

**ASIA LEAST-COST GREENHOUSE GAS ABATEMENT  
STRATEGY (ALGAS)**

**Draft Final Report**

**PRIORITISATION OF MITIGATION OPTIONS  
FOR BANGLADESH  
Task B.5**

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## **INTRODUCTION**

This report has been prepared to fulfil Task B.5 PRIORITISATION OF MITIGATION OPTIONS of the ALGAS Bangladesh task order. This report draws heavily upon Task B.4 which is the Workshop on Mitigation Options. It also refers to Tasks B.1 to B.3. In Task B.2 fifty nine (59) mitigation options were identified. This large list of mitigation options though helpful in understanding the full range of mitigation opportunities, to be useful must be prioritised because investment funds for mitigation projects are severely limited. The prioritisation was performed in a workshop which is Task B.4 of the ALGAS task order. The workshop proceeding has been presented as a report to fulfil Task B.4. For prioritisation of the mitigation options three criteria were employed, namely, National Priority, Social Acceptance and Barriers.

The relevant details from the workshop proceedings and the process of evaluation leading to the final prioritised list is presented in the following sections.

## **RESULTS OF THE WORKSHOP PRIORITISATION**

To perform the prioritisation the opinions of the participants were recorded in specially designed forms. Appendix A shows the form distributed to participants in the ALGAS MITIGATION WORKSHOP. The form lists the 59 mitigation options identified (Task B.2) for Bangladesh. Against each option three boxes are provided to indicate the following

1. National Priority (1-10, 1-low, 10-high)
2. Social Acceptance (1-10, 1-low, 10-high)
3. Barriers (Low, Medium or High)

Participants were asked to rate each option in terms of the above three criteria. For the first two criteria a scale of 1 to 10 was suggested. If the mitigation option has a high national priority or social acceptance then a high score close to 10 should be given. On the other hand if the option has a low priority then a score close to 1 should be chosen. For the last criteria a qualitative response was sought. The results were analysed in an Excel spreadsheet. Appendix B gives the detailed result of the workshop prioritisation. Column 1 shows the total score (the sum of the scores awarded by all the participants) received by options on the basis of "National Priority", column 2 shows the scores received on the basis of social acceptance of mitigation options. To facilitate the treatment of the data in columns (1) and (2) with the responses to "Barriers to Implementation", the raw data, i.e., responses of workshop participants as low, medium or high had to be quantified. To do this the following conversion was used

Low - 2

Medium - 5

High - 8

Using this scheme the responses of participants were converted into numeric data between 2 and 8. Column (3) gives the total score received by each option on the basis of barriers to implementation. The addition of the entries in columns (1) and (2), i.e., the effect of considering "National Priority" and "Social Acceptance" together is given in column (4). The total of columns (1), (2) and (3), i.e., the effect of all three criteria, is given in column (5). It is worth remarking that barriers is a negative quantity. Therefore, its value was subtracted from the total of the other two. Thus if a mitigation option had a score 200 for "National Priority", 200 for "Social Acceptance" and 200 for "Barriers" then the overall score was 200 (200+200-200).

## **PRIORITISATION ON THE BASIS OF NATIONAL PRIORITY**

The top fifteen mitigation options in terms of "National Priority" are shown below.

1. T8 2-Stroke to 4-Stroke
2. T1 Vehicle Maintenance
3. ES1 Combined Cycle
4. T3 Better Traffic Management
5. R11 Metering natural gas
6. T7 Brickmaking
7. T3 Efficient boilers
8. T2 Road Improvement
9. T10 CNG vehicles (Buses, Trucks, etc.)
10. T10 Integrated urban development
11. R10 Improved Biomass Cookstove
12. T7 Mass Transit System
13. R1 Incandescent Replaced by Fluorescent
14. I1 Fluorescent replaced by CFL
15. T9 CNG Three-wheelers

By considering national priority the workshop participants have rated the mitigation option T8 2-Stroke to 4-Stroke as the number one mitigation option. This option deals with the highly polluting three-wheelers on urban roads. This problem has become so severe that to tackle the growing menace the government in the latest budget has increased the import duty. This is expected to encourage the use of 4-Stroke engines in three-wheelers. The second option in the above list also concerns urban pollution. Most vehicles are poorly maintained and are a large source of pollution. The third option in the list highlights the growing concern about the electricity supply situation in the country. Every day several hours of load shedding is becoming a regular feature. It can therefore be concluded that the workshop participants have correctly identified the most urgent issues affecting the country.

