MINISTRY OF PETROLEUM AND NATURAL GAS

CHAPTER VII

Indian Oil Corporation Limited

Efficiency of Panipat and Mathura Refineries

Executive summary

Indian Oil Corporation Limited is India's largest commercial enterprise with a turnover of Rs.2,85,337 crore and a net profit of Rs.2,950 crore in 2008-09. The Company has eight refineries with a total capacity of 49.70 Million Metric Tonne Per Annum (MMTPA). A performance audit conducted to assess the efficiency of the Mathura and Panipat refineries (with refining capacities of 8 MMTPA and 12 MMTPA respectively) located in northern India, for the three year period from 2006-07 to 2008-09 disclosed that both the Refineries achieved more than 100 per cent of their respective achievable targets during the period reviewed (except Panipat Refinery during 2006-07 due to stabilisation problem). There was scope for further improvement in capacity utilisation of processing units and improving yield by enhancing the middle and light distillates, which are more profitable. The major audit observations were:

- The Company could not install Delayed Coker unit at Mathura Refinery and, thus, was deprived of the benefits of higher distillate yield and enhanced Gross Refinery Margin of about Rs. 800 crore per annum.
- The Mathura Refinery produced Propylene more than its demand and had to blend back 16,665 MT of propylene with LPG resulting in loss of Rs. 11.38 crore.
- The Company revamped Continuous Catalytic Reforming Unit at Panipat Refinery at an expenditure of Rs. 61.77 crore but did not utilise its enhanced capacity rendering the investment on its revamping infructuous.
- Vis Breaker Unit of Panipat Refinery set up at a cost of Rs. 38.34 crore did not achieve designed yield resulting is loss of Rs. 27.22 crore.
- A PX-PTA project at Panipat Refinery set up at a cost of Rs. 2,630.11 crore did not produce the designed yield leading to loss of Rs. 69.93 crore.
- An investment of Rs. 81.67 crore on revamping of Reside Fluidised Catalytic Unit proved to be unproductive as LPG yield increased only marginally from 19 per cent to 20 per cent against the envisaged LPG yield of 29 per cent.

- On environment front Audit found that the Company did not achieve ILP targets in terms of Sulphur recovery, production of Euro III compliant MS and HSD in all the three years except production of MS in 2007-08. The short recovery of sulphur also resulted in loss of Rs. 108.66 crore during the above three year period besides polluting the environment.

Some of the important recommendations made by Audit deserve attention of the Management for further improving its performance by (a) optimum utilisation of the installed capacities, (b) achieving the designed yield in both the Refineries and (c) increasing distillate yield in respect of Mathura Refinery by Installing Delayed Coker Unit by perusing the most feasible option.

Summary of recommendations

The Management may improve the performance of the refineries by:

- ***Increasing the distillate yield in respect of Mathura refinery by implementing a viable yield optimization project and optimal utilisation of PX/PTA at Panipat Refinery,***
- ***Optimum utilisation of the capacity created among its various processing units like the Vis- Breaker Unit, the Continuous Catalytic Reforming Unit, the Resid Fluidised Catalytic Unit etc. at Panipat refinery,***
- ***Managing costs through rationalizing its manpower,***
- ***Giving due importance to environmental issues like sulphur content and the Clean Development Mechanism project.***

7.1 Introduction

Indian Oil Corporation Limited (Company) is India's largest commercial enterprise, with a turnover of Rs. 2,85,337 crore and a net profit of Rs. 2,950 crore during 2008-09. It is also the highest ranked Indian Company in the Fortune 'Global 500' listing, currently at 105th position in 2009. The Company has eight refineries with a total capacity of 49.70 Million MTs Per Annum (MMTPA). The performance audit has been conducted of Mathura (8 MMTPA) and Panipat (12 MMTPA) refineries which constituted a capacity of 20 MMTPA.

- Mathura Refinery

Mathura Refinery was commissioned in 1982 as the Company's sixth refinery with an original capacity of 6 MMTPA, which was increased to 8 MMTPA through a revamp in July 2000. The refinery processes crude oil to produce petroleum products like Motor Spirit (MS), High Speed Diesel (HSD), Aviation Turbine Fuel (ATF), Superior Kerosene Oil (SKO), Liquefied Petroleum Gas (LPG), Furnace Oil (FO) and Bitumen.

- Panipat Refinery

Panipat Refinery was commissioned in 1998, with an original capacity of 6 MMTPA which was increased to 12 MMTPA after commissioning of Panipat Refinery Expansion Project (PREP) in August 2006 and its further expansion to 15 MMTPA by August 2010 was in progress (December 2009).

- Refining Process

At a refinery, petroleum products are produced by refining the crude oil. The process involved in production can be classified under four basic steps: Distillation, Cracking, Treating and Reforming.

- Distillation

Distillation involves pumping oil through pipes in hot furnaces and separating light hydrocarbon molecules from heavy ones. During this process, the lightest materials like propane and butane, vaporise and rise to the top of the atmospheric columns. Medium weight materials like gasoline, jet and diesel fuels, condense in the middle. Heavy materials called Reduced Crude Oil (RCO) condense in the lower portion of the atmospheric column. The basic distillation is done in Crude Distillation Unit (CDU) and Vacuum Distillation Unit (VDU).

- Cracking

Vacuum Gas Oil (VGO) is converted into gasoline, jet and diesel fuels by using processing plants that "crack" large, heavy molecules into smaller, lighter ones. Heat and catalysts are used to convert the heavier oils to lighter products using different "cracking" methods: (i) Fluidised Catalyst Cracking Unit (FCCU), (ii) Hydro cracking Unit (HCU) and (iii) Coking (or thermal cracking).

