CCM.

cc: FM/HRM.

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
पाइपलाइन्स प्रभाग

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
निर्माण डाकघर, पालनपुर
18 JAN 2010
डाक प्राप्ति

अंतर कार्यालय ज्ञापन

प्रेषक : महाप्रबंधक (परियोजना-सिस्टम्स व गैस), पाइपलाइन्स मुख्यालय, नौएडा

प्रेषिती: महाप्रबंधक (परियोजना- मैकेनिकल/टी & आई/संविदा), पाइपलाइन्स मुख्यालय, नौएडा
उपमहाप्रबंधक इन चार्ज (निर्माण/सामग्री), पाइपलाइन्स मुख्यालय, नौएडा
उपमहाप्रबंधक (परियोजना-सिविल/विद्युत्त/मौनिटरिंग)/ वित्त-श्री बनर्जी
उपमहाप्रबंधक (निर्माण) जयपुर/ उपमहाप्रबंधक (तकनीकी), प.क्षे.पा., राजकोट

संदर्भ : पीएल/पीजे/एस/एसएमपीएल-डीबीएन/II दिनांक 11.01.2010

विषय : Debottlenecking of SMPL System

आई ओ सी बोर्ड ने दिनांक 30.12.2009 की मीटिंग में सलाया- मथुरा पाइपलाइन के डिबॉटलनेकिंग के प्रस्ताव को अनुमोदन प्रदान किया है। इस परियोजना हेतु कुल Rs. 1,584 crore की राशि अनुमोदित की गयी है।

इस पत्र के साथ आई ओ सी बोर्ड द्वारा अनुमोदित उपरोक्त परियोजना से सम्बन्धित एजेन्डा आइटम (P/207), रिजॅल्यूशन एवं विस्तृत व्यवहार्यत्ता रिपोर्ट (Detailed Feasibility Report) की एक प्रति आपकी जानकारी एवं आगे की कार्यवाही हेतु संलग्न है।

आपका ध्यान बोर्ड के निम्नलिखित दिशा निर्देश की तरफ भी आकर्षित किया जा रहा है।
"...the Board Desired that financial committment for the project should be made only after obtaining environmental clearance from the Govt. of Gujarat for the enhanced capacity"

(अनीश अग्रवाल) 11/1/2010

संलग्नक: यथा उपर्युक्त.

प्रतिलिपि: कार्यकारी निदेशक (सीपी&ईएस)/महाप्रबंधक(ऑप्.), कॉर्पोरेट ऑफिस,नई दिल्ली
कार्यकारी निदेशक (प्रचालन), रिफाइनरीज मुख्यालय, नई दिल्ली — सूचनार्थ

कार्यकारी निदेशक (वित्त/मानव संसाधन/परियोजना), पाइपलाइन्स मुख्यालय
कार्यकारी निदेशक, प.क्षे. पाइपलाइन्स, राजकोट
महाप्रबंधक इन चार्ज (प्रचालन), पाइपलाइन्स मुख्यालय, नौएडा
महाप्रबंधक, उ.क्षे.पा. पानीपत/ पू. क्षे.पा., कोलकता/ द.क्षे.पा. चेन्नै

CPJM (Sys)
PL circulate
11/01/2010

इंडियन ऑयल

IndianOil

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कार्यसूचि मद संख्या : P/207
AGENDA ITEM NO.

प्रति TO GM (PJ-Sys.&Gas) PL.Divn.

559th Board Meeting

बैठक की तारीख
Meeting Held on 30th December, 2009

SUBJECT विषय	ACTION BY किसके द्वारा कार्रवाई
De-bottlenecking of SMPL System	

कार्यवृत्त MINUTES

Shri S.Sundareshan, Chairman of the PEC briefed the Board on the deliberations of the Committee on the proposed project. The PEC had desired that information be provided to the Board on availability of funds and cashflow position as well as overview of projects which have been prioritised / deferred keeping in view the current financial constraints of the Corporation.

A presentation was made to the Board on the prioritisation of the projects and fund management of the Corporation. The salient features of the presentation are as under :-

- Total commitment on the ongoing projects :-

Approved	: Rs.65073 crore
Expenditure incurred upto Nov.'09	: Rs.23217 crore
Balance required	: Rs.41856 crore

- Capex plan expenditure upto 2012-13 estimated to be Rs.44504 crore.
- Major ongoing projects of Refineries, Pipelines and Marketing Divisions were presented, which are mainly need based and value addition projects.
- Projects amounting to Rs.3266 crore have been deferred.
- Projects amounting to Rs.32957 crore for which FR / DFR is to be carried out have been deferred. However, FR/DFR would be prepared and investment approval would be taken at the appropriate time.
- The estimated profitability for the next 3 financial years as well as the generation of internal resources in various scenarios of under-recoveries to be borne was presented.

Shri S.V.Narasimhan, Director(F) observed that the funding assumptions are based on the fact that the Corporation has to bear under-recoveries to the extent of 10% and the current burden sharing mechanism would continue and on this assumption, this project could be funded. Other projects would be taken up selectively on priority basis and depending upon their attractiveness.

...2/-

प्रतिलिपि COPY TO : ED(PJ), PL.Divn.

DATED :
दिनांक : 7th January, 2010

कंपनी सचिव COMPANY SECRETARY

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कार्यसूचि मद संख्या : Contd.. P/207
AGENDA ITEM NO. _____

प्रति TO GM (PJ-Sys.&Gas) PL.Divn.

559th Board Meeting

बैठक की तारीख Meeting Held on 30th December, 2009

SUBJECT विषय	ACTION BY किसके द्वारा कार्रवाई
Page-2 De-bottlenecking of SMPL System	

कार्यवृत्त MINUTES

Shri Anees Noorani observed that the financial outlook as presented to the Board should also be shared in the meetings of the PEC while appraising specific projects to enable the Committee to arrive at a prudent decision.

Shri S.Sundareshan observed that conscious decision needs to be taken before embarking on any project keeping in view the financial position of the Corporation.

Shri P.K.Sinha desired that there is a need to compare the returns of competing projects in order to prioritise them accordingly.

The Board felt that the assumption of the Corporation bearing 10% of the under-recoveries is fair in the current scenario. However, the Board desired that hereafter new projects should be undertaken only after detailed analysis of the fund availability.

While approving the proposal, the Board desired that financial commitment for the project should be made only after obtaining environmental clearance from the Govt. of Gujarat for the enhanced capacity.

With the above, the Board approved the item and passed the following resolution:-

"**RESOLVED THAT** approval of the Board be and is hereby accorded for debottlenecking of Salaya-Mathura Pipeline System i.e. enhancing the capacity of Salaya-Viramgam section from 21 MMTPA to 25 MMTPA, Viramgam-Koyali section from 8.5 MMTPA to 9 MMTPA, Viramgam-Chaksu section from 13.5 MMTPA to 16.5 MMTPA, Chaksu-Mathura section from 7.5 MMTPA to 9.2 MMTPA and Chaksu-Panipat section from 6 MMTPA to 7.3 MMTPA at an estimated cost of Rs.1584 crore including a foreign exchange component of Rs.565 crore at April, 2009 price level."

