

# **Vision Long Terme de l'Avenir Énergétique**

**Réunion Groupe IDées et Prospectives**

**Jeudi 4 novembre 2010**

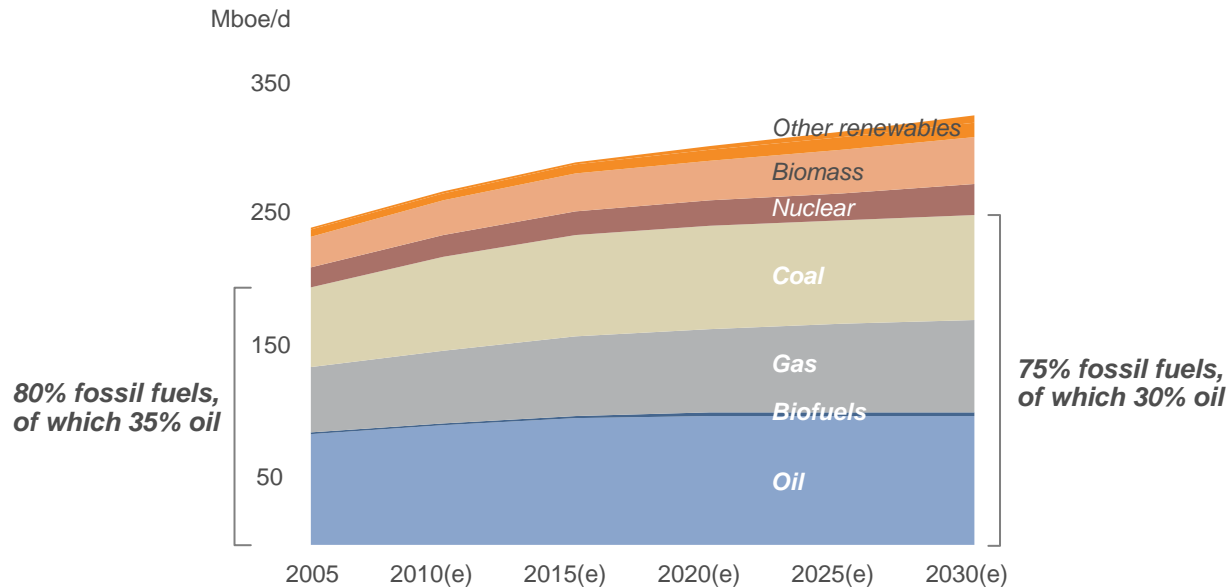
---

Présentation Bruno Weymuller

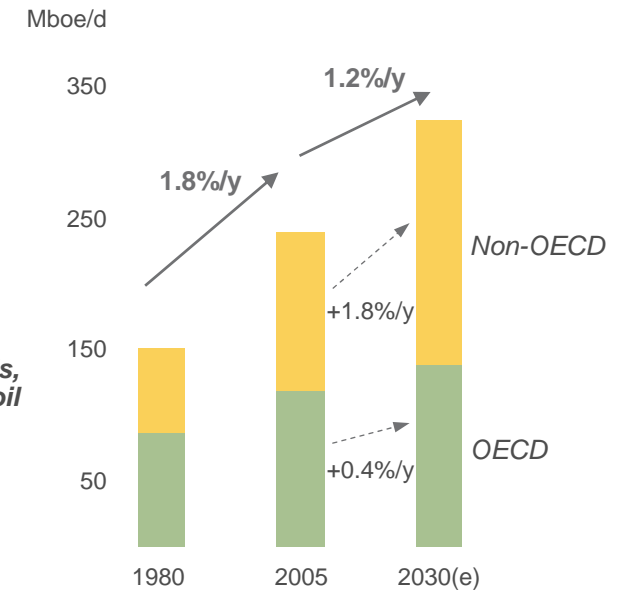


# Energy supply constraints will curb energy demand growth

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)*

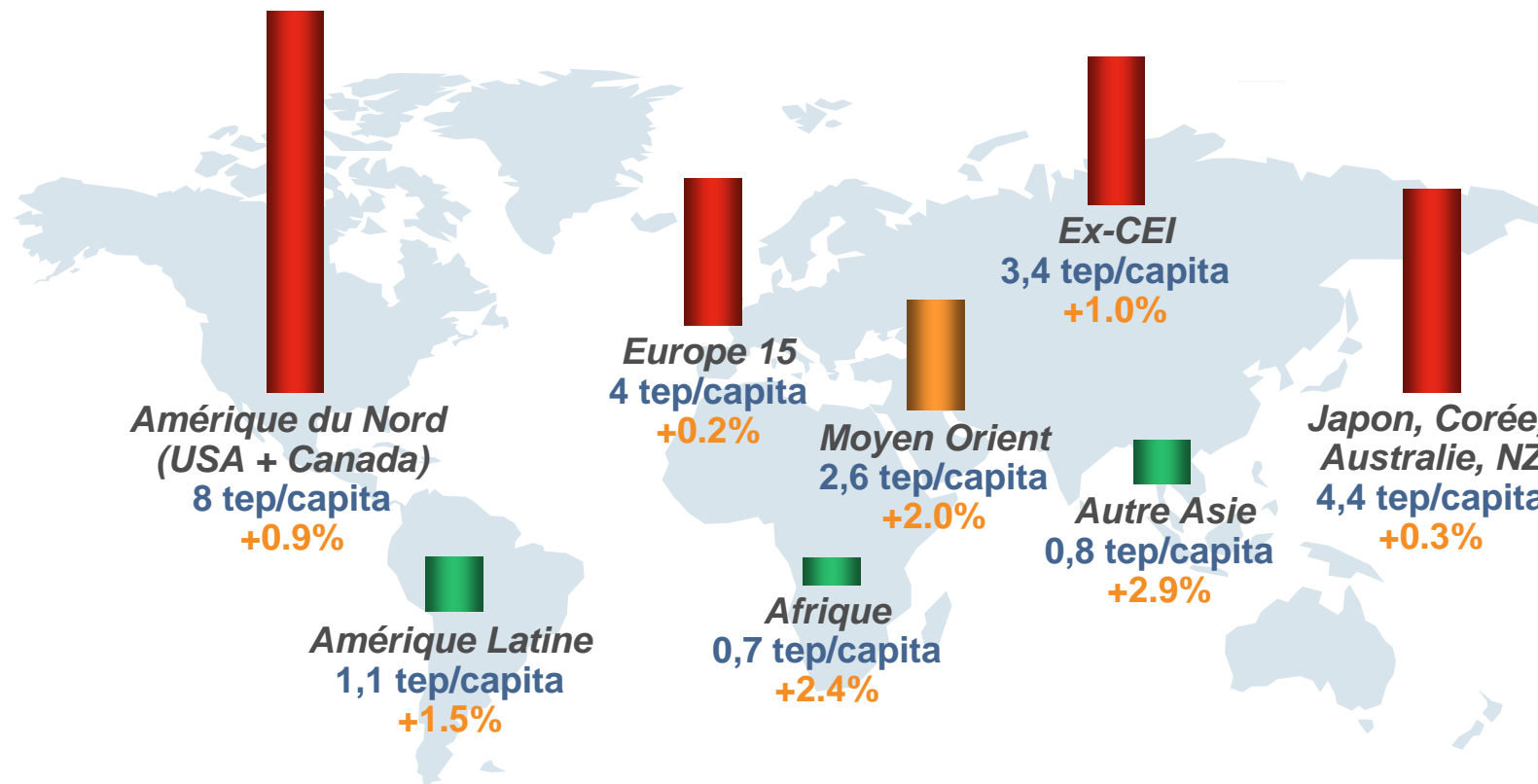
*Consommation annuelle d'énergie par tête : 1,8 tep*

