Annexure-I

Annexure to Directors' Report on Energy Conservation, Technology Absorption and Foreign Exchange Earnings as per Companies (Disclosure of particulars in the Report of Board of Directors) Rules, 1988.

A. CONSERVATION OF ENERGY

a. Energy Conservation measures taken :

As a part of continued efforts towards energy conservation, a number of projects have been implemented during 2008-09 at Refineries.

Major energy conservation projects implemented are:

SI. No.	Item	Cost (Rs. in Lakh)	Fuel Savings (Standard Fuel Equivalent) (MT/Year)
1.	Flare gas recovery system at Guwahati Refinery	776	1460
2.	Stepless control in Make-up gas compressor of HDT unit at Guwahati Refinery	85	515
3.	Yield and Energy Improvement in AVU 1 at Barauni Refinery	1733	3200
4.	Commissioning of GT-II alongwith HRSG at Haldia Refinery	10000	12000
5.	Flare gas recovery system at Haldia Refinery	824	3250
6.	Foggy cooler for Gas turbines at Mathura Refinery	141	1000
7.	Stepless control in Make-up gas compressor of DHDT unit at Mathura Refinery	262	1000
8.	Pre-heat improvement in AVU through heat exchanger train optimisation at Digboi Refinery.	192	1400
9.	Enhancing Waste Heat Boiler capacity in SSRU at Panipat Refinery	100	2860
Additional investment and expression if any being involvemented for anonymetrics.			

b. Additional investment and proposals, if any, being implemented for energy conservation:

Major schemes under implementation:

- Stepless control in Recycle Gas Compressor of HDT at Guwahati Refinery and in CRU & DHDT make-up gas compressors at Barauni Refinery.
- Flare gas recovery at Barauni, Haldia and Guwahati Refineries
- Hydrogen Recovery from CLPS off gas of HCU at Gujarat Refinery
- Vent gas recovery in VDU-II and pre-heat improvement in CDU-II at Haldia Refinery.
- Pre-heat improvement in CDU at Mathura Refinery
- c. Impact of the measures at (a) and (b) above for reduction of energy consumption and consequent impact on the cost of production of goods The above schemes on completion, are expected to result in savings of about 159,000 MT per annum of standard fuel.
- d. Total energy consumption and energy consumption per unit of production as per Form 'A' of the Annexure in respect of Industries specified in the schedule thereto

Necessary information is provided in Form 'A' annexed hereto.

B. TECHNOLOGY ABSORPTION

Details of Efforts made in technology absorption are provided in Form 'B' annexed hereto.

C. FOREIGN EXCHANGE EARNING AND OUTGO

(a) Activities relating to exports, initiatives taken to increase exports, development of new export market for products and services; and export plans:

IndianOil has been consistently exporting Petroleum & Petrochemical Products and during the year has exported HSD, MS, Lubricants & Bitumen to various countries. The export market of Linear Alkyl Benzene expanded to 12 countries during the year. IndianOil also exported Paraxylene to Indonesia during the year.

(b) Total foreign exchange used and earned:

Foreign Exchange earnings	:	Rs. 14,963 crore
Foreign Exchange used	:	Rs.1,49,943 crore



FORM - 'A'