प्रतिलिपि COPY TO : ED(PJ), PL.Divn.

DATED : दिनांक : 7th January, 2010

कंपनी सचिव COMPANY SECRETARY

INDIAN OIL CORPORATION LIMITED

AGENDA FOR THE BOARD MEETING TO
BE HELD ON 30TH DECEMBER, 2009

ITEM NO. P/207

Sub: De-bottlenecking of SMPL System

The Project Evaluation Committee of the Board considered the subject item at its meeting held on 24th December, 2009.

Based on the decision of the Committee at its meeting held on 30th November, '09, a presentation was made based on a study on the year-wise supply-demand balance taking into consideration the present and projected market share of IndianOil as well as the commissioning of ongoing refinery projects.

Keeping in view the current financial constraints of the Corporation due to accumulated under-recoveries, the Committee desired that the following information be provided to the Board :-

1. A separate note on availability of funds and cashflow positon.
2. Overview of the projects
   - Projects that have been deferred due to fund constraints
   - Projects that have been prioritized and approved for implementation.
3. A re-look at the proposal based on the 3rd quarter financial results.

Subject to the above observations, the Committee recommended the proposal to the Board for consideration.

(Raju Ranganathan)
Company Secretary

CONTENTS

CHAPTER – I

1.0 INTRODUCTION

1.1 Salaya-Mathura pipeline (SMPL) system feeds crude oil to the three landlocked refineries of IndianOil viz. Koyali, Mathura and Panipat. Part of the crude oil requirement of Koyali refinery is also met from Gujarat oil fields by ONGC, whereas part requirement of Panipat refinery is met through Mundra-Panipat pipeline (MPPL) system.

1.2 At present, the installed capacity of Koyali, Mathura and Panipat refineries is 13.7, 8.0 and 12.0 MMTPA respectively. The capacity of Panipat refinery is being augmented to 15 MMTPA. With this, the total name plate capacity of these refineries would become 36.7 MMTPA, out of which about 5.8 MMTPA crude oil would be supplied by ONGC to Koyali refinery. Balance crude, about 30.9 MMTPA, would be required to be supplied from the west coast through SMPL and MPPL. The present capacity of SMPL and MPPL system is 21 MMTPA and 9 MMTPA respectively. Both these pipelines have been designed to transport 25 cst crude oils.

1.3 With the increase in crude oil prices and wider gaps between heavy & regular crude prices, it is economically becoming more attractive to process heavy crude at our refineries. At Mundra, crude oil blending facilities have already been provided to facilitate blending of heavy crude oils for transportation through MPPL. Further, a proposal is under implementation for providing blending facilities at Vadinar after which heavy HS crude oils will also be handled through SMPL.

1.4 The higher viscosity of such heavy crude oils will have adverse impact on the capacity of the existing pipeline system. If the kinematic viscosity of the crude oil is considered as 40 cst, the capacity of SMPL would become 20 MMTPA and that of MPPL would be 8.4 MMTPA. Thus, the total capacity of SMPL and MPPL would become 28.4 MMTPA and there will be shortfall of about 2.5 MMTPA (30.9-28.4) in the combined capacity of SMPL & MPPL, to meet even the name plate capacity requirement of these 3 refineries. Therefore, this would necessitate debottlenecking of the pipeline system by 2.5 MMTPA.

1.5 An Inter Divisional Committee was constituted in July 2007 by Chairman to study "Integrated crude oil supply plan for Mathura, Panipat and Koyali refineries from West Coast". During the discussions, Refineries Division indicated that these refineries could process crude oil more than their name plate capacity, especially during the peak demand seasons. It was also indicated that for the refineries to operate at peak level, it would appear appropriate to design the pipeline system as well, to meet the requirement for supplying such additional quantity of crude oil. Moreover, pipelines are to be designed for transportation of blend of HS-heavy and HS-regular crude oils, which will have higher Kinematic Viscosity as compared to regular HS crude. Accordingly, for working out the pipeline capacity requirements, Refineries Division furnished the data on refinery wise name plate and potential/peak processing capacity, for short term as well as long term.

1.6 A scheme for debottlenecking the capacity of SMPL system to meet the crude oil requirement of the refineries was accordingly drawn and a Feasibility Report was prepared.

1.7 Vide Agenda Item No. P/189 dated 29.4.2008, the Board accorded 1st Stage approval to the proposal for debottlenecking of SMPL system and approved an amount of Rs. 7 crore for initiating pre-project activities so as to facilitate preparation of Detailed Feasibility Report (DFR) for the proposal.

1.8 PAG had, in their Project Appreciation Note dated 09.4.2008, indicated to explore possible alternatives at the DFR stage to arrive at the least cost option considering both short term and long term investments.

1.9 Accordingly, this DFR has been prepared, which deals with the system configuration, cost, technical viability, implementation methodology and other details in respect of de-bottlenecking of the capacity of SMPL system to meet the peak processing requirement of the refineries.

CHAPTER - II

2.0 EXISTING SMPL SYSTEM AND NEED TO AUGMENT THE FACILITIES

2.1 Existing Facilities

2.1.1 Salient features of the existing facilities in SMPL system are described herein below**.**

a) Offshore crude handling facilities comprising two Single Point Mooring (SPM) systems capable of mooring tankers up to 3,00,000 DWT capacity and operating off Salaya (Vadinar) shore. The system has two submarine and twin onshore pipelines of 42" diameter and approximately 5.5 km long each, connecting shore tanks at Vadinar to the offshore mooring system. The two SPMs are inter-connected through a 2.1 km long submarine pipeline.

b) A 275 km long pipeline running from Vadinar to Viramgam with originating pump station at Vadinar and intermediate pump stations at Jamnagar, Gauridad and Surendranagar. The pipeline has a diameter of 28" and wall thickness 0.281" conforming to API 5L-X52 Grade. It also has about 160 km loopline of same size and specifications (46 km in Vadinar-Jamnagar section, 12 km in Jamnagar-Gauridad section and 100 km in Gauridad-Surendranagar section).

c) A 148 km long pipeline from Viramgam to Koyali to feed Koyali refinery with a pumping station at Viramgam and terminal station at Koyali. This line has a diameter of 28" and wall thickness of 0.281" conforming to API 5L-X52 Grade.

d) A 606 km long pipeline from Viramgam to Chaksu with pumping stations at Viramgam, Sidhpur, Abu Road, Kot, Rajola, Sendra and Ramsar. The pipeline size of this section is 24" diameter and 0.281" wall thickness, conforming to API 5L-X52 Grade. This pipeline also has about 110 km looplines in various sections i.e. 38 km in Viramgam-Sidhpur section, 16 km in Sidhpur-Abu Road section, 34 km in Abu Road-Kot section and 22 km in Ramsar-Chaksu section.