*Croissance de la consommation à 2030 : +1.6%*

*Pays en développement:*

*82 % de la population mondiale*

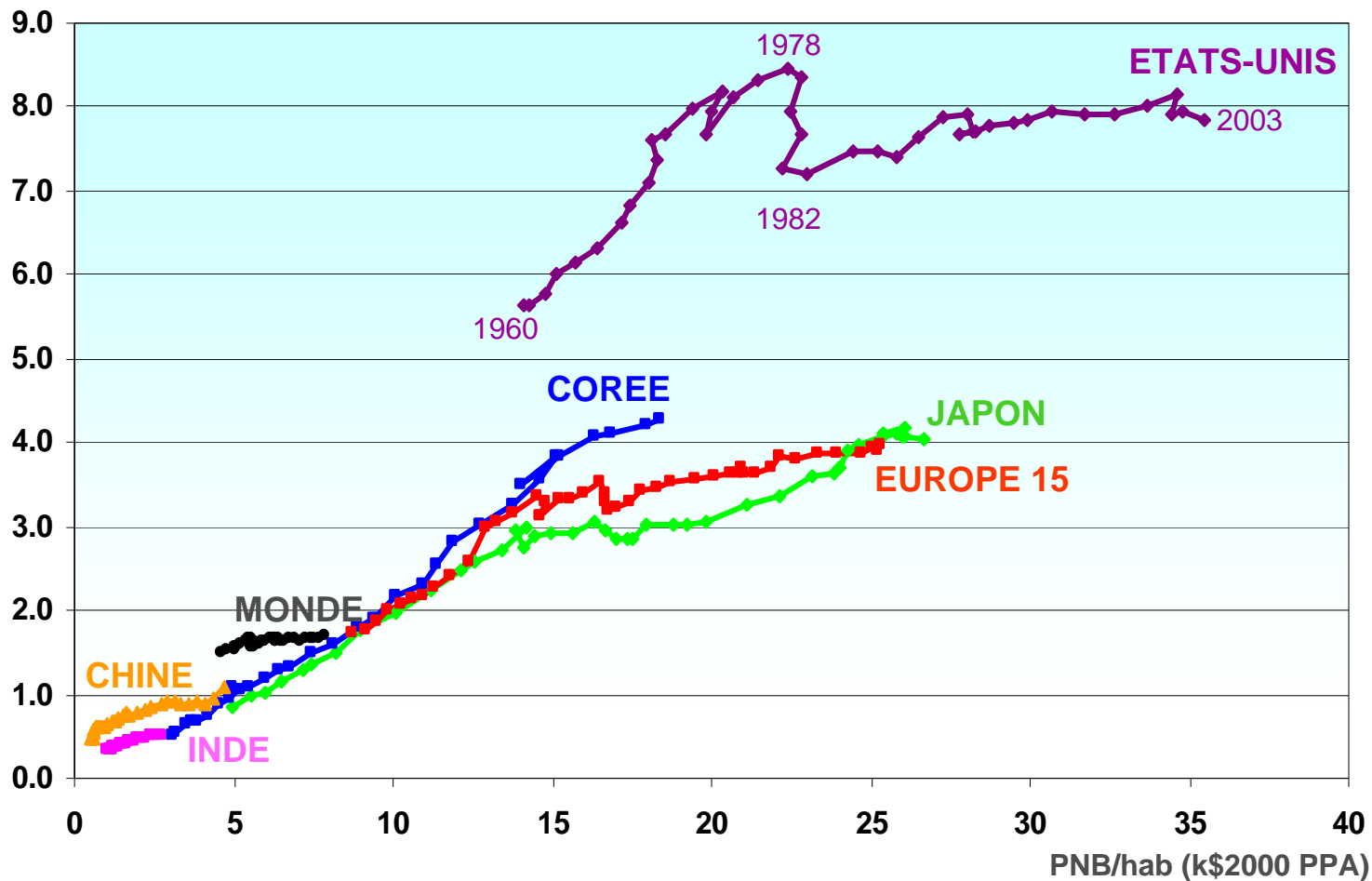
*41 % de la consommation d'énergie*



*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)



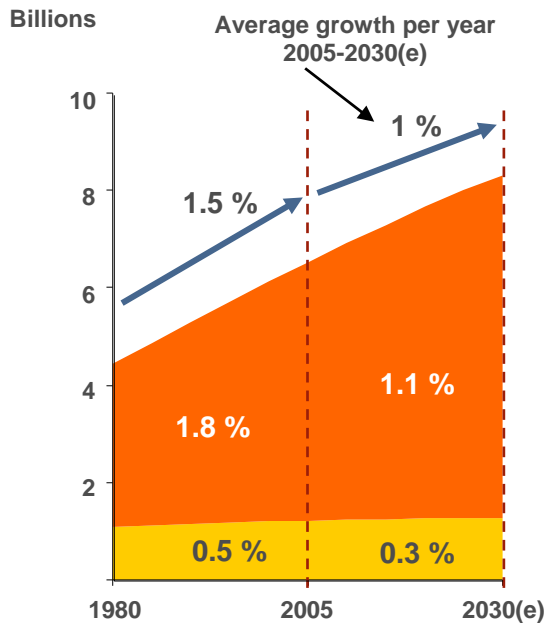
Source : AIE 2005, balance énergétique 2003  
 Excepté pour la Chine, l'Inde et le Monde, 1971-2003

