

What energy future ?

The global demand/future need for oil and gas, and potential for interesting and long lasting career opportunity

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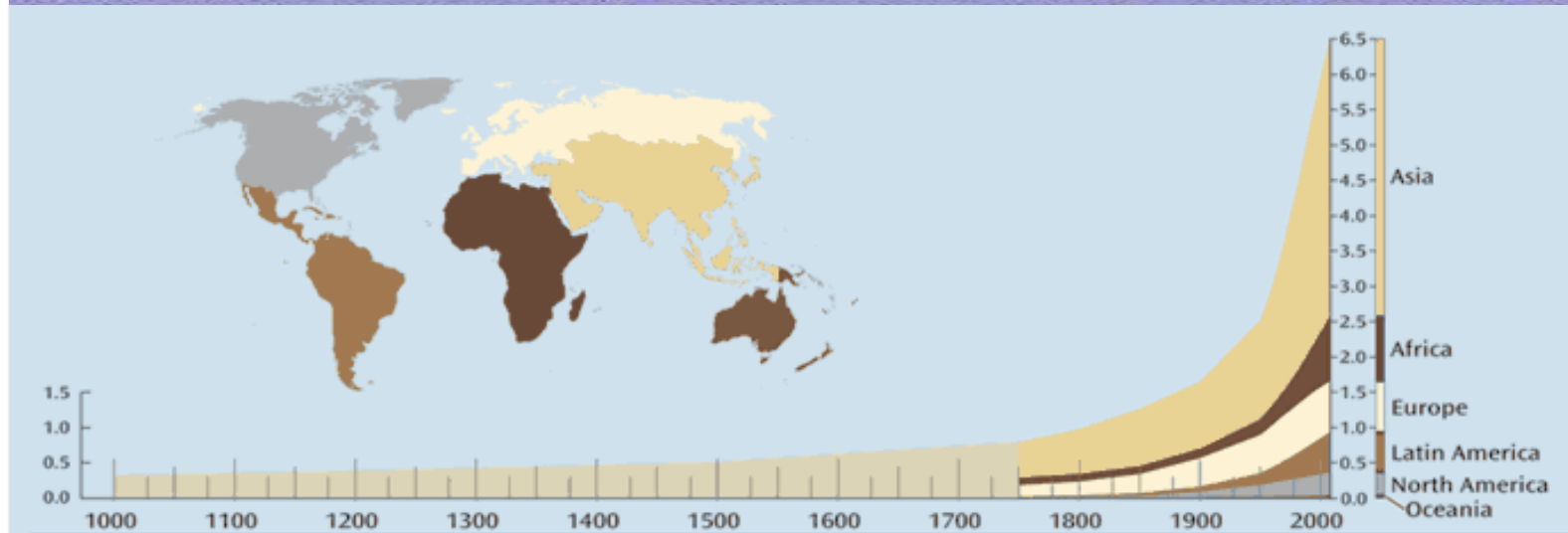
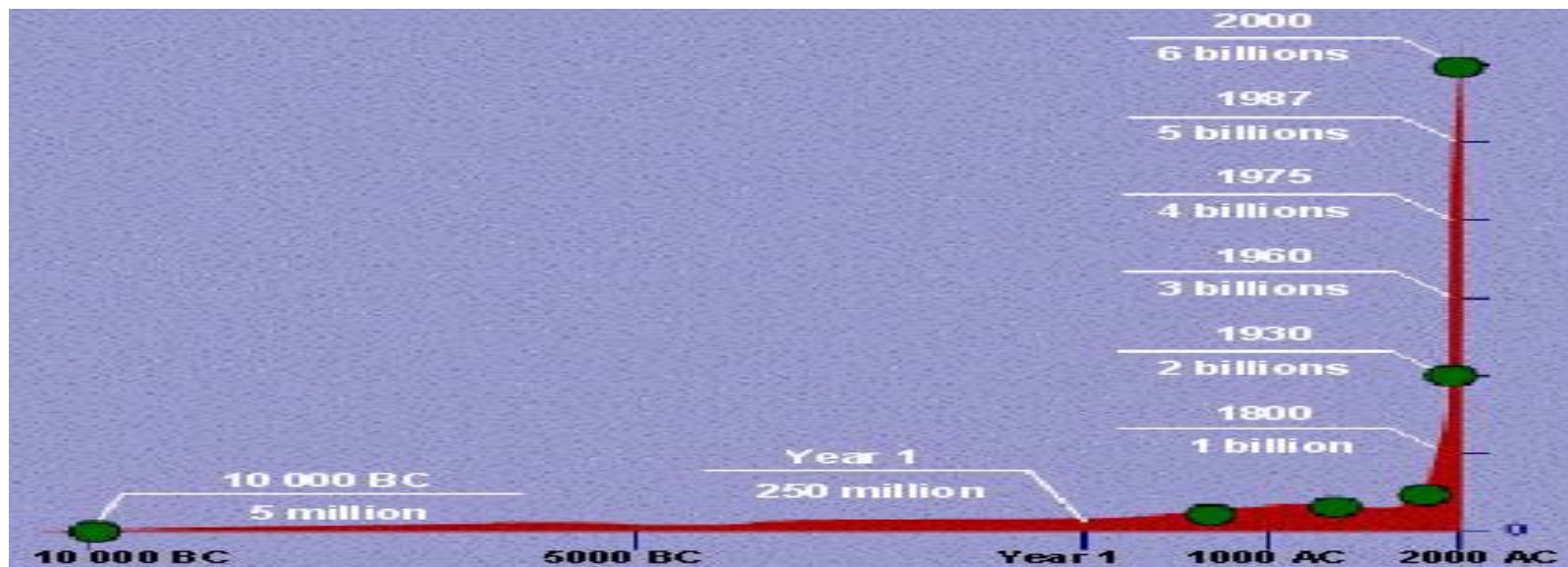
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Energy and our way of life



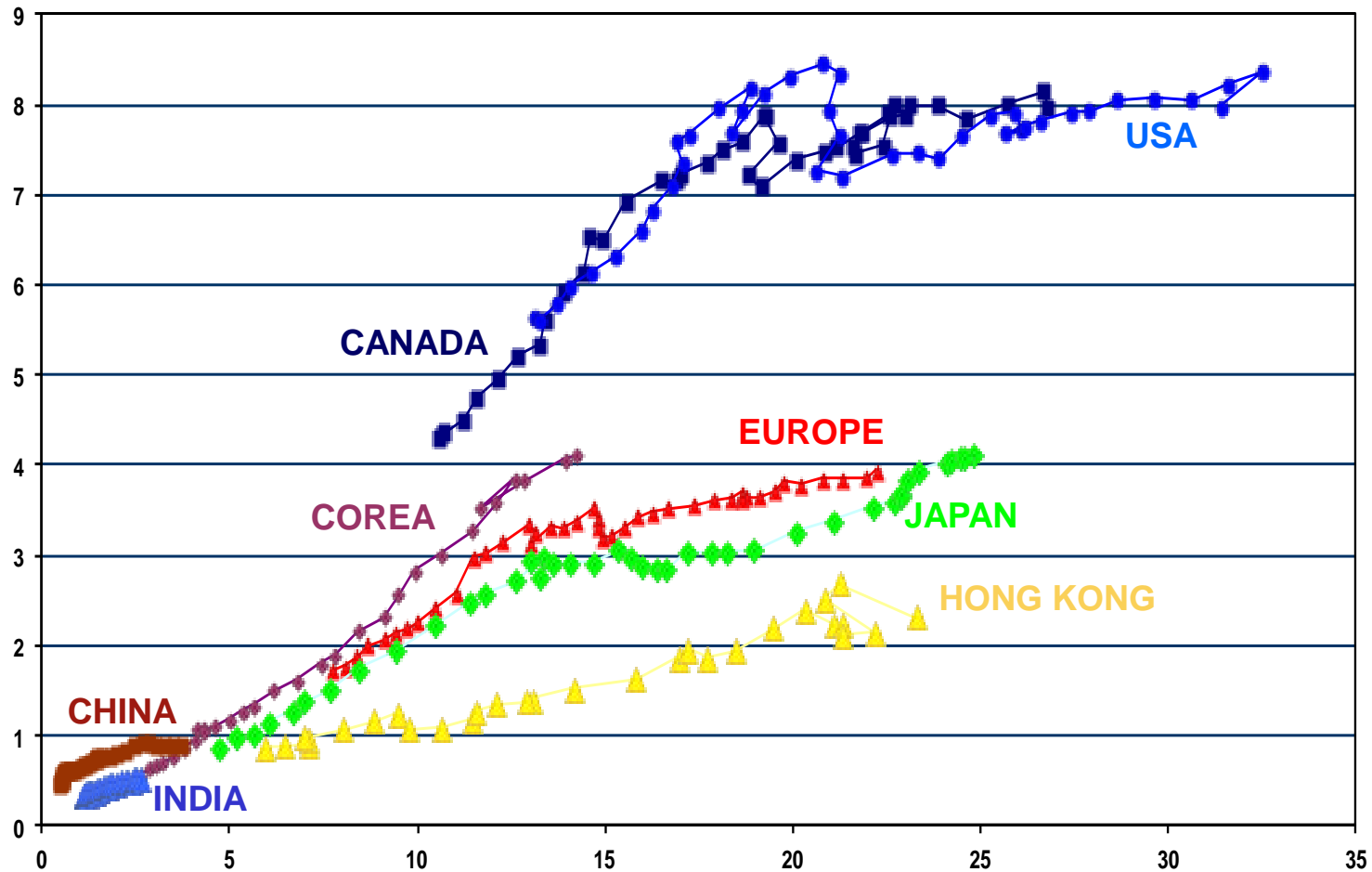
Sources: 1 - The World at Six Billion; Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision, <<http://esa.un.org/unpp>> 2 - United Nations, 1973. "The Determinants and Consequences of Population Trends, Vol.1" (United Nations, New York). United Nations, (forthcoming). "World Population Prospects: The 1998 Revision" (United Nations, New York). <<http://www.geohive.com/global/>>



Growth is based on increasing energy needs

Energy consumption per person (tep)

1960-2001 or 1971-2001



Source : IEA

GDP per capita (k\$1995 PPP)



