Pre-Feasibility Report

for

Expansion of Onshore Oil & Gas Well Appraisal, Developmental Drilling and Production through Surface Facilities

Cambay Field
Taluka Khambhat, District Anand
Gujarat

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April, 2019

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1.0 Executive Summary

1.0 Executive Summary

Oilex Ltd is an international upstream oil and gas operator with presence along the Indian Ocean Rim. The Company operates across a full range of upstream business activities from exploration and appraisal to development and production delivery. Oilex's strategy is to use its extensive technical and commercial expertise in exploring, appraising and developing petroleum resources around the Indian Ocean Rim to meet the growing energy demands in the region. The Company's principle assets are near term production projects (under Pre-NELP DSF-discovered small fields) in India and an early stage exploration project located in the Canning Basin, North West Australia. The Company is also actively seeking to diversify opportunities internationally.

Located in the prolific Cambay Basin, the Cambay field is the most significant component of the Company's portfolio, covering 161 km² in Gujarat, India. The Cambay PSC is located onshore in Gujarat, approximately 100 km south of Ahmedabad. Oilex Ltd. is a 45% joint venture partner and operator of the PSC and GSPC is the 55% joint venture partner.

Environmental Clearance was obtained for the existing operations in 2008 from MoEF for the re-development of the Field by drilling of about 60 new appraisal/production wells with target depth ranging from 1500 to 3000 m and expansion-cum-modernisation of the existing Gas Collection Station (GCS) to separate reservoir fluids based on success rate of drilling campaign with production capacity of about 2,385 m^3/day [i.e. 15,000 barrels/day] of crude oil and 2.83 million standard cubic meter natural gas per day.

The Gas Collection Station which was proposed for modernization in the EC of May 2008 was re-appraised. After a thorough technical due-diligence was found not suitable for operation, therefore not considered for further modernisation.

The proposed project is a revision of its earlier programme of development drilling and enhancing of existing hydrocarbon production but within the limits for which EC in May, 2008 was obtained from the MoEF. In continuation with the ongoing activities by the company at Cambay field, Oilex intends to expand its development drilling, workover activities and surface facility development. The present/so far activities include drilling 09 wells, work over of 06 wells and installation of associated early gas production facility (installation of EGPF for test gas production from wells - C-73 and C-77H).

Activities proposed for the applied Environmental Clearance *inter alia* include drilling of 30 new wells, work over activities on 09 wells and development of surface facilities (installation of EGPFs, QPF, GCS and terminal as required).

2.0 Introduction and Background

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2.1 The Proponent

Oilex is an upstream oil and gas company listed with the Australian and London stock exchange having operational presence along the Indian Ocean Rim. The Company operates across the entire range of upstream business activities from exploration, appraisal to development and production delivery.

Located in the prolific Cambay Basin, the Cambay field is the most significant component of the Company's portfolio, covering 161 km² in Gujarat. The Cambay PSC is located onshore in Gujarat, approximately 100 km south of Ahmedabad. Oilex is a 45% joint venture partner and operator of the PSC along with GSPC having 55% partnership in the joint venture.

The Cambay Field was initially discovered and developed by ONGC in 1960-70. A total of 68 wells were drilled in the Cambay Field from 1957 to 2017, within the boundaries of the present Cambay Field PSC, of these ONGC had drilled 54 well prior to the PSC period. Niko Resources Ltd drilled 5 wells during their Operatorship of the Field (1994-2006) followed by 09 wells by Oilex Ltd (from 2006 to date)

Activities carried out by Oilex at Cambay Field till date

Environmental Clearance was obtained for the existing operations in 2008 from MoEF for the re-development of the Field by drilling of about 60 new appraisal/production wells with target depth ranging from 1500 to 3000 m and expansion-cum-modernisation of the existing Gas Collection Station (GCS) to separate reservoir fluids based on success rate of drilling campaign with production capacity of about 2,385 m^3/day [i.e. 15,000 barrels/day] of crude oil and 2.83 million standard cubic meter natural gas per day.

The Gas Collection Station which was proposed for modernization in the EC of May 2008 was re-appraised. After a thorough technical due-diligence was found not suitable for operation, therefore not considered for further modernisation.