- Treating

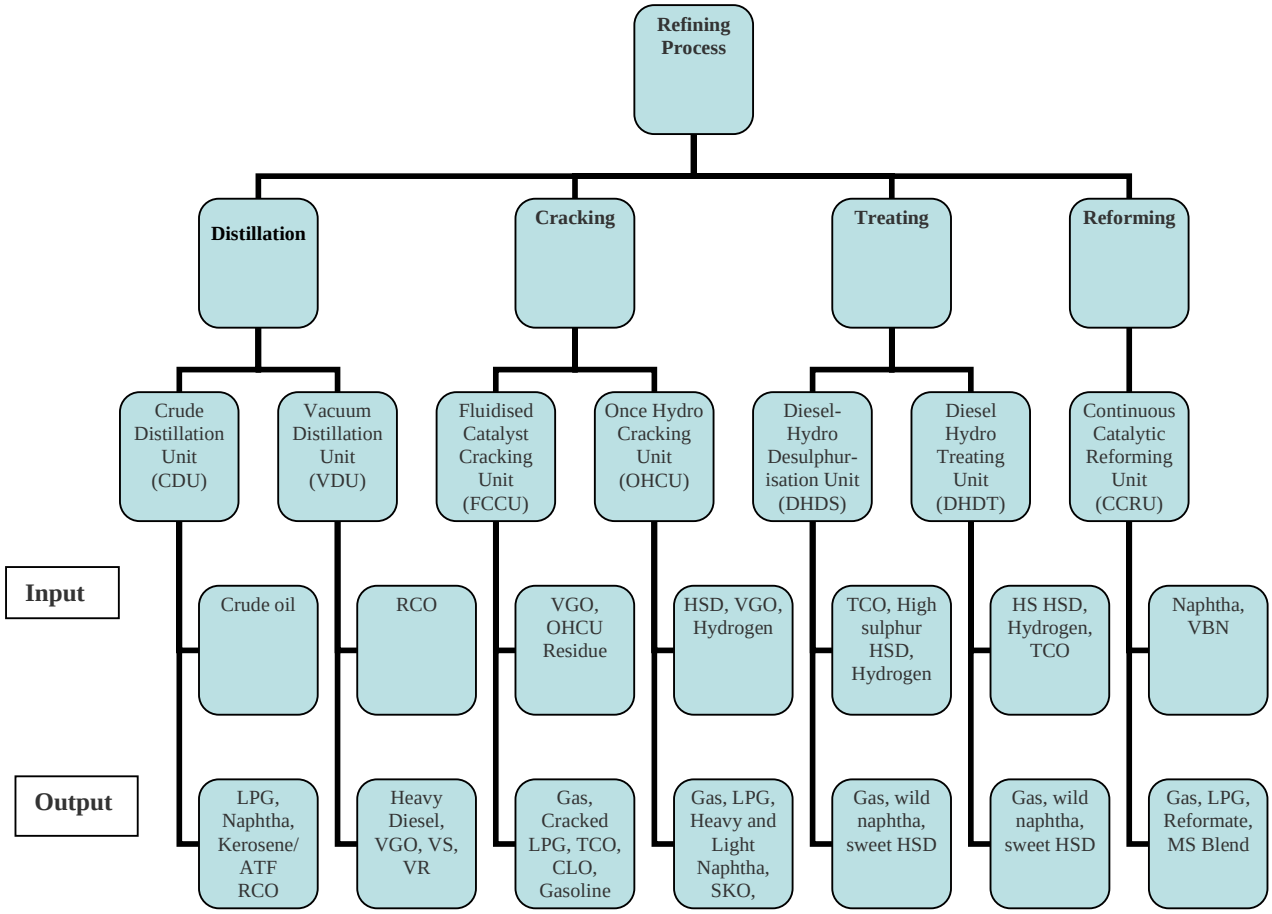
In order to meet environmental norms (Bharat Standard (BS)-II / Euro-III), the sulphur content of gas oil has to be reduced to the acceptable levels. For this purpose, the gas oil produced in Crude Units / FCCU is treated in Diesel Hydro Desulphurisation (DHDS)/ Diesel Hydro Treating Unit (DHDT) with the help of hydrogen.

- Reforming

Much of the gasoline component that comes from the Crude Units does not have enough octane to burn well in vehicles. The reforming process involves removing of hydrogen from the low-octane gasoline and helps in improving the octane rating in the gasoline.

Under the above refining processes, the main processing units and their major products are depicted in the following **Chart 7.1**:

Chart 7.1



ATF- Aviation Turbine Fuel, CLO-Clarified Oil, HSD- High Speed Diesel, MS-Motor Spirit, RCO-Reduced Crude Oil, TCO-Total Cycle Oil, VGO-Vacuum Gas Oil, SKO-Superior Kerosene Oil, VBN-Vis-Breaker Naphtha, VGO-Vacuum Gas Oil, VR-Vacuum Residue, VS-Vacuum Slop

7.2 Scope of Audit

The Audit covered appraisal of the performance of the various primary and secondary units of Mathura and Panipat Refineries including auxiliary services, process planning, cost controls, creation of additional facilities and environment and safety for three years from 2006-07 to 2008-09. The Audit was conducted from July to November 2009.

7.3 Audit objectives

The main objective of audit was to adjudge the efficiency of the refineries during the period 2006-07 to 2008-09 based on the following sub-objectives:

- To examine the designed *vis-à-vis* actual capacity utilisation of process units and utilities;

- To examine the rationale behind fixation of production targets by the Company in MOUs with GOI and review the actual performance, including designed and actual yield pattern;
- To examine the existing costing system including various cost elements such as fuel, power, chemical, catalyst, repairs and maintenance, manpower, administration and other overheads;
- To review repairs and maintenance policy, annual shutdown plan and emergency shutdown management, justification for having an idle / standby asset and to evaluate the mechanism in place for augmentation of infrastructure; and
- To examine compliance reports of the Company regarding environmental, occupational health and safety laws, regulations, guidelines and permit requirements.

7.4 Audit criteria

Following criteria were adopted for assessing the efficiency of Mathura and Panipat Refineries:

- Designed capacity of processing units and utilities;
- System of fixation of efficiency targets and achievement;
- MOU targets and achievements;
- Internal targets with respect to cost elements;
- Management and Government's policies and Feasibility Reports;
- Prevalent Industrial Standards / Norms; and
- Environmental laws, Government's policy and guidelines.

7.5 Audit Methodology

Audit involved review and analysis of refinery performance reports with reference to Detailed Project Reports (DPR) / Feasibility Reports for augmentation of infrastructure, Memorandum of Understanding (MOU) with the Government of India (GOI). An entry conference was held on 3 July 2009 with the Management to discuss the audit objectives, audit criteria and audit methodology. The draft performance report was issued to the Management on 7 October 2009 and partial reply was received on 25 November 2009. Exit conference was held on 27 November 2009 with the Management to discuss the draft performance audit report. The views expressed therein and the Management's replies, wherever, received have been suitably incorporated in this report.

7.6 Acknowledgement

Audit acknowledges the co-operation of the Company in providing necessary records and information at various stages of the performance audit.