**PRIORITISATION ON THE BASIS OF “NATIONAL PRIORITY” +**  
**“SOCIAL ACCEPTANCE”**

The top fifteen options in terms of “National Priority” and “Social Acceptance” are shown below.

1. T3 Better Traffic Management
2. T2 Road Improvement
3. T8 2-Stroke to 4-Stroke
4. ES1 Combined Cycle
5. T1 Vehicle maintenance
6. R10 Improved biomass cookstove
7. T5 Integrated urban development
8. T7 Mass transit system
9. T3 Efficient boilers
10. T4 Improved telecommunications
11. R11 Metering Natural Gas
12. T10 CNG Vehicles
13. R1 Incandescent Replaced By Fluorescent
14. T9 CNG three-wheelers
15. R5 Improved Kerosene Lamps

In terms of social acceptance the workshop participants have put the transport options ahead of all others. The traffic situation in Dhaka is deteriorating every day. Unless urgent measures are taken, jams and long delays in travel will become a regular feature. Road improvement is also urgently required because bad roads cause damage to vehicles and increase fuel consumption due to slower travel. Thus it is easy to appreciate that Better Traffic Management and Road Improvement will enjoy high popularity. Here again we notice that the workshop participants have correctly identified options which have high social acceptance.

**PRIORITISATION ON THE BASIS OF “NATIONAL PRIORITY” +**  
**“SOCIAL ACCEPTANCE” + BARRIERS”**

The top fifteen options in terms of “National Priority”, “Social Acceptance” and “ Barriers” are shown below.

1. T3 Better traffic management
2. ES1 Combined cycle
3. T8 2-Stroke to 4-Stroke
4. T2 Road Improvement
5. R10 Improved Biomass cookstove
6. T1 Vehicle Maintenance
7. T4 Brickmaking
8. T7 Mass transit system
9. R11 Metering Natural Gas
10. R5 Improved kerosene lamps
11. I4 Housekeeping + Energy Management
12. T5 Integrated urban development
13. I3 Efficient Boilers
14. T10 CNG Vehicles
15. I10 Pulp and Paper

As can be seen, most of the mitigation options are common in the three prioritisations performed so far. The list above can be considered to be the workshop prioritised list by considering three criteria in equal weightage. Even though this list contains excellent mitigation options for Bangladesh, from the point of view of expert judgement certain modifications were felt necessary. This list has been used to generate the final prioritised by incorporating certain important considerations.

## **THE FINAL PRIORITISED LIST**

As can be seen in the workshop prioritised list given in the previous section, except for a very few all options are excellent options for Bangladesh. However, some of the options shown in the list are not easy to assess. For example it is very difficult to estimate the cost per ton of carbon abated for the option T3 Better Traffic Management or the option T2 Road Improvement. There is no doubt that these options will mitigate carbon dioxide, but it is very difficult to characterise these mitigation options and to collect the relevant data. In view of these difficulties the following options have been dropped from that list.

- T3 Better Traffic Management
- T2 Road Improvement
- T5 Integrated Urban Development
- I10 Pulp and Paper

In addition to the above considerations, it was felt that that the expert judgement of the NTEs should be incorporated. Thus the following mitigation options were added to the list.

- C3 and I5 Cogeneration
- T6 Modal Shift From Road to Rail  
Modal Shift From Road to Water
- I2 Efficient motors + drives + pumps, etc.
- R6 PV Lanterns
- R9, C6 and I6 Solar Water Heaters

The justification of including the first three options comes from two facts. First, the potential of abatement are large and, second, these options are from sub-sectors whose carbon dioxide emission are significant. The justification of PV lanterns arises out of the fact that many places in

Bangladesh is not served by the grid. Solar water heaters should be an obvious choice in a hot country.

The final prioritised list of mitigation options for Bangladesh is shown below. This list incorporates the following

- The workshop prioritised list
- A screening to eliminate options which could not be assessed
- Expert judgement of NTEs to include technically superior options

1. ES1 Combined cycle
2. T8 2-Stroke to 4-Stroke
3. R10 Improved Biomass cookstove
4. T1 Vehicle Maintenance
5. T4 Brickmaking
6. T7 Mass transit system
7. R11 Metering Natural Gas
8. R5 Improved kerosene lamps
9. I4 Housekeeping + Energy Management
10. R1 Incandescent replaced by Fluorescent
11. T10 CNG Vehicles
12. I3 Efficient boilers
13. R2 Incandescent replaced by CFL
14. C3 and I5 Cogeneration
15. T6 Modal shift from road to rail  
Modal shift from road to water
16. I2 Efficient motors + drives + pumps, etc.
17. R6 PV lanterns
18. R9, C6 and I6 Solar Water Heaters

