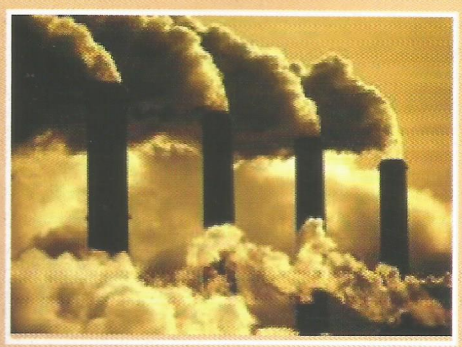
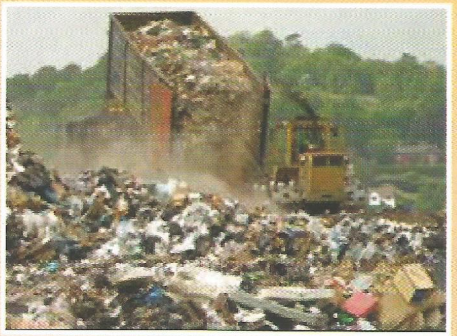
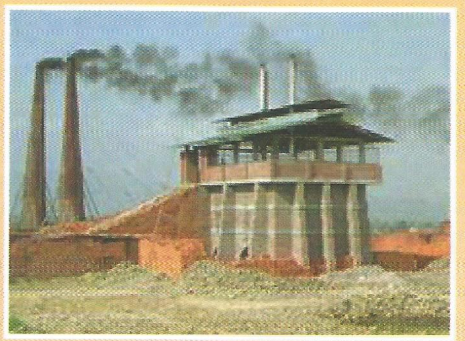
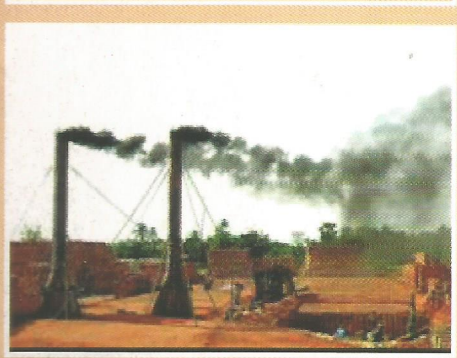
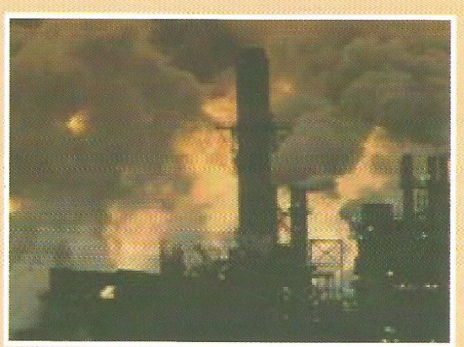
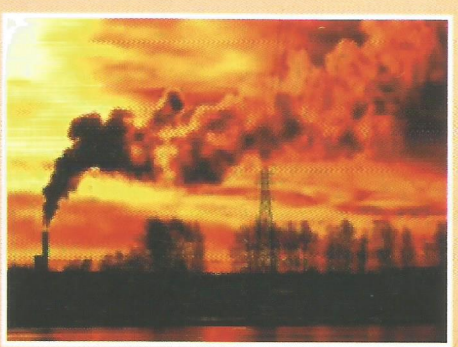
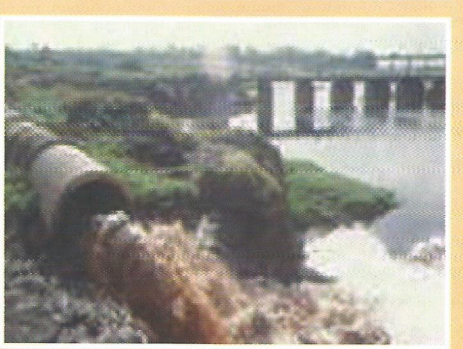
Clean Development Mechanism (CDM) Baseline

Power and Energy Sector



CDM Capacity Building and Baseline Development Project

Department of Environment

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Government of the People's Republic of Bangladesh

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Reviewed by
A.M. Monsurul Alam, Director (Climate Change & Int Convention), DoE
Mudabbir Bin Anam, Executive Engineer, Power Cell.
Mirza Shawkat Ali, Deputy Director (Int. Convention), DoE & Project Director
Md. Ziaul Haque, Deputy Director, DoE
Md. Mahfujur Rahman, Research Officer, CDM Capacity Building & Baseline Development project, DoE

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Preface

Bangladesh is regarded as one of the most vulnerable countries in the world due to climate change impact. As a developing country adaptation is the priority for Bangladesh. Nevertheless, Bangladesh has taken various initiatives in mitigation; Clean Development Mechanism (CDM), one of the flexible mechanism of Kyoto Protocol, is a such process through which most of the mitigation initiatives have been taken in the country.

The CDM Capacity Building and Baseline Development project is the initiative of the Department of Environment as the Secretariat of CDM Designated National Authority (DNA) in Bangladesh to facilitate the CDM project development in the country through capacity building.

It is expected, one of the activities of the project, the Baseline Development in the power and energy sector shall facilitate CDM project Development in this sector. The Initiative of the project will be successful if this Baseline helps to take up several future CDM projects in this sector.

Monowar Islam
Director General
Department of Environment

Acknowledgement

The Project Director of the CDM Capacity Building and Baseline Development Project would like to convey his heartfelt gratitude to the following institutions and individuals who extended their sincere support and cooperation for completion of the Baseline Study.

The Study Team of the Bangladesh Carbon, Rahimafrooz Renewable Energy Ltd. for developing the CDM Baseline in the Power and Energy Sector".

Climate Change Unit of the Ministry of Environment and Forests for financial support to pursue the CDM Capacity Building and Baseline Development Project.

Director General, Department of Environment and Director (Climate Change and International Convention) for providing continued encouragement and guidance to conduct the study.

The Deputy Project Director, Hasan Hasibur Rahman and Team members of CDM Capacity Building and Baseline Development project.

Finally, Department of Environment, Ministry of Environment and Forests, Government of Bangladesh, for appointing me as the Project Director of the project to pursue this study.

Mirza Shawkat Ali
Project Director and
Deputy Director (International Convention)

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Abbreviations

BM	Build Margin
BPDB	Bangladesh Power Development Board
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CERs	Certified Emission Reductions
CES	Connected Electricity System
CM	Combined Margin
EF	Grid Emission Factor
GWh	Giga Watt hour
HFO	Heavy Fuel Oil
HSD	High Speed Diesel
IPCC	Intergovernmental Panel on Climate Change
kW	Kilo Watt
kV	Kilo Volt
MR	Non-Must-Runs Low-Cost/Must-Runs
MW	Mega Watt
MWh	Mega Watt hour
NCV	Net Caloric Value
NMR	Non-Must-Runs
OM	Operating Margin
PD	Peak Demand
PES	Project Electricity System
SSC	Small Scale
tCO2	Tons Carbon Dioxide
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

Being engaged as CDM baseline development Consultant, Bangladesh Carbon, Rahimafrooz Renewable Energy Ltd. conducted a study on developing national baseline on power and Energy sector. The objective of this assignment is to develop a generalized emission baseline in the host country context that will facilitate the development of Clean Development Mechanism (CDM) projects acting as a reference source (when the baseline is accepted and approved by Department of Environment (DOE), Ministry of the Environment and Forest (MoEF) of Bangladesh). This final report is submitted as a part of this initiative to finalize the Grid Emission Factor (GEF) for national grid electricity system to be referred by the CDM projects as per scope. While doing so, we have incorporated the feedback/clarification sought by DoE on the Draft final report.

The calculation of the grid emission factor is based on the most recent version of UNFCCC's "Tool to calculate the emission factor for an electricity system" (Version 2.2.1, hereafter referred to as the "tool"), CDM Executive Board (CDM EB) 63, Annex 19. The tool can be found under following link: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

The team comprised members from Bangladesh Carbon of Rahimafrooz Renewable Energy Ltd. led by Dr. Ijaz Hossain Professor, Department of Chemical Engineering, Bangladesh University of Engineering and Technology. The authors would like to thank Bangladesh Power Development Board (BPDB) for their support in providing information required for this study. The teams may be found in below box:

Table 1: The Composition of the Study Team

Name	Designation
Dr. Ijaz Hossain	Professor, Department of Chemical Engineering, Bangladesh University of Engineering and technology Email: ijazhossain@gmail.com
Utpal Bhattacharjee	Manager, Carbon Project Development Service, Rahimafrooz Renewable Energy Ltd. Email: utpal.bhattacharjee@rahimafrooz.com
Tanuja Bhattacharjee	Executive, Carbon Project Development Service, Rahimafrooz Renewable Energy Ltd. Email: tanuja.bhattacharjee@rahimafrooz.com
Shayan Shafi	Senior Officer, Carbon Project Development Service, Rahimafrooz Renewable Energy Ltd. Email: shayan.shafi@rahimafrooz.com

This GEF determination was carried through a rigorous process as per UNFCCC guidelines and split into 7 steps to show the sequence of detail calculation. The objective of this step-by-step approach is to

compact the scope of GEF determination and arriving at a concrete estimated value of GEF on the national electricity system as mentioned in UNFCCC tool.

