PTSC Technological Strategy and Deployment

January 2016
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President & CEO

Solution for Oil and Gas Industry
1. Some highlights of changes in Vietnamese law and policy.
2. Overview of PTSC
3. PTSC Technological Strategy & Deployment
4. PTSC Strategy in current market situation

- State enterprise/ the State Owned Corporation (SOC) is the company where the State hold 100% capital;
- Currently, the State is making its divestment from the SOC and promote the equitization of the SOC
- The equitized SOC is now working under the Enterprise Law of the equitized company.
- The State is decreasing its protection towards SOC;
- Vietnam Government is now encouraging a multi-component economy.

2. **WTO**

- Vietnam officially joint WTO on 7th Nov 2006
- After years being a dynamic member of WTO, Vietnam economy grows stably and sustainably.
Some highlights of changes in Vietnamese law and policy.

3. **Trans-Pacific Partnership (TPP):**
   - Vietnam is opening to all contractor from TPP countries to equally supply goods and services without any discrimination;
   - Foreign investors shall have more opportunities;
   - Foreign investor, with its technical and financial strengths, are encouraged to increase their investment in Vietnam to diversify and increase the competitiveness in Vietnam market;
   - Vietnam is decreasing taxes on goods and services from TPP countries;
   - Vietnam also have more stringent policies regarding environment protection, competition or intellectual property … and other bindings related to technical barriers, sanitary and etc.

4. **Free Trade Agreement (FTA):**
   - Currently Vietnam is also negotiating FTA with: EU, USA, South Korea, Japan
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Overview of PTSC

PetroVietnam Technical Services Corporation (PTSC) is a member of the Vietnam National Oil and Gas Group (PVN) with PVN holding 51% of the charter capital.

PTSC currently has 27 branches, subsidiaries, joint ventures and others located inside and outside Vietnam, operating in 07 core services.

PTSC is currently listed on the Hanoi Security Trading Center with the stock code PVS.

The average annual growth rate is 10-15%.

PTSC has nearly 10,000 employees in work force.

Core Services:

- EPCI for Offshore Oil & Gas Facilities
- EPC for Industrial Facilities
- Marine Services
- FSO/FPSO Services
- Operation & Maintenance (O&M), Repairing, Installation and Transportation Services
- Seismic Survey, G&G Survey, ROV and Subsea Services
- Supply Base and Port Services
PTSC’S BRANCHES, SUBSIDIARIES AND AFFILIATES IN VIETNAM

PTSC Headquarter
1-5 Le Duan, Dist. 1, HCM City

PTSC Marine
PTSC Supply Base
PTSC M&C
PTSC Offshore Services
PTSC Production Services
PTSC Geos and Subsea Services
Engineering & Construction Division
Petro Hotel
PTSC CGGV Geos
PetroVietnam Marine Shipyard
Sao Mai – Ben Dinh
PTSC Power
PTSC Phu My Port
PTSC Quang Ngai
PTSC Da Nang
PTSC Son Tra Port
PTSC Quang Binh
PTSC Thanh Hoa
PTSC Dinh Vu
PTSC’s Ha Noi Branch
PV Security

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OVERSEAS OPERATION

Solution for Oil and Gas Industry

Cuba
Venezuela
India
Myanmar
Vietnam
Malaysia
Brunei
Singapore
Russia
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PTSC BUSINESS OUTCOME

(amount in USD Million)

Charter Capital  Turnover  Profit

2010: Charter Capital = 95, Turnover = 866, Profit = 58
2011: Charter Capital = 141, Turnover = 1,156, Profit = 87
2012: Charter Capital = 210, Turnover = 1,178, Profit = 81
2013: Charter Capital = 210, Turnover = 1,176, Profit = 84
2014: Charter Capital = 210, Turnover = 1,497, Profit = 108
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Have successfully completed 60 turn key EPCI projects for Vietnam and exportation to foreigner countries (Malaysia, India, Brunei, Ghana) including Center Processing Platform (float-over or lifting modules) and Well Head Platforms.

