EXPLORATION STRATEGIES and ATTRACTING INVESTMENTS IN THE FRONTIER BASINS IN VIETNAM

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Content

★ Exploration Highlights & Production Highlights
★ Related Infrastructure
★ Frontier Basins
★ Incentive terms of Petroleum Agreements
★ Summary
Exploration Highlights

Domestic
• Exploration started early of 1960s
• 1988 up to now: 50 petroleum contracts with more than 7 billion USD investment, 27 contracts still valid
• 300,000 km 2D, 30,000 sq. km 3D seismic acquired, 600 exploratory and production wells drilled up to now
• More than 70 discoveries, 10 oil and gas fields under appraisal and development
• Oil Reserves 3.75 billion barrels, Natural Gas Reserves 20.8 TCF

Overseas
• 7 exploration and development projects

• 8 high potential hydrocarbon basins defined: Song Hong, Phu Khanh, Cuu Long, Nam Con Son, Tu Chinh-Vung May, Malay-Tho Chu and Truong Sa-Hoang Sa Basins.
• Major exploration targets:
  - Fractured basement plays
  - Oligocene-Miocene clastic plays
  - Miocene carbonate plays
• Potential resources:
  - 22.1 billion barrels oil equivalent
Production Highlights

- Producing fields: Bach Ho, Rong, Rang Dong, Ruby, Su tu den (Cuu long), Dai hung, Lan Tay (Nam Con Son), Bunga Kekwa - Cai Nuoc, Bunga Raya và Bunga Seroja (Malay)
- Appraising and developing fields: Su Tu Vang, Su Tu Trang (Cuu Long), Hai Thach, Rong Doi, Rong Doi Tay (Nam Con Son), Kim Long, Ca Voi, Ac Quy (Malay)
- 2004 Oil Production: 450,000 bopd
- 2004 Natural Gas Production: 700 mmcf/d
- Vietnam’s energy strategy to the year 2020 is to maintain the oil production of around 500,000 bopd and increase gas production of up to 1,000 mmcf/d

Oil and Gas Infrastructure

- Bach Ho Integrated Gas Project, 107 km offshore pipeline, capacity 100 bcf annually
- Nam Con Son Integrated Gas Project, 370 km offshore pipeline, capacity 250 bcf annually
- Southwest Integrated Gas Project, comprising both pipeline systems with more than over 500 km length offshore, total capacity 220 bcf annually
- Construction of two refineries are on going, with total capacity up to 100 mmmbls per annum by 2008
- Available fabrication yards with total 1,500,000 sq. meters, capable of supporting 20 offshore drilling rigs and fabricating 5-6 offshore platforms
Petrovietnam – To the Future

- Expanding exploration and development activities throughout the country
- Finding new oversea projects in exploration and production
- Developing infrastructure – gas market and pipelines
- Attracting more foreign investment:
  - Improving legal and administrative framework, offer more incentives for foreign investors
  - Preference given to companies with long-term commitments to exploration projects
- Developing our technological and managerial ability to adapt to the development of the industry

Frontier Basin In Vietnam

Frontier basin is area never developed because hydrocarbon discoveries (which indicate the presence of oil and gas) were thought too small to be commercially viable, and technology was not advanced enough to understand the regional complex geology. Also, this area is logistically and technically difficult for exploration. In the line of above definition: there are some basins in Vietnam to be considered as frontier basin: Song Hong, Phu Khanh, Tu Chinh- Vung May, Truong Sa-Hoang Sa Basins. Especially, Tu Chinh- Vung May, Truong Sa-Hoang Sa Basins are largely unexplored areas offshore Vietnam

- Our strategy: to encourage exploration through the incentive interest process in frontier areas that might contain oil and gas for potential use in local communities as well as to meet national energy needs. To increase petroleum activities in these areas (acquire more data, study…)
 Frontier Basin In Vietnam

• Song Hong Basin: covers about 126,000 km² with approximately 4000 km² onshore and near onshore zone. Water depth in the area: 20-800m. Seismic surveys: >80000 km² 2D, 1200 km² 3D. Drilled: >50 wells (25 wells offshore). Estimated reserves: 5.76 billion barrels oil equivalent.