STEP 1. Identify the Relevant Electricity Systems

Bangladesh Energy and power generation structure is grossly divided in Eastern and Western part separated by the geographical location of the river Jamuna and geological features as well as natural resource distribution. The electricity distribution system of Bangladesh is comprised of Single National grid. In the east zone electricity generated is mainly by indigenous gas based power plants. Hydro in south-east region contributes a small portion to total generation. East zone has almost all the deposit of land based Natural Gas reserve, where west zone is solely dependent of imported fuel like HFO and HSD to generate conventional electricity. Although a good deposit of coal has been found in the north-west side of Bangladesh, but due to lack of capacity only a 240 MW mine mouth power plant is running with the Barapukuria coal extracted through underground mining. The east zone is highly industrialized and for which significant share of electricity generation goes to cater the requirement of the industrial. Upon requirement and based on national priority, power from east zone is transferred to west through two high voltage 230 kV East-West Inter-connector (EWI).

Bangladesh Power Development Board (BPDB) is responsible for major portion of generation and distribution along with a number of utility subsidiaries. The Electricity framework below of Bangladesh is shown (Figure 1). Power Grid Company of Bangladesh (PGCB) is the sole grid operating agency under BPDB and practically wheels the entire grid connected power to the connected 33 kV distributing utilities and some bulk 33kV dedicated industries.

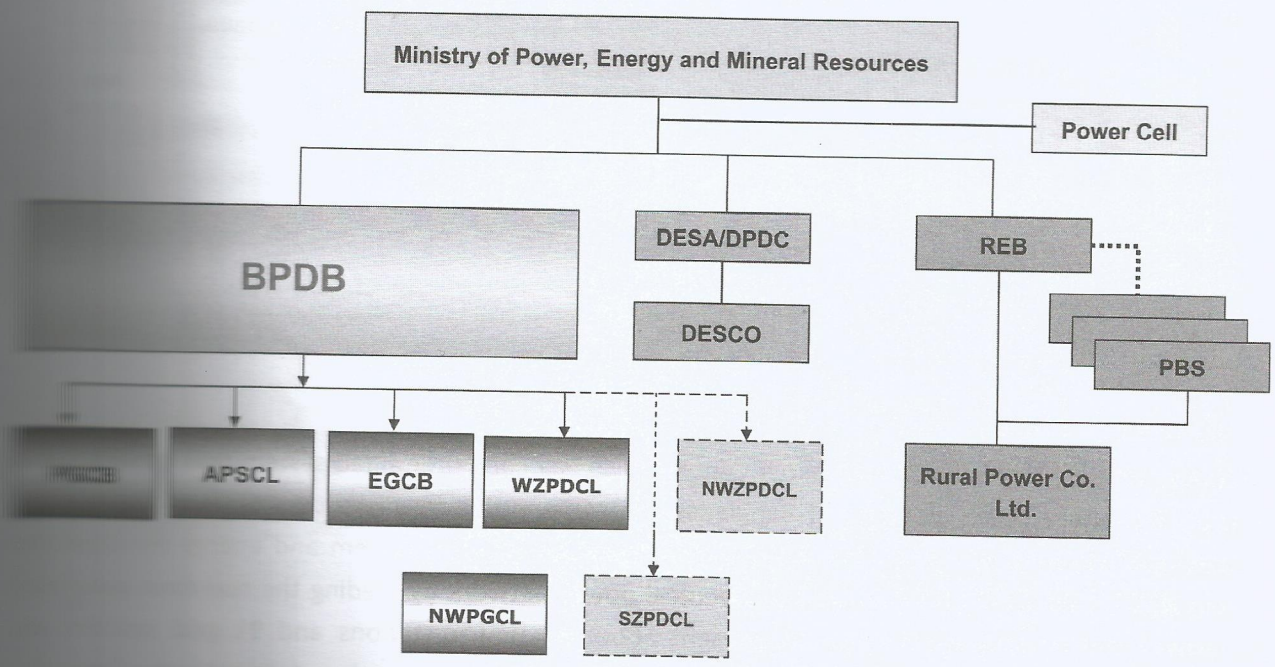

Figure 1: Structure of Power Generation in Bangladesh

There is no import or export in national grid at present in Bangladesh Electricity system. Figure 2 presents the overall Energy flow of Bangladesh electricity system.

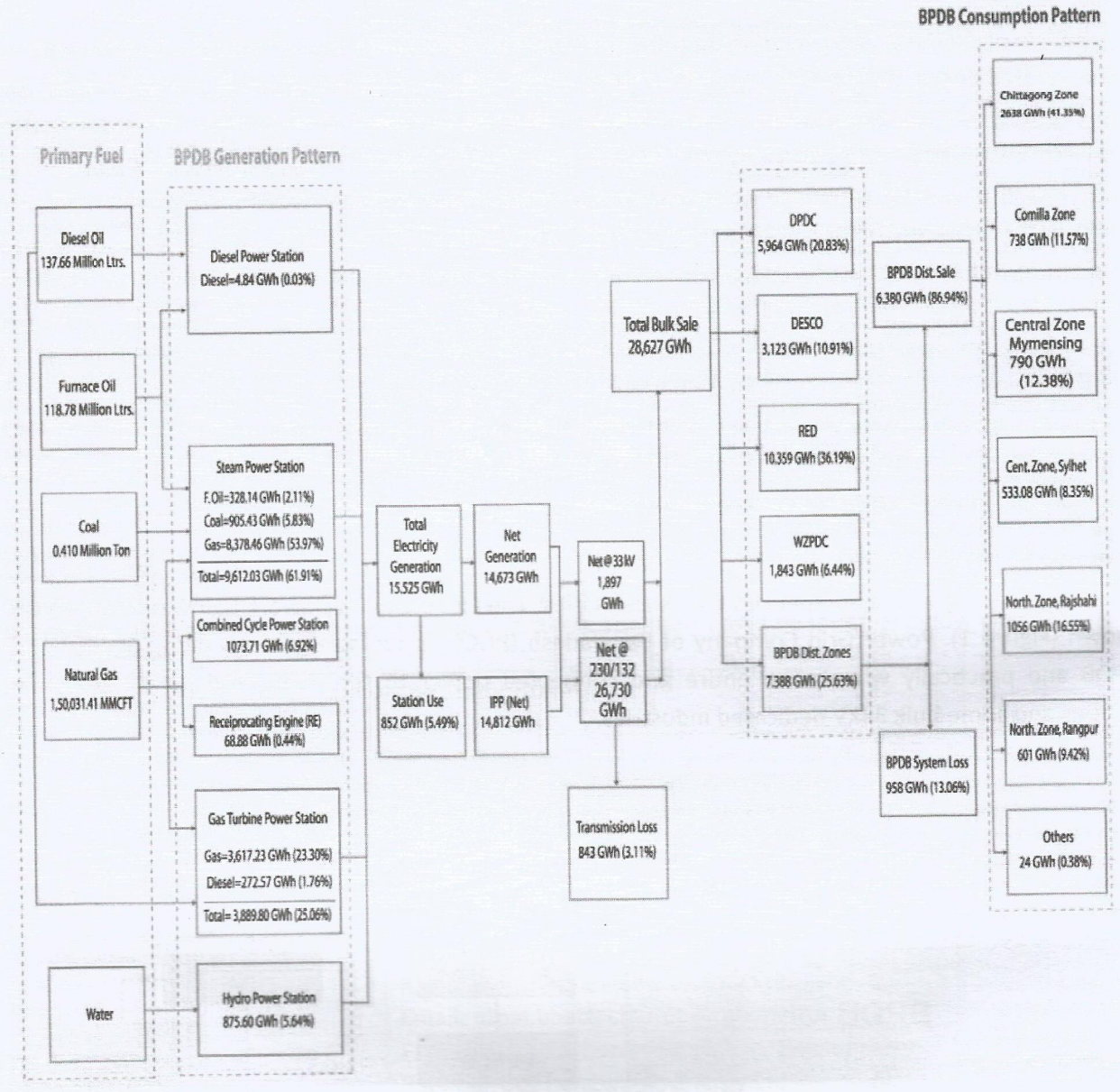

Figure 2: Bangladesh Electricity System at a Glance

PGCB has set up a National Load Dispatch Center which is a computer aided system that monitors and controls the entire power network of Bangladesh, become visible from the central point. This facility induced a modern supervisory control and data accusation (SCADA) system and energy management system (EMS) to control and manage the electrical power network by feeding the real time data from the power station and substations. At present about 86 power stations and 91 grid stations are interfaced with NLDC through 4300 km optical ground wire (OPGW) network as detailed in the Figure 3.