7.7 Audit findings

Audit noted that though Mathura and Panipat Refineries achieved performance targets based on parameters fixed in MOU (except Panipat Refinery during 2006-07), there was scope for improvement in the following areas:

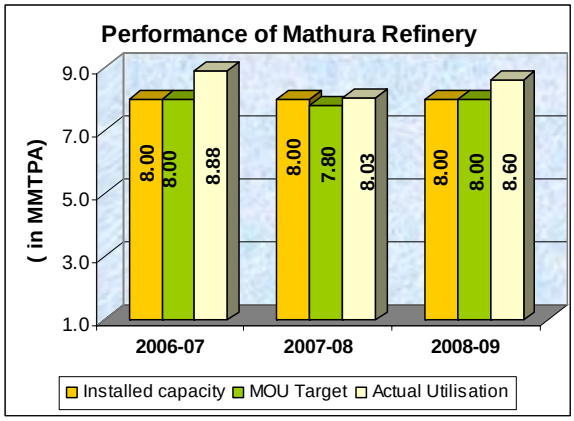
- Improper production of Propylene – Mathura Refinery;
- Under utilisation and non-achievement of designed yield by Vis-Breaker Unit- Panipat Refinery;
- Under-utilisation of Continuous Catalytic Reforming Unit - Panipat Refinery;
- Low distillate yield due to non-providing of Delayed Coker unit - Mathura Refinery;
- Under performance of PXPTA Complex - Panipat Refinery;
- Un-fruitful expenditure on the revamping of Resid Fluidised Catalytic Unit- Panipat Refinery;
- Excess consumption of power - Panipat Refinery;
- Creation of excess power generation capacity - Panipat Refinery;
- Non-recovery of sulphur to the optimum level - Panipat Refinery;
- Non registration of Flare Gas Recovery System as Clean Development Mechanism project - Panipat and Mathura Refineries; and
- Higher expenditure on overtime allowance due to non-rationalisation of manpower - Mathura Refinery.

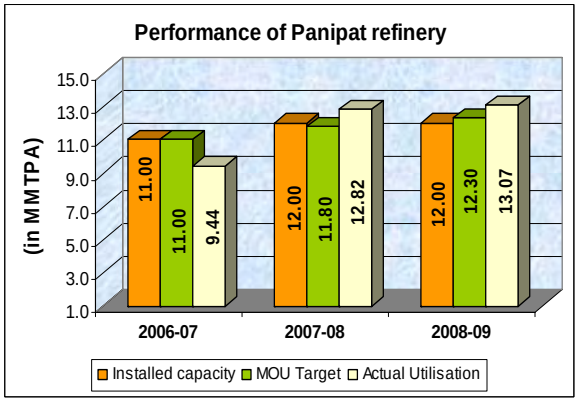
Detailed audit findings are discussed in the succeeding paragraphs:

7.7.1 Performance of the Mathura and Panipat Refineries vis-à-vis MOU Targets

The major parameters for a performance benchmark fixed by the Ministry of Petroleum and Natural Gas (MoPNG) are crude throughput, capacity utilisation, yield and fuel and loss. The targets for these parameters are fixed in the MOU with the GOI for evaluation of the performance of refineries. Performance of the refineries against the installed capacity and MOU targets during 2006-07 to 2008-09 is given in the following **Chart 7.2**:

Chart 7.2





From the above, it may be seen that both the refineries had achieved more than 100 *per cent* of the targets during the last three years except during 2006-07[1] when Panipat Refinery could not achieve the target due to stabilisation problems of PREP. The Refineries achieved the targets in terms of distillate yield and fuel and loss in all the three years except in 2006-07 in Panipat Refinery as could be seen from ***Annexure-XXI.***

From the analysis of installed capacity, MOU targets and available on stream hours, it was observed that installed capacity and MOU targets were fixed based on 8000 standard on stream hours per annum whereas the available on stream hours were more as could be seen from the following **Table 7.1**. Thus, MOU targets were fixed on lower side.

Table 7.1

Refinery	Available on stream hours after adjusting planned shut down			Throughput for available on stream hours (in MMTP)			MOU target (in MMTP)		
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09
Mathura	8760	7764	8760	8.76	7.764	8.76	8.0	7.8	8.0
Panipat	7963	8352	8760	10.53	12.83	12.85	11.0	11.8	12.3
PREP	7296	8760	8366						

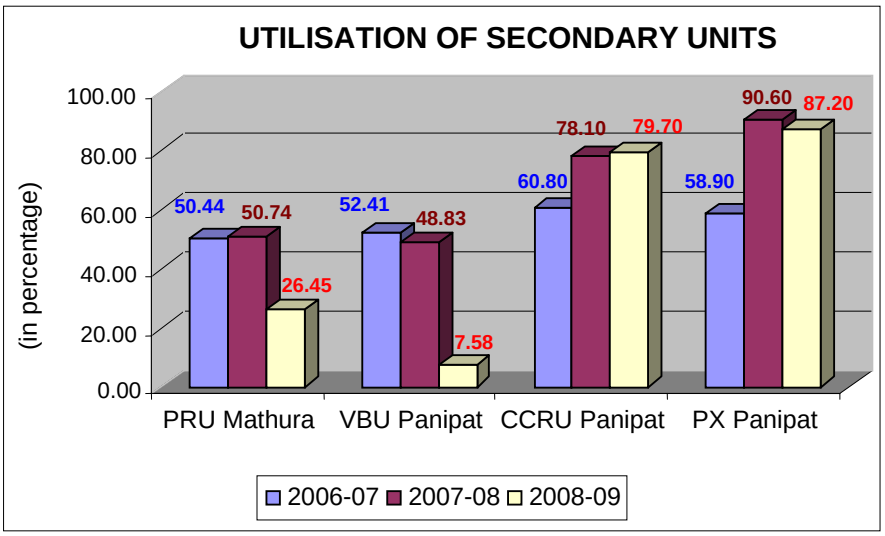
7.7.2 Capacity Utilisation of Processing Units

Refining capacity utilisation is an important measure of a refinery's efficiency. It indicates the percentage of utilisation of the total installed capacity during a year. Processing units at a refinery include primary and secondary processing units. Primary

[1] ***For 2006-07, the Management indicated the installed capacity of 7.5 MMTPA, however, in view of commissioning of AVU of PREP on 1 June 2006, the proportionate installed capacity worked out to 11 MMTPA***

processing units are CDU (Crude Distillation Unit) and VDU (Vacuum Distillation Unit); both units together are called Atmospheric Vacuum Unit (AVU).
Secondary processing units include all other remaining processing units, which get feed from the primary units or any other secondary processing unit. Details of capacity utilisation of processing units are shown at ***Annexure-XXII*** and details of production of various products are shown in ***Annexure-XXIII.*** From the analysis of the utilisation of the secondary units, it was observed that the utilisation was generally in line with the installed capacity except some cases mentioned in the Annexure. Underutilisation of Propylene Recovery Unit (PRU), Vis Breaker Unit (VBU), Continuous Catalytic Reforming Unit (CCRU) and Para Xylene Unit (PX) which are discussed in detail in this report are depicted below in **Chart 7.3**:

