

Vision Long Terme de l'Avenir Énergétique

Réunion Groupe IDées et Prospectives

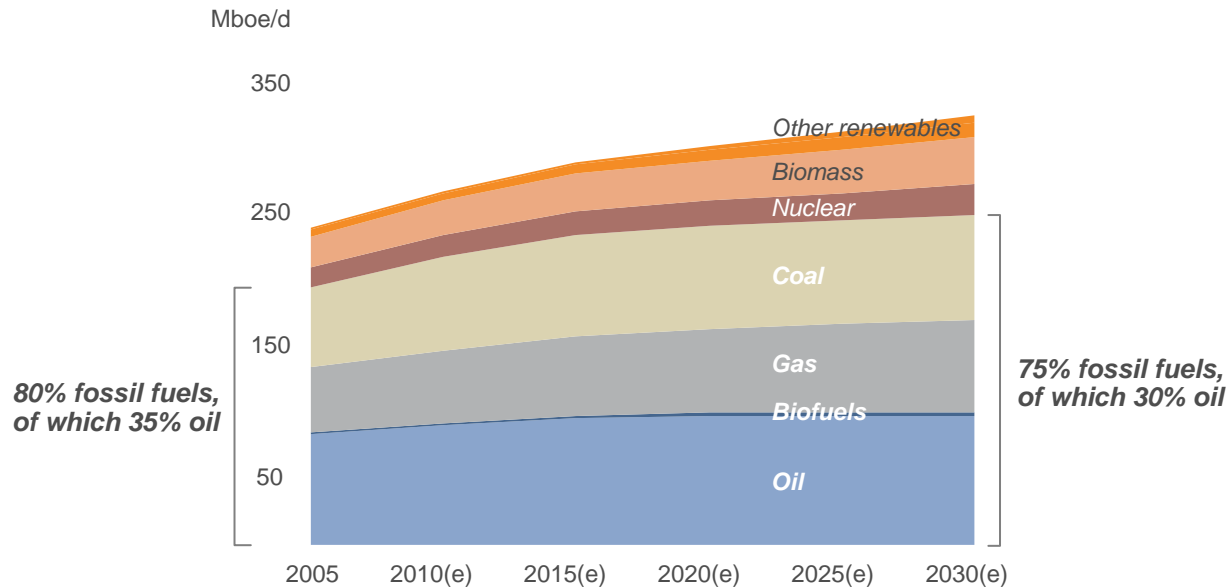
Jeudi 4 novembre 2010

Présentation Bruno Weymuller

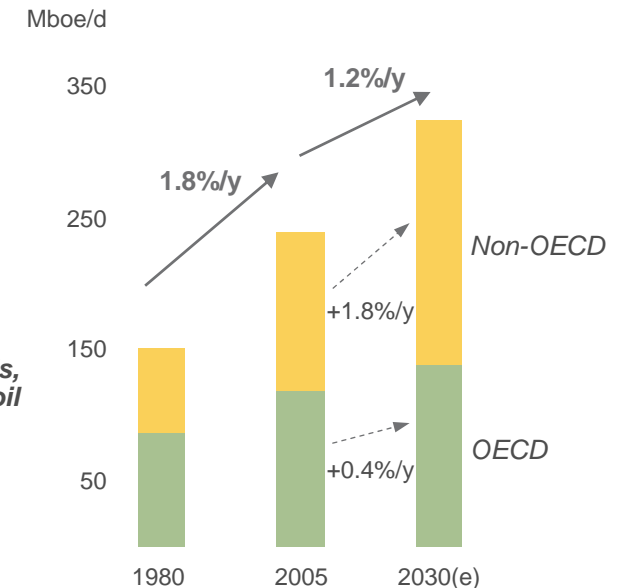


Energy supply constraints will curb energy demand growth

Energy supply



Energy demand



Environmental, economic and resource access constraints affect the energy supply
Energy demand growth will be mainly driven by Asia and the Middle East
Reduced OECD demand growth will continue to contribute to global energy balance

source : Total estimates

2 – TPA, April 2009 - Bruno Weymuller - November 2010



Le demande d'énergie à long terme est portée par la croissance du PIB mondial et de la population...

Moyenne Mondiale (situation actuelle)

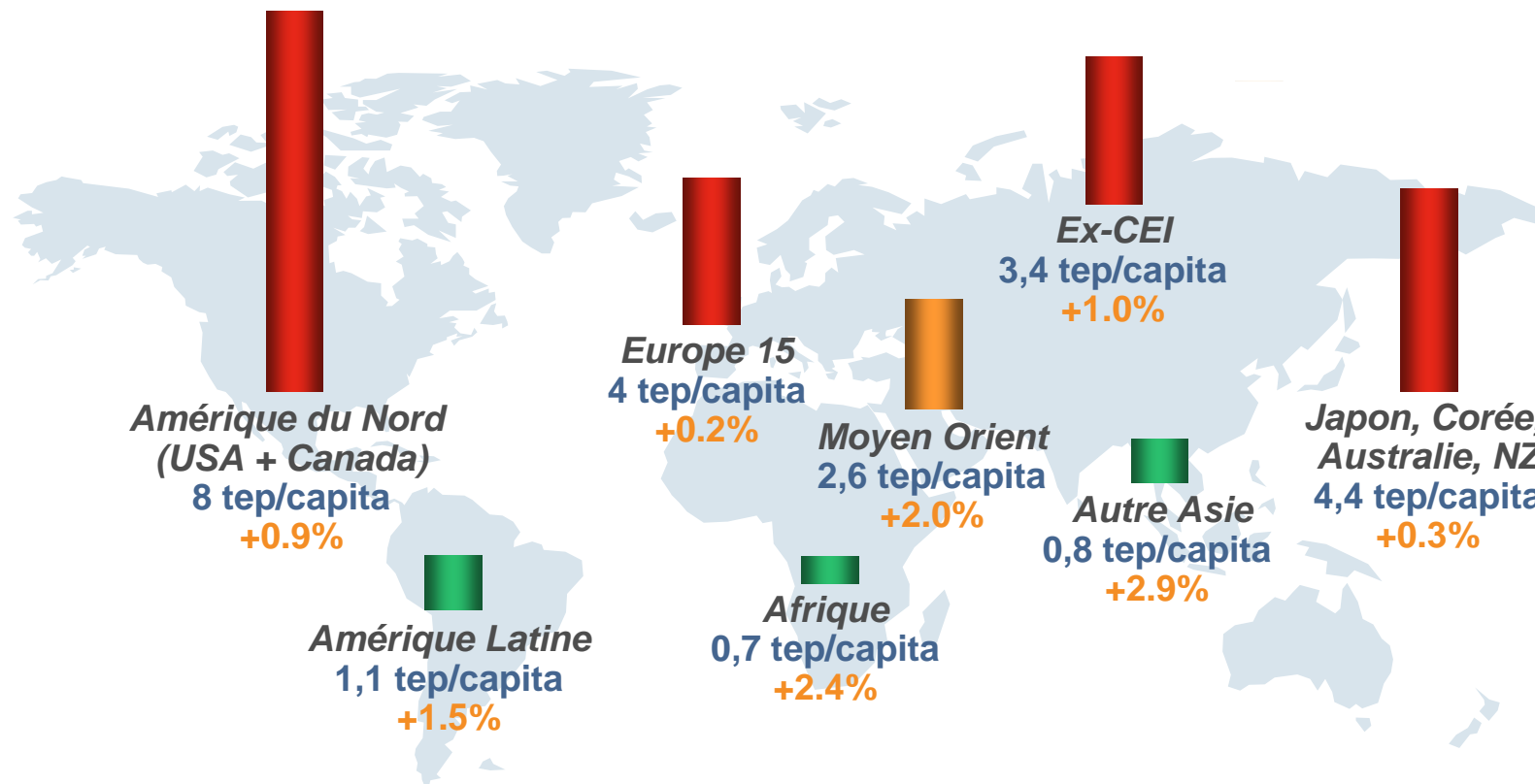
Consommation annuelle d'énergie par tête : 1,8 tep

Croissance de la consommation à 2030 : +1.6%

Pays en développement:

82 % de la population mondiale

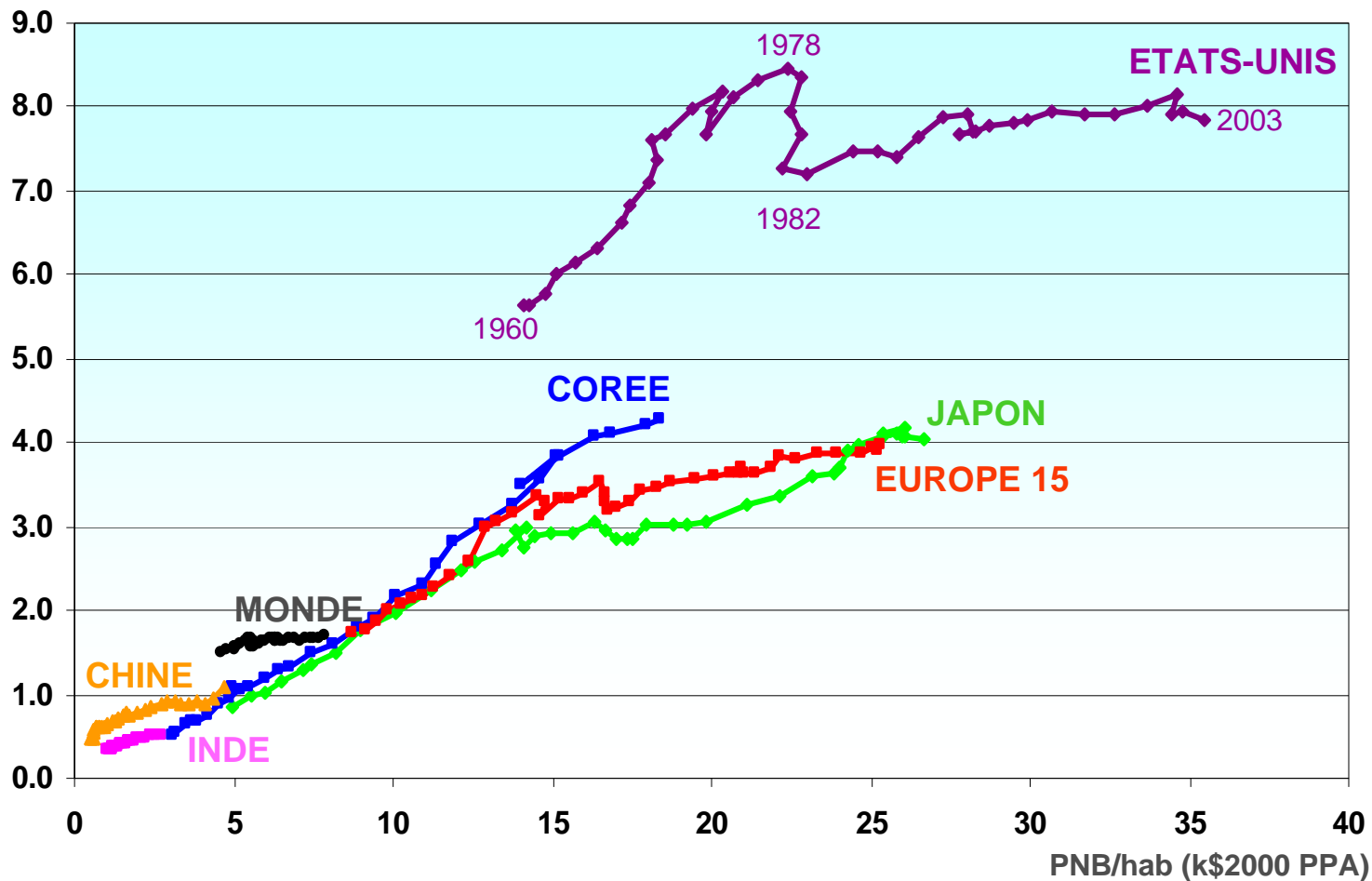
41 % de la consommation d'énergie



**Une large partie de la population mondiale ne dispose pas des formes modernes d'énergie.
Comment permettre l'accès aux besoins énergétiques ?**

Et plus particulièrement en Inde et en Chine

Offre totale d'énergie primaire entre 1960-2003* (tep/an/hab)



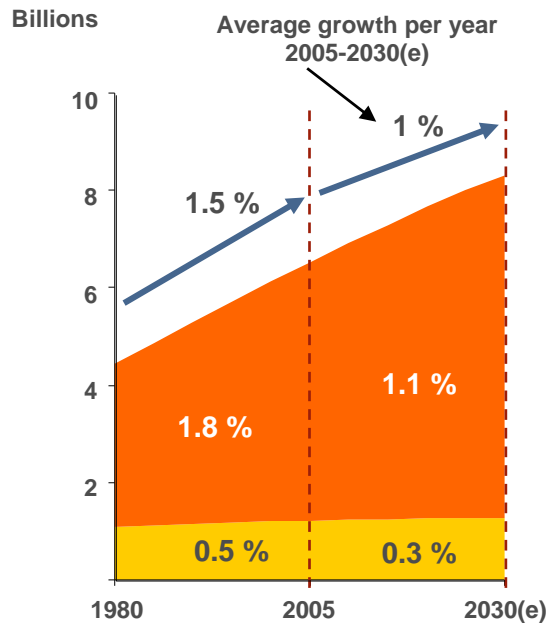
Source : AIE 2005, balance énergétique 2003
Excepté pour la Chine, l'Inde et le Monde, 1971-2003

4 - TOTAL stratégie du groupe, 30 mai 2007 – Bruno Weymuller – November 2010



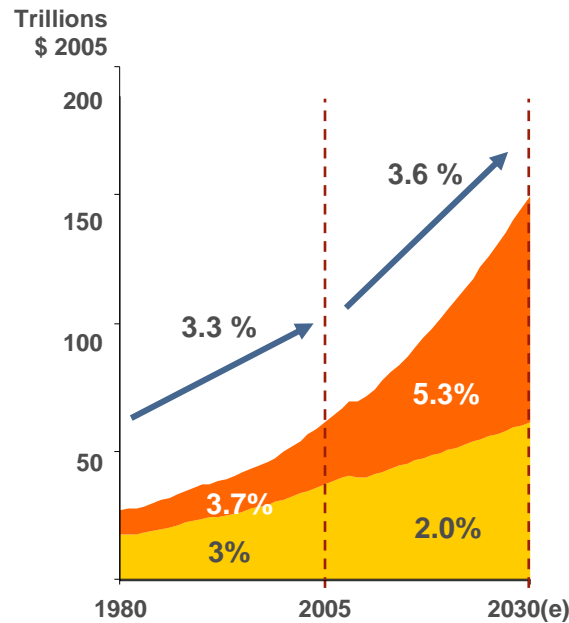
Global energy demand growth

Population

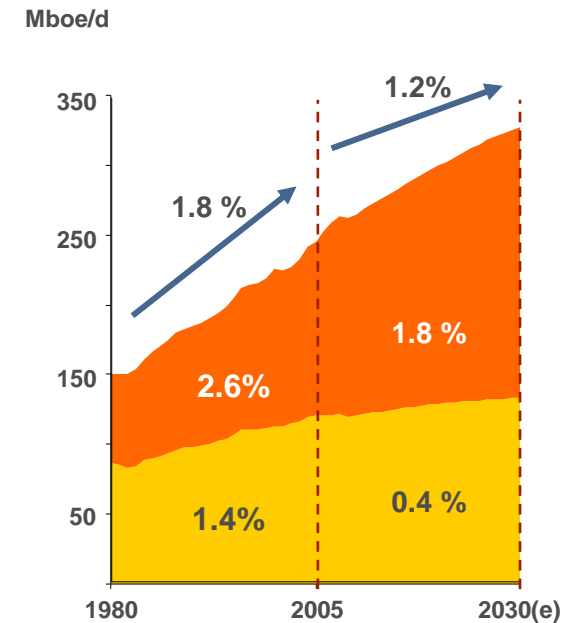


GDP

(purchasing power parity)



