

**Data on Petroleum Fuels  
used by various Gas Turbines &  
Diesel Engine Power Plants in the country  
During 2003-04**



**Central Electricity Authority**  
**TPI&A DIVISION**  
**New Delhi**

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### **1.0 Introduction:**

As per the responsibility given vide Section 73(i) of the Electricity Act, 2003, Central Electricity Authority has initiated compiling from the year 2001-02 the data concerning cost of fuels being used in various power plants in the country. The data for the year 2001-02 & 2002-03 regarding fuel used in various gas turbines & diesel engine power plants across the country was compiled and was put on CEA's website. The data for the year 2003-04 has also been compiled. Various power utilities using petroleum fuels as primary fuel were requested to furnish the data for the year 2003-04. The data from 46 nos. of power stations having a total capacity of 12540 MW have been received. The data has been compiled and an analysis on the same is presented in this booklet for the benefits of all utilities/agencies. Similar data from power plants using coal will be brought out separately.

### **2.0 Type of data sought**

The following data was sought from various power plants:

- a. Installed Capacity
- b. Total Generation in MkwHr.
- c. Type of fuel being used (primary & Secondary)
- d. Source of fuel
- e. Appr. Distance of the source
- f. GCV & NCV
- g. Quantity used/year
- h. Cost of fuel (primary & secondary) along with break-up.

### **3.0 Data compilation:**

The data received from various power plants has been compiled and a summary of the same is presented in Annexure-I.

### **4.0 Type of fuels:**

As per the details received, Natural Gas is being used in most of the petroleum fuel based power plants. With the commissioning of Dahej LNG terminal, few power plants have used LNG as primary fuel. Naphtha & other liquid fuels are used as primary fuel in some Gas Turbines Plants. In one power plant namely DVC Maithon GT, HSD was used as primary fuel. Light Diesel Oil(LDO) was used in Vatwa CCGT plant of M/s Ahmedabad Electric Co. as primary fuel due to rupture of gas pipeline since 25.3.01 & non-supply of gas by M/s ONGC. Low Sulphur Heavy Stock (LSHS) was used as primary fuel in large size Diesel Engine Power Plants and two liquid fuel based Steam power plants namely Dhuvanan plant of GEB and Trombay plant of Tata Power. M/s TATA also used Kerosene as secondary fuel.

### **5.0 Source of Fuels:**

Most of the gas based power plants receive gas from ONGC wells via GAIL. Two power plants in Assam namely Namrup (133.5 MW) and NEEPCO (291 MW) plant received gas from the oil fields of Oil India Ltd. Five power plants in Gujarat received gas from Gujarat State Petroleum Corp. (GSPC) & Gujarat Gas (GGCL) in addition to that from ONGC/GAIL. Power Plants in Andhra Pradesh received gas from RAVVA gas fields operated by Joint Venture Company. Two power plants in Gujarat received gas from the newly built LNG Terminal at Dahej.

The source of liquid fuels is mostly the Govt. Oil Companies namely IOCL, HPCL & BPCL. Vatwa CCGT plant of Ahmedabad Electric Company Ltd. received LDO from Reliance Industries Ltd.( Jamnagar) for use as primary fuel due to non-availability of gas from ONGC. Trombay power plant of M/s Tata Power received imported LSHS/LSFO in addition to LSHS from indigenous BPCL/HPCL/IOCL. Their captive D.G. Power Plant at Belgium also received imported LSHS.

## 6.0 Calorific Value

Based on the data on calorific value received from various power plants, it is noticed that the gross calorific value(GCV) of gas supplied to power plants varied from 8371 Kcal/SCM at Utran in Gujarat to 10,000 Kcal/SCM at Jegurupadu plant of M/s GVK. The net calorific value of gas varied from 8150 Kcal/SCM at Rokhia & Baramura plants in Tripura to 9443 Kcal/SCM at Kovilkalappal plant of TNEB. The NCV of gas in most of the cases is about 89% to 91% of GCV.

The calorific values of liquid fuel as indicated by most of the power plants are as follows:

Liquid Fuel	GCV Kcal/kg	NCV Kcal/kg
Naphtha	11200-11347 Kcal/kg	10320-10680
LDO	10530	9876
HSD	10600-11300	10100-10300
LSHS	10350-10532	9741-9751
LSFO	10300	9800

It may be seen that NCV of liquid fuels is about 92 to 95 per cent of GCV.

## 7.0 Heat Rate

Table showing heat rate in Kcal/kWh in various petroleum fuel based power plants computed on the basis of data received from the power plant authorities is enclosed at Annexure-II.