Form for Disclosure of particulars with respect to conservation of Energy

				2008-09	2007-08
A Power and Fuel Consumption					
	1.	Elec	tricity:		
		a)		24511	25161
			QUY (UUU KWII) Bate/Linit	6 1/	6.22
			Amount (Bs /Lakhs)	2119	2186
		b)	Own Generation	2110	2100
		,	i) Through Dual Fuel (HSD/Natural Gas Generator)		
			Unit ('000 KWH)	2355489	2272147
			KWH per MT of Std. Fuel	6827	6867
			Cost/Unit (Ks./KWH)	3.31	3.07
			II) ITITOUGH Steath Turbine/Generator	0178/0	860075
			KWH ner MT of Std. Fuel	3838	4075
			Cost/Unit (Rs./KWH)	5.17	4.03
		C)	Electricity Consumed		
			(a+b) ('000 KWH)	3307849	3167383
	2.	Coa		-	-
	3.	Liqu	id Fuel (FO/Naphtha/Diesel)	4004405	4005700
		Qty Amo	(WIS) wat (Pa /Lakha)	1831435	1035700
		Ant	ane Rate (Rs /MT)	20542	15471
	4.	Othe	ers / Internal Fuel	20042	101/1
		a)	Internal Fuel		
			i) Fuel Gas		
			Unit (MTs)	1429830	1392821
			Amount (Rs./Lakhs)	274705	19/38/
			Average Rate (RS./MT)	19212	14172
			linit (MTs)	350245	338488
			Amount (Rs./Lakhs)	48728	40879
			Average Rate (Rs./MT)	13913	12077
		b)	Purchased Fuel		
			Natural Gas	407000	057505
			Unit (MIS) Amount (Da /Lakha)	42/908	35/505
			Altiouili (RS./Ldkiis) Average Rate (RS./MT)	12573	40540
В	1.	Con	sumption Per MT of Production: Petroleum	12010	11010
_		Actu	al Production ('000 MTs)	46811	43038
		Con	sumption per MT of Product		
		-	Electricity (KWH/MT)	63.927	66.140
		-	Liquid Fuel (MT/MT)	0.035	0.033
		-	FUELGAS/LDU/GOKE (MIT/MIT)	0.030	0.038
	2	- Con	sumntion ner MT of Production: I AB	0.009	0.000
		Actu	al Production ('000 MTs)	128,750	132.810
		Con	sumption per MT of Product		
		-	Electricity (KWH/MT)	612.404	583.202
		-	Liquid Fuel (MT/MT)	0.405	0.403
		-	Fuel Gas/LDU/Coke(MT/MT)	0.145	0.164
	3	- Con	Natural Gas (MI/MI)	0.000	0.000
	υ.	Actu	Consumption per MT of Production: PTA Actual Production (1000 MTs)		415 848
		Con	sumption per MT of Product	400.100	110.040
		-	Electricity (KWH/MT)	581.549	585.240
		-	Liquid Fuel (MT/MT)	0.381	0.370
		-	Fuel Gas/LDO/Coke (MT/MT)	0.139	0.165
		-	Natural Gas (M1/M1)	0.000	0.000

Note: Figures for 2008-09 are inclusive of Bongaigaon Refinery figures.

Form 'B'

Form for disclosure of particulars with respect to Technology Absorption, Research and Development (R&D)

1. Specific areas in which R&D carried out by the company

- Development of Refinery process technologies
- Catalysts development for FCC and hydro processing units
- Refinery process modelling
- Trouble shooting and optimisation in refineries
- Material failure analysis, corrosion and remaining life assessment
- Development of Intelligent & Caliper pigs for Pipelines
- Pipeline transportation of petroleum products
- Product development Lubricant, Greases and Specialities
- Boundry Lubrication and Metal Working Tribology
- Bitumen
- Development of Fuel additives
- Fuels and emission studies
- Alternative Fuels Hydrogen and Biofuels
- Biotechnology
- Nanotechnology

2. Benefits derived as a result of the above R&D

- Ten patents were granted, taking the effective portfolio of patents to 223, including 63 international patents.
- 186 new lubricant formulations developed, out of which 153 formulations have been commercialised.
- 47 Lubricant formulations received approvals from user industries and Original Equipment Manufacturers.
- Catalyst loss from Indmax Unit at Guwahati Refinery was brought down from 640 Kg to 225 Kg/day.
- 27 catalysts were evaluated for enabling Refineries to select the best catalyst.
- Prediction of yield pattern in Gujarat FCCU for processing 100% hydrotreated VGO.
- FCCMOD simulator was licensed to M/s. Intercat, USA.
- Minimization of LCN in RFCC at Haldia refinery by 4.7 wt% increase in diesel yield by 4-wt% was achieved.
- Developed DHDT catalyst for production of EU-IV quality Diesel.
- Significant advances were made in the iMAX series of Additives designated for enhancement of LPG yield.
- Servo Lubricity Improver (LI) developed for LS, HSD & Naphtha.
- Heterogeneous Catalyzed Process developed for continuous Production of Bio-diesel & commissioned successfully.