Song Hong Basin

• Sub-mature basin, medium seismic/drilling density
• Gas-dominated basin
• Major play types:
  - Oligocene-Miocene sandstones fault blocks
  - Oligocene-Miocene stratigraphic plays
  - Middle Miocene carbonate platforms
  - Pre-Tertiary fractured basement
• Several marginal oil/gas fields discovered, some giant gas fields with various CO2 content
• 17 open blocks, total 108,000 sq. km
Song Hong Basin – Prospects

Petroleum system and plays

**Source Rocks:** Oligocene lacustrine oil prone shales, kerogene type III/II. Oligocene-Miocene deltaic/paralic gas-prone coal/coaly shales, kerogene mainly type III.

**Seals:** Oligocene delta plain or prodelta lacustrine shales. Miocene transgressive shales.

**Reservoirs:** Miocene-Oligocene clastics, porosity 10-30%. Carbonates build-up, reefs, porosity 12-25%. Fractured basement.

### Stratigraphy of Song Hong Basin

<table>
<thead>
<tr>
<th>Geological Age</th>
<th>Petroleum System</th>
<th>Lithological Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eocene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cretaceous (and older)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paleogene</td>
<td></td>
<td>Interbedded shales, sandstones, limestones, shallow marine</td>
</tr>
<tr>
<td>Neogene</td>
<td></td>
<td>Interbedded shales, sandstones, limestones, shallow marine</td>
</tr>
<tr>
<td>Tertiary</td>
<td></td>
<td>sediments, fine sands, marine - deltaic.</td>
</tr>
</tbody>
</table>

### Schematic Cross-section Song Hong Basin

- Quaternary
- Pliocene
- Clay Diapir
- Submarine Fans
- Middle Miocene
- Upper Miocene
- Lower Miocene
- Paleogene
- Alluvial Fans
- Reservoir
Frontier Basin In Vietnam

- Phu Khanh Basin: covers about 56,000km². Water depth in the area: 50-2500m. Seismic surveys: >30 000km²D. Drilled: 2 wells Estimated reserves: 2.48 billion barrels oil equivalent

Phu Khanh Basin

- Virgin basin, medium seismic density
- Potential oil/gas basin
- Major play types:
  - Oligocene-Miocene sandstones fault blocks
  - Miocene stratigraphic plays
  - Miocene-Pliocene carbonate reefs
  - Pre-Tertiary fractured basement
- 56,000 sq. km
Phu Khanh Basin – Prospects

Petroleum system and plays

**Source Rocks:** Oligocene and possible lower Miocene-Eocene shale organic rich.

**Seals:** Oligocene-Miocene claystones and claystones intercalated with silstones.

**Reservoirs:** Miocene-Oligocene deltaic to shallow marine sandstones. Paleogene-Miocene carbonates platforms, reefs. Possible fractured basement.

**Traps:** Fault blocks, Fractured Basement. Carbonates. Stratigraphic plays. Carbonate reef platforms
Frontier Basin In Vietnam

- Tu Chinh- Vung May Basin: covers about hundred km2, approximately 28 000km2 with water depth less than 500m. Water depth mainly in the area: 1000-1500m. Seismic surveys: about 12 000km2D. Drilled: 1well. Estimated reserves: 6.3 billion barrels oil equivalent.

Petroleum system and plays

**Source Rocks:** Oligocene and possible lower Miocene-Eocene shale organic rich.

**Seals:** Pliocene-quartery claystones deposited in marine conditions- regional seal. Interbeded claystones/shale in Miocene-Oligocene- intra-formational seal.

**Reservoirs:** Miocene-Oligocene sandstones. Paleogene-Miocene carbonates platforms, reefs. Possible fractured basement.