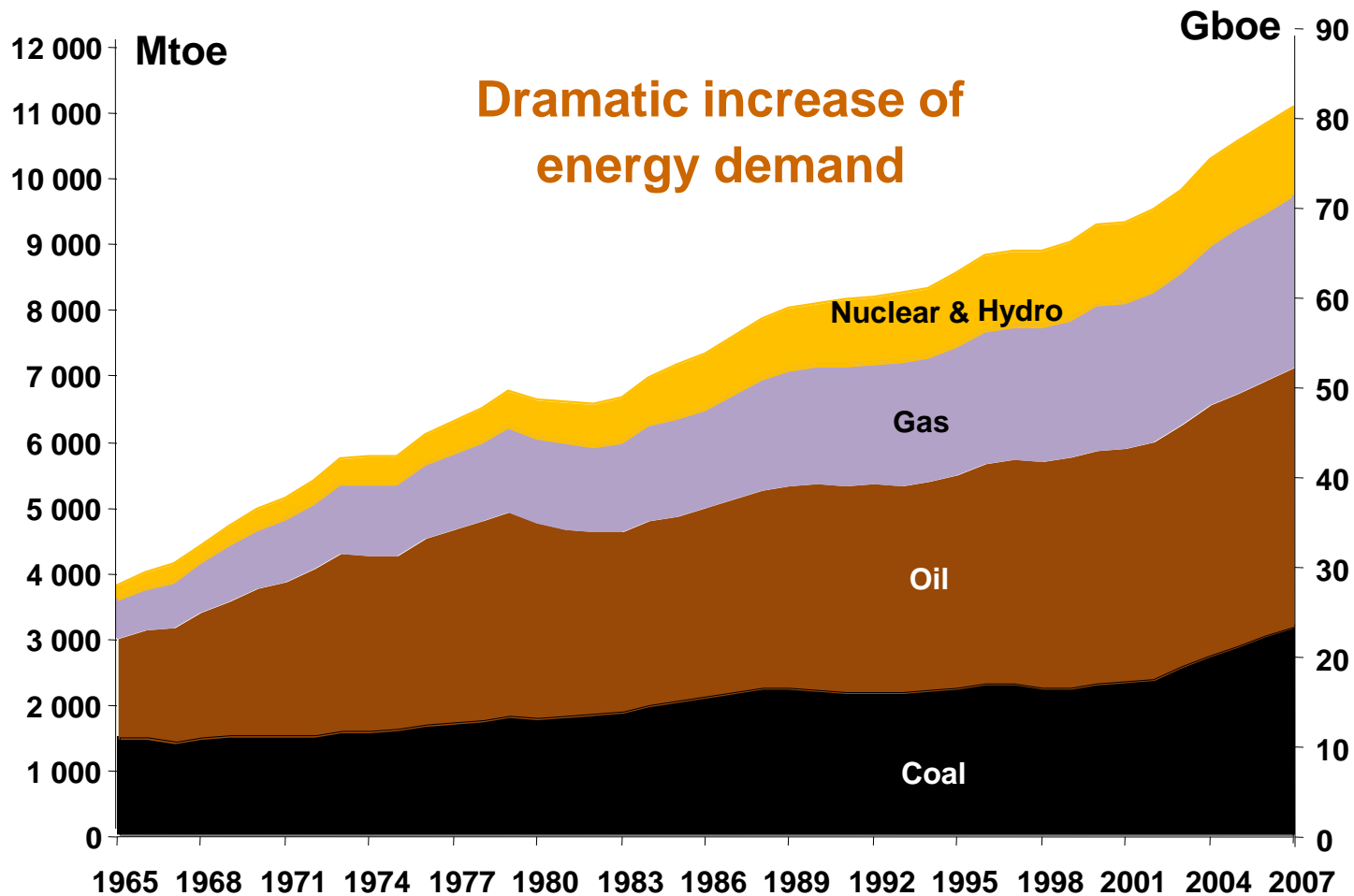
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Demand and price evolution

Economic development based on cheap oil !



Key considerations about energy fundamentals

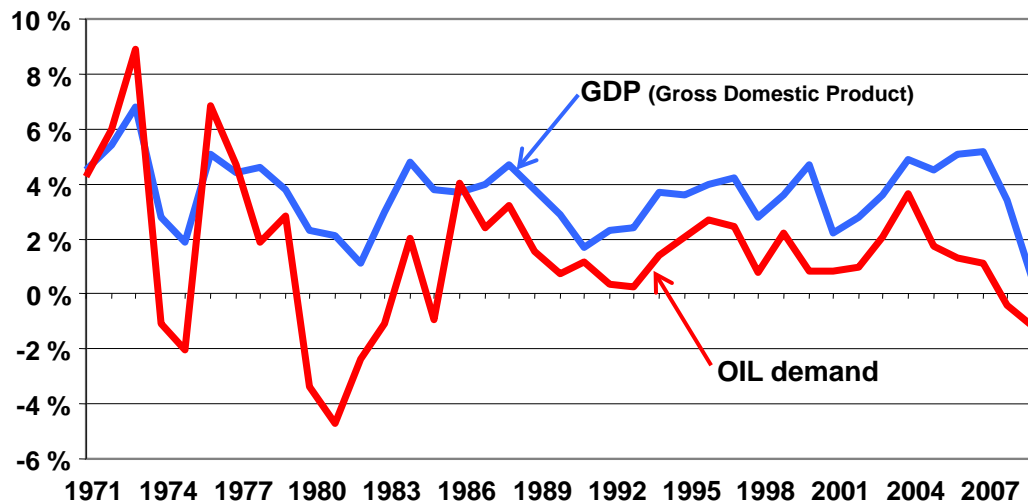


Since 2003 coal has become the "physical regulator" of the World Energy system

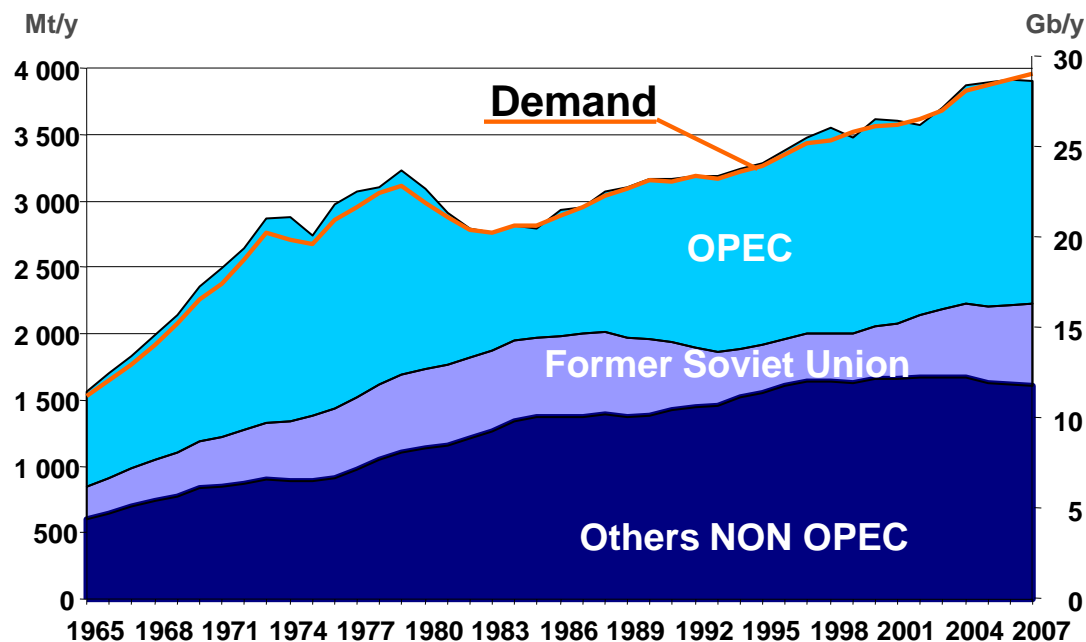


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GDP and demand for oil annual growth rate (% , worldwide)



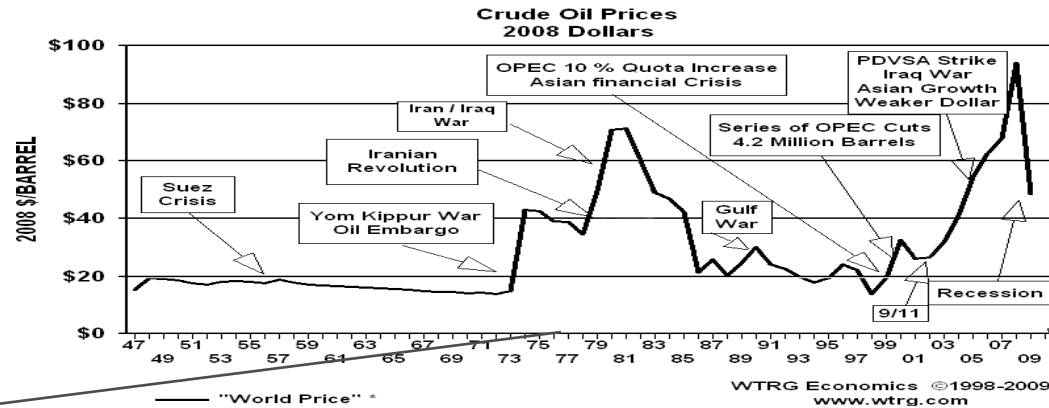
- ▶ In 2004 2/3 of GDP Increase coming from China



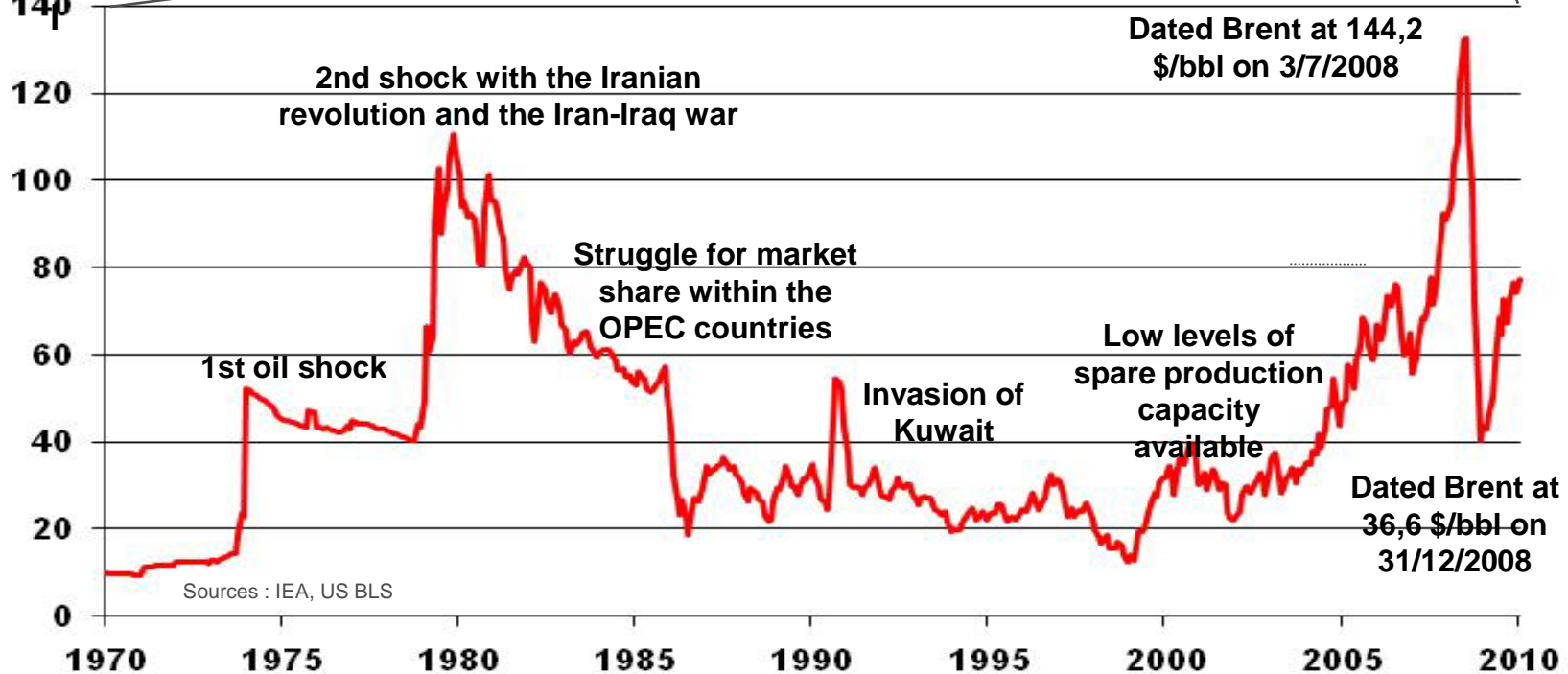
- ▶ World Energy in the past was simple: oil was the “physical regulator”