Present activities of Oilex includes

a. drilling and workover activities, and
b. surface activities

a. Drilling & Workover Activities

Towards the end of 2006, a 160 km² 3D seismic survey was acquired for the entire Contract Area. Since 2006, Oilex has drilled 9 wells and carried out various workover activities

b. Surface Activities

After obtaining a valid CTE & CTO/CCA, C-73 facility (EGPF) was commissioned in 2015 to test gas production from C-73 & C-77H well. This facility is designed to process 1 MMSCFD of gas and 100

blpd of liquid. The gas produced is supplied to the low-pressure network as “off spec” gas which is predominantly consumed for domestic purposes & other small-scale industries.

Existing facility consists of a two-phase vertical separator, Crude oil/condensate storage tanks, transfer facilities, Gas metering station, Power generation units, utility units, fire water systems and sales gas pipeline to low pressure network.

2.2 Nature of the Project

The nature of project is an onshore oil and gas appraisal, development and production covered under Schedule, 1(b) of EIA Notification, 2006 (amended).

2.3 Need of the Project, Importance to Country/Region

The hydrocarbons sector plays vital role in the economic growth of the country. With the ever-increasing gap between demand of energy and requirement of an indigenous supply, the scenario represents a challenge for the Indian economy. India depends on imported crude oil and natural gas to meet its energy requirements which presently stands at 80-85% of its energy demand and is growing rapidly. The existing and proven Cambay block is of immense importance for the country and will not only help in the growth of the economy but also stride to reduce import dependency of hydrocarbons.

Enhanced exploitation of an asset in the prolific Cambay basin for much needed natural resource from the proposed development activity will not only benefit the country by reducing its import bill but also save on precious foreign exchange.

The project will also generate further direct & indirect employment & foster effective utilisation of local resources.

2.4 Demand and Supply Gap

The demand and supply gap of hydrocarbons is tilted towards imports. About 80% of hydrocarbon demand is met through imports while 20% is satisfied by indigenous production, exerting a heavy strain on the foreign exchange reserve of the country.

2.5 Import Vs. Indigenous Production

India currently imports around 80-85% of its hydrocarbon requirement while the remaining is produced indigenously.

2.6 Export Possibility

The domestic market demand is too huge to foster export of hydrocarbon resources.

2.7 Domestic/Export Market

The produced hydrocarbons will be used to satisfy the Indian energy appetite, liquid hydrocarbons would be consumed by Indian refiners while natural gas produced would be supplied to the national gas grid.

2.8 Employment Generation (Direct and Indirect) due to the Project

About 50-65 persons will be deployed at each drilling rig for drilling duration at each well. About 50 persons will be employed for direct manning of the operations this will be followed by hiring of additional local personnel as support staffs through third party contracts.

Indirect employment opportunities will arise through drilling and development work programmes. Significant vibrancy and entrepreneurial opportunities for local Khambhat residents would be introduced because of development activities by Oilex Ltd.

3.0 Project Description

3.0 Project Description

Oilex would be drilling 30 new appraisal wells and will undertake workover on 09 existing wells. New wells when drilled will be hydro fracked for stimulating hydrocarbon flow. Once commercial production rates have reached, surface facilities as required would be erected.

3.1 Type of Project including Interlinked or Interdependent Projects

The proposed project is a revision of its earlier work programme of drilling appraisal/development wells and production for which EC in May 2008 was obtained from the MoEF. The proposal involves developmental drilling of 30 new wells, 09 workovers and provision of surface facilities in the existing Cambay field, in addition to activities already executed by Oilex in the field.

Development of this project which would be undertaken on the grant of applied EC is not interlinked or interdependent on any other project previously undertaken by Oilex Ltd.

3.2 Location of the Project

The Cambay Field (approximate area of 161 sq.km) falls in Khambhat Taluka, Anand District, Gujarat. The coordinates of the points of the project field boundary are given in **Table 3.1** and **Figure 3.1**.

Table 3.1. Coordinates of the Points of the Project Field Boundary

Point	Latitude	Longitude
A	22˚ 25' 00" N	72˚ 32' 53" E
B	22˚ 17' 51" N	72˚ 32' 53" E
C	22˚ 17' 51" N	72˚ 35' 42" E
D	22˚ 18' 56" N	72˚ 35' 42" E
E	22˚ 18' 56" N	72˚ 40' 50" E
F	22˚ 25' 00" N	72˚ 40' 50" E

3.3 Alternative Sites

Environmental Clearance is sought for developmental drilling of 30 new wells, 09 workovers and provision of surface facilities in the existing Cambay Field, in revision to activities already cleared in the EC *vide'* letter dated 6th May, 2008 and covering the existing operations.

