Annexure - Project Brief

Expansion of onshore oil and gas production from existing 300,000 barrels of oil per day (bopd) to 400,000 bopd and165 Million Standard Cubic Feet per Day (MMSCFD) to 750 MMSCFD from RJ-ON-90/1 Block, Barmer, Rajasthan

Introduction

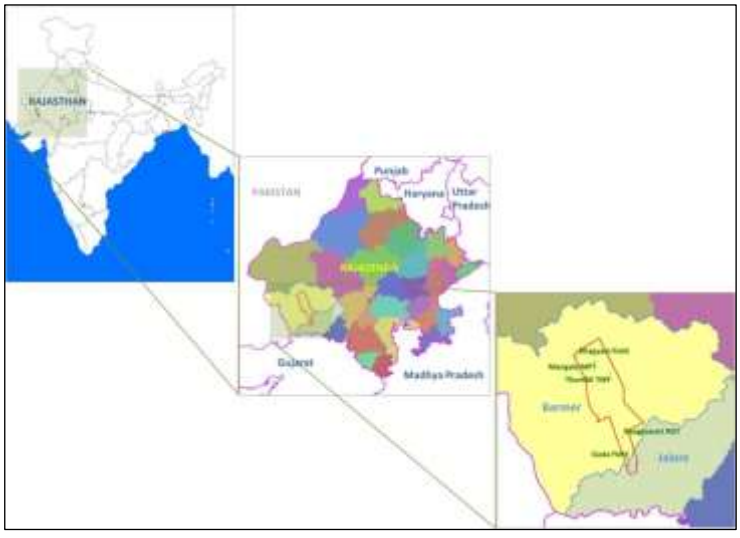
Cairn India Limited had merged with Vedanta Limited, effective 11th April 2017. Cairn Oil and Gas is a division, which is now part of the Vedanta Group, is a globally diversified natural resources group with wide ranging interests in aluminium, copper, zinc, lead, silver and iron ore.

The Rajasthan Joint Venture (RJ JV) comprising of Vedanta Limited and Oil and Natural Gas Corporation (ONGC) Limited, is involved in hydrocarbon exploration and production activities in Block RJ-ON-90/1. The Block RJ-ON-90/1 is an onshore pre-New Exploration License Period (NELP) block and is located in Barmer and Jalore Districts of Rajasthan spread over an area of 3,111km^2. The production from the Block is currently contributing to more than 20 per cent of India's domestic crude oil production.

Location of the Block

The Block is located largely in the Barmer District (94%) with minor portion falling in the adjoining Jalore District (6%). The Block is linked by road with Jaisalmer, Jodhpur, Pali, Jalore, Jaipur, Ajmer and Ahmedabad. Major roads within the block include NH-15, NH-112, SH-16 and SH-28. The study area is well connected to Jodhpur, Jaipur and Delhi through rail linkages. The location of the block is depicted below in **Figure 1**:

Figure 1: RJ-ON-90/1 Block map location



The Project

The RJ-ON-90/1 Block covers an area of 3,111 km^2. Vedanta Ltd. has drilled around 130 exploratory and appraisal wells and has made 38 hydrocarbon discoveries in the Block, with the Mangala discovery termed as the largest on-land hydrocarbon discovery in India. The other major discoveries in the block

