XI V Rice Global E&C Forum
4 October 2011, Houston, Texas USA
2011: The Challenge of doing EPC Project in Thailand
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VP and Project Director - BPA
PTT Phenol Company Limited
1. Introduction to Thailand energy, gas and oil
2. PTT Group
3. EPC Projects in Thailand; History and Outlook
4. Comparison of Tier 1, 2 and 3 Contractors
5. PTT Phenol Project learning experience
6. Q/A
Thailand: Top 10 Petrochemicals Complex

- 75% the size of Texas (198,116 square mile)
- Population 2011 = 65 million (2.6 time that of Texas)
- GDP = 24th (on par Saudi, Egypt)
- 2010 = 7.8% Economic Growth
- GDP by Industry:
  - Agriculture 10%
  - Manufacture 40%
  - Construction/mining 4%
  - Others (tourism etc.) 46%
- World scale petrochemicals complex ranking 6th worldwide

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Supply and Demand of Oil products in Thailand (barrels/day)

From 2005 demand exceeds supply by average 13,000 barrels/day
Crude import volume in 2010 was 803 KBD down 0.1% but higher cost
Thai Electricity Generation by Fuel Type

2000 - Thai Energy Generation
(98,487GWh)

- Oil: 46%
- Natural Gas: 36%
- Coal/Lignite: 15%
- Hydro/Renewable: 3%

2010 - Thai Energy Generation
(150,000GWh)

- Oil: 72%
- Natural Gas: 18%
- Coal/Lignite: 6%
- Hydro/Renewable: 3%

Source: EPPO

- Not enough local Natural Gas for electricity generation
- New Natural Gas Source or new fuel type needed by 2020
Thai Electricity Demand

-Thailand Electricity Demand Projection

GWh

250,000
200,000
150,000
100,000
50,000
0

2010 2011 2012 2013 2014 2015

Source: EPPO

• Electricity demand expected to reach 201,998 GWh in 2015
• At least 5 nuclear power plants needed by 2020

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• Natural Gas for Electricity will increase if no new nuclear plants
• New LNG terminal already constructed to handle imports

Source: PTT

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Thailand Natural Gas Supply Outlook

- Local field to be depleted within 10-12 years
- Neighboring supply not reliable due to stiff Chinese & Indian demand
- Possible New Gas from shale deposits in onshore sedimentary basins?

Source: PTT

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PTT Group at a Glance

• Largest Thai Gas, Oil and Petrochemicals Company

• 2010 Net revenues (consolidated) = US$ 63 billion

• 2010 Net Profit (consolidated) = US$ 2.76 billion

• Income by Group: Oil = 73%; Gas = 24%; Petrochem 3%

• Shareholders: Thai Ministry of Finance = 51.36%

Current Global 500 ranking = 128 (Target 100 by year 2020)
Predominant Infrastructure & Networks:
Allow for Profit Maximisation & Well Positioned for Organic Growth

- A fully extended network and infrastructure enables PTT to gain advantages over its competitors and maintain its leadership position.

- Storage capacity
  - Crude oil & Products: 9.6 MM BBL
  - LPG: 75,500 tonnes

- 1,398 service stations (excluding 8 LPG service stations for vehicles)

- 23 Depots
  - Petroleum: 6
  - Oil: 15
  - LPG: 2

- 15 Aviation depots

- 2 JV Multi products pipelines (613 KBD)
Chemical | Capacity (mil Ton)
---|---
Ethylene | 2.73
Propylene | 0.95
Benzene | 0.95
EG | 3.25
HDPE | 0.70
PP | 1.11

Source: PTIT 2011

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• 1970’s First PVC Plant 15,000MTPY – German Contractor, LSTK, located 30 km from downtown

• 1980’s Petrochemical Phase 1: USA, Japan, German Contractors, LSTK and some Cost Reimbursable, PMC (US, UK, German) a must

• 1990’s Petrochemical Phase 2: USA, Japan, Germany, French, Korean, Taiwan and Thai Contractors, PMC (US, German)

• 2000’s Domination by Korean, Taiwan, Thai Contractors
Thai Pipeline projects - Offshore

- Engineering 91% USA; Construction: Italian, Korean, Japan
- Average depth 45 meter (147 ft)
- Pipe size 42 – 18 in.

Source: PTIT
Thai Gas Pipelines Onshore

Thai Onshore Gas Pipelines Engineering (1,979 km)

- USA 50%
- UK 11%
- Canada 12%
- Australia 15%
- Others 12%

Thai Onshore Gas Pipelines Construction (1,979 km)

- Thai 45%
- Japan 28%
- Others 27%

- Engineering USA 50%
- Construction Thai 45%
- All work 90% for PTT
- Pipe 42-10 in.

