Fifty-Year Crude Oil Supply Scenarios: Saudi Aramco’s Perspective

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Saudi Aramco

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World Oil Demand
(Million Barrels / Day)

Source: OPEC OWEM (2002)
2002 Year-End Conventional Oil Reserves
(1050 Billion Barrels)

North America
50 Billion Barrels

South & Central America
99 Billion Barrels

Europe
19 Billion Barrels

Africa
77 Billion Barrels

Middle East
686 Billion Barrels

F. S. U
77 Billion Barrels

Asia Pacific
39 Billion Barrels

Source: BP Annual Statistical Review
Saudi Aramco’s Perspective

**Principles:**

- Sustainable Performance
- Maximum Hydrocarbon Recovery
- Life-Cycle Economics
- Prudent Reserves Management
- Excellence in Safety and Environmental Practices

Reliable Supplier of Oil
Current Operations

Area: 579,000 Square Miles
Fields: 85
Reservoirs: 320
Global Oil Reserves: 25%
Current Capacity: 10 Million Barrels/Day & 9.6 Billion Cubic Feet/Day
Seismic Crews: 9
Rigs: 48
Replace Annual Oil Prod: 3 Billion Barrels
Add Annual Gas: 5 Trillion Cubic Feet
Exploration Wells in Saudi Arabia
US Geological Survey 2000 Estimate of Top 8 Regions of Undiscovered Recoverable Oil Resources

Source: USGS 2000
Discovered & Undiscovered Oil Initially in Place by 2025 in Saudi Arabia
## Proved Reserves
(Saudi Aramco vs. Industry)

<table>
<thead>
<tr>
<th>Commercial (Current)</th>
<th>SPE/WPC/AAPG</th>
<th>Saudi Aramco</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Prices</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>- Operating Methods</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Areal Extent</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>- Hydrocarbon Water Contact</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>- Deepest Known Hydrocarbon Depth</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Improved Recovery</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>- Pressure Maintenance</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>- All Other EOR Methods</td>
<td>✔</td>
<td>none</td>
</tr>
</tbody>
</table>

| Degree of Certainty | 90% | 90% |

Saudi Arabia’s Oil Reserves are Conservative
Extent of Proved Reserves Depletion
Select Fields (1/1/2004)

Note: Haradh and ‘Ain Dar / Shedgum are part of Ghawar
Discovered Oil Reserves
Development Status
(1/1/2004)

260 Billion Barrels

131 Billion Barrels (50%)
Developed

Proved
Saudi Aramco’s Reservoir Management “Learning Model”

Emphasis:

- Maximum Hydrocarbon Recovery
- Reservoir Monitoring
- Low Depletion Rates
- Advanced Diagnostics
- Cutting Edge Technologies

Continual Improvement
### Maximum Annual Depletion Rates
(\% of Initial Proved Reserves)

<table>
<thead>
<tr>
<th>Region</th>
<th>Depletion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Aramco</td>
<td>1.0</td>
</tr>
<tr>
<td>SFNY (S &amp; K)</td>
<td>1.5</td>
</tr>
<tr>
<td>ZULF (K)</td>
<td>1.8</td>
</tr>
<tr>
<td>ANDR</td>
<td>2.2</td>
</tr>
<tr>
<td>ABQQ (D &amp; H)</td>
<td>2.8</td>
</tr>
<tr>
<td>BRRI (H &amp; H)</td>
<td>4.1</td>
</tr>
<tr>
<td>Other Majors</td>
<td></td>
</tr>
<tr>
<td>Prudhoe Bay</td>
<td>4.2</td>
</tr>
<tr>
<td>Yibal</td>
<td>4.3</td>
</tr>
<tr>
<td>East Texas</td>
<td>4.5</td>
</tr>
<tr>
<td>Ekofisk</td>
<td>6.5</td>
</tr>
<tr>
<td>Forties</td>
<td>7.4</td>
</tr>
<tr>
<td>Brent</td>
<td>9.6</td>
</tr>
</tbody>
</table>

Source: Saudi Aramco
Source: SPE Publications
Shaybah Field

Depletion Rate: 1% per Year
Production Plateau: > 50 Years

Area Size: 38 Miles x 13 Miles

Production Start: July 1, 1998
500,000 B/D

Gas
Oil
Water
Evolution of Horizontal Drilling Technology (South Shaybah)

**Horizontal**
- 1996
  - 3,000 B/D
  - 1 km

**Maximum Reservoir Contact**
- 2002
  - 10,000 B/D
  - 12 km

JPT (Dec. 2003)
SPE 81487 (MEOS 2003)
Ghawar Field
The Super Giant

- Largest Oil Field in the World
- Discovery (1948)
- Onstream (1951)
- Peripheral Water Injection (1965)

Area Size: 174 Miles x 16 Miles
‘Ain Dar/Shedgum Area
Arab D Production History

Reservoir Pressure

Pressure

Oil Production

Start-up Water Injection (1965)

2 Million B/D

36% Water-Cut

Production Rate, B/D X 1000

Water - Cut %
‘Ain Dar/Shedgum Area / Arab D Resources Depletion State (1/1/2004)

OIIP: 68.1 Billion Barrels
Proved Reserves: 40.8 Billion Barrels (60% of OIIP)
Estimated Ultimate Recovery: 51 Billion Barrels (75% of OIIP)

Contingent Resources: 17.1 Billion Barrels

Produced: 26.9 Billion Barrels
Remaining Proved: 13.9 Billion Barrels

* Probable: 3.4 Billion Barrels
* Possible: 6.8 Billion Barrels
* Incremental

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Ghawar Field
Water Management

Average Oil Rate
Million Barrels per Day

Water - Cut %

Oil Rate

0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

1993 1995 1997 1999 2001 2003

36.5%
33%

Ghawar Field
Water Management
e-Field/Smart Wells
Haradh Increment III

Quad-Lateral Smart Completion

Onstream: July 2006
Rate: 300,000 B/D
Plateau: 30 Years
Depletion: 1.7% per Year
Haradh Increment III Forecast

Rate: 300,000 B/D

22% Water - Cut
50-Year Crude Scenarios
10 Million Barrels / Day
Maximum Sustainable Capacity - MSC

Reserves: 260 Billion Barrels
MSC = Production Rate

Reserves Replacement 15 Billion Barrels (15% of Prob. & Pos. Reserves)

Production Rate: Based on Market Outlook Until 2016
50-Year Crude Scenarios
12 Million Barrels / Day
Maximum Sustainable Capacity - MSC

MSC = Production Rate in 2016

Reserves Replacement 35 Billion Barrels
(34% of Prob. & Pos. Reserves)

Reserves: 260 Billion Barrels

Production Rate: Based on Market Outlook Until 2016
The Future

- Real-Time Reservoir Management
- Intelligent Wells / e-Field
- 100 Million Cell Models
- Best-in-Class Practices

- Lower Unit Costs
- Increase Recovery
Synopsis

• Conservative Reserves with Significant Upward Potential

• Capacity and Commitment to Continue as a Reliable and Cost-Effective Global Oil Supplier

• Sustained Production Levels at 10, 12 and 15 Million Barrels per Day, Well Beyond 2054