JX Nippon Oil & Energy’s Challenges for Best Practice

26 January 2012

Hidetoshi Ueno
Deputy General Manager
Negishi Refinery
Contents

- Oil Supply & Demand Trends in Japan
- JX Nippon Oil & Energy’s Challenges - I
  - Business Integration
  - Distillation Capacity Reduction
  - The capacity and the feature of each refinery
    - Features of Negishii Refinery
- JX Nippon Oil & Energy’s Challenges - II
  - Best Practice Activities & Cross-Functional Team
    - Examples of Activities
      （Aroma-operation WG, Maintenance WG）
- Conclusion
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➢ Oil Supply & Demand Trends in Japan
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    - Business Integration
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    - The capacity and the feature of each refinery
      -Features of Negishii Refinery
  □ JX Nippon Oil & Energy’s Challenges - Ⅱ
    - Best Practice Activities & Cross-Functional Team
      -Examples of Activities
        （Aroma-operation WG, Maintenance WG）
  □ Conclusion
Oil Supply & Demand Trends in Japan

- Primary Energy Demand in Japan

Source: Ministry of Economy, Trade and Industry.
Oil Supply & Demand Trends in Japan

• Petroleum Oil Demand in Japan

Oil Supply & Demand Trends in Japan

- Petroleum Oil Prices in Japan

Oil Supply & Demand Trends in Japan

- Domestic Demand and Crude Capacity

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✓ Oil Supply & Demand Trends in Japan
  ➢ JX Nippon Oil & Energy’s Challenges - I
    - Business Integration
    - Distillation Capacity Reduction
    - The capacity and the feature of each refinery
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  □ JX Nippon Oil & Energy’s Challenges - II
    - Best Practice Activities & Cross-Functional Team
    - Examples of Activities
      （Aroma-operation WG、Maintenance WG）
  □ Conclusion
Business Integration

- Organization for Business Integration

< First Step >
Incorporation of the Holding Company
April 1, 2010

< Completion of the Integration >
Integrate, Restructure and Reorganize all business into three core business companies
July 1, 2010

Holding Company: JX Holdings

- Nippon Oil Corporation
  - Nippon Petroleum Refining Co., Ltd.
  - Nippon Oil Exploration Limited
- Nippon Mining Holdings, Inc.
  - Japan Energy Corporation
  - Japan Energy Development Co., Ltd.
  - Nippon Mining & Metals Co., Ltd.

Holding Company: JX Holdings

- JX Nippon Oil & Energy Corporation
  - Petroleum Refining and Marketing Business
    - Nippon Oil, Nippon Petroleum Refining and Japan Energy merged
- JX Nippon Oil & Gas Exploration Corporation
  - Oil and Natural Gas Exploration and Production Business
    - Nippon Oil Exploration and Japan Energy Development merged
- JX Nippon Mining & Metals Corporation
  - Metals Business
    - Nippon Mining and Nippon Mining & Metals merged

Listed Subsidiaries
Common Function Subsidiaries
Independent Business Subsidiaries
Business Integration

- JX Group Distillation Capacity Reduction Plan & The Refineries

**JX Group Capacity Reduction Plan**

<table>
<thead>
<tr>
<th>Plan</th>
<th>(thousand BD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,790</td>
<td>Mar. 2009</td>
</tr>
<tr>
<td>1,390</td>
<td>Mar. 31, 2011</td>
</tr>
<tr>
<td>1,190</td>
<td>Mar. 31, 2014</td>
</tr>
</tbody>
</table>

(400) Completed on Oct. 31, 2010

**Breakdown of 400 thousand BD reduction**

<table>
<thead>
<tr>
<th>Refinery</th>
<th>Reduction (thousand BD)</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negishi</td>
<td>70</td>
<td>Oct. 31, 2010 Terminated operation of 2nd CDU</td>
</tr>
<tr>
<td>Osaka</td>
<td>115</td>
<td>Oct. 1, 2010 Joint venture with CNPC; Specialized in exports</td>
</tr>
<tr>
<td>Mizushima</td>
<td>110</td>
<td>Jun. 30, 2010 Terminated operation of 2nd CDU</td>
</tr>
<tr>
<td>Oita</td>
<td>24</td>
<td>May 31, 2010 Terminated operation of 1st CDU</td>
</tr>
<tr>
<td>Kashima</td>
<td>21</td>
<td>May 31, 2010 Reduced capacity of 1st CDU</td>
</tr>
<tr>
<td>Toyama</td>
<td>60</td>
<td>Mar. 31, 2009 Closed Toyama refinery of Nihonkai Oil Co., Ltd.</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