Chart 7.3

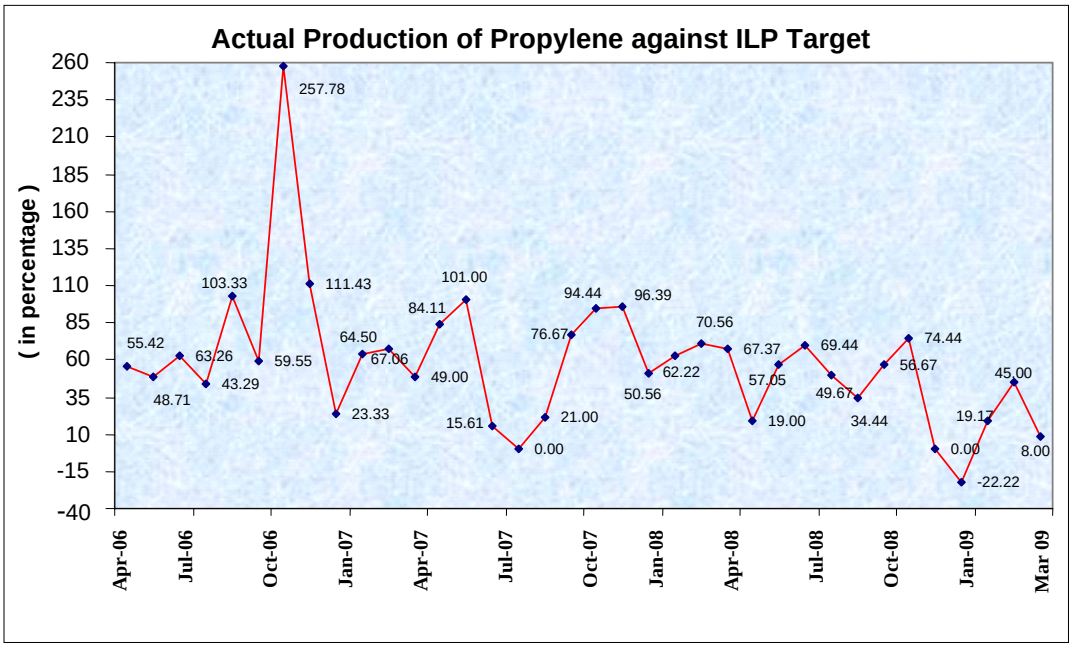


7.7.2.1 Improper production of Propylene - Mathura Refinery

Propylene Recovery Unit (PRU) at Mathura refinery was commissioned (January 1996) at a cost of Rs. 38.24 crore. It was designed to produce 34,460 MT *per annum* polymer grade propylene from cracked Liquified Petroleum Gas (LPG).

The capacity utilisation of PRU during the years 2006-07 to 2008-09 was 39.22, 39.02 and 21.50 *per cent* respectively, producing 13,514 MT, 13,445 MT and 7,408 MT of propylene. Monthly Industry Logistics Plan targets and actual production of propylene during last three years is depicted in the following **Chart 7.4**:

Chart 7.4



It is seen from above that Mathura refinery could achieve the ILP projections only in four months during 2006-09. Further, during the year 2007-08, the unit was operated continuously despite low demand and it failed to market actual production. Consequently, 16,665 MT of propylene was blended back with LPG resulting in loss of Rs. 11.38 crore[2] on variable cost of production of propylene.

The Management stated that the unit was kept running in order to avoid intermittent start-up, shut down and stabilisation and resultant quality problems. The ILP projections were stated to have been finalised in anticipation of identifying new customers and then meeting the supply, which did not materialise. This low capacity utilisation was attributed to low market demand for propylene.

The reply is not convincing as the Company should fix ILP production target after detailed market research. Blending of propylene back to LPG reflected deficiency in the system of fixation of ILP targets. Further, the unit was shut-down seven times during the year 2008-09 due to high stocks available. To avoid additional production cost, the unit could have been shut-down in 2007-08 also in tune with the demand pattern.

Recommendation No. 7.1

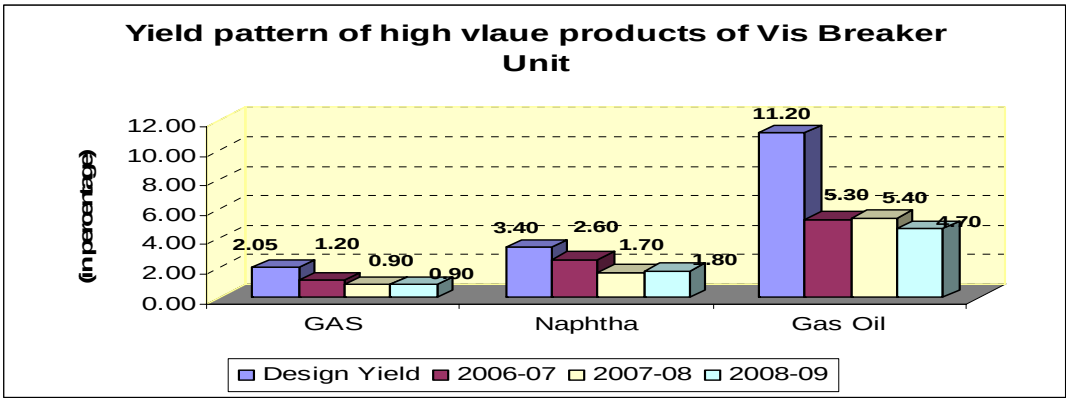
While fixing the ILP targets, the Management may consider the market demand of the product and actual production may be done in tune with the market demand to avoid additional production cost.

[2] ***Worked out at Rs.6,831 per MT being the additional variable cost on 16,665 MT of propylene blended with LPG***

7.7.2.2 Underutilisation of Vis-Breaker Unit - Panipat Refinery

Vis-breaker Unit (VBU) at Panipat Refinery was commissioned (October 1998) at a cost of Rs. 38.34 crore and was designed to process through cracking 4,00,000 MT per annum of Vacuum Residue (VR) received from Vacuum Distillation Unit (VDU). The main product from the unit is Fuel Oil (Heavy Petroleum Stock-HPS) besides other products like Gas Oil, Naphtha and Fuel Gas. During 2006-07, capacity utilisation of VBU was 52.41 *per cent*, which declined to 48.83 *per cent* in 2007-08 and 7.58 *per cent* in 2008-09. The designed product pattern and actual production of gas, naphtha and gas oil during 2006-07 to 2008-09 are given in the following **Chart 7.5**:

Chart 7.5



From the above, it is seen that the yield of value added products such as gas, naphtha and gas oil had declined. As per the VBU Operating Manual, the potential yield of gas, naphtha, and gas oil should have been to the extent of 2.05 *per cent*, 3.40 *per cent* and 11.20 *per cent* respectively. However, in actual operations, the potential yield could never be achieved during the years 2006-07 to 2008-09. Due to underutilisation of the installed capacity of VBU and non-achievement of designed yield, the Company lost net margin of Rs. 27.22 crore during the above period**.**

The Management stated that the unit could not be utilised up to its designed capacity due to lower demand of HPS and that it was considered non operational after commissioning of Delayed Coker Unit (DCU) which also uses the common feed *i.e.* vacuum residue. It further stated that profitability of process units was not separately identified.