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



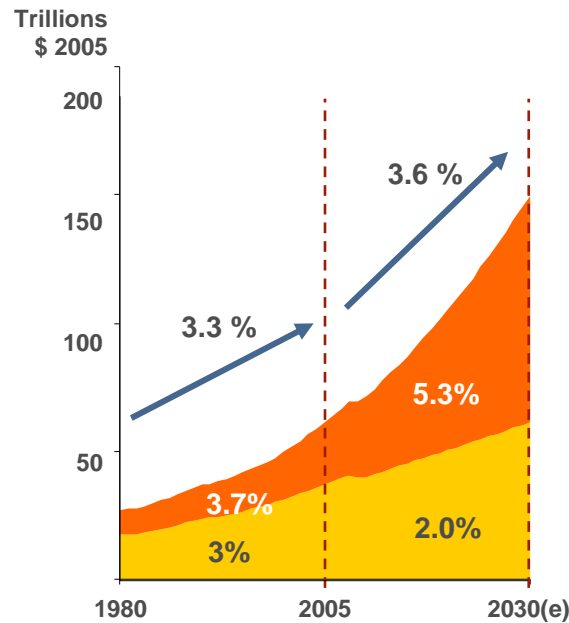
# Global energy demand growth

Population

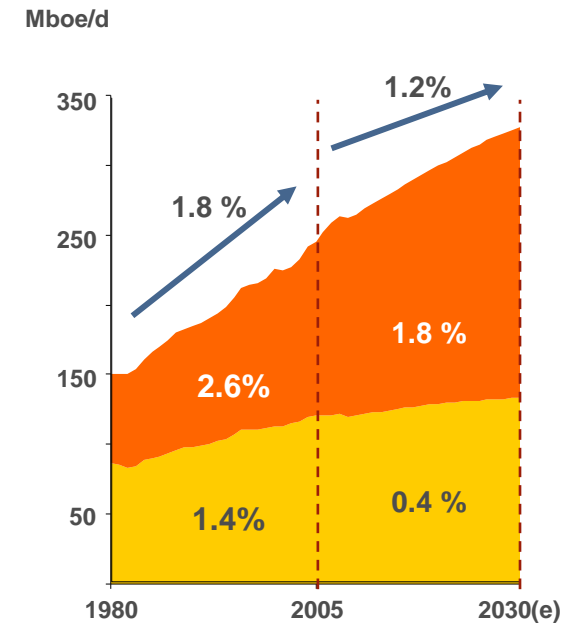


GDP

(purchasing power parity)



