L&T Hydrocarbon Engineering Limited (LTHE)

A wholly owned subsidiary of Larsen & Toubro Limited

Integrated EPCIC Capabilities for Offshore Oil & Gas Projects
Agenda

HSE

Company Overview

Engineering

Procurement

Fabrication

Subsea @ LTHE

Transportation & Installation

Mega Projects (Select Examples)
HSE: Embedded in Core Execution Philosophy

Zero Incident Credo
- No work-related ill-health
- No occupational accident and material damage
- No harm to environment

HSE Award 2014's International Contractor Category – PETRONAS

British Safety Council International Safety Awards

Project/Unit - Safe Million Man-hours Achieved

<table>
<thead>
<tr>
<th>Project/Unit</th>
<th>Safety First</th>
</tr>
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<tbody>
<tr>
<td>29.5</td>
<td></td>
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<tr>
<td>KOC GC-30</td>
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<td>19.5</td>
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<tr>
<td>MFY Sohar</td>
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<tr>
<td>18.7</td>
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<tr>
<td>MFF Hazira</td>
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<td>18.6</td>
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<tr>
<td>PCG-SEZ, RIL J3</td>
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</tr>
<tr>
<td>18.2</td>
<td></td>
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<tr>
<td>Hasbah II</td>
<td></td>
</tr>
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<td>15.7</td>
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<tr>
<td>MFF Kattupalli</td>
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</tr>
<tr>
<td>5.4</td>
<td></td>
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<tr>
<td>GSFC Melamine</td>
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<td>6.5</td>
<td></td>
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<tr>
<td>NRDp</td>
<td></td>
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</tbody>
</table>
Select HSE Awards & Accolades

- **British Safety Council International Safety Award for LTHE Fabrication Yards**
- **HSE Award Winner 2013 - ADMA OPCO**
- **HSE Award 2014’s International Contractor Category – PETRONAS**
- **MFF Kattupalli won the RoSPA Gold Award 2018**
- **NSC Award 2015**

Highest “Green Band” rating achieved in Shell’s HSE Audit

One of the 50 Companies to achieve the “Sword of Honor”

Continuous commitment to ensuring “Safe Million Manhours” in our offshore projects
Agenda

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Mega Projects (Select Examples)
Larsen & Toubro (L&T) - At a Glance

Founded in 1938 by two Danish engineers, H. Holck-Larsen & S. K. Toubro, Larsen & Toubro is India’s largest E&C company with interests in Projects, Infrastructure Development, Manufacturing, IT & Financial Services.

- **Established**: 1938
- **Order Book (FY'18)**: US$ 40 BILLION
- **Employees**: 51,000+
- **Revenue (FY'18)**: US$ 18 BILLION
- **Market Cap**: US$ 25 BILLION
- **Credit Rating**: ICRA, CRISIL: AAA
- **Management**: Professional
- **Presence**: ~ 30 COUNTRIES
- **L&T - Shareholding Pattern**:
  - Institutional Investors: 58%
  - Other Investors: 22%
  - Public: 12%
  - 12% L&T Employees Foundation
  - No promoter holding

Largest E&C Company In India

Uninterrupted Dividend Payment Record since 1946
L&T Sectoral Presence

**PROJECTS**
- **Infrastructure**
  - Buildings & Factories
  - Transportation Infrastructure
  - Heavy Civil Infrastructure
  - Metallurgical & Material Handling
  - Power Transmission & Distribution
  - Water & Renewable Energy
  - Power Plants & Equipment

**Hydrocarbon (Subsidiaries)**
- Offshore
- Onshore
- Construction Services
- Modular Fabrication
- Engineering Services

**M’FNG**
- Heavy Engineering & Defence
- Electrical & Automation
- Machinery & Industrial Products

**SERVICES**
- Financial Services (Subsidiaries)
- Information Technology (Subsidiaries)
- Technology Services

**Domestic**:
- 75%
- 25%

**International**:
- 75%
- 25%

**Domestic**:
- 40%
- 60%

**International**:
- 25%
- 75%

**Domestic**:
- 25%
- 75%

**Domestic**:
- 25%
- 75%
L&T Hydrocarbon Engineering (LTHE)

A wholly owned subsidiary of L&T

- Offshore
  - Process Complex & Wellhead Platforms
  - Subsea Pipelines & Systems
  - Brownfield Projects
  - Living Quarters
  - FPSO Modules
  - Wind Farms
  - Decommissioning

