Challenges and Opportunities of Offshore Development in South China Sea

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ISOPE-2014 Busan Conference
The 24th International Ocean and Polar Engineering Conference
CONTENTS

- Overview of Oil and Gas Resources in South China Sea
- Challenges and Development Scenarios
- Liwan 3-1 Development Highlights
- CNOOC Overseas Deepwater Challenges
Oil & Gas Resources in South China Sea

- A map of the possible oil and gas deposits in the South China Sea.
- In total, the South China Sea has about 11 billion barrels of oil and 190 trillion cubic feet of natural gas rated as proved or probable reserves.
- China’s oil & gas exploration and development has steadily pushed toward deepwater.
CNOOC Focus: Northern Continental Shelf

• CNOOC focuses its exploration and development in the northern continental shelf
• Combined strategy of independent operation and cooperation
• 19 deepwater blocks in Pearl River Mouth Basin & Qiongdongnan Basin
• Major partners: Devon, BG, Kerr-McGee, Husky, etc.
June 2012, 9 offshore blocks opened for cooperative exploration and development
August 28, 2012, 22 offshore blocks in South China Sea
The Geographical Location of LW3-1 Gas Field

- LW3-1 deepwater field subsea tieback to a shallow water central production platform;
- A large processing capacity reserved for future tieback developments in the vicinity.
Potential Resources in the Vicinity of LW3-1 Field
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Harsh Environmental Challenges in South China Sea

Paths of Typhoons from 1949 to 2013
Northern South China Sea is Typhoon Alley

Internal Solitary Wave
Long-Distance Challenges in South China Sea

- Long Distance Tieback
  - Pressure Drop
  - Pipeline Corrosion
  - Stability of Slopes
  - Slug flow

- Flow Assurance
  - Slugs in Risers
  - Pipe Corrosion
  - Solid Sediments
  - Hydrate Clogs
An integrated data service system for offshore engineering geology

- The delineation of Baiyun landslide including detailed description of surface morphology and internal structured;
- Multi-temporal 2D/3D regional geological model
- A reasonable mechanism to trigger Baiyun Landslide and Sliding Process
- Risks of geological disasters evaluated, classified and predicted for the Baiyun landslide Area.

114.5° ~116° E, 19° ~20.25° N
158km × 138km, 17500km²
Ongoing Metocean Monitoring Grids

• Deepwater Environment Monitoring Demonstration System in Continental Slope with the aid of existing offshore sea oil facilities: advanced wave buoys, submerged buoys, C-band wave-measuring radar system, ADCP & CTD sensors.

• 2 Monitoring Sections:
  ① One parallels to the 200m-300m isobaths, based on the in-service oil production facilities
  ② Another perpendicular to the isobaths for monitoring tropical cyclones and winter monsoons
The First 1,500m Deepwater Subsea Production System in South China Sea

Flow Assurance in 79-km Tie-back

Remote Control System via Optical Fibres

Stability & Safety for Deepwater Subsea Pipelines

Material Selection for Subsea Pipelines
Major Development Scenarios for Oil Field
Criteria for Selection of Scenarios for Gas Field

- Gas Sale Market and Production Rate
- Location Selection for Shallow Water Platform
- Selection for Onshore Gas Plant
- Flow Assurance from Subsea Wells to Surface Facilities
- Investment and Development Schedule
- Future Developments in the Vicinity
Deepwater Development Scenarios for LW3-1 Gas Field

- **Scenario A:** Spar/TLP/SEMI to Shallow Water Platform then export to Onshore Gas Plant
- **Scenario B:** Subsea Facilities tieback to Shallow Water Platform then export to Onshore Gas Plant
- **Scenario C:** Spar/TLP/SEMI directly export to Onshore Gas Plant
- **Scenario D:** Subsea Facilities directly tie-back to Onshore Gas Plant
Development Scenario of Liwan 3-1

- Extend the onshore pipeline to the edge of continental slope.
- Support the developments of gas fields in deepwater area.
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Phase Developments & Process Capacity