Energy demand



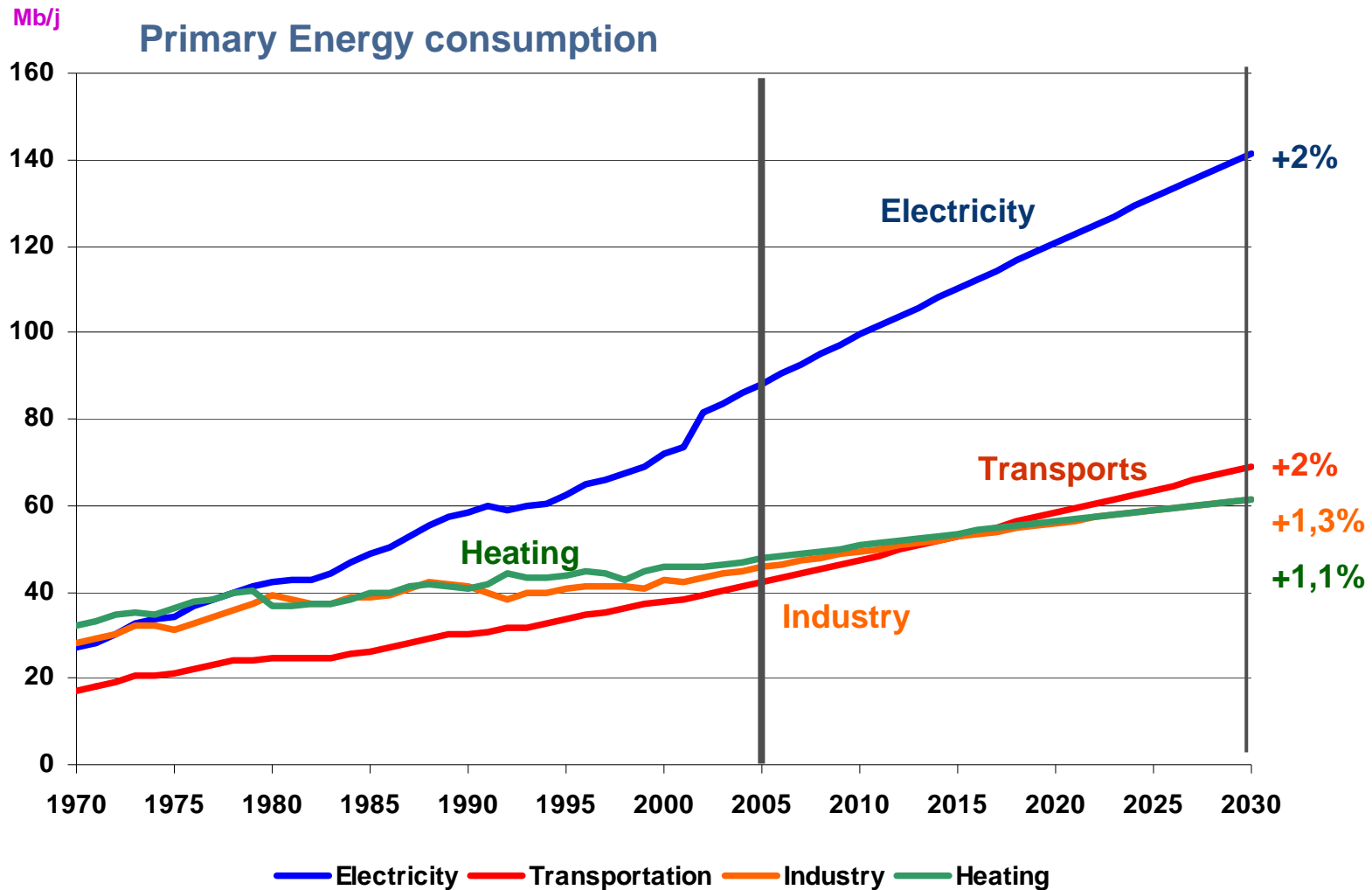
● OECD ● Non-OECD

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

Sources : Total estimates



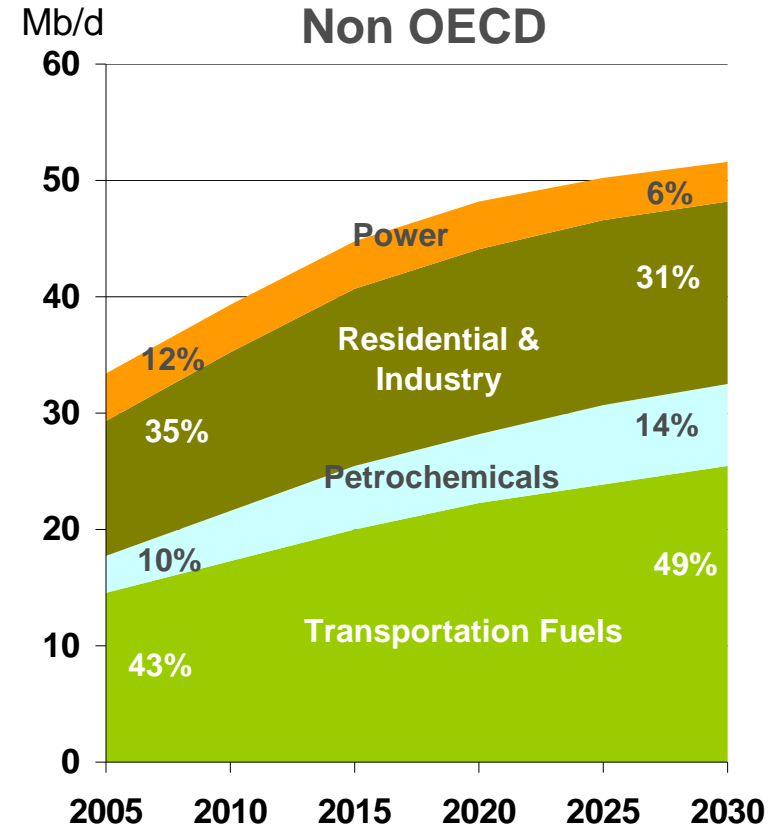
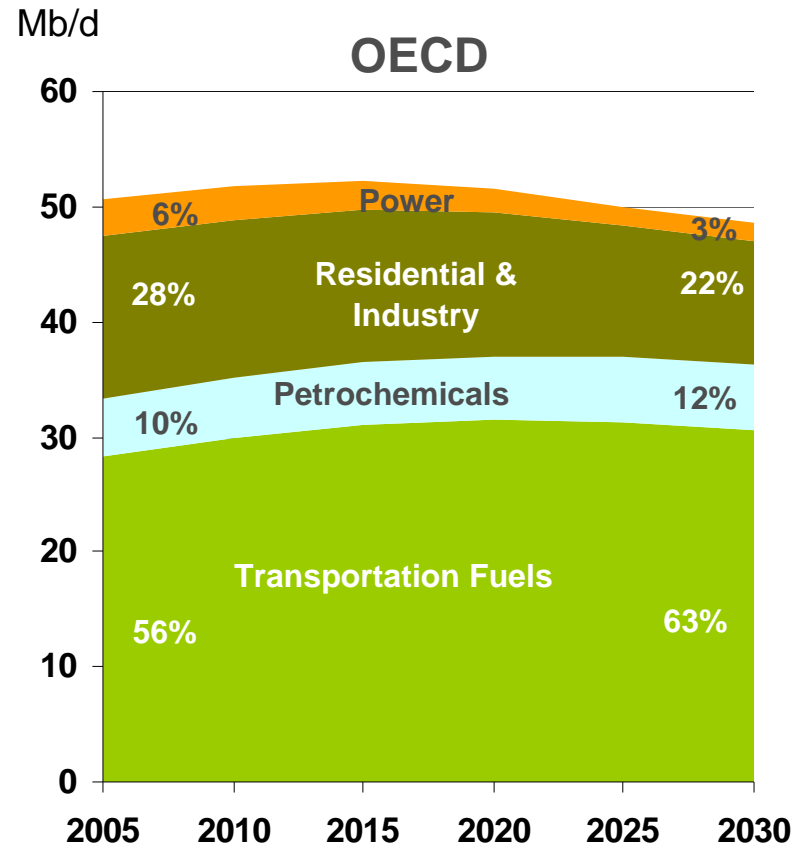