Energy demand

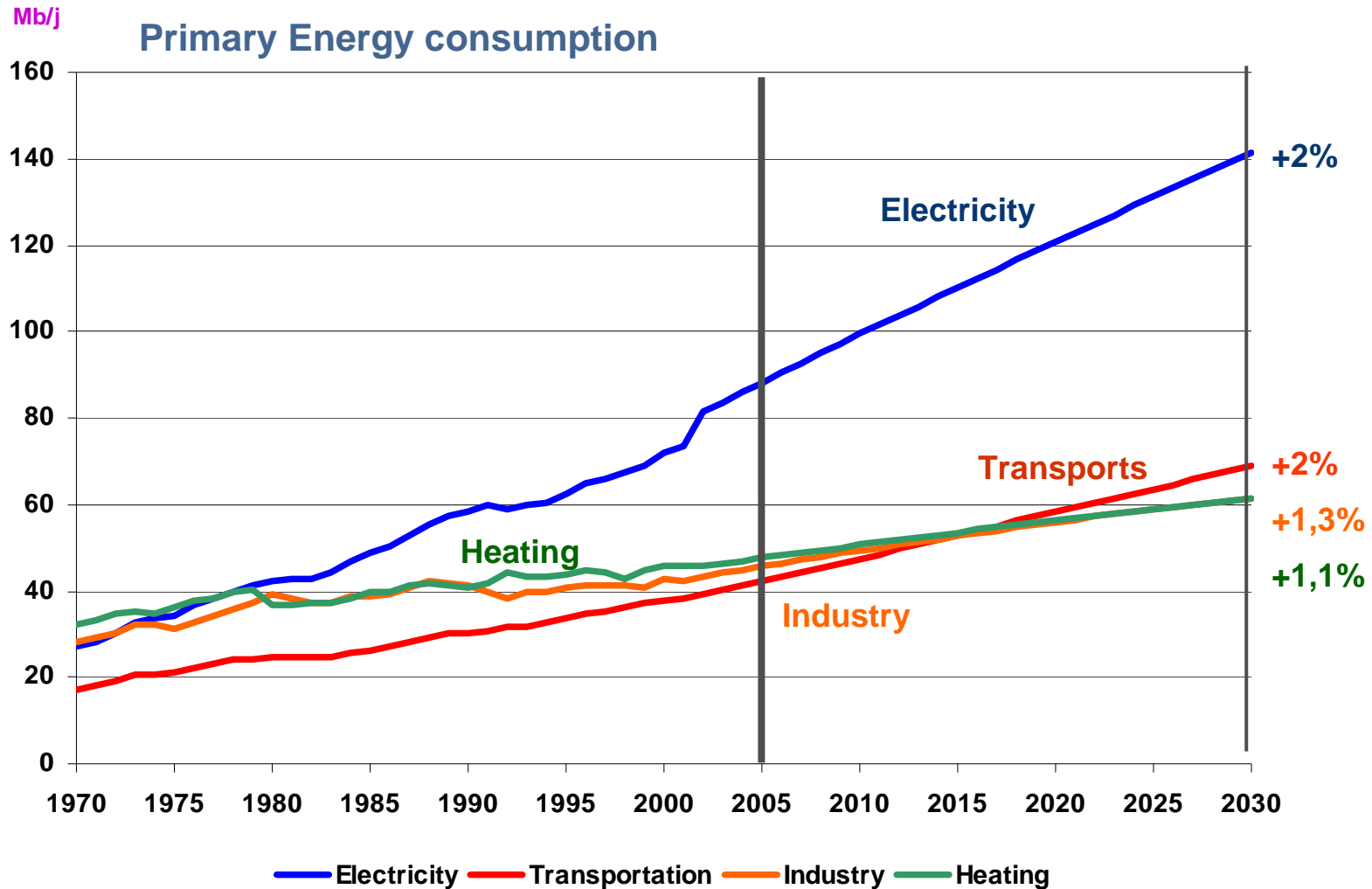


● OECD ● Non-OECD

Energy demand growth mainly driven by transportation and power generation
Need to limit energy demand

Sources : Total estimates

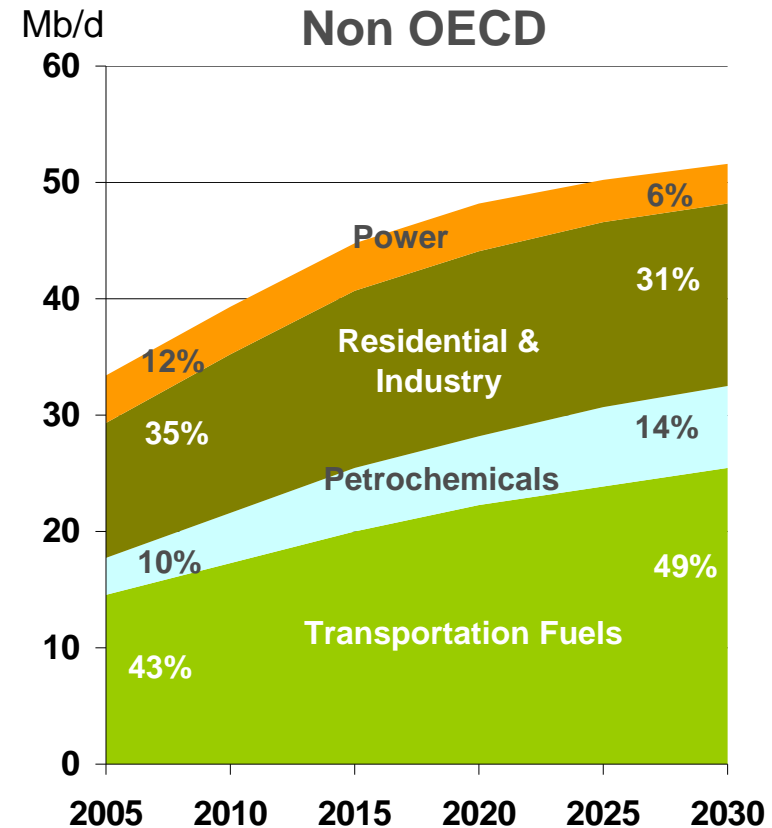
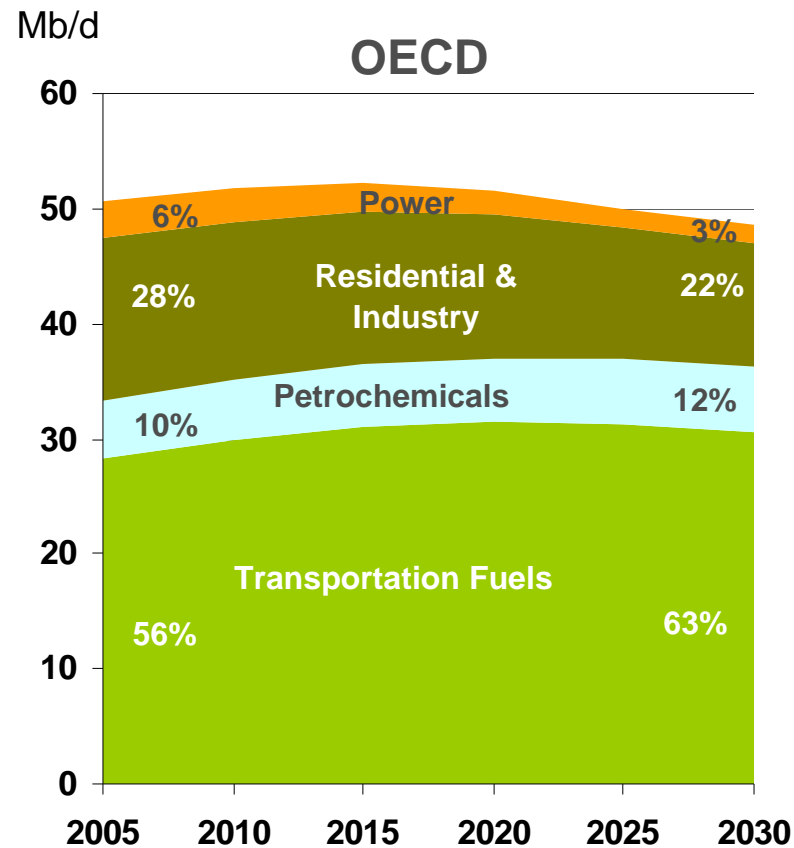
The use of energy : it depends on the level of development



Not the same issues for stationary uses, electricity and transport

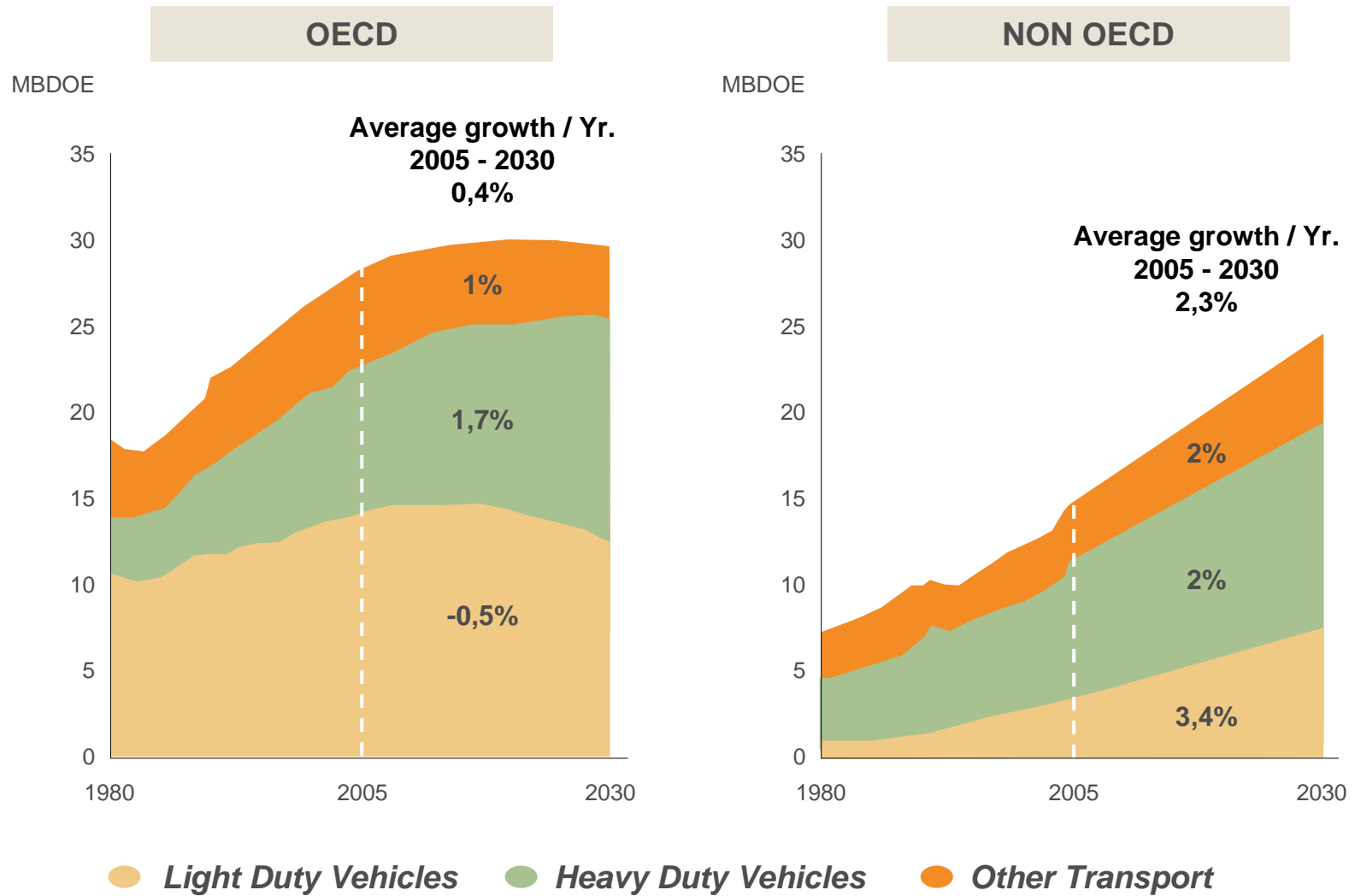
Oil products : demand decrease in OECD countries, consumption concentrated on transport & petrochemicals

Oil product uses



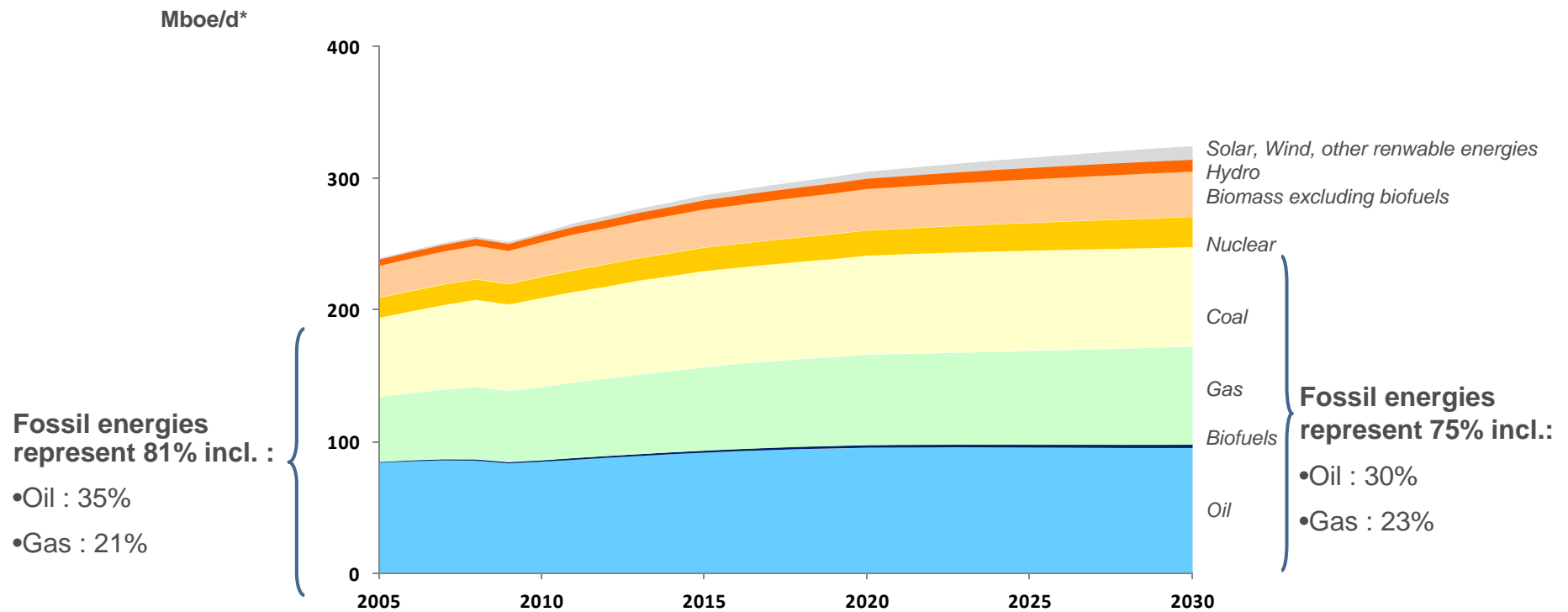
- ▶ Transportation fuels & petrochemicals : +10 % both OECD & non-OECD
- ▶ More efficient cars & more specialized uses

Transportation: current crisis consolidates long term trends



Fossil energies to represent 75% of energy supply in 2030

World energy supply



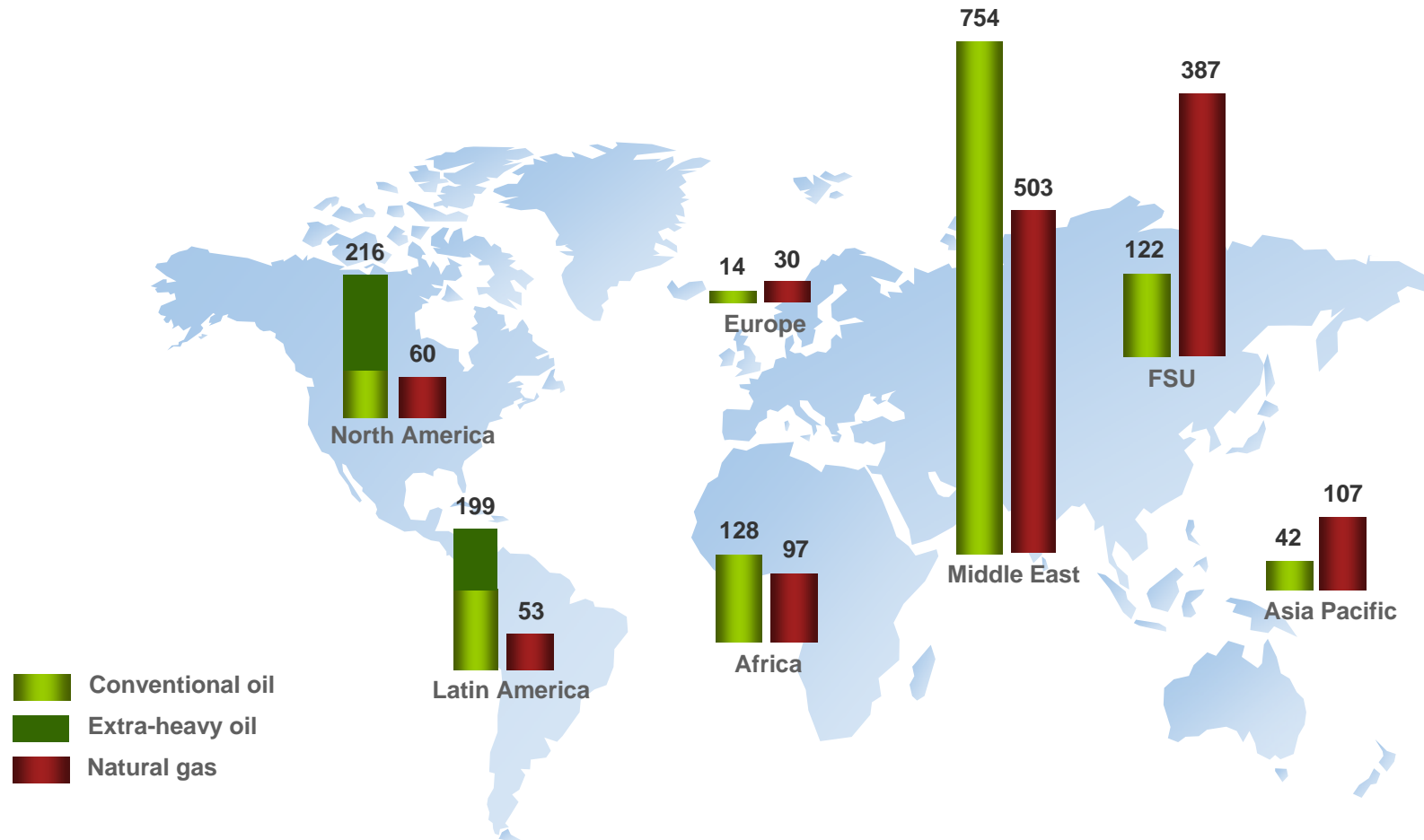
Efficient CO2 emissions management and diversification of energy supply are key issues

Source: Total estimates.

