

CALCULATION OF BASELINE EMISSION FACTORS FOR NORTHERN GRID						
Reference : ACM 0002 with Combined Margin Approach						
Year of offer	2002-03		2003-04		2004-05	
Generation Mix						
Sector	MU	%	MU	%	MU	%
NTPC - Coal	40150.22	27.93	40919.58	26.15	42247.11	26.81
Delhi - Coal	1302.55	0.91	1356.43	0.87	1412.61	0.90
Haryana - Coal	5231.45	3.64	6038.26	3.86	5953.43	3.78
Punjab - Coal	12462.74	8.67	13022.35	8.32	12977.90	8.24
Rajasthan - Coal	12533.00	8.72	13808.13	8.82	15471.86	9.82
UP - Coal	18240.03	12.69	18175.80	11.61	17227.48	10.93
NTPC - Gas	14600.28	10.16	14568.35	9.31	15159.22	9.62
Delhi - Gas	1181.96	0.82	3533.59	2.26	3995.30	2.54
Haryana - Gas	80.99	0.06	27.45	0.02	92.55	0.06
J&K - Gas	19.64	0.01	16.89	0.01	23.36	0.01
Rajasthan - Gas	215.00	0.15	344.19	0.22	336.49	0.21
NHPC - Hydro	8896.35	6.19	10155.77	6.49	10242.27	6.50
SJVNL - Hydro	0.00	0.00	1181.35	0.75	5108.77	3.24
BBMB - Hydro	10508.60	7.31	11302.73	7.22	8493.95	5.39
Haryana - Hydro	243.31	0.17	250.58	0.16	283.89	0.18
HP - Hydro	1590.63	1.11	3977.17	2.54	2772.19	1.76
J&K - Hydro	403.02	0.28	856.07	0.55	719.78	0.46
Punjab - Hydro	3516.82	2.45	4328.31	2.77	3204.07	2.03
Rajasthan - Hydro	59.97	0.04	650.82	0.42	926.83	0.59
Uttaranchal - Hydro	3395.81	2.36	3437.35	2.20	3111.00	1.97
UP - Hydro	1377.38	0.96	2050.75	1.31	1097.35	0.70
NPC - Nuclear	7731.14	5.38	6491.03	4.15	6255.93	3.97
Other - Low Cost (Wind, Biomass)					476.63	0.30
Total	143740.89	100.00	156492.95	100.00	157589.97	100.00
Total generation excluding Low-cost power generation	106017.86		111811.02		114897.31	
Generation by Coal out of Total Generation excluding Low-cost power generation	89919.99	84.82	93320.55	83.46	95290.39	82.94
Generation by Gas (Naphtha) out of Total Generation excluding Low-cost power generation	16097.87	15.18	18490.47	16.54	19606.92	17.06
Imports from others						
Imports from WREB	131.64	0.09	282.02	0.18	1495.77	0.95
Imports from EREB	1019.53	0.71	2334.76	1.49	3581.79	2.27

Estimation of Baseline Emission Factor (tCO <sub>2</sub> /MU)						
Simple Operating Margin						
Fuel 1 : Coal						
Avg. Efficiency of power generation with coal as a fuel, %		34.518		35.103		35.103
Avg. Calorific Value of Coal used (kcal/kg)		4171		3820		3820
Estimated Coal consumption (tons/yr)		53712265		59849987		61113319
Emission Factor for Coal-IPCC standard value (tonne CO <sub>2</sub> /TJ)		96.1		96.1		96.1
Oxidation Factor of Coal-IPCC standard value		0.98		0.98		0.98
COEF of Coal (tonneCO <sub>2</sub> /ton of coal)		1.642		1.503		1.503
Fuel 2 : Gas						
Avg. Efficiency of power generation with gas as a fuel, %		45		45		45
Avg. Calorific Value of Gas used (kcal/kg)		10750		10750		10750
Estimated Gas consumption (tons/yr)		2861723		3287056		3485528
Emission Factor for Gas- IPCC standard value(tonne CO <sub>2</sub> /TJ)		73.3		73.3		73.3
Oxidation Factor of Gas-IPCC standard value		0.995		0.995		0.995
COEF of Gas(tonneCO <sub>2</sub> /ton of gas)		3.277		3.277		3.277
EF (OM Simple, excluding imports from other grids), tCO <sub>2</sub> /MU		920.13		901.08		899.07
EF (WREB), tCO <sub>2</sub> /MU		910.00		910.00		906.00
EF (EREB), tCO <sub>2</sub> /MU		1192.00		1186.00		1178.00
EF (OM Simple), tCO <sub>2</sub> /MU		922.70		906.92		907.48
Average EF (OM Simple), tCO <sub>2</sub> /MU		912.37				
Considering 20% of Gross Generation						
Sector	MU	%	MU	%	MU	%
Thermal Coal Based					17089.61	51.16
Thermal Gas Based					5584.78	16.72
Hydro					8093.53	24.23
Nuclear					2619.40	7.84
Wind					18.45	0.06
Total					33405.77	100.00