The reply of the Management is not convincing as it continued to operate VBU though at low capacity in spite of commissioning of DCU in August 2006 that too without any cost benefit analysis. Further, the Management's reply was silent regarding non-achievement of designed yield and consequential loss.

Recommendation No. 7.2

While installing new units to the existing refinery, the Management may consider alternate uses/disposal of units, which may become obsolete/non-operational after conducting its cost-benefit analysis. To enhance Gross Refinery Margin (GRM), the Management may endeavour to optimise the actual yield.

7.7.2.3 Under-utilisation of Continuous Catalytic Reforming Unit - Panipat Refinery

The CCRU at Panipat refinery was commissioned (December 1998) originally at a cost of Rs. 134.19 crore and was designed to process through reforming 5,00,000 MT per annum of feedstock (chiefly naphtha) to produce high octane reformate[3]. The CCRU was revamped in 2008-09 at a cost of Rs. 61.77 crore by augmenting its capacity[4] from 500 to 640 Thousand MTs Per Annum (TMTPA). The capacity utilisation data of CCRU during 2006-07 to 2008-09 was as follows:

Table 7.2

Year	Installed Capacity (TMTPA)	Actual Throughput (in TMT)	Capacity Utilisation (*in percentage*)
2006-07	500	304.2	60.8
2007-08	500	390.6	78.1
2008-09	640	510.3	79.7

It was observed in Audit that:

(i) Even though the existing capacity of CCRU was not being fully utilised[5], {in spite of Naphtha (the feed for CCRU) being available in surplus}, a decision was taken (March 2006) for revamping of CCRU to increase the capacity to 640 TMTPA. Even after revamping (March 2008), only 510 TMT of input was processed in 2008-09, which could have been done without revamping of CCRU.

(ii) As per Detailed Feasibility Report of the CCRU revamp, returns from revamping of CCRU at about 53 *per cent* per annum was expected for a period of 24 months from the date of commissioning of revamped CCRU to the installation of Naphtha Cracker Project (NCP). NCP was approved in December 2006 at a cost of Rs.14,439 crore and was expected to be commissioned in the first quarter of 2010. The refinery could not gainfully use the enhanced capacity of CCRU.

Thus, it is evident that the Management's decision for revamping CCRU overlooked the underutilisation of its existing capacity and rendered the additional investment wasteful.

The Management stated that CCRU capacity utilisation was basically linked to MS production numbers finalised in ILP target by Corporate Optimisation group and after implementation of CCRU revamp project, MS production from Panipat refinery had increased from 673 TMT in 2006-07 to 987 TMT in 2008-09 matching increase in the All India demand of the Company. The Management further stated that to meet MS quality improvement project requirements, full capacity utilisation of CCRU was required even in post Naphtha Cracker scenario.

Reply is not convincing as production of 673 TMT MS was achieved with a throughput of 304.2 TMT in CCRU and, thus, with this level of performance[6], the refinery was capable of producing as much as 1,106 TMT MS with the existing capacity *i.e.* 500 TMT itself. Thus, revamping did not fetch any additional gains and investment (Rs. 61.77 crore) made on revamping the unit was not fruitful. It is clear from the Management's contention that full capacity utilisation would be required in the post NCP scenario to

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[3] Octane reformate is used as one of the blending components for production of Motor Spirit
[4] with 98 RON of reformate and also to increase MS production by 174 TMTPA
[5] At 82.54, 86.76 and 81.82 per cent in 2001-02, 2002-03 and 2003-04
[6] (MS production/CCRU throughput)*100 = (673 TMT/304.2 TMT)*100 =221.24 per cent

meet MS quality improvement project requirements is an afterthought as no such utilisation was envisaged in the DFR.

Recommendation No. 7.3

Before initiating proposal for capacity augmentation, the Management may take into account the existing idle capacity and inbuilt cushion in the design.

7.7.3 Production Process and Yield Pattern

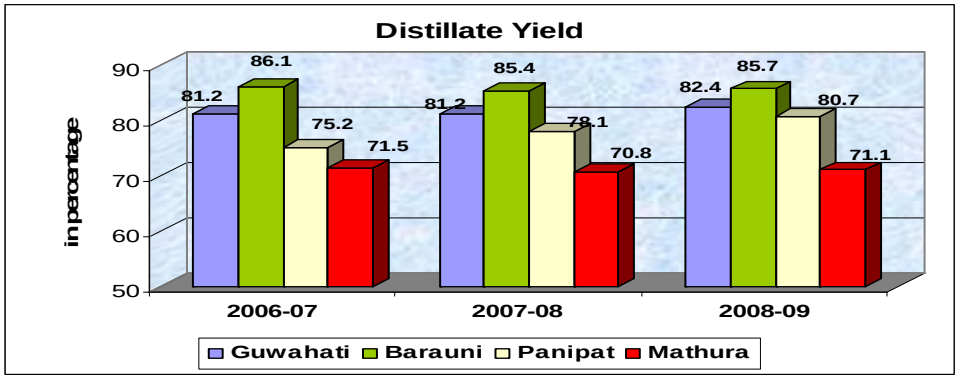
The Company does production process maximisation (enhancing gross refinery margin by optimizing distillate yield) by making production plans based on a linear programming module for each refinery, on the basis of demand for petroleum products, availability of required grade of crude oil as per designed parameters of processing units, refinery configuration and other constraints like emergency shutdown, non-availability of feed for secondary units. Yield pattern of the refinery depends upon the crude mix, refinery configuration, technology, finished product demand, production process optimisation and operating performance of primary and secondary processing units. Scrutiny of records revealed the following:

7.7.3.1 Low Distillate yield due to non-providing of Delayed Coker Unit - Mathura Refinery

Mathura Refinery was originally designed to process 6.0 MMTPA of crude oil, which was later increased to 8 MMTPA in July 1988. The Company carried out another revamp in June 2004 in order to increase yield, optimise energy and augment the capacity of one of its primary Units *i.e.* CDU to 11 MMTPA. The capacity of VDU as well as the secondary processing units, however, remained compatible only to the pre-revamped crude process capacity of 8 MMTPA.