* Million barrels of oil equivalent per day.

Oil and gas world reserves

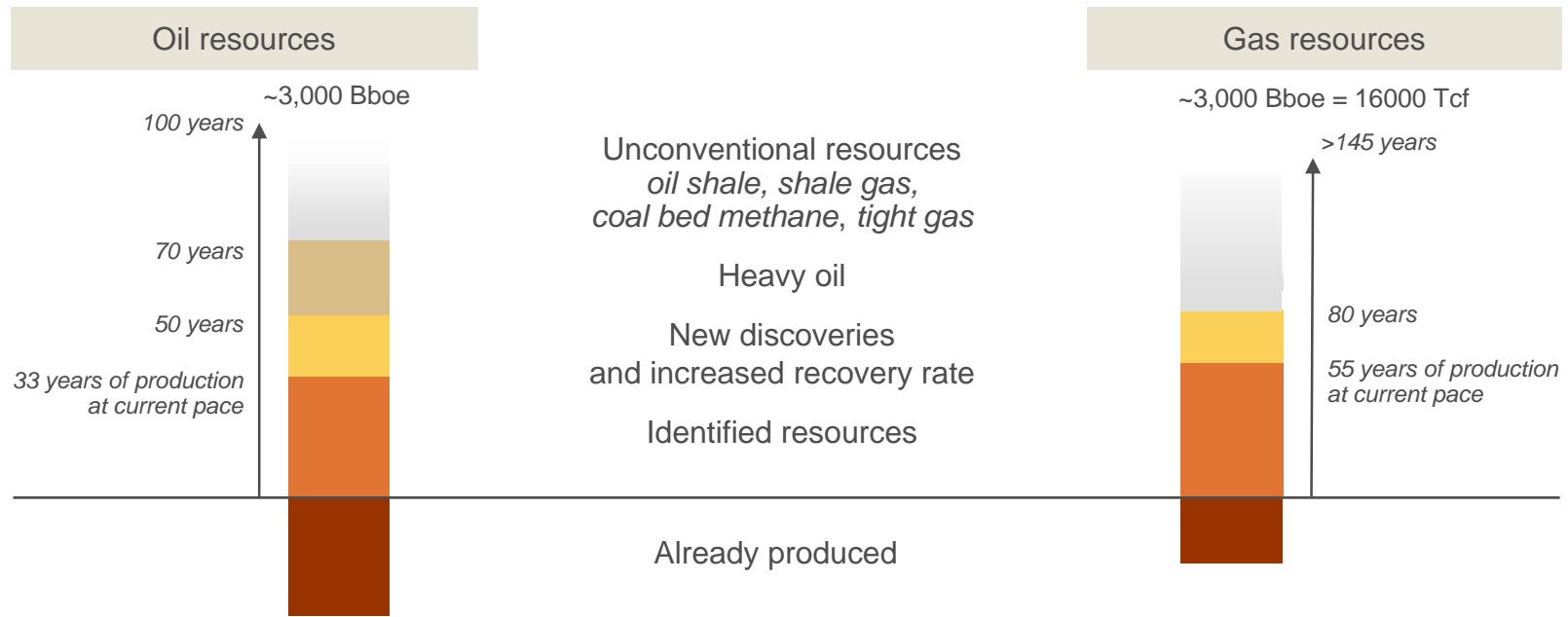
Billion barrels oil equivalent



World oil reserves 31/12/2009 : 1475 Bboe incorporating 230 Bboe of extra-heavy oil
 World gas reserves 31/12/2009 : 1235 Gboe

Sources: O&G Journal 2010, BP SR 2010, USGS, IEA

Significant hydrocarbon 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 reevaluation of unconventional gas resources
- > Transportation and liquefaction constraints limit development of isolated gas resources

Oil and gas resources require advanced technology and large scale investment

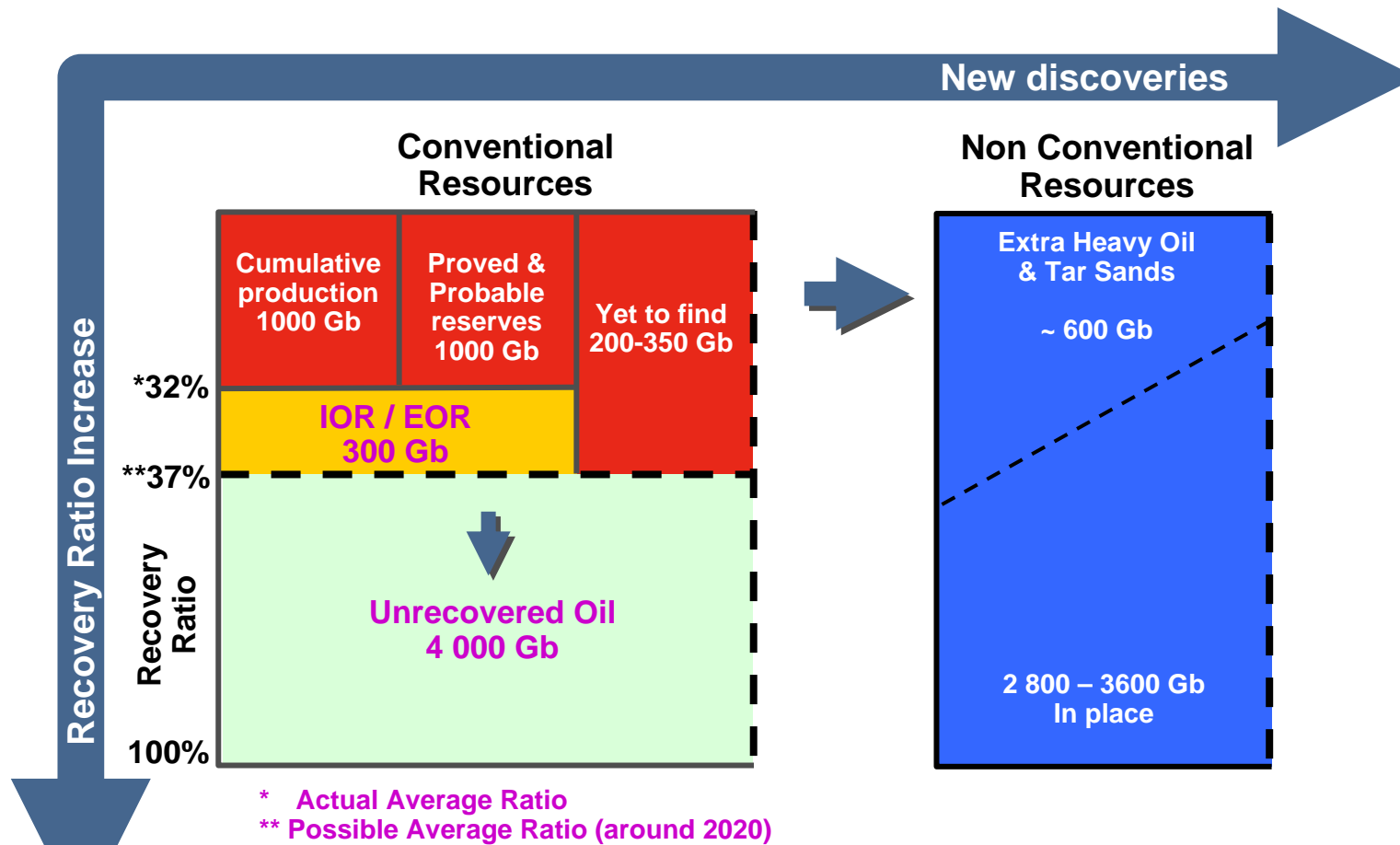
With ample availability of oil and gas and existing infrastructure, hydrocarbons will be dominant fuel source for the next decades

Total estimates

11 - Bruno Weymuller - November 2010



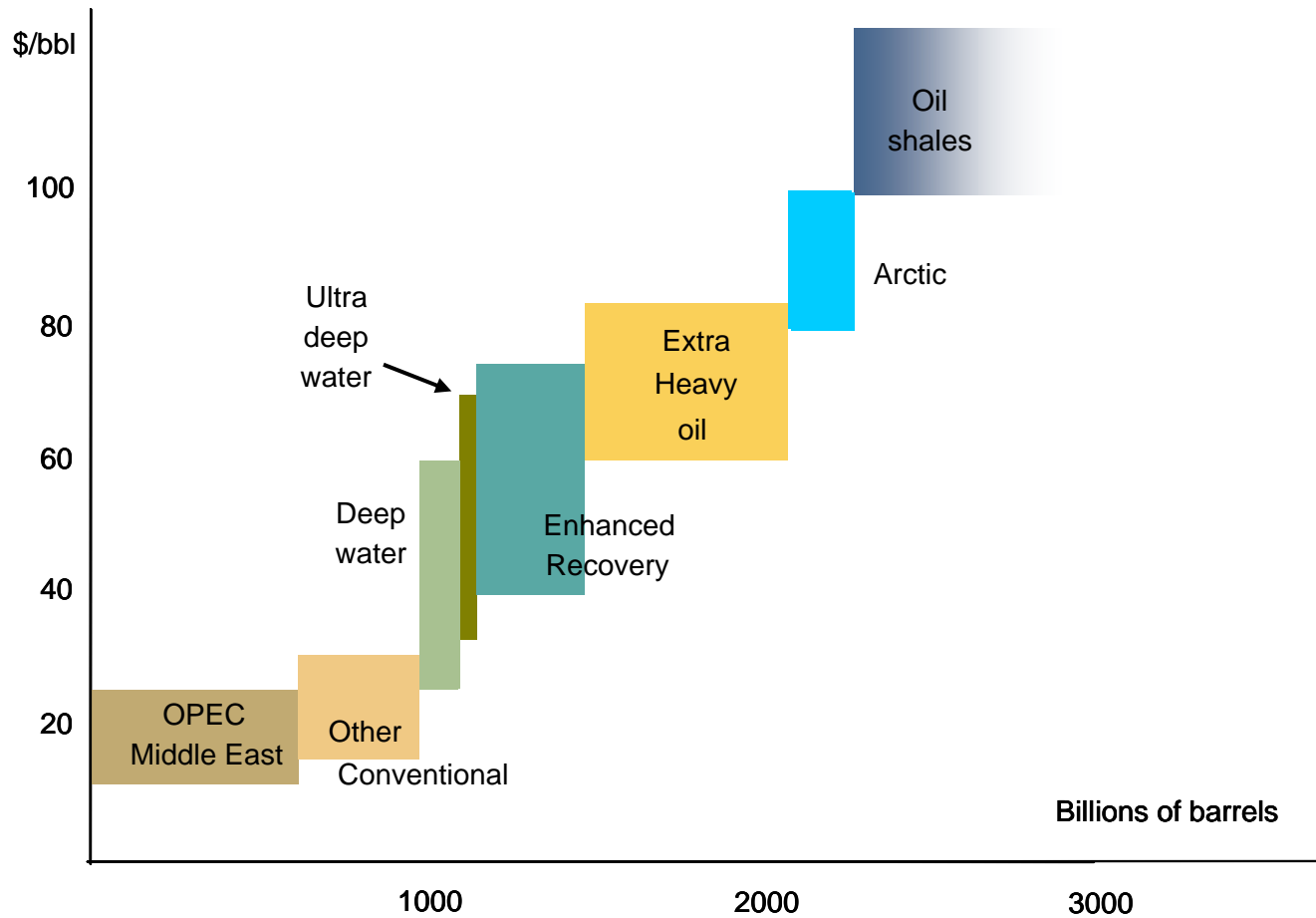
From discoveries to oil resources



Equivalent to 40-45 years of today's production

High costs for the marginal projects

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

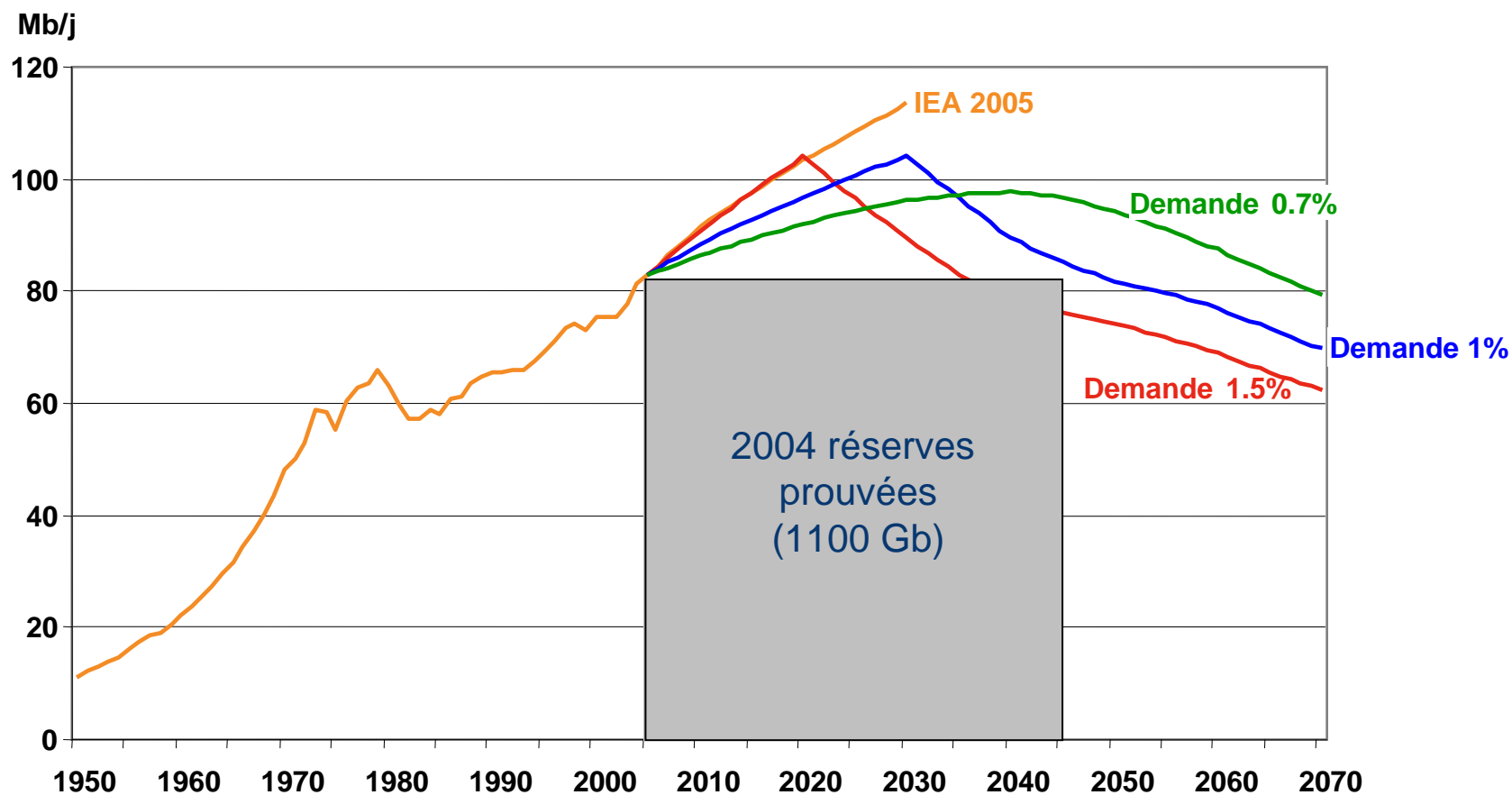


Sources: IEA, CERA, Total



Quelles sont les prévisions de production dans le long terme ?

