

MB-OSDSF-B9/2016
B9 CLUSTER DEVELOPMENT

Document No.: AWEL-RX-B9 Cluster-PFR-0001

Project Feasibility Report



Rev	Date	Purpose of Issue	Prepared By	Reviewed By	Approved By
1	27.11.17	Issued for EIA study	LS	AS/VIM	AH
0	25.10.17	Issued for Review	LS	AS/VIM	AH

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1. Executive Summary

Adani Welspun Exploration Limited (AWEL) “**Company**” has been awarded contract area MB/OSDSF/B9/2016 comprising of B9 Cluster and has signed the Revenue Sharing Contract (RSC) with the Government of India. The field was originally discovered by ONGC and was subsequently offered for bidding under Discovered Small fields (DSF) bid round. Adani Welspun Exploration Limited (AWEL) is a joint venture E&P Company formed by two Indian based multinational business conglomerates *Adani Group* and *Welspun Group* to undertake upstream oil & gas business with 65% and 35% shares respectively.

AWEL plans to develop the B9 Cluster field by drilling wells and installing offshore facilities to produce natural gas and crude oil. The Project Feasibility Report (PFR) provides an outline of the overall plan to for the development of B9 Cluster fields

2. Project details

Justifications for the project:

Government of India through Directorate General of Hydrocarbons (DGH) invited bids from companies to develop the DSF fields with the objective of reducing the huge import of hydrocarbons and encourages the speedy implementation of the development. The local hydrocarbon production is about 20% of the demand.

B9 Offshore Cluster details

The contract area MB/OSDSF/B9/2016 comprises of three DSF fields offshore namely B-9, B-7 and BRC located in the Mumbai Offshore Basin (Figure 1). While B-9 & B-7 are gas fields, BRC is an Oil field.



Figure 1: Location Map of Contract Area MB/OSDSF/B9/2016)

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The latitude & longitude of the B-9 Cluster is shown in the table below.

B-9 (approximate area- 138.5 Sq. km.)		
Points	LATITUDE (N)	LONGITUDE (E)
A	20° 10' 53.88"	71° 22' 44.13"
B	20° 04' 20.03"	71° 29' 43.40"
C	20° 00' 29.86"	71° 28' 49.56"
D	20° 00' 23.72"	71° 26' 04.36"
E	20° 06' 44.21"	71° 25' 01.02"
F	20° 06' 32.26"	71° 20' 13.92"
G	20° 08' 56.76"	71° 18' 52.32"

B-7 (approximate area- 22.7 Sq. km.)		
Points	LATITUDE (N)	LONGITUDE (E)
A	19° 59' 29.6"	71° 07' 29.00"
B	19° 59' 36.37"	71° 09' 13.69"
C	19° 59' 27.67"	71° 11' 48.86"
D	19° 58' 18.92"	71° 12' 00.32"
E	19° 57' 31.03"	71° 07' 47.36"

BRC (approximate area- 22.03 Sq. km.)		
Points	LATITUDE (N)	LONGITUDE (E)
A	19° 53' 59.72"	71° 09' 58.11"
B	19° 54' 0.32"	71° 12' 59.65"
C	19° 51' 32.77"	71° 12' 59.10"
D	19° 52' 11.67"	71° 09' 38.40"

Table 1: Longitude and Latitude measurements for the Contract Area MB/OSDSF/B9/2016

The P50 hydrocarbon in-place volumes of B-9, B-7 and BRC are 158.4 Bcf, 69.5 Bcf and 73 MSTB respectively, as estimated by ONGC and provided in the pre-bid technical information through DGH.

3. Fields development concept

Being a discovered small field no additional exploration activities are planned. Offshore geo-technical & geo-physical surveys will be undertaken to design and execute the development activities including drilling and installation of platforms and sub-sea pipelines.

The following are the details in which the three fields are planned to be developed.

B-9 field:

7 wells are proposed to be drilled. Peak production rate is expected to be about 32 mmscfd for a plateau period of 4 years followed by declining profiles (refer Annexure A), the estimated field life is currently estimated to be 10 years.

B-7 Field

3 wells are proposed to be drilled. Peak production rate is expected to be about 21

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mmscfd (Annexure A) the field life is estimated to be 10 years.