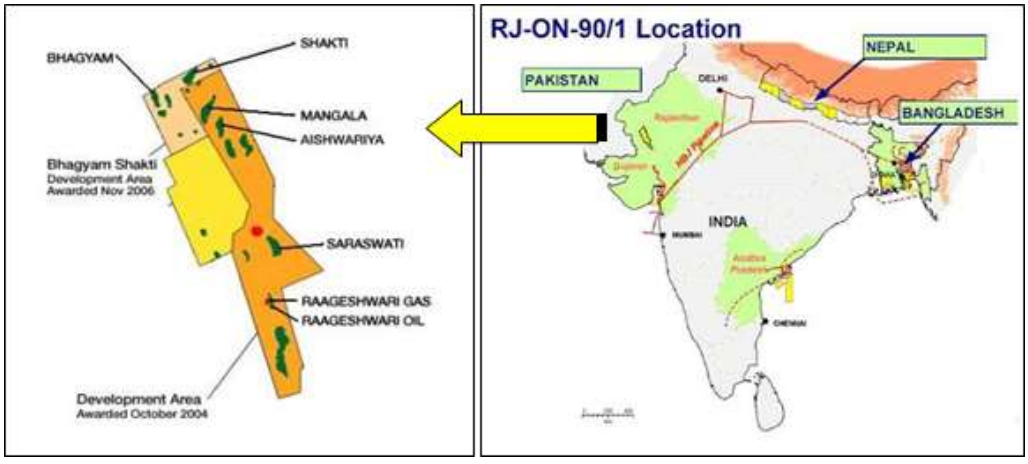
are the Bhagyam field and Aishwariya field, both located in the vicinity of the Mangala field. A comprehensive review of the resource potential in the Block has been carried out by Vedanta through the application of innovative technologies and advanced geo-sciences. In addition, DeGolyer and MacNaughton have conducted an independent estimate of reserves and contingent resources, and have also reviewed the majority of the leads and prospects of the hydrocarbon resources.

Till date about 38 hydrocarbon discoveries has been identified in the Block, of which ten discoveries have been developed or are being developed. There are two terminals processing the hydrocarbons within the block. Environmental Clearance (EC) has been obtained to produce up to 300,000 BOPD in Mangala Processing Terminal (MPT) and 100 MMSCFD of natural gas in Raageshwari Gas Terminal (RGT).

MPT is located near Nagana village in Barmer Tehsil and District and RGT is located near Dhandalwas Village in Gudamalani Tehsil of Barmer District. Both the terminals receive well fluids from various well pads located within the Block. The Mangala, Bhagyam and Aishwariya well pads are currently connected through in-field pipelines to the Mangala Processing Terminal (MPT). The gas well pads are connected through in-field pipelines to the Raageshwari Gas Terminal (RGT). The well pads of Saraswati, Raageshwari and Guda are presently stand-alone satellite fields, from which processed crude oil is trucked through road tankers to the MPT.

Raageshwari Deep Gas is a tight, lean gas condensate reservoir, with excellent gas quality of approximately 80% methane, low CO_2 and no H_2S. Wells have tested at gas production rates in the range 2 to 4 mmscfd and producing condensate gas ratios in 40 to 50 bbl/mmscf range. Condensate density on test has varied but approaches 60°

Figure 2: RJ-ON-90/1 Block map location



Raageshwari Gas Terminal is under operation and a dedicated 12" gas trunk line supplies Raageshwari gas to the MPT to meet energy demands. A 4"condensate line is also laid connecting the Raageshwari gas terminal to the MPT. Raageshwari deep gas is also the main source of natural gas for the Barmer-Bhogat crude oil pipeline system fuel requirements.

Upstream Development

Gas Terminal and associated facilities augmentation:

Raageshwari Deep Gas (RDG) is a tight, lean gas condensate reservoir, with excellent gas quality of approximately 80% methane, low CO_2 and no H_2S. At present the Raageshwari Gas Terminal (RGT) is designed to produce up to 55 MMSCFD of natural gas. The produced natural gas is used for captive power generation, internal usage within operating of gas engines at various above ground installations and export of the gas to GSPL grid in Gujarat. The expansion of RGT plant is already underway to produce additional 45 MMSCFD of natural gas (i.e., total 100 MMSCFD) for which the Environmental Clearance has already been obtained. Condensate will be generated as part of the gas processing. At present the condensate is sent to Mangala Processing Terminal through pipeline for processing along with Crude Oil.

The gas production augmentation is being planned to produce from existing 165 MMSCFD to 750 MMSCFD. The proposed projects will cover the following activities:

1. Augmentation of Raageshwari Gas Terminal (RGT) from existing 100 MMSCFD to 400 MMSCFD with condensate processing of 70,000 barrels per day.
2. Development of satellite gas fields (standalone well pads) to produce and process up to 100 MMSCFD.
3. Handling of associated gas from RJ oil fields from existing 65 MMSCFD to 250 MMSCFD.
4. Setting up of CNG and LPG fuel filling stations up to fifty (50) no's in and around Rajasthan.