3.4 Size and Magnitude of Operation

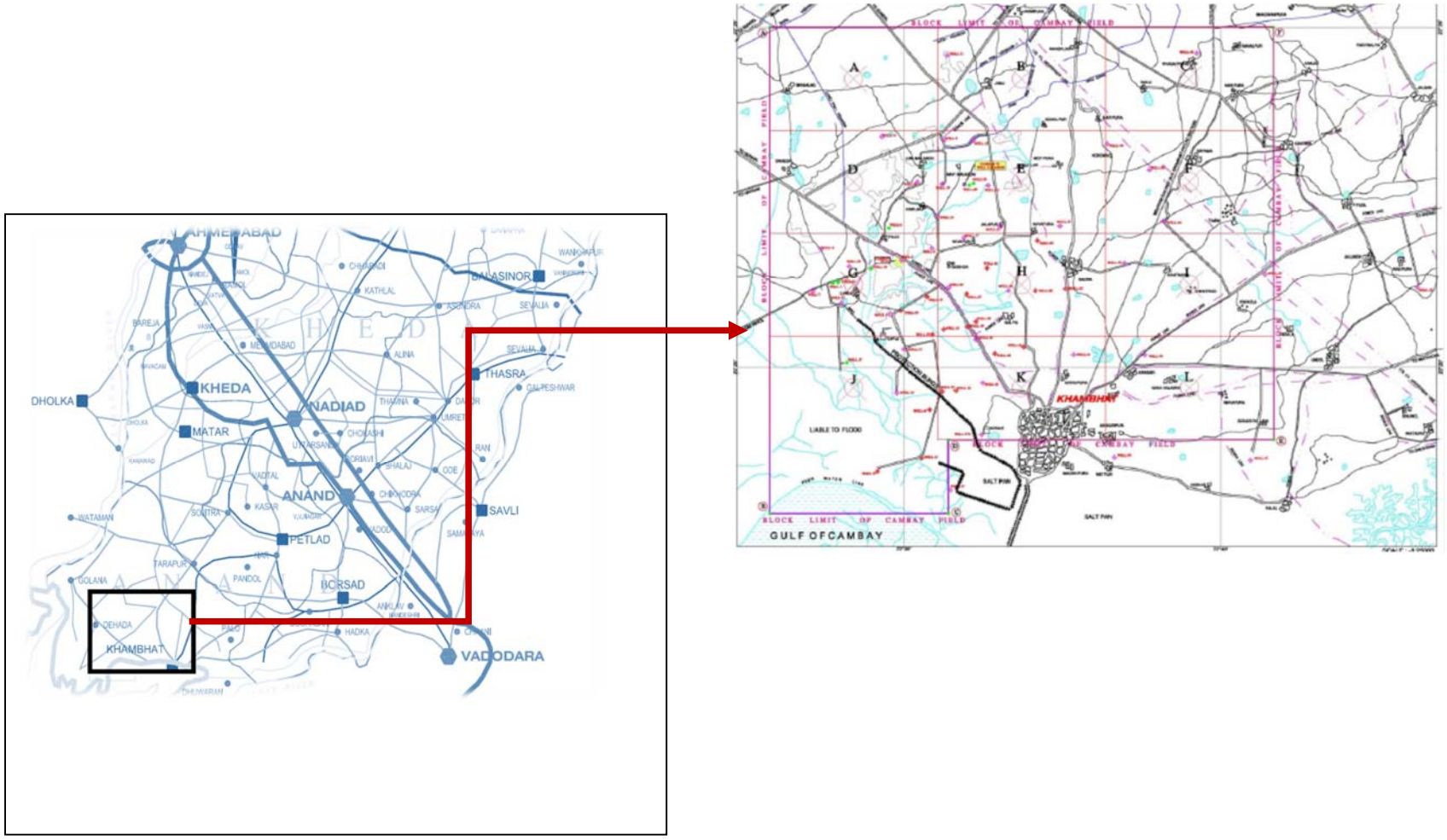
The project involves:

- Developmental drilling of 30 new wells
- 09 workovers
- Setting up and operation of new surface facilities in the existing Cambay Filed
- Operation of existing activities and facilities carried out under MoEF's EC *vide'* letter dated 6th May 2008

3.5 Schematic of Process, Flow Diagram

Typical, generic process of Oil and Gas Appraisal, development and production is given in **Annex I.**

Figure 3.1 Location of the Cambay Field



3.6 Raw Materials Required

Water and drilling mud are the chief raw materials required for drilling of wells. Water -based drilling mud of approximately 1000 m3 will be used for the drilling the proposed wells. The mud will carry drill cuttings and will be screened out through solid control equipment. The mud will drain back into the mud tanks and will be recycled back into the well. Main constituents of the water-based mud are Bentonite (or KCl polymer), barites and calcium carbonate, all of which are natural minerals.

Fuel (HSD) will be used to power the drilling and completion rigs during drilling of the well. Steady state operations comprising of production and care and maintenance activities would be powered by HSD/NG driven DGs/GEGs.

3.7 Resource Optimization / Recycling / Reuse

Water based drilling mud will be recycled for the drilling operation. Additionally, flare gas generation during production/steady state operations would be minimized and the gas flared would be monetized.

3.8 Water and Power Availability

The quantity of water required for the drilling development will be 40 m^3/day for a period of 25 to 30 days for each well. The water will be used for preparation of drilling mud, equipment cleaning and washing of drill cuttings.

Water requirement for drilling will be met through tankers from local authorised water suppliers supplying water from their tube/bore well.

About 10 M^3/day water will be used at the well site for domestic usages, make up water for fire-fighting and engine coolant makeup, etc.

Being away from electrical sub stations, drilling as well as production operations will have to be dependent on DGs/GEGs running on HSD/NG. For a particular drilling site, during drilling operation there would be four diesel generators (of 1200 to 1400 KVA capacity each); one of them would be for backup. Two diesel generators of about 250 KVA would be required for the campsite (likely to be located at about 1 km from the drilling site), only one of them will be operational at any point of time. The diesel fuel consumption in drilling operations would be about 7 to 10 m^3/day. Rig facilities would have a storage capacity of approximately 30m^3 of diesel fuel.

During production/steady state operations GEGs/DGs powered through produced hydrocarbons/HSD would be used to supply electricity.

3.9 Wastes – Solid, Liquid and Gaseous

Wastewater coming out along with the drill cuttings will be transported to the drill cutting waste pit. Overflown water from the drill cutting waste pit will be taken to adjoining wastewater pit. The pit

will be protected with Bentonite liners followed by HDPE liner (of thickness varying from 500 to 600 µm size). A pit of 1000 m^3 will be provided for collection of drilling wastewater. Any oil will be skimmed off from wastewater pit. Water will be evaporated off in the mud pits.

Conditioned drill cuts would be disposed through hazardous waste disposal system.

Domestic waste water at the site will be collected in septic tank followed by soak pit.

Tailpipe emissions of the diesel engines powering the Rig during drilling activity and DGs/GEGs and during production operation are the only sources of emissions envisaged from this project.

4.0 Site Analysis

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4.1 Connectivity[1]

The Cambay Field (approximate area of 161 sq km) falls in Khambhat Taluka, Anand District, Gujarat. The Khambhat town is approachable by the SH-6 Kheda Khambhat State Highway. The town is also connected by meter guage railway line. Nearest broad guage railway station is Anand at approx. 40 km. Vadodara airport is about 65 km from Khambhat.

4.2 Land forms, Landuse, Land ownership

A 120 m x 120 m area would be required for carrying out drilling operations for each well. Land for drilling wells and for production facilities will be taken on lease.

The Cambay field lies in a relatively evenly-graded terrain. Agriculture is the dominant land use of the Cambay field. Water bodies, fallow lands and habitations are the other prevalent land uses.

4.3 Topography

Average altitude of the Cambay field varies from 4 to 22 m above mean sea level. Extensive low undulating plains interspersed by many temporary and permanent water bodies form the landscape. Network of irrigation canals and a drainage canal are present across the block. The block is covered in the Survey of India Toposheet no. F43G11.