# The use of energy : it depends on the level of development



Not the same issues for stationary uses, electricity and transport

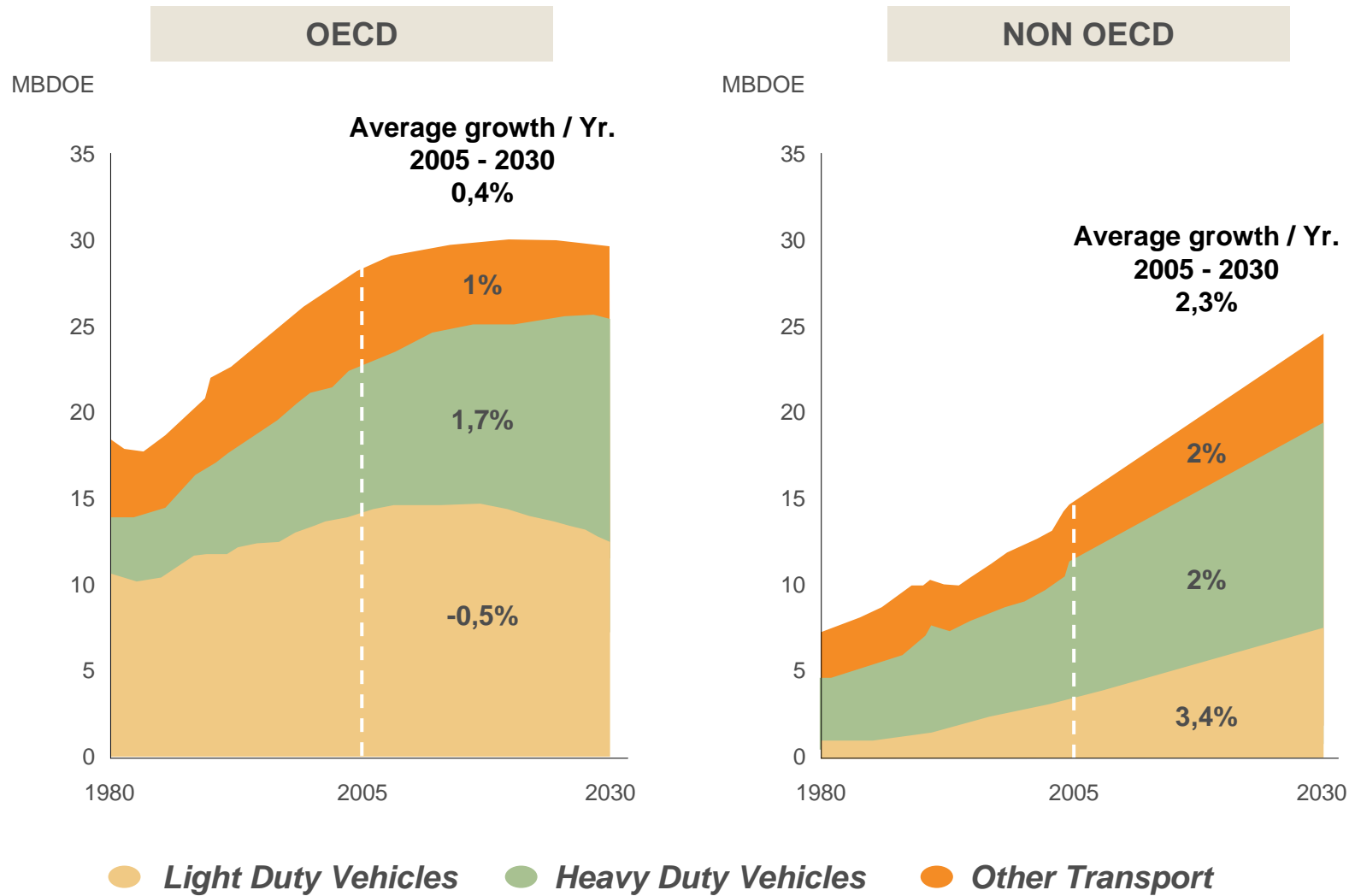
# Oil products : demand decrease in OECD countries, consumption concentrated on transport & petrochemicals