- Onshore
  - Petroleum Refining
  - Gas Processing
  - Fertilizers
  - Petrochemicals
  - Cross-country Pipelines & Terminals
  - Cryogenic Storage Systems

- Construction Services
  - Site Development & Pile Foundation
  - Plant & Non-plant Buildings
  - Tankages
  - Cross-country & In-field Pipelines

- Modular Fabrication
  - Offshore Structures & Topsides
  - Modular Process Plants / Reformer Packages
  - Equipment Skids
  - Piping Spools

- AdVENT
  - Concept, Basic & FEED
  - Detailed Engineering
  - Advanced Engineering
  - EPCM/PMC/E&P services
  - Trouble-shooting & de-bottlenecking

More than 600 projects (150+ international) Completed

7500+ Staff | ~60,000 Manpower in Yards & Sites
LTHE: Offshore Offerings

- Vertically integrated EPC Player
- Project Management with Task Force concept
- In-house detailed engineering
- Dedicated Supply Chain management team with global sourcing expertise
- Fully Integrated Fabrication and Construction Yards (3 yards)
- In-house Installation & Pipe-lay (LTS3000, LTB300) + Close tie-ups for Major Installation Spreads
- Focus on Yard Pre-Commissioning with Zero Punch List dispatch for early start up at Offshore

ONGC- EPC of MHN PLQP & PGC Project- $1.1 Billion
ONGC- EPC of Bassein Development Project- $421 Million
GSPC- EPC of Deen Dayal PLQP Project- $318 Million
Saudi Aramco – Hasbah Project $ 1.6 Billion

Integrated Project Execution Framework

Engineering  Procurement  Fabrication & Construction  Installation and Commissioning
LTHE: Offshore project experience

More than 3 Decades of Experience across Geographies

- New Process Platforms: 10
- New Wellhead Platforms: 72
- Gas Compression Modules: 14
- FPSO Topsides Engineering: 7
- Living Quarters Modules: 9
- Subsea Pipelines: 1150+ Kms
- Platform Modifications: 212+
- Jack-up Rig Refurbishment: 4
International Acceptance
Agenda

HSE

Company Overview

Engineering

Procurement

Fabrication

Subsea @ LTIE

Transportation & Installation

Mega Projects (Select Examples)
LTHE Offshore Engineering Spectrum

Offshore Oil & Gas Engineering

400+ projects over 21+ years

Concept Studies
FEED & Basic Engg.
Detail Engineering
Procurement Engg.
As Built Documentation
Special Analyses & Studies
Pre-service Engg & Marine Installation support

Concurrent 3D-based multi-discipline engineering; Deliverables integrated with Fabrication priorities

Transient flow studies, Dynamic simulation, Spectral & Fatigue, Safety, etc

Load-out, Sea-fastening, Transportation, Launch, Floatation & upending, etc

Subsea Systems
FPSO Topsides
Process Platforms
Wellhead Platforms
Process Modules
Submarine Pipelines
Brownfield Engineering
Accommodation Platforms
Jack up Rig Refurbishment

Larsen & Toubro
Agenda

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Company Overview

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Mega Projects (Select Examples)
Procurement Management

Digitalization of SCM
- Optimize use of procurement technology platforms

Excellence & Continuous Improvement
- Focus is on developing skills and capabilities to deliver continuous superior performance

Compliance
- Through strong supervision and controls ensure that standard processes are fully adopted and maintained

Safety & Quality
- Exhibit zero tolerance to Safety risks within LTHE and sub-contractors

Total Cost of Ownership
- Systematically analyze TCO and make decisions in accordance with it

Schedule
- Rigorously plan and resource work to ensure no delays in work execution and delivery

Objectives

Cost Competitive, Customer-oriented Global Sourcing with On-time Delivery
Procurement Volumes

Spend on Indian & LCC vendors (2012-2018): US$ 1175 Mn

Spend on vendors from other regions (2012-2018): US$ 1804 Mn
Procurement Manpower

Total LTIE SCM Manpower: 228

No. of Buyers: 109
Avg Experience: 17 Yrs

POM Manpower: 75
Avg Experience: 14 Yrs

% Distribution of Shared resources Vs Project specific resources: 50%

Academic Background: 90% Engineering Graduates & 10% Diploma

No. Of PPM/Deputy PPM: 21
Avg Experience: 17 Years

Spend Handled Per Buyer (MUSD):