The Distillate yield of Mathura Refinery *vis-à-vis* other refineries of the Company are depicted below in **Chart 7.6**:

Chart 7.6



The main reason attributed to significantly higher distillate yields in other refineries was presence of a Coker unit in them. The Coker unit is an additional secondary unit, which converts heavy bottom feed into lighter feed stocks resulting in significantly higher distillate yield. Even an increase of one *per cent* in distillate yield contributes to increase of approximately Rs. 100 crore in Gross Refinery Margin (GRM). This also enables the

refinery to optimise utilisation of crude by deriving maximum possible yield and saving foreign exchange for the country.

Mathura Refinery initiated (April 2007) a proposal for 'Residue up gradation and distillate yield improvement' including installation of a Coker Unit (estimated cost – Rs. 1,607 crore) at the existing capacity of 8 MMTPA for which the Ministry of Environment and Forest (MOEF) finalised the Terms of Reference (TOR). In the meanwhile, the Refinery initiated (March 2008) another proposal (estimated cost-Rs. 5,514 crore) for 'Residue up gradation and distillate yield improvement' at an enhanced capacity of 11 MMTPA. The environmental clearance for capacity augmentation for refinery as a whole was also sought (April 2008) from MOEF. As the second proposal was for capacity expansion of a plant falling under Tajmahal Trapezium Zone (TTZ), the MOEF directed the Company to file an affidavit before the Supreme Court and take necessary orders from the Court for facilitating further action as MOEF had filed (1996) an affidavit in the Court to the effect that no expansion would be allowed in the units operating in TTZ without their approval. The matter was pending (December 2009).

Instead of pursuing its earlier proposal of distillate yield improvement including Coker unit for which the Terms of Reference had already been finalised by MOEF, the Company entangled itself in a complex scenario wherein it cannot proceed further without getting environmental clearance from the Court for its capacity enhancement project. Resultantly, the Company could not install Coker unit and, thus, was deprived of the benefits of higher distillate yield and enhanced GRM.

The Management stated that Mathura Refinery approached MOEF seeking clearance for capacity augmentation from 8 to 11 MMTPA in view of the favourable indications from statutory authorities and considering its long term plan. The Coker capacity would have been inadequate, had the unit been upgraded at 8 MMTPA.

The reply is not convincing as there had already been an inordinate delay in initiating the process for providing Coker Unit at Mathura Refinery whereas the same was initiated much earlier (1999) in Panipat Refinery. Besides, environmental clearance for higher capacity was to be obtained from the Court which is time consuming while the original proposal without capacity expansion could have been cleared by the MOEF. Considering the magnitude of incremental GRM foregone (around Rs. 800 crore *per annum* with increase of distillate yield by about eight *per cent*), it was in the interest of the Company to upgrade the refinery with a Coker unit (estimated to cost Rs. 1,607 crore) at the existing capacity, if not at an enhanced capacity of 11 MMTPA at the earliest. Thus, the Company continues to be deprived of improved yield.

Recommendation No. 7.4

Efforts may be made to install a Coker unit, of the capacity permitted by MOEF with cushion for its up-gradation, without loss of time by pursuing the most feasible option to improve distillate yield.

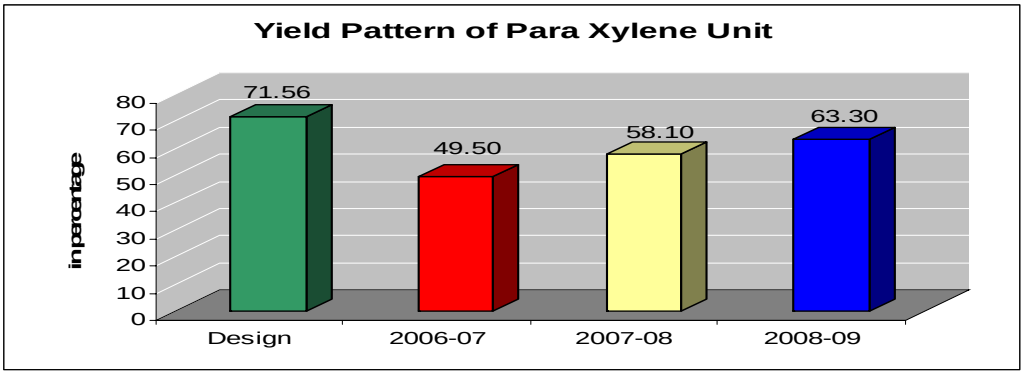
7.7.3.2 Under performance of PXPTA Complex – Panipat Refinery

The Company set up an Integrated Para Xylene (PX)/ Purified Teraphthalic Acid (PTA) integrated project (PXPTA Complex) (May-November 2006) at a cost of Rs. 2,630.11 crore at Panipat. The Project envisaged to process 5,00,000 MTPA of 'Heart Cut Naphtha' to be made available from Panipat and Mathura refineries to produce 3,57,810

MTPA Paraxylene, which would then be fed to PTA plant with other inputs (Oxygen and hydrogen) to produce 5,25,000 MTPA Purified Teraphthalic Acid.

A review of performance of the integrated PXPTA plant revealed that though the capacity utilisation of the unit was generally satisfactory, its yield recovery was less than the designed rate of recovery during all the three years (2006-09) of review as could be seen from the following chart **Chart 7.7**:

Chart 7.7



Audit also noticed that the Company was aware that one *per cent* increase in yield of PX unit enhances GRM by Rs. 8.47 crore[7], however, it could not achieve the designed yield in spite of commissioning of PX plant in May-November 2006. During 2008-09, there was a short recovery of 36,070.17 MT of PX resulting into loss of GRM of Rs. 69.93 crore[8].

The Management stated that the production of PX had not been as per projected yield as the actual feed to the complex was at variance from the designed feed.

The reply is not convincing as different grades of the feed (Naphtha) considered in DFR envisaged yield from 71.56 *per cent* to 71.74 *per cent*.

Recommendation No. 7.5

The Management should analyse the reasons for non-achievement of projected yield and take remedial measures to optimise the yield.

7.7.3.3 Un-fruitful expenditure on revamping of Resid Fluidised Catalytic Unit - Panipat Refinery

Resid Fluidised Catalytic Unit (RFCCU) at Panipat refinery was commissioned (January 1999) at a cost of Rs. 190.39 crore. In order to enhance LPG yield from 19 *per cent* to 29 *per cent* by weight from RFCCU, Panipat Refinery developed (November 2003) a process package and also increased (September 2008) its capacity from 7,00,000 MTPA to 8,50,000 MTPA at a cost of Rs. 81.67 crore through a revamp.