## Oil product uses



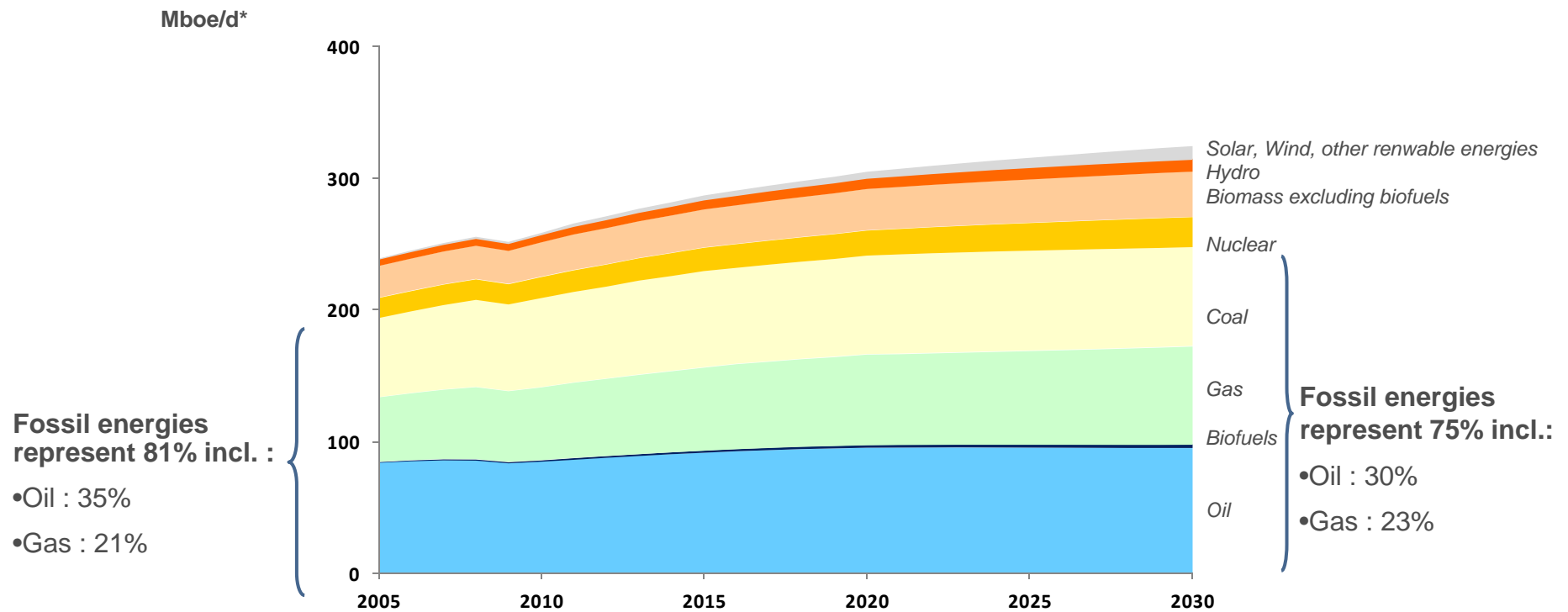
- ▶ Transportation fuels & petrochemicals : +10 % both OECD & non-OECD
- ▶ More efficient cars & more specialized uses

# Transportation: current crisis consolidates long term trends



# Fossil energies to represent 75% of energy supply in 2030

World energy supply



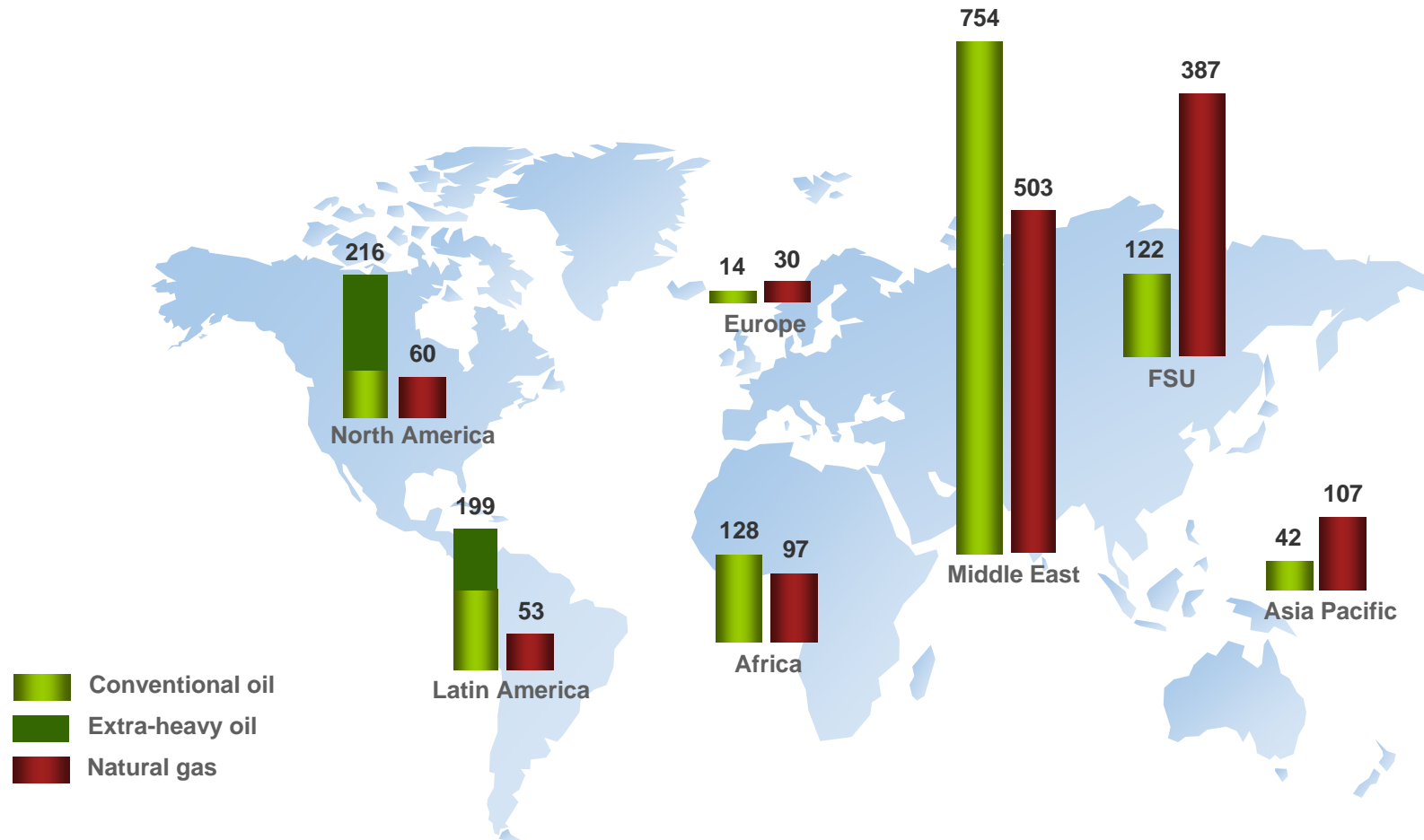
*Efficient CO2 emissions management and diversification of energy supply are key issues*