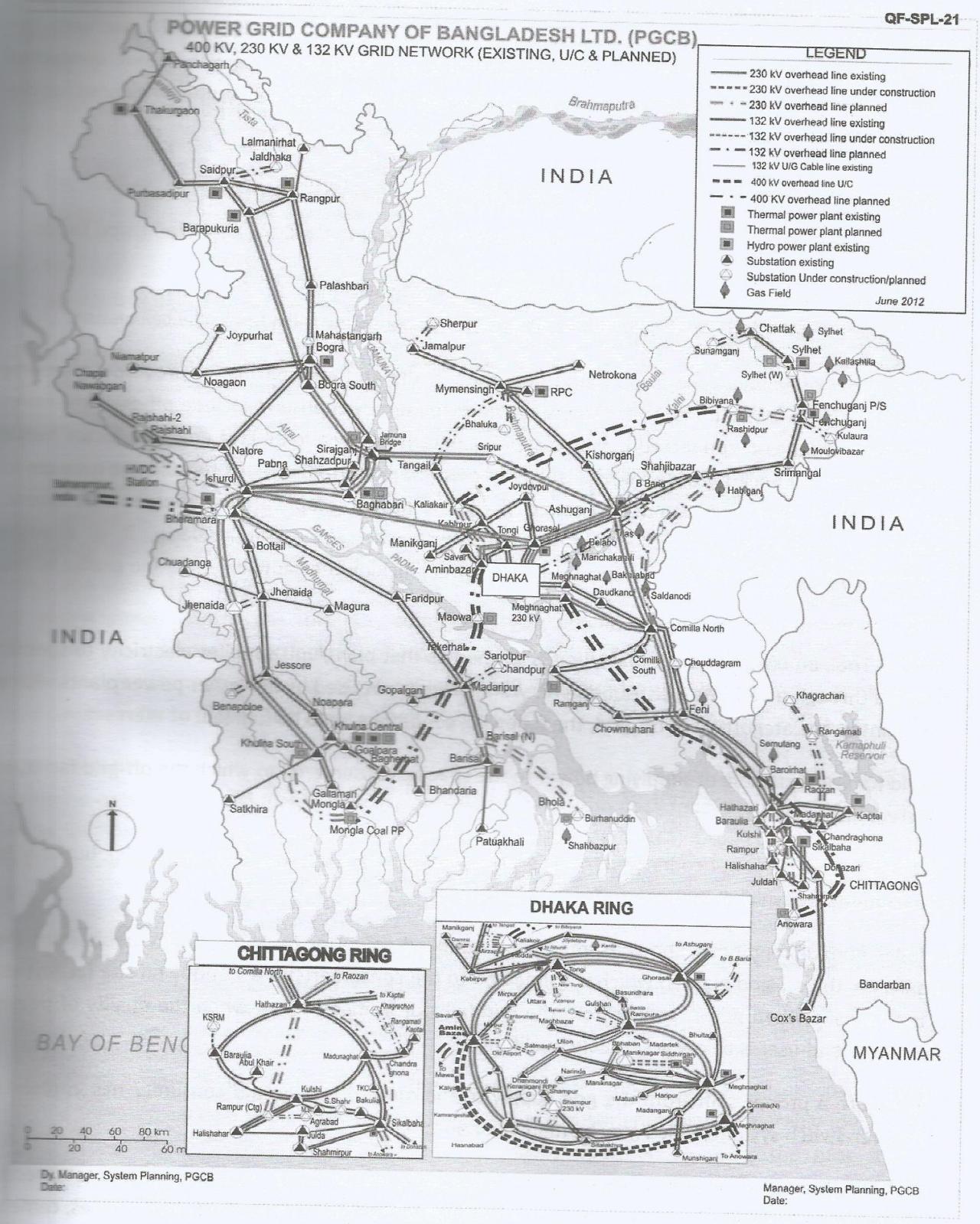

Figure 3 National Grid System of Bangladesh

The Build Margin (BM), the Operating Margin (OM) as well as the resulting Combined Margin (CM) are determined for the Project Electricity System (PES). This is consistent with CDM EB 28, and with the current version of the tool. As can be seen from Figure 2 and Figure 3, the PES is not connected to the neighboring countries through any import or export of electricity this is not considered for the calculation of the GEF in this study.

STEP 2. Choose whether to Include Off-Grid Power Plants

CDM EB63, Annex 19 page 4f, the tool offers two options to calculate the OM and BM emission factor:

- Option I: Only grid power plants are included in the calculation.
- Option II: Both grid power plants and off-grid power plants are included in the calculation.

A large number of captive generators are in operation in the grid area having no provision of adding surplus electricity to the national grid. The project participant may choose to include off-grid emissions. This report includes grid connected power plants for determining national grid emission factor hence option I was chosen because of the unavailability of published information. It is beyond the capacity of this assignment in time and resource to collect necessary data for captive generation to that extent. Considering the margin and its impact on national power generation scenario, it is strongly recommended to for calculating Grid Emission Factor (DEF) include the captive generation profile of the country.

As per the Tool, an off-grid power plant/unit is defined as that plant/unit supplies electricity to specific consumers through a dedicated distribution network which is not used by any other power plants. For a power plant to be categorized as off-grid, the following conditions need be fulfilled:

(i) A grid (or grids) capable of supplying power to the specific consumer(s) to which the off-grid facility is connected, must exist;

(ii) The off-grid facility is not connected to the grid(s) and cannot supply power to the grid(s), but only to the consumer(s) to which it is connected;

(iii) Under normal conditions, the consumer(s) are supplied power as fer their requirements from the grid only, i.e. the off-grid plant(s) which is connected to the consumer(s) is a standby on-site facility(ies that is only used when power supply from the grid fails (or in many cases, when the quality of power supply to the end-user is below acceptable quality);

(iv) To ensure a proper shift from the grid supply to the off-grid supply, the consumer has in place a change-over-switch system (which may be manual or automatic).

In case of Bangladesh, captive power generation in industrial sector though widely used but not directly matches to the entire scope of GEF calculation as outlined in the tool. In industries like textiles, cement and large RMG, use of grid power is limited as a stand by source or official due to the lack power quality historical record of load shedding and outage and availability of indigenous natural gas for captive

generation at a comparatively lower rate. However, there is a also a big group fallen under off-grid plants in residential and commercial and partly in industrial sector, operated by liquid fuel and gas serving as standby power generating units in the country which need to be investigated for its applicability in GEF calculation. Moreover, the inclusion of off-grid plants in the GEF is only allowed if one of the following two conditions are met.

- The total capacity of off-grid power plants (in MW) is at least 10% of the total capacity of grid power plants in the electricity system; or
- The total electricity generation by off-grid power plants (in MWh) is at least 10% of the total electricity generation by grid power plants in the electricity system.

If one of these conditions is not met, then off-grid power plants cannot be included in the calculation of the grid emission factor of the electricity system. In this study, however the extent of off-grid has not been possible to assess due to the constraint of time and resource.

STEP 3. Select a Method to Determine the Operating Margin

The calculation of the operating margin emission factor (EFgrid,OM,y) is based on the simple OM is applied. This section analyses whether the share of Low-Cost/Must-Runs (MR) is below 50%. In a first step, the share of Non-Must-Runs (NMR) in the PES is determined. For this case, NMRs are defined as **steam power plants, gas turbines, combined cycle power,** and **diesel plants.** Annex I provides a list of all grid connected power plants in Bangladesh with the fuel type. Using above definition allows for classifying all power plants in MR and NMR. This definition is based on the guidance of the tool (please refer to CDM EB63, Annex 19, p5, footnote 2).