Source: JX Holdings.
## Business Integration

### Major Plants & Capacity

<table>
<thead>
<tr>
<th>Plant</th>
<th>Topper</th>
<th>Vacuum</th>
<th>FCC</th>
<th>Reformer</th>
<th>Feature of Refinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muroran</td>
<td>180,000</td>
<td>65,000</td>
<td>30,000</td>
<td>36,000</td>
<td>Cumen、HDC、RDS、IPP</td>
</tr>
<tr>
<td>Sendai</td>
<td>145,000</td>
<td>60,000</td>
<td>43,000</td>
<td>54,000</td>
<td>RDS、RFCC</td>
</tr>
<tr>
<td>Kashima</td>
<td>189,000</td>
<td>42,000</td>
<td>35,500</td>
<td>22,000</td>
<td>PX、KAC(RIPE-X)、RDS</td>
</tr>
<tr>
<td>Negishi</td>
<td>270,000</td>
<td>130,000</td>
<td>83,000</td>
<td>50,000</td>
<td>IGCC、RDS</td>
</tr>
<tr>
<td>Chita</td>
<td>-</td>
<td>40,000</td>
<td>-</td>
<td>23,500</td>
<td>PX、Cyclo-hexane、(Specialized Petro-chemical)</td>
</tr>
<tr>
<td>Osaka</td>
<td>115,000</td>
<td>60,000</td>
<td>27,000</td>
<td>17,000</td>
<td>IPP</td>
</tr>
<tr>
<td>Mizushima A</td>
<td>140,000</td>
<td>77,000</td>
<td>46,000</td>
<td>22,640</td>
<td>PX、SDA、RDS</td>
</tr>
<tr>
<td>Mizushima B</td>
<td>205,000</td>
<td>109,000</td>
<td>52,000</td>
<td>44,000</td>
<td>COKER-2series</td>
</tr>
<tr>
<td>Marifu</td>
<td>127,000</td>
<td>75,000</td>
<td>28,000</td>
<td>24,000</td>
<td>COKER-2series、IPP</td>
</tr>
<tr>
<td>Oita</td>
<td>136,000</td>
<td>66,000</td>
<td>26,000</td>
<td>30,000</td>
<td>RDS、SDA、PX、IPP</td>
</tr>
</tbody>
</table>
Introduction of Negishi Refinery

- Outline of Negishi Refinery

  - Start of operation: 1964／1972 (Completion of construction)

  - Site area: 2.2 million m²
    (5 times larger than Tokyo Disneyland)

  - Crude oil Distillation capacity:
    270 k barrels/day (43 thousands kl/day)

  - No. of employees: 655 Regular employees
    (including about 300 shift workers)
    650 Cooperative companies’ employees
Introduction of Negishi Refinery

- Layout of Negishi Refinery

- Visitors’ hall
- JR Negishi Station
- IGCC
- Crude oil receiving jetty
- Honmoku I Area
- Sankeien
- Honmoku II Area
# Introduction of Negishi Refinery

- **Outline of Negishi Refinery**

## TANK

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Storage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRUDE OIL</td>
<td>17</td>
<td>1.2 mil.KL (7.6 mil.BBL)</td>
</tr>
<tr>
<td>PRODUCTS / INTERMEDIATES</td>
<td>318</td>
<td>2.7 mil.KL (17.4 mil.BBL)</td>
</tr>
</tbody>
</table>

## JETTY

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Storage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRUDE OIL</td>
<td>1</td>
<td>314,000 DWT</td>
</tr>
<tr>
<td>CRUDE OIL / PRODUCTS / INTERMEDIATES</td>
<td>1</td>
<td>80,000 DWT</td>
</tr>
<tr>
<td>PRODUCTS / INTERMEDIATES</td>
<td>16</td>
<td>120 – 6,3000 DWT</td>
</tr>
</tbody>
</table>