e) A 197 km long pipeline from Chaksu to Mathura to feed Mathura refinery with a pumping station at Chaksu and terminal station at Mathura. This line has been laid with pipes of 24" diameter and 0.281" wall thickness, conforming to API 5L-X52 Grade.

f) A 347 km long pipeline from Chaksu to Panipat to feed Panipat Refinery with pumping stations at Chaksu and Rewari. This line has also been laid with pipes of 24" diameter and 0.281" wall thickness, conforming to API 5L-X52 Grade.

g) Storage facilities consisting of 13 tanks of 85,000 kL capacity each are presently available at Vadinar. 5 more tanks of same capacity along with crude oil mixing facility are being installed at Vadinar for handling and storage of heavy crude oils planned to be processed at Koyali refinery. In addition to the above, 7 tanks of 65,000 kL capacity each and 2 tanks of 30,000 kL capacity each are available at Viramgam. At Chaksu, 6 tanks of 60,000 kL capacity each are in operation.

2.2 Berth Occupancy of the SPMs at Vadinar

The two SPMs available at Vadinar can be operated either simultaneously or one at a time. An analysis has been carried out to work out the berth occupancy factor of the two SPMs for handling the projected crude oil requirement at Vadinar i.e. 25 MMTPA in short term and 35.1 MMTPA in long term. The details are given below.

Tanker configuration	Berth Occupancy	
	Short Term	Long Term
90% VLCC + 10% Suez Max + others*	40%	54%
80% VLCC + 5% Suez Max + 15% others	44%	61%
70% VLCC + 15% Suez Max + 15% others	45%	63%

* Assuming handling of 2 MMTPA BH crude oil in LR-I type tankers.

It is seen that it would be possible to handle the above projected crude oil requirement with the two SPM systems at Vadinar. Need for additional SPM would be again reviewed before augmentation of SMPL system for meeting the long term requirements.

2.3 Clearance for Handling Additional Crude Oil Through the Existing SPM Systems at Vadinar

2.3.1 Clearance was earlier sought from Government of Gujarat for handling increased quantity of crude oil at Vadinar through the existing SPM facilities. It was confirmed to the concerned authorities that the enhanced quantity of crude oil was intended to be handled exclusively through a modified tanker configuration comprising larger number of VLCCs (compared to that being received at present) and would not involve any addition/alteration/modification of any existing offshore facilities. During deliberations, it

was informed by Environment & Forest department, Government of Gujarat that it would be necessary to first regularise the second SPM and that the question of augmentation of capacity could be considered thereafter only.

2.3.2 On 23.4.2009, Government of Gujarat has conveyed ex-post facto permission for use of land falling under Marine National Park and Marine Sanctuary in the Gulf of Kutch under Wild Life Protection Act 1972 for oil pipelines already laid from SPM-1 and SPM-2 to the Vadinar tank farm. With this, the matter has again been taken up with the concerned authorities of Gujarat Government, seeking permission for handling increased quantity of crude oil at Vadinar through the existing SPM facilities. With the latest developments, it is expected that the required clearance would be granted by the concerned authorities.

2.4 Adequacy of Tanks at Vadinar

As indicated above, storage facilities consisting of 13 tanks each of 85,000 kL capacity are presently available at Vadinar. Further, 5 tanks of similar capacity are being constructed. With the completion of these new tanks, total 18 tanks would be available at Vadinar, which would be distributed as under for handling various types of crude oils.

Types of Crude	No. of Tanks
HS regular	5 x 85,000 kL
HS heavy	5 x 85,000 kL
LS	5 x 85,000 kL
BH	1 x 85,000 kL
Sub-total	16 x 85,000 kL
Tanks under M&I	2 x 85,000 kL
Total	18 x 85,000 kL

Note: 5 tanks of 85,000 kL capacity each are required to unload one VLCC (270,000 MT).

It is seen that 18 tanks would be adequate to handle 4 different types of crude oils viz. HS heavy, HS regular, LS and BH at Vadinar.

2.5 Need for De-bottlenecking and Augmentation of SMPL System

2.5.1 For working out the crude oil supply plan, Refineries Division have furnished revised projections on crude oil requirement of the refineries in the short term and long term, based on which the requirement of crude oil from the West Coast works out as under.

(Fig. in MMTPA)

Refinery	Short Term		Long Term	
	Name Plate Capacity	Peak Processing Requirement	Name Plate Capacity	Peak Processing Requirement
Crude Oil Requirement:				
Mathura	8	9.2	11	12.2
Panipat	15	15.7	15	16.5
Koyali	13.7	14.3	18	19.8
Total	36.7	39.2	44	48.5
Crude Oil Supply:				
From Gujarat Oil Fields		5.8	5.0	
Balance from West Coast		33.4	43.5	

2.5.2 It is evident from the above that for the refineries to operate at peak level, in addition to debottlenecking of the SMPL system, as indicated in para 1.4, it would be necessary to augment capacity of the pipeline system as well by additional 2.5 MMTPA (33.4-30.9) to meet the short term requirement.

2.5.3 Out of total crude oil requirement from west coast, as indicated above, about 8.4 MMTPA would be transported through MPPL. Thus, the balance 25 MMTPA & 35.1 MMTPA would be required to be transported through SMPL in short term and long term respectively for which the section-wise pipeline capacity requirement of SMPL would be as under.

(Fig. in MMTPA)

Pipeline Section	Existing Capacity (25 cst)	Capacity Requirement (40 cst)	
		Short Term	Long Term
Salaya-Viramgam	21	25.0	35.1
Viramgam-Koyali	8.5	9.0*	14.8
Viramgam-Chaksu	13.5	16.5	20.3
Chaksu-Mathura	7.5	9.2	12.2
Chaksu-Panipat	6	7.3	8.1

* It is envisaged that about 0.5-0.6 MMTPA Rajasthan crude would be introduced in VK section at Viramgam.

2.5.4 It is seen from the above that capacity requirement of various sections of SMPL to meet the name plate as well as the peak processing requirement of the refineries at Koyali, Mathura and Panipat in the short term is higher than the existing capacity. In the long term, the

pipeline capacity requirement would increase further.

2.5.5 Therefore, it is considered essential to de-bottleneck capacity of SMPL system to transport blend of HS-regular and HS-heavy crude oil to match with the name plate capacity of the refineries and to augment it further to meet the peak processing requirement of the refineries. With the proposed de-bottlenecking and augmentation, the refineries would be in a position to process more crude oil, which would add to the refinery margins and to the overall profitability of the Corporation.