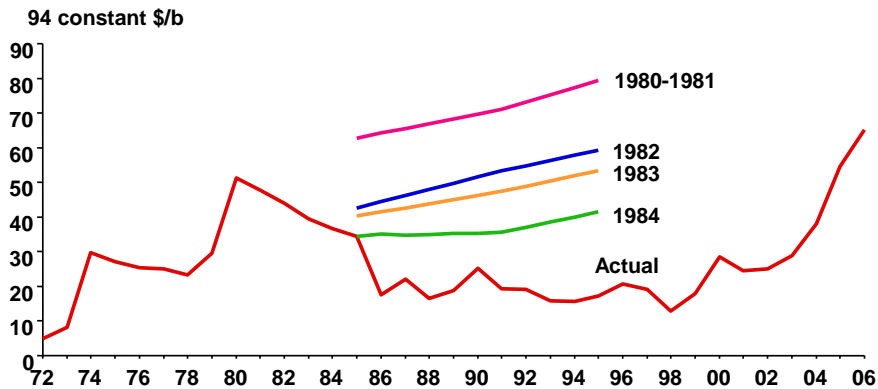
Crude oil price and crises



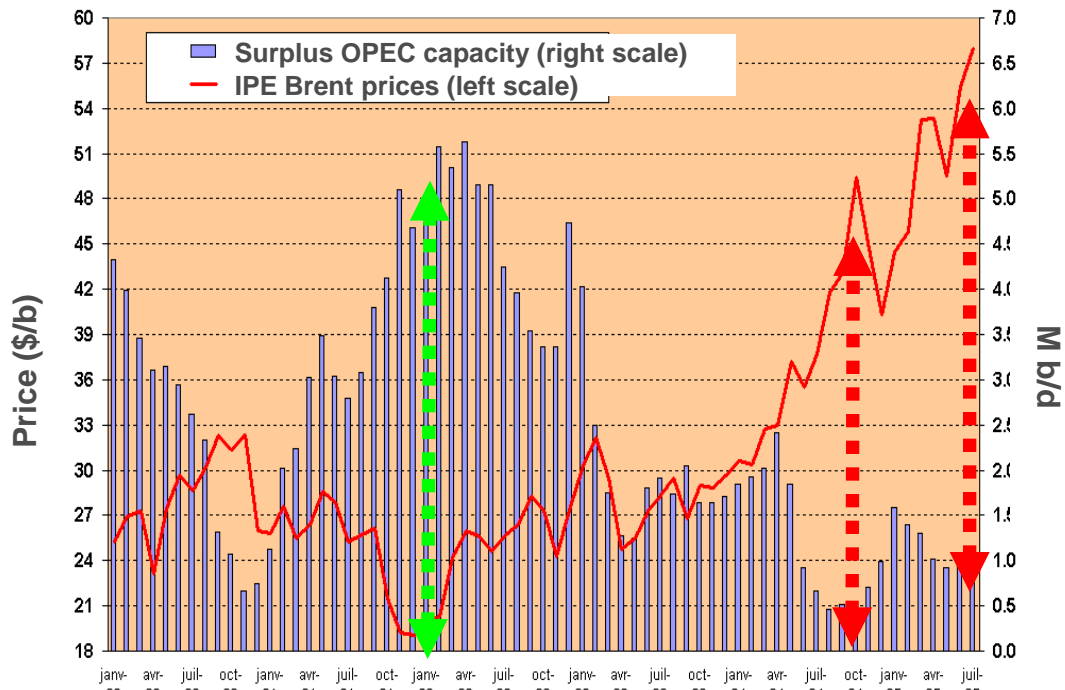
\$²⁰⁰⁸/bb Brent price



What is driving oil prices today ?



- Financial press: stocks, stocks market anticipations...
- Economic press: investment, economic growth,....
- Green/red press: speculation, speculation, greed....



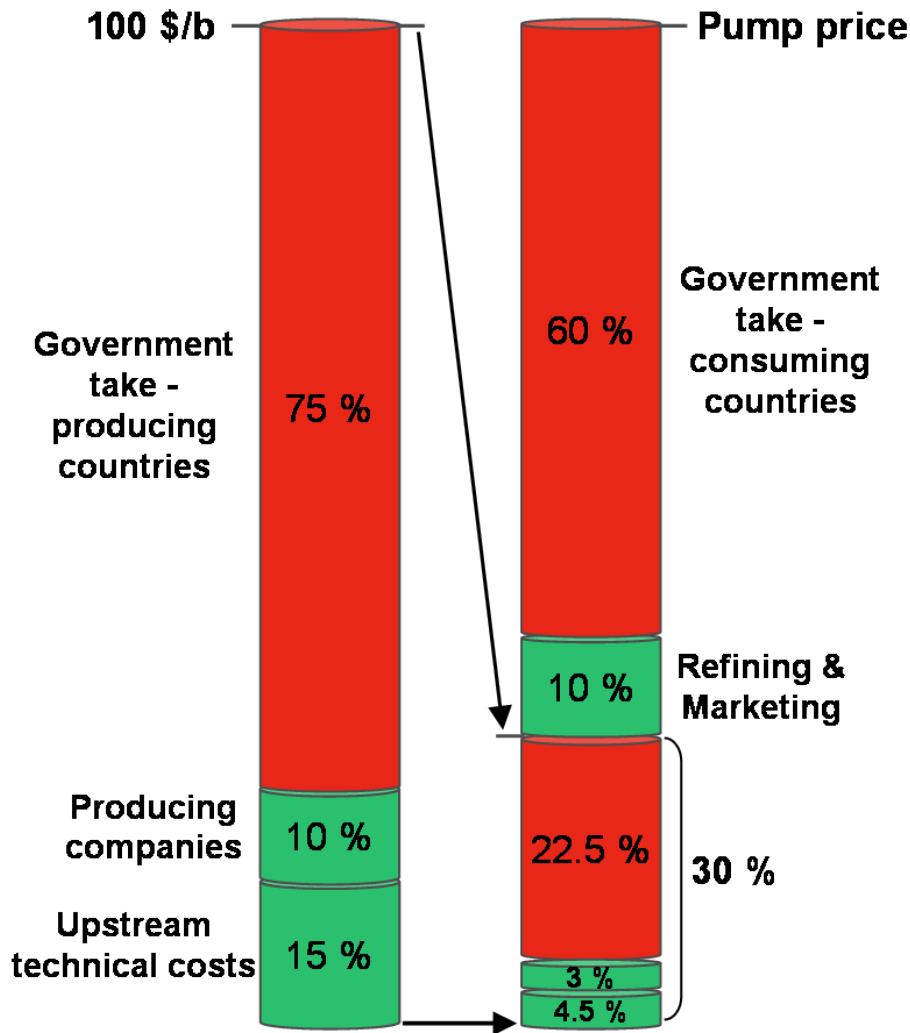
Sources : AIE - PLATTS - IFP.

- All these explanations are partially relevant : world unused surplus capacity is the key factor



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The key paradoxes of the oil industry



► At 100 \$/b crude oil, the upstream worldwide average technical costs represent 15% , while 10% are for the producing companies and around 75% for the **producing countries** «government take ».

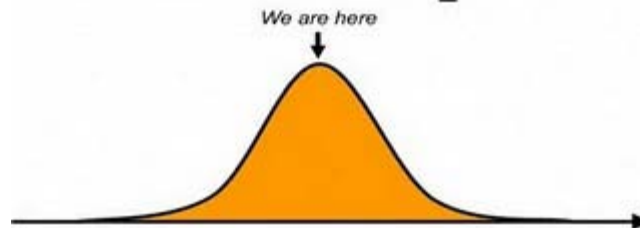
► These 100 \$/b « crude oil cost » represent an average 30% of the pumps prices in the E.U. The other 70% consist of 60% for the **consuming countries** «government take », and 10% for downstream costs (refining and marketing).



History & peak oil scenario

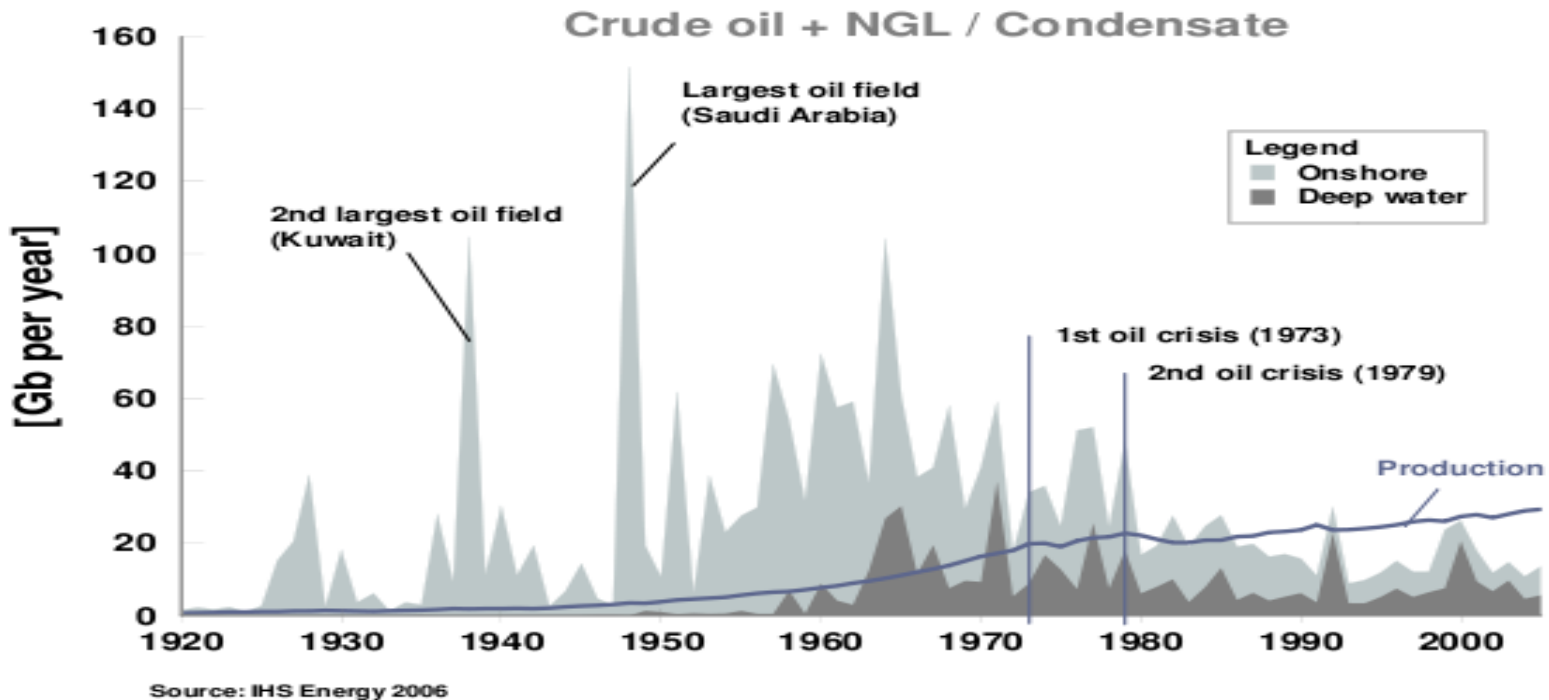


Wake up!!!