## PRODUCT SHIPPING

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BY SHIP</td>
<td>54%</td>
</tr>
<tr>
<td>BY TRAIN</td>
<td>22%</td>
</tr>
<tr>
<td>BY TANK TRUCK</td>
<td>23%</td>
</tr>
<tr>
<td>BY DRUM</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Introduction of Negishih Refinery

- IGCC for Power Generation Business

<table>
<thead>
<tr>
<th>Start of operation</th>
<th>June 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation capacity</td>
<td>431 MW</td>
</tr>
<tr>
<td>Net capacity</td>
<td>342 MW</td>
</tr>
</tbody>
</table>
  (All sold to Tokyo Electric Power Company)

- Generation system
  Integrated Gasification Combined Cycle

- Fuel
  Asphalt (extra heavy oil)

- Net efficiency
  36%  
  (based on the higher heating value)

- Operating hours
  24 hours
Introduction of Negishi Refinery

- Asphalt IGCC Process flow

Air Separation Unit

- Air
- N2

Sour gas Removal

- CO,H2

Clean Syn-gas

Raw Syn-gas

- CO,H2,H2S

Waste Water Treater

Gasifier

Steam

Boiler

Stack

Gas turbine

Generator

Electric Power

Boiler feed Water

Asphalt

O2

Asphalt IGCC Process flow

- Asphalt IGCC Process flow

N2

Air

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    - Examples of Activities
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- Conclusion
Best Practice Activity

“Champion Group”
- Executive Vice President
- Refining Technology & Engineering Division
  - Executive Director of Division
  - Deputy Director of Division

“Champion Hearing”
Meeting with top management

Held for each subject

Leader: Deputy General Manager of Refinery
Member: Selected from each refinery

Cross-Functional Team
- Muroran Refinery
- Sendai Refinery
- Kashima Refinery
- Negishi Refinery
- Mizushima Refinery
- Marifu Refinery
- Oita Refinery
- Kawasaki Plant
- Yokohama Plant
- Chita Plant

Feed back Best Practice
# Best Practice Activity

- **PDCA of Cross-Functional Team**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Phase (6〜12 months)</td>
<td>‘Picking up subjects for BP and Planning the application of BP’</td>
</tr>
<tr>
<td>2nd Phase (3〜5 years)</td>
<td>‘Follow-up of the execution’</td>
</tr>
</tbody>
</table>

## Plan

- **Subject Selection** by “Champion”
  - Share the goal and objective with “Champion” and WG leaders

## Do

- **Kickoff Meeting**
  - Study BP

## Check

- **Interim Report**
  - “Champion Hearing” Meeting with top management

## Action

- Apply BP to each refinery IMMEDIATELY

### Subject Selection
- Share the goal and objective with “Champion” and WG leaders

### Kickoff Meeting
- Study BP

### Interim Report
- “Champion Hearing” Meeting with top management

### Final Report
- Achievement of purpose

### Final Report
- “Champion Hearing” (Held every 6 months)
## Best Practice Activity

- **Cross-Functional Working Group List**

<table>
<thead>
<tr>
<th>Maintenance Technology</th>
<th>Operation Technology</th>
<th>Task Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating Machine</td>
<td>TOPPER/VACUUM</td>
<td>Upgrading process schedule controlling</td>
</tr>
<tr>
<td>Instrumentation Apparatus</td>
<td>Reforming (aromatics) Unit</td>
<td>Construction contract</td>
</tr>
<tr>
<td>Electric Apparatus</td>
<td>FCC</td>
<td>Upgrading Operation procedure manuals</td>
</tr>
<tr>
<td>Inspection</td>
<td>Desulfurizing Unit</td>
<td>Optimization of Production Process and Amount</td>
</tr>
<tr>
<td>Column and Vessels</td>
<td>Lubricant Unit</td>
<td>Optimization of sift operation</td>
</tr>
<tr>
<td>Heating Furnace</td>
<td>Power Producing Unit/IPP</td>
<td>Optimization of outsourcing</td>
</tr>
<tr>
<td>Tank</td>
<td>Advanced Process Control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coker</td>
<td></td>
</tr>
</tbody>
</table>