A conservative approach for the definition of NMR would be followed, if it is ensured that NMR comprise only those fossil fueled power plants which serve the peak load of the electricity system. In exchange, fossil fueled power plants would have to be classified as MR, if the power plants (or units of the power plants) would serve the base load. Fossil fueled power plants/units generate base load only if:

- The power plant (or units of the power plants) is designed as a district heating/cooling power plant (i.e. Combined Heat and Power (CHP)). As the CHP not only generates electricity but also supplies heat, the power plant (or units of the power plant) may also serve the base load of an electricity system, and/or
- The power plant (or units of the power plant) applies supercritical coal technology. Supercritical coal technology features high initial investments and comparably low operational expenditures. Hence this project type is usually operated to serve the base load of an electricity system.

Annex 1 provides a list of fossil fuel power plants. None of the power units covered by these power plants is based on their supercritical coal nor features a CHP design.

Based on above analysis, the standard definition was adopted as the PES.

The table below shows that the five year average total generation amounts to 27,892 GWh/yr whereas the average share of MR amounts to 748 GWh/yr. The share of MR amounts to 2.68%. It is concluded that as the share of MR is below 50%, the simple OM can be applied.

Table 2: Determination of the Low-Cost/Must-Run Share					
Year	2007-08	2008-09	2009-10	2010-11	2011-12
Total electricity generation (GWh/yr)	24946	26533	26744	28613	32626
Average annual electricity generation in five years (GWh/yr)	27,892				
Generation from Low-Cost/Must-Run Resource (GWh/yr)	949.62	413.792	728.561	871.431	777.966
Average annual electricity generation in five years from Low-Cost/Must-Run Source (GWh/yr)	748.274				
Low-Cost/Must-Run resource share (%)	2.68				
Applicability of Simple OM or Average OM	Simple OM				

Conservativeness: The conservativeness of the evaluation was ensured by

- Discussing the classification of NMR/MR at the power unit level

STEP 4. Calculate the Operating Margin Emission Factor

In our next step the simple OM was calculated. The following input data was used:

- All fuel consumption data and all electricity consumption data was collected directly from the power companies or gathered through BPDB.
- Annex I provides a list of all power plants as well as their electricity generation for 2009-10, 2010-11 and 2011-12.
- Annex II-IV provides a default efficiency, Net Calorific Value (NCV) and emission factors for the various fuels used taken from UNFCCC Tool and IPCC default values

CDM EB's default efficiency factors were applied (Please refer to Annex II., Table 9) for the power plants where no actual data is available. For the diversity of quality and properties of imported fuel oil, default efficiency value is used for HFO/Furnace oil based power plants where no published data from BPDB are available.

Based on the above outlined input data, the OM emission factor was determined. Following CDM EB63, Annex 19, p7, formula (1), this allows in a subsequent step to calculate the OM emission level:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \; x \; EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO2 emission factor in year *y* (tCO2/MWh)
$FC_{i,y}$	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
y	Most recent historical year for which power generation data is available

For those power plants, where the fuel consumption data for the year 2011-2012 was available, we applied the formula as follows (CDM EB63, Annex 19, and formula 2).

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \; x \; NCV_{i,y} \; x \; EF_{CO2,i,y}}{EG_{m,y}}$$

Where

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
i	All fossil fuel types combusted in power unit *m* in year *y*
y	Most recent historical year for which power generation data is available

For those power plants, where the fuel consumption data was not available, the calculation approach was applied as follows (CDM EB63, Annex 19, formula 2):

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x \; 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	Average CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (ratio)
m	All power units serving the grid in year y except low-cost/must-run power units
y	Most recent historical year for which power generation data is available

Based on above calculation, the OM was determined. The findings are presented in Table 3 below.

Table 3: Calculation of the Simple OM	
2009-10 Electricity Generation (in MWh)	26,743.752
$EF_{grid,OMsimple,\ 09\text{-}10}$ (in tCO2)	0.641
2010-11 Electricity Generation (in MWh)	28,613.055
$EF_{grid,OMsimple,\ 10\text{-}11}$ (in tCO2)	0.658
2011-12 Electricity Generation (in MWh)	32,626.366
$EF_{grid,OMsimple,\ 11\text{-}12}$ (in tCO2)	0.666
Operating Margin Emission Factor(t-CO_2/MWh)	0.656

Conservativeness: The conservativeness of the calculation was ensured by:

- Using the most accurate data (i.e. measured data) when ever feasible,
- Using published data from BPDB Source, where available (I.e. power generation, fuel consumption, NCVs and EFs)
- For some power plants, IPCC default values for NCVs and EFs were applied.

STEP 5. Identify the Group of Power Units to be Included in the BM (Built Margin)

Following CDM EB63, Annex 19, Step 5, §a-§f, the sample group of power units m used to calculate the build margin consists of either:

- The set of five power units that have been built most recently; or
- The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Following the guidance of the tool, this analysis was conducted for the most recent year (i.e. 2011-12). The last five power plants generate 377,917 MWh (1.16% of total generation). The set which comprises the last 20% of the system generation covers 28 power plants. These 28 plants generate 6894552 MWh in 2011-12 (21.13% of total generation). Therefore the latter option shall be applied, as it encompasses the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Following this approach results in a BM which comprises twenty eight facilities commissioned between July, 2012 and March, 2011. Aggreko Int. RPP (70 MW) in Brahmanbaria is the power plant on the margin. Without Aggreko Int. RPP (70 MW), the BM group would generate only 19.57% of the total 2011-12 generation. Including Aggreko (70 MW) increases the generation share to 21.13%. Following the stipulations of the Tool, Aggreko (70 MW) has to be included. Calculating the BM emission factor results in a value of 0.674 tCO_2/MWh. Details may be found in Table 4.

According to information gathered from the BPDB, there is no power plant which is a) already commissioned b) developed under the CDM and c) supplies electricity to the grid. Hence, the analysis of the BM is constrained to those power plants which comprise the last 20% of system generation.

Step 6. Calculate the Build Margin Emission Factor

According to the tool, the build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units m identified in step 5 above. To calculate the BM, the following formula was applied (CDM EB63, Annex 19, formula 12):

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} x\, EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where,

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power generation data is available

Following this approach leads to the determination of the BM emission level for 2011-12. The results are presented in Table 4.

Table 4: Calculation of the Build Margin for 2011-12

Build Margin Group Option		(b)The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.				
No.	Name of power plant	Year commissioned	Fuel Type Energy Source	Net Electricity Generation (MWh/yr)	Emission Factor (tCO_2/MWh)	Emissions ($ktCO_2$)
1	Chandpur Combaind Cycle	Jul-12	Gas	91,558	0.467	42.729
2	Kata khali	22-May-12	HFO	36,855	0.705	25.998
3	Sylhet 150 MW GT	28-Mar-12	Gas	101,986	0.666	67.973
4	Power Pac mutiara Keranigonj	27-Mar-12	HFO	73,383	0.705	51.766
5	Julda,Acron Infra.Service Ltd.	26-Mar-12	HFO	74,135	0.705	52.296
6	Energyprima Ltd.[50MW Fenchuganj)	15-Feb-12	Gas	192,105	0.708	136.008
7	Amnura, Chapainababganj	13-Jan-12	HFO	67,081	0.705	47.320
8	Sangu,Dohazari	31-Dec-11	HFO	78,898	0.705	55.656
9	Hathazari	23-Dec-11	HFO	72,617	0.705	51.225
10	Shiddirgonj 2X120 MW SPS EGCB Ltd.	Dec-11	Gas	675,753	0.806	544.708