Source: Total estimates.

\* Million barrels of oil equivalent per day.

# Oil and gas world reserves

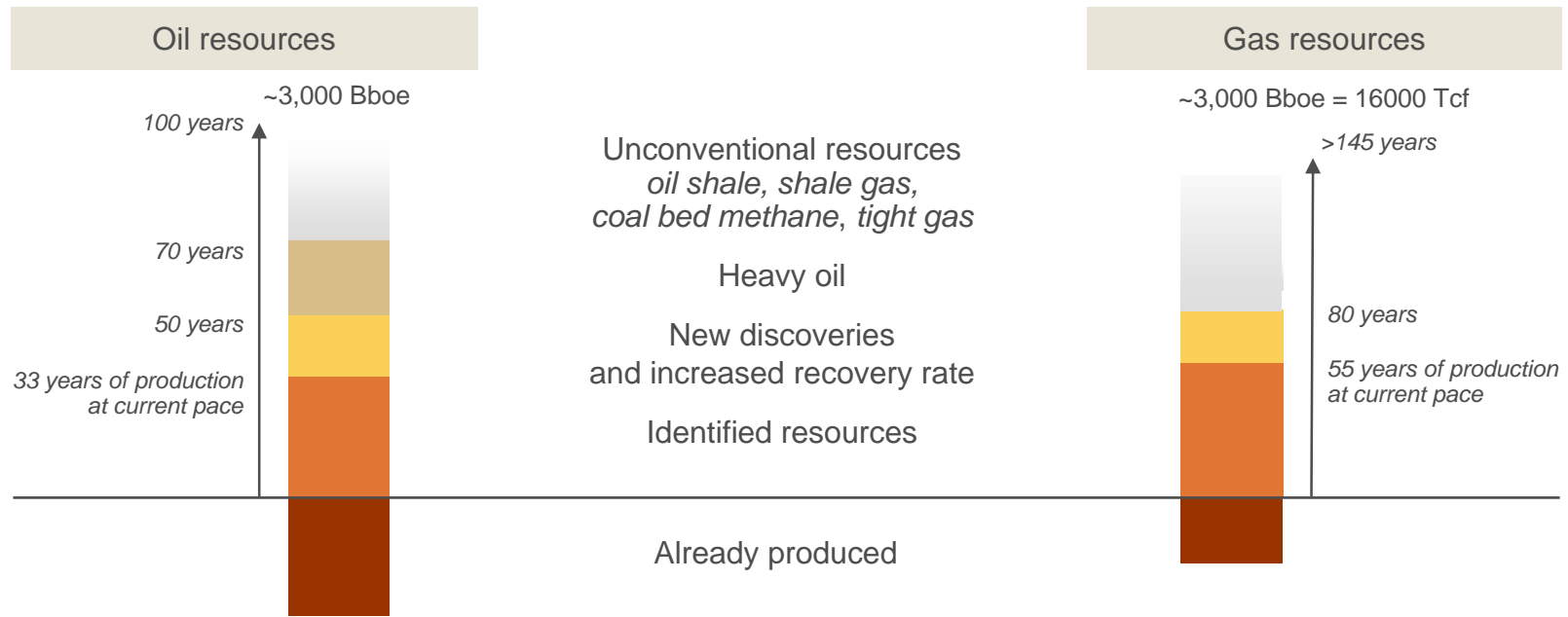
Billion barrels oil equivalent



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*

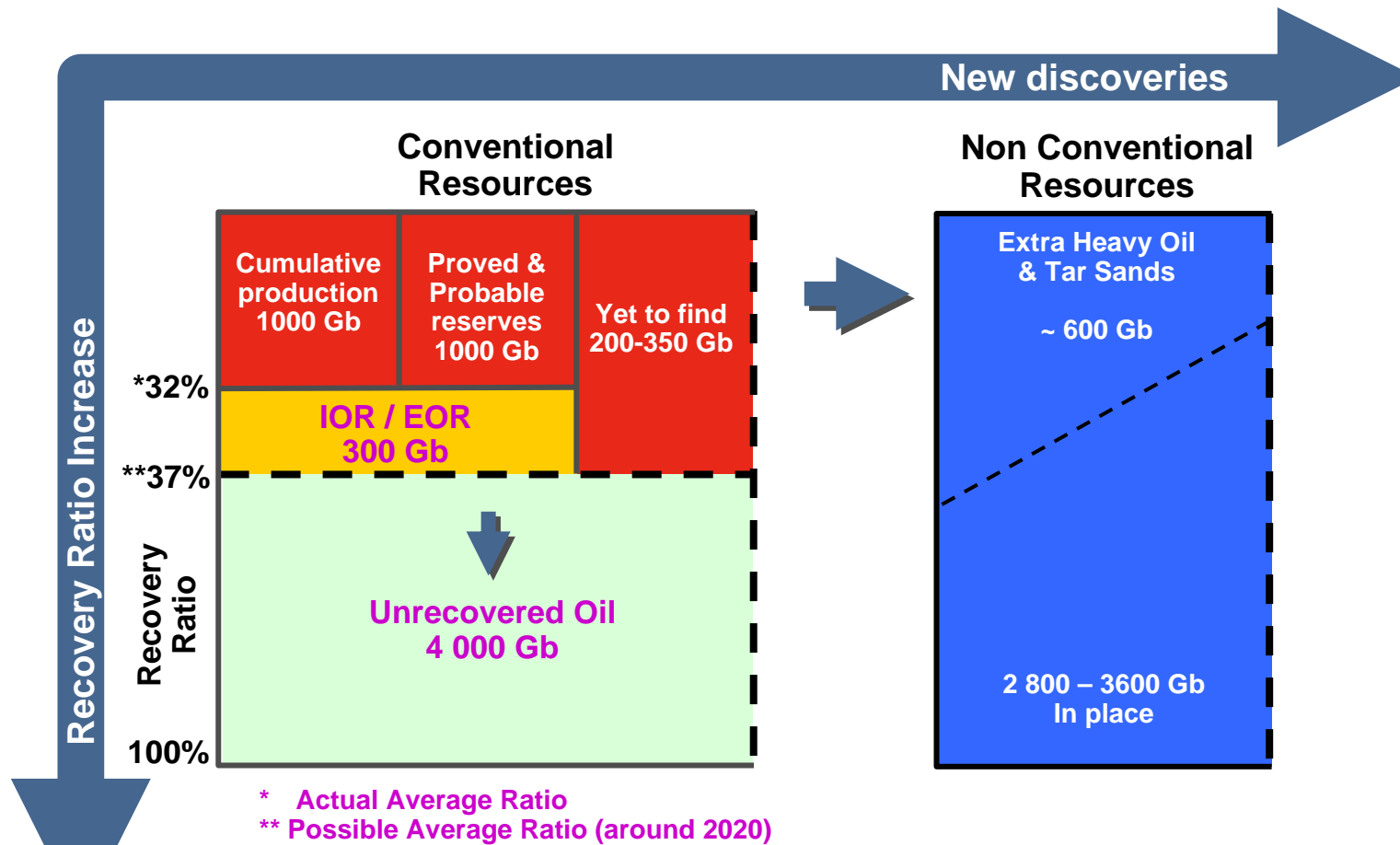
*With ample availability of oil and gas and existing infrastructure, hydrocarbons will be dominant fuel source for the next decades*