Audit observed that even after revamping of RFCCU, the yield of LPG remained at almost the same level (20 *per cent* weight) as it was before revamping (19 *per cent*

[7] ***As per performance of the Company and price of the PX prevailing during 2008-09***
[8] ***36070 MT at the rate of Rs 19386 per MT***

weight) which was much less than the envisaged LPG yield of 29 *per cent*. Thus, the expenditure incurred for revamping of RFCCU did not prove to be remunerative.

The Management in its reply stated that RFCCU's capability to produce 29 *per cent* of LPG was demonstrated and operation of RFCCU was adjusted because prices of MS were more than that of LPG.

The reply of the Management is not convincing as price of MS had always been more than that of LPG. This should have been considered at the DFR stage to avoid unfruitful investment.

7.7.4 Operating Cost Management and control

Operating cost is the cost of running a particular process, utility or department for a given period of time. The Company had fixed norms for cost control for power, steam and other utilities. However, it had not prepared any norms for payment of overtime allowance. The actual consumption of the utilities were within norms except excess consumption of power in Panipat Refinery in 2006-07 and 2007-08 resulting in extra expenditure of Rs. 20.94 crore.

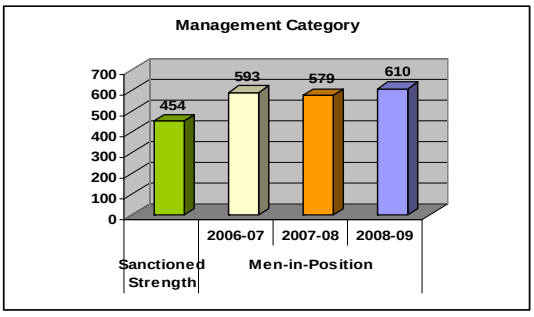
The Management stated that the excess consumption of electricity was on account of shut-down, start-up, revamp shut down and stabilisation.

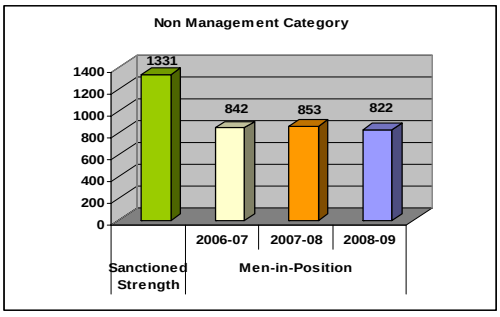
The reply is not convincing as the Company itself was able to control the excess consumption of power in 2008-09 and there were no excessive unscheduled shut down in 2006-07 and 2007-08.

7.7.4.1 Higher establishment cost on payment of overtime allowance due to non-rationalisation of manpower - Mathura Refinery

In Mathura Refinery, the operating cost *per* MT had increased from Rs. 535 in 2006-07 to Rs. 693 in 2008-09. This increase was mainly attributed to increase of establishment cost from Rs. 137 *per* MT to Rs. 280 *per* MT. The sanctioned staff strength and men-in-position is given below in **Chart 7.8**:

Chart 7.8





It is seen from the above that there is excess men-in-position in the management category leading to higher establishment cost and less men-in-position than required in non-management category leading to higher overtime hours. As against the sanctioned strength of 331 in the production department, the actual men-in-position were 266, 291 and 282 at the end of 2006-07, 2007-08 and 2008-09 respectively. This shortfall in manpower was co-related with higher number of overtime hours which were 6,14,146

hours (Rs. 14.47 crore) during 2006-07, 6,25,711 hours (Rs. 15.54 crore) during 2007-08 and 5,70,363 hours (Rs. 15.32 crore) during 2008-09.

The Management stated that increased manpower cost was due to pay-revision and overtime (OT) hours had decreased over the last three years and initiatives to optimise manpower have been taken based on the attrition profile.

The reply is not convincing as an analysis of increase in establishment costs during last three years ending March 2009 across the Company's other refineries revealed that percentage increase was in the range of 97 to 111 in 2007-08 and 161 to 200 in 2008-09 whereas the same in Mathura refinery was 122 and 204 respectively.

Similar analysis of OT hours *per* MMT of throughput revealed that utilisation of OT hours in Panipat refinery ranged between 29,961 and 37,820 hours per MMT of throughput as against between 66,313 and 77,892 hours per MMT in Mathura. This indicates that there was scope for improvement in the case of Mathura Refinery.

Recommendation No. 7.6

The Management may strive to rationalise manpower and reduce establishment cost considering the parameters set by other refineries.

7.7.5 Refinery Asset Management

Refinery assets include primary and secondary processing units, storage facilities, utilities like power, steam, water *etc*. The main focus of refinery asset management is the adequacy of infrastructure available at refineries, commissioning of new plant(s)/secondary unit(s) and utilities, idle asset/standby assets, impairment of assets *etc.* A review of utilities provided in the refineries revealed that though water, steam and storage facilities were being utilised satisfactorily, there was a scope for improvement in respect of the utilisation of power generation capacity created in Panipat refinery, as brought out in the following paragraph.

7.7.5.1 Creation of excess power generation capacity

While considering the feasibility for expansion of Panipat refinery from 6.0 MMTPA to 12.0 MMTPA, the total power requirement was assessed to be 95 MW (50 MW normal power requirement of the existing refinery and 45 MW for expansion requirement) and additional requirement of 40 MW for PXPTA. Against the requirement of 135 MW the Panipat refinery created a total of 225 MW power generation capacity[9]. The refinery had also additional power back up from HSEB to take care of emergencies. Creation of such excess capacity was not justifiable.

The Management stated that normal power requirement for PR, PREP and PX/PTA units on the basis of design/feasibility report of consultant was 167 MW to 187 MW; DFR for Panipat Expansion Project did not include power requirements of PX/PTA. Accordingly, captive power plant of 225 MW capacity was installed considering additional requirements on account of annual maintenance and repair jobs.

[9] ***Three Turbo Generators with a capacity of 25 MW each and five Gas Turbines with a capacity of 30 MW each***

The reply is not convincing as the maximum regular usage during the three years (2006-09) *i.e.* consumption of power in the refinery as well as township was around 120 MW and it also had power back up arrangements with HSEB for temporary additional requirement.

Recommendation No. 7.7

The Management needs to evolve a proper mechanism to make reasonable estimates of the power requirement and explore possibilities of alternate uses of the excess generation capacity available with the Company.