<table>
<thead>
<tr>
<th>FY 13-14</th>
<th>FY 14-15</th>
<th>FY 15-16</th>
<th>FY 16-17</th>
<th>FY 17-18 H1</th>
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<tbody>
<tr>
<td>2.8</td>
<td>3.2</td>
<td>2.8</td>
<td>3.4</td>
<td>1.4</td>
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</tbody>
</table>
Agenda

- HSE
- Company Overview
- Engineering
- Procurement

Fabrication

- Subsea @ LTBE
- Transportation & Installation
- Mega Projects (Select Examples)
Modular Fabrication Yards

- **Sohar, Oman**
  - Total Area: 700,000 m²

- **Kattupalli, India**
  - Total Area: 600,000 m²
  - (Additional 1,000,000 m² available)

- **Hazira, India**
  - Total Area: 500,000 m²

All yards ISO 9001, ISO 14001 and OHSAS 18001 certified
LTHE’s Hazira Yard

Total Area : 500,000 sq. m.
Fabrication Yards : 419,000 sq. m.
Fabrication Shops : 27,000 sq. m.
Warehouses/Stores : 25,000 sq. m.
Offices : 4,000 sq. m.

Location
295 km north of Mumbai, 21km from Surat on the right bank of river Tapti. Unimpeded passage to Arabian Sea, 8 km away.

Set up in 1988, the Hazira yard has set multiple benchmarks in fabricating and loading out offshore structures for Oil & Gas majors.
LTHE’s Sohar Yard

- Located at Sohar Industrial Port Company (SIPC) Complex with exclusive sea front facility.
- Yard Waterfront: 450 m
- All weather heavy loadout Jetty: 300 m

Fabricated 13,500 MT 8-legged jacket for ONGC in record 9 months.

Tie-in platforms (6376 MT each) fabricated for Saudi Aramco’s Mega Project.
LTHE’s Kattupalli Yard

- Located on the East Coast of India – 200 NM from the Krishna Godavari Deepwater basin
- Yard Waterfront: 450 m
- Water Depth 12 m
- A unit in Special Economic Zone (SEZ)
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- HSE
- Company Overview
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- Procurement
- Fabrication

Subsea @ LTIE

- Transportation & Installation
- Mega Projects (Select Examples)
Subsea Installation Of Vashista & S1 Development (India)

Client- ONGC (NOC of India)
Type- ICB, Turnkey / EPC Lump sum Contract
Location : Odalarevu (Andhra Pradesh), India
Year- 2015-2017

Scope:
• Pipeline 98 Kms, Umbilical 48 Kms
• 13 Subsea Structures (PLETs, ILTs, PLEM)
• Flying Leads, Hookup of Subsea Production System

Project Completed within schedule

Subsea structures fabrication
Reeling of line pipes
# KG-98/2 SURF+SPS - Ongoing (India)

## Client - ONGC (NOC of India)
- **Type:** ICB, Turnkey / EPC Lump sum Contract
- **Location:** East Coast of India
- **Year:** 2018-2021
- **Consortium with McDermott & BHGE**

## LTHE Scope

<table>
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<tr>
<th><strong>Procurement &amp; Fabrication of Subsea Structures &amp; Stalks</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>SURF Structures (PLETs/ILT)s</td>
<td>4000 MT</td>
</tr>
<tr>
<td>SPS Structures – Manifolds / SDUs</td>
<td>3000 MT</td>
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<tr>
<td>Total Fabricated Stalk Length (Spool base)</td>
<td>300 kms</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Procurement &amp; Coating of Linepipes</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total length of Pipelines</td>
<td>480 kms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Onshore Installation</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Pipelines</td>
<td>22 kms</td>
</tr>
<tr>
<td>Umbilicals</td>
<td>-</td>
</tr>
</tbody>
</table>

SURF – Subsea, Umbilicals, Risers & Flowlines
SPS – Subsea Production Systems
Agenda

HSE

Company Overview

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Fabrication

Subsea @ LTHE

Transportation & Installation

Mega Projects (Select Examples)
LTHE: Installation Vessel LTS3000

Crane Capacity
3000 ST (maximum)

Pipe lay Capacity
Pipe OD: 6”-60”
S-Lay Method

Accommodation
290 Men LQ

Owned and operated by LTHE in Joint Venture with Majority Stake
LTHE: Pipelay cum Accommodation Barge LTB300

300 MT Pedestal Mounted Offshore Crane
300 men accommodation
Pipe Tensioner: 2 x 600 MT (20 m/min)
Pipe Laying: 4” to 60”
8 point mooring
Tenets Of LTHE T&I