Production mondiale de pétrole

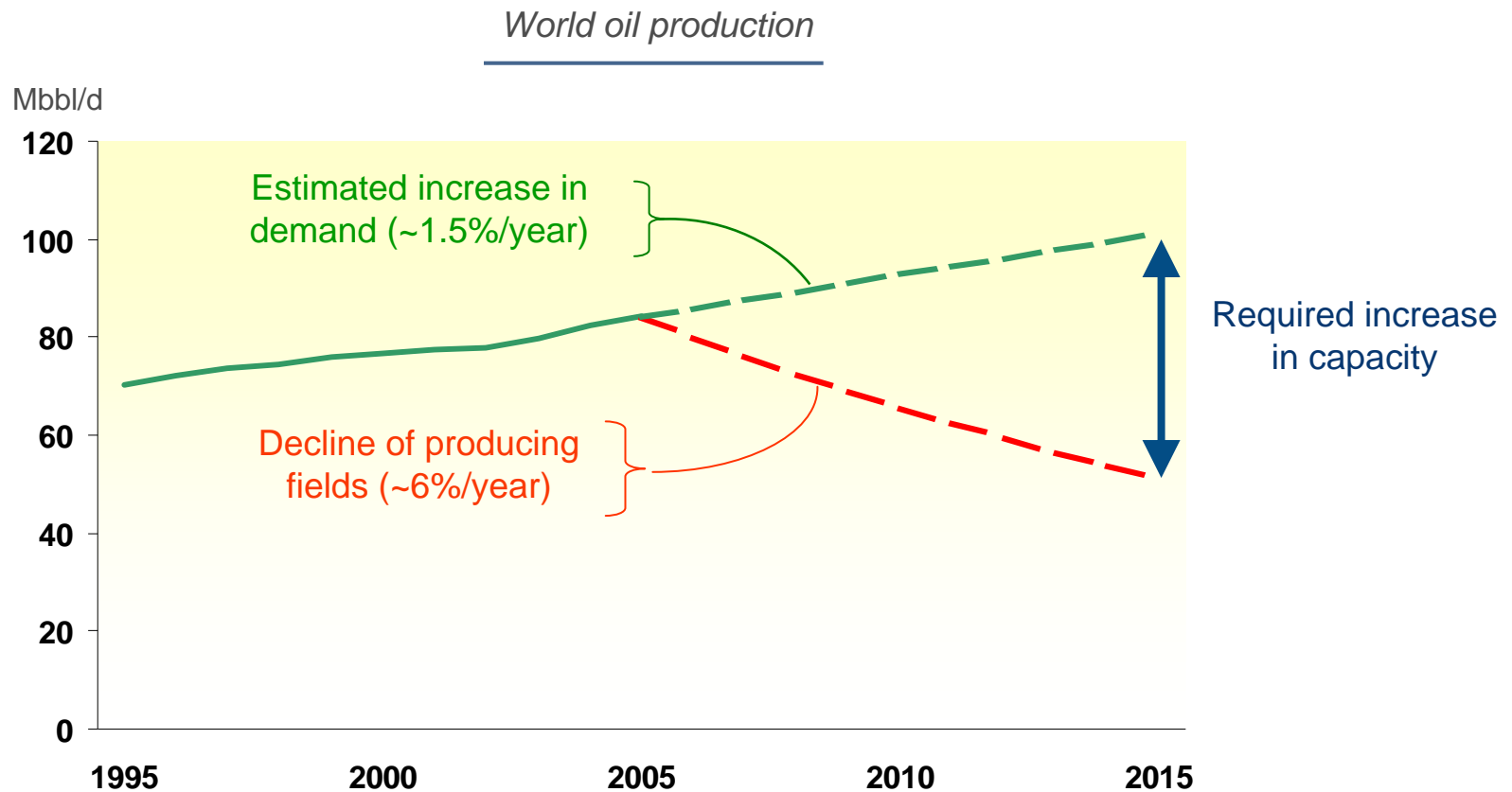


Source: AIE 2006, TOTAL

14 - TOTAL stratégie du groupe, 30 mai 2007 - Bruno Weymuller - November 2010



The challenge of production growth

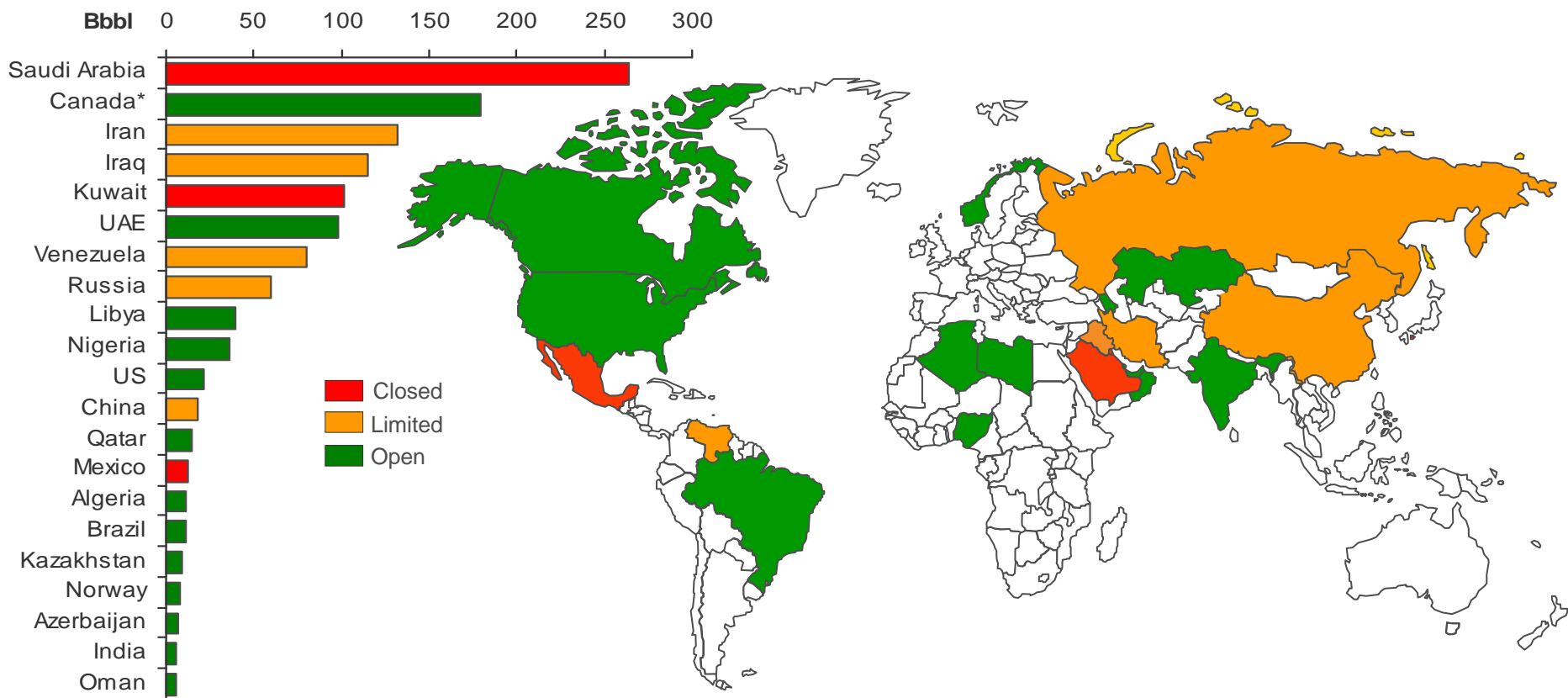


~ 50 Mbb/d of new production is required from 2009 to 2018

Mbb/d = Million barrels per day

Access to reserves is becoming more difficult

Conventional proved reserves
(1/1/2009)



Around 1300 Gbbl of proved reserves :
~ 95% in 20 countries ; ~ 40% in « closed » countries

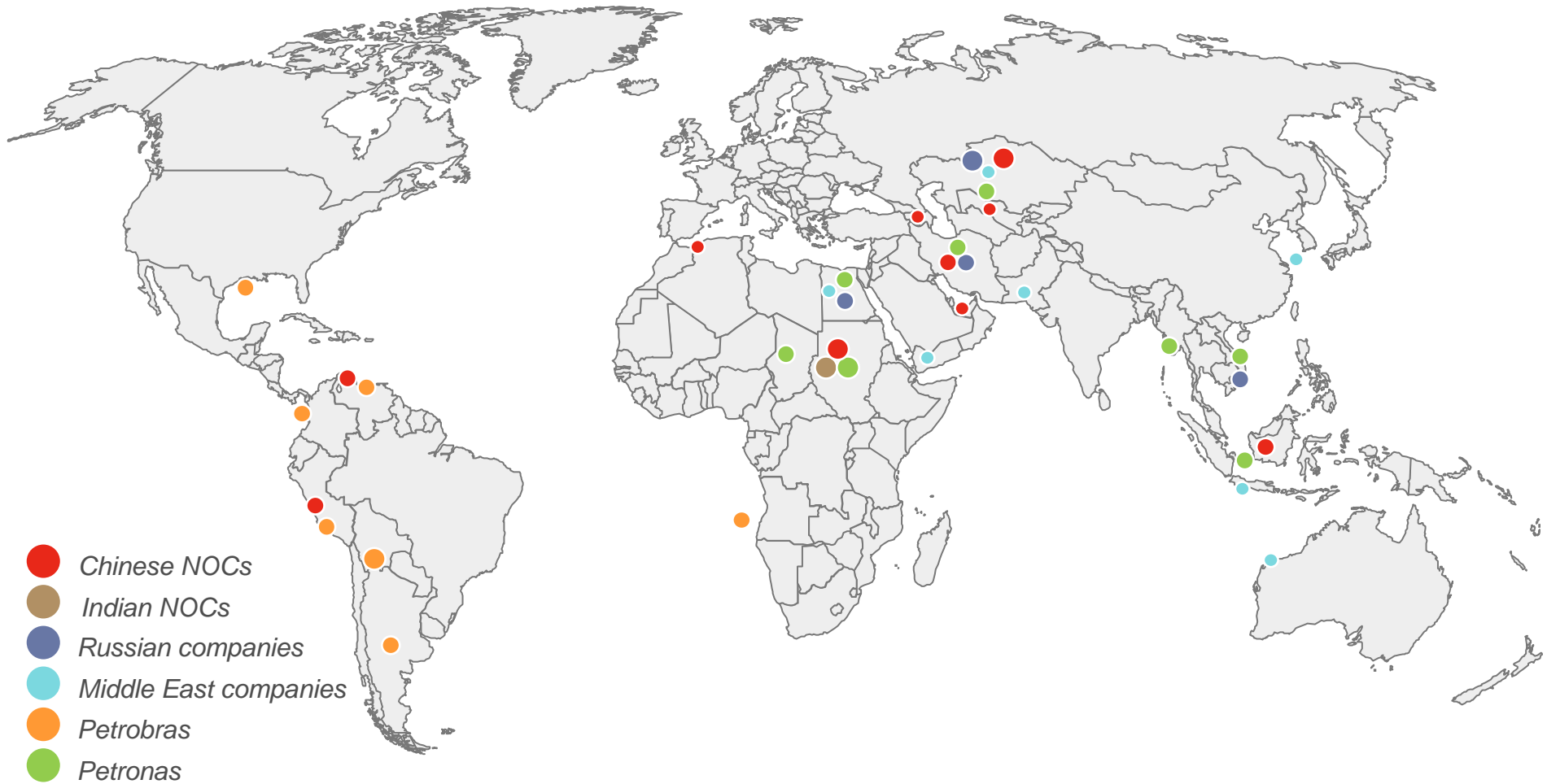
Source: OGJ

*: Canada including extra-heavy oil



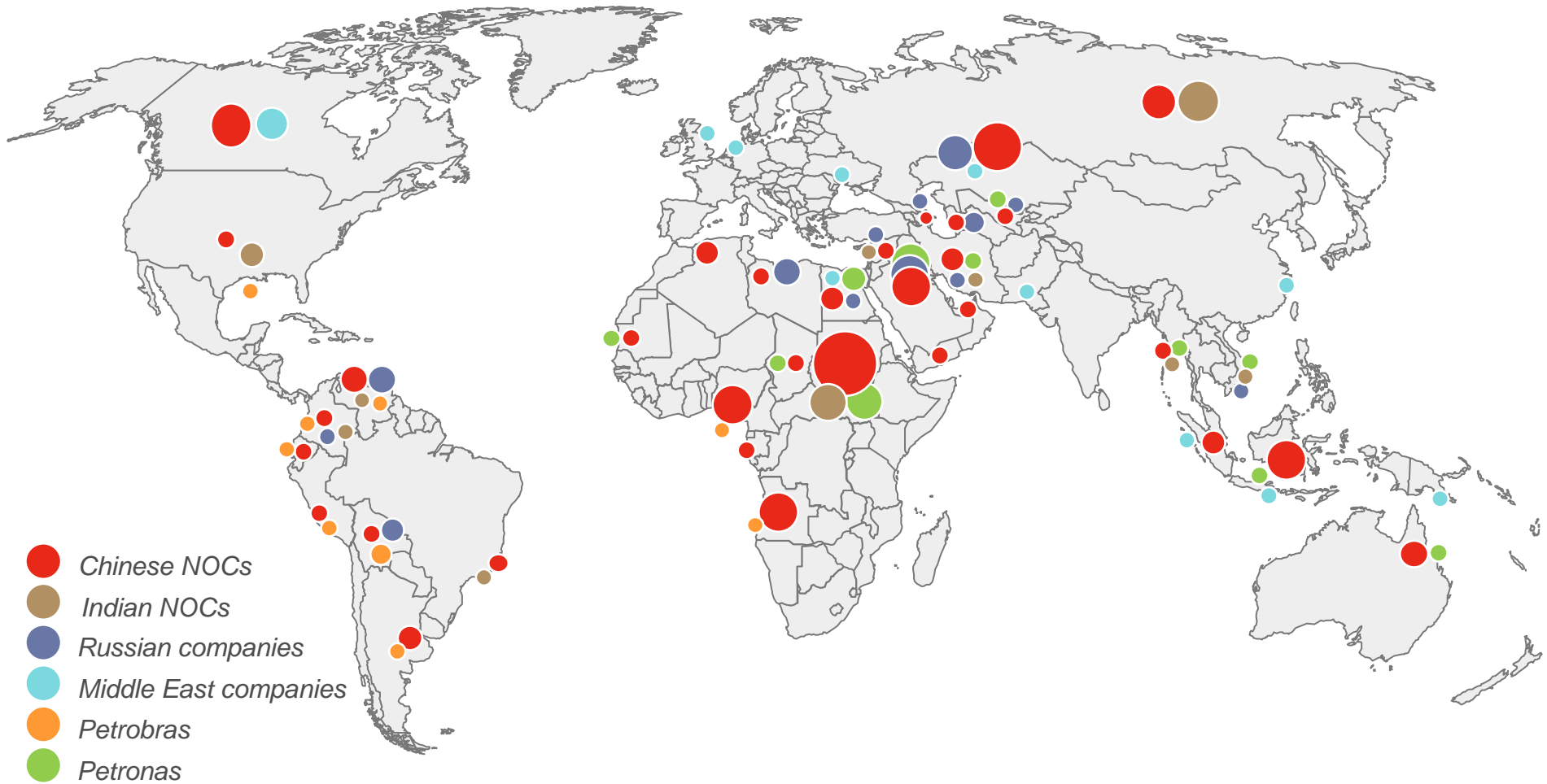
Un développement très rapide des compagnies nationales ... hors de leurs frontières