BRC field :

Current plan is to drill two wells in the BRC field, the peak production rate is expected to be about 800 bopd & 0.4 mmscfd for a plateau period of 2 years followed by declining profiles. The studies for estimating the field production profiles are currently ongoing.

Process technology

Minimum facilities platforms are considered for oil and gas production and no processing facilities are envisaged. Platform jackets being considered as mono- towers or three-legged Jackets or alternatives. Sub-sea completions of wells may also be explored as options if economically viable.

Talks are in advanced stages with a nearby operator for sharing their gas export and processing facilities. The combined wellhead fluids will be routed to the nearby Operator’s existing well head platform through a dedicated pipeline. Processing of the oil and gas is envisaged to be done by nearby operator’s existing facilities, gas will be further routed to an existing on-shore gas processing complex from where the gas buyers’ offtake point will be identified later. No onshore facilities are envisaged in the current concept. The BRC Oil production is envisaged to be stabilised in the BRC platform and exported at offshore, the details will be finalised later.

The field is proposed to be operated unmanned with periodical visits through helicopter/ boat-landing to conduct routine maintenance, well interventions and any repair work etc.

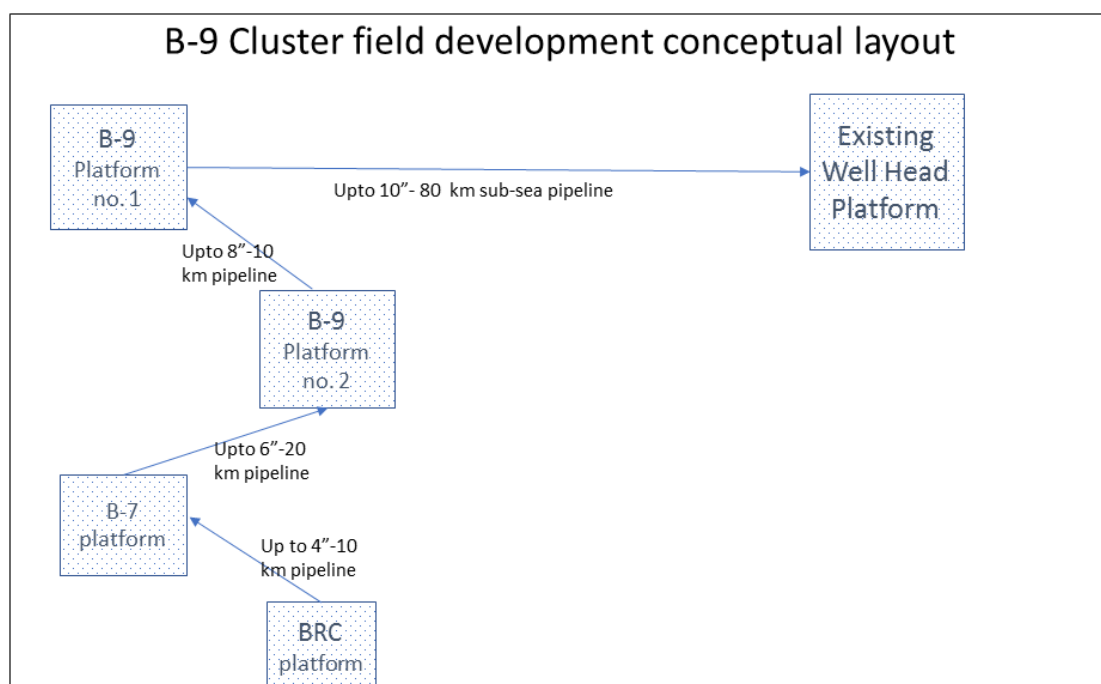


Figure 2: Conceptual plan for B9 DSF Cluster fields development

4. Scope of Project

The overall scope of the current development project comprises of

- Drilling of 12 wells, 7 wells in B-9 field, 3 wells in B-7 & 2 well in BRC fields,
- Installation of two wellhead platforms in B-9 area, and one each in B-7 & BRC areas. Alternately sub-sea completion wells may also be explored during the design stage.
- Laying of approx. 80 km sub-sea pipeline (upto 10") from B9 field to a nearby operator's existing well head platform and hooking-up with the platform facilities.
- Laying of approx. 10 km intra-field sub-sea pipeline (upto 8") within the B-9 area and hooking-up with the platform facilities.
- Laying of approx. 30 km sub-sea pipeline (upto 8") from B-7 platform/ area to B-9 platforms /area and hooking-up with the platform facilities.
- Laying of approx. 10 km sub-sea pipeline (upto 6") from BRC platform/ area to B-7 platform /area or B-9 platforms/ area and hooking-up with the platform facilities. Additionally, oil stabilisation, storage & loading facilities are also to be considered. The details are to be finalised during the design phase of the development.