**APPENDIX A**  
**ALGAS**  
**MITIGATION OPTIONS FOR BANGLADESH**

MITIGATION OPTION	NATIONAL PRIORITY	SOCIAL ACCEPTANCE	BARRIERS	TOTAL
<b>TRANSPORT</b>				
T1 Vehicle Maintenance				
T2 Road Improvement				
T3 Better Traffic Management				
T4 Improved Telecommunications				
T5 Integrated Urban development				
T6 Modal shift from road to rail Modal shift from road to water				
T7 Mass Transit System				
T8 2-Stroke to 4-Stroke				
T9 CNG three wheelers				
T10 CNG Vehicles (Buses, Trucks, etc.)				
<b>AGRICULTURE</b>				
A1 Retrofitting irrigation pump-sets				
A2 Efficient motors				
<b>RESIDENTIAL</b>				
R1 Incandescent replaced by Fluorescent				
R2 Incandescent and replaced by CFL				
R3 Advanced Fluorescent				
R4 Electronic ballast				
R5 Improved kerosene lamps				
R6 PV Lanterns				
R7 Low wattage CFLs				
R8 Efficient air-conditioners				
R9 Solar water heaters				
R10 Improved biomass cookstoves				
R11 Metering natural gas				

<b>MITIGATION OPTION</b>	<b>NATIONAL PRIORITY</b>	<b>SOCIAL ACCEPTANCE</b>	<b>BARRIERS</b>	<b>TOTAL</b>
R12 Efficient coal cookstoves				
R13 LPG/Kerosene to replace coal				
R14 LPG/Kerosene to replace biomass				
<b>COMMERCIAL</b>				
C1 Incandescent replaced by CFL				
C2 Efficient air-conditioners				
C3 Cogeneration				
C4 Building design (AC load reduction)				
C5 Improved Cookstoves				
C6 Solar Water Heaters				
<b>INDUSTRY</b>				
I1 Fluorescent replaced by CFL				
I2 Efficient motors + drives + pumps, etc.				
I3 Efficient boilers				
I4 Housekeeping + energy management				
I5 Cogeneration				
I6 Solar Water Heaters				
I7 Brickmaking				
I8 Paddy parboiling				
I9 Textile				
I10 Pulp and paper				
<b>ENERGY SUPPLY</b>				
ES1 Combined cycle				
ES2 IGCC				
ES3 Pressurised fluidised bed				
ES4 Fuel cells				
ES5 Renewables and Hybrid				
ES6 T&D improved maintenance				
ES7 T&D rehabilitation				

**APPENDIX B**

Mitigation Option	National Priority	Social Acceptance	Barrier	NP + SA	NP + SA + B
T1	244	202	158	446	288
T2	209	244	139	453	314
T3	229	250	125	479	354
T4	154.5	164.5	115	319	204
T5	196	185	142	381	239
T6	123	127	133	250	117
	xx	xx	xx	xx	xx
T7	191	183	117	374	257
T8	270	228	163	498	335
T9	171	154	146	325	179
T10	201	159	130	360	230
A1	133	128	84	261	177
A2	147	150	122	297	175
R1	177	148	108	325	217
R2	161	151	95	312	217
R3	115	106	111	221	110
R4	67	69	79	136	57
R5	156	164	73	320	247
R6	100	103	96	203	107
R7	75	83	57	158	101
R8	90	98	75	188	113
R9	113	104	85	217	132
R10	195	185	87	380	293
R11	218	150	115	368	253
R12	104	87	81	191	110
R13	146	129	88	275	187
R14	148	137	87	285	198
C1	167	134	112	301	189
C2	124	120	103	244	141
C3	146	109	106	255	149
C4	100	86	89	186	97
C5	158	136	78	294	216
C6	130	122	98	252	154
I1	173	138	107	311	204
I2	139	121	86	260	174
I3	211	165	137	376	239
I4	170	138	64	308	244
I5	156	130	103	286	183
I6	139	123	99	262	163
I7	216	156	104	372	268
I8	162	134	91	296	205
I9	155	130	75	285	210
I10	167	140	89	307	218
ES1	237	208	106	445	339
ES2	113	100	48	213	165
ES3	57	46	43	103	60
ES4	82	71	69	153	84
ES5	128	110	72	238	166
ES6	83	72	53	155	102
ES7	75	67	68	142	74