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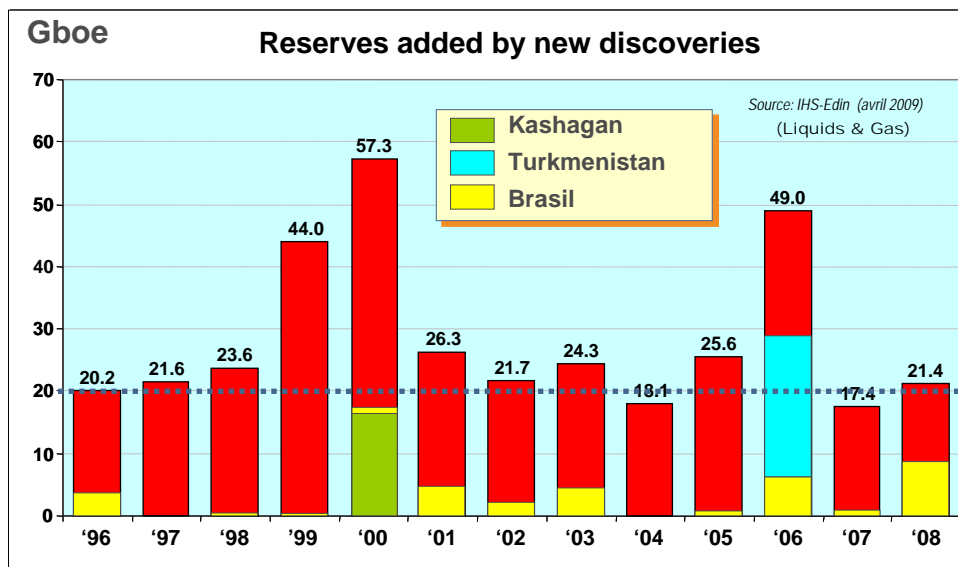
History of oil discoveries



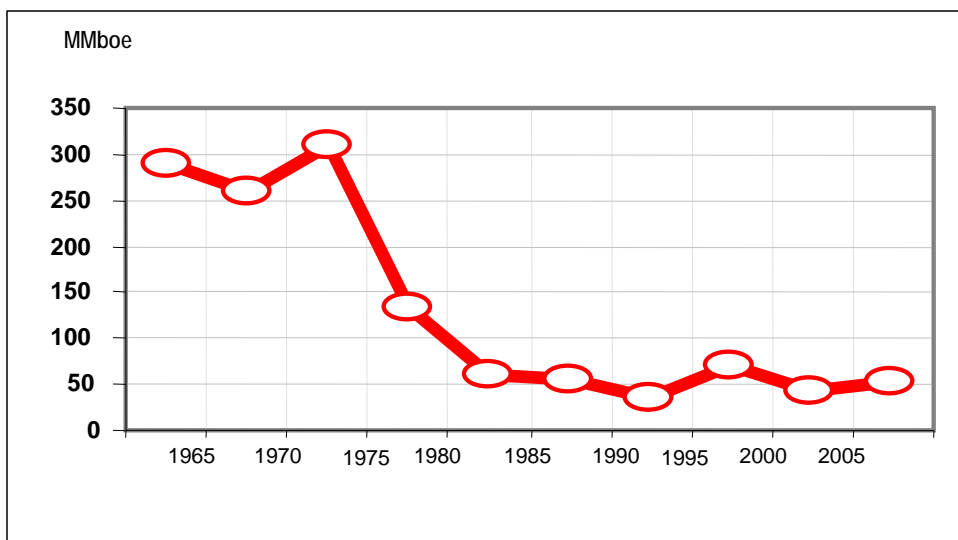
Oil history a strong link with history and geopolitics of the whole XX° century



History of oil discoveries

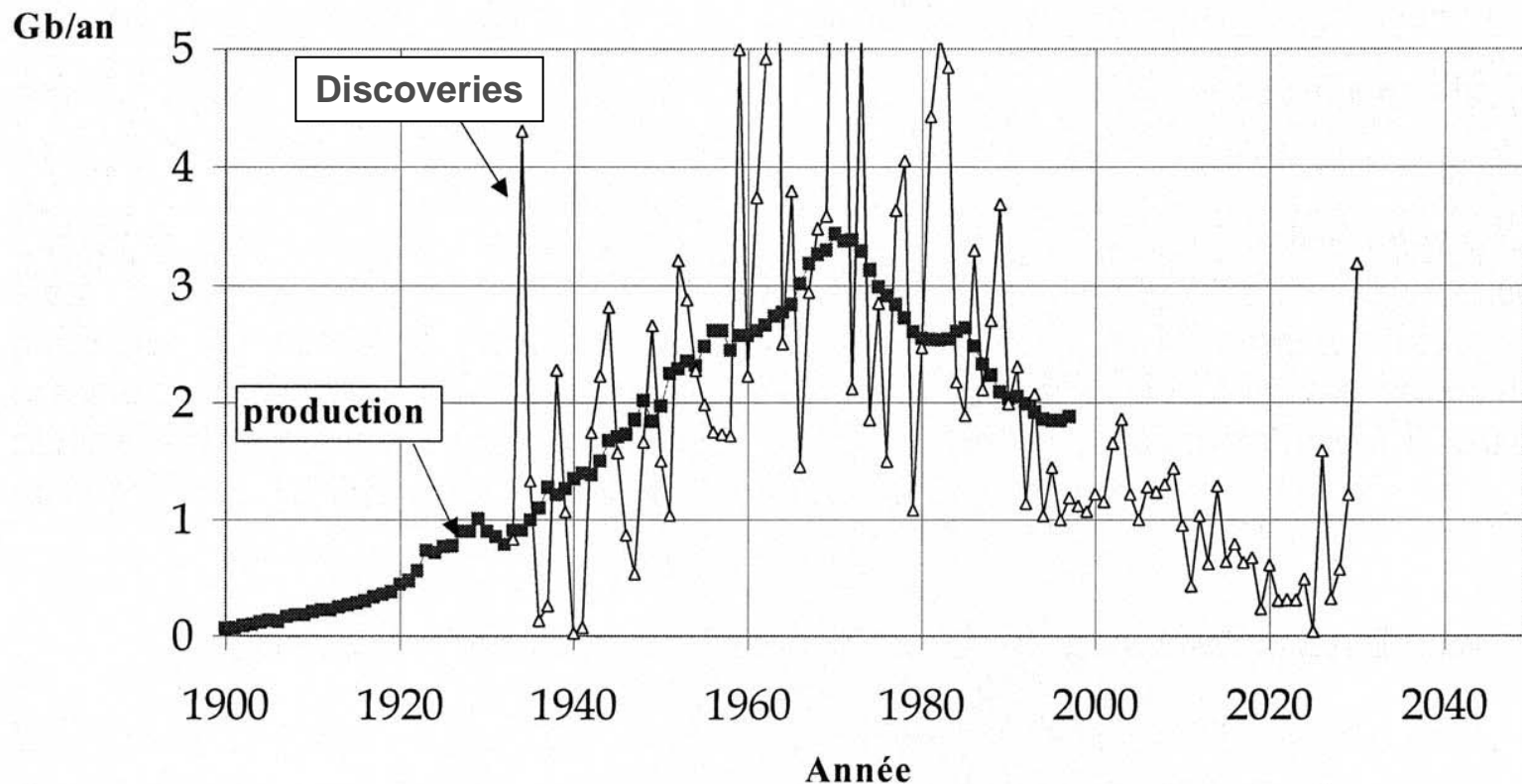


- ▶ World discoveries flat since 1996 at 20Gboe per year (excluding nugget effect).
 - ▶ 10 Gb oil and 10 Gboe gas
 - ▶ 8 Gboe discovered by NOC
 - ▶ 10 Gboe discovered by IOC
 - ▶ 2 Gboe discovered by others



- ▶ Average size of discoveries constant since 1980

Peak oil origin : the irreversible decline of oil production in the USA



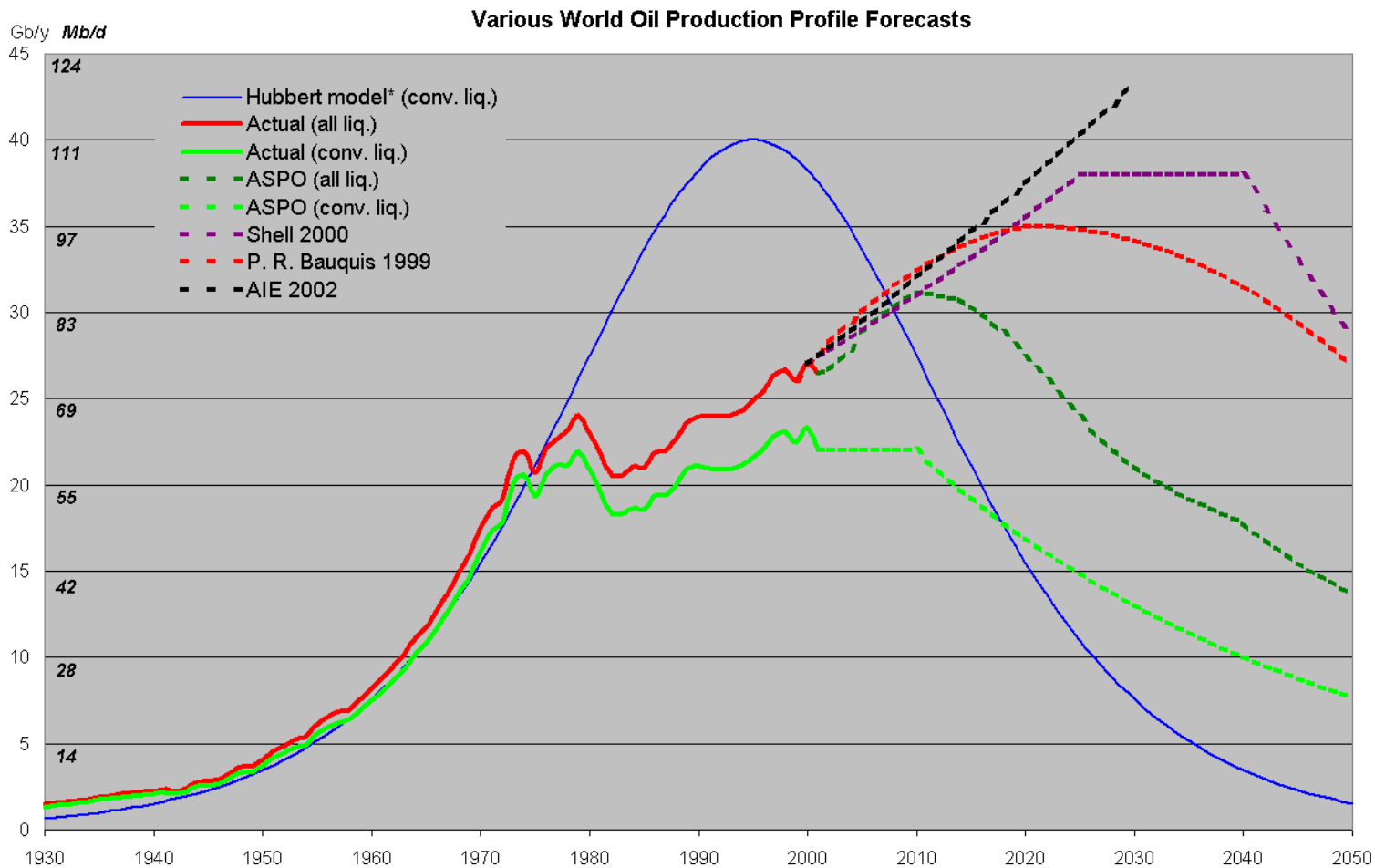
(*) Discoveries are registered as per their initially declared sizes and their timing is « forwarded » by 33 years

Source : King Hubbert 1956 - Updated by Jean Laherrere



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Various world oil production profile forecasts



Source: ASPO Uppsala 2002 press release - USGS mean estimates 2000 (Shell) - Author

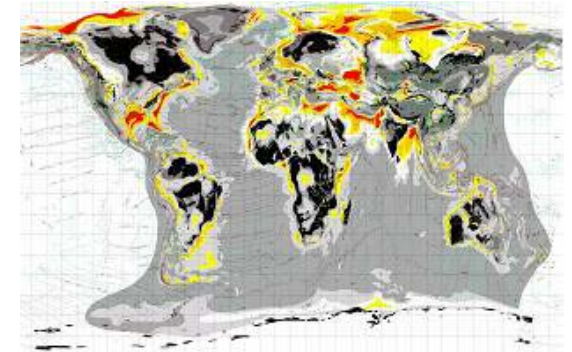
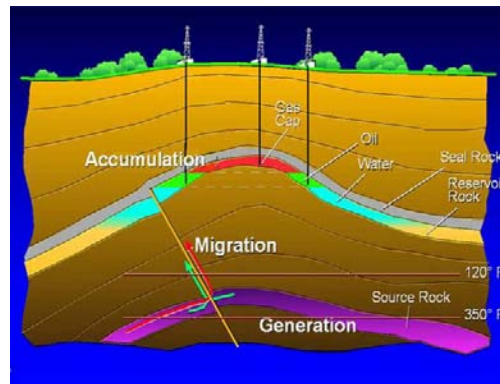
* Best fit for a Hubbert model based on current ultimate reserves estimates.

