



<div> ABU DHABI OIL CO., LTD (JAPAN)</div>	MUBARRAZ REDEVELOPMENT STUDY – SELECT STAGE (CONTRACT NO. DP-22-101)		<div></div>
	COST ESTIMATE BASIS AND METHODOLOGY		
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COST ESTIMATE BASIS AND METHODOLOGY

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1.0 INTRODUCTION

1.1 Project Background

Abu Dhabi Oil Co. Ltd. (Japan); hereafter referred as COMPANY, has been involved in development and oil production from three (3) fields, namely Mubarraz, AR and GA since 1970's. Recently, COMPANY has also developed and started production from Hail oil field. These fields are located 60 to 100 km west of Abu Dhabi City. Field layout depicting the stated fields is provided below.

Mubarraz field, largest among the fields, is located in the southern part of the Arabian Gulf, 60 km west of the coast of Abu Dhabi at approximately 24°30' of north latitude and 53°40' of east longitude. Mubarraz field consists of two major northeast-southwest anticlinal trends, each of which was further divided by subtle saddles into six separate structures, namely, AB, AA, B, CD, CB and MR-6, with no major faults. Oil is accumulated within the Cretaceous Thamama Group, which consists of Zones 2 to 6 at depths between 8,800 and 11,000 ft. subsea. The crude oil in the Thamama Group can be featured as highly under-saturated with relatively low solution gas-oil-ratios ("GOR"), indicating a medium to light oil in a range of approximately 35 API to 45 API in gravity.



Commercial production through Mubarraz field commenced in May 1973. Electrical submersible pumps ("ESPs") have been successfully applied since 1975 to boost oil production from Mubarraz Field. Production is realized through offshore production platforms (e.g. AAP, BAP, BBP, BDP, BFP, CAP, CDP and MR-1) located within the Mubarraz field with final processing and export through Mubarraz Island.

1.2 Project Description

COMPANY intends to re-develop Mubarraz field to enhance oil production from current levels through new development planning. COMPANY, over the course of 2020 and 2021, had undertaken IDENTIFY and ASSESS (I&A) stage studies on multiple production profiles and were able to identify a set of production profile and developmental option which are economically viable and bears merit to be forwarded for SELECT Stage Study.

COMPANY intends to undertake SELECT Study with to further evaluate the options identified and recommended by the I&A Stage Study, select the best scheme/concept based on technical, economical and risk evaluation and develop conceptual design for the selected concept.

The execution of this SELECT study will be managed by COMPANY. Said study is awarded to BILFINGER TEBODIN Middle East, with an objective to perform this SELECT Study in full compliance with ADNOC's Value Assurance Process (VAP) as well as the requirements outlined.

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1.3 Project Title

The title of the Project is “MUBARRAZ REDEVELOPMENT STUDY – SELECT STAGE (CONTRACT NO. DP-22-101)”.

1.4 Project Objective

The key objective of the SELECT Stage Study is to SELECT and DESIGN the most optimal techno-economic concept by assessing all the possible alternatives and explore opportunities to establish a robust business case for development of new facilities.

1.5 Project Location

The Project Site is at ADOC offshore site which includes Mubarraaz, Umm Al Anbar (AR), Neewat Al Galan (GA) and Hail Field, which is located at approximately 100 km west from Abu Dhabi city as shown in below field key plan.