3. Future plan of action

- Development of Novel Catalytic Cracking technologies for resid upgradation
- Setting up state of the art laboratory infrastructure for Polymers and Petrochemical Research
- Development of high performance, value added, cost effective products especially for segments like railways, marine propulsion and other industrial & automotive sectors
- Development of bio-fuel compatible, bio-degradable and eco-friendly long drain lubricants
- Setting up of continuous pilot plants, life cycle analysis of Jatropha biodiesel and value added bio-chemicals from glycerine
- Production of 2nd generation Bio-Fuels _Bio-Ethanol, Bio-Butanol) from Technology for Lignocellulogic bio-mass
- Study on coal gasification and petcoke to liquid and also in the frontier area of nano-technology
- Development of low emission fuels & additives

4. Expenditure on R&D

			(Rs in Crore)
a)	Capital	-	56.73
b)	Revenue	-	117.50
C)	Total	-	174.23



TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

1. Efforts made towards technology absorption, adaptation and innovation:

With a view to further improve the product pattern and product quality as well as to meet the environmental emission norms, IndianOil has adopted most modern technologies in line with the latest developments worldwide. Major steps taken in this regard are given below:

A. IMPORTED TECHNOLOGY:

i) Hydrocracker Technology:

The first Hydrocracker unit of the country was commissioned at Gujarat Refinery in 1994, adopting technology from M/s Chevron, USA for conversion of Vacuum Gas Oil to Jet fuel, Kerosene and Diesel. Thereafter, a new Hydrocracking Unit with technologies from M/s UOP, USA has been commissioned at Panipat Refinery.

ii) Once Through Hydrocracking Technology:

Once Through Hydrocracker Units (OHCU) were commissioned at Panipat and Mathura refineries with technologies from M/s UOP, USA and M/s. Chevron, USA respectively and is under implementation at Haldia Refinery with technology from M/s Axens, France for improvement of distillate yield and diesel quality.

iii) Diesel Hydro-Desulphurisation Technology:

Diesel Hydro Desulphurisation Units have been commissioned in Mathura and Panipat Refineries with technology from M/s IFP, France and at Gujarat and Haldia refineries with technology from M/s UOP, USA to meet the Diesel quality requirement.

iv) Diesel Hydrotreatment Technology:

Diesel Hydrotreatment Units have been commissioned at Guwahati, Barauni and Digboi Refineries with technology from M/s.UOP, USA and at Mathura and Panipat Refineries with technology from M/s Axens, France to meet the diesel quality requirement. Technology from M/s Axens is under implementation at Gujarat Refinery under Resid Upgradation Project.

v) Fluidised Catalytic Cracking Technology:

Fluid catalytic cracking (FCC) technology from M/s UOP, USA has been implemented in Gujarat and Mathura Refineries for conversion of Vacuum Gas Oil to LPG, MS and Diesel.

vi) Resid Fluidised Catalytic Cracking Technology:

The Resid Fluidised catalytic cracking (RFCC) technology from M/s S&W, USA has been successfully implemented at Panipat, Haldia and Barauni Refineries.

vii) Catalytic Iso-Dewaxing Unit at Haldia Refinery:

For improving the lube oil quality in line with international standards and augmenting production capability, Iso-dewaxing technology from M/s MOBIL, USA has been implemented at Haldia Refinery.

viii) Solvent Dewaxing/Deoiling Technology at Digboi:

In order to upgrade the process for the production of Paraffin Wax at Digboi Refinery, Solvent dewaxing/deoiling technology from M/s U.O.P, USA has been implemented.

ix) Hydrofinishing Technology:

Process technology from M/s. IFP, France for hydro finishing of paraffin wax has been implemented at Digboi Refinery and for production of Microcrystalline wax has been implemented at Haldia Refinery.

x) Biturox Technology:

To produce various grades of Bitumen as well as to meet the quality requirements, Biturox technology from M/s Porner, Austria has been implemented at Gujarat Refinery and is under implementation at Mathura Refinery.

xi) Hydrogen Generation Technology:

Hydrogen generation technology from M/s Linde, Germany was adopted in 1993 for Hydrogen production and supply to Hydrocracker unit at Gujarat Refinery and has been selected for implementation at Barauni Refinery under MS Quality Improvement Project. Also Hydrogen generation technology obtained from M/s. Haldor Topsoe, Denmark is in operation at Gujarat, Mathura, Haldia, Panipat and Barauni Refineries and has been selected for implementation at Gujarat Refinery under Resid Upgradation Project as well as Paradip Refinery Project. Similar technology from M/s KTI, The Netherlands has been adopted for Hydrogen generation at Guwahati, Digboi and Mathura Refineries and selected for implementation at Haldia Refinery under Once Through Hydrocracker Project.

xii) Sulphur Recovery Technologies for reduction of SO, emission:

Refineries at Gujarat, Haldia, Mathura and Barauni are provided with Sulphur Recovery Technology from M/s. Stork Comprimo (now Jacob), the Netherlands. Sulphur Recovery Technology from M/s.Delta, Hudson, Canada has been implemented at Panipat Refinery.

Further, Sulphur recovery technologies from M/s B & V Pritchard, USA has been implemented at Panipat Refinery and is under implementation at Gujarat Refinery and Paradip Refinery Project. Technology from M/s Technip, KTI, Spain is under implementation at Haldia Refinery. Technology from M/s.Jacobs, Netherlands is under implementation at Mathura Refinery.

xiii) ISOSIV Technology at Guwahati Refinery:

For production of unleaded MS at Guwahati Refinery, ISOSIV technology from M/s UOP, USA has been implemented.

xiv) Delayed Coker Technology:

For bottom of the barrel upgradation, Coker technology from M/s ABB Lummus, USA has been implemented at Panipat Refinery. Coker technology from M/s Foster Wheeler, USA is under implementation at Gujarat Refinery and Paradip Refinery Project.

xv) VGO Hydrotreatment Technology:

Technology form M/s UOP has been selected for implementation at Gujarat Refinery and from M/s Axens, France for implementation at Paradip Refinery Project.

xvi) Continuous Catalytic Reforming Technology:

For improvement in Octane number of Motor Spirit, Continuous Catalytic reforming technology from M/s IFP, France has been implemented at Mathura and Panipat Refineries. Technology from M/s UOP, USA has been implemented at Gujarat Refinery under MS Quality Upgradation Project.

xvii) Technology for ParaXylene:

For production of ParaXylene at Panipat, technology from M/s UOP, USA has been implemented and the same have been selected for implementation at Paradip Refinery Project.

xviii) Technology for Purified Terephthalic Acid (PTA):

For production of PTA at Panipat Refinery, technology from M/s Du Pont, USA has been implemented.

xix) Technology for Linear Alkyl Benzene (LAB)

Technology from M/s.UOP, USA has been implemented for production of Linear Alkyl Benzene at Gujarat Refinery.

xx) MS Quality Upgradation Technology

For MS Quality Upgradation, Isomerisation Technology of M/s.UOP, USA and M/s Axens, France has been implemented at Mathura and Haldia Refineries respectively. Technology from M/s UOP is under implementation at Gujarat and Panipat Refineries. Technology from M/s Axens is under implementation at Guwahati, Digboi and Barauni refineries.

FCC Gasoline desulphurisation technology (Prime-G) from M/s Axens, France has been implemented at Haldia Refinery and has been selected for implementation at Mathura, Barauni and Panipat Refineries.

xxi) Naphtha Cracker Technology

Naphtha Cracker Technology from M/s ABB Lummus, USA has been selected for adoption at Panipat refinery. Technologies from M/s Basell, Italy, M/ s Basell, Germany, M/s Nova Chemicals, Canada & Scientific Design, USA are under implementation for various downstream polymer plants viz. Poly-Propylene Unit, HDPE unit, Swing unit (HDPE/LLDPE) and MEG unit respectively.