PRB/VL 2003



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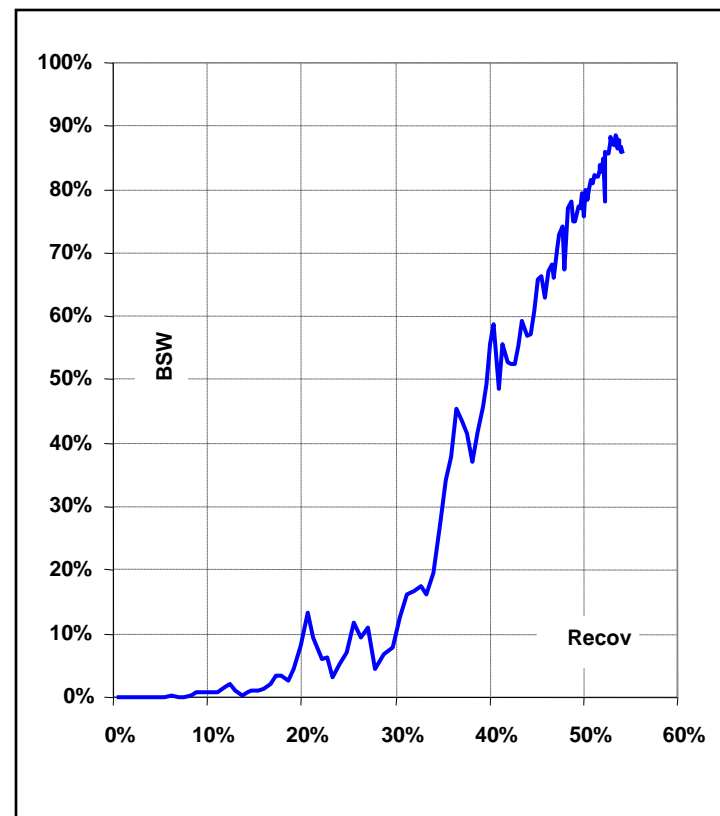
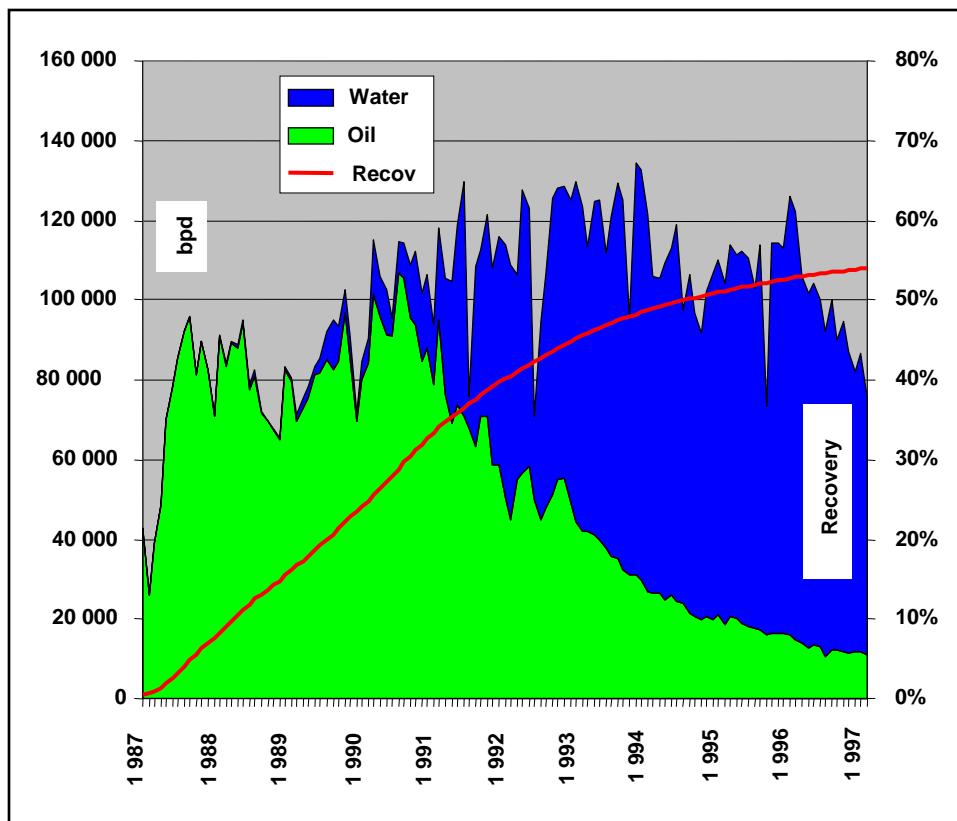
Resources-Productions evaluations



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From resources to reserves: production profiles liquids

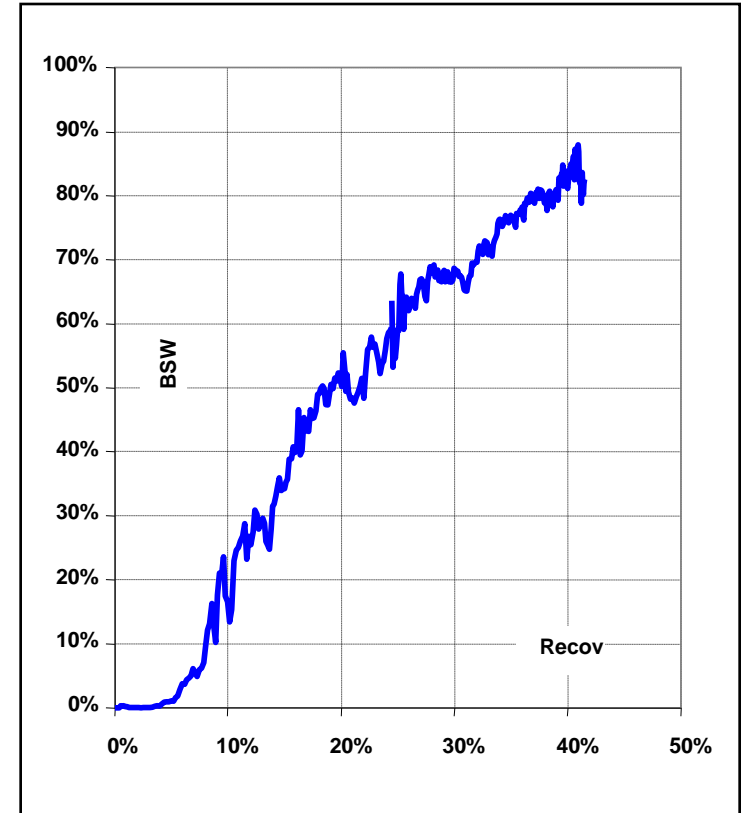
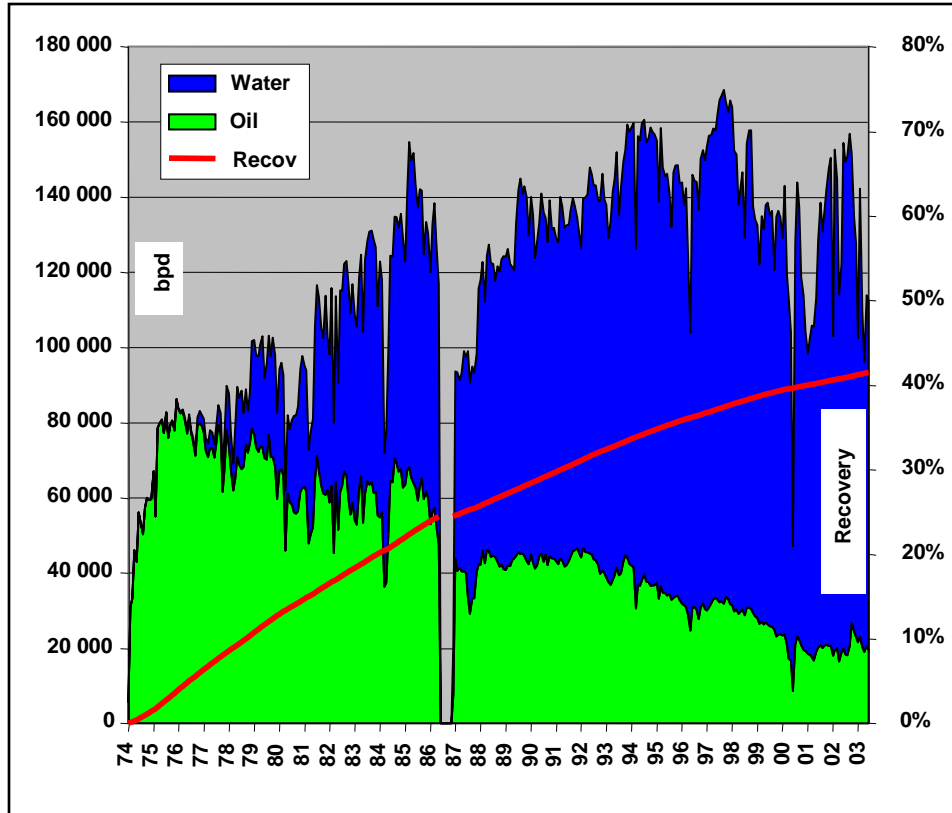
North Sea clastics



