

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 the continued efforts towards energy conservation, a number of Energy Conservation projects have been implemented during 2009-10 in Refineries, resulting in savings of around 82,000 SRFT in 2009-10. Some of the major investment proposals implemented for the reduction of Energy are:

Sl. No.	Item	Cost (Rs. in Lakh)	Fuel Savings (Standard Fuel Equivalent) (MT/Year)
1.	Flare gas recovery system at Barauni Refinery	1138.30	2600
2.	Stepless control in Make-up gas compressor of DHDT & CRU units at Barauni Refinery	614.52	3000
3.	H ₂ recovery from CLPS off-gas of HCU at Gujarat Refinery	290.77	7700
4.	Installation of second heat exchanger to recover additional heat from VDU-II tempered water for pre-heating DM water for GT-2 at Haldia Refinery	53.32	1700
5.	Replacement of fouled APH in HGU-1 at Mathura Refinery	151.00	2500
6.	Pre-heat improvement in CDU at Mathura Refinery	103.00	4800
7.	Revamp of bitumen unit with Butrox technology at Mathura Refinery	1944	4700
8.	Energy optimization in Bitumen Blowing Unit by installing additional heat exchangers in two trains at Mathura Refinery	549	4300
9.	Replacement of gas AC compressor with Vapour Absorption Machines in TPS, MCR & ADM Building at Panipat Refinery	350.00	4070
10.	Flare gas recovery system at Bongaigaon Refinery	961.00	4800
11.	Installation of Helitower in CRU	740.40	806

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

Major schemes under implementation:

• Back pressure mode in TG-1 at Barauni Refinery • Bypass of K-9 in AU-II at Gujarat Refinery • Flare gas recovery system at Gujarat Refinery • Foggy cooler in GT-1 at Gujarat Refinery • Step-less control in make-up gas compressor of HCU at Gujarat Refinery • Routing of FPU-2 and VDU hot well off-gas to furnace at Gujarat Refinery • Installation of GT-III with HRSG at Haldia Refinery • Installation of magnetic resonators in GTs at Mathura Refinery • Flare gas recovery system at Panipat Refinery • Steam condensate recovery in units and off-site areas at Panipat Refinery • Heat recovery from C-7 overhead & bottom streams in NSU-1 at Panipat 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 measures taken under item (a) resulted in savings of 82,000 SRFT in 2009-10. The impact of additional savings with major investments under item (b) in 2010-11 is 53,000 SRFT.

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 in Form 'A'.

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 continues to export petroleum & petrochemical products and during the year has exported fuel products, lubricants and bitumen to various countries. While the export of fuel products has increased by 14.55%, the export of lubricants / base oil increased by 52.65% as compared to the previous year. A *SERVO* Distributor was appointed in Qatar taking the tally of overseas distributors to 11. The export market for Linear Alkyl Benzene has expanded to 18 countries in 5 continents.

(b) Total foreign exchange used and earned:

	(Rs./ crores)
Foreign Exchange earnings	13,743
Foreign Exchange used	1,17,947



IndianOil

FORM - 'A'