CHAPTER – III

3.0 ANALYSIS OF ALTERNATIVES

3.1 Based on the projected refinery wise crude oil requirements in the short term and the long term, it is seen that there would be major variation in the throughput requirement of S-V and V-C sections. Therefore, to augment capacity of these two sections, various alternative/schemes involving the following have been identified.

- Conversion of existing loops to full loop
- Laying new pipeline in the section
- Conversion of full loop to two parallel lines

3.2 Preliminary analysis of various alternatives has been carried out and following options have been shortlisted for detailed analysis so as to arrive at least cost option.

3.2.1 Salaya-Viramgam Section

Option I **:**

*Short Term (25.0 MMTPA)***:** Providing loopline for full length of S-V section by laying about 115 km additional pipeline (55 km in Jamnagar-Gauridad section and 60 km in Surendranagar-Viramgam section).

*Long Term (35.1 MMTPA)***:** Old S-V set up would be restored to operate it at 20 MMTPA whereas loopline laid in short term would be converted into new pipeline by laying additional 160 km pipeline with pump stations at Vadinar and Gauridad (15.1 MMTPA).

Option II**:**

*Short Term (25.0 MMTPA)***:** Existing S-V section would operate at 15 MMTPA with pump stations at Vadinar and Gauridad.

New pipeline of 30" OD x 0.312" WT, API 5L-X70 Grade would be laid from Vadinar to Viramgam and operated at 10 MMTPA with pump station at Vadinar only.

*Long Term (35.1 MMTPA)***:** Existing S-V section would operate at 15 MMTPA whereas new pipeline laid in short term would be augmented to 20.1 MMTPA by installing an intermediate pump station at Gauridad.

3.2.2 Viramgam-Chaksu Section

Option I:

*Short Term (16.5 MMTPA)***:** Providing full loop by laying about 496 km additional loopline.

*Long Term (20.3 MMTPA)***:** Old V-C set up would be restored and operate at 12 MMTPA whereas looplines laid in the short term would be converted into new pipeline of 8.3 MMTPA capacity by laying additional 110 km pipeline with pump stations at Viramgam, Abu Road and Rajola.

3 additional tanks of 60 TKL capacity each at Viramgam and 2 additional tanks of 60 TKL capacity each at Chaksu would also be required to meet the operational requirements.

Option II:

*Short Term (16.5 MMTPA)***:** Existing V-C section would operate at 7.2 MMTPA with three pump stations at Viramgam, Abu Road and Rajola.

A new pipeline of 28" OD x 0.281" WT, API 5L-X70 Grade would be laid from Viramgam to Chaksu and operated at 9.3 MMTPA with three pump stations at Viramgam, Abu Road and Rajola.

*Long Term (20.3 MMTPA)***:** Existing V-C section would continue to operate at 7.2 MMTPA, as in short term. The new pipeline of 28" OD x 0.281" WT, API 5L-X70 Grade, laid in the short term, would be augmented to 13.1 MMTPA by installation of intermediate pump stations at Sidhpur and Beawar.

3 additional tanks of 60 TKL capacity each at Viramgam and 2 additional tanks of 60 TKL capacity each at Chaksu would also be required to meet the operational requirements.

3.3 The alternatives have been compared on the basis of the present value of the costs worked out at 13% rate of discount over 15 years of operation. The long term scenario has been considered to materialise by 2016-17.

3.4 Results of the above study indicate that for S-V section, option-I and for V-C section, option-II have the least present value of costs. Accordingly, these options have been selected for debottlenecking the capacity of S-V and V-C sections of existing SMPL.

CHAPTER – IV

4.0 DESIGN PHILOSOPHY

4.1 The SMPL system was initially designed for transportation of imported crude oils. For the purpose of hydraulic calculations and design of the pipeline, the following parameters were adopted.

Specific Gravity : 0.855

Kinematic Viscosity : 12.44 cst

4.2 Subsequently, while working out the scheme for augmentation of SMPL system to meet the crude oil requirement of Panipat refinery (6 MMTPA), the system was designed taking into consideration the following characteristics of the BH crude oil.

Specific Gravity : 0.833

Kinematic Viscosity : 25 cst

4.3 Presently, a proposal is under consideration of the Management to provide mixing facilities at Vadinar. With the commissioning of the mixing facilities, heavy HS crude oils will also be handled through the pipeline system. The typical characteristics of some of the heavy HS crude oils, expected to be received at Vadinar, are as under.

Crude	Specific Gravity	Kinematic Viscosity (cst)	
		At 20°C	At 30°C
Ratawi	0.9095	93.10	53.70
Baobab	0.9195	77.00	42.93
Souedie	0.9066	49.86	34.00
Oriente	0.9101	108.59	68.10

4.4 Based on the above, the following crude oil characteristics have been considered for working out the debottlenecking requirement.

Specific Gravity : 0.88

Kinematic Viscosity : 40 cst

4.5 Design parameters

4.5.1 The pipeline system has been designed on the basis of 8000 hours of operation per year.

4.5.2 Maximum allowable operating pressure (MAOP) of the existing SMPL system remains unchanged.

4.5.3 MAOP of new pipeline in V-C section is based on 72% SMYS of the pipe material.

4.5.4 For loopline, station and other piping, a weld joint factor of 1 (one) has been considered.

4.5.5 Pipes of higher wall thickness are envisaged to be laid across major rivers, water courses etc. At rail/road crossings, the higher wall thickness pipes will be provided wherever necessary.

4.5.6 The impressed current cathodic protection system, already in place for existing SMPL system to protect the pipeline against external corrosion, would be extended to cover the proposed extension of looplines. No corrosion allowance has, therefore, been considered in the wall thickness of the pipes. For new pipeline in V-C section, permanent impressed current cathodic protection system would be provided.

CHAPTER –V

5.0 PROJECT DESCRIPTION

5.1 Introduction

5.1.1 This chapter deals with various features of the project, viz. pipeline system configuration, facilities required, control system, cathodic protection, implementation methodology, construction schedule etc.

5.2 Hydraulics and System Configuration

5.2.1 In order to cater to the peak processing crude oil requirement of Mathura, Panipat (post P-15) and Koyali refineries in the short term, it is proposed to debottleneck/augment the capacity of Salaya-Viramgam section from 21 MMTPA to 25 MMTPA, Viramgam-Koyali section from 8.5 MMTPA to 9 MMTPA, Viramgam-Chaksu section from 13.5 MMTPA to 16.5 MMTPA, Chaksu-Mathura section from 7.5 MMTPA to 9.2 MMTPA and Chaksu-Panipat section from 6 MMTPA to 7.3 MMTPA.

It may also be mentioned that a separate proposal for replacement of 17 old MLPUs/ Engines of SMPL is under consideration for approval. The same has also been considered in the project scheme.

5.2.2 The scheme for debottlenecking would broadly involve the following.

5.2.3 Salaya-Viramgam section

5.2.3.1 *Short Term (25 MMTPA)*

(i) Providing loopline for full length of S-V section by laying about 115 km additional pipeline (55 km in Jamnagar-Gauridad section and 60 km in Surendranagar-Viramgam section). Details are as under.