- Have successfully completed number of Skids, vessels and equipment packages
- Fabrication capacity is up to 50,000T/year. Facilities are equipped for Heavy Structures up to 25,000 Te
1. Strategy for Marginal Field

- Minimum Offshore Substructure using suction pile, gravity foundation;
- Using generic platforms which are retrievable to be reused for several operating life cycles
- Design light structures so that Drilling Rig can be used for installation to save cost for mobilization of Heavy Lift Vessel
Technological Strategy and Deployment for Offshore EPCI

Suction Piles & Gravity Based Structure

- Quick & easy Installation: Less than 12 hours for real installation activities (4 - 5 days for driven piles)
- Integral TS/JK/piles installed together
- Retrievable – REUSABLE
- Save hundred tons in comparison to driven piles
- Best solution for gravel & rocky soils, hard clayeyed soil

Minimal Platform Concept

- Drilling risers serves as platform legs
- Using Self-installation suction piles
- Installed by Jack up Rig

Seabed preparation
Scour protection

Solution for Oil and Gas Industry
2. Strategy for Deep Water Technologies:

- Developing resources for Tension Leg Platforms; Semi-sub, Spars and FPSO

**FPSO:** capable to perform EPCI including integration at PTSC yard

**Semi-Sub, TLP, SPAR:** capable to perform EPCI including integration onshore at PTSC yard

**Engineering Capability:** Performed by in-house resources
Technological Strategy and Deployment for Offshore EPCI

4. EPC/EPCI Strategy in current market situation:
   - Cost optimization for EPCI Projects by utilizing: In-house engineering capabilities, competitive local resources, compact Project Management Team, contractors interface reduction, resources mobilization cost optimization.
   - Capex optimization by sharing resources with multiple projects, multiple facilities tie-in concept, design optimization using retrievable light substructure that can be installed quickly.
   - Promote the collaboration with international partners such as licensor for Conceptual Design.
EPCI & O&M for FPSO/FSO

✓ Have successfully completed 2 EPCI FPSO/FSO projects
✓ Currently jointly owned and operated a fleet of 5 FPSOs/FSOs
✓ Currently providing Operation & Maintenance services for 6 FPSOs/FSOs in Vietnam and Malaysia
✓ Have successfully decommissioned and disconnected 2 FPSO/FSO in Vietnam
Developing strategy to build *standard FPSO* with typical configuration (Processing modules, mooring system, storage capacity…) to:

- **Accommodate different fields’ fluid** in multiple fields tie-in concept
- **Re-deploy for other fields** following field depletion

This is a good solution for new field development in current oil price situation.
Moving from “Repair – focused” to “Reliability-focused” culture to increase uptime, reliability of facilities and reducing maintenance cost

✓ Application of Risk Based Inspection (RBI) for static equipment and structure

✓ Application of Reliability Centered Maintenance (RCM) for rotating equipment

Application of new maintenance strategies to achieve optimal availability/reliabilities of assets and equipment at lower cost without compromising HSE.

**Technological Strategy for FPSO/FSO Operation and Maintenance**

Source: Risk Based Inspection, DNVGL, 2014

**FPSO/FSO Uptime Statistic 2015**

<table>
<thead>
<tr>
<th></th>
<th>FPSO RUBY II</th>
<th>FPSO LAMSON</th>
<th>FSO BIENDONG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uptime</td>
<td>100</td>
<td>99.5</td>
<td>100</td>
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**Solution for Oil and Gas Industry**
1. Geophysical Site Survey Services
   ✓ Have successfully performed number of Geophysical Survey Projects in the field of seabed geophysical structure survey, including:
     • 2D High-resolution Seismic survey.
     • Analogue survey:
     • Single beam Echo-Sounder.
     • Multi beam Echo-Sounder.
     • Side Scan Sonar.
     • Magnetometer.