Form for Disclosure of particulars with respect to conservation of Energy

	2009-10	2008-09
A Power and Fuel Consumption		
1. Electricity:		
a) Purchased		
Unit ('000 KWH)	45255	34511
Rate/Unit	6.37	6.14
Total Amount (Rs./Lakhs)	2882	2119
b) Own Generation		
i) Through Dual Fuel (HSD/Natural Gas Generators)		
Unit ('000 KWH)	2429914	2355489
KWH per MT of Std. Fuel	6065	6827
Cost/Unit (Rs./KWH)	3.35	3.31
ii) Through Steam Turbine/Generators		
Unit ('000 KWH)	778248	917849
KWH per MT of Std. Fuel	2835	3838
Cost/Unit (Rs./KWH)	6.40	5.17
c) Electricity Consumed		
(a+b) ('000 KWH)	3253417	3307849
2. Coal	-	-
3. Liquid Fuel (FO/Naphtha/Diesel)		
Qty (MTs)	1682125	1831435
Amount (Rs./Lakhs)	351866	376220
Average Rate (Rs./MT)	20918	20542
4. Others / Internal Fuel		
a) Internal Fuel		
i) Fuel Gas		
Unit (MTs)	1403068	1429830
Amount (Rs./Lakhs)	278849	274705
Average Rate (Rs./MT)	19874	19212
ii) Coke		
Unit (MTs)	334247	350245
Amount (Rs./Lakhs)	42995	48728
Average Rate (Rs./MT)	12863	13913
b) Purchased Fuel		
Natural Gas		
Unit (MTs)	460671	427908
Amount (Rs./Lakhs)	61816	53801
Average Rate (Rs./MT)	13419	12573
B 1. Consumption Per MT of Production: Petroleum		
(i) Actual Production ('000 MTs)	45895	46811
(ii) Consumption per MT of Product		
- Electricity (KWH/MT)	65.341	63.927
- Liquid Fuel (MT/MT)	0.032	0.035
- Fuel Gas/LDO/Coke (MT/MT)	0.036	0.036
- Natural Gas (MT/MT)	0.010	0.009
2. Consumption per MT of Production: LAB		
(i) Actual Production ('000 MTs)	123.692	128.750
(ii) Consumption per MT of Product		
- Electricity (KWH/MT)	637.446	612.404
- Liquid Fuel (MT/MT)	0.421	0.405
- Fuel Gas/LDO/Coke(MT/MT)	0.151	0.145
- Natural Gas (MT/MT)	0.000	0.000
3. Consumption per MT of Production: PTA		
(i) Actual Production ('000 MTs)	530.604	406.736
(ii) Consumption per MT of Product		
- Electricity (KWH/MT)	410.527	581.549
- Liquid Fuel (MT/MT)	0.270	0.381
- Fuel Gas/LDO/Coke (MT/MT)	0.149	0.139
- Natural Gas (MT/MT)	0.000	0.000

Form 'B'

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

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

- a) Development of Refinery process technologies
- b) Catalysts development for refining processes
- c) Refinery process modelling
- d) Trouble shooting, revamp and optimization in refineries
- e) Material failure analysis, corrosion and remaining life assessment
- f) Development of Intelligent & Caliper pigs for Pipelines
- g) Pipeline transportation of petroleum products
- h) Product development – Lubricant, Greases and Specialities
- i) Boundary Lubrication and Metal Working Tribology
- j) Speciality bituminous products
- k) Development of Fuel additives
- l) Fuels and emission studies
- m) Alternative Fuels – Hydrogen, Ethanol, 2nd & 3rd Generation bio-fuels solar energy
- n) Biotechnology
- o) Nanotechnology
- p) Petrochemicals & polymers

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

- Successful demonstration of in-house developed DHDS/DHDT catalyst, **INDICAT-DH-IV** carried out at Chennai Petroleum Corporation Ltd. The catalyst developed for production of Euro-III & IV grade HSD, is successfully producing diesel meeting even Euro-V specifications.
- The high metal tolerant RFCC metal passivation catalyst additive, **IndVi**, has been successfully tried at Haldia refinery.
- Panipat RFCC revamp study carried out for various cases for propylene maximization with increase in capacity and without any major modification in R-R section.
- Capacity revamp study of Barauni RFCCU upto 1.7 MMTPA without major hardware modifications completed for different cases including LCO maximisation case using BCA additive.
- 14 case studies of remaining life assessment material failure analysis carried out.
- Successful re-run in Delhi–Panipat section (112 km) of MJPL using 14" IPIG and on-site data analysis carried out indicated pilferage.
- 96 Catalysts were evaluated; e-cat monitoring was carried out on 300 samples.
- 181 product formulations developed. 65 OEM/ Customer approvals and defence re-certifications obtained.
- Listing by ZF, Germany to Servo Gear LS 90, 80W-90, Servo Gear ALT 90 and Servo Gear ALT 80W-90 LL etc., against several of their TE ML specifications.
- 24 IOC *SERVO* Food grade lubricants were listed in the NSF international, (USA) white book.
- Technical and performance evaluation of Gasoline and Diesel Multifunctional additives carried out for empanelment. High performance & cost effective formulation of *SERVO* DMFA, a multifunctional additive for XTRAMILE diesel commercialized
- Base line Structure-Property-Performance data generation on commercial polymer samples already available in Indian market.
- Benchmarking of commercial additives for polyolefin resins.
- For the first time, Oilivorous-S technology extended to marine applications to control oil spillage caused due to sunken ship (Black Rose) at Paradip Port. IOC R&D and TERI jointly carried out the bioremediation of the spilled oil in sea as well as onshore.