Pipeline Section	Length (km)	Loopline Length (km)		
		Existing	Proposed (Addl.)	Total
Salaya-Jamnagar	46.7	46.7	0.0	46.7
Jamnagar-Gauridad	67.9	12.6	55.3	67.9
Gauridad-Surendranagar	100.4	100.4	0.0	100.4
Surendranagar-Viramgam	59.4	0.0	59.4	59.4
Total	274.4	159.7	114.7	274.4

5.2.3.2 *Long Term (35.1 MMTPA)*

(i) Old S-V set up would be restored to operate at 20 MMTPA.

(ii) The looplines laid in short term would be converted into new pipeline with pump stations at Vadinar and Gauridad (15.1 MMTPA) by laying about 160 km additional pipeline in different sections. Details are as under.

Pipeline Section	**Length (km)**	**Additional Pipeline Length (km)**		
		Short term	**Long term**	**Total**
Salaya-Jamnagar	46.7	0.0	46.7	46.7
Jamnagar-Gauridad	67.9	55.3	12.6	67.9
Gauridad-Surendranagar	100.4	0.0	100.4	100.4
Surendranagar-Viramgam	59.4	59.4	0.0	59.4
Total	274.4	114.7	159.7	274.4

5.2.4 Viramgam-Koyali section

5.2.4.1 *Short Term (9.0 MMTPA)*

The new motor driven MLPUs of higher capacity would be installed at Viramgam against condemnation of the existing MLPUs.

5.2.4.2 Long Term (14.8 MMTPA)

About 35 km long loopline, originating at Viramgam and terminating at Sanand Repeater station, would be laid.

5.2.5 Viramgam-Chaksu section

5.2.5.1 *Short Term (16.5 MMTPA)*

(i) Existing V-C section of SMPL would operate at 7.2 MMTPA with three pump stations at Viramgam, Abu Road and Rajola. The existing pumps at Viramgam, Abu Road and Rajola pump stations would be replaced with new pumps suitable for lower flow requirement.

(ii) New pipeline of 28" OD x 0.281" WT, API 5L-X70 Grade would be laid from Viramgam to Chaksu. It would operate at 9.3 MMTPA with three pump stations at Viramgam, Abu Road & Rajola.

5.2.5.2 *Long Term (20.3 MMTPA)*

(i) Existing V-C section of SMPL would continue to operate at 7.2 MMTPA with three pump stations at Viramgam, Abu Road & Rajola.

(ii) The new pipeline of 28" OD x 0.281" WT, API 5L-X70 Grade, laid from Viramgam to Chaksu in the short term, would be augmented from 9.3 MMTPA to 13.1 MMTPA by installation of intermediate pump stations at Sidhpur and Beawar.

5.2.6 Chaksu-Mathura section

5.2.6.1 Short Term (9.2 MMTPA)

(i) Laying about 46 km loop line ex-Chaksu.

(ii) New motor driven MLPUs would be installed against condemnation of existing engine driven MLPUs. Additionally, existing booster pumps would be replaced by booster pumps dismantled from Salaya/Viramgam.

5.2.6.2 Long Term (12.2 MMTPA)

The loopline laid in short term would be further extended by another 88 km (to be terminated at nearby repeater station). One additional MLPU would be provided at Chaksu.

5.2.7 Chaksu-Panipat section

5.2.7.1 *Short Term (7.3 MMTPA)*

New motor driven MLPUs would be installed at Chaksu and Rewari against condemnation of existing engine driven MLPUs.

5.2.7.2 *Long Term (8.1 MMTPA)*

No modification is envisaged for meeting long term throughput requirement.

Section wise line diagrams are shown in **Annexure-I (a), (b), (c), (d) & (e)**.

5.3 System Hydraulics

Based on the crude characteristics (Kinematic Viscosity- 40 cst & Specific Gravity-0.88), hydraulics details have been worked out for the scheme proposed and the same for the short term are given below.

5.3.1 Salaya-Viramgam section (25 MMTPA)

Parameters	Mainline	Existing Loopline	Proposed Loopline (Addl.)
Line Size	28" OD x 0.281" WT, API 5L-X52 Grade	28" OD x 0.281" WT, API 5L-X52 Grade	28" OD x 0.281" WT, API 5L-X70 Grade
MAOP (mcl)	600	600	

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	Loopline Length (km)	SDH (mcl)	RH (mcl)	No. of Units
1	Salaya	0.0	8	46.7	210	-	2+2
2	Jamnagar	46.7	24	67.9	349	50	2+1
3	Gauridad	114.6	113	100.4	326	50	3+1
4	Surendranagar	215.0	80	59.4	179	50	2+1
5	Viramgam	274.4	26	-	-	50	

km : Kilometre, m : Metre, mcl : Metre Column of Liquid, SDH : Station Discharge Head, RH : Residual Head

5.3.2 Viramgam-Koyali section (9 MMTPA)

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	SDH (mcl)	RH (mcl)	No. of Units
1	Viramgam	0.0	26	312	-	2+1
2	Koyali	148.0	30	-	50	-

5.3.3 Viramgam-Chaksu section (16.5 MMTPA)

5.3.3.1 *Existing V-C section of SMPL to operate at 7.2 MMTPA*

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	Loopline Length (km)	SDH (mcl)	RH (mcl)	No. of Units
1	Viramgam	0.0	28	53.8	630	-	2+1
2	Abu Road	177.4	261	33.9	505	50	2+1
3	Rajola	363.5	310	23.0	610	50	2+1
4	Chaksu	605.8	307	-	-	50	-

5.3.3.2 *New Viramgam-Chaksu (V-C) Pipeline for 9.3 MMTPA*

Length	:	606 km
Pipe size & Grade	:	28" OD x 0.281" WT, API 5L-X70 Grade
MAOP	:	808 MCL (71.1 kg/cm^2) @ 72% SMYS

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	SDH (mcl)	RH (mcl)	No. of units
1	Viramgam	0.0	28	625	-	2+1
2	Abu Road	177.4	261	459	50	2+1
3	Rajola	363.5	310	515	50	2+1
4	Chaksu	605.8	307	-	50	-

5.3.4 Chaksu-Mathura section (9.2 MMTPA)

Parameters	Mainline	Proposed Loopline
Line Size	24" OD x 0.281" WT, API 5L-X52 Grade	24" OD x 0.281" WT, API 5L-X52 Grade
MAOP (mcl)	632	632

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	Loopline Length (km)	SDH (mcl)	RH (mcl)	No. of Units
1	Chaksu	0.0	307	46	550	-	2+1
2	Mathura	197.2	176	-	-	50	-

5.3.5 Chaksu-Panipat section (7.3 MMTPA)

Hydraulics

S. No.	Station	Chainage (km)	Altitude (m)	SDH (mcl)	RH (mcl)	No. of Units
1	Chaksu	0.0	307	514	-	2+1
2	Rewari	205.7	247	403	50	2+1
3	Panipat	348.0	237	-	50	-

5.3.6 Pipeline section wise hydraulic gradients are shown in **Annexure-II (a), (b), (c), (d), (e) & (f)**.

5.4 Modifications Required in existing SMPL System in the Short Term

5.4.1 Following modifications would be required in existing SMPL system to meet the enhanced throughput requirement in the short term.