2. Geotechnical Soil Boring Services
   ✓ Have successfully performed number of Geotechnical Soil Boring services including:
     ✓ Offshore Soil Investigations.
     ✓ Seabed Sampling/PCPT.
     ✓ Offshore and Onshore Laboratory Testing.
     ✓ Engineering Analysis for Foundation Offshore Structures, ….

3. ROV Survey & Subsea Works
   ✓ Have successfully performed number of Remotely Operated Vehicle & Diving Services certified by BV & DNV including:
     ✓ Drilling support/Diving
     ✓ Subsea Inspection/IRM Works
     ✓ UWILD for FPSO/FSO
     ✓ Installation/ Construction Support
Red: Amadeus
Green: Binh Minh 02

2D Vessel Binh Minh 02 – 01 x 12,000m sentinel solid streamer

3D Vessel CGG Amadeus – 8 x 8,100m sentinel solid streamers
Broadseis and Broadsorce (Broadband) Technology

Solution for Oil and Gas Industry
Binh Minh 02 & CGG Amadeus have carried out surveys in Vietnam, Malaysia, Indonesia, Myanmar, Bangladesh, Taiwan, India, Papua New Guinea.

- Red: Amadeus
- Green: Binh Minh 02
Technological Strategy for Seismic Survey

- Broadband Acquisition (BroadSeis / Broadsourse): Industry-leading broadband marine acquisition solution combining advanced equipment, proprietary variable-depth streamer profiles and de-ghosting and imaging technology
- BroadSeis: acquiring physical data at any frequency of bandwidth
- BroadSeis: strong and reliable low frequency content

Variable Depth Streamer allows acquisition of physical data at any notches of the spectra

Deep tow is the optimum solution for Low Frequencies

Variable Depth Streamer the best way for ghost diversity
Technological Strategy for Seismic Survey

Seismic source principle

Conventional Source
Focusing the primaries as well as their ghost

Synchronized Multi Level Source: BroadSource
Focusing the primaries by defocusing their ghosts

signature: primary + ghost (acquisition)
designature – deghosting (processing)
available bandwidth
impossible

signature: primary + ghost (acquisition)
designature – Residual deghosting (processing)
available bandwidth
possible

Conventional

BroadSeis & BroadSource

Solution for Oil and Gas Industry
Implement onshore EPC projects such as oil and gas plants, power plants, refinery units, process and mechanical skids, petrochemical and fertilizer plants etc.

Cooperate and establish strategic partnership with numerous major players in the industry to jointly bid and execute the projects.

Execute clients’ projects with in-depth local and international understanding/knowledge and experience as well as international standards and professionalism.
LONGPHU 1 THERMAL POWER PLANT
- Client: PV Power
- Project type: EPC
- Duration: 06/2013 – 05/2017
- Key SOW: 2x600 MW with supercritical boilers and advanced low NOx technology and FGD, to satisfy the environmental requirements; Procurement and Construction for all Jetties
- Partner: Power Machines (Russia)
- Workforce: ~3,200 persons

CA MAU GAS PROCESSING PLANT
- Client: PV Gas
- Project type: EPC
- Duration: 08/2015 – 04/2017
- Key SOW: Survey, Engineering (FEED and detailed design), Procurement, Construction/Installation, Pre-commissioning and Commissioning
- Partner: Posco Engineering Co. Ltd (PEN), Korea
- Capacity: 6.2 MMSCMD
- Products: 5.8MMSCMD Residue Gas, 440-660 ton/day of LPG, 34-45 ton/day of Condensate

NPK PLANT PROJECT
- Client: PVFCCo
- Project type: EPC
- Duration: 06/2015 – 09/2017
- Key SOW: Engineering, Procurement, Construction, Start-up, Precom/Commissioning
- Partner: ThyssenKrupp Industrial Solutions (TKIS)
- Capacity: 250000 MTPY