Source GSR Total P.Carpentier et al

From resources to reserves: production profiles liquids

Middle East carbonates

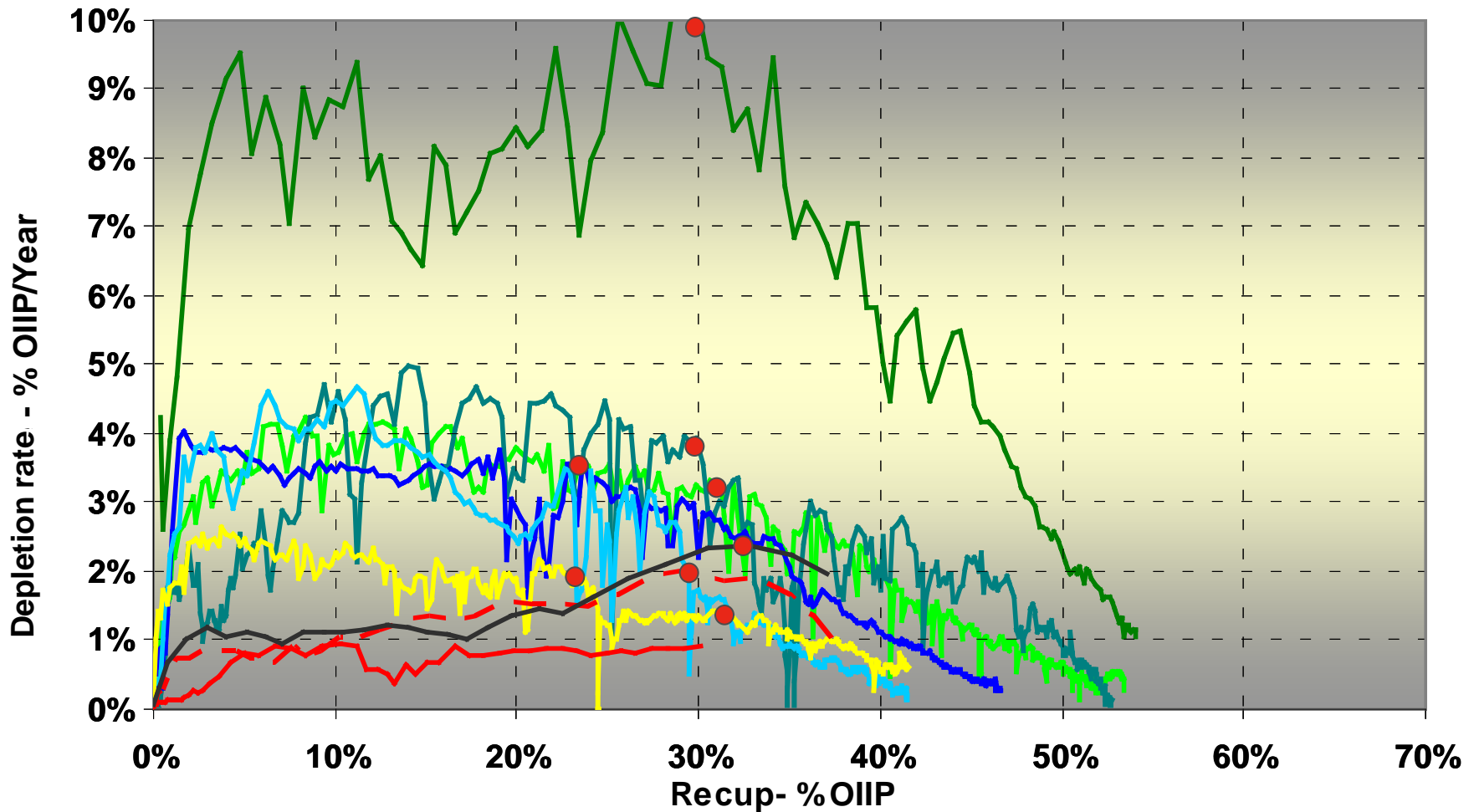


Source GSR Total P.Carpentier et al

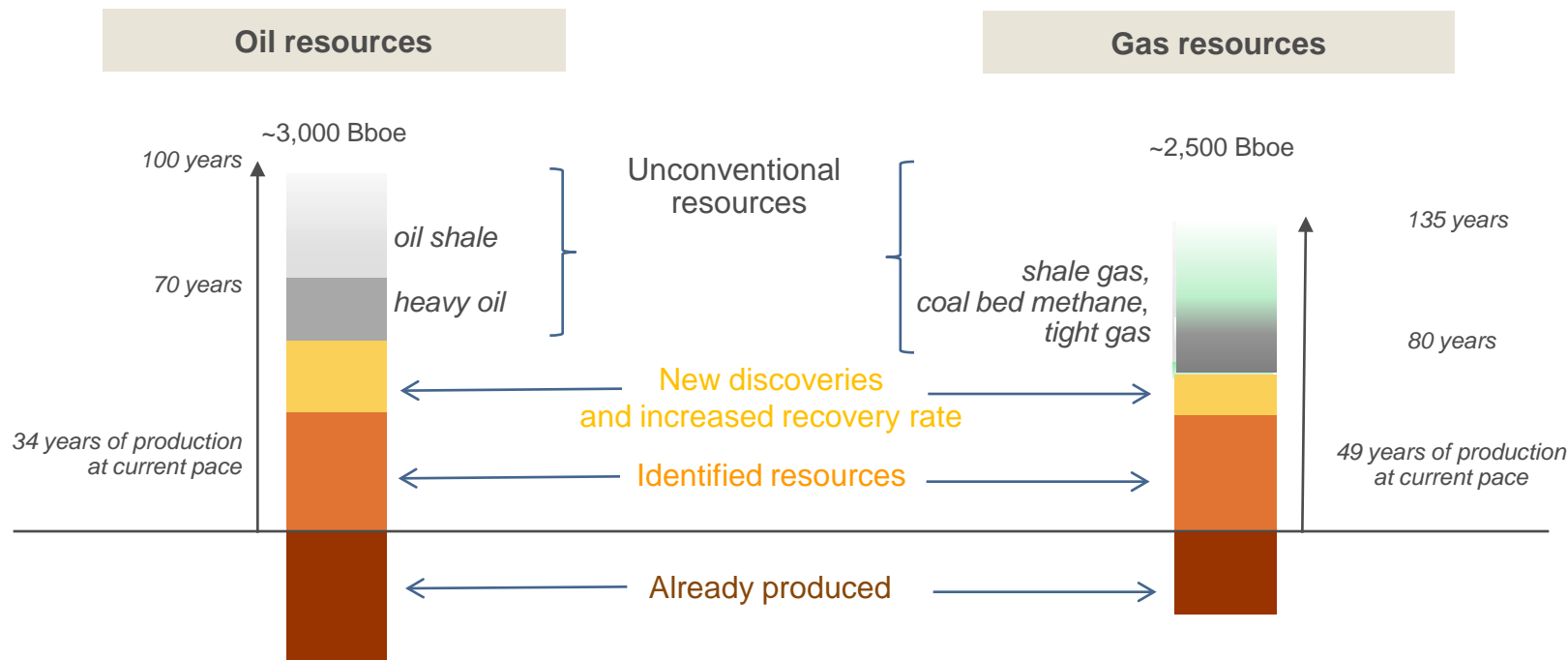


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Normalisation of production profiles



Significant resources yet to be produced



- › Conventional oil located mainly in the Middle East
- › Heavy oil concentrated in Canada and Venezuela

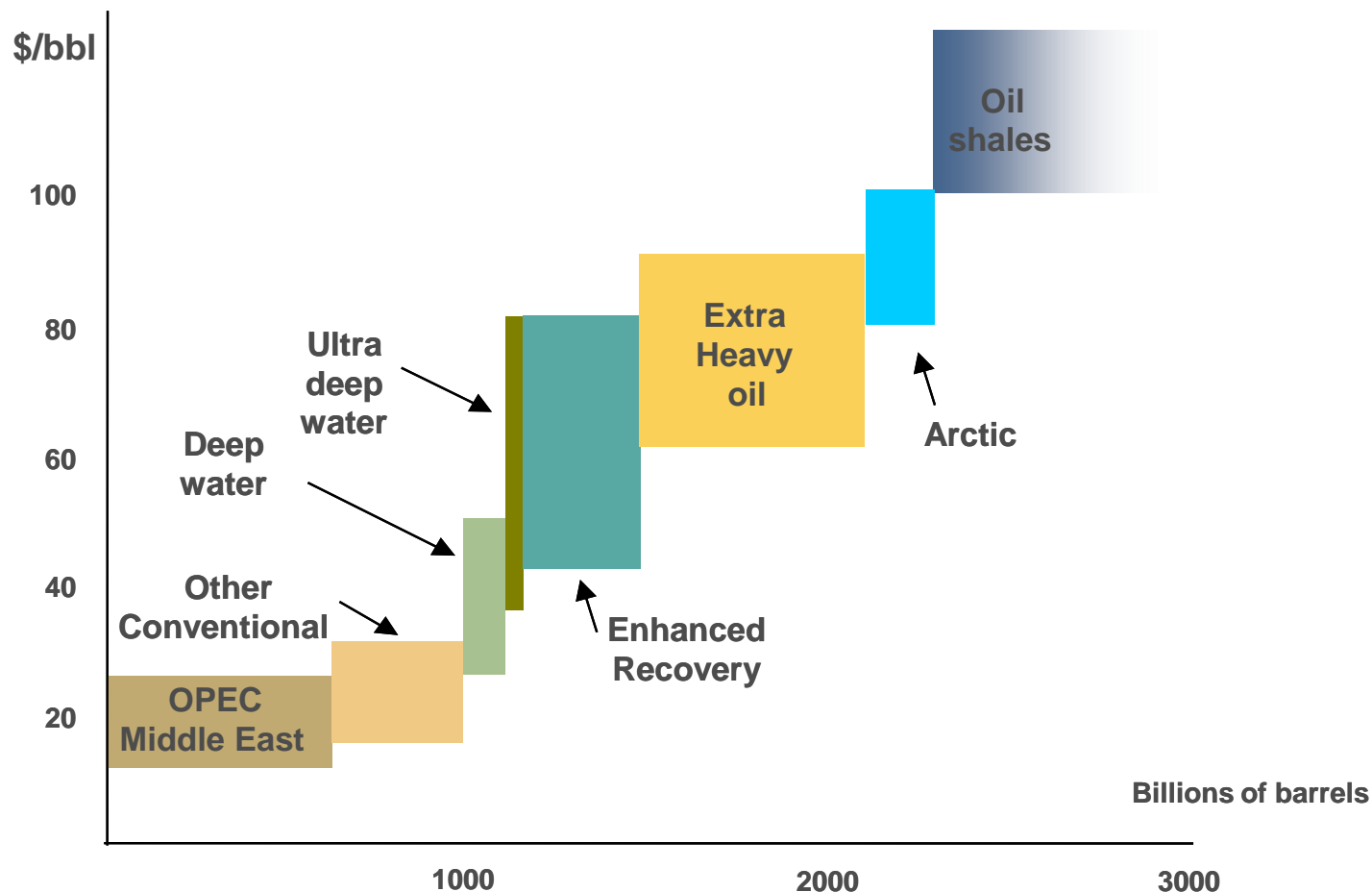
- › Conventional gas resources concentrated in Russia, Iran and Qatar
- › Development of shale gas production in the US driving a re-evaluation of unconventional gas resources

Large resources available, but require advanced technology and large scale investment