2003



... hors de leurs frontières

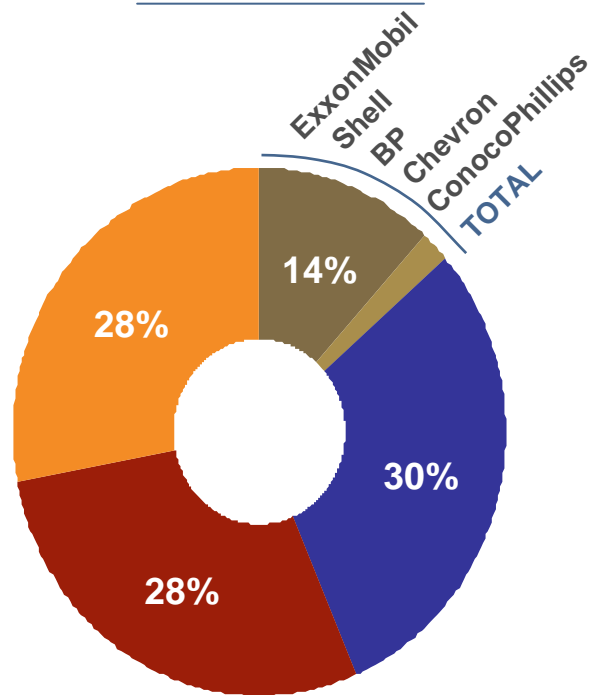
Juin 2010



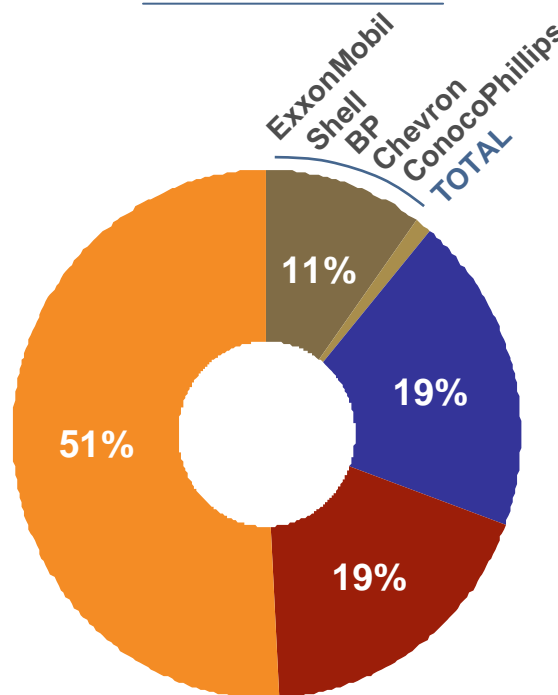
L'accompagnement des NOCs : une voie de croissance décisive pour une IOC...

Majors' Capex share exceeds their production and resources oil and gas share

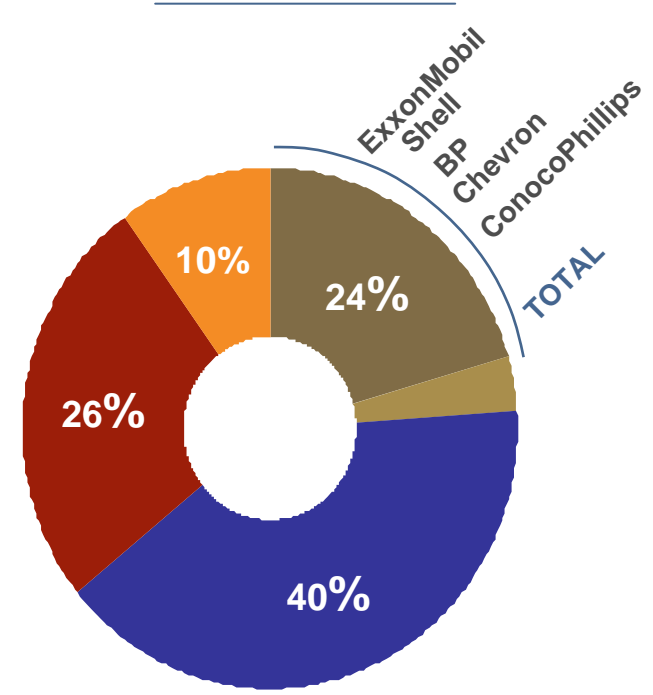
World Production
Oil & Gas
2008
133 Mboe/d (oil = 81.8 Mbd)



World Reserves
Oil & Gas
At end 2008
2535 Bboe



Worldwide E&P
capital expenditure
2008
\$ 496B



■ 6 Majors ■ Other Companies ■ Non-OPEC NOCs ■ OPEC NOCs

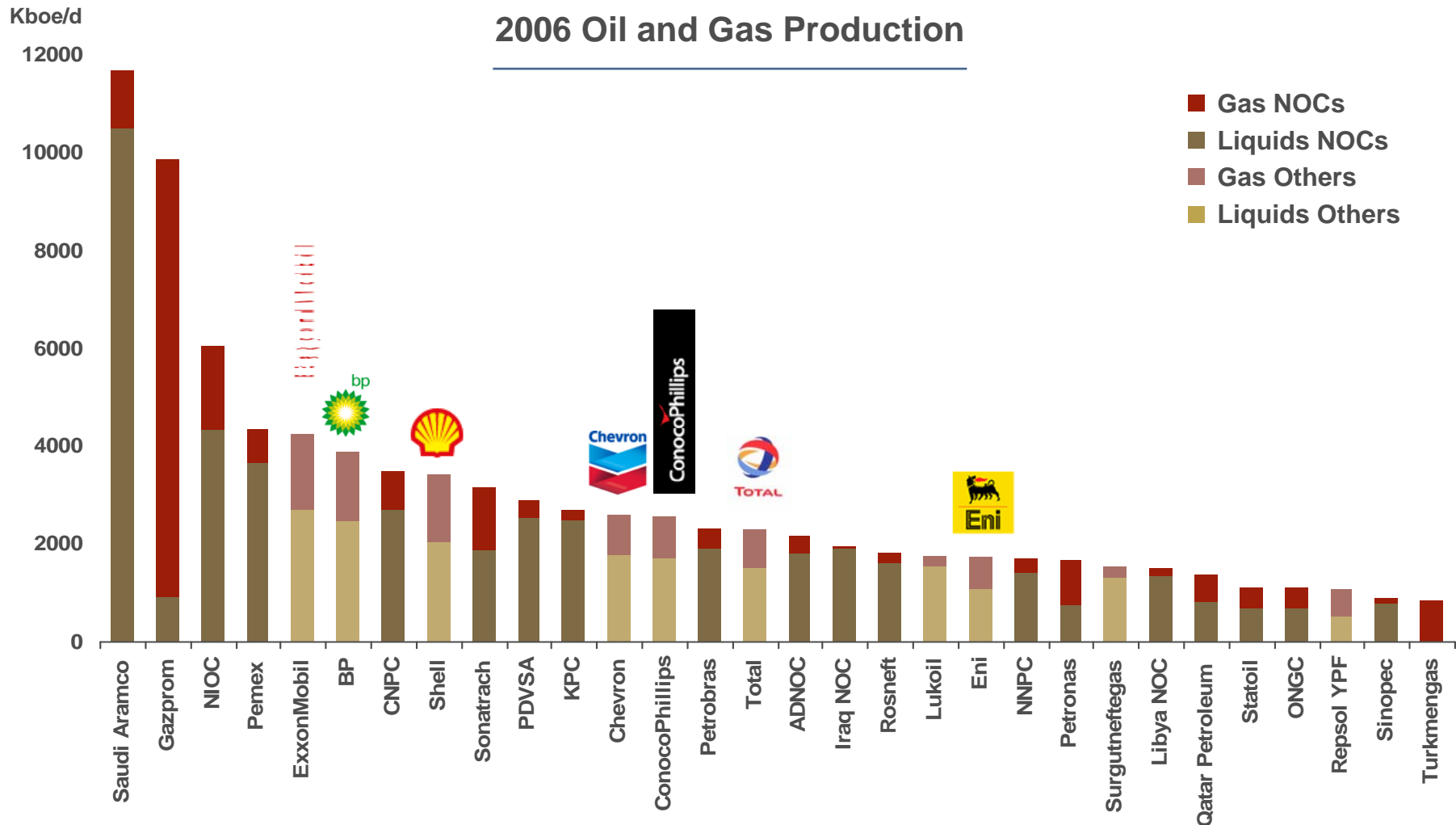
OPEC NOCs: Saudi Aramco, PDVSA, NNPC, QatarPetroleum, Sonatrach, NIOC, ADNOC, NOC, KPC, Sonangol, PetroEcuador,TAQA

Non-OPEC NOCs: PEMEX, Petrobras, Statoil, Sinopec, Petronas, ONGC, Gazprom, CNOOC, CNPC (yc Petrochina), Ecopetrol, etc.

Sources: BP Statistical Review, Wood Mackenzie, Total estimates, IFP, Barclays Capital, PFC,



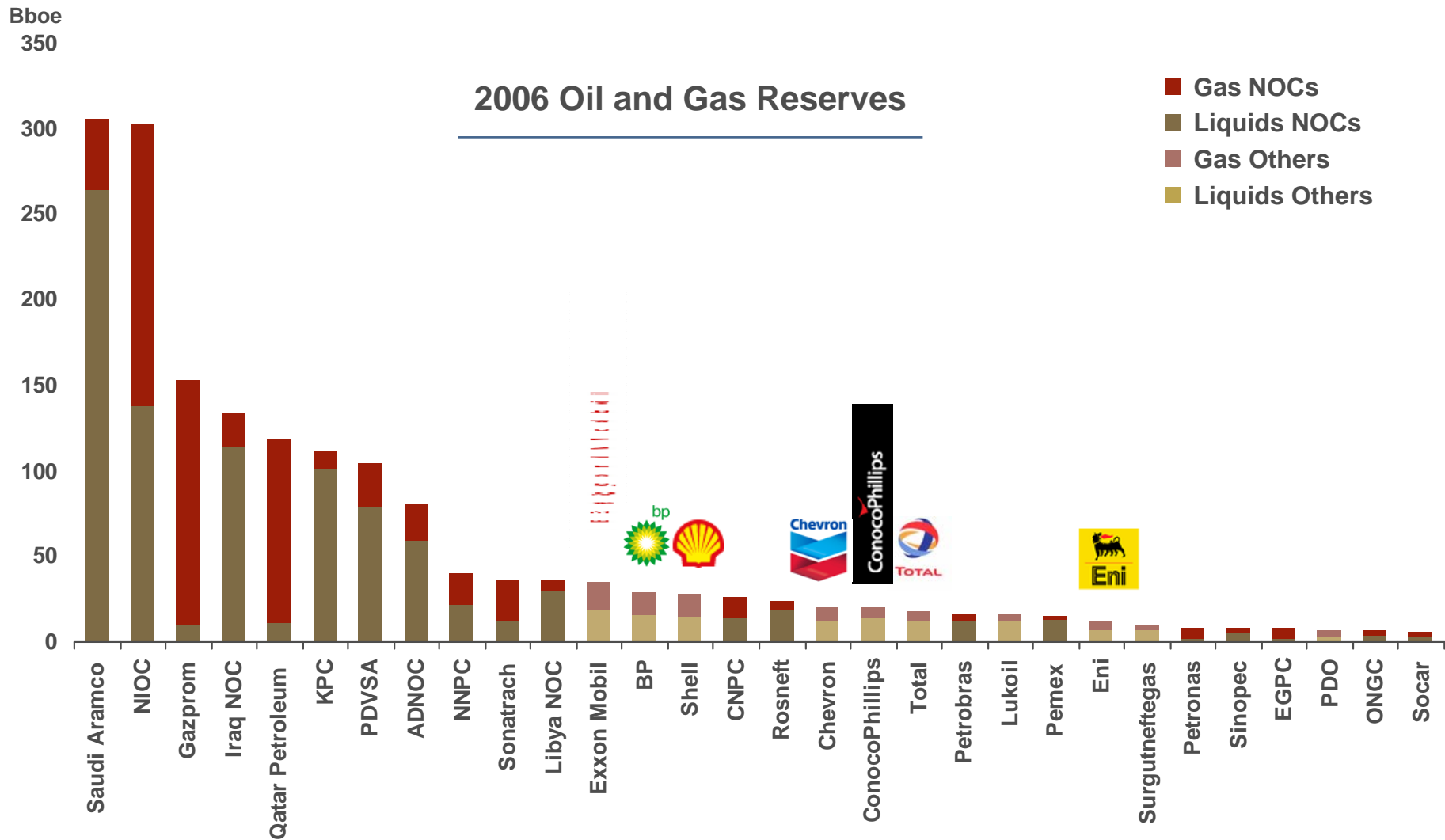
But NOCs dominate oil and gas production...



56% of world production (half for OPEC NOCs) versus 15% for IOCs

Source: Energy Intelligence Weekly Top 100: Ranking the World's Top Energy Countries 2008

... and hold the vast majority of reserves



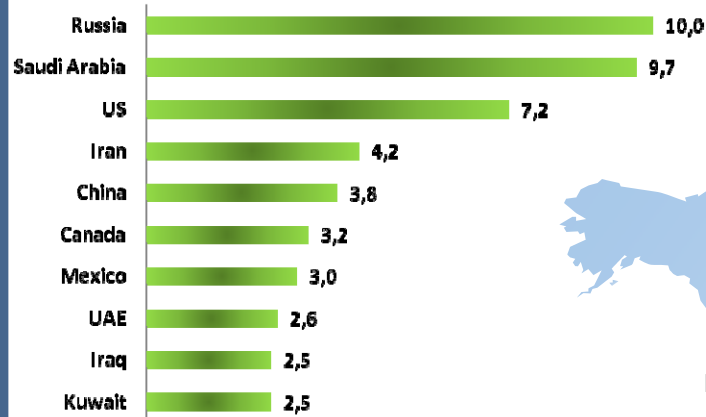
NOCs 73% of world reserves (OPEC NOCs 54%), versus 15% for IOCs

Source: Energy Intelligence Weekly Top 100: Ranking the World's Top Energy Countries 2008 for NOC Reserves + WM RADAR reports for 2P reserves of publicly listed companies

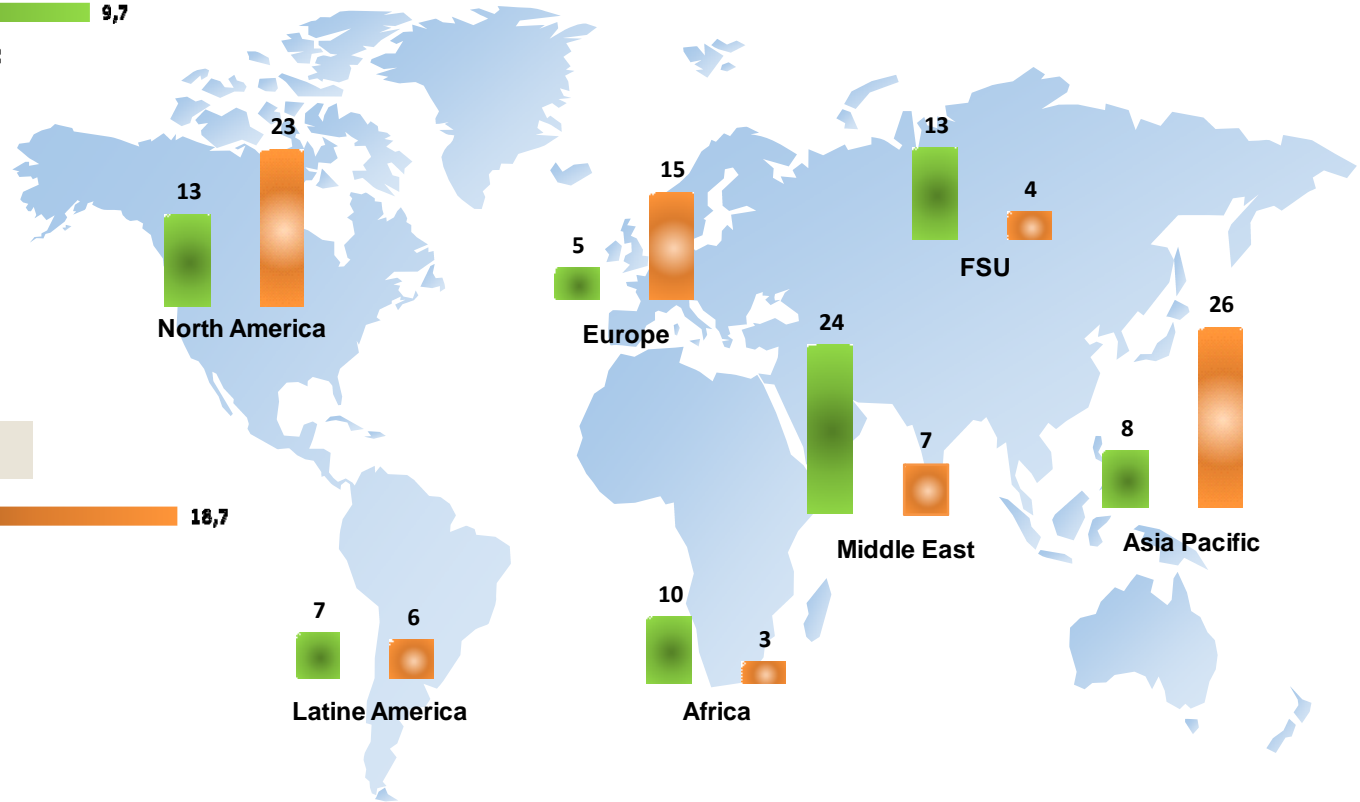
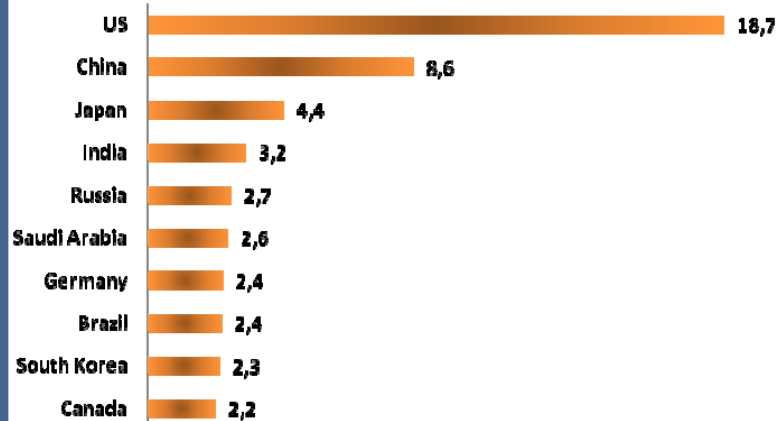