5. Drilling & completion philosophy

The development drilling & completion work are planned to be performed using a Jack-up rig at the wellhead platform. The wells will be deviated wells and horizontal displacement of around 1500m, TVD of 2500 m to 4000 m.

Wells are tentatively planned to be drilled with 4 casing policy having 30" Conductor, 20" surface casing, 13-3/8" & 9 5/8" Intermediate casings and 7" Production Liners. Completion strings will be 3 1/2" Tubings with gas-tight connections. Wells are planned to be completed with sand-screens. The wellheads planned are integrated wellhead-4CP 10K type with matching Christmas-trees. The drilling fluids are planned to be of high performance water-based muds, or SOBMs. Test flaring per well is expected to be of about 4 days per well.

The drilling rigs and the spread including supply vessels, etc. will be primarily run on diesel and power will be generated within the rigs/ vessels through diesel generators. Maximum capacity of cranes is expected to be 100 T.

The Drilling Contractor is expected to handle the logistics of transporting material and consumables & chemicals viz. Bentonite, Barite, Cement etc. to & fro offshore through warehouse facilities located inland.

6. Surface facilities

The production of oil and gas in the field will be from up to 12 wells. Gas produced from the wells will be co-mingled and sent to a nearby operator's existing wellhead platform in located about 80 km away. The two platforms within B-9 field are located at a distance of 10 km between. The platforms are envisaged to be minimum facilities wellhead platforms comprising of wellhead, Christmas tree, production & test manifold, wellhead control panel, scrapper launcher., instrument gas system, local power generation (solar or other), heli-deck, jib-crane, fiscal metering, real time production data transfer to DGH through satellite communication, etc.

The inter-platform sub-sea pipeline of size 6" for a length of about 10 km will be laid at the same time with the installation of main pipeline. This spur line is planned to be either routed to the wellhead platform or tied-in to the 8"-10" sub-sea main pipeline.

On-bottom stability analysis study will be performed at the design stage and appropriate requirements for protection of pipeline, environment & other consideration like security, etc. will be finalised at the time.

The development for B-7 field & BRC field will include installation of 2 wellhead platforms, inter-field sub-sea pipelines and hooking up at B-9 area. The BRC platform is also envisaged to include facilities to handle, stabilise, store and export oil.

The project is planned to be executed through a reputed EPIC Contract and the Contractor would perform detailed design, procure, fabricate/ construct platforms & jackets, install platforms, jackets & pipeline, hook-up and commission. The platforms & Jackets will be fabricated at a remote fabrication yards (in India or abroad), transported to the offshore field through barges, installed and commissioned. The pipelines will be sourced from reputed mills, corrosion/weight coated, transported to the field through barges/ vessels, installed sub-sea, hooked up with the platforms and commissioned.

The installation spread including derrick and lay barges, supply vessels, etc. will be primarily run on diesel and power generated within the rigs/ vessels through diesel generators. Maximum capacity of Cranes is expected to be 1000 T.

7. Resources:

This is an offshore development project beyond 12 nautical miles, and is planned to be executed through lump-sum integrated project management (IPM) and Engineering, Procurement, Construction, Installation & commissioning (EPIC) models. Construction materials like sand, brick, stone chips, borrow pits, etc. is not envisaged for this project.

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8. Rejects:

No pollution potential rejects are envisaged in this project

9. Development schedule

The high level development schedule of all the three fields in Contract area MB-OSDSF-B9-2016 is as given below:

B-9 DSF - Tentative Development Schedule

Key Events	2017	2018				2019				2020				2021				2022					
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
B-9 Field																							
FDP and Project Planning																							
Project Execution through IPM and EPIC																							
First Gas																							
B-7-Field																							
FDP and Project Planning																							
Project Execution through IPM and EPIC																							
First Gas																							
BRC Field																							
FDP and Project Planning																							
Project Execution through IPM and EPIC																							
First Oil																							

10. Development costs

The overall development is expected cost tentative is about US\$ 250 million (Indian Rupees 1600 Crores).

11. HSES requirements

The Facilities shall be designed and constructed as per standard existing oilfield practices, and are to be operated and maintained to meet the safety philosophies and criteria outlined hereunder. Key elements in achieving the safety objectives are:

- The facilities shall be designed, constructed, and are to be operated and maintained such that they are fail-safe and of high safety integrity.
- The selected process configuration and equipment shall have proven safety and operability characteristics.
- The Facilities engineering design processes shall include thorough quantitative and qualitative safety case assessments and safety reviews, including the HAZOP process etc.
- The Facilities shall be constructed, installed and are to be operated and maintained in accordance with safe work practices and procedures. The target site safety objective shall be zero lost time injury (LTI) frequency rate.
- Site emergency response and evacuation procedures shall be developed and personnel will be trained /instructed in these procedural requirements.
- All statutory compliance such as Environmental Clearance (EC), approvals from OISD, State Maritime board, Defence / MHA/ MoD Clearances etc. shall be strictly enforced.
- Safety studies such as HAZID, HAZOP, SIL Safety case, material handling, etc. would to be conducted and all action items closed. All documentation shall be properly maintained and made available to Authorities for verification.
- The wells shall be drilled as per API & OISD standards. Drilling equipment and services shall be selected as per the above Guidelines.
- All well related safety devices such as Blow-out Preventers (BOP), Safety valves, etc. shall be tested as per API, OISD or other Statutory Guidelines and records kept.
- Proper training shall be ensured for all crew personnel and adequate safety-kits shall be used all time.

12. De-commissioning

At the end of the life of the field, the offshore platform facilities will be decommissioned as per the national/ international standards required for Abandonment/ Site restoration. The wells will be plugged, safely abandoned and the structures and equipment will be dismantled and disposed as per the norms.

13. List of abbreviations

API	American Petroleum Institute	OISD	Oil Industry Safety Directorate
bbl	barrel	MoEF&CC	Ministry of Environment & Forest and Climate Change
bpd	Barrels per day	LTI	Lost Time Incident
CGR	Condensate Gas ratio		
DSF	Discovered Small Field	SIL	Safety Integrity Levels
EC	Environmental Clearance	TVD	True Vertical Depth
EPIC	Engineering Procurement Installation & Commissioning		
EUR	Expected Ultimate Recovery		
FDP	Field Development Plan		
FEED	Front-end Engineering Design		
HAZOP	Hazardous Operability studies		
HAZID	Hazard Identification studies		
MHA	Ministry of Home Affairs		
MD	Maximum Depth		
MoD	Ministry of Defence		
MPFM	Multi-phase Flow meter		
IPM	Integrated Project Management		

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Annexure A: Production profile

A.1 Overall indicative Production profile for B-9 field

Date (dd-mm-yyyy)	B-9 Profile			B-7 Profile		
	Gas	Cum Gas	Number	Gas	Cum Gas	Number
	Rate (MMscf/day)	Produced Bscf	of Producers	Rate (MMscf/day)	Produced Bscf	of Producers
4/1/2019	15.0	0.0	3.0			
4/1/2020	32.0	11.7	7.0			
4/1/2021	32.0	23.4	7.0	21.0	7.7	3.0
4/1/2022	32.0	35.1	7.0	21.0	15.3	3.0
4/1/2023	25.4	46.1	7.0	21.0	23.0	3.0
4/1/2024	16.6	53.7	7.0	21.0	30.7	3.0
4/1/2025	10.5	58.6	7.0	13.6	35.6	3.0
4/1/2026	6.5	61.7	7.0	8.8	38.9	3.0
4/1/2027	3.9	63.6	7.0	5.7	41.0	3.0
4/1/2028	1.8	64.4	7.0	3.7	42.3	3.0
4/1/2029	1.2	64.9	7.0	2.4	43.2	3.0
4/1/2030				1.6	43.8	3.0

Production potential from BRC field is being evaluated. Profiles will be estimated after detailed G&G evaluation.