement
3. T3 Better Traffic Management
4. T4 Improved Telecommunications
5. T5 Integrated Urban Development
6. T8 Two Stroke to Four Stroke Engine
7. R5 Improved Kerosene Lamps
8. R10 Improved Bio-mass Cooking stove
9. R11 Metering Natural Gas
10. I3 Efficient Boilers

REDUCTION OF EMISSION

Priority Areas for GHG Mitigation

1. Development of Power Sector
2. Reduction of Transmission and Distribution of Electricity
3. Reduction of Transmission and Distribution of Natural Gas
4. Saving Industrial Process Heat
5. Process Improvement in Industries
6. Freight Transport
7. Passenger Transport
8. Residential Lighting
9. Residential Cooking
10. Promotion of Renewable Energy Sources
11. Enteric Fermentation
12. Landfill Management

Enhancement of Sinks

Afforestation

Country-wide afforestation programme

- * Development of nurseries
- * Roadside strip plantation
- * Coastal plantation

Rationale

- 0 Large scale deforestation has taken place in the last two decades
- 0 Large potential exists

Potential

500,000 Gg of CO₂ sequestration

POTENTIAL AND RATIONALE

1. ***Development of Power Sector (>100PJ)***
 - 1990 efficiency 26%
 - Chronic shortage of electricity
2. ***Reduction of Transmission and Distribution Losses of Electricity (40 PJ)***
 - 1990 loss 40%
 - Chronic shortage of electricity
3. ***Reduction of Transmission and Distribution Losses of Natural Gas***
 - 1990 loss 8%
 - Gas companies facing severe financial problems
4. ***Saving Industrial Process Heat (>100 PJ)***
 - Largest demand category
 - Very inefficient
5. ***Process Improvement in Industries (>50 PJ)***
 - Primitive technologies used
 - Other environmental benefits
6. ***Freight Transport (20 PJ)***
 - Large demand
 - Heavy pressure on road system
 - Most inefficient mode is the most popular one
7. ***Passenger Transport (10 PJ)***
 - Urban congestion
 - Urban pollution
8. ***Residential Lighting (10 PJ)***
 - Lowers peak demand
 - Saves on electricity generation
9. ***Residential Cooking (> 50 PJ)***
 - Large wastage of resource (N.G.)
 - Loss of soil quality and deforestation
10. ***Promotion of Renewable Energy Sources (100 MW)***
 - Lot of scope of rural applications
 - Grid electricity is inefficiently distributed
 - Not cost effective to build transmission and distribution lines in rural areas
11. ***Enteric Fermentation (1500 Gg C eq.)***
 - Large Demand
 - Very simple solution
 - Fits in with other goals
12. ***Landfill Management (>5000 Gg Carbon equivalent)***
 - Serious public nuisance at the outskirts of cities
 - Health hazard
 - Large land requirement

Development of Power Sector

Combined Cycle Power Plant (short term option)

Rationale

80% of electricity is generated from natural gas

Investment cost is very low

Reduction of Transmission and Distribution Losses (both in power and gas sector)

1. ***Improvement of Management***

Rationale

Problem is theft and lack of incentive for the employees of the utility company

2. ***Metering***

Rationale

Proper metering can assess where the electricity/gas is going

Saving Industrial Process Heat

1. ***Housekeeping***

2. ***Energy Management***

3. ***Efficient Boilers***

4. ***Co-generation***

Rationale

Very poor idea of energy issues

Bad combustion control

Very bad maintenance

Inferior technology

Attitude to always avoid high first cost

Very large potential of co-generation

Process Improvement in Industries

1. ***Brick-making***

2. ***Paddy parboiling***

3. ***Textile***

4. ***Pulp and paper***

Rationale

Large use of bio-mass and wood causing loss of soil quality and deforestation

Use of modern technology can save a large quantity of bio-fuel and energy

Freight Transport

1. *Vehicle maintenance*
2. *Modal Shift from Road to Rail and Water*

Rationale

Vehicles are in very poor condition

The efficiency of rail and water are several times higher than road

Passenger Transport

1. *Vehicle Maintenance/Road Improvement/Traffic Management*
2. *Mass transit System*
3. *Two-stroke to four-stroke engines*
4. *CNG fuelled vehicle*

Rationale

The choice of these measures have been governed by the urban problems of congestion and pollution

All these measures in addition to tackling the above problems result in energy savings

Residential Lighting

1. *Fluorescent Lamp (short term option)*
2. *Compact Fluorescent Lamp (medium and long term option)*
3. *Improved Kerosene Lamps*
4. *Low wattage compact fluorescent lamps (CFL) for rural applications*

Rationale

In addition to saving energy these measures help ease out the peak electricity demand

The kerosene lamps used in rural areas are very inefficient

Residential Cooking

1. *Metering of Natural Gas*
2. *Improved Bio-mass Cooking stoves*
3. *LPG and Kerosene Cookers*