Worldwide oil production and consumption

Top 10 producing countries



Top 10 consuming countries

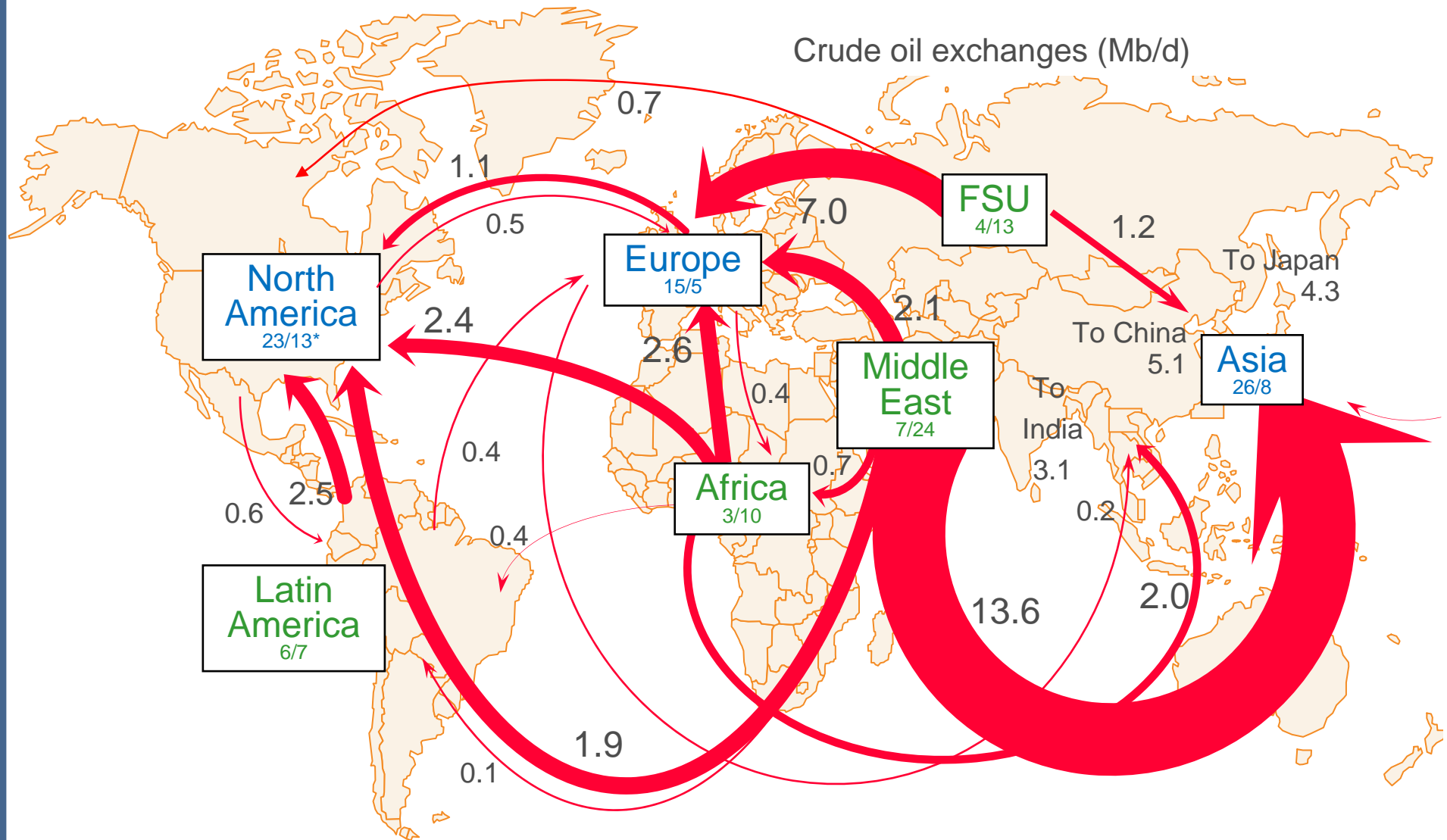


Million barrels per day

Oil production in 2009 : 80 Mb/d
Oil consumption in 2009 : 84 Mb/d

Sources: BP SR 2010

Crude oil : a global market



*: Demand and production (Mb/d)

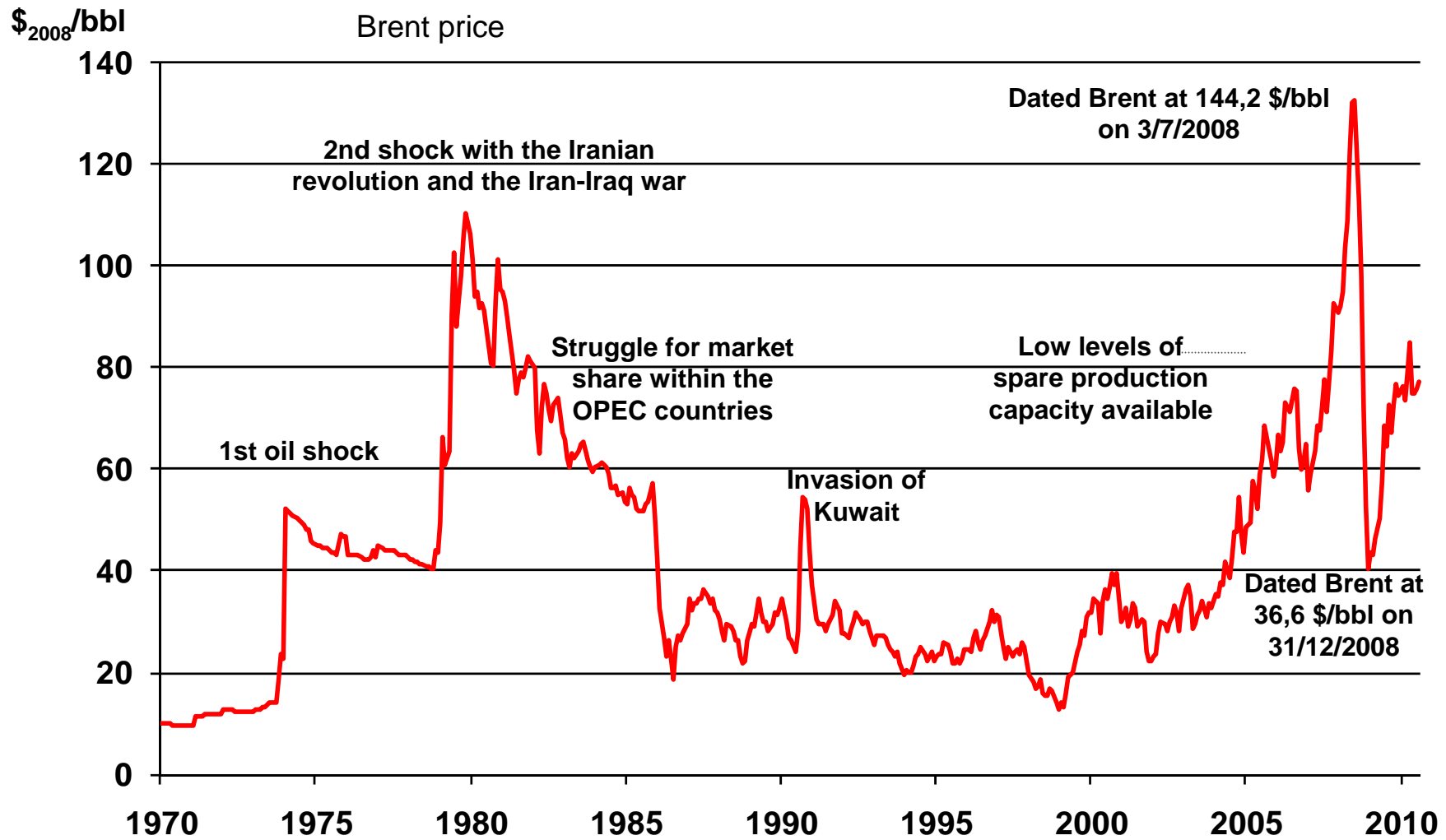
Source: BP SR

23- DSIE - Stratégie - octobre 2010 - Bruno Weymuller - November 2010

Inter-regions Exchanges in 2009: 44 Mb/d



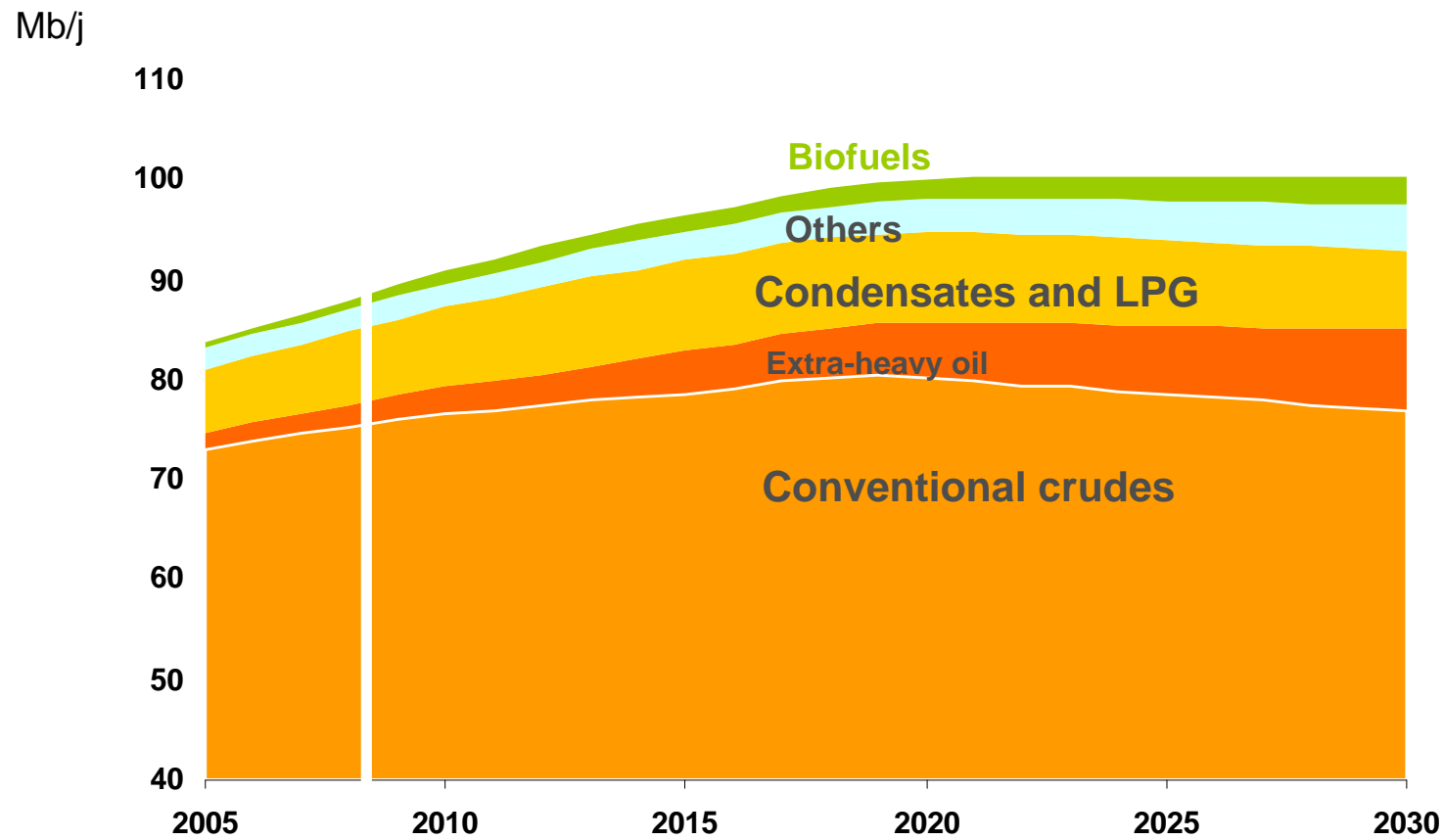
Historically strong volatility in oil prices



Sources : IEA, US BLS



Supply will be limited to around 100 Mb/d by 2020



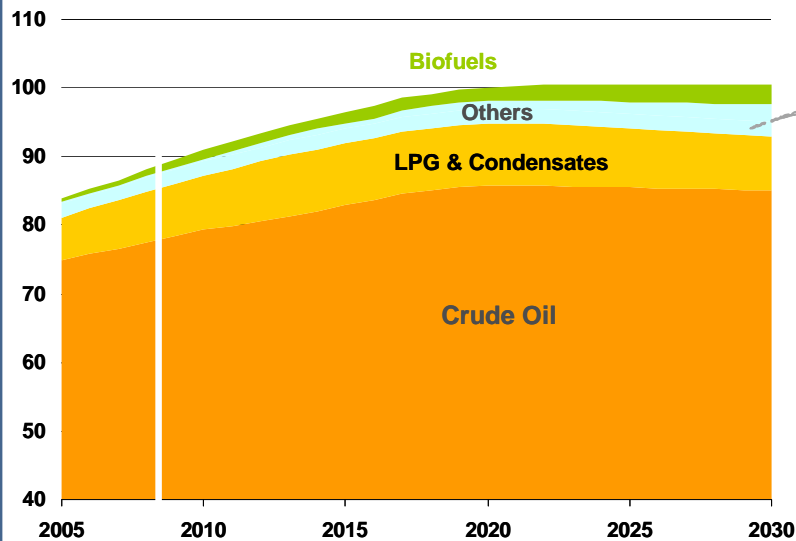
* Others = GtL + CtL + refinery gains

25 - Bruno Weymuller - November 2010

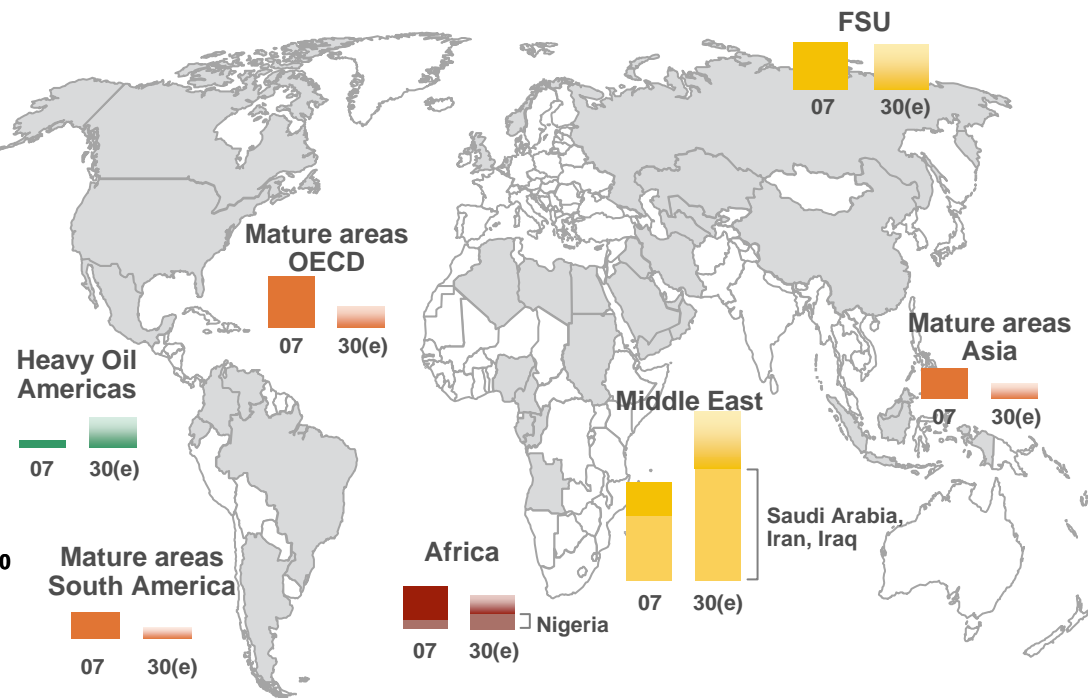


Oil production to remain below 95 million barrels per day by 2020

Oil production



Oil production by area



- ▶ Geopolitical uncertainties delaying development of new capacities
- ▶ Stronger role for OPEC