NH3 REVAMPING PROJECT
- Client: PVFCCo
- Project type: EPC
- Duration: 06/2015 – 09/2017
- Key SOW: Engineering, Procurement, Construction, Start-up, Precom/Commissioning
- Partner: Technip
- Capacity: Upgrade from 1350 to 1620 MTPD

Solution for Oil and Gas Industry
1. THERMAL POWER PLANT:
✓ Current Technology: Super critical boilers and advanced low NOx technology and FGD.
✓ New technology of Ultra-Super critical is being studied to reduce CO2 emissions from coal-fired electric generating plants with improved thermal efficiency by increasing steam temperatures to 700OC. Less resource consumed (save ~11% coal), less impact to infrastructure demands.
✓ Developing strategy to implement Gas Power Plant EPC.

2. GAS PROCESSING PLANT:
✓ Licensor: UOP (Universal Oil Product), USA.
✓ Main Process Technology: Single Column Overhead Recycle Technology (SCORE) is applied for Cryogenic NGL Recovery Unit. This technology can achieve >99% Propane Recovery, maximize LPG product and minimize the total compression power in the plant.

3. NH3 REVAMPING PROJECT:
✓ Licensor: Haldor Topsoe, Denmark.
This is a new licenses such as CMFP in burner systems, logic system for system safety control, layout heat resistance concrete layer arrangement and ammonia synthetic equipment.
4. **NPK PLANT:**

- Based on INCRO (Spain) licensed technology, chiefly devoted to produce DAP and NPK.
- Capable of producing **various grades of NPK fertilizer** in either of the following modes: Slurry granulation mode (chemical route) using either Pipe Reactor or Pre-neutralizer or a combination of both and with solid recycle.
- Solid granulation mode by injection of steam in granulator.

5. **REFINERY:**

- Developing strategy to implement Refinery EPC
Transportation and Installation (T&I) for Offshore Facilities

- Have successfully completed number of Offshore Transportation and Installation Projects.
- Have successfully completed number of Offshore Hook up and Commissioning Projects
- Developing **Topside Float-Over** using twin barges with below advantages:
  - **Economical and cost efficient/ Easy and Safe installation**
  - **Overcome the difficulty in sourcing for 5000 ton or above Installation Crane Barge/ Project schedule optimization.**

Accom. Work Barge POS1 (300Pax)  Cargo Barge PTSC 01  DP2 MSV POS2 (Under Investment)

Solution for Oil and Gas Industry
Technological Strategy for T&I of Offshore Facilities

TECHNOLOGY FOR OFFSHORE INSTALLATION WITHOUT CRANE BARGE

TOPSIDES FLOAT-OVER USING TWIN BARGES

TOPSIDES: 5000 – 10000 Tons
Technological Strategy for T&I of Offshore Facilities

TECHNOLOGY FOR OFFSHORE DECOMMISSIONING WITHOUT DRILLING RIG

RIGLESS FOR WELL PLUG & ABANDONMENT (WORK BARGE)

DOWNHOLE CUTTING TOOL

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PTSC Strategy in current market situation

- Promote the cooperation/partnership/strategic partnership/long term collaboration with numerous major players/investors in the industry for every dedicated field, utilize the best and most competitive resources of both sides to promote potential business.

- Promote the close relationship with global licensors/partners to approach, participate international bidding and execute projects of oil & gas, petrochemical, thermal power, other industries.

- Collaborate with licensors to create appropriate methodology for design philosophy and manufacturing and construction of main equipment, systems for the purpose of required quality, cost saving & schedule shortening for Vietnam's market, developing for international market.

- Promote the collaboration/partnership/agentship in manufacturing/sales/after sales, repair, maintenance, trouble-shoot… services of Oil & Gas and Industrial skids/equipment/auxiliaries, systems and for other industries.
MAJOR CLIENTS & PARTNERS

Solution for Oil and Gas Industry
Thank you for your attention!