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Design Process Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW3-1 Central Platform</td>
<td>Phase 1 Process: 8.0 BCM/Year</td>
</tr>
<tr>
<td></td>
<td>Boosting: 10.0 BCM/Year</td>
</tr>
<tr>
<td>LW3-1 Central Platform</td>
<td>Phase 2 Process: 12.0 BCM/Year</td>
</tr>
<tr>
<td>Export Pipeline</td>
<td>Shallow Export: 12.0 BCM/Year</td>
</tr>
<tr>
<td></td>
<td>(BCM = Billions Cubic Meters)</td>
</tr>
<tr>
<td>Onshore Gas Plant</td>
<td>Phase 1 Process: 8.0 BCM/Year</td>
</tr>
<tr>
<td></td>
<td>Phase 2 Process: 12.0 BCM/Year</td>
</tr>
<tr>
<td></td>
<td>Future Process: 20.0 BCM/Year</td>
</tr>
</tbody>
</table>

Operator - CNOOC
- Gaolan Onshore Terminal in Zhuhai
- LW3-1 Central Platform
- PY34-1 Central Platform
- PY35-1 Central Platform
- PY35-2 Central Platform
- LW3-1 Subsea
- PY35-1 Subsea
- PY35-2 Subsea

Operator - Husky
- LH34-2 Subsea
- LH29-1 Subsea
- Future

Operator - CNOOC
- LW3-1 Subsea
- Future
Liwan 3-1 Subsea Tieback Gas Development

- 10 × Subsea wells in water depth ranging from 1,350 to 1,500 meters
- 2 × Manifolds and 1 × PLEM
- 2 × ø22” × 79 km Main Deepwater Flowlines and 79 km Subsea Umbilical & MEG Supply Line from PLEM to Platform
- 1 × ø30” × 261 km shallow-water export pipeline to onshore gas plant
- 1 × Central Production Platform w/Separation, Gas Dehydration, Compression & MEG Systems, 200 Person Living Quarters, located in water depth of 189.5m
- 1 × Onshore Gas Plant with an area of 1.4 millions m² located at the Gaolan Island in Zhuhai next to Macao
32,000Te LW3-1 CEP Jacket Construction & Installation

Jacket Fabrication from Dec 2010 to Jul 2012

Loadout onto T-Shaped Launch Barge HYSY229 July 18, 2012

HYSY229 w/ CEP Jacket Sailaway July 27, 2012

Jacket Launch August 30, 2012
26,000Te LW3-1 CEP Topsides Construction & Floatover Installation with 4,888Te Deck Support Frame (DSF)

Topsides Fabrication from Jun 2011 to April 2013

Loadout onto T-Shaped Launch Barge HYSY229 April 10, 2013

HYSY229 w/ CEP Topsides Sailaway July 27, 2012

The Most Challenging Floatover Installation May 23, 2013
Green & Low Carbon Emission Onshore Gas Plant

World Largest Slug Catcher (7000m³)
CONTENTS

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CNOOC Deepwater Marine Fleet

HYSY981: Deepwater Semisubmersible Drill Rig
Hai Yang Shi You (HYSY) 201: 4000Te DP3 Deepwater Derrick/Pipelay Vessel

HYSY720: Deepwater Research/Survey Vessel
HYSY708: Deepwater Research/Survey Vessel
HYSY681: Multi-Purpose Offshore Support Vessel
CNOOC Deepwater Strategy

• Self development and cooperation with foreign companies
• Combination of domestic and foreign developments
• Combination of independent study and cooperative study
• A strong and efficient deepwater marine fleet
• Deepwater construction sites and operation teams
• Combination of national major projects
• Combination with capital market operations
CNOOC Global Operations

Assets Profile
In Asia, Africa, North America, South America, Oceania and Europe

Europe and Africa
Asia Pacific
America

- UK
- Poland
- Algeria
- Iraq
- Nigeria
- Uganda
- Equatorial Guinea
- Congo
- Kenya
- Qatar
- Yemen
- Myanmar
- Cambodia
- Indonesia
- Australia
- Canada
- US
- Trinidad and Tobago
- Colombia
- Argentina
- Brazil
- Argentina
Appomattox Deepwater Oilfield in GOM (CNOOC Nexen)

Field Location

SPS+Semi-FPS, 2000m
Nigeria OML 130 Egina Oilfield (with Total)

(FPSO)

OLT
(SPM Buoy, 9x Moorings, 2x 2.3km of OOL 20-in ID)

GAS EXPORT to AKPO TIE-IN (20km, 1.58mmbar/ST)

FPSO anchors (16x)

RISERS (8x), FLOWLINES (7x - 55km)
4x Prod. and 3x Water Injection lines

SPS (6 manifolds – 6 slots)

UMBILICALS (4x – 60km)

21 oil producing wells
23 water injection wells
Deepstar Joint Study (CNOOC & Nexen)
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Thank You!
Any Question?