Technology from M/s Basell, Italy has been selected at Paradip Refinery Project for production of Poly-Propylene.

xxii) Alkylation Technology:

For production of MS, Alkylation technology from M/.s Exxon Mobil has been selected for implementation at Paradip Refinery Project.

xxiii) Ethyl Benzene/Styrene Technology:

For production of Ethyl Benzene/Styrene, technology from M/s ABB Lummus, USA has been selected for implementation at Paradip Refinery Project.

xxiv) Regenerative type Flue Gas De-Sulphurisation Technology:

In order to recover Sulphur Di-Oxide from Boiler flue gases a Regenerative type Flue gas De-sulphurisation technology from M/s Cansolv Technology Incorporate (CTI), Canada, has been selected for implementation at Paradip Refinery Project.

xxv) Spent Acid Regeneration Technology:

In order to regenerate fresh sulphuric acid from spent sulphuric acid recovered from Alkylation Unit a Spent Acid Regeneration technology from M/s MECS, USA has been selected for implementation at Paradip Refinery Project.

xxvi) ATF Treatment Technology:

ATF Treatment Technology from M/s UOP is under implementation at Gujarat Refinery. Technology from M/s Merichem, USA has been selected for Paradip Refinery Project.



B. INDIGENOUS TECHNOLOGY:

i) INDMAX Technology:

INDMAX technology developed in-house by IOC(R&D) for converting heavy distillate and residue into LPG/light distillate products has been implemented successfully at Guwahati Refinery. For production of petro-chemical feedstocks viz. Ethylene, Propylene from VGO, INDMAX technology has been selected for implementation at Paradip Refinery Project.

ii) Hexane Hydrogenation Technology:

Hexane Hydrogenation process for production of Food grade Hexane (WHO Grade quality), developed by IOC (R&D) with indigenous catalyst has been successfully implemented at Gujarat Refinery.

C. MODERNISATION OF INSTRUMENTATION & CONTROL

A) Distributed Digital Control System (DDCS)

DDCS has already been implemented and commissioned in all Process Units and Captive Power Plants of all Refineries. Also, all the new units already commissioned and planned in future have been / will be provided with DDCS.

B) Advanced Process Control (APC)

APC has been implemented in the various units of the Refineries as under:-

- Crude & Vacuum Distillation Unit, Delayed Coker Unit and INDMAX Unit of Guwahati Refinery.
- Atmospheric & Vacuum Distillation Units, Coker, LPG Recovery Unit and Resid Fluidized Catalytic Cracking Unit of Barauni Refinery.
- Crude & Vacuum Distillation Units, Hydro-Cracker, Fluidized Catalytic Cracking Unit & Catalytic Reforming Unit of Gujarat Refinery.
- Resid Fluidized Catalytic Cracking Unit and Atmospheric & Vacuum Distillation Unit of Haldia Refinery.
- Once Through Hydrocracker, Fluidized Catalytic Cracking Unit, Atmospheric & Vacuum Distillation Unit, Continuous Catalytic Reforming Unit, Visbreaker, Diesel Hydro-Desulphurization Technology Unit / Hydrogen Generation Unit-II and Motor Spirit Quality Upgradation Unit of Mathura Refinery.
- New Delayed Coker Unit and Atmospheric & Vacuum Distillation Units of Digboi Refinery.
- Solvent Dewaxing Unit of Digboi Refinery.
- Atmospheric & Vacuum Distillation Unit-I, Once Through Hydrocracker, Resid Fluidized Catalytic Cracking, Visbreaker & Continuous Catalytic Reforming Unit of Panipat Refinery.
- Atmospheric & Vacuum Distillation Unit -1-Ii, Hydrocracker Unit, Delayed Coker Unit and DHDT Diesel Hydro-Desulphurization Technology Unit of Panipat Refinery (completed and is in operation since Nov'08).

C) Offsite Modernisation

As a part of modernisation of Oil Movement & Storage (OM&S) facilities, the following have already been implemented

- Automation of Tank Wagon loading at Barauni, Gujarat, Mathura & Haldia Refineries.
- Automation of Tank Truck loading at Gujarat & Haldia Refineries.
- Blending Automation at Haldia, Mathura & Barauni Refineries.
- Auto tank gauging has been completed at all Refineries.
- Advanced Blend Control (ABC) system for online blending of MS & HSD is being implemented at Panipat Refinery.

D) Automation of Laboratories

Automation of Laboratories has been completed at all Refineries.

E) Networking & Real Time Data Base Management System (RTDBMS)

- Networking of units and offsite facilities has been completed at all Refineries.
- Real Time Data Base Management System (RTDBMS) has been implemented at all Refineries and are in operation.