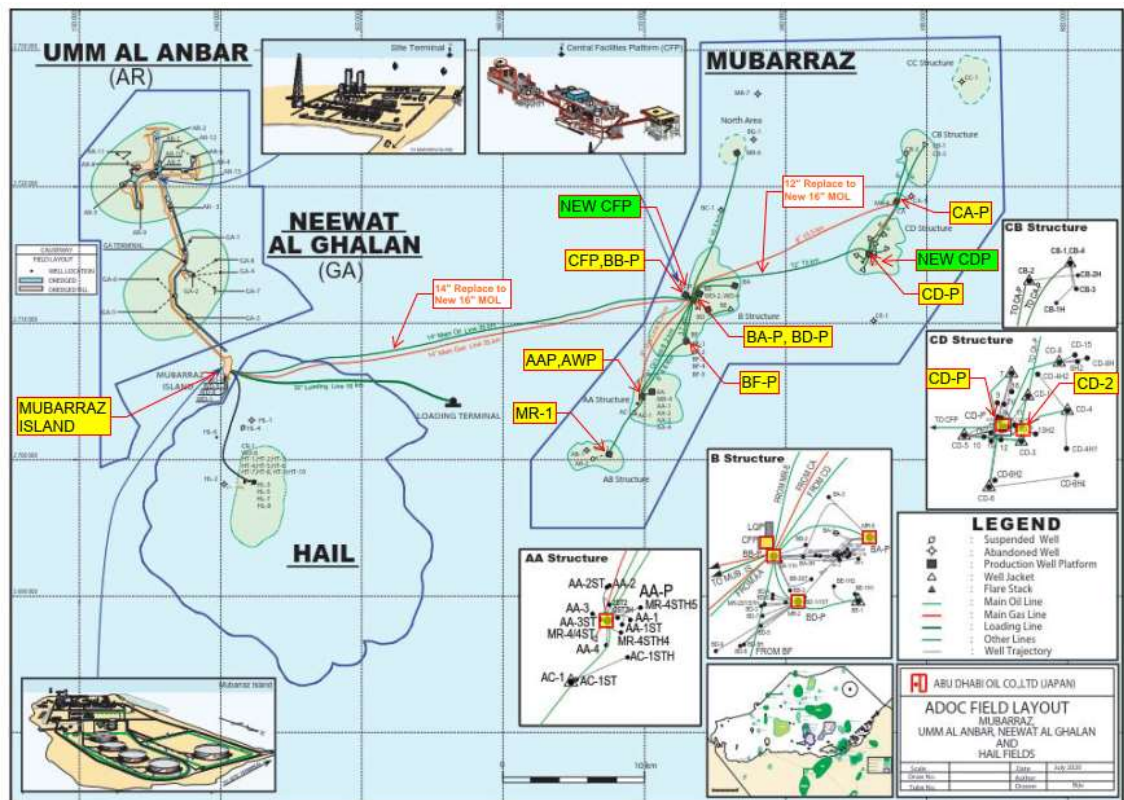




Figure 1 – Company Field Key Plan

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2.0 DEFINITIONS & ABBREVIATIONS

2.1 Definitions

COMPANY	: Abu Dhabi Oil Company Ltd. (Japan)
CONSULTANT	: Bilfinger Tebodin Middle East
PROJECT	: Project for “MUBARRAZ REDEVELOPMENT STUDY – SELECT STAGE (CONTRACT NO. DP-22-01)”
SHALL	: The use of the word “shall” means mandatory requirement
SHOULD	: The use of the word “should” indicates a strong recommendation to comply with the requirements of this document.
VENDOR	: The party(s) which manufactures and/or supplies piping, equipment and services, as may be required.

2.2 Abbreviations

Abbreviation	Description
ADNOC	Abu Dhabi National Oil Company
ADOC	Abu Dhabi Oil Co., Ltd. (Japan)
AED	Arab Emirates Dirham
BFD	Block Flow Diagram
FAT	Factory Acceptance Test
MTO	Material Take-off
PMC	Project Management Consultancy
PMT	Project Management Team
TIC	Total Installed Cost
TPIA	Third Party Inspection Agency
USD	United States Dollar
VAT	Value Added Tax

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Abbreviation	Description
WHT	Well Head Tower

3.0 REFERENCE DOCUMENTS

SL.NO	DESCRIPTION	DOCUMENT NUMBER
1	Section-4 Scope of Work	RFT No. DP-22-101

4.0 PURPOSE OF DOCUMENT

This document summarises the basis, assumptions and methodology to be adopted for developing the cost estimate for the proposed options for the Select study. The accuracy of the cost estimate shall be +/-40% in Concept selection step and +/-30% in Concept design step.

5.0 CAPEX ESTIMATION

5.1 General

Cost estimation, as part of this study will be performed to support the following:



**Cost
Estimate
for the
Options**

- +/-40% Cost Estimate Accuracy in Concept Selection step
- +/-30% Cost Estimate Accuracy in Concept Design step
- To understand Overall Investment Cost of the Project Based on the proposed options

The estimate will be developed in accordance with requirements of +/-40% accuracy levels in Concept selection step and +/-30% accuracy levels in Concept design step by utilizing the TIC developed for the cost blocks.