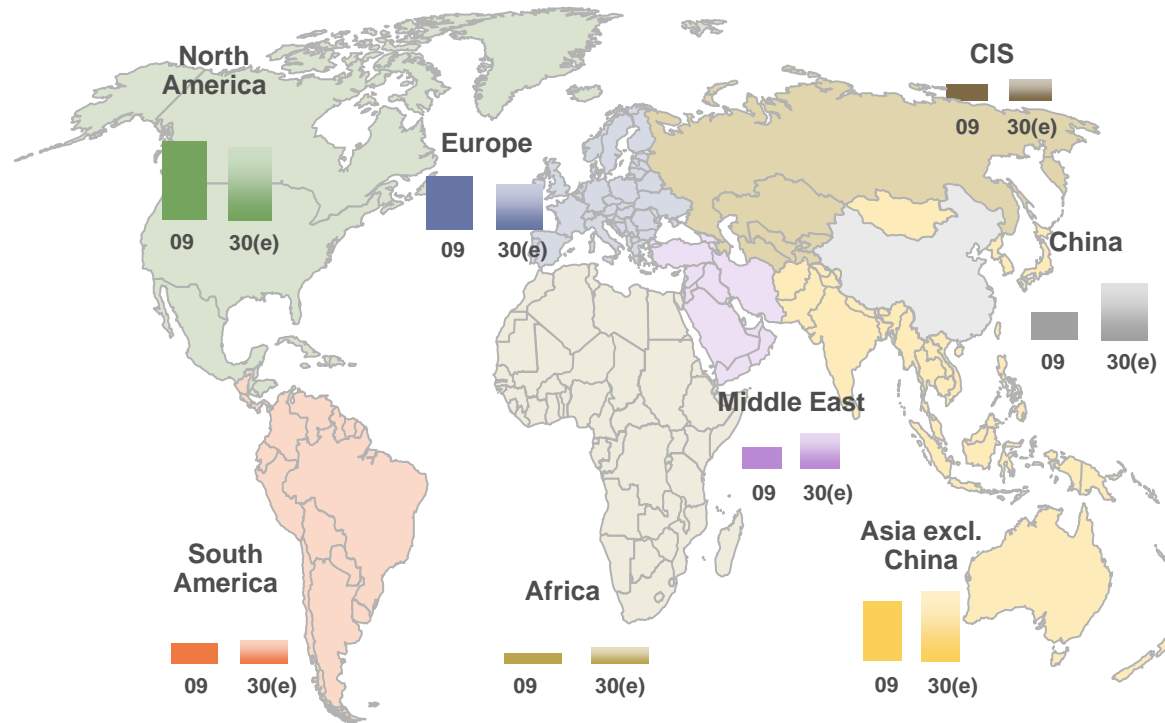
sources : Total estimates

26 -- TPA, April 2009 – Bruno Weymuller - November 2010



Oil demand driven by transport and growth in emerging countries

Oil products demand

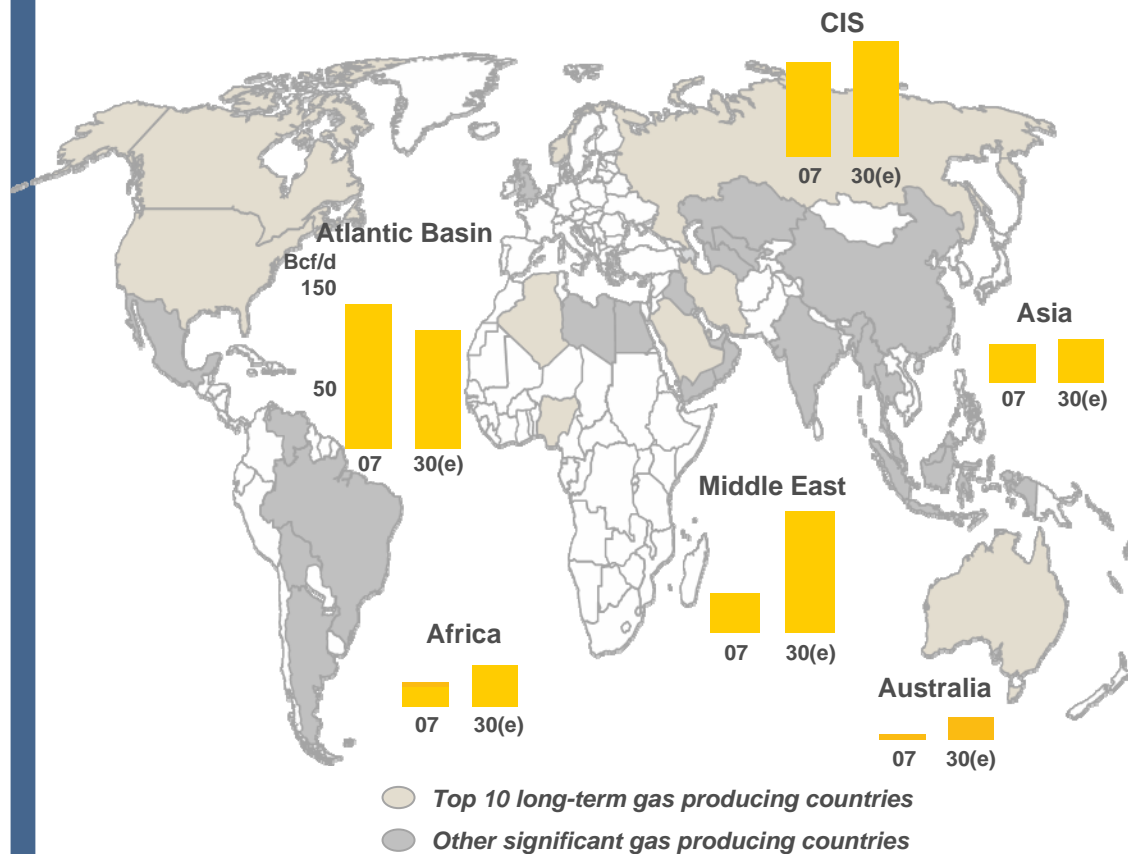


2009-2030 evolution of each segment	
Transport	+23%
Petrochemicals	+47%
Power generation	-33%
Industry and other	-2%
Total	+15%

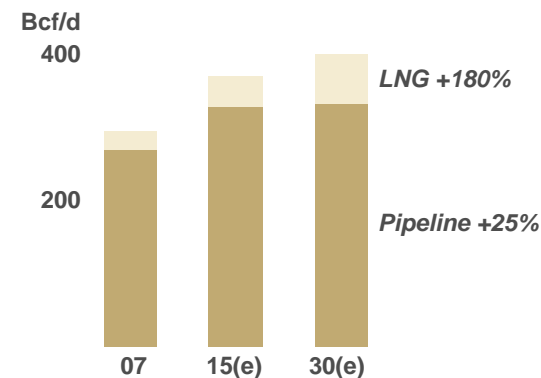
*Increasing demand for light products :
naphtha for petrochemicals, gasoline and diesel for transport
Necessary to upgrade refining and petrochemical plants to curb oil demand*

Gas demand to grow by 1.5% per year through 2030

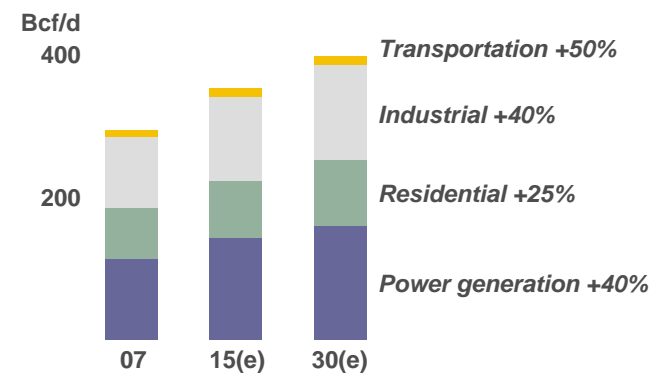
Gas production



Gas production



Gas demand by sector

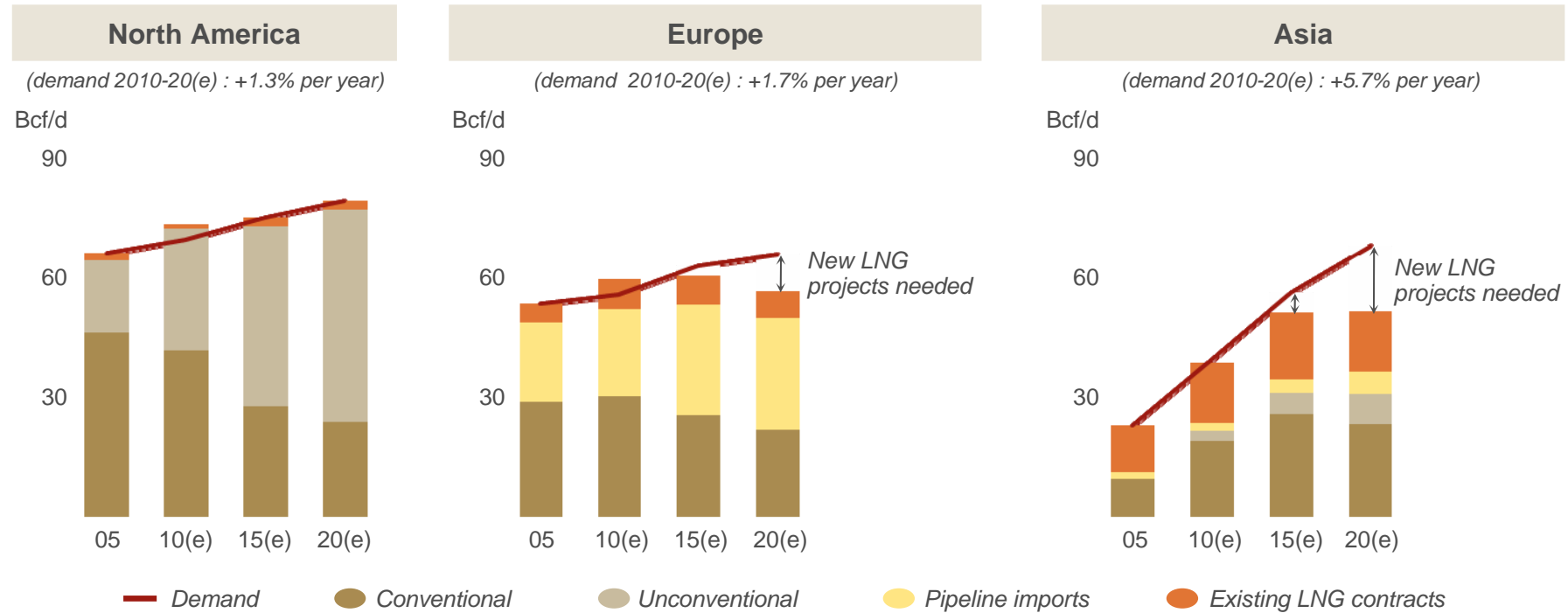


Gas demand mainly driven by power generation, Asia and Middle East
Growth of gas supply driven by LNG expansion

source : Total estimates
 28 - TPA, April 2009 – Bruno Weymuller - November 2010



Gas market to tighten progressively



- > Strong growth of unconventional gas to compensate for decline of conventional production
- > US spot gas prices to remain disconnected from oil prices for the medium term

> Growth of pipeline imports do not compensate for declining North Sea production

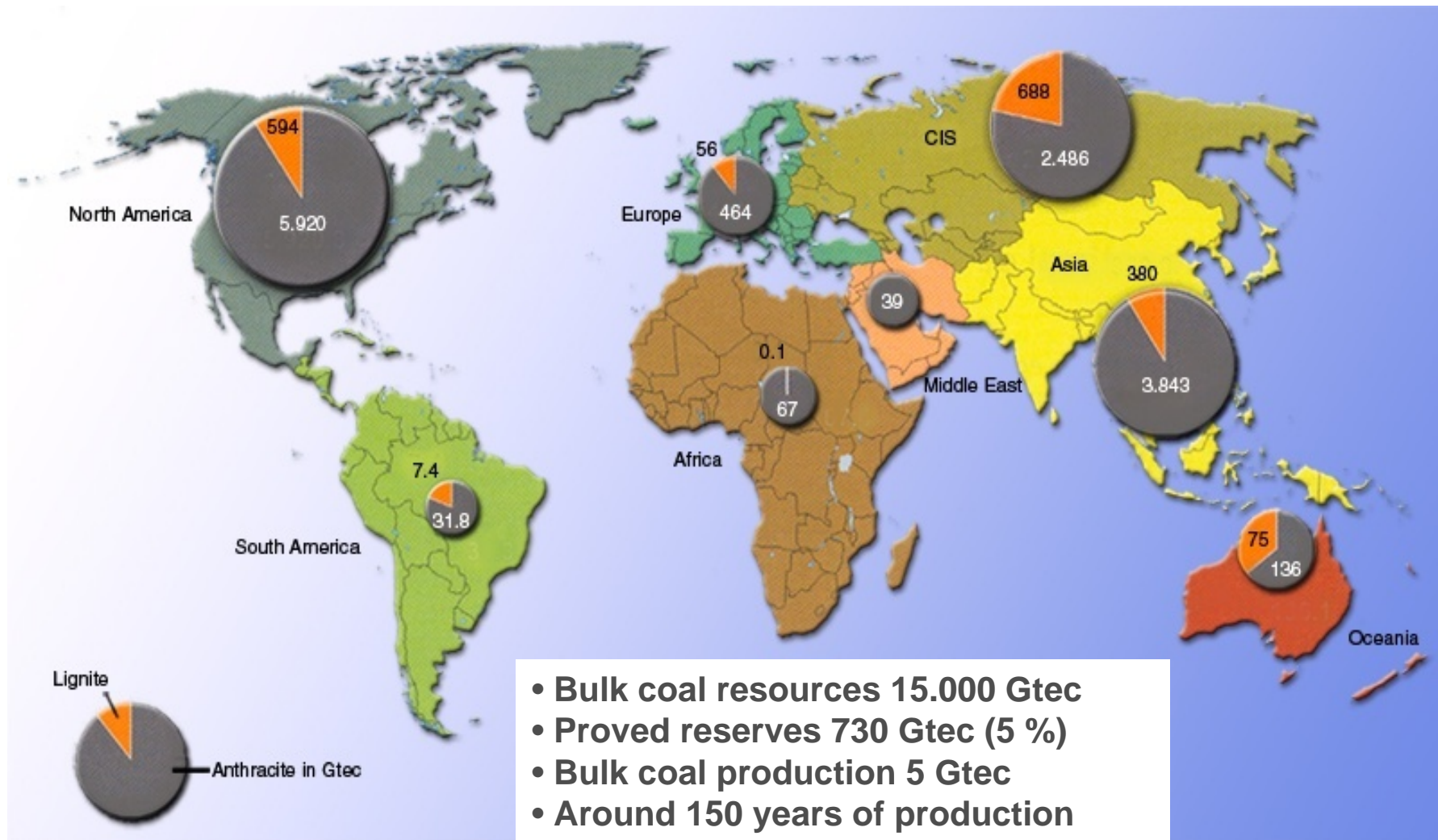
> Unconventional gas still limited by 2020(e)

Europe and Asia to be increasingly dependant on LNG with 25 Bcf/d of new projects needed by 2020(e)

Total estimates, based on average GDP growth over the period of 2.3% in North America, 2% in Europe and 6% in Asia



Coal resources



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

Nuclear Energy

- Mainly used for electricity production
- 2007 : 5,9 % of the global primary energy supply
- 2030 : 5,3 % *Reference Scenario* of International Energy Agency
- 2030 : 9,5 % *450 Policy Scenario* of International Energy Agency

The 450 policy scenario assumes that a global climate-policy framework will stabilise the concentration of global greenhouse gases at 450 ppm after 2012.