**Traps:** Fault blocks, Fractured Basement.Carbonates. Stratigraphic plays (turbidite…). Carbonate reef platforms
Hoang Sa–Truong Sa Basin

- Hoang Sa & Truong Sa Basin: covers about 250,000km². Water depth: 1000-2000m.
- Pre-mature basin, sparse seismic density
- Petroleum resources: up to 3 bbls of oil equivalent
- Possible gas-dominated basin
- Major play types:
  - Oligocene-Miocene sandstones fault blocks
  - Middle Miocene-Pliocene carbonate build-ups
Frontier Basin In Vietnam

• Several of these frontier areas, although presently nonproductive and poorly explored, have many geologic characteristics in common with producing basins and hopefully represent a significant part of future oil and gas production.
• Every block in the frontier basins keep the big size while the blocks in producing basins tend to be divided in smaller blocks.
• Vietnam constitutes of a system of Cenozoic sedimentary basins. They are all rift basins and have multiphase history.
• Major exploration targets
  - Fractured basement plays
  - Oligocene-Miocene clastic structural plays
  - Miocene carbonate platforms

Incentive terms of Petroleum Agreements

➢ The Government of Vietnam and PetroVietnam are improving the petroleum contract’s terms and incentive conditions to attract more investment
➢ The form of cooperation:
  ✓ PSC (Production Sharing Contract) selected as the basic frame for petroleum contract
    - flexibility
    - competitiveness
  ✓ JOC (Joint Operating Company) is an extended type of a PSC, applied for most prospective blocks/areas
    - JOC will be the Operator
    - All parties shall enjoy the cooperative work
### Basic Terms of a Contract

| Contract Duration | - Maximum 25 years for normal  
<table>
<thead>
<tr>
<th></th>
<th>- Maximum 30 years for incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation of PV</td>
<td>Up to 20%</td>
</tr>
</tbody>
</table>
| Work Program and Budget (firm and optional basis) | - Term of each exploration phase  
|                          | - Work commitments (seismic, drilling, etc.)  
|                          | - Estimated financial commitments  |
| Tax Regime | Royalty 4-25% for Oil, 0-10% for Gas, depends on rate of production and nature of the contract normally 50% - normal, 32% - incentive  
| Enterprise Income Tax | 4% for Oil, N/A for Gas  
| Value Added Tax (VAT) | 4% for Oil, N/A for Gas  
| Export Tax | 4% for Oil, N/A for Gas  
| Other taxes, levies and fees | 4% for Oil, N/A for Gas  |
| Maximum Cost Recovery | Up to 50%-normal; 70% - incentive  |
| Profit Sharing | Incremental tranched ratios productions/profit  |

#### Basic Terms of a Contract

| Normal Project | Term: 25 years (+5)  
| Exploration Period: | 5 years (+2)  
| Royalty: 6%-25% (Oil)  
| 0%-10% (Gas)  |
| CIT: 50%  
| Tax: no exemption, no reduction  
| Cost recovery: up to 50%  |
| Promotion Project | Term: 30 years (+5)  
| Exploration Period: | 7 years (+2)  
| Royalty: 4%-20% (Oil)  
| 0%-6% (Gas)  |
| CIT: 32%  
| Tax: exemption 1 year & 50% reduction 1 year  
| Cost recovery: up to 70%  |
Royalty System

<table>
<thead>
<tr>
<th></th>
<th>Normal Projects</th>
<th>Incentive Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crude Oil</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 20,000 bopd</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Over 20,000 – 50,000 bopd</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Over 50,000 – 75,000 bopd</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Over 75,000 – 100,000 bopd</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Over 150,000 bopd</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Natural Gas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 5 mmcmd</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Over 5 mmcmd – 10 mmcmd</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Over 10 mmcmd</td>
<td>10%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Procedures

- **Bidding Announcement**
- **Data Review**
- **Register for Bidding Participation**
- **Prepare and Submit Bid**
- **Bids Evaluation**
- **Bidding Results Verification**
- **Contract Negotiation**
- **Government Approval & Signing**

- **Direct Negotiation**
- **Data Review**
- **Prepare and Submit Proposal**
- **Terms Negotiation - HOA**
- **Government Approval**
- **Contract Negotiation**
- **Government Approval & Signing**
The country is very promised in oil and gas resources with almost 50% of potential are under-explored, especially in frontier basins. It is necessary to increase petroleum activities in these areas: more data, more study, oil and gas potential assessment…in order to attract foreign investment.

The legal and fiscal regime is flexible and competitive in comparison with regional countries. However, incentive fiscal terms may be more detail for frontier basins.

The required infrastructure is significantly developed to assist exploration and production projects.