A World Addicted to Oil

It’s time to sober up!

Kjell Aleklett
Uppsala University, Sweden

Pisa, July 2006
Kjell [ ]
"We have a serious problem. America is addicted to oil, which is often imported from unstable parts of the world,"

Fact: 5% of the global population consume 25% of the oil produced
How much energy is bound in oil?

100 ml of oil contains 1 kWh

What can you do with 1 kWh?

You can move a small car to the top of the Eiffel tower!

Filling your car with 50 liter is equal to the energy you need to move 500 cars to the top of the Eiffel tower.

If you drive a’n SUV one mile you will use oil with the same energy content as pulling the SUV to the top of the Eiffel Tower.
Energy is running the world

Money is not running the world, money is used to buy energy

NYMEX

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Agenda for “Time to sober up”
The future of energy

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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When will we run out of oil?

Not in our lifetime as there always will be a tiny production. For the crude oil from the oldest producing oil well in the world I paid $10,000 per barrel

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Import and Export
The world needs to increase the import with 30 mbpd by 2030
State of the Union address, Feb 1, 2006

"Another great goal: to replace more than 75 percent of our oil imports from the Middle East by 2025."
LONG-TERM OUTLOOK FOR U.S. ENERGY MARKETS

Guy Caruso, Administrator
Energy Information Administration

Center for Strategic & International Studies
January 10, 2006
Washington, DC

- Not due to “Peak Oil” considerations, although we are following this issue closely
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**
Energy production in USA

Figure 7. Energy production by fuel, 1980-2030 (quadrillion Btu)

- **2030:** 4.6 mbpd
- **2004:** 5.4 mbpd
- **Decline:** 0.8 mbpd
Numbers for China

Percentage of global population: 21%
Percentage of global oil consumption: 8%, 6.3 Mbpd
Average increase in GDP last 5 years: 8.2 %
Average increase in oil consumption last 5 years: 8.4 %
Official statement is that China will reach Peak Oil in 2009

Future directions:
Consumption of 21% of the global oil: Today 17.6 mbpd, year 2030 25 mbpd

Questions:
Is it OK that China consume 21% of the global oil production?
Is it possible for the oil exporting countries to deliver 22 mbpd to China in 2030?
China: Discovery and Production

Production will start to decline within 5 years

Oil Discovery and Production of China

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Forecast by USGS

3.3000 Gb in year 2025
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.
IEA, (International) The OECD Energy Agency

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Oil is the driving force of the world economy

Relation between Oil Demand and GDP Growth, figure 3.1 in WEO2004
Figure 1.1 • World primary energy demand over time in IEA Reference Scenario

“Other” encompasses both traditional and modern renewables (biomass, wind, solar, etc.)

Source: WEO-2004, IEA.
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* Average annual growth rate.
** Includes bunkers and stock changes.
Deepwater Discoveries and the Largest Field per Region

- Thunder Horse (US GoM) 1.0 Gb
- Dalia (Angola) 0.94 Gb
- Bonga (Nigeria) 1.0 Gb
- Roncador (Brazil) 2.6 Gb

Other Africa
Asia-Pacific
US Gulf of Mexico
Nigeria
Angola
Brazil

Million Barrels

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Deepwater Production Forecast

- Other Africa
- Asia-Pacific
- US Gulf of Mexico
- Nigeria
- Angola
- Brazil

Daily Production (bpd)

Oil export in the future
Official numbers:
Oil in place: 720 billion barrels
Produced so far: 105 bb, 15%
Reserves to produce: 260 bb, 36%
Recovery factor: 15%+36%=51%
Oil in place to find: 200 bb
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
Recovery of the world

Saudi recovery factor
Oil in place: 720 billion barrels
Produced so far: 105 bb, 15%
Reserves with 29% IOR: 104 bb
Reserves with 38% IOR: 169 bb
Years of world consumption: ~4 to 5

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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

Total 115 bb in 2033
Within the Oil Triangle you can find roughly 60 percent of the remaining oil reserves in the world. The 2001 Cheney report, US Energy Policy, says that in year 2020 around 54 to 67 percent of the world consumption of oil needs to come from the Oil Triangle.

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Russia

![Graph showing oil production, consumption, and net exports in Russia over time. The graph includes data from 1990 to 2030, with a peak in production in 2010.](image)
Norway official numbers

Oljeproduksjon, Norsk kontinentalsokkel
Alle ressurskategorier

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

Produsert per 31.12.2005: 3,0 GSm3
Gjenværende reserver: 1,2 GSm3
Ressurser i felt: 0,4 GSm3
Ressurser i funn: 0,1 GSm3
Uoppdagede ressurser: 1,2 GSm3

M:\Lag\D-RessAnalyse\ERM\Totalprod.xls
The future
The world needs new oil fields

ExxonMobil:
In other words, by 2015, we will need to find, develop and produce a volume of new oil and gas that is equal to eight out of every 10 barrels being produced today.

Kjell Aleklett
A Producer's Perspective on the Oil Industry

London 2004
Sadad I. Al-Husseini
Dhahran, Saudi Arabia
Reservoir capability declines: the leaking bucket syndrome

3-5% capability decline rate
ExxonMobil: 4-6%

97.6 mmbd = 10 Saudi Arabias by 2025

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Figure 3.20: World Oil Production by Source

- Existing capacities
- Enhanced oil recoveries
- Development of existing reserves
- Development of new discoveries
- Non-conventional oil
The first field in the North Sea was discovered in year 1969. The oil production peaked 30 years later with a maximum production of 6 mbpd. Is it possible to make new discoveries within 25 years that will yield a production of 25 mbpd in year 2030?
January 24 2006

My view is that “easy” oil has probably passed its peak.
Oil sand and crude oil

Saudi Arabia
Iran
Iraq
United Arab Emirates
Kuwait
Venezuela
Russia
Libya
Nigeria
U.S.
Canada’s Oil Sands

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Oil from oil sand in Canada

Total Mining, Crash Program

Total In Situ, Crash Program

Year

Thousand Bbls Per Day
Produktion of Oil from Canada, the North Sea and Oil Sand in Canada

Year


Thousand BBls Per Day

0 1000 2000 3000 4000 5000 6000 7000 8000

Conventional Oil Production, Canada + The North Sea

Canadian Oil Sands, Crash Program Production
Statement by the Swedish Prime Minister Göran Persson

"The oil might declining? We have someone here in Uppsala named Aleklett that claims that."

The Swedish government have appointed a commission that should make suggests what to do to make Sweden less dependent on oil by 2020.

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Comparison between discovery and consumption

- Discovery
- Extrapolation
- Consumption
- IEA forecast