121	Gopalgang Peaking Power Station 100MW	16-Nov-11	HFO	98,284	0.705	69.331
122	Energy Prima, Bogra 55 MW	13-Nov-11	Gas	84,242	0.554	46.670
123	Faridpur Peaking Power Station 50MW	Nov-11	HFO	53,381	0.705	37.656
124	Titas 50MW Peaking Power Plant Daudkandi	29-Oct-11	HFO	73,100	0.705	51.566
125	Bera Peaking Power Station 71MW	28-Oct-11	HFO	68,496	0.705	48.318
126	Fenchugonj (Unit-2, 90 MW)	26-Oct-11	Gas	440,327	0.550	241.969
127	Baghabari 50 MW Peaking PS	29-Aug-11	HFO	95,847	0.705	67.612
128	Quantum Noapara (105 MW)	26-Aug-11	HFO	152,413	0.705	107.515
129	Shiddirganj Dutchbangla 100 MW	21-Jul-11	HFO	440,415	0.705	310.676
130	Ashuganj (United Power Ltd.) (53 MW)	22-Jun-11	Gas	419,662	0.619	259.640
131	KPCL(Khulna Power Company 115 MW)	1-Jun-11	HFO	609,008	0.705	429.605
132	Aggreko Int.Ashugonj (80MW)	31-May-11	Gas	628,505	0.615	386.658
133	Khanjahan Ali Noapara 40 MW	28-May-11	HFO	183,762,759	0.705	129.630
134	Ghorashal, Max Power 78.5 MW	22-May-11	Gas	303,755	0.617	187.541
135	IEL, Meghnaghat 100 MW	8-May-11	HFO	436,030	0.705	307.583
136	Precision Energy Ltd (Ashuganj 55 MW)	30-Apr-11	Gas	420,193	0.679	285.499
137	Summit Power Co. Ltd Madangonj (100 MW)	10-Apr-11	HFO	413,852	0.705	291.938
138	Aggreko Int. B.Baria RPP (70 MW)	6-Mar-11	Gas	508,908	0.610	310.435
Build Margin for 2011-12		Net Generation (GWh) 6,894,552			EF (tCO2/MWh) 0.674	
		CO_2 Emission (ktCO2) 4645.522				

Conservativeness: The conservativeness of the calculation was ensured by

- Using the most accurate data (i.e. measured data) when ever feasible,
- Using published data for power plants, where available (I.e. power generation, fuel consumption, NCVs and EFs)
- For some power plants, IPCC default values for NCVs and EFs were applied which is much higher than the average national efficiency level of the plants or specifically for that type of plants where published data is available

STEP 7. Calculate the Combined Margin Emissions Factor

Based on standard weighting of the BM and the OM, the GEF is 0.665 tCO2/MWh. Details are found in Table 5. Guidance on the selection of alternative weights can be found in the tool (CDM EB63, Annex 19, page 18f).

Table 5: Summary of the GEF Calculation of Bangladesh			
OM Emission Factor (in t-CO_2/MWh)	0.656		
BM Emission Factor (in t-CO_2/MWh)	0.674		
	Weight of the OM	Weight of the BM	CM Emission Factor (in t-CO2/MWh)
CDM Projects for the first year of the crediting period	0.50	0.50	0.665
CDM Projects for the second and third year of the crediting period	0.25	0.75	0.670

Conclusion and Recommendation

This final report is prepared with an estimated result of GEF considering our grid connected system only. In this process, critical observation and suggestion was taken from team leader from time to time to arrive at a reasonable choice. In some cases, due to unavailability of proper data on imported liquid fuel based power plant, IPCC default value was considered and due to that a lower value of emission in terms of tCO_2/MW than actual have been incorporated in the overall calculation. As this might have a significant contribution on GEF (estimated), we duly convey our concern to line ministries and BPDB in this case.

To ensure the wide scale usage of this GEF for the CDM project developers and GoB utilities, following things are recommended to extend the scope of this assignment

- To submit the approved national baseline to UNFCCC for final approval as standardized national baseline
- To update the baseline in every three years to incorporate the changes taken place in between as per the decision of CDM EB and to benefit the user of this database in the host country context

From our observation to utilize the potential of CDM project development in Bangladesh, the following aspects will have to be considered under a separate study.

- To include off-grid generation profile in the calculation of GEF through allocation of appropriate resource and time under new scope of this assignment.
- To extend the scope of national baseline for Power and Energy through identifying baseline fuel and technology for power and thermal energy generation for different potential users like residential, commercial and industrial sector.

The extension of this baseline project will be essential to cover the above potential scope of emission baseline study and require new timeline and budget.

Annex. I: List of Power Plants

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
					Gross Generation (KWh)	Net Generation (KWh)	Gross Generation (KWh)	Net Generation (KWh)	Gross Generation (KWh)	Net Generation (KWh)
Public Sector										
60 MW Shikalbaha	1984	40	551	Gas	43,551,529	38,550,126	115,650,061	102,923,391	98299567	87676869
28MW Ctg. BMPP				Gas	-	-			0	-18831
Shikalbaha 150MW PS	2010	150	3829	Gas	324,094,918	313,326,759	298,770,701	285,585,736		
Ashugonj 2x64 MW S.P.S (1,2)	1970	128	3735	Gas	340,279,697	306,946,203	631,217,720	578,058,611	838109303	785341987
Ashugonj 3x150 MW ST (3,4,5)	1986-88	380	27937	Gas	2,786,063,637	2,609,158,392	2,233,508,001	2,098,016,622	3065105495	2860820534
Ashugonj 90 MW CC	1982-86	58	4341	Gas	318,499,342	316,044,350	376,847,130	371,983,384	291707684	314893945
Ashugonj 56 MW GT	1984	40	5000	Gas	316,171,098	315,844,548	316,969,586	316,387,861	295513635	269210757
Ashugonj 50 MW	1982-86	50	3446	Gas	406,739,828	394,250,928	68,881,427	66,546,027		
Shiddirgonj 2X120 MW SPS EGCB Ltd.	2010	210	8847	Gas	702,689,000	675,752,832	522,954,000	502,594,200	173960000	166358260
Shahazibazar GT 57 MW	1968-69	38	464	Gas	19,431,000	19,188,120	134,008,000	132,654,174	26343000	25911720
Shahazibazar 60 MW (8,9)	2000	69	5254	Gas	415,902,712	414,179,764	423,435,424	421,772,333	458888938	457111223
Ghorasal 2x 210 MW ST (3,4)	1986-89	380	23430	Gas	2,213,033,651	2,052,899,311	2,365,830,765	2,206,767,129	2386082391	2232590430
Ghorasal 2x 55 MW ST (1,2)	1974	85	4201	Gas	335,302,204	312,782,856	357,818,453	332,278,834	360296373	323389005
Ghorasal 2x 210 MW ST (5,6)	1994,99	380	14438	Gas	1,389,102,534	1,269,977,592	1,336,584,851	1,220,646,393	2657339368	2502276796
Haripur 100 MW GT	1987	96	5003	Gas	355,036,500	353,686,580	461,991,700	460,452,700	183502100	182268780
Shiddirgonj 210 MW		150	12	Gas		-		860,803,096	1079190000	1013562684

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
SPS					1,984,500	2,070,036	919,034,550			
Tongi 109 MW GT Power Station	2005	105	5317	Gas	451,913,217	434,191,565	280,529,010	268,017,469	334063670	317062282
Sylhet 20 MW GT	1986	20	215	Gas	13,455,000	13,250,190	49,529,500	49,235,050	61677000	61321930
Sylhet 150 MW GT	2012	142	1104	Gas	103,951,646	101,985,761				
210 MW Rauzan # 1 (Chittagong)	1993	180	5927	Gas	566,250,000	507,983,964	212,950,000	187,058,287	461800000	408779452
210 MW Rauzan # 2 (Chittagong)	1997	180	1165	Gas	118,000,000	104,860,720	206,000,000	183,702,005	639300000	574820760
Fenchugonj 90 MW CC	1994-95	91	4838	Gas	538,550,000	527,326,240	618,688,000	607,990,940	604222000	602104790
Fenchugonj (Unit-2, 90 MW)	2011	105	3930	Gas	447,148,175	440,327,175	36,645,481	36,645,481	138050	138050
Baghabari 71 MW GT	1991	71	4254	Gas	364,490,000	362,487,535	489,112,000	486,605,620	470040000	466713477
Baghabari 100 MW GT	2001	100	8735	Gas	735,179,000	733,417,871	681,455,000	679,623,690	369175000	368057258
Chandpur Combaind Cycle	2012	163	694	Gas	98,112,804	91,558,285				
Total Gas		3,411	146,667		13,404,931,992	12,707,907,631	13,138,411,360	12,456,349,033	14,854,753,574	14,020,392,158
Kaptai H.P.S 230 MW	1962-88	230	0	Hydro	780,259,100	776,966,359	875,598,565	871,430,833	732043300	728560516
Barapukuria Power Station	2006	220	0.454	Coal	1,022,956,353	883,302,714	905,430,540	779,640,731	1183237087	1030747258
Bera Peaking Power Station 71MW	2011	71	16	HFO	70,339,769	68,496,206				
Baghabari 50 MW Peaking PS	2011	52	21	HFO	97,442,865	95,846,605				
Hathazari	2011	98	15	HFO	73,793,886	72,616,800				
Sangu,Dohazari	2011	102	17	HFO	80,021,370	78,897,595				
Titas 50MW Peaking Power Plant daudkandi	2011	52	15	HFO	75,170,527	73,100,211				
Isolated		2	0.563	HSD					1829307	1829307