4.4 Existing Land Use

The Cambay block project is located in the rural area and the land use pattern is largely agricultural. No natural vegetation complexes, forests or other biodiversity rich habitats are present in the region. Herbaceous vegetation dominated by wetland species and annual weeds are common.

4.5 Existing Infrastructure

Khambhat town has adequate social infrastructure such as places of residence, educational, medical and recreational facilities. Khambhat is well connected with Anand and Vadodara by road.

4.6 Soil Classification

The Cambay Field and surrounding area is situated between Sabarmati River (to the West) and Mahi River (to the East), both of which are the tidal rivers. Hence the soil is soaked with salt and water is brackish, especially in the southern portion of the Field facing offshore region. No river flows through the Field.

[1] Radial distances

4.7 Climatic Information

The climate of the Field and surrounding area is semi-arid and is governed by Summer, Monsoon, Post Monsoon and Winter seasons. The average annual rainfall reported for the region is 532.5 mm. January is the coldest month with minimum temperature of 12.2°C while May is the hottest month with maximum temperature of 40.3ºC. During the monitoring (summer) season, the predominant 24-hourly wind directions were observed from SW and WSW with wind speed of 0.1 to 5.8 m/sec.

4.8 Social Infrastructure

The Cambay Field and surrounding area is spread across the Anand District in Southern Gujarat. Within the block limit of Cambay field, there are approximately 34 villages along with the urban town of Khambhat. The study area around Khambhat town has a good network of roads and telecommunication facilities making it easily accessible. Rural areas have a decent availability of social and physical infrastructure.

5.0 Planning Brief

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5.1 Planning Concept

In continuation with the ongoing activities by the company at Cambay field, Oilex intends to expand its appraisal and development activities by drilling new wells and their associated surface facilities. The activities carried out so far include 09 development wells, work over activities in 06 wells and surface facility (installation of EPGF for test gas production from wells - C-73 and C-77H).

Activities proposed for the applied Environmental Clearance include appraisal and development drilling of 30 wells, work over activities in 09 wells and surface facility development (installation of EGPFs, QPFs, GCS and terminals as required).

Drilled wells would be hydro fracked to stimulate them for production. Once commercial rates of production are established, Oilex would be erecting surface facilities to process and condition produced hydrocarbons from the wells drilled. Subsequently as the expansion of the project would take place, facilities for new lodging of site personnel would be established. This would also be supplemented by setting up of laboratories for testing of produced hydrocarbons and warehouses for storage of routine production consumables.

5.2 Population Projections

Population projections are not relevant in oil and gas upstream activities.

5.3 Land Use Planning

The proposed oil and gas upstream activities do not have potential to affect the land use of the field in a significant way. A 120 m x 120 m area per well would be required for carrying out drilling operations.

Land would also be required for a centralised production facility in future as deemed fit technically acreage acquired would depend on the production facility capacity.

Land for drilling wells and for production facilities will be taken on lease or will be purchased as deemed fit.

5.4 Assessment of Infrastructure Demand (Physical and Social)

The proposed oil and gas upstream activities would not have a significant footprint of physical and social infrastructure. All drilling, work over activities will be carried out by acquiring 120 m x 120 m area of land per well. Surface facilities as required would be set up adjacent to the wells or a centralised production unit would be commissioned as required. Acreage of land required for central production facility would be as per its envisaged capacity.

5.5 Amenities/Facilities

During drilling/workover activities bunk houses would be used for stationing of personnel deployed at site. As production activities commences site office with provisions of lodging of deployed personnel would be set up. Associated amenities of warehouses, laboratories and security bunks would also be established.

6.0 Proposed Infrastructure

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6.1 Industrial Area (Processing Area)

The proposed oil and gas upstream activities are deemed industrial activities; however, they will be limited to the 120 m x 120 m activity area per well. Additionally, land could be required for a centralised production facility if deemed technically viable. Acreage of land required for such production facilities would be determined as per its capacity envisaged.

6.2 Residential Area

Temporary accommodation would be required during drilling activities for which bunk houses would be sourced. As production activities along the block increases, lodging facilities for deployed personnel's would be set up as per prevailing circumstances.

6.3 Greenbelt

A greenbelt will be developed as per the stipulated guidelines.