7.7.6 Environment, health, safety and social aspects

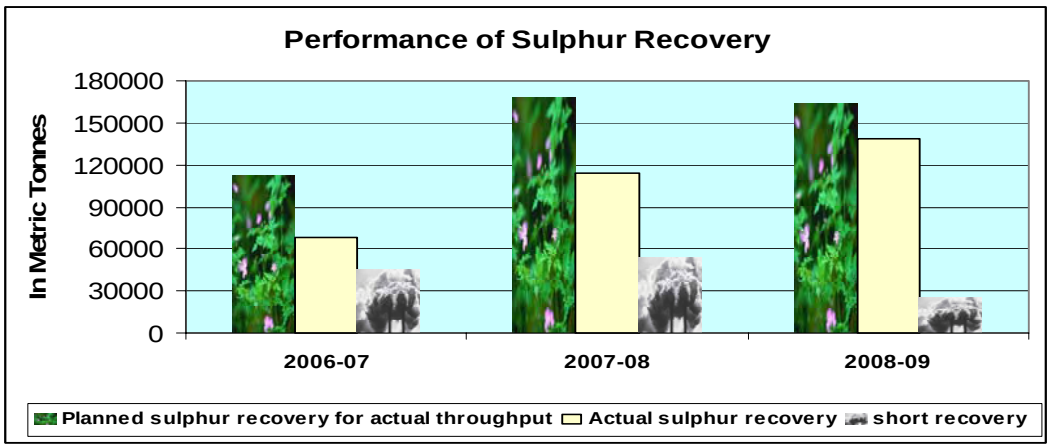
The details of norms fixed by statutory authorities for various pollutants and actuals there against in respect of Mathura and Panipat Refineries during the last three years ending 2008-09 are shown in ***Annexure-XXIV*** and there were no violations of any stipulation in respect of environmental aspects during last three years. However, there was scope for improvement in the following areas:

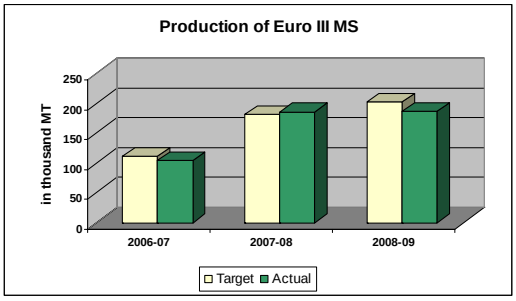
7.7.6.1 Non-removal of Sulphur to the optimum level - Panipat Refinery

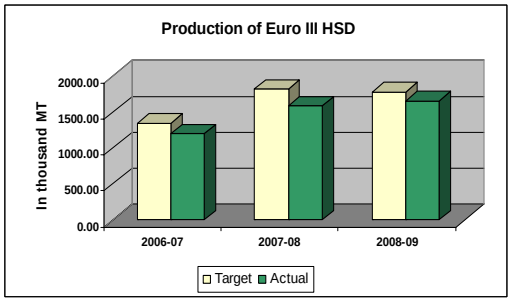
The Panipat refinery has a Diesel Hydro De-sulphurisation Unit (DHDS) and the Expansion Project has a Sulphur Recovery Unit. These units desulpharise the products and only residual amount of Sulphur remain in them. The more the Sulphur in the product, the more will it pollute the air after combustion leading to environmental hazards.

The planned sulphur recovery, production of Euro-III compliant MS and HSD as per ILP targets *vis-à-vis* actuals thereagainst in respect of Panipat Refinery during the last three years is depicted in the following **Chart 7.9**:

Chart 7.9







It is seen from above that the Company did not achieve ILP targets in terms of Sulphur recovery, production of Euro III compliant MS and HSD in all the three years except production of MS in 2007-08. The short recovery of sulphur also resulted in loss of Rs. 108.66 crore during the above three year period besides polluting the environment.

The Management stated that quality requirement of all the products was met and sulphur dioxide emission was well within the environmental norms. Quantity of Euro III grade product was decided considering the least positioning cost of product to the demand centers.

The reply is not convincing as the sulphur recovery in line with the ILP targets fixed by the Company would have resulted in additional profit from increased quantity of sale of sulphur and better quality of MS and HPS, besides reducing the environmental pollution.

Recommendation No. 7.8

The Panipat Refinery may endeavour to achieve maximum possible production targets (including sulphur recovery) rather than being content with the achievement of minimum statutory requirement.

7.7.6.2 Non Registering of FGRS as a Clean Development Mechanism project

For getting Clean Development Mechanism **(**CDM) benefits, Mathura and Panipat Refineries registered the following proposed projects with United Nations Framework Convention on Climate Change (UNFCCC):

- Pressure Recovery Turbine (PRT) in FCCU project,
- Reduction of the stripping steam in LGO and HGO stripper,
- Stoppage of DHDT furnace and Pinch analysis study of CDU pre-heat train,
- Utilisation of bio gas from PTA ETP to SRU incinerator,
- Installation of blending unit for use of water emulsified fuel in VDU-I furnace and
- Heat Recovery from C-7(Naphtha splitter) bottom product through stabliser-splitter heat integration.

Audit noted that Flare Gas Recovery System (FGRS) at Mathura[10] and Panipat[11] refineries initiated in August 2004 and June 2009 respectively were not registered for CDM. During the initial period of registration of ten years with UNFCCC, the Company could have gained Rs. 62.71 crore through 'Certified Emission Reduction' (CER) credits.

In response, the Management stated that FGRS projects at Panipat and Mathura did not meet the additionality criteria to get registered as CDM projects.

The reply is not convincing as similar projects at Haldia, Guwahati and Gujarat refineries were registered as CDM projects.

Recommendation No. 7.9

Once a policy decision has been taken by the Company to take credit under CDM, the Management may endeavour to make maximum use of the scheme in respect of eligible projects undertaken by it.

7.8 Conclusion

Out of the eight refineries of the Company, performance audit was conducted of two refineries located in northern India at Mathura and Panipat for three years 2006-09. Audit found that though the Company achieved MOU targets fixed by the Ministry, these targets were fixed without considering actual throughput in the previous year and planned on stream days. There was scope for enhancing capacity utilisation of the various secondary processing units (CCRU and RFCCU at Panipat Refinery) and enhancing the light and middle distillates, which are more profitable, by installation of Delayed Coker Unit at Mathura Refinery and achievement of designed yield in VBU and PXPTA at Panipat Refinery.

There was also a scope for more recovery of sulphur in accordance with the targets fixed by the Company and thereby enhancing GRM and helping in reduction of environmental pollution.

The matter was reported to the Ministry in February 2010; their reply was awaited (March 2010).

[10] ***Commissioned in October 2006***
[11] ***Scheduled to be commissioned in December 2010***