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
					1,728,799	1,728,799	1,832,217	1,832,217		
Khulna 110 MW SPS	1984	60	44	HFO	147,619,735	130,993,355	181,315,868	159,025,816	0	-1050852
Khulna 60 MW SPS	1973	35	9	HFO	26,045,035	21,541,686	146,828,504	131,518,439	25509770	21718113
Bheramara3x20 MW GT	1976,76 ,80	54	24	HSD	56,148,140	55,718,983	119,812,200	119,272,206	125991400	125470839
Saidpur 20 MW GT	1987	19	8	HSD	19,333,000	19,109,890	48,175,000	47,955,650	35816500	35574635
Rangpur 20 MW GT		20	9	HSD	20,273,500	20,045,183	38,232,500	37,874,548	32025200	31611400
Bhola (old) Diesel PS	1988	4	0	HSD	266,940	249,450	1,019,800	974,550	692540	657670
Barisal 2x20 MW GT	1984-87	32	19	HSD	41,062,462	40,168,158	66,354,847	65,284,876	84333082	83305170
Barisal Diesel PS	1975-80	3	0	HSD	107,376	93,856	2,003,891	1,765,451	2219053	1966003
Faridpur Peaking Power Station 50MW	2011	54	12	HFO	55,085,208	53,381,290				
Gopalgang Peaking Power Station 100MW	2011	109	22	HFO	100,766,829	98,284,251				
Total Oil		767			865,205,441	830,272,318	605,574,827	565,503,753	308,416,852	301,082,285
Isolated Generation (Char Fashion, Monpura, Mehendigonj)					-	-				
Sub Total					-	-				
Total BPDB's Generation(Gas+Oil+Hydro+Coal)		4,628	146,682		16,073,352,886	15,198,449,022	15,525,015,292	14,672,924,350	17,078,450,813	16,080,782,217
Private Sector										
IPP										
Rural Power Company Ltd.(RPCL)	1999-2000	175	10599	Gas	-	1,306,528,608	-	880,614,250		830993250
WESTMONT POWER	1999	70	2557	Gas	-	241,766,400	-	467,462,400		474345600

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
MW)						589,434,220	-			
Energyprima Ltd.[Shajibazar] (50 MW)	2008	50	3355	Gas		281,947,689	-	301,345,200		297372600
Desh Combridge Kumargaon Ltd.(10 MW)	2009	10	486	Gas		48,106,980	-	68,848,600		74039400
Barakatullah Elec Dyna.Ltd.(Fenchugang 51MW)	2009	51	3569	Gas		304,429,342	-	381,875,356		264199425
Energyprima Ltd.[50MW Fenchuganj)	2012	50	2209	Gas		192,104,985	-			
Regent Power Ltd.(Barabkundu 22MW)SIPP	2009	22	1438	Gas		153,206,160	-	171,362,289		166309103
Malancha		30	1241	Gas		133,693,824	-	125,074,320		18157920
Venture Energy Resources Ltd.(Bhola 32MW)	2009	33	553	Gas		45,023,630	-	143,020,285		163218975
Ghorashal 45 MW (Aggreko)	2010	45	32	HSD		110,000,000	-	226,671,952		
			1664	Gas		156,000,000				
Aggreko Int.Ashugonj (80MW)	2011	80	6280	Gas		628,505,072	-	61,947,643		
Ghorashal, 100 MW (Aggreko)	2010	100	3764	Gas		347,000,000	-	522,707,270		
			79	HSD		266,000,000				
Sub-total(Rental Power Gas)		979	60,078		-	5,940,087,720	-	4,356,768,206	-	2,683,233,922
Thakurgaon 50MW PS(RZ Power Ltd.)	2010	47	20	HSD		76,948,309	-	113,338,229		48500
Aggreko Int.Khulna RPP (40MW)	Aug-10	53	39	HSD		131,429,570	-	224,619,060		233459250
Khulna RPP 55 MW (Aggreko)	2008	40	31	HSD		133,388,170	-	272,539,280		

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
Bheramara RPP (Quantum)	2010	105	61	HFO		257,386,483	-	195,583,581		
KPCL(Khulna Power Company 115 MW)	2011	115	137	HFO		609,008,483	-	97,322,568		
Khanjahan Ali Noapara 40 MW	May-11	40	41	HFO		183,762,759	-	42,053,805		
Quantum Noapara (105 MW)	2011	100	29	HFO		152,412,600	-	2,779,799		
Pagla DPA Power Generation Int.Ltd.	2010	49	33	HSD		132,678,070	-	137,734,590		
Desh Energy Shiddirganj,100 MW	2011	96	62	HSD		254,576,568	-	205,976,976		
Summit Power Co. Ltd Madangonj (100 MW)	2011	102	90	HFO		413,851,725	-	200,498,135		
IEL, Meghnaghat 100 MW	2011	100	95	HFO		436,030,135		126,108,019		
Shiddirganj Dutchbangla 100 MW	2011	100	96	HFO		440,414,640				
Energies Shikalbaha 55MW	2010	53	19	HFO		84,845,280	-	272,217,684		105804792
Amnura, Chapainababganj	2012	50	14	HFO		67,080,936				
Power Pac mutiara Keranigonj	2012	100	16	HFO		73,382,880				
Julda,Acron Infra.Service Ltd.	2012	100	15	HFO		74,135,370				
Kata khali	2012	50	8	HFO		36,854,994				
Sub-total(Rental Power Plant Oil)		1,300	7,864		-	3,558,186,972	-	1,890,771,726	-	339,312,542
Total(Rental Power Plant Gas+Oil)		2,279	67,942		-	9,498,274,692	-	6,247,539,932	-	3,022,546,464
Total Gas Generation(Pdb+IPP+Rental)		5,445	268,598		13,404,931,992	26,460,581,169	13,138,411,360	24,081,824,389	14,854,753,574	23,985,370,820
Total Oil Generation(Pdb+IPP+R		2,067	7,878		865,205,441	5,282,481,690	605,574,827	3,751,589,979	308,416,852	1,727,615,827

Name of Power Plants	Commission Date	Present Capacity (MW)	Fuel Consumption yr 2011-12	Fuel Type	FY 2011-2012		FY 2010-2011		FY 2009-2010	
ental)										
Total Net Gen(BPDB+IPP+RPP)		7,962	276,477		16,073,352,886	33,403,331,932	15,525,015,292	29,484,485,932	17,078,450,813	27,472,294,421
Total Net Gen(BPDB+IPP+RPP) Fossil Fuel						32,626,365,573				

Annex II: Default Efficiency for Power Plants from UNFCCC Tool

Grid power plants		
Generation Technology	**Old units (before and in 2000)**	**New units (after 2000)**
Coal	-	-
Subcritical	37%	39%
Supercritical	-	45%
Ultra-supercritical	-	50%
IGCC	-	50%
FBS	35.5%	-
CFBS	36.5%	40%
PFBS	-	41.5%
Oil	-	-
Steam turbine	37.5%	39%
Open cycle	30%	39.5%
Combined cycle	46%	46%
Naural gas	-	-
Steam turbine	37.5%	37.5%
Open cycle	30%	39.5%
Combined cycle	46%	60%

Annex. III: Default NCVs, Upper and Lower Limits

TABLE 1.2
DEFAULT NET CALORIFIC VALUES (NCVS) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS [1]