Rationale

Domestic natural gas is not metered

Excessive use of bio-mass is causing serious environmental problems

Promotion of Renewable Energy Sources

1. *Solar photo-voltaic energy systems (PV) for rural domestic and commercial applications*
2. *Harnessing wind energy in the coastal regions*

Enteric Fermentation

Methane emission reduction through improved feed

Landfill Management

1. *Incineration of urban refuse to stop production and emission of methane*
2. *Methane from sanitary landfill*

List of Mitigation Options Considered For Bangladesh: Scoring sheet

MITIGATION OPTIONS	National Priority	Social Acceptance	Barriers	Comment
<i>TRANSPORT SECTOR</i>				
T1 Vehicle maintenance				
T2 Road improvement				
T3 Better traffic management				
T4 Improved telecommunications				
T5 Integrated urban development				
T6 Modal shift from rail to road Modal shift from road to water				
T7 Mass transit system				
T8 Two-stroke to four-stroke engines				
T9 CNG three wheelers				
T10 CNG vehicles (buses, trucks etc.)				
<i>AGRICULTURE SECTOR</i>				
A1 Retrofitting irrigation pump-sets				
A2 Efficient motors				
<i>RESIDENTIAL SECTOR</i>				
R1 Incandescent replaced by fluorescent				
R2 Incandescent replaced by CFL				
R3 Advanced fluorescent bulbs				
R4 Electronic ballast				
R5 Improved kerosene lamps				
R6 Photo-voltaic (PV) lanterns				
R7 Low wattage CFLs				
R8 Efficient air-conditioners				
R9 Solar water heaters				
R10 Improved bio-mass cooking stoves				
R11 Metering natural gas supply				
R12 Efficient coal cooking stoves				
R13 LPG/kerosene to replace coal				
R14 LPG/kerosene to replace bio-mass				

List of Mitigation Options Considered For Bangladesh: Scoring sheet

MITIGATION OPTIONS	National Priority	Social Acceptance	Barriers	Comment
COMMERCIAL SECTOR				
C1 Incandescent replaced by CFL C2 Efficient air-conditioners C3 Co-generation C4 Building design (AC load reduction) C5 Improved cooking stoves C6 Solar water heaters				
INDUSTRY SECTOR				
I1 Fluorescent replaced by CFL I2 Efficient motors + drives + pumps etc. I3 Efficient boilers I4 Housekeeping + energy management I5 Co-generation I6 Solar water heaters I7 Brick-making I8 Paddy parboiling I9 Textile I10 Pulp and paper				
ENERGY SUPPLY				
ES1 Combined cycle power generation ES2 IGCC ES3 Pressurised fluidised bed ES4 Renewables and hybrids ES5 T&D improvement and maintenance ES6 T&D rehabilitation				

WORKSHOP PROGRAMME
Bangladesh ALGAS Second National Workshop

Date : 10 May 1997

Venue : Ball Room, Dhaka Sheraton Hotel

Inaugural Session (09:30 - 10:30)

Chairperson : Mr. Saiyid Mosharraf Husain, Director General, Department of Environment and Additional Secretary, Government of Bangladesh

09:15 Guests take their seats

09:30 Recitation from the Holy Quran

09:35 Address of Welcome by Mr. M. Reazuddin, ALGAS Project Manager, DOE

09:45 Keynote Address : "**Priority Areas for Greenhouse Gas Abatement in Bangladesh**" by Dr. Saleemul Huq, Co-ordinator, Bangladesh ALGAS Consortium

10:05 Inaugural Address by the Chief Guest, Mr. Ahabab Ahmed, Secretary, Ministry of Environment and Forest, Government of Bangladesh

10:20 Concluding remarks by the Chairperson, Mr. Saiyid Mosharraf Husain, Director General, Department of Environment and Additional Secretary, Government of Bangladesh

10:40 Refreshments

Technical Session 1 (11:00 - 13:00)

Chairperson : Mr. Saiyid Mosharraf Husain, Director General, DOE

11:00 "**Options for GHG Emission Mitigation in Bangladesh**" by Dr. Ijaz Hussain, BUET

12:00 Open Discussion

Prayer & Lunch Break (13:00 - 14:00)

Technical Session 2 (14:00 - 15:30)

Chairperson : Dr. Fasihuddin Mahtab, Chairman, National Advisory Committee on Climate Change

14:00 **Prioritisation of Mitigation Options from National Perspective: An Exercise**

Tea Break (15:30 - 16:00)

Concluding Session (16:00 - 17:30)

Chairperson : Dr. Shamsuzzaman Majumder, Additional Secretary, Ministry of Industries, GOB