It is seen that the heat rate in gas turbine power plants varied from 1771.47 Kcal/kW-hr at Anta (NTPC) combined cycle GT Plant (419.33 MW) in Uttar Pradesh to 5613.53 Kcal/kW-hr at Rokhia open cycle GT Plant in Tripura. Considering only combined cycle plants, the heat rate varied from 1771.47 Kcal/kW-hr at Anta to

3002.32 Kcal/kW-hr at Kuttalam, Tamilnadu. Kuttalam plant was commissioned in November, 03 under open cycle and achieved only 12% PLF during 2003-04. If we consider combined cycle plants which operated above 60% PLF, the heat rate varied from 1771.47 Kcal/kW-hr at Anta to 2719.15 Kcal/kW-hr at Godavari plant in A.P.

The heat rate in diesel engine plants using LSHS varied from 2023.28 Kcal/kW-hr at Basin Bridge DG Plant to 2170.44 Kcal/kW-hr at Brahmapuram Plant in Kerala. The heat rate of HSD as secondary fuel in gas turbine plants using Naphtha as primary fuel varied from 1858.06 Kcal/kW-hr of Kochi (Reliance) to 3486.67 Kcal/kW-hr at Basin-bridge in Tamil Nadu.

## **8.0 Price of Gas:**

The basic price of gas in respect of power plants which received ONGC gas from GAIL under Administered Price Mechanism (APM) was Rs. 2850 per 1000 SCM except those located in North East States. For North East States, it varied from Rs. 1446.87 to Rs. 1700 per 1000 SCM.

The basic price of gas supplied by GSPC (Hazira) to GIPCL Plant was Rs. 4850 per 1000 SCM. The basic market price of gas from Ravva satellite gas fields to gas based power plants in Andhra Pradesh is reported to be denominated in U.S. dollars. The basic price of this gas is indicated as US \$ 3.3/MMBTU which works out to about Rs. 5413/1000 SCM.

The price of gas including royalty, taxes etc. but excluding transportation cost supplied by GAIL under APM outside N.E. states varied from Rs. 2844/1000 SCM at Trombay TPP in Maharashtra to Rs. 4366/1000 SCM at Dhuvaran plant in Gujarat even though the basic price is same. This is mainly due to difference in calorific value of gas from different sources including compression charges at some place and different rates of sales tax being levied in different states. The total delivered price of APM gas varied from Rs. 2892/1000 SCM at Trombay (Tata Power) in Maharashtra to Rs. 4996/1000 SCM at Dhuvaran plant in Gujarat.

For the gas under market price, the price of gas including royalty, taxes etc. but excluding transport cost was Rs. 7109 to Rs. 7197 per 1000 SCM. Including transportation cost it was about Rs. 7266 & Rs. 7377 per 1000 SCM.

The price charged for LNG gas supplied for Dahej LNG terminal was Rs. 212.4 per MMBTU which worked out to Rs 7940 to Rs 8229 per 1000 SCM depending upon the calorific value.

## **9.0 Transportation Cost for Gas:**

The transportation cost of gas supplied from HBJ pipeline was charged at Rs. 1150 per 1000 SCM on uniform basis.

The cost of gas transportation and the corresponding distance of transportation of gas was also obtained from the gas based power plants not being fed from HBJ pipeline. It is seen that the transportation cost varied from Rs. 1.0 per 1000 SCM Km to Rs. 74.53 per 1000 SCM Km. The transportation cost for a distance between 100-200 Km generally worked out to Rs. 6.3 to Rs. 8.43 per 1000 SCM km.

## **10.0 Price of Liquid Fuels:**

The price of Naphtha during the year 2003-04 as indicated by different gas turbine power plants varied from Rs. 13882/MT at Faridabad project of NTPC in Haryana to Rs. 20050/MT at Kawas Project of M/s NTPC in Gujarat. The HSD price was indicated as Rs. 19093/ KL by IPGCL project in Delhi to Rs. 25209 /KL by Visvesvaraya plant of Karnataka. The price of Kerosene as reported by M/s TATA for Trombay Plant was Rs. 19982/KL. The price of Light Diesel Oil (LDO) used by Vatwa plant of Ahmedabad Electric Co. in Gujarat was Rs. 21124 /KL.

The price of LSHS being used in Diesel Engine Plants in Tamil Nadu namely Basin Bridge, Samalpatti & Madurai was in the range of Rs. 11333 /MT to Rs. 13199/MT.