- **Advanced Process Control**
- **Coker**
- **Desulfurizing Unit**
- **Lubricant Unit**
- **Power Producing Unit/IPP**
- **Reforming (aromatics) Unit**
- **TOPPER/VACUUM**
- **FCC**

**JX Nippon Oil & Energy**
## Best Practice Activity

### Activities for Variable Cost Reduction by Aromatics WG

<table>
<thead>
<tr>
<th>N-HDS</th>
<th>Heat Exchanger</th>
<th>Washing of RX Feed/Effluent heat exchanger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor</td>
<td></td>
<td>Energy conservation by N-HDS reaction temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimization RX temperature</td>
</tr>
<tr>
<td>Column &amp; Vessels</td>
<td></td>
<td>Low operating pressure and decrease in reflux</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimization of operating temperature for Cold Separator</td>
</tr>
<tr>
<td>PLAT</td>
<td>Heating Furnace</td>
<td>Reduction of O2 concentration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleaning: tube, convection, APH, WHB</td>
</tr>
<tr>
<td>Reactor</td>
<td></td>
<td>Lowered heating furnace load and optimizeH2/Oil ratio</td>
</tr>
<tr>
<td>Rotating Machine</td>
<td></td>
<td>Electric drive operation of condensing turbine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⋮ ⋮ ⋮ etc.</td>
</tr>
</tbody>
</table>
Best Practice Activity

- Results of Variable Cost Reduction by Aromatics WG

<table>
<thead>
<tr>
<th>Location</th>
<th>Cost Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muroran #2PLAT</td>
<td></td>
</tr>
<tr>
<td>Sendai PLT</td>
<td></td>
</tr>
<tr>
<td>Negishi #3PLAT</td>
<td></td>
</tr>
<tr>
<td>Mizushima #7PLAT</td>
<td></td>
</tr>
<tr>
<td>Marifu CCR</td>
<td></td>
</tr>
<tr>
<td>Oita 2PL</td>
<td></td>
</tr>
<tr>
<td>Kashima 2RF</td>
<td></td>
</tr>
<tr>
<td>Kashima 3RF</td>
<td></td>
</tr>
</tbody>
</table>

Total
# Best Practice Activity

- Cross-Functional Working Group List

<table>
<thead>
<tr>
<th>Maintenance Technology</th>
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<tr>
<td></td>
<td>Coker</td>
<td></td>
</tr>
</tbody>
</table>

*JX Nippon Oil & Energy*
# Best Practice Activity

- Follow-up sheet for Column and Vessel WG

<table>
<thead>
<tr>
<th>Executor (Section)</th>
<th>Subject</th>
<th>Goal</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refinery Plant</td>
<td>Maintenance Cost Reduction</td>
<td>(1) Overhaul ratio of instrument ≥ ▲20% (Compared with the present state)</td>
<td>Set the standard for overhaul</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) S/D Maintenance Cost (Column and Vessels) ≥ ▲20%</td>
<td>Standardize work selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Optimize overhaul work</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shorten process schedule</td>
</tr>
<tr>
<td></td>
<td>Shortening of process schedule</td>
<td></td>
<td>Utilize MS-PJ</td>
</tr>
<tr>
<td>WG</td>
<td>Maintenance Cost Reduction</td>
<td></td>
<td>Benchmark maintenance cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Consider overhaul procedure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Optimize overhaul cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardize work selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“Cold Eye Review”</td>
</tr>
</tbody>
</table>
Best Practice Activity

- Goal of Maintenance Cost Reduction

![Graph showing maintenance cost reduction over years from 2010 to 2020 with a trend line indicating decreasing costs.]

Maintenance Cost

- COST DOWN
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- Conclusion
Conclusion

With emphasis on the concept of “Best Practices,”

dramatically transform the Petroleum Refining and Marketing Business by realizing integration synergies and rigorously reducing costs,

and maximize corporate value by allocating management resources to highly profitable operations on a priority basis.
Thank you very much for your attention.

JX Nippon Oil & Energy Corporation. Negishi refinery
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Yokohma 235-0006 Japan
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FAX +81-45-757-7220
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