16:00 Presentation by the Rapporteurs

16:20 Open Discussion

17:00 Chairperson's Closing Remarks

17:20 Vote of Thanks

LIST OF PARTICIPANTS

SL. No.	Name	Affiliation
1.	Dr. Azizur Rahman	Senior Fellow, BCAS
2.	Prof. M. Nurul Islam	Inst. of Appropriate Technology, BUET
3.	Mr. Abdus Soban	deputy Director, Department of Environment (DOE)
4.	Dr. Mohammed Eusuf	Senior Fellow, BCAS
5.	A. F. M. Anisur Rahman	Department of Environment (DOE)
6.	Md. Golam Mostafa Khan	Department of Environment (DOE)
7.	Dr. Syed Zahir Haider	Professor, Dept. of Chemistry, Dhaka University
8.	Zahidul Arif	Exec. Engineer, Dhaka Water Supply Authority
9.	Md. Muazzem Hussain	Beximco Pharmaceuticals
10.	Golam Mohiuddin	Research Officer, BCAS
11.	Ishtiaq Ahmed	Department of Forest
12.	Dr. S. M. Imamul Huq	Professor, Department of Soil Science, Dhaka University
13.	M. Auwar Iqbal	Bangladesh Agriculture Research Council
14.	Abdul hamid	Department of Environment (DOE)
15.	M.A. Malek	Department of Environment (DOE)
16.	Mosharaf Hossain	Deputy Director, Department of Environment (DOE)
17.	Md. Abul Kalam Azad	Department of Environment (DOE)
18.	Ahmed Al Faroq	Director, Department of Environment (DOE)
19.	Md. Shahjahan	Deputy Director, Department of Environment (DOE)
20.	Dr.M. K. Farooque	Joint Director, Department of Environment (DOE)
21.	Q. S. I. Hashemi	Deputy Director, Department of Environment (DOE)
22.	Kamar Ali	Research Associate, BIDS
23.	Dr. M. Mujibur Rahman	Bangladesh Univ. of Engineering and Technology

24.	Chinmoy Mutsuddi	Federation of Environmental Journalists of Bangladesh
25.	Md. Joynul Abedin	Assistant Director, Department of Environment (DOE)
26.	Md. Aminul Islam	Department of Environment (DOE)
27.	Md. Zillur Rahman	Department of Environment (DOE)
28.	Md. Abdul Mannan	Department of Environment (DOE)
29.	Dr. Q. K. Ahmad	Chairman, Bangladesh Unnayan Parishad (BUP)
30.	Dr. Ijaj Hossain	PMRE Department, BUET
31.	Engr. Rabiul Karim	Dhaka Water Supply Authority
32.	Mirza Shawkat Ali	Department of Environment (DOE)
33.	K. Md. Fazlul Haq	Department of Environment (DOE)
34.	Nurul Haque	Department of Environment (DOE)
35.	M. Shameem	Department of Environment (DOE)
36.	Md. Sohrab Ali	Department of Environment (DOE)
37.	A. H. M Kamruzzaman	Department of Environment (DOE)
38.	Dr. S. K. Purkayastha	Department of Environment (DOE)
39.	Kazi Abed Hussain	Department of Environment (DOE)
40.	B. U. H. Mst. Akhtaruzzahan	Department of Environment (DOE)
41.	M. A Ahed	Department of Environment (DOE)
42.	M. A. Jalil	Department of Environment (DOE)
43.	Mohammad Joynal Abadeen	Department of Environment (DOE)
44.	Sunil Kanti Bose	Assist. Chief Conservator of Forest, Forest Department
45.	Shah Ahmed Shafi	Research Officer, Department of Environment (DOE)
46.	Champa Nag	Bio-Chemist, DOE
47.	Razinara Begum	DOE
48.	Dr. Syed Abdul Hye	Professor, Economics Dept., Jahangirnagar University

49.	Md. Abdur Razzak	Department of Environment (DOE)
50.	Syed Nazmul Ahsan	Department of Environment (DOE)
51.	Dr. M. Asaduzzaman	Senior Research Fellow, BIDS
52.	Sukumar Biswas	Department of Environment (DOE)
53.	Rabi Gopal Biswas	Deputy Director, Department of Environment (DOE)
54.	Faruque Ahmed	Programme Co-ordinator, BCAS
55.	Md. Ziaul Huque	Department of Environment (DOE)
56.	Kazi Abu Sayeed	Green Earth
57.	Shahidul Islam	BCAS
58.	Mr. Yousuf	BCAS
59.	Olena Reja	Research Officer, BCAS
60.	M. Alam (Babu)	Fellow, BCAS
61.	Dwijen Mollick	Senior Research Officer, BCAS
62.	Dr. Youssuf Ali	Fisheries Advisor, BCAS
63.	Dr. Saleemul Huq	Executive Director, BCAS
64.	Mr. M. Reazuddin	ALGAS Project Manager, DOE
65.	Dr. Fasihuddin Mahtab	Bangladesh ALGAS Study Convenor