BFDs and other documents which are part of the technical definition of options will be used as an input to the estimates. Wherever, additional details are required for proper estimation, the same will be requested from the disciplines.

Estimation will be performed using in-house spreadsheets and cost database e.g. per ton material cost, installation vessel day rates, ton/ton bulk factors, man-hour/ton factors,

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rate/man-hour, previous project vendor quotations etc. Cost indexation will be done to take care of the year of database.

All the items required for the cost estimate have sufficient cost references in the in-house database in Middle East or ASPEN Capital Cost Estimator and will be used in the estimation. Budgetary vendor offers will be requested for Produced Water Treatment Package and Compressors, however availability of the same is subject to receiving the Vendor responses on time. Basis of cost for each item will be clearly stated in the cost estimation sheet for that item as a part of the cost estimation report.

Other input to cost estimation will include, as applicable:

1. Equipment size, weights, plot area etc.
2. High level discipline inputs for bulks (e.g. piping, instrumentation, electrical, structural) outside the package or skid.
3. Brownfield modifications on existing facilities such as process equipment, piping & pipelines, electrical and instrument systems, platform structures (deck extension, strengthening)
4. Preliminary sizing and tonnage for New WHT Deck & Jacket Structures based on structural inputs.

5.2 Contracting Strategy

Following the Concept Select and Concept Design phase completion as a part of the Study, the subsequent stages in the Project lifecycle are envisaged as follows:



- DEFINE Stage
- EPC Stage

Cost estimate will be prepared based on the assumption that a single EPC contract for the project shall be awarded on a lump sum basis.

5.3 CAPEX Estimation Basis

Cost estimation basis for this study are listed below:

Software	: ASPEN Capital Cost Estimator (ACCE) & Microsoft Excel
Currency	: United States Dollars (USD)
Conversion	: 1 USD = 3.67 AED

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Cost Estimation Accuracy : +/-40% in Concept selection step and +/-30% in Concept design step

Design Growth Allowance : 10% (typical) for Vendor Quotations
10% (typical) for the bulk materials

Contingency : Based on qualitative analysis for the proposed options

Contracting Strategy : Based on one single EPC Contract Award

Exclusions : Taxes, Land Acquisition/Leasing Costs, Bank Guarantees/Bonds, Cost incurred to-date, Forward Escalation

Notes:

1. Cost estimation will be for 2022, however inflation will be accounted for the cost items based on CAPEX spend profile in the Economics

2. Definitions:

Taxes: service tax, value added tax, etc.

Land Acquisition / Leasing cost: Cost for land purchase or lease (not applicable for this project)

Bank Guarantees/Bonds: Form of guarantee provided by bank for compensation of money when there is any delay in delivering the performance or operation. Payment will have to be made even if the service is delivered inadequately.



Cost incurred to date: Cost incurred in this study and previous studies till the end of the completion of this study

Forward Escalation: is the cost estimate in a particular with inflation applied over the cost of 2022 (current year)

5.4 Cost Breakdown Structure

Cost break down structure should consider the following elements:

- Equipment Material and Bulk Material Cost
- 2 years Operational Spares
- Fabrication and Installation cost

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- Commissioning Assistance cost
- Detailed Engineering including Construction Engineering
- Freight Cost
- Third Party Inspection Agency / Vendor Representative Cost
- Construction, Supervision & Project Management
- FEED
- PMC and PMT cost
- Insurance
- Contingency

5.5 Cost Estimation Methodology



Cost Estimation Methodology based on the cost breakdown structure is highlighted in table below. This will be used to calculate TIC for each cost block which will then be added to arrive at the total option cost.