Total estimates

11 - Bruno Weymuller - November 2010



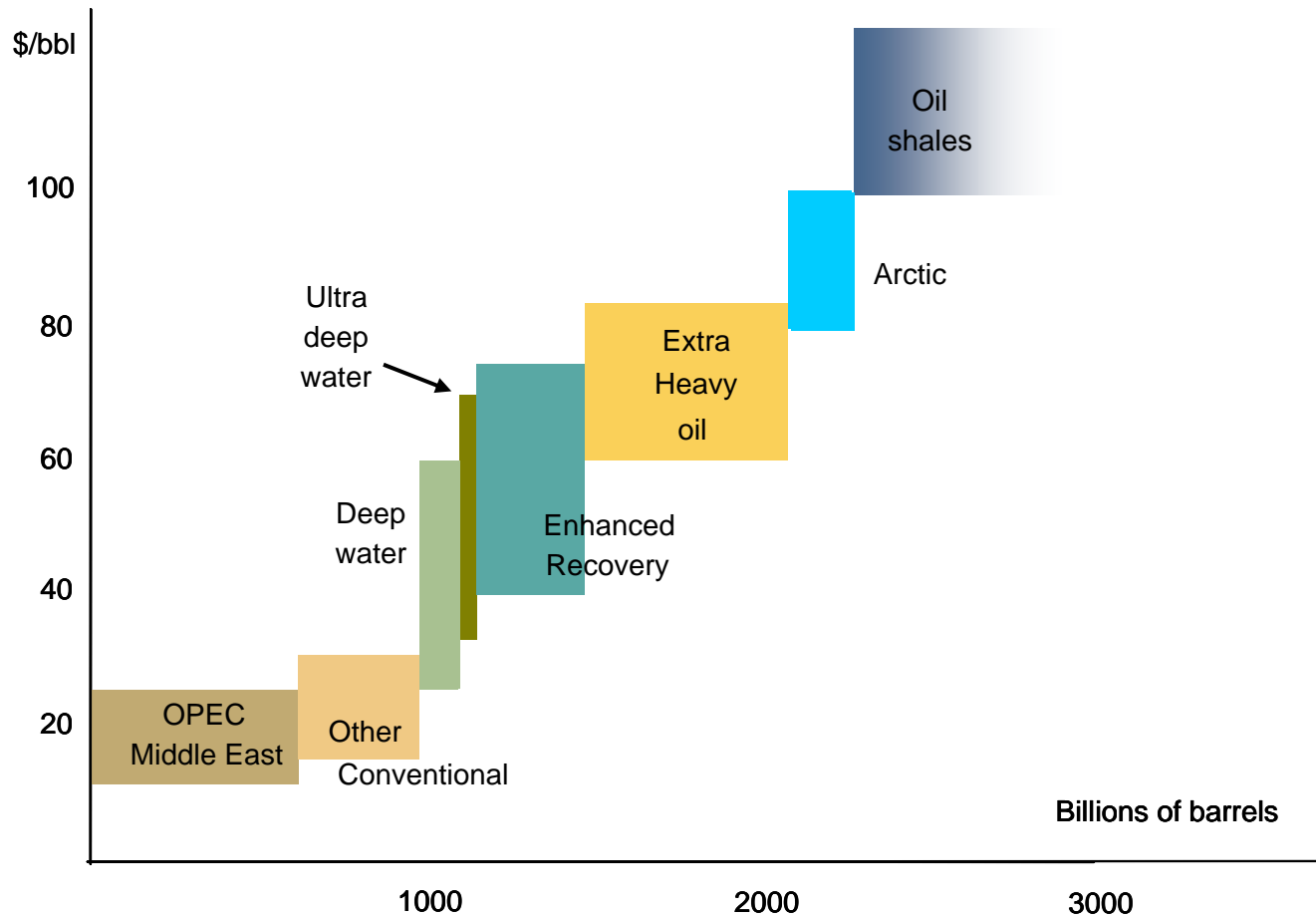
# From discoveries to oil resources



**Equivalent to 40-45 years of today's production**

# High costs for the marginal projects

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

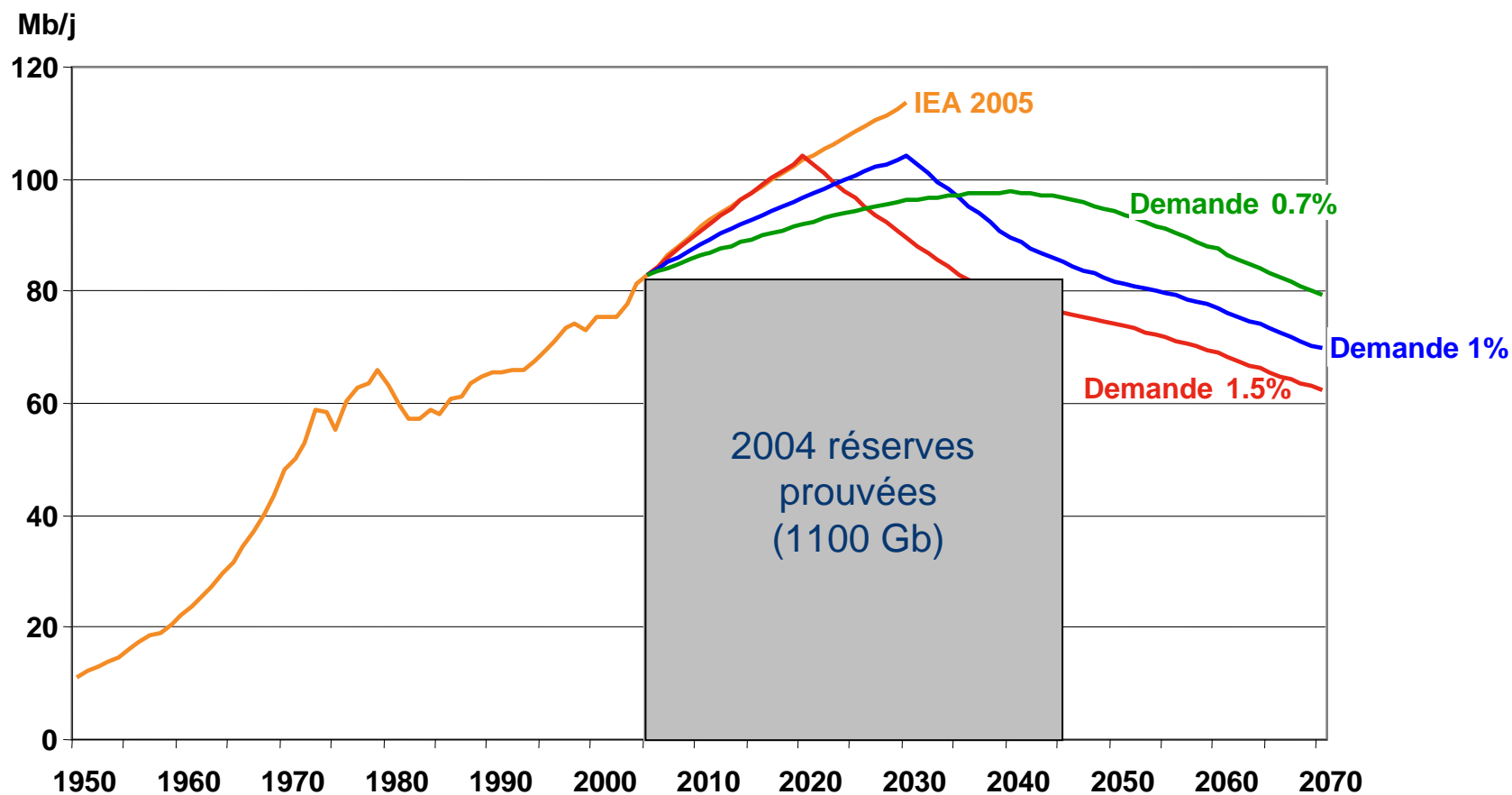


Sources: IEA, CERA, Total



# Quelles sont les prévisions de production dans le long terme ?

Production mondiale de pétrole

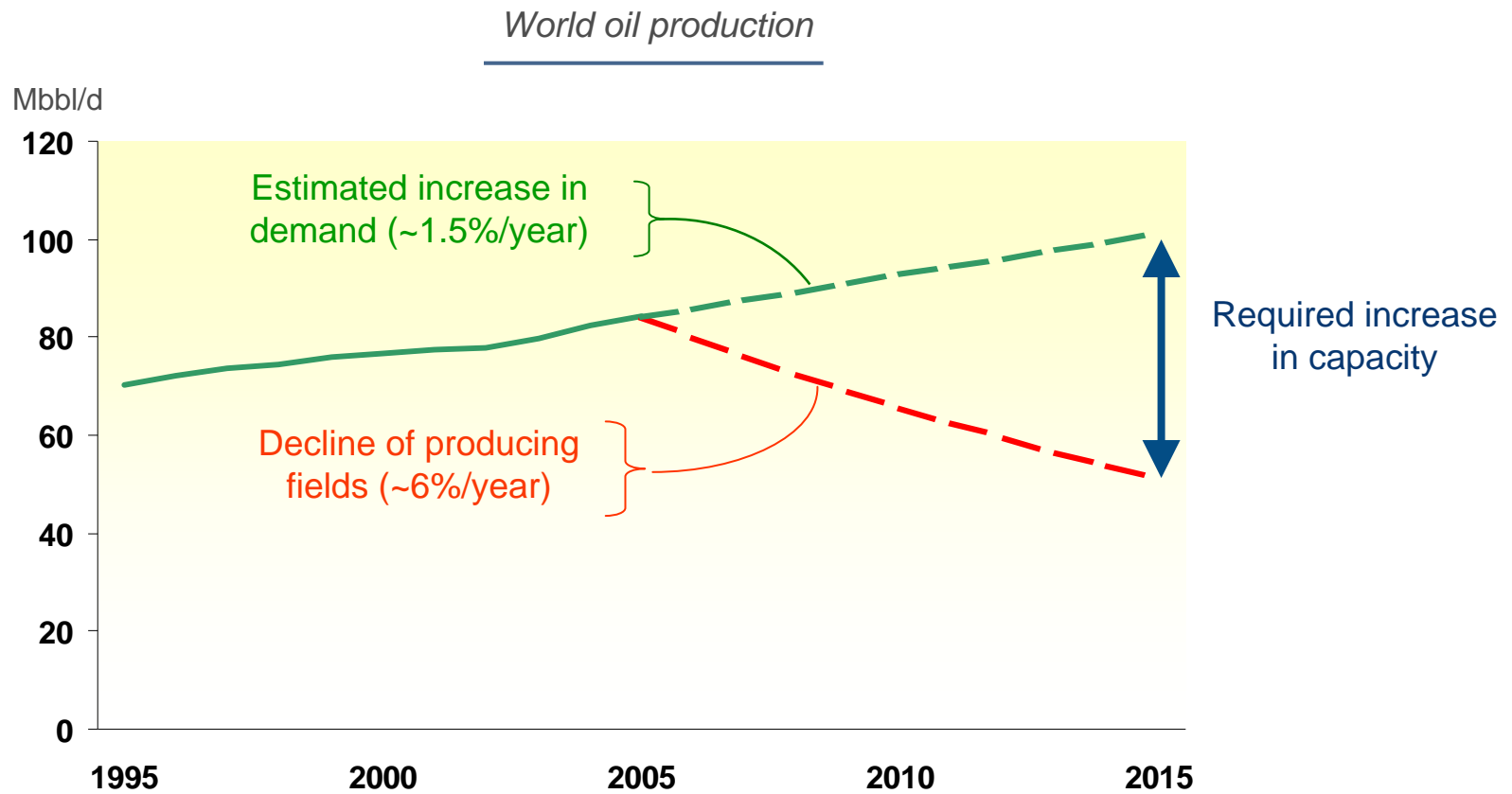


Source: AIE 2006, TOTAL

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



# The challenge of production growth