<b>Built Margin</b>					
Fuel 1 : Coal					
Avg. efficiency of power generation with coal as a fuel, %					35.103
Avg. calorific value of coal used in Northern Grid, kcal/kg					3820
Estimated coal consumption, tons/yr					10960213
Emission factor for Coal (IPCC), tonne CO <sub>2</sub> /TJ					96.1
Oxidation factor of coal ( IPCC standard value)					0.98
COEF of coal (tonneCO <sub>2</sub> /ton of coal)					1.503
Fuel 2 : Gas					
Avg. efficiency of power generation with gas as a fuel, %					45
Avg. calorific value of gas used, kcal/kg					10750
Estimated gas consumption, tons/yr					992807
Emission factor for Gas (as per standard IPCC value)					73.3
Oxidation factor of gas ( IPCC standard value)					0.995
COEF of gas(tonneCO <sub>2</sub> /ton of gas)					3.277
EF (BM), tCO <sub>2</sub> /MU					590.65
Combined Margin Factor (Avg of OM & BM)					751.51
Baseline Emissions Factor (tCO <sub>2</sub> /MU)					751.51

<b>Power generation Mix of Northern Region for five years</b>					
<b>Energy Source</b>	<b>2000-01</b>	<b>2001-02</b>	<b>2002-03</b>	<b>2003-04</b>	<b>2004-05</b>
Total Power Generation (MU)	134492.72	140515.2	143740.88	156492.94	157589.97
Total Thermal Power Generation	99766.38	104339.68	106017.85	111811.02	114897.30
Total Low Cost Power Generation	34726.33	36175.51	37723.02	44681.92	42692.67
Thermal % of Total grid generation	74.18	74.26	73.76	71.45	72.91
Low Cost % of Total grid generation	<b>25.82</b>	<b>25.74</b>	<b>26.24</b>	<b>28.55</b>	<b>27.09</b>
<b>% of Low Cost generation out of Total grid generation - Average of the five most recent years</b>					
<b>26.69%</b>					

**Generation Details**

	Name	Type	Fuel	Installed Capacity (MW)	Effective Capacity (MW)	Net Generation in MU		
						2002-2003	2003-2004	2004-2005
1	Badarpur TPS	Thermal	Coal	720	705	4801.20	4940.36	4971.87
2	Singrauli STPS	Thermal	Coal	2000	2000	15087.69	14557.85	14633.12
3	Rihand STPS	Thermal	Coal	1000	1000	7124.15	7320.19	7308.58
4	Dadri NCTPS	Thermal	Coal	840	840	5568.71	5683.23	6235.54
5	Unchahar-I TPS	Thermal	Coal	420	420	2791.83	2918.30	3052.36
6	Unchahar-II TPS	Thermal	Coal	420	420	2832.00	2956.71	3119.50
7	Tanda TPS	Thermal	Coal	440	440	1944.64	2542.94	2926.14
8	Anta GPS	Thermal	Gas	419.33	419.33	2691.31	2698.10	2702.31
9	Auriya GPS	Thermal	Gas	663.36	663.36	4198.80	4225.91	4008.30
10	Dadri GPS	Thermal	Gas	829.78	829.78	5075.77	4913.21	5359.92
11	Faridabad GPS	Thermal	Gas	431.57	431.57	2634.40	2731.14	3088.69
12	Bairasiul	Hydro	Hydel	180	180	668.69	674.35	676.67
13	Salal	Hydro	Hydel	690	690	3131.49	3480.47	3435.05
14	Tanakpur HPS	Hydro	Hydel	94.2	94.2	418.55	507.27	491.97
15	Chamera HPS	Hydro	Hydel	540	540	2249.75	2456.83	2102.26
16	Uri HPS	Hydro	Hydel	480	480	2427.88	2852.81	2192.25
17	Chamera 2 HPS	Hydro	Hydel	300	300	0.00	184.04	1344.07
18	RAPS-A	Nuclear	Nuclear	440	300	1386.12	1167.32	1195.49
19	RAPS-B	Nuclear	Nuclear	440	440	3122.88	2632.00	2619.40
20	NAPS	Nuclear	Nuclear	470	440	3222.14	2691.71	2441.04
21	Bhakra Complex	Hydro	Hydel	1490.15	1480.3	6501.06	7003.98	4517.12
22	Dehar	Hydro	Hydel	990	990	3243.69	3220.24	3102.12
23	Pong	Hydro	Hydel	396	396	763.85	1078.51	874.71
24	Nathpa-Jhakri	Hydro	Hydel	1500	1500	0.00	1181.35	5108.77
25	Delhi	Thermal	Coal	397.5	382.5	1302.55	1356.43	1412.61
26	Delhi	Thermal	Gas	612	612	1991.83	3533.59	3995.30
27	Haryana	Thermal	Coal	1040	1025	5312.44	6038.26	6045.97
28	Haryana	Hydro	Hydel	48	48	243.31	250.58	283.89
29	H.P.	Hydro	Hydel	712.2	712.2	1590.63	3977.17	2772.19
30	J&K	Hydro	Hydel	311.69	311.69	403.02	856.07	719.78
31	J&K	Thermal	Gas	175	175	19.64	16.89	23.36
32	Punjab	Thermal	Coal	2130	2130	12462.74	13022.35	13071.14
33	Punjab	Hydro	Hydel	1145.1	1145.1	3516.82	4328.31	3204.07
34	Rajasthan	Thermal	Coal	1295	1295	12533.00	13808.13	15471.86
35	Rajasthan	Thermal	Gas	38.5	38.5	215.00	221.80	336.49
36	Rajasthan	Hydro	Hydel	434.85	434.85	59.97	650.82	1310.25
37	U.P.	Thermal	Coal	4192	3909	18240.03	18175.80	17227.48
38	U.P.	Hydro	Hydel	501	501	1377.38	2050.75	1097.35
39	Uttaranchal	Hydro	Hydel	999.05	999.05	3395.81	3437.35	3111.00
	<b>TOTAL</b>			<b>30226.28</b>	<b>29718.43</b>	<b>144550.77</b>	<b>156343.12</b>	<b>157589.99</b>