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### GAS SEPARATION PLANT (as of April 2011)

<table>
<thead>
<tr>
<th>Company</th>
<th>Operation Unit</th>
<th>Location</th>
<th>Capacity (MMSCFD)</th>
<th>Start-up Year</th>
<th>Engineering</th>
<th>Contractor</th>
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<tbody>
<tr>
<td>PTT</td>
<td>GSP 1</td>
<td>Rayong</td>
<td>390</td>
<td>1984</td>
<td>Linde AG</td>
<td>Toyo Engineering, Randall, Mitsui</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>Nippon Kokan (NKK), Fish International, Toyo Menka, Vattana Phaisal Eng., NKK</td>
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<td>GSP 2</td>
<td></td>
<td>Rayong</td>
<td>320</td>
<td>1990</td>
<td>Linde AG</td>
<td>Toyo Engineering Hitashi Zosen</td>
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<td>GSP 3</td>
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<td>Rayong</td>
<td>430</td>
<td>1996</td>
<td>Linde AG</td>
<td>Toyo Engineering Hitashi Zosen</td>
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<tr>
<td>GSP 4</td>
<td>Khanom; Nakhon Si Thammarat</td>
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<td>190</td>
<td>1995</td>
<td>Linde AG</td>
<td>Samsung Engineering Samsung Corp., Fish International</td>
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<td>GSP 5</td>
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<td>2005</td>
<td>Foster Wheeler</td>
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<td>Phalang Phet</td>
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<td>Sino-Thai</td>
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<td>2006</td>
<td>Kvaerner</td>
<td>Samsung Engineering</td>
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</table>

Source: PTIT’s Industry Survey

- Contractors are predominantly Japanese and Korean
E&C for Thai Ethylene Cracker Project 1990-2010

- No clear cut winner for cracker construction but..
- Korean contractors are gaining awards

Source: PTIT
E&C for Aromatics Project in Thailand 1990-2010

- USA is still the leader in BTX engineering and construction
- Korean constructions aggressive and rising

Thai BTX E&C Award 1990-2010 (Capacity 3.35 million ton/year)

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For the past 20 years at Map Tha Phut for olefins & aromatics

- Korean contractors equal to Japanese for awards
- Local Engineering Contractors are yet to be established

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Different story for Intermediate and downstream projects

- Japanese Contractors high due to process technology usage
- Korean, Taiwan and Thai contractors getting more competitive

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<table>
<thead>
<tr>
<th>Contractor by Country</th>
<th>Eng</th>
<th>Proc</th>
<th>Const</th>
<th>HSE</th>
<th>Sched.</th>
<th>Cost Control</th>
<th>Customer</th>
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</table>

*Based on experience in Thailand EPC LSTK projects*
• Name Plate Capacity = 150,000 MTPY

• Technology – Mitsubishi Chemicals Corporation, Japan

• 100% Utilization of Acetone/Phenol from PTT Phenol

• Startup – April 2011

• Market: Domestic – 70%; Export- 30%

• Project Management Consultant – Foster Wheeler

• EPC Contractor – Toyo Thai Corporation Public Company

• Project Cost – US$ 300 million
Contracting Philosophy for PTT

EPC Lump Sum Turnkey ; Payment in US$ and Thai Baht

Pros:
• Schedule control
• Equipment warranty and repair after initial acceptance
• Clear cut budget allocation
• Others

Cons:
• Higher cost due to additional risk marked up in price
• No direct control during procurement and construction
• Owner learns less
• Others

PTT Group prefers LSTK over cost reimbursement
Prequalification of EPC Bidders – Bisphenol-A Project

What we look at:

- Past experience in Aromatics Phenol, BPA Chain project
- Financial record past 4 years
- Reference work
- Safety track record
- Project Attitude

We PQ 4 EPC Contractors; all were allowed to proceed in Bid submission

2 Korean, 1 Taiwan, 1 Thai Contractor
What we look for:

• ITB Compliance
• EPC Capability, track record, manpower quality, Fairness, Flexibility
• Top Management commitment to schedule
• Others

Winner: Thai Contractor by a thin margin
**Bisphenol-A Project S-Curve**

| WORK CATEGORY     | WEIGHTED VALUE (%) | PLAN PROGRESS (%) | ACTUAL PROGRESS (%) | 000 | 10.00 | 20.00 | 30.00 | 40.00 | 50.00 | 60.00 | 70.00 | 80.00 | 90.00 | 100.00 |
|-------------------|--------------------|-------------------|--------------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Design & Engineering | 7.00              | 7.00              | 7.00               |     |       |       |       |       |       |       |       |       |         |
| Procurement       | 58.65             | 58.65             | 58.65              |     |       |       |       |       |       |       |       |       |         |
| Construction      | 34.35             | 34.35             | 3-34               |     |       |       |       |       |       |       |       |       |         |
| **TOTAL**         | 100.00            | 100.00            | 99.99              |     |       |       |       |       |       |       |       |       |         |

- Construction was stopped by court due to EHIA at 75% progress
- Political turmoil created delay in commissioning

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Problems encountered during project

• New Constitution (year 2007) Clause 67. All new projects must pass HIA and EIA.

• No Law passed to regulate HIA… all 76 Projects freeze by Central Admin Court – Dec 2009

• PTT Phenol files petition for permission to continue BPA construction – Jan 2010

• Court overturned initial verdict and allowed BPA to resume construction Feb 24, 2010

• Political Unrest during construction create unnecessary work stoppage
Outlook for doing Project in Thailand

• NGO and public ‘s role in new investment will be more pronounced
• Allowed ample time for EHIA; recommend extra 12-18 months
• Advance PR and CSR will play a pivotal role
• Environmental friendly project will proceed faster
• Higher project cost for Thailand
We are here, 170km E of BKK

Undisturbed Luxury….