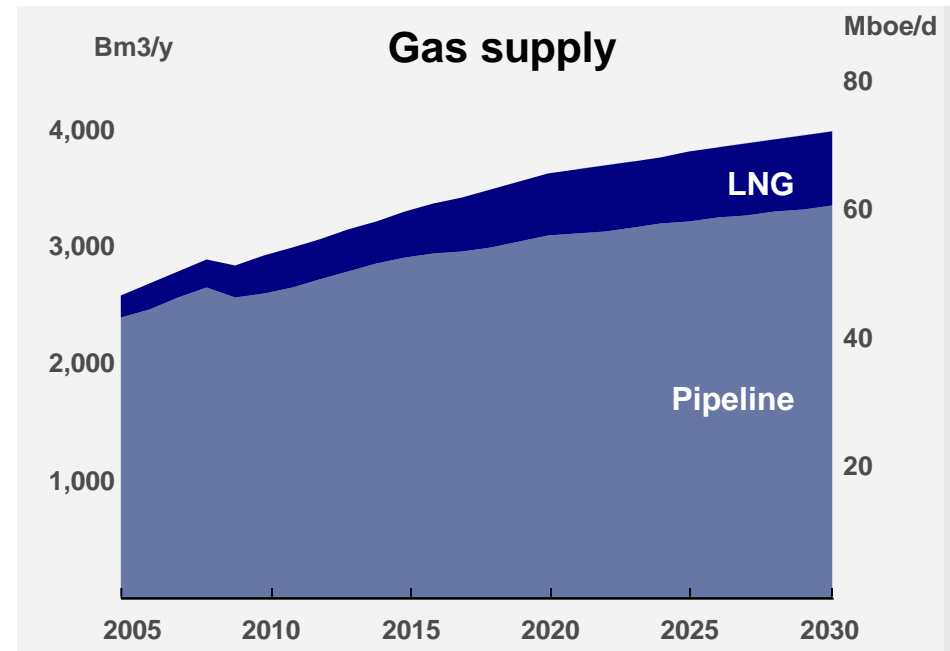
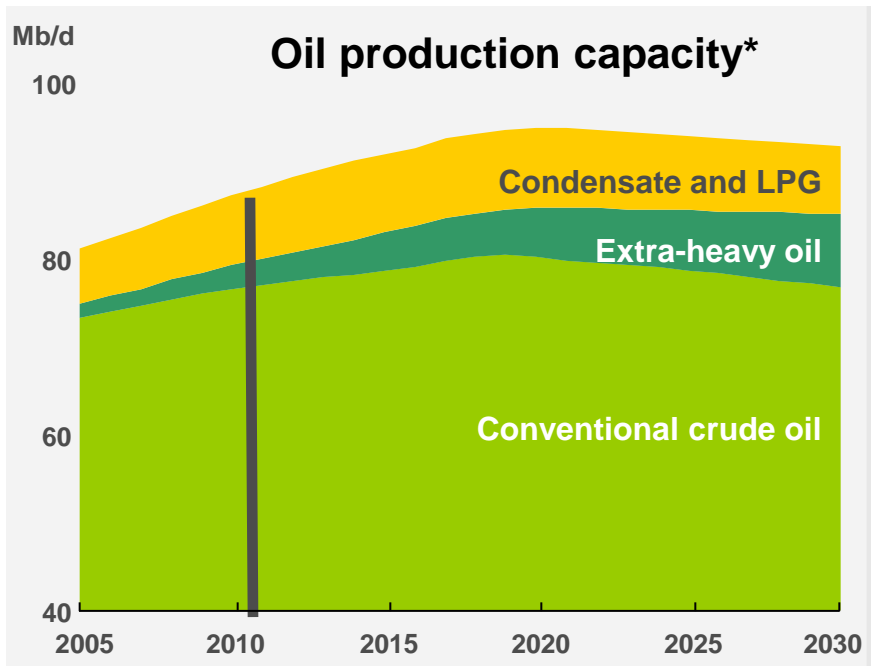
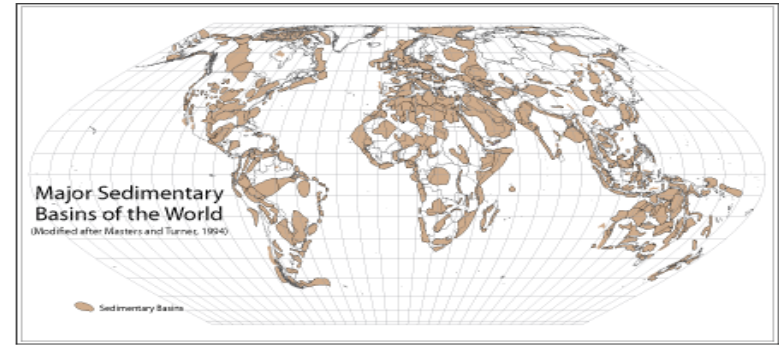
« The stone age did not end by lack of stones » Sheik Mohamed Yaki Yamani

Huge investments for the highly technical oil projects

Break even oil price in 2010
(IRR >10%)



The 2010 « TOTAL view » of future world O&G productions



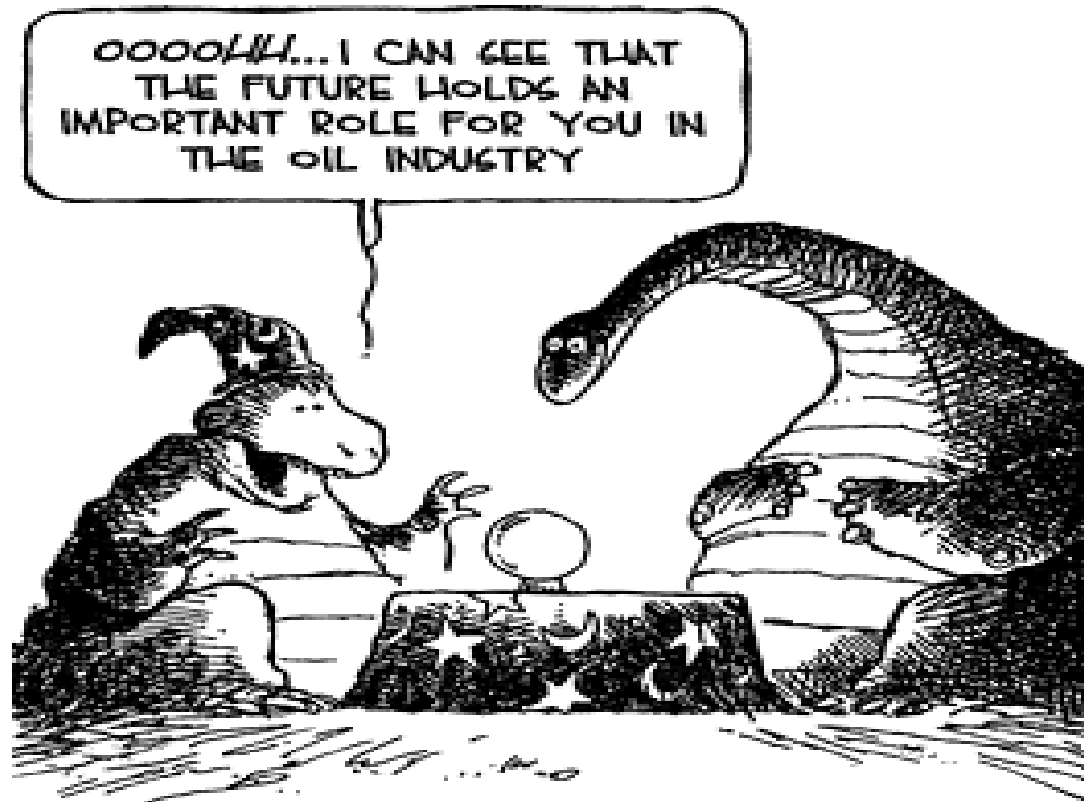
* excluding biofuels, CTL, GTL, but including extra-heavy oil and condensate



TOTAL

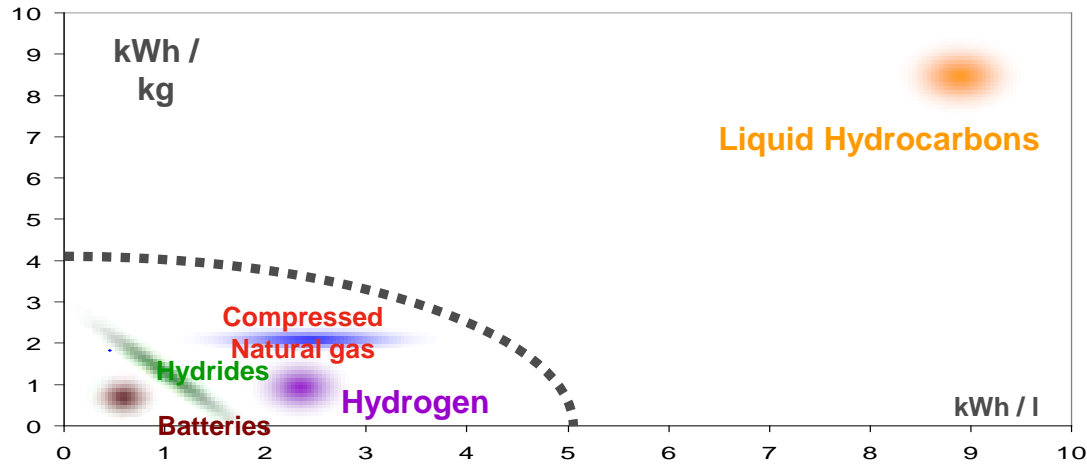
What energy future ?

Educated guesses



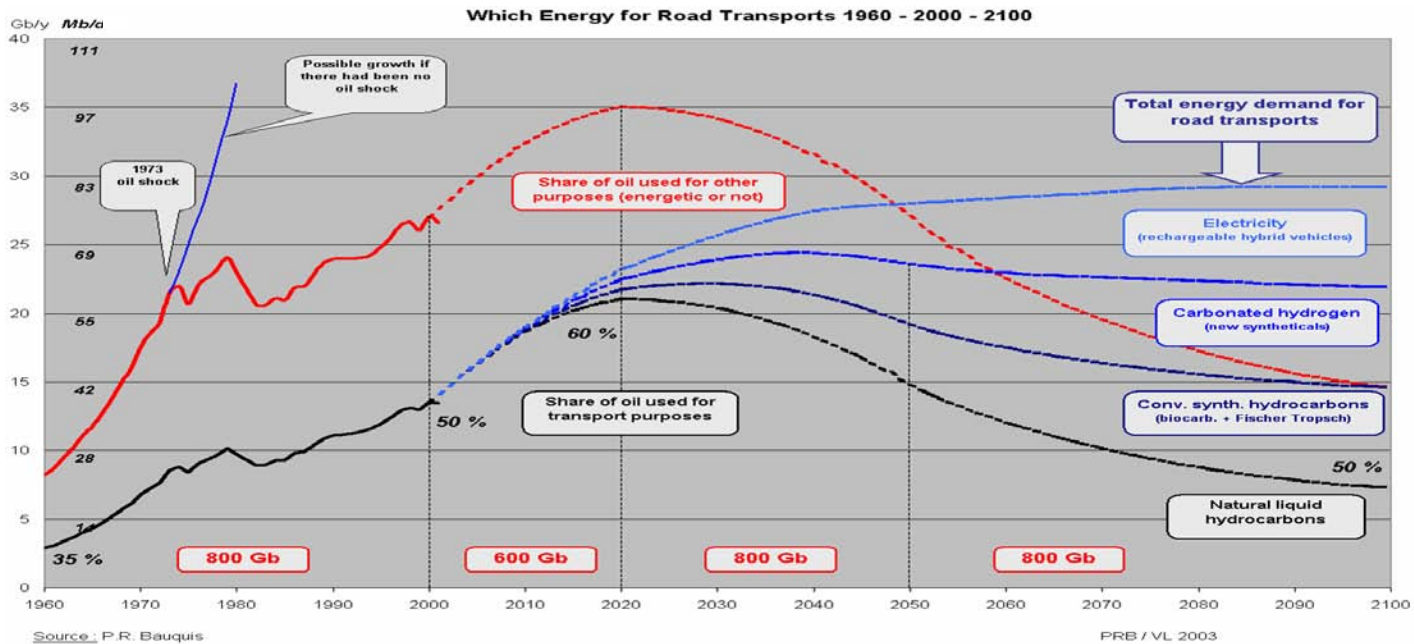
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Which energy for road transports