3. Future plan of action

- Setting up of state-of-the-art infrastructure and instruments for petrochemical and polymer research.
- Developing state-of-the-art process, catalyst and technologies for application in oil refining.
- Marketing and licensing of refining technologies, catalysts and additives developed by IndianOil-R&D.
- Development of long life, energy efficient, cost effective lubricants for railways, marine applications and other automotive and industrial sectors.
- Study on coal gasification and pet coke to liquid fuel
- Frontier areas of nanotechnology, biotechnology and bio-processes
- Development of fuel saving and environment-friendly additives for fuels.
- Development of bio-degradable and FDA compatible lubricants

- Production of second & third Generation bio-fuels
- Work on gas Hydrates.

4. Expenditure on R&D

		(Rs. in crore)
a) Capital	-	80.92
b) Revenue	-	162.42
c) Total	-	243.34

TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

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

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

A. Imported Technology :

i) Hydrocracker Technology

A new Hydrocracking Unit with the technologies from M/s UOP, USA has been commissioned at Panipat under expansion project of the refinery from 6.0 to 12.0 MMTPA.

ii) Once-Through Hydrocracking Technology

Once Through Hydrocracker Units (OHCU) were commissioned at Panipat, Haldia and Mathura refineries with technologies from M/s UOP, USA, M/s Axens, France and M/s Chevron, USA respectively.

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 w.r.t. Sulphur.

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 w.r.t. Sulphur and Cetane Number Technology from M/s Axens is under implementation at Gujarat Refinery under Resid Upgradation Project. Technology from M/s Shell Global Solutions, Netherlands has been selected for implementation at Paradip Refinery 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 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 for Treatment of Paraffin Wax/Microcrystalline Wax

Process technology from M/s IFP, France for hydro finishing of paraffin wax has been implemented at Digboi refinery. The same technology from M/s IFP, France 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 employed at Gujarat refinery and 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 is under 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 is under implementation at Gujarat refinery under Resid Upgradation Project. Technology from M/s UHDE, Germany has been selected for

implementation through BOO operator M/s Prax Air, USA at Paradip Refinery Project. Similar technology from M/s KTI, The Netherlands has been adopted for Hydrogen generation at Guwahati, Digboi and Mathura refineries and has been implemented at Haldia refinery under Once Through Hydrocracker Project. Hydrogen generation technology from M/s Technip Benelux B.V. Netherlands is under implementation at Bongaigaon Refinery under Diesel Quality Improvement Project.

xii) Sulphur Recovery Technologies for reduction of SO₂ 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 employed at Panipat Refinery. Further, Sulphur recovery technologies from M/s B & V Pritchard, USA has been implemented under Panipat Refinery Expansion Project and is under implementation at Gujarat refinery under Resid Upgradation Project and the same has also been selected for implementation at Paradip Refinery Project. Technology from M/s Technip, KTI, Spain is under implementation at Haldia refinery under Once Through Hydrocracker Project. Technology from M/s Jacobs, Netherlands is under implementation in additional Sulphur Recovery Unit at Mathura Refinery. Technology from M/s Lurgi, Germany has been selected for implementation under Distillate Yield Improvement (Coker) project at Haldia 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 as part of Panipat Refinery Expansion Project. Coker technology from M/s Foster Wheeler, USA is under implementation at Gujarat refinery under Resid Upgradation Project and has also been selected for implementation at Paradip Refinery Project as well as at Haldia Refinery.

xv) VGO Hydrotreatment Technology

Technology from M/s UOP has been selected for implementation at Gujarat refinery under Resid Upgradation Project. Technology from M/s Axens, France has been selected 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 and has also been selected for implementation at Paradip Refinery 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 have been implemented at Mathura and Panipat refineries and is under implementation at Gujarat Refinery. Technology from M/s Axens, France has been implemented at Haldia Refinery and is under implementation at Guwahati, Digboi and Barauni refineries.