T&I Engineering
(GRL WEAP, OFFPIPE, SACS, MATHCAD, MOSES, WINCAT)

LTS 3000
(Lift Capacity – 3000 ST, Pipelaying Capability – 6” to 60”)

LTB 300
(Pipelaying Capability – 6” to 60”
300 Men Accommodation Work Barge)

Proficient Offshore Team with Global exp.
(Right person at right place)

Project /Operations Management
(Managing installations with Chartered Barges, DSV’s and other marine spreads)

LTHE Operates LTS 3000 & LTB 300
Heavy lift, pipelay, HUC

Projects executed on EPCI basis with full responsibility for T&I

In-house Transportation & Installation Teams
In-house T&I Engineering Capabilities
T&I Engineering Capabilities

**STRUCTURAL**
- Rigging Design & Lift Point Check
- Pile/Conductor Drivability Analysis
- Lift Study
- Floatation & Upending Analysis
- Launch Analysis
- Wet Tow Analysis
- Docking Analysis
- Mooring Analysis
- Transportation Engineering
- On-Bottom Stability Analysis

**PIPELAY**
- Start-up Analysis (Bow String, Hold Back, Beachpull, etc)
- DMA
- Static and Dynamic Analysis
- Fatigue Check
- Abandonment, Laydown and Recovery Analysis
- Weld Repair Analysis
- Davit Lift Analysis
- Beach pull Analysis
- Trenching related Analysis

**SOFTWARES**
- MATHCAD
- AUTODESK
- OFFPIPE
- SACS (Subscription based)
- MOSES (Subscription based)
- GRLWEAP (Subscription based)
- In-house Excel Spreadsheets
- well versed in latest design codes and best practices such as API, ISO, DNV, etc.
LTIE: Offshore T&I Capabilities

Jacket Installation (Including launch type)

Topside/Deck Modules

Flexible/ Cable Lay

Subsea Pipelay

Platform Bridge/ Modules

Services covering entire spectrum of offshore installations
**Brief Scope:**

- 3 Jacket Installation in 150m WD (7000MT)
- 3 Topside Installation (1100 MT)
- Installation of intra-field Sea lines (approx. total 21kms) in 150 – 170 m WD

**24 Single piece piles (Length: 133 m; Wt: 450 MT each) installed**
**Brief Scope:**

- 3 WHP + 1 Process Platform
- 6” & 12” 33 km Pipeline – 55-60m WD
- 09 Subsea Tie-in’s and 2 Riser Stalk-on

**Recently Completed 33 km Pipeline and 1 WHPs in Neelam Field**
T&I Daman Development Project (India)

Brief Scope:
• 5 WHP
• 8” 12” & 18”
  Pipeline installation total 72 KM in 35m WD
• Subsea Tie-in’s, Umbilical and SSIV

- T&I Fast track Project with adverse currents (> 4 knots) and poor subsea conditions (Near Zero Visibility)
- Strong Tidal / Currents Variation

In a Challenging field, completed 5 WHP in record time - one month ahead of schedule
Balance Works for PRP4 - T&I (India)

Brief Scope:
• 63 Km Rigid Pipeline
• 23 Km Flexible Pipeline
• 16 No’s of Riser Stalk-on
• 12 No’s of I/J tubes
• 53 No’s Riser Demolition

Complex T&I project with challenging schedule...
Additional Development of Vasai East Project (India)

**Brief Scope:**
- 2 WHPs & 36 km Pipeline:
- 47-53 m WD

*Single vessel mobilization (LTS3000) ensured an economical solution*
Mumbai High North Process & LQ Project (India)

JACKET WEIGHT: 13,500 MT (8 LEGGED) Launch installation

1

2

3

4

5

6
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Mega Projects (Select Examples)
Hasbah Gas Development Increment Project II (Saudi Arabia)
Mega Gas Increment Field Development

Client- Saudi Aramco
Type- Lumpsum EPIC (In consortium with Subsea7 for Installation)
Year- 2016-2019 (*Ongoing)

To produce and supply 2000 MMSCFD (Gas)
6 Wellhead (Topside), 2 Tie-in platforms, flare platform, bridge,
Offshore pipeline & 164 km onshore pipeline,
OHL line connectivity & Other Utilities

Modules Information (In-house Fabrication)
6Nos. of Topsides, 2 Nos. Platforms & 2 Nos. Jackets