**List of plants supplying power to Northern grid arranged in descending order of date of commissioning**

**Total generation 158303.91**  
**20 % of total generation 31660.78**

	Plant	Date of commissioning	MW	Generation of the unit in 2004-2005 (MU)	Fuel Type	
1	Chamera HPS-1	2003-2004	100		Hydro	
2	Chamera HPS-2	2003-2004	100		Hydro	
3	Chamera HPS-3	2002-2003	100	1344.07	Hydro	
4	SJVPNL	2003-2004	1500	5108.77	Hydro	
5	Suratgarh TH-5	2003-2004	250	1698.37	Coal	
6	Kota TH-6	2003-2004	195	1302.49	Coal	
7	Pragati steam turbine	2002-2003	114		Gas	
8	Pragati gas turbine-2	2002-2003	108		Gas	
9	Pragati gas turbine-1	2002-2003	108	2493.01	Gas	
10	Upper Sindh Extn (HPS)(1)	2002-2003	35	48.58	Hydro	
11	Suratgarh stage-II (4)	2002-2003	250	1698.37	Coal	
12	Suratgarh stage-II (3)	2001-2002	250	1698.37	Coal	
13	Wind Energy RPSC	2001-2002	2.15	6.45	Wind	
14	Upper Sindh Stage II (2)	2001-2002	35	48.58	Hydro	
15	Malana-2	2001-2002	43		Hydro	
16	Malana-1	2001-2002	43	266.08	Hydro	
17	Panipat TPS (6)	2000-2001	210	1269.31	Coal	
18	Chenani Stage III (1,2,3)	2000-2001	7.5	19.10	Hydro	
19	Ghanvi HPS (2)	2000-2001	11.25		Hydro	
20	Ghanvi HPS (1)	2000-2001	11.25	74.06	Hydro	
21	RAPS-B (2)	2000-2001	220	1309.70	Nuclear	
22	Ranjit Sagar HPS (2)	2000-2001	150	282.84	Hydro	
23	Ranjit Sagar HPS (4)	2000-2001	150	282.84	Hydro	
24	Gumma HPS	2000-2001	3	4.35	Hydro	
25	Ranjit Sagar HPS (3)	2000-2001	150	282.84	Hydro	
26	Ranjit Sagar HPS (1)	2000-2001	150	282.84	Hydro	
27	Faridabad GPS	2000-2001	146	1044.90	Gas	
28	Devgarh wind farm	2000-2001	2	6.00	Wind	
29	Wind Farm (RSEB)	1999-2000	2	6.00	Wind	
30	Suratgarh TPS #2	1999-2000	250	1698.37	Coal	
31	RAPS-B (2)	1999-2000	220.00	1309.70	Nuclear	
32	Uppersindh-2 HPS #1	1999-2000	35	48.58	Hydro	
33	Faridabad GPS #2 (NTPC)	1999-2000	143	1023.43	Gas	
34	Unchahar-II TPS #2	1999-2000	210	1559.75	Coal	
35	Faridabad GPS #1(NTPC)	1999-2000	143	1023.43	Gas	
36	Unchahar-II TPS #1	1998-1999	210	1559.75	Coal	
36	Suratgarh TPS #1	1998-1999	250	1698.37	Coal	
37	GHGTPLM (Unit 2)	1998-1999	210		Coal	
38	GHGTPLM (Unit 1)	1997-1998	210	2906.46	Coal	
<b>Total</b>				<b>33405.77</b>		
<b>20% of Ex-Bus Generation</b>				<b>31660.78</b>	%age	
				<b>Coal</b>	17089.61	51.16
				<b>Gas</b>	5584.78	16.72
				<b>Hydel</b>	8093.53	24.23
				<b>Wind</b>	18.45	0.06
				<b>Nuclear</b>	2619.40	7.84