6.4 Social Infrastructure

Khambhat town has adequate social infrastructure such as places of residence, educational, medical and recreational facilities. Khambhat is well connected with Anand and Vadodara by road. Cambay field and settlements around Khambhat town have good network of roads and telecommunication facilities making it easily accessible. Rural areas have a decent availability of social and physical infrastructure.

6.5 Connectivity

The Cambay Field (approximate area of 161 sq km) falls in Khambhat Taluka, Anand District, Gujarat. The Khambhat town is approachable by the SH- 6 Kheda Khambhat State Highway. The town is also connected by meter gauge railway line. Nearest broad guage railway station is Anand at approx. 40 km. Vadodara airport is about 65 km from Khambhat.

6.6 Drinking Water

About 10 M^3/day water will be used at the well site for domestic usages, make up water for fire-fighting and engine coolant makeup, etc. RO filtered mineral water for drinking will be sourced in 25 ltrs dispensable cans from local suppliers during drilling, completion and construction phase.

6.7 Sewage System

Drilling and workover activities being temporary, septic tank-soak away pit shall be created at all well-sites for disposal of sewage from make-shift toilets. The system will also serve operations should staff be deployed at the site during operation. During steady state operations sewerage plant would set up.

6.8 Industrial Waste Management

During drilling and operations phase, Waste Oil Cat 5.1, Hazardous and Other Wastes (Storage and Transboundary Movement Rules, 2016) will be generated. It will be given away to an authorised re-processor following the Passbook system as prescribed in the Rules. Drilling mud and drill cuttings will be disposed into lined Mud Pits as described in section 3.8.

6.9 Solid Waste

Project activities will generate little quantity of innocuous waste from administrative operations, which shall be given to a waste collection contractor.

6.10 Power Requirement and Source

Being away from electrical sub stations, the drilling as well as production operations will have to be dependent on DGs/GEGs running on HSD/NG. For a particular drilling site, during drilling operation, there would be four diesel generators (of 1200 to 1400 KVA capacity each); one of them would be for backup. Two diesel generators of about 250 KVA would be required for the campsite (likely to be located at about 1 km from the drilling site), only for one of them will be operational at any point of time. The diesel fuel consumption in drilling operations would be about 7 to 10m^3/day. Rig facilities would have an approximate storage capacity of approximately 30 m^3 of diesel fuel.

During routine production or steady state operations GEGs/DGs would be used for power generation using produced hydrocarbons as fuel.

7.0 Rehabilitation and Resettlement

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No population is proposed to be displaced for the oil and gas upstream developmental activities. Restoration of acquired land for production and drilling of wells shall completed once the economic feasibility of these units are no longer viable or on termination of PSC agreement with MoPNG, GoI as directed by the regulator.

8.0 Project Schedule and Cost Estimate

8.0 Project Schedule and Cost Estimates

8.1 Likely date of initiation of Project

Developmental drilling will commence immediately after obtaining EC from the MoEF & CC, estimated by December 2019.

8.2 Estimated Project Cost

Estimated project cost of the proposed project is about Rs. 965 crores with the investment being accrued in two phases.

9.0 Analysis of Proposal

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The proposal is for development and production of a hydrocarbons – crude oil, natural gas and associated condensate, a valuable natural resource. It is in continuation of activity being carried out at Cambay field. Similar activities have been conducted in the area without any major episode of pollution or incidents/accident. The project has an insignificant environmental and social impacts, and the economic benefits far outweigh the impacts.

Annex I
Schematic Process Flow of Oil and Gas Appraisal, Development and Production Activities

Activity	Potential requirement on ground
Appraisal: Drilling of new wells to determine reservoirs economic feasibility.	Additional drill sites Additional access for drilling units & supply units Facilities to export production Construction of access roads Additional waste disposal units
Development & Production: Production of hydrocarbons from the reservoir through drilling new wells or deploying artificial lifts in existing wells and possibly advanced recovery techniques, until economically feasible reserves are depleted.	Wellheads Flowlines Separation /treatment facilities Storage of oil/condensate facility Facilities to export production Flares ETP Hazardous waste disposal arrangements Captive power generation unit/ Grid supply facility Accommodation, infrastructure Transport equipment's Storage of waste and its disposal
Decommissioning & Site Restoration activities as per recommendation guidelines.	Equipment to plug wells Plug & Abandonment activities Equipment to demolish & remove installations Equipment to restore site