5.4.1.1 S-V section

- ❖ About 115 km additional pipeline (55 km in Jamnagar-Gauridad section and 60 km in Surendranagar-Viramgam section) would be laid to make full loop in the entire section.
- ❖ The existing booster pumping units at Vadinar are being replaced as part of the ongoing project for providing additional tankage and mixing facilities at Vadinar. The existing booster pumps of Vadinar would be shifted to Chaksu.
- ❖ One additional MLPU would be installed at Gauridad.
- ❖ The interconnection between mainline and loop line at the existing loopline terminal would be dismantled and the flange connected to mainline would be blinded using suitable blind flanges.
- ❖ For smooth operation of the pipeline, dedicated OFC based communication with 99.9% availability is envisaged in SV section (Jamnagar to Viramgam) with redundant STM-1 equipments.

5.4.1.2 V-K section

- ❖ At Viramgam, new booster pumps (total 5 for both V-C and V-K section) would be provided to meet higher flow requirement.
- ❖ Existing engine driven mainline pumping units at Viramgam would be replaced with motor driven MLPUs against condemnation.

5.4.1.3 V-C section

- ❖ The existing pumps at Viramgam, Abu Road and Rajola pump stations would be replaced with new pumps suitable for lower flow requirement.

5.4.1.4 C-M and C-P sections

- ❖ Apart from laying 46 km loopline, as indicated in para 5.2.6.1 in C-M section, three new motor driven MLPUs would be installed at Chaksu against condemnation of existing engine driven MLPUs. For C-P section, three new motor driven MLPUs each would be installed at Chaksu and Rewari against condemnation of existing engine driven MLPUs.

5.4.1.5 The looplines would be laid mostly in the ROW of existing SMPL. Additionally, new ROW would be acquired to lay the looplines, wherever required.

5.4.1.6 To mitigate external corrosion of the new looplines, existing impressed current based cathodic protection (CP) system of existing pipeline system would be suitably extended to meet the requirement.

5.4.1.7 The mechanical, electrical, instrumentation and control systems in the existing stations would be suitably modified to meet the requirement, wherever required. Necessary modifications in the civil structures would be carried out at the stations as per requirement.

5.4.1.8 One additional basket strainer of similar size and capacity would be provided at some of the stations to meet higher flow requirement. The corresponding valves, pipes and pipe fittings would be of ANSI-400 pressure class.

5.4.1.9 The field instrumentation at station comprises of pressure transmitter, pressure switches, pressure gauges, turbine/ clamp on ultrasonic flow meters, level switch, level transmitter, temperature gauge, temperature transmitter, scraper detector, emergency shut down switches etc. Turbine flow meters have been considered as per requirement for Vadinar, Viramgam & Chaksu with one main & standby arrangement. The intermediate stations have been considered with clamp on ultrasonic flow meters. At Vadinar, to reduce the friction loss, one additional turbine meter shall be provided in parallel of existing turbine meters such that 2 turbine meters shall be operating and 1 turbine meter shall be available as standby.

5.5 New Viramgam-Chaksu pipeline

5.5.1 Mainline Route

5.5.1.1 The new V-C pipeline would be laid mostly in the ROW of existing V-C section of SMPL. Additionally, new ROW would be acquired to lay the pipeline, wherever required.

5.5.2 Civil

5.5.2.1 Civil structures are envisaged to be erected in the pump station to provide shelter to men and machinery. Pump shed to accommodate the pumping units with associated facilities has been planned to be of steel structure. All the safety factors like wind load, seismic factor, soil bearing capacity etc. have been taken into account while designing the structures.

5.5.3 Cathodic Protection System

5.5.3.1 In order to mitigate external corrosion of the mainline, impressed current based cathodic protection (CP) system will be provided. The system envisages impressed current anodes, equipped with a cathodic protection unit having uninterrupted power supply arrangement. The CP station will be located primarily at co-located RCP stations. The CP units will have features of automatic control of pipe-to-soil potential.

5.5.4 Electrical

5.5.4.1 Suitable electrical facilities would be provided at the pump stations. Existing contract demand at Viramgam, Abu Road and Rajola station would be reviewed considering enhanced load due to requirement of new pipeline and action would be initiated for enhancement of contract demand.

5.5.5 Mechanical

5.5.5.1 At each of the proposed pump stations i.e. Viramgam, Abu Road and Rajola, three engine driven mainline pumping units, horizontal split case centrifugal pumps, unit control panels and interface panels will be installed.

5.5.5.2 Engines and Pumps for above three locations would be shifted from the stations of existing V-C section. Existing 3 MLPUs from Sidhpur station would be shifted to Viramgam station. These MLPUs would include 1 new MLPU to be procured against condemnation of existing 'G' Series MLPU of Sidhpur. The existing 2 MLPUs of Kot and 1 MLPU of Sendra would be shifted to proposed pump station at Abu Road. All the 3 MLPUs from existing Ramsar station would be shifted to proposed Rajola station. Scraper station facilities would be provided at Beawar.

5.5.5.3 Pipes, pipe fittings, flanges etc. will be conforming to international standards such as API 5L, ANSI B-16.5, ANSI B-16.25, WPB-234, MSS-SP-44, MSS-SP-75 etc. and will be suitable for ANSI-150 and 600 pressure classes. Gate valves, ball valves, swing check valves will conform to API 600/ API 6D standards. Electric motor actuators of suitable power ratings will be installed for the operation of gate and ball valves.

5.5.6 Instrumentation and Station Control Centre

5.5.6.1 Instrumentation will be provided to cater for operation and control to optimise the use of equipment and manpower and to protect the equipment. The stations will be self-protected and nearly failsafe by means of local sequence control as well as instrument closed loop control. Modifications in the existing PLC systems have been envisaged. New PLC based control system has been envisaged at Viramgam, Abu Road & Rajola. The control system shall be provided with hot standby PLC based station control system to perform local control functioning and to monitor and report local conditions.

5.5.6.2 Station Control Centre (SCC) would have Workstations as operator interface to the station instrumentation and control system. The computers would be connected to dual local area network (LAN) in client server mode. They shall work in hot stand by configuration and shall be connected to the PLC control system over LAN. They shall be interfacing with the

PLC system on real-time basis for monitoring of station parameters and control. The SCC computers shall have several graphic screens depicting the station pipeline network and the station equipments. Operators shall monitor, operate and control the station equipment and parameters through these graphic screens. All alarms, events, status of equipment etc., shall be logged in the computer system and periodic/on demand print out as hard copy shall be possible through printers connected on LAN.