Increase the part of renewable energies ?

Wind



Solar Photovoltaic



Geothermal

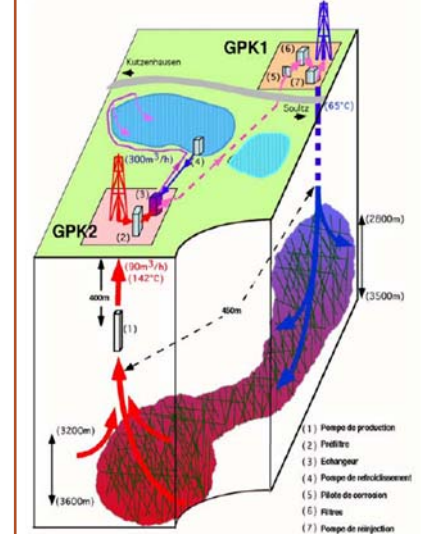


Schéma Simplifié de la circulation test conduite à SOULTZ en 1997 (© TOTAL non respectées)

Hydroelectricity



Ocean



Solar thermal



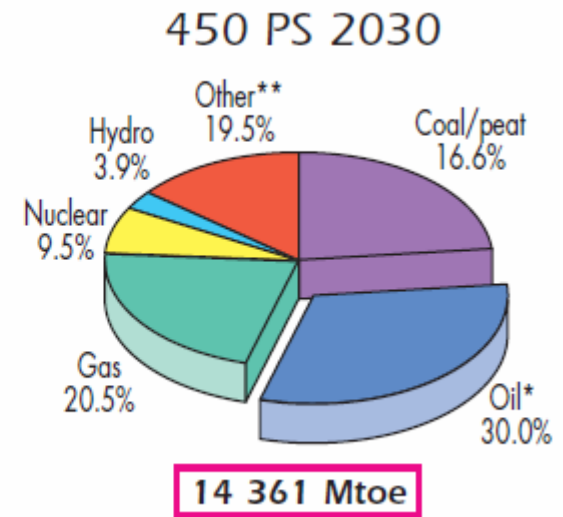
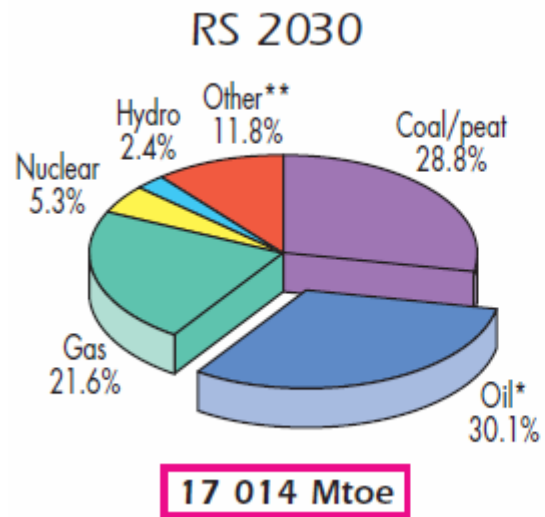
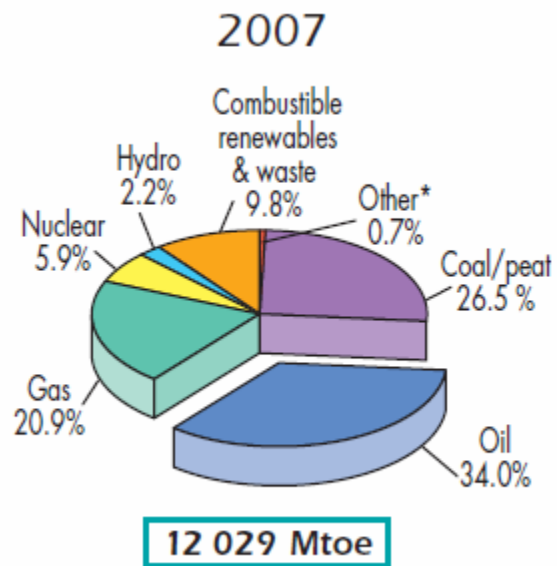
Biomass



Concentrating Solar



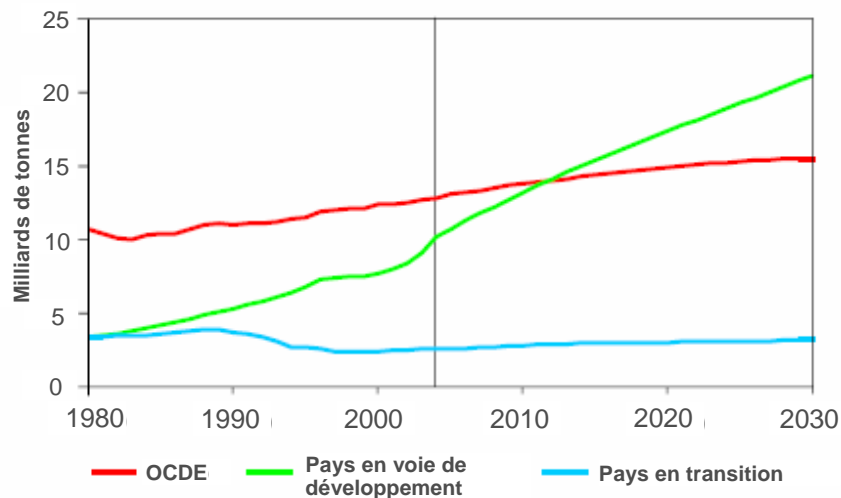
World energy outlook (IEA)



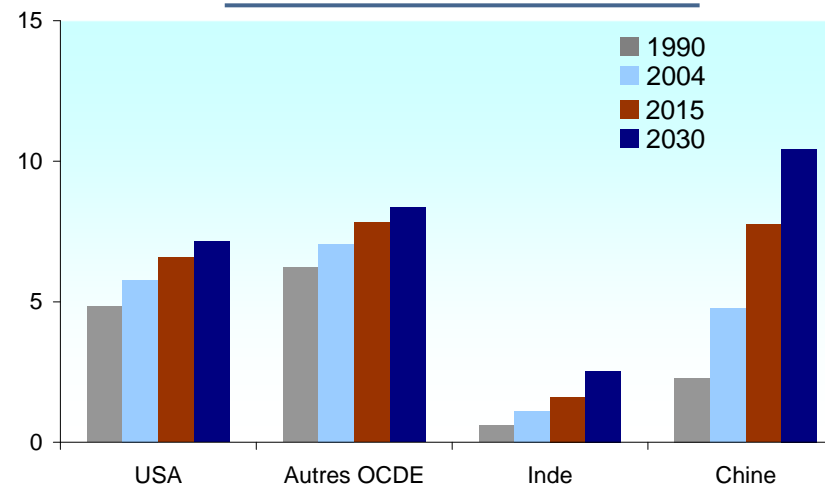
Still 70 % (450 PS) to 80% (RS) of the energy mix still derived from fossil fuels in 2030

Croissance des émissions de CO₂ 1980-2030

Émissions de CO₂ par région

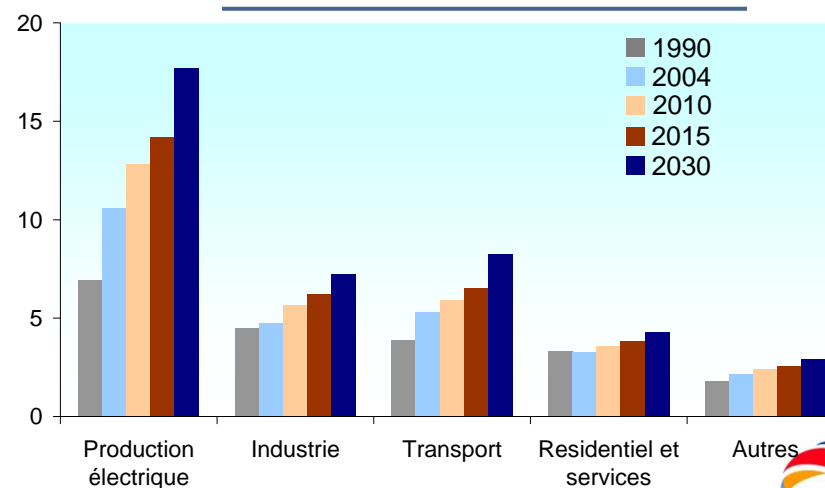


Émissions de CO₂ par pays en GT/an



- Les émissions de CO₂ augmenteront plus rapidement dans les pays en voie de développement, surpassant celles des pays développés dès 2020.
- Les émissions de CO₂ liées à la production d'électricité et au transport augmenteront le plus.

Émissions de CO₂ par secteur en GT/an

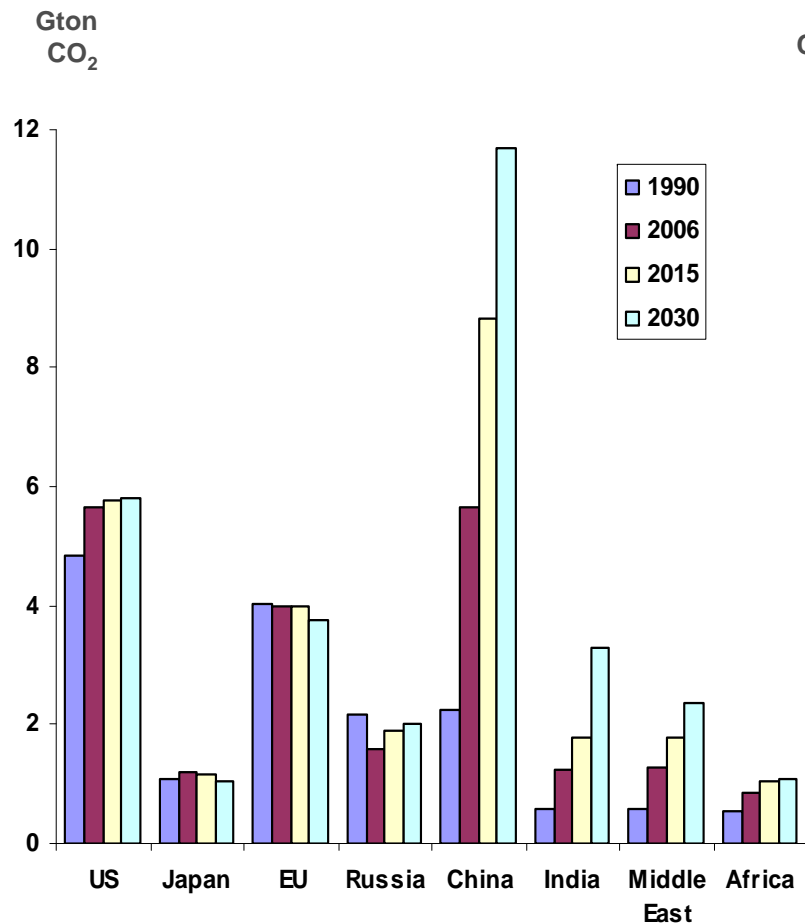


Source: AIE 2006

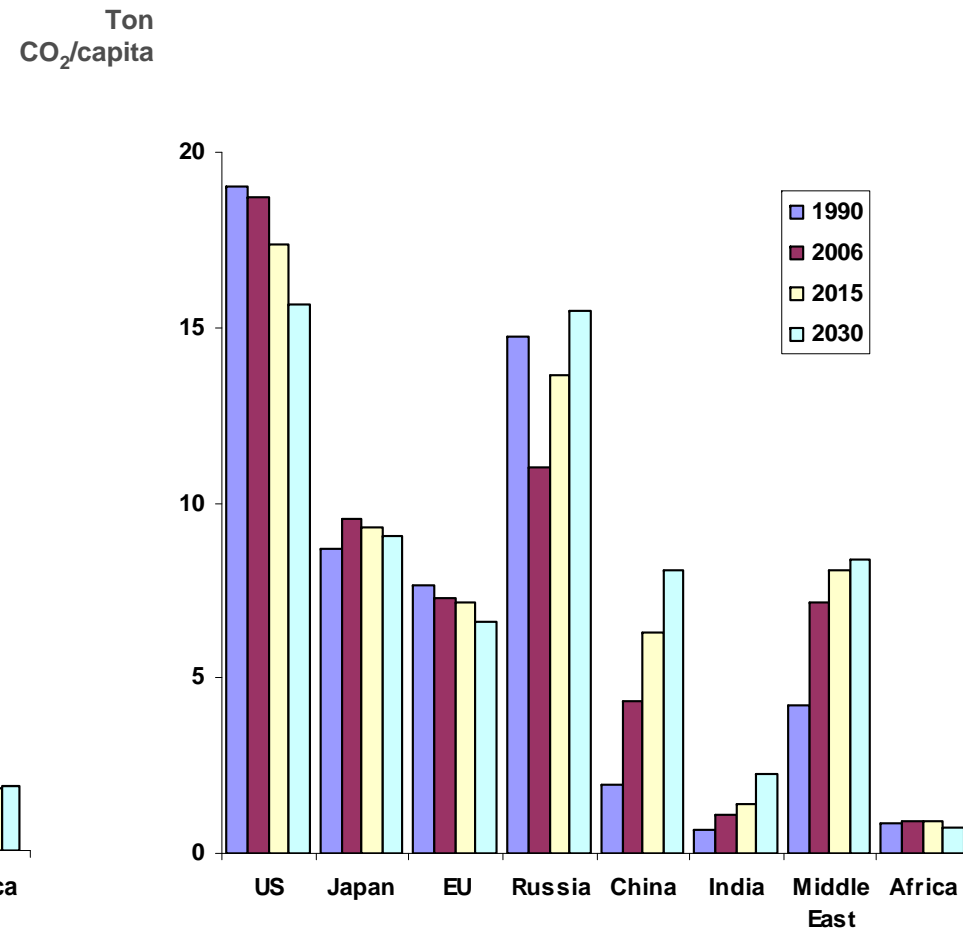


Greenhouse gas emissions: a major issue for sustainable growth

CO₂ emissions by countries

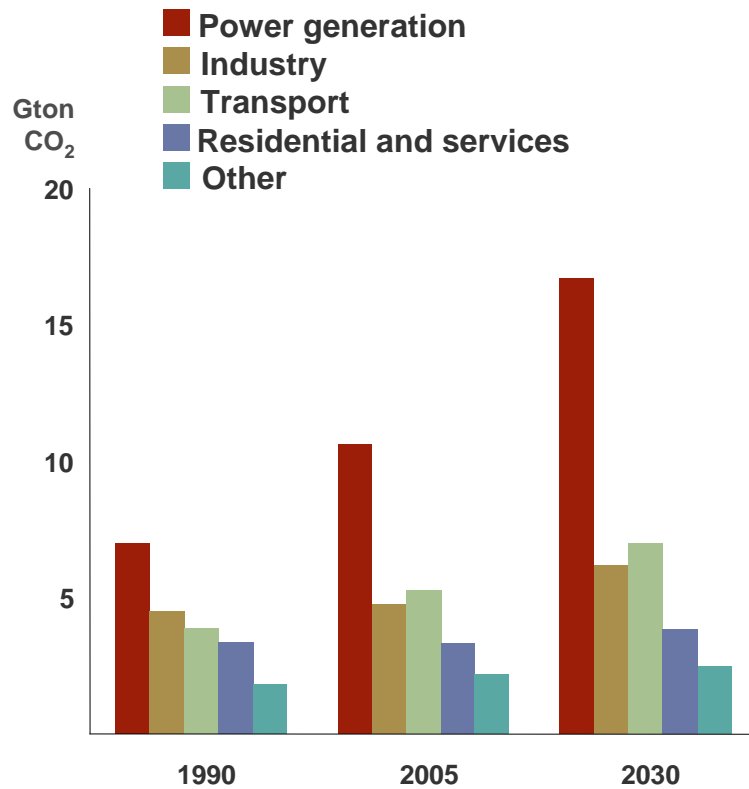


CO₂ emissions/capita by countries



Greenhouse gas emissions: a major issue for sustainable growth

CO₂ emissions by sector



CO₂ emissions : Potential reduction