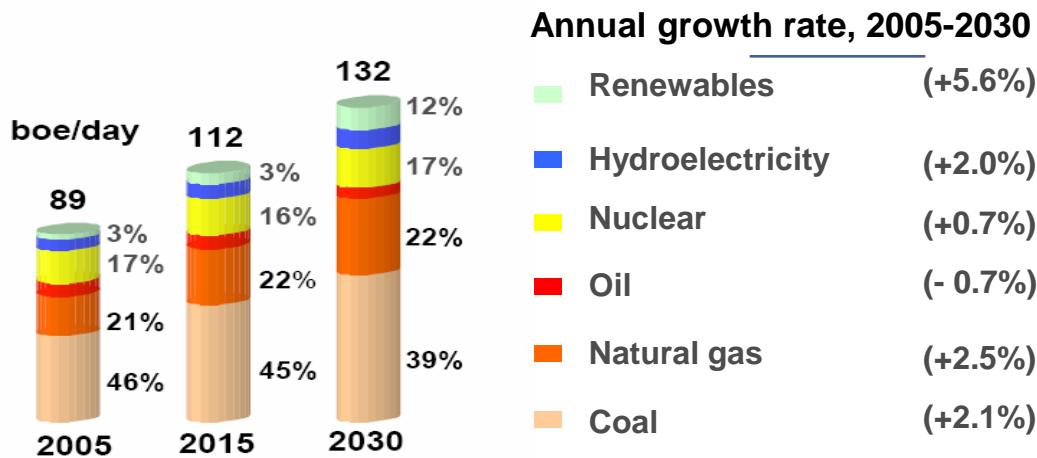
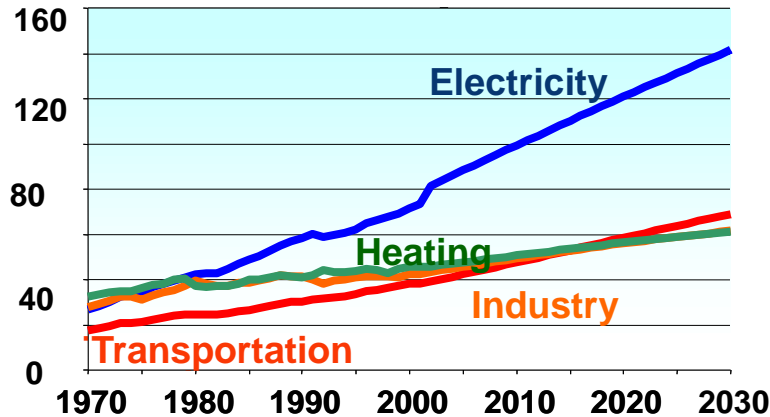
Compressed natural gas :
steel or composite tanks

Hydrogen :
liquid or compressed from 5000 to 10000 PSI in composite tanks



Gas demand

IEA primary energy consumption by segment



Sources: Total, AIE Alternative Policy Scenario

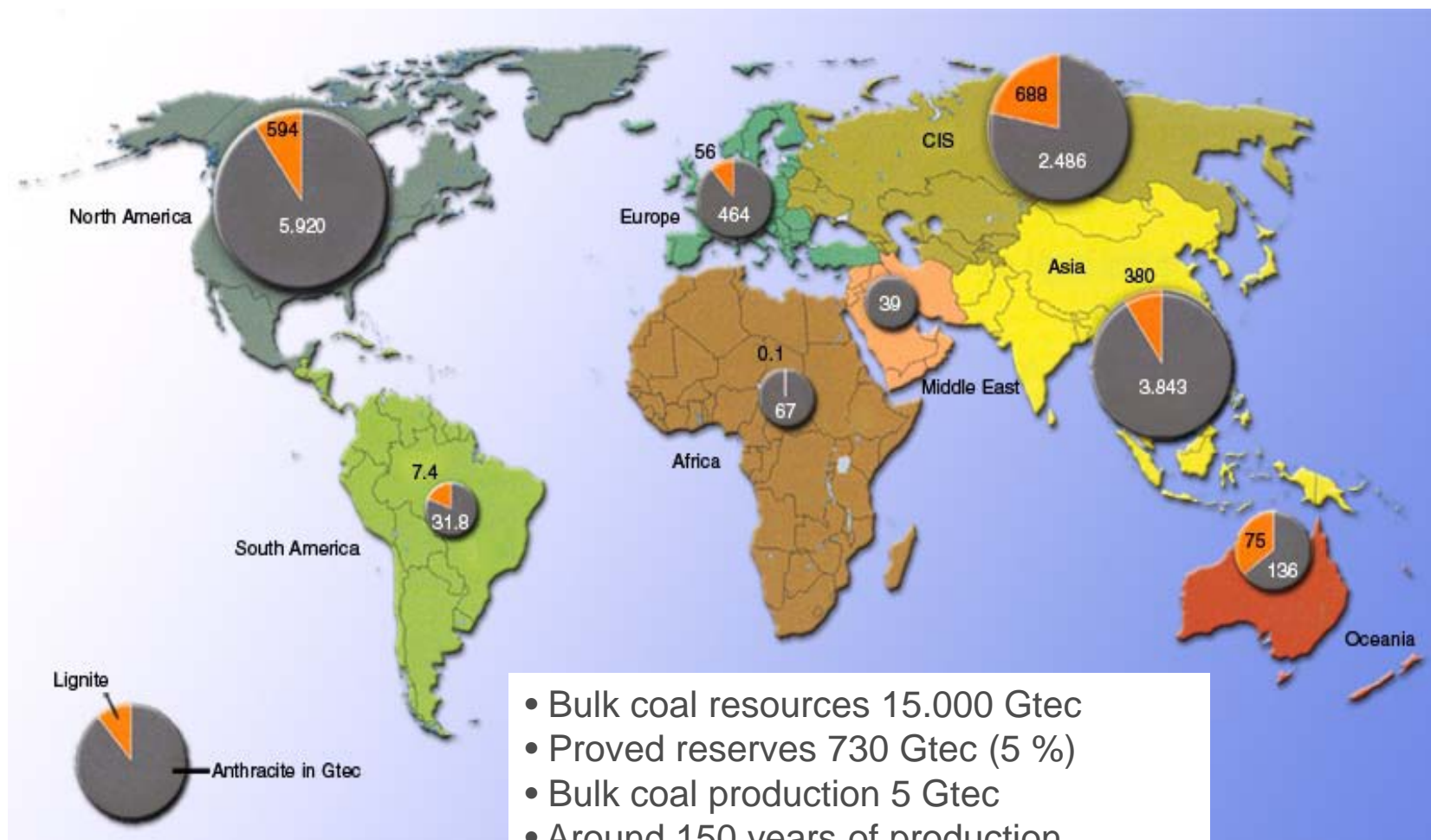
- ▶ Coal and gas are the main fuels used for power generation.
- ▶ Renewables are expected to increase their share

mainly driven by power generation, the fastest-growing energy demand segment



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Coal is back : coal resources



- Bulk coal resources 15.000 Gtec
- Proved reserves 730 Gtec (5 %)
- Bulk coal production 5 Gtec
- Around 150 years of production

FROM F.W. WELLMER

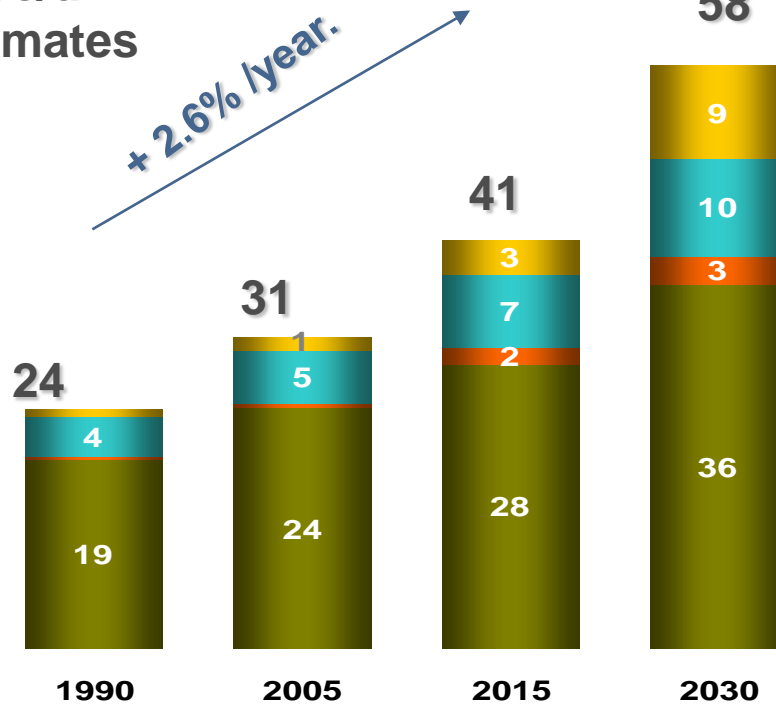
... Capture and sequestration of CO2 is not an option, it is a necessity.



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Renewable energies ... unavoidable, necessary and useful !

Mboe/d
Estimates



Annual growth
2005 - 2030

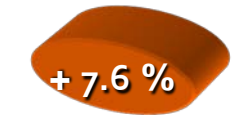
■ Solar, wind, etc



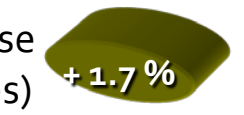
■ Hydroelectric power



■ Biofuels (incl BtL)



■ Biomass (incl. forest use in developing countries)

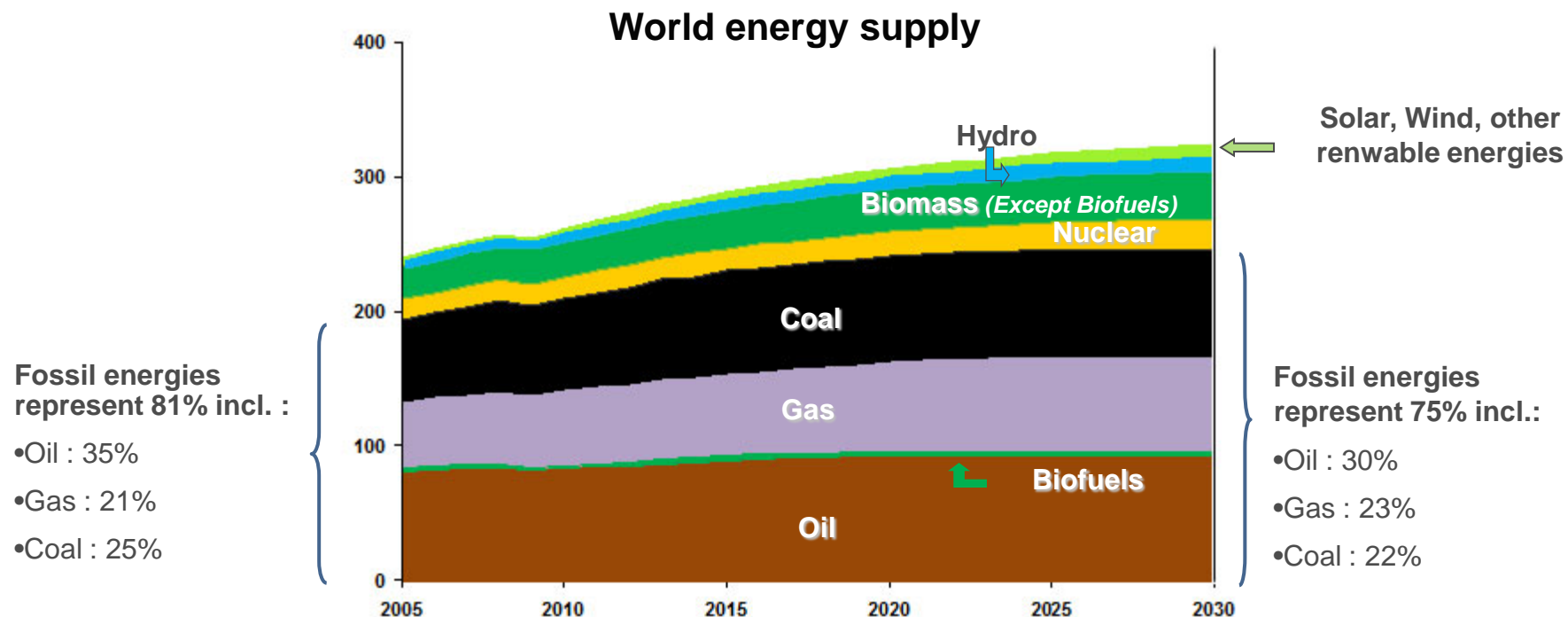


Source: IEA World Energy Outlook , Alternative Policy Scenario



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Fossil energies to represent 75% of energy supply in 2030



Energy mix is unavoidable, necessary and useful

Source : Total estimates.

* Million barrels of oil equivalent per day.



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Future needs oil and gas O&G business needs talented new crew



A sustainable development challenge



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