5.5.6.3 The system power supply shall be through UPS system with battery back up for round the clock uninterrupted operation.

5.5.6.4 CCTV system has been considered for pump sheds for new V-C line at Viramgam, Abu Road & Rajola.

5.5.7 Telecommunication System

5.5.7.1 For smooth operation of the pipeline, dedicated OFC based communication with 99.9% availability is envisaged with redundant STM-1 equipments. The telecommunication system is envisaged to have a dedicated synchronous digital hierarchy (SDH) based Optical Fibre Cable communication system. The 12 fibre OFC cable shall be laid in the same trench as the mainline pipe through HDPE conduit as per the recommended codes & practices.

5.5.7.2 The station/ repeaters will have OLTEs connected back-to-back for boosting of signals in both directions. All the OLTEs are envisaged to have 1+1 hot standby with auto-mode of operation. This redundancy by way of in-built equipment duplication is provided to ensure uninterrupted voice and data communication between different stations along the pipeline route and to maintain continuous and reliable pipeline operation.

5.5.7.3 Each attended station will have multiplexing equipment and existing electronic exchanges will be used to connect to the local subscribers through telephone instruments. In addition to this facility, provision for conferencing between various stations has been envisaged through conference sets. For existing repeater stations, the existing Power Plant and No-break supply from the combination of existing DG set, battery bank, Float-cum-boost Charger with automatic changeover facility to ensure continuous and uninterrupted equipment operations under prolonged mains power failure.

5.5.7.4 The system envisaged above is highly flexible and is up-gradable for future operational requirement by addition of suitable hardware/ software. The switchover from the failed part to the hot standby is automatic, without operator's intervention.

5.6 Implementation Methodology

5.6.1 IOCL (Pipelines Division) possesses adequate expertise in the field of design and engineering, procurement of materials and supervision of construction activities of such projects including telecommunication and telesupervisory systems. It is, therefore, proposed that execution of the project will be done by IOCL.

5.7 Statutory Clearances

5.7.1 Suitable action would be taken for obtaining Environment & Forest clearance and other statutory clearances for the proposed debottlenecking of SMPL from the concerned authorities, as applicable.

5.8 Construction Schedule

5.8.1 The proposed scheme is expected to be completed in a period of about 30 months after receipt of the statutory clearances stated in para 2.3 above. Time schedule for the project is shown in **Annexure-III.**

CHAPTER – VI

6.0 CAPITAL COSTS

6.1 The complete scheme for de-bottlenecking of SMPL i.e. augmentation of Salaya-Viramgam section from 21 MMTPA to 25 MMTPA, Viramgam-Koyali section from 8.5 MMTPA to 9 MMTPA, Viramgam-Chaksu section from 13.5 MMTPA to 16.5 MMTPA, Chaksu-Mathura section from 7.5 MMTPA to 9.2 MMTPA and Chaksu-Panipat section from 6 MMTPA to 7.3 MMTPA is estimated to cost **Rs. 1584 crore**, including a foreign exchange (FE) component of Rs. 565 crore, at April 2009 price level.

6.2 The project cost for above has been estimated on the basis of the following.

- ❖ Cost actually incurred in the past with appropriate escalation.
- ❖ Establishing physical requirements, preliminary specifications and in-house cost data.
- ❖ Experience of virtually identical projects elsewhere to establish physical requirements and cost.
- ❖ Experience of slightly different projects adjusted approximately to establish physical requirements and budgetary quotations.
- ❖ Experience of similar projects in value/terms adjusted for price difference by past experience and escalation data.

6.3 Survey and Field Engineering

6.3.1 This includes the cost of surveys, sub-soil investigation & field engineering.

6.4 Land Acquisition, ROW and Crop Compensation

6.4.1 This includes the cost of Right-of-way (ROW) compensation for the new ROU to be acquired for the looplines/new V-C pipeline. Crop compensation has also been considered.

6.5 Project Management & Engineering, Insurance

6.5.1 The proposed scheme is expected to be completed in a period of about 30 months after receipt of statutory clearances. The cost of project management & engineering is estimated on the basis of envisaged time schedule. The manpower requirement during construction phase would be about 50. However, it would be reviewed before commencement of construction activities.

6.6 Mainline Pipes and Materials

6.6.1 The cost of pipe and coating has been considered as per the latest data available. The

cost of materials required such as casing pipe, coating and wrapping materials, valves etc. has been estimated on the basis of budgetary offers and cost actually incurred in recent past on similar items.

6.7 Mainline Construction

6.7.1 The cost of mainline/loopline construction has been estimated on the basis of the cost incurred in similar project executed elsewhere, suitably adjusted to bring it to April 2009 price level.

6.8 Pump Station and Terminal

6.8.1 The cost under this head includes the cost of mechanical, civil, electrical and instrumentation & control facilities proposed at various stations of SMPL system, including the erection and installation of requisite facilities.

6.9 Cathodic Protection

6.9.1 This includes the cost of materials required for temporary and permanent cathodic protection required for the new looplines and new V-C pipeline etc. Estimates are based on budgetary offers and the rates from similar projects executed in the recent past.

6.10 Telecommunication and Telesupervisory System

6.10.1 Extending telecommunication system and telesupervisory system for the new facilities have been envisaged for the proposed pipeline system. Cost estimates are based on budgetary offers/earlier purchase orders, adjusted suitably.

6.11 Escalation

6.11.1 No provision has been made for price escalation during the period of execution of the project and, as far as possible, the estimates have been prepared on the basis of the costs prevalent in April 2009. However, provision for contingencies to the tune of 5% has been made in the cost estimate, which is considered to be adequate to cover unforeseen factors.

6.12 The summary of capital cost the short term is given in **Attachment-6.1.**

Attachment - 6.1

CAPITAL COSTS

DEBOTTLENECKING OF SALAYA-MATHURA PIPELINE SYSTEM

(April 2009 Price Level)

(Rs. in Lakh)

S. NO.	DESCRIPTION OF ITEM	FE	RUPEES	TOTAL
1	Surveys & Field Engineering	0	414	414
2	Land Acquisition, ROW & Crop Compensation	0	8889	8889
3	Project Management & Engineering, Insurance	0	7000	7000
4	Mainline Pipes	46634	25038	71672
5	Mainline Materials	0	1106	1106
6	Mainline Construction	4961	28137	33098
7	Pump Station and Terminal	4916	19651	24567
8	Cathodic Protection	0	694	694
9	Telecommunication & Telesupervisory	0	2207	2207
	Sub total (a)	56511	93136	149647
10	Interest During Construction (b)	0	8734	8734
	Total (c=a+b)	56511	101870	158381
	Say, Rs. Crore	**565**	**1019**	**1584**

EXCHANGE RATE: 1 US$ = Rs. 50.58, 1 UK £ = Rs. 74.73, 1 Euro = Rs. 67.27

CHAPTER – VII

7.0 OPERATING COSTS

7.1 The operating cost of the pipeline system includes the differential operating cost due to augmentation of Salaya-Viramgam section from 21 MMTPA to 25 MMTPA, Viramgam-Koyali section from 8.5 MMTPA to 9 MMTPA, Viramgam-Chaksu section from 13.5 MMTPA to 16.5 MMTPA, Chaksu-Mathura section from 7.5 MMTPA to 9.2 MMTPA and Chaksu-Panipat section from 6 MMTPA to 7.3 MMTPA. The operating cost of the pipeline system is estimated to reduce by **Rs. 6 crore/year** at April 2009 price level.