Fuel type English description		Net calorific value (TJ/Gg)	Lower	Upper
Crude Oil		42.3	40.1	44.8
Orimulsion		27.5	27.5	28.3
Natural Gas Liquids		44.2	40.9	46.9
Gasoline	Motor Gasoline	44.3	42.5	44.8
	Aviation Gasoline	44.3	42.5	44.8
	Jet Gasoline	44.3	42.5	44.8
Jet Kerosene		44.1	42.0	45.0
Other Kerosene		43.8	42.4	45.2
Shale Oil		38.1	32.1	45.2
Gas/Diesel Oil		43.0	41.4	43.3
Residual Fuel Oil		40.4	39.8	41.7
Liquefied Petroleum Gases		47.3	44.8	52.2
Ethane		46.4	44.9	48.8
Naphtha		44.5	41.8	46.5
Bitumen		40.2	33.5	41.2
Lubricants		40.2	33.5	42.3
Petroleum Coke		32.5	29.7	41.9
Refinery Feedstocks		43.0	36.3	46.4
Other Oil	Refinery Gas [2]	49.5	47.5	50.6
	Paraffin Waxes	40.2	33.7	48.2
	White Spirit and SBP	40.2	33.7	48.2
	Other Petroleum Products	40.2	33.7	48.2
Anthracite		26.7	21.6	32.2
Coking Coal		28.2	24.0	31.0
Other Bituminous Coal		25.8	19.9	30.5
Sub-Bituminous Coal		18.9	11.5	26.0
Lignite		11.9	5.50	21.6
Oil Shale and Tar Sands		8.9	7.1	11.1
Brown Coal Briquettes		20.7	15.1	32.0
Patent Fuel		20.7	15.1	32.0
Coke	Coke Oven Coke and Lignite Coke	28.2	25.1	30.2
	Gas Coke	28.2	25.1	30.2
Coal Tar [3]		28.0	14.1	55.0
Derived Gases	Gas Works Gas [4]	38.7	19.6	77.0
	Coke Oven Gas [5]	38.7	19.6	77.0
	Blast Furnace Gas [6]	2.47	1.20	5.00
	Oxygen Steel Furnace Gas [7]	7.06	3.80	15.0
Natural Gas		48.0	46.5	50.4
Municipal Wastes (non-biomass fraction)		10	7	18
Industrial Wastes		NA	NA	NA
Waste Oil [8]		40.2	20.3	80.0
Peat		9.76	7.80	12.5

TABLE 1.2 (CONTINUED)
DEFAULT NET CALORIFIC VALUES (NCVS) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS [1]

Fuel type English description		Net calorific value (TJ/Gg)	Lower	Upper
Solid Biofuels	Wood/Wood Waste [9]	15.6	7.90	31.0
	Sulphite lyes (black liquor) [10]	11.8	5.90	23.0
	Other Primary Solid Biomass [11]	11.6	5.90	23.0
	Charcoal [12]	29.5	14.9	58.0
Liquid Biofuels	Biogasoline [13]	27.0	13.6	54.0
	Biodiesels [14]	27.0	13.6	54.0
	Other Liquid Biofuels [15]	27.4	13.8	54.0
Gas Biomass	Landfill Gas [16]	50.4	25.4	100
	Sludge Gas [17]	50.4	25.4	100
	Other Biogas [18]	50.4	25.4	100
Other non-fossil fuels	Municipal Wastes (biomass fraction)	11.6	6.80	18.0

Notes:

[1] The lower and upper limits of the 95 percent confidence intervals, assuming lognormal distributions, fitted to a dataset, based on national inventory reports, IEA data and available national data. A more detailed description is given in section 1.5.

[2] Japanese data; uncertainty range: expert judgement

[3] EFDB; uncertainty range: expert judgement

[4] Coke Oven Gas; uncertainty range: expert judgement

[5-7] Japan and UK small number data; uncertainty range: expert judgement

[8] For waste oils the values of "Lubricants" are taken

[9] EFDB; uncertainty range: expert judgement

[10] Japanese data ; uncertainty range: expert judgement

[11] Solid Biomass; uncertainty range: expert judgement

[12] EFDB; uncertainty range: expert judgement

[13-14] Ethanol theoretical number; uncertainty range: expert judgement;

[15] Liquid Biomass; uncertainty range: expert judgement

[16-18] Methane theoretical number uncertainty range: expert judgement;

Source: 2006 IPCC Guidelines Volume

Annex IV. Default CO2 Emission Factors for Combustion

TABLE 1.4
DEFAULT CO_2 EMISSION FACTORS FOR COMBUSTION [1]

Fuel type English description		Default carbon content (kg/GJ)	Default carbon oxidation factor	Effective CO_2 emission factor (kg/TJ) [2]		
				Default value [3]	95% confidence interval	
		A	B	C=A*B*44/12*1000	Lower	Upper
Crude Oil		20.0	1	73 300	71 100	75 500
Orimulsion		21.0	1	77 000	69 300	85 400
Natural Gas Liquids		17.5	1	64 200	58 300	70 400
Gasoline	Motor Gasoline	18.9	1	69 300	67 500	73 000
	Aviation Gasoline	19.1	1	70 000	67 500	73 000
	Jet Gasoline	19.1	1	70 000	67 500	73 000
Jet Kerosene		19.5	1	71 500	69 700	74 400
Other Kerosene		19.6	1	71 900	70 800	73 700
Shale Oil		20.0	1	73 300	67 800	79 200
Gas/Diesel Oil		20.2	1	74 100	72 600	74 800
Residual Fuel Oil		21.1	1	77 400	75 500	78 800
Liquefied Petroleum Gases		17.2	1	63 100	61 600	65 600
Ethane		16.8	1	61 600	56 500	68 600
Naphtha		20.0	1	73 300	69 300	76 300
Bitumen		22.0	1	80 700	73 000	89 900
Lubricants		20.0	1	73 300	71 900	75 200
Petroleum Coke		26.6	1	97 500	82 900	115 000
Refinery Feedstocks		20.0	1	73 300	68 900	76 600
Other Oil	Refinery Gas	15.7	1	57 600	48 200	69 000
	Paraffin Waxes	20.0	1	73 300	72 200	74 400
	White Spirit & SBP	20.0	1	73 300	72 200	74 400
Other Petroleum Products		20.0	1	73 300	72 200	74 400
Anthracite		26.8	1	98 300	94 600	101 000
Coking Coal		25.8	1	94 600	87 300	101 000
Other Bituminous Coal		25.8	1	94 600	89 500	99 700
Sub-Bituminous Coal		26.2	1	96 100	92 800	100 000
Lignite		27.6	1	101 000	90 900	115 000
Oil Shale and Tar Sands		29.1	1	107 000	90 200	125 000
Brown Coal Briquettes		26.6	1	97 500	87 300	109 000
Patent Fuel		26.6	1	97 500	87 300	109 000
Coke	Coke oven coke and lignite Coke	29.2	1	107 000	95 700	119 000
	Gas Coke	29.2	1	107 000	95 700	119 000
Coal Tar		22.0	1	80 700	68 200	95 300
Derived Gases	Gas Works Gas	12.1	1	44 400	37 300	54 100
	Coke Oven Gas	12.1	1	44 400	37 300	54 100
	Blast Furnace Gas [4]	70.8	1	260 000	219 000	308 000
	Oxygen Steel Furnace Gas [5]	49.6	1	182 000	145 000	202 000