Oil Terminal and associated facilities augmentation:

Mangala Processing Terminal (MPT) is producing on average around 175,000 BoPD. The expansion of MPT plant is already underway to produce additional 125,000 BoPD (i.e., total 300 BoPD) for which the Environmental Clearance has already been obtained. The augmentation and new projects will cover the following activities:

- Oil production augmentation from RJ oil fields 300,000 BOPD to 400,000 BOPD
- Additional processing train from 1.02 Million barrels of fluid per day (BFPD) to 1.6 Million BFPD to handle increased water cut.
- Setting up of total thirty (30) numbers of quick processing facilities (three phase separation) of the well fluids at various fields such as Mangala, Bhagyam and Aishwariya. The separated produced water will be injected back to the reservoir of that field. The associated gas will be used for captive power generation within the field or otherwise sent to MPT or RGT. The separated crude oil will be sent to MPT for further processing & export or direct export to the refineries through trucks.
- ASP (Alkaline – 4000 MT per day; Surfactant – 600 MT per day and

Polymer – 600 MT per day) flooding across various fields within RJ Block. Permission to manage, store and handle hazardous ASP chemicals as per the MISHC and applicable Rules.

- Produced Water treatment facility capacity augmentation to treat up to 1.55 Million Barrels of Water per Day (BWPD) along with disposal facilities for 0.2 Million BWPD of effluent and solid waste. The effluent after treatment will be disposed in deep dump well.
- Enclosed ground flare system at well pads.
- Additional 25,000 KLD deep saline ground water abstraction (i.e., total 93,500 KLD abstraction), considering already CGWA abstraction permission obtained for 53,500 KLD and CGWA application under consideration for 15,000 KLD).
- Setting up waste/slope oil processing facility up to 10,000 barrels per day.
- Setting up waste 100 TPD (ton per day) to energy based facility to process oily sludge (including tank bottom sludge, oily media filters etc.,) using appropriate technology.

Pipeline (Midstream) Development:

CIL has developed Mangala Development Pipeline (hereafter referred to as MDP), running approximately 700 km through Rajasthan and Gujarat, to evacuate crude oil and natural gas produced from the block. The crude oil is sold to refineries of Essar Oil and Reliance Industries Limited at Jamnagar, Gujarat and Indian Oil Corporation Limited at Radhanpur and Viramgam, Gujarat. Through marine export facilities periodically crude oil is also exported to Mangalore Refinery and other refineries in coastal region through the sea route from already installed single point mooring (SPM) and Bhogat Terminal. Natural gas around 30 MMSCFD at present being is sold through connecting in Gujarat State Petronet Ltd. (GSPL) network in Gujarat.

The additional natural gas being planned to produce from existing 100 MMSCFD to 400 MMSCFD will be evacuated to the distributors in Gujarat through laying of new 30 inches gas pipeline. However the new 30 inches gas pipeline will be laid to evacuate natural gas of quantity up to 500 MMSCFD. The gas evacuation projects will cover the following facilities:

1. Laying of new 30 inches natural gas pipeline of 700 km from Barmer to Bhogat to evacuate capacity up to 500 MMSCFD of natural gas
2. Laying of new 10 inches gas pipeline of 100 km from RDG to MPT to evacuate condensate
3. Laying of new 10 inches gas pipeline of 100 km from RDG to AGI – 5 for stabilized condensate transportation
4. Laying of new 12 inches pipeline at various locations to connect processed crude from satellite fields to main export pipeline.
5. Laying of new 12 inches pipeline at various locations to connect processed gas from satellite fields to main gas pipelines.

The total project cost would be INR 12000 Crores, which includes around INR 8000 Crores for upstream and INR 4000 Crores for midstream. This project will be implemented in phased manner up to seven (07) years period.

Environmental Sensitivity

There are no ecologically sensitive areas within 15 km radius of the RJ-ON-90/1 Block.

Environmental Consultant

ERM India Pvt. Ltd. is the Consultant Organization with Category 'A' accreditation in Sector 2 and 18 as per QCI-NABET scheme.