## 11.0 Taxes & Duties:

Two types of taxes are applicable in case of indigenous gas. One is Royalty and the other being sales tax. The excise duty is not levied on gas. The Royalty is 10% of the basic purchase price of gas. Due to difference in basic price of gas from different sources, the absolute value of Royalty varied from project to project considerably. While in case of gas being supplied by GAIL outside N.E. states, it worked out to Rs. 212.8/1000 SCM to Rs. 222.4 per 1000 SCM, in N.E. States it varied from Rs. 140 to Rs. 170 per 1000 SCM. In case of gas being supplied to Namrup TPS from the M/s Oil India Ltd. it is being charged as Rs. 91.51 per 1000 SCM (flat). Due to higher basic price of gas being supplied by M/s GSPC & others at market rate, the absolute value of Royalty worked out as high as Rs. 545 per 1000 SCM in case of HAZIRA project of M/s ESSAR Power Ltd. In case of gas from Ravva satellite field in Andhra Pradesh where there was no royalty charge, a marketing margin of 2.5% was charged on the base price of \$3.3 per MMBTU by GAIL.

The rate of sales tax charged on gas varied from State to State. The minimum rate of Sales tax indicated in case of Delhi Project of Pragati, which was less than 4% and the maximum rate being 20% in case of projects in Gujarat. In Andhra Pradesh, the sales tax was 16% whereas in Maharashtra it was 4.4% including surcharge. In the N.E. States, the applicable sales tax rate is 13.2%. In absolute terms, the sales tax worked out as Rs. 97.86 per/1000 SCM in Delhi Project whereas in case of Gujarat Projects, it worked out to Rs. 559 to Rs. 1200 per 1000 SCM depending upon the gas price.

In case of liquid fuels, various types of taxes are being charged. While excise duty on Naphtha was indicated as exempted by most of the plants but IOC has levied 16% excise duty on Naphtha for Paguthan Plant in Gujarat. Excise duty & custom duty was charged on HSD supplied to Maithon Gas Plant at DVC which worked out to 25%. Excise duty @ 14-16% on HSD was charged for Delhi, Gujarat & T.N. Power Plants. Excise duty of 16% plus 10% Additional Excise duty was

charged on LDO supplied to Ahmedabad Electricity Company for Vatwa Plant from Reliance Refinery at Jamnagar.

Rates of Sales tax on different liquid fuels in different States was found to be mostly in the range of 4%

In case of DG Plant in Tamil Nadu, Entry Tax on LSHS fuel was levied at 3% in addition to Sales Tax. Similarly, for Vatwa plant in Gujarat, Octroi @ 2.5% was levied on LDO. TOT (Turn over tax) @ 1.5% was levied on Furnace oil & Kerosene supplied to Trombay Power Station.

## **12.0 Conclusions:**

The fuel data analysis as presented above indicates the large variation in price of indigenous gas as delivered to different power plant. One reason for such variation is the large difference in basic price of gas supplied by GAIL from ONGC fields under APM vis-à-vis by the other suppliers namely GSPC. GGCL etc. under market price regime. The other reason being the high rate of sales tax being levied in some states. There is need to rationalize gas pricing as well as taxes being levied in different states for power generation so as to limit the variation in prices of gas & other liquid fuels being supplied to different power plants.



**CENTRAL ELECTRICITY AUTHORITY**  
**THERMAL PROJECTS INVESTIGATION & ASH UTILISATION DIVISION**

**Subject: Report on Data on Petroleum Fuels used in various Gas Turbines & Diesel Engine power Plant in the country during 2003-04.**

As per Section 73(i) of the Electricity Act, 2003, Central Electricity Authority has been given the responsibility to collect the data concerning inter-alia the generation of power, to carry out studies relating to cost, efficiency and such other matters. In order to collect the data regarding fuel being used in various gas turbines & diesel engine power plants across the country, CEA in May, 2004 requested all the power plants using petroleum fuels as primary fuel to furnish the details regarding fuels being used by them in a standard format for the year 2003-04. The data from 46 nos. of power stations totaling to 12540 MW have been received. The data has been compiled and an analysis on the same is presented in this booklet. The booklet along with soft copy is enclosed which may please be got posted on the CEA's website.