7.2 The details of the differential operating cost in short term are given in **Attachment-7.1**.

7.3 Basis of estimation

7.3.1 Fuel/Power

For the purpose of operating cost calculations, cost of crude oil to be used as fuel has been considered @ Rs.14,819/MT and cost of power required for running the motors @Rs. 6 per kwh.

7.3.2 Lube Oil

For the purpose of operating cost calculations, cost of lube oil to be used in engines has been considered @ Rs.57,026/MT.

7.3.3 Power and Utilities

7.3.3.1 Power is required for operation of auxiliaries & controls and for illumination of the stations.

7.3.4 Repair and Maintenance

7.3.4.1 Repair and maintenance of the mainline/looplines has been considered @ 1% of the investment on the mainline/looplines. Similarly, repair and maintenance of the stations has been considered @ 2% of the investment on stations, telecommunication & telesupervisory system.

Attachment -7.1

OPERATING COSTS

DEBOTTLENECKING OF SALAYA-MATHURA PIPELINE SYSTEM

(April 2009 Price Level)

(Rs. in Lakh)

S.No.	DESCRIPTION OF ITEM	DIFFERENTIAL COST
1.	Consumables	
	a) Fuel	(-)4954
	b) Electricity	3659
	c) Lube Oil	(-)154
2.	Power & Utilities	(-)25
3.	Manpower	-
4.	Repair & Maintenance	
	a) Mainline	1066
	b) Pump Station and others	(-)186
5.	Other Expenses	
	a) General Administration Expenses	1
	Total	**(-)593**
	Say,	**(-) Rs. 6 crore**

CHAPTER – VIII

8.0 FINANCIAL ANALYSIS

8.1 Project Financing

8.1.1 The capital cost of the project is considered to be financed through internal resources/commercial borrowings. Requirement of working capital will be met through internal resources. For the purpose of financial analysis, debt - equity ratio of 1:1 has been considered, with interest @ 12.25% per annum and repayment in eight equal instalments, with one year moratorium after commissioning of the system.

8.2 Financial Analysis

8.2.1 Financial analysis for the proposed scheme has been carried out on the basis of expected increase in revenue/incremental refinery margins due to increased processing of crude oil. Details regarding the crude processing considered at the refineries for this purpose are as under.

Refinery	Crude processing Capacity (MMTPA)
Koyali	13.7
Mathura	8.5
Panipat	15
Total	**37.2**

8.2.2 Considering availability of 8.4 MMTPA crude through MPPL and 5.8 MMTPA (short term) /5 MMTPA (from 2016-17) from Gujarat oil fields to Koyali refinery, the crude oil transportation requirement through SMPL corresponding to the above indicated crude processing at the three refineries works out to 23 MMTPA (short term)/23.8 MMTPA (from 2016-17). Accordingly, financial analysis for the proposed scheme has been carried out considering the expected increase in revenue/incremental refinery margins due to increased processing of 2(23-21)/ 2.8(23.8-21) MMTPA (from 2016-17) of additional crude oil (over and above the existing capacity of SMPL i.e. 21 MMTPA) after implementation of this scheme.

8.2.3 Accordingly, the IRR in the base case works out as under.

Description	Based on last 3 years refinery margins	Based on refinery margins as per MoU for 2009-10
IRR (%)	23.8	19.0

8.3 Sensitivity Analysis

8.3.1 Sensitivity analysis has been carried out for different scenarios of cost and incremental crude oil processing etc. Results of the analysis are tabulated below.

Sensitivity Case	IRR (%)	
	Based on last 3 years refinery margins	Based on refinery margins as per MoU for 2009-10
Increase in capital cost by 10%	22.0	17.4
Decrease in incremental crude processing by 10%	21.9	17.2

8.4 It is seen that the IRR is above the prevailing hurdle rate of 13% in all the cases. It can, thus, be concluded that the proposal is economically viable.

8.5 APPRAISAL BY FINANCIAL INSTITUTION

8.5.1 A copy of the Detailed Feasibility Report was sent to M/s Industrial Development Bank of India (IDBI) for appraisal. In their appraisal report, IDBI has recommended that the proposal may be considered technically and financially viable.

CHAPTER –IX

9.0 CONCLUSIONS & RECOMMENDATIONS

9.1 IOCL's refineries at Koyali, Mathura and Panipat have potential to process crude oil more than their name plate capacities. Processing of higher quantity of crude oil is desirable, especially during peak demand seasons, and also for increasing the revenue/refinery margins.

9.2 The existing capacity of various sections of SMPL system is lower than the required capacity to meet the name plate as well as peak processing requirement of the refineries in the short term. In the long term, the pipeline capacity requirement would increase further. Therefore, it is considered essential to debottleneck/augment the SMPL system. With the proposed de-bottlenecking, the refineries would be in a position to process more crude oil, which would add to the refinery margins and to the overall profitability of the Corporation.

9.3 Results of the financial analysis indicate that the proposed debottlenecking of the SMPL system is viable under all the scenarios considering the prevailing hurdle rate of 13%. M/s IDBI, in its financial appraisal report, has also recommended that the proposal may be considered technically and financially viable.

9.4 It is, therefore, recommended to consider debottlenecking of SMPL system i.e. enhancing the capacity of

- Salaya-Viramgam section from 21 MMTPA to 25 MMTPA,
- Viramgam-Koyali section from 8.5 MMTPA to 9 MMTPA,
- Viramgam-Chaksu section from 13.5 MMTPA to 16.5 MMTPA,
- Chaksu-Mathura section from 7.5 MMTPA to 9.2 MMTPA and
- Chaksu-Panipat section from 6 MMTPA to 7.3 MMTPA

in the short term at an estimated cost of Rs. 1584 crore, including a foreign exchange component of Rs. 565 crore, at April 2009 price level.

9.5 The project is estimated to be completed in a period of about 30 months after receipt of statutory clearances.

9.6 Accordingly, this report is being submitted for approval of the Board to the above recommendation.

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