Peak Oil and the Evolving Strategies of Oil Importing and Oil Exporting Countries

RESEARCH ROUND TABLE:

OIL DEPENDENCE: IS TRANSPORT RUNNING OUT OF AFFORDABLE FUEL?

Organized by the Joint Transport Research Centre of the OECD and the International Transport Forum


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Historical “Peak Oil”

The end of the Oil Age

Oct 23rd 2003
Leaders from The Economist print edition

On a time scale starting at year 0 everyone think that there will be a peak in the production between 2000 and 2100

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“An Inconvenient Truth About Oil”
USGS Estimates to 2025

World Discovery
All Liquids except tar etc

USGS Estimates to 2025
Low Probability  4443 Gb
Mean          3345
High Probability 2452 Gb

Cumulative Gb


Actual
Import and Export countries

Import of oil
- USA
- Japan
- China
- Germany
- South Korea
- France
- India
- Italy
- Spain
- Netherlands
- Taiwan
- Singapore
- Belgium & Lux.
- Thailand
- Turkey
- South Africa
- Poland
- Greece
- Pakistan
- Australia

Export of oil
- Saudi Arabia
- Russian Fed.
- Norway
- Nigeria
- Venezuela
- Iran
- UAE
- Kuwait
- Iraq
- Mexico
- Algeria
- Libya
- Angola
- Kazakhstan
- Qatar
- Canada
- Oman
- Syria
- Yemen
- Vietnam

2005
Energy consumption in USA

Figure 3. Energy consumption by fuel, 1980-2030 (quadrillion Btu)

- **Petroleum**
  - 2030: 27,7 mbpd
  - 2004: 20,7 mbpd
  - Increase: 7,0 mbpd

- **Coal**
- **Natural gas**
- **Nuclear**
- **Nonhydro renewables**
- **Hydro**

Future oil production in USA

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China: Discovery and Production

Oil Discovery and Production of China

**Graphical Representation:**
- **Production** and **Discovery** trends over years from 1930 to 2050.
- Key points:
  - Production peak around 2010-2012.
  - Discovery and Production decline within 5 years.

**Key Numbers:**
- Production: 14.0 Gb.
- Discovery: 1.40 Gb.

**Caption:**
- Peak Production: about 189 million tons.
- Peak Time: about 2012 year.
Consumption of oil in EU25
The world needs to increase the import with 30 mbpd by 2030 - from 48 mbpd to 78 mbpd
Reality from the speech of the silent elephants

Cantarell is speaking with Ghawar, Greater Burgan and Safaniya waiting
Cantarell is declining

- **Actual production**
  - 2.00 million
  - 1.75
  - 1.50
  - 1.25
  - 1.00
  - 0.75
  - 0.50
  - 0.25
  - 0

- **Pemex’s official forecast**
  - Assumes an effective recovery of 50% of Cantarell’s total oil

- **Pemex’s “worst-case” scenario**
  - Assumes an effective recovery of 30% of Cantarell’s total oil

Source: Pemex

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Definitions

- Ultimate Recoverable Reserves (URR) – cumulative production plus the estimated remaining reserves
- Gb – Giga barrel = $10^9$ barrels = billion barrels
  \[ = 0.159 \times 10^9 \text{ m}^3 = 159 \text{ million m}^3 \]
- Giant Oil Field – an oilfield with estimated ultimate recoverable oil of more than 500 million barrels (>0.5 Gb), also called an elephant.
Production of oil – UHDSG Giant Oilfield Model

The production of oil can be divided into the following fractions:

1. Giant oil fields – long term
2. Smaller oil fields – long term
3. Heavy oil – long term
4. New fields developments – medium term
5. Deep water – medium term
6. Natural gas liquids – long term

Global Giant Oilfields

- Discovered Recoverable Reserves in Giant Fields (Gb)
- Number of Giant Oil Fields Discovered

F. Robelius, Uppsala Hydrocarbon Depletions Study Group
Giant fields
New discoveries from 1995 till 2025 is 100 billion barrels found and 100 billion barrels expected to be found. USGS mean prediction for the same time period is 649 billion barrels.
Giant High Case

- NGL - assumed at 10Mbpd
- Orinoco - Venezuela
- Oil Sand - Canada
- New Field Developments
- Deep Water
- Other: decline rate 3%
- Giant High Case

Daily Production (Mbpd)

Year:
- 1925
- 1935
- 1945
- 1955
- 1965
- 1975
- 1985
- 1995
- 2005
- 2015
- 2025
- 2035
- 2045
Import and Export countries

Import of oil
- USA
- Japan
- China
- Germany
- South Korea
- France
- India
- Italy
- Spain
- Netherlands
- Taiwan
- Singapore
- Belgium & Lux.
- Thailand
- Turkey
- South Africa
- Poland
- Greece
- Pakistan
- Australia

Export of oil
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- Angola
- Kazakhstan
- Qatar
- Canada
- Oman
- Syria
- Yemen
- Vietnam

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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
Reported reserves (2p), Developed reserves (1P) and Cumulative production for Saudi Arabia

Extrapolated curves are for 17.5, 12.0, 10.0 respectively 7.7 Mbdp
Production in Saudi Arabia

Expected production increases did not happen

Crude oil production Saudi Arabia [mb/d]

- Qatif, Abu Sa'fah improvements
- No response
- Haradh 3 improvement

Actual IEA from www.oilmarketreport.org
Actual EIA from www.eia.doe.gov/emeu/ipsr/t11c.xls
+ 950 Kb/d expected from Qatif, Abu Sa'fah, Haradh 3
OPEC production cuts announced
Decline at -8% pa

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Russia

Graph showing trends in net exports, consumption, and production over time in Russia.
Figure 38. Mean export comparison between the reference policy and the alternative policy for 70, 120 and 170 Gb oil left estimates.
Found and produced oil in Norway

The time between tops is 27 years
Norway official numbers 2006

Oljeproduksjon, Norsk kontinentalsokkel
Alle ressurskategorier

- Uoppdagede ressurser
- Ressurser i felt
- Ressurser i funn
- Reserver
- Faktisk

Ressurser i felt: 0,4 GSm³
Ressurser i funn: 0,1 GSm³
Uoppdagede ressurser: 1,2 GSm³
Exports + and - in 2030
World liquids production from USDOE/EIA 1997-Feb.2007

- monthly production
- annual production
- IEA-OMR oil supply
- Brent spot price $/b

Jean Laherrere 2007
The Uppsala Giant Oilfield Model

- Best Case
- Standard Case - High End
- Standard Case - Low End
- Best Case - Demand Following
- Worst Case
- Demand - Low
- Demand High

Daily Production (Mbdp)

We have to build a “Crash Mat”
Uppsala Hydrocarbon Depletion Study Group, Uppsala University, Sweden

Resource Physics
Energy Systems
Energy and Technology in the Society

www.tsl.uu.se/uhdsg

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