Annex. V: Operating Margin Calculation

		2011-2012		2010-2011		2009-2010	
Name of Power Plants	Fuel Type	Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2
Public Sector							
60 MW Shikalbaha	Gas	38,550,126	33.92	102,923,391	82.36	87,676,869	71.00
Ashugonj 2x64 MW S.P.S (1,2)	Gas	306,946,203	229.96	578,058,611	395.88	785,341,987	529.40
Ashugonj 3x150 MW ST (3,4,5)	Gas	2,609,158,392	1,720.07	2,098,016,622	1,267.09	2,860,820,534	1,802.16
Ashugonj 90 MW CC	Gas	316,044,350	267.27	371,983,384	351.55	314,893,945	138.19
Ashugonj 56 MW GT	Gas	315,844,548	307.85	316,387,861	218.60	269,210,757	226.82
Shiddirgonj 2X120 MW SPS EGCB Ltd.	Gas	675,752,832	544.71	502,594,200	398.99	166,358,260	126.07
Shahazibazar GT 57 MW	Gas	19,188,120	28.57	132,654,174	94.97	25,911,720	35.19
Shahazibazar 60 MW (8,9)	Gas	414,179,764	323.49	421,772,333	301.95	457,111,223	309.07
Ghorasal 2x 210 MW ST (3,4)	Gas	2,052,899,311	1,442.58	2,206,767,129	1,436.75	2,232,590,430	1,500.48
Ghorasal 2x 55 MW ST (1,2)	Gas	312,782,856	258.65	332,278,834	236.04	323,389,005	274.65
Ghorasal 2x 210 MW ST (5,6)	Gas	1,269,977,592	888.94	1,220,646,393	810.93	2,502,276,796	1,560.23
Haripur 100 MW GT	Gas	353,686,580	308.03	460,452,700	387.31	182,268,780	140.18
Tongi 109 MW GT Power Station	Gas	434,191,565	327.37	860,803,096	523.01	1,013,562,684	629.65
Sylhet 20 MW GT	Gas	13,250,190	13.24	268,017,469	210.13	317,062,282	251.61
Sylhet 150 MW GT	Gas	101,985,761	67.97	49,235,050	39.43	61,321,930	47.87
210 MW Rauzan # 1 (Chittagong)	Gas	507,983,964	364.92	187,058,287	138.38	408,779,452	299.77
210 MW Rauzan # 2 (Chittagong)	Gas	104,860,720	71.73	183,702,005	124.46	574,820,760	375.46
Fenchugonj 90 MW CC	Gas	527,326,240	297.87	607,990,940	315.49	602,104,790	296.01
Fenchugonj (Unit-2, 90 MW)	Gas	440,327,175	241.97	36,645,481	19.02	138,050	
Baghabari 71 MW GT	Gas	362,487,535	261.92	486,605,620	351.11	466,713,477	342.26
Baghabari 100 MW GT	Gas	733,417,871	537.81	679,623,690	488.11	368,057,258	259.36
Shikalbaha 150MW PS	Gas	313,326,759	235.75	285,585,736	206.43		
Ashugonj 50 MW	Gas	394,250,928	212.17	66,546,027	33.52		
Chandpur Combaind Cycle	Gas	91,558,285	42.73				
Barapukuria Power Station	Coal	883,302,714	1,122.03	779,640,731	990.36	1,030,747,258	1,156.99
Isolated	HSD	1,728,799	1.17	1,832,217	1.24	1,829,307	1.24
Khulna 60 MW SPS	HFO	21,541,686	27.96	131,518,439	170.69	21,718,113	29.75
Bheramara3x20 MW GT	HSD	55,718,983	64.91	119,272,206	83.23	125,470,839	148.63
Saidpur 20 MW GT	HSD	19,109,890	21.69	47,955,650	57.37	35,574,635	42.77
Rangpur 20 MW GT	HSD	20,045,183	24.42	37,874,548	85.84	31,611,400	37.80
Bhola (old) Diesel PS	HSD	249,450	0.38	974,550	1.47	657,670	0.99
Barisal 2x20 MW GT	HSD	40,168,158	51.52	65,284,876	93.63	83,305,170	113.21
Barisal Diesel PS	HSD	93,856	0.22	1,765,451	4.17	1,966,003	3.52
Khulna 110 MW SPS	HFO	130,993,355	161.86	159,025,816	196.50		
Baghabari 50 MW Peaking PS	HFO	95,846,605	67.61				
Hathazari	HFO	72,616,800	51.23				
Sangu,Dohazari	HFO	78,897,595	55.66				
Titas 50MW Peaking Power Plant	HFO	73,100,211	51.57				
Bera Peaking Power Station 71MW	HFO	68,496,206	48.32				
Faridpur Peaking Power Station 50MW	HFO	53,381,290	37.66				

Name of Power Plants	Fuel Type	2011-2012		2010-2011		2009-2010	
		Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2
Gopalgang Peaking Power Station 100MW	HFO	98,284,251	69.33				
Private Sector /IPP							
Rural Power Company Ltd.(RPCL)	Gas	1,306,528,608	652.58	880,614,250	439.84	830,993,250	415.06
WESTMONT POWER	Gas	241,766,400	157.43	467,462,400	304.40	474,345,600	308.89
Haripur Power Ltd.	Gas	2,601,598,000	1,193.90	2,610,395,500	1,197.94	2,675,185,000	1,227.67
Meghnaghat Power Ltd.	Gas	3,662,692,810	1,804.36	3,310,235,000	1,630.73	3,301,220,890	1,626.29
KPCL(Khulna Power Company 19*8 MW D)	HFO	516,346,900	312.77	748,581,400	453.45	750,144,500	454.39
NEPC Consortium (8*15 MW GT)	HFO	377,675,500	228.77	546,733,100	331.18	337,076,500	204.18
Rental Power							
Bogra RPP (24MW)	Gas	167,580,700	134.59	171,547,760	137.78	149,752,460	120.27
Doreen Power Ltd.(Tangail 22 MW)SIPP	Gas	138,592,661	79.98	152,205,048	87.83	154,588,716	89.21
Doreen Power Ltd.(Feni 22 MW)SIPP	Gas	159,618,420	92.17	167,949,240	96.98	160,862,184	92.89
Summit Purbanchol Po.Co. Ltd(Jangalia 33MW)SIPP	Gas	214,637,197	124.06	209,020,315	120.82	226,937,311	131.17
Precision Energy Ltd (Ashuganj 55 MW)	Gas	420,192,863	285.50	435,593,567	295.96	114,630,720	77.89
Energyprima Ltd.[Kumargao] (50MW)	Gas	267,446,540	176.46	321,574,240	212.17	257,646,860	169.99
*Sahzibazar RPP (86 MW)	Gas	589,434,220	487.88	651,615,360	539.35	635,518,248	526.02
Energyprima Ltd.[Shajibazar] (50 MW)	Gas	281,947,689	206.57	301,345,200	220.78	297,372,600	217.87
Desh Combridge Kumargaon Ltd.(10 MW)	Gas	48,106,980	29.92	68,848,600	42.82	74,039,400	46.05
Barakatullah Elec Dyna.Ltd.(Fenchugang 51MW)	Gas	304,429,342	219.74	381,875,356	275.64	264,199,425	190.70
Regent Power Ltd.(Barabkundu 22MW)SIPP	Gas	153,206,160	88.54	171,362,289	99.03	166,309,103	96.11
Malancha	Gas	133,693,824	76.41	125,074,320	71.48	18,157,920	10.38
Venture Energy Resources Ltd.(Bhola 32MW)	Gas	45,023,630	34.05	143,020,285	108.16	163,218,975	123.43
Energy Prima, Bogra 55 MW	Gas	84,241,728	46.67	9,238,104	5.12		
Ghorashal, Max Power 78.5 MW	Gas	303,755,212	187.54	29,877,975	18.45		
Aggreko Int.B.Baria RPP (70 MW)	Gas	508,908,110	310.43	185,269,320	113.01		
Ashuganj (United Power Ltd.) (53 MW)	Gas	419,662,387	259.64	20,024,362	12.39		
Aggreko Int.Ashugonj (80MW)	Gas	628,505,072	386.66	61,947,643	38.11		
Ghorashal 45 MW (Aggreko)	HSD	110,000,000	86.56	226,671,952	178.37		
	Gas	156,000,000	102.45				
Ghorashal, 100 MW (Aggreko)	Gas	347,000,000	231.75	522,707,270	349.10		
	HSD	266,000,000	213.73				
Energyprima Ltd.[50MW Fenchuganj)	Gas	192,104,985	136.01				
Thakurgaon 50MW PS(RZ Power Ltd.)	HSD	76,948,309	54.16	113,338,229	79.77	48,500	0.03
Aggreko Int.Khulna RPP (40MW)	HSD	131,429,570	105.60	224,619,060	180.48	233,459,250	187.58
Energies Shikalbaha 55MW	HFO	84,845,280	59.85	272,217,684	192.03	105,804,792	74.64
Khulna RPP 55 MW (Aggreko)	HSD	133,388,170	83.92	272,539,280	171.47		
Bheramara RPP (Quantum)	HFO	257,386,483	181.56	195,583,581	137.97		
KPCL(Khulna Power Company 115 MW)	HFO	609,008,483	429.61	97,322,568	68.65		
Khanjahan Ali 40 MW	HFO	183,762,759	129.63	42,053,805	29.67		
Quantum Noapara (105 MW)	HFO	152,412,600	107.51	2,779,799	1.96		
Pagla DPA Power Generation Int.Ltd.	HSD	132,678,070	89.38	137,734,590	92.78		

Name of Power Plants	Fuel Type	2011-2012		2010-2011		2009-2010	
		Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2	Net Generation (KWh)	CO2 Emission kt-CO2
Desh Energy Shiddirganj,100 MW	HSD	254,576,568	168.10	205,976,976	136.01		
Summit Power Co. Ltd Madangonj (100 MW)	HFO	413,851,725	291.94	200,498,135	141.43		
IEL, Meghnaghat 100 MW	HFO	436,030,135	307.58	126,108,019	88.96		
Shiddirganj Dutchbangla 100 MW	HFO	440,414,640	310.68				
Amnura, Chapainababganj	HFO	67,080,936	47.32				
Power Pac mutiara Keranigonj	HFO	73,382,880	51.77				
Julda,Acron Infra.Service Ltd.	HFO	74,135,370	52.30				
Kata khali	HFO	36,854,994	26.00				