- Platform Topsides- 2 X 6376 MT (Integrated Floatover Topsides)
- Platform Jackets- 2 X 1750 MT
- 6 Wellhead Topsides- 6 X 1900 MT

Total Tonnages - 34,400 MT
MHN Process Complex (India) - Largest Process Complex in Mumbai High

Client - ONGC (NOC of India)
Type - Lumpsum EPIC Value
(Phase 1 – All Jackets) 19.5 Months
(Phase 2 – All Topsides) 33 Months
Year - 2009-2012

(1) Process Platform,
(1) 150 men Living Quarter Platform,
(2) Flare Tower Platforms,
(3) Process Gas Compressor Modules, Associated Modifications

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>TYPE</th>
<th>WEIGHT</th>
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<tbody>
<tr>
<td>MNP Process Deck</td>
<td>TOPSIDE</td>
<td>26500 MT</td>
</tr>
<tr>
<td>MNP PROCESS Jacket</td>
<td>JACKET</td>
<td>13500 MT</td>
</tr>
<tr>
<td>MLQ LIVING Quarter Deck</td>
<td>TOPSIDE</td>
<td>6400 MT</td>
</tr>
<tr>
<td>MLQ LIVING QUARTER Jacket</td>
<td>JACKET</td>
<td>2400 MT</td>
</tr>
<tr>
<td>MNF 1 (HP &amp; Acid Flares Platform)</td>
<td>TRIPOD</td>
<td>1000 MT</td>
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<tr>
<td>MNF2 (LP Flare Platform)</td>
<td>TRIPOD</td>
<td>1000 MT</td>
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<tr>
<th>PARAMETER</th>
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<td>Water depth</td>
<td>Metre</td>
<td>72</td>
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<td>Gas Processing</td>
<td>MMSCMD</td>
<td>8.8</td>
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<tr>
<td>Oil Processing</td>
<td>BOPD</td>
<td>23,877 X 2 Trains</td>
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<td>Water treatment</td>
<td>BWPD</td>
<td>117,900 X 2 Trains</td>
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<tr>
<td>Acid Gas Removal</td>
<td>MMSCMD</td>
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</table>
Bassein Development Project (India)

Client- ONGC (NOC of India)
Type- ICB, Turnkey / EPC Lump sum Contract
Location : Bassein Field, Western Offshore, India
Year- 2015-2017

Scope:
• 1 Nos 8 Legged Launch Jacket & Process Platform
• 4 Legged - 50 Men Living Quarter Platform (BLQ3 Platform)
• 4 Legged Well Head Platform (BH Platform) Pipeline laying
• Modification on BPA, BCPA & BPCA-2

<table>
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<tr>
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<th>Key Milestone</th>
<th>Contractual Completion Dates</th>
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<th>Actual Completion Dates</th>
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<td>1</td>
<td>14” Gas Pipeline Installation</td>
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<td>BCPA3 Jacket Installation</td>
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<td>Feb 26, 2017</td>
<td>1 day ahead</td>
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<td>4</td>
<td>BCPA3 Deck Installation</td>
<td>Dec 27, 2017</td>
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<td>Apr 15, 2017</td>
<td>256 days ahead</td>
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<td>5</td>
<td>BLQ3 Deck Installation</td>
<td>Dec 27, 2017</td>
<td>✓</td>
<td>Apr 17, 2017</td>
<td>254 days ahead</td>
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<tr>
<td>6</td>
<td>Overall Project Completion</td>
<td>Jan 27, 2018</td>
<td>✓</td>
<td>Nov 03, 2017</td>
<td>Facilities handed over 86 days ahead</td>
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</table>

Project handed over 86 days ahead of schedule

Booster compressor facilities under BDP Project were dedicated to the nation by Hon’ble Prime Minister Shri Narendra Modi on Sept 25, 2017
**Other Landmark Projects - Offshore**

- **ONGC (INDIA) - BOOSTER COMPRESSOR PLATFORM PROJECT (BCP-B2)**
- **ONGC (INDIA) - PROCESS CUM LQ PLATFORM (PLQP) PROJECT**
- **ONGC (INDIA) - HRC Process Platform, Bridge & Platform Modification Project**
- **GSPC (INDIA) - PROCESS/ LIVING QUARTER AND DDW-1 16 SLOT WELLHEAD**
- **ADMA OPCO (UAE) - UMM LULU NASR FIELD DEVELOPMENT PROJECT PHASE-I**
- **PETRONAS CARIGALI’S YETAGUN PROJECT, MYANMAR**
Thank You