FCC Gasoline desulphurisation technology (Prime-G) from M/s Axens, France has been employed at Haldia, Mathura and Panipat refineries and is under implementation at Barauni.

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

xxvii) LPG Treatment Technology

Coker LPG Treatment Technology from M/s UOP, USA has been selected for implementation at Haldia Refinery under the distillate yield improvement (Coker) project.

xxviii) Coker Gas Oil Hydrotreatment Technology

Coker Gas Oil Hydrotreatment Technology from M/s Axens, France has been selected for implementation at Haldia Refinery under the distillate yield improvement (Coker) 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 and has been selected for implementation at Bongaigaon Refinery. For production of petrochemical 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.

iii) Diesel Hydrotreatment Technology

Diesel Hydrotreatment Technology developed by IOC (R&D) and licensed jointly with EIL is under implementation at Bongaigaon Refinery for meeting Diesel quality requirements.

iv) Isomerisation Technology

Isomerisation Technology developed by IOC (R&D) and licensed jointly with EIL is under implementation at Bongaigaon Refinery for meeting MS quality requirements.

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)

Model based Multi-variable Predictive Advanced Process Control Systems (APC) have been implemented in the various units of the Refineries.

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 & Panipat Refineries.
- Auto tank gauging has been completed at all Refineries.

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.
- Data Reconciliation and Yield Accounting Package (DRYA) has been implemented in all refineries for working out accurate Daily Production Balance using real time process data.

Annexure-II

SC/ST/OBC REPORT-I

Annual statement showing the representation of SCs, STs and OBCs as on 1st January, 2010 and number of appointments made during the preceding calendar year

Groups	Representation of SCs/STs/OBCs (As on 01.01.2010)				Number of appointments made during the calendar year 2009									
	Total number of employees	SCs	STs	OBCs	By Direct Recruitment				By Promotion			By Deputation/Absorption		
					Total	SCs	STs	OBCs	Total	SCs	STs	Total	SCs	STs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	14308	2340	947	1218	676	90	36	110	211	32	17	3	0	0
B	6288	999	543	127	No recruitment is made in this group				565	99	53	0	0	0
C	13616	2830	1073	1467	612	104	24	174	38	8	3	1	0	0
D (Excluding Sweeper)	282	63	29	50	33	9	2	6	0	0	0	0	0	0
D (Sweeper)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	34494	6232	2592	2862	1321	203	62	290	814	139	73	4	0	0

SC/ST/OBC REPORT-II

Annual statement showing the representation of SCs, STs and OBCs in various Group "A" services as on 1st January, 2010 and number of appointments made in the service in various grades in the preceding calendar year

Pay Scale (In Rupees)	Representation of SCs/STs/OBCs (As on 01.01.2010)				Number of appointments made during the calendar year 2009									
	Total number of employees	SCs	STs	OBCs	By Direct Recruitment				By Promotion			By Deputation/Absorption		
					Total	SCs	STs	OBCs	Total	SCs	STs	Total	SCs	STs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
23,000-46,500	4247	636	294	658	670	90	36	110	195	31	16	0	0	0
Prov. Max 50,500	2765	432	195	281	3	0	0	0	550	107	48	0	0	0
32,900-58,000	2768	556	195	234	2	0	0	0	451	74	29	0	0	0
36,600-62,000	1603	323	122	32	No recruitment is made in this group				324	65	24	3	0	0
43,200-66,000	1274	237	107	6	No recruitment is made in this group				212	41	16	0	0	0
Prov. Max 68,500	1030	120	27	6	No recruitment is made in this group				201	28	9	0	0	0
Prov. Max-71,000	432	28	7	0	1	0	0	0	105	11	1	0	0	0
51,300-73,000	129	6	0	1	No recruitment is made in this group				34	2	0	0	0	0
62,000-80,000	60	2	0	0	No recruitment is made in this group				16	0	0	0	0	0
Grand Total	14308	2340	947	1218	676	90	36	110	2088	359	143	3	0	0