Encl: As Above

**(S. Seshadri)**  
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SA to Member(Thermal)

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No. 75/Fuel price/ /TPI&A/2005/CEA/

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**ANNEXURE-II****Details of heat rate in various Petroleum Fuel Based Power Plants****(2003-04)**

<b>SI No.</b>	<b>Name of Power Plant</b>	<b>Capacity (MW)</b>	<b>Plant Load Factor (%)</b>	<b>Type of fuel</b>	<b>Specific Heat (Heat Rate) Kcal/kW-hr</b>
1.	Pragati( PPCL)	330	83.24	Natural Gas	1801.676
2.	Indrapastha (IPGCL)	282	49.16	Natural Gas/ HSD	2669.92
3.	Maithon (DVC)	82.5		HSD	4231.9
4.	Vadodara (GIPCL) Station-1	145	74.05	Natural Gas/ R-LNG /Naphtha	2217.7
5.	Vadodara (GIPCL) Station-II	160	60.2	Naphtha/HSD/ Natural Gas/ R-LNG	2144.8
6.	Utran (GSECL)	135	61.13	Natural Gas/ R-LNG	2017.24
7.	Hazira (Essar Power Ltd)	515	55.76	Natural Gas/Naphtha	2063.39
8.	Paguthan (GPEC)	655	63.23	Natural Gas/Naphtha/ HSD	1971.84
9.	Vatwa (AECL)	100		Natural Gas/LDO	-
10.	Dhuvaran (GEB)	534	31.1	LSHS/ Natural Gas	3273.33
11.	Dhuvaran (GSECL)	106.617	21.8	Natural Gas	2850.96*
12.	Hazira (GSEG)	156.1		Natural Gas/HSD	-

13.	Trombay (Tata Power)	1330	77.57	LSHS/ Natural Gas	-
14.	Uran (MSEB)	852	53.67	Natural Gas	2311.64
15.	Jegurupadu (GVK)	216	79.67	Natural Gas/Naphtha	2073.92
16.	Kondapalli (Lanco)	368.144	71.28	Natural Gas/Naphtha	1968.77
17.	Godavari (Spectrum)	208	60.45	Natural Gas/Naphtha	2719.15
18.	Tanir Bhavi (GMR)	220	45.17	Naphtha/HSD	2075
19.	Yelhanka (Visvesvarya)	127.92	35.5	LSHS/HSD	2082.4
20.	Belgaum (TATA)	81.3	33.98	Low Sulphur Furnace Oil	2130.39
21.	Kovilkalappal CCGT (TNEB)	107	77.21	Natural gas	1985.84
22.	Basinbridge GT(TNEB)	120	8.45	Naphtha/HSD	3486.67
23.	Kuttalam CCGT(TNEB)	100	12.32	Natural gas	3002.32**
24.	Valuthur CCGT (TNEB)	95	79.97	Natural gas	2107.08
25.	Samalpatti DG (SPC)	105.66	50.54	LSHS	2158.32
26.	Samayanallur DG (Madurai)	106	50.44	LSHS	2158.22
27.	Basinbridge DG (GMR)	200	56.58	LSHS	2023.28
28.	Karaikal CCGT(PPCL)	32.5	96.74	Natural Gas	2480.76
29.	Goa CCGT(Reliance)	48	78.02	Naphtha	2274.61
30.	Peddapuram CCGT (Reliance)	220	66.55	Natural Gas/Naphtha	2021.5
31.	Kochi (Reliance)	165	71.94	Naphtha/HSD	1858.06
32.	Namrup (ASEB)	133.5	33.27	Natural gas	3436.77
33.	Lakwa (ASEB)	120	30.58	Natural gas	4098.64
34.	Assam Gas (NEEPCO)	291	62.43	Natural gas	2543.05
35.	Agartala (NEEPCO )	84	76.78	Natural gas	4014.75
36.	Rokhia (Govt of Tripura)	69	48.53	Natural gas	5613.53
37.	Barmura (Govt. of Tripura)	21	77.92	Natural gas	4562.24

38.	Anta (NTPC)	419.33	75.47	Natural gas/Naphtha	1771.47
39.	Dadri Gas(NTPC)	829.78	69.61	Natural gas/HSD	1997.67
40.	Jhandor Gandhar(NTPC)	657.39	55.91	Natural gas	1965.12
41.	Kayamkulam CCPP(NTPC)	360	67.16	Naphtha/HSD	1980.23
42.	Faridabad Gas(NTPC)	431.586	73.75	Natural gas/Naphtha/HSD	1922.6
43.	Kawas Gas(NTPC)	656.2	67.64	Natural gas/Naphtha	1995.71
44.	Auraiya gas (NTPC)	663.36	73.11	Natural gas/Naphtha	2096.63
45.	Brahmapuram DG(KSEB)	100	30.04	LSHS/HSD	2170.44
46.	Kozhikode DG (KSEB)	128	27.77	LSHS/HSD	2110.20

\*Commissioned on June 2003.

\*\* Kuttalam Project was commissioned on 27.11.03 under open cycle mode.