Table 1: Cost Estimation Methodology

Parameter	Method	Basis
<u>Direct Costs</u>		
Equipment Material cost	Weight (ton) x per ton cost or Equipment cost based on in-house database or vendor offer	In-house database
Bulks materials cost	(Piping, electrical, instrumentation, structural, safety) Bulk weight % of equipment weight & Bulk weight (ton) x per ton cost Or % of equipment cost	In-house database
Equipment + bulk onshore fabrication & construction cost	% of equipment & bulk material costs	20% (typical)

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Parameter	Method	Basis
Installation cost	% of equipment & bulk material costs (Note: For offshore installation, it will be based on installation barge type, day rate, Mobilisation/demobilisation days, number of installation days, etc.) For pipelines and subsea cables, it will be based on lay vessel, support vessel, etc. day rate and no. of days.	30% (typical) In-house database In-house database
2 year operational spares cost	% of equipment cost	2% (typical)
Commissioning assistance cost including commissioning spares	% of equipment & bulk material costs	2% (typical)
<u>Contractor Indirects</u>		
Detail engineering including construction engineering	% of direct costs	10% (typical)
Freight	% of material (equipment + bulks + operational spares) costs	7% (typical)
TPIA (third party inspection agency) and vendor representative cost	% of material (equipment + bulks + operational spares) costs	2% (typical)
Construction supervision & project management	% of direct costs	10% (typical)
<u>EPC Costs</u>	Direct Costs + Contractors Indirects	
<u>Client Indirects</u>		
FEED	% of EPC Costs	2.5% (typical)
PMC & PMT	% of EPC Costs	7% (typical)
Project insurance & other overheads	% of EPC Costs	1% (typical)
<u>Base Estimate</u>	EPC Costs + Client Indirects	

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Parameter	Method	Basis
<u>Contingency</u>	% of Base Estimate	<p>For subsea cables and subsea pipelines, no contingency is considered as 20% contingency in length will be considered.</p> <p>For individual equipment, only 10% contingency is considered as detailed sizing is carried out.</p> <p>For Well head towers, platforms, structures, piping modifications, deck extensions, contingency of 20% is considered as engineering details are still not as matured as for equipment.</p>
<u>Total Installed Cost</u>	Base Estimate + Contingency	

Note:

This methodology can be equally applied to both the Concept Select and Concept Design. For Concept Design, the cost estimate will be refined from +/-40% to +/-30%. This more accuracy level will be achieved through use of more refined available technical definition of the selected option during Design stage.

5.6 Assumptions



- Custom duties are considered to be not applicable.
- Food and accommodation have been included in the barge cost.
- Most of the fabrication and welding work will be done onshore.
- Firefighting / rescue vessel as required for emergency escape is considered as already available at offshore platform.
- Weather downtime will be considered of the Barge usage (no. of days) in Offshore.

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5.7 Exclusions

Following items to be excluded from the cost estimate:

- Operation and maintenance cost
- COMPANY costs (FAT and other COMPANY costs)
- Costs incurred to-date.
- Allowance towards following:
 - Delays in execution
 - Storing of fabricated materials at contractor's yard due to any delays during execution
 - Effect of non-availability of workboats/barges at the time of execution
- Factor or contingency towards following:
 - Currency hedging
 - Currency trends

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6.0 OPEX ESTIMATION

6.1 OPEX Basis and Methodology

OPEX basis and approach is tabulated below:



Table 2: OPEX Basis

OPEX Element	Basis	Approach
1. OPEX Direct Expenses (Note 1)	1.5% of CAPEX	
2. OPEX Indirect Expenses		
CAPEX Depreciation	10% Straight Line method	
Drillex Depreciation	10% Straight Line method	
3. ESP Work over	3 MMUSD / ESP	Based on 0.12 MM USD / per day rate & 25 days of work over duration.

Notes:

1. Direct expenses include the following

- Utilities
- Operating Labour
- Supervision
- Maintenance Labour, Materials and Supply (includes Equipment Maintenance, Piping and valves, Electrical, Instruments, Civil and Buildings, Telecoms, Office/camp services, Miscellaneous). Maintenance cost as per good cost engineering practices is considered as a percentage of the total CAPEX.
- Miscellaneous direct expense (office supplies, clothing, laboratory, etc.)

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7.0 COST ESTIMATION REPORT

Based on the above described methodology, Cost Estimation report will be prepared. It shall contain below details:

- Basis of Cost Estimate
- Cost blocks identified for all options
- Capital Cost estimation for all options

8.0 ATTACHMENTS

Attachment 1 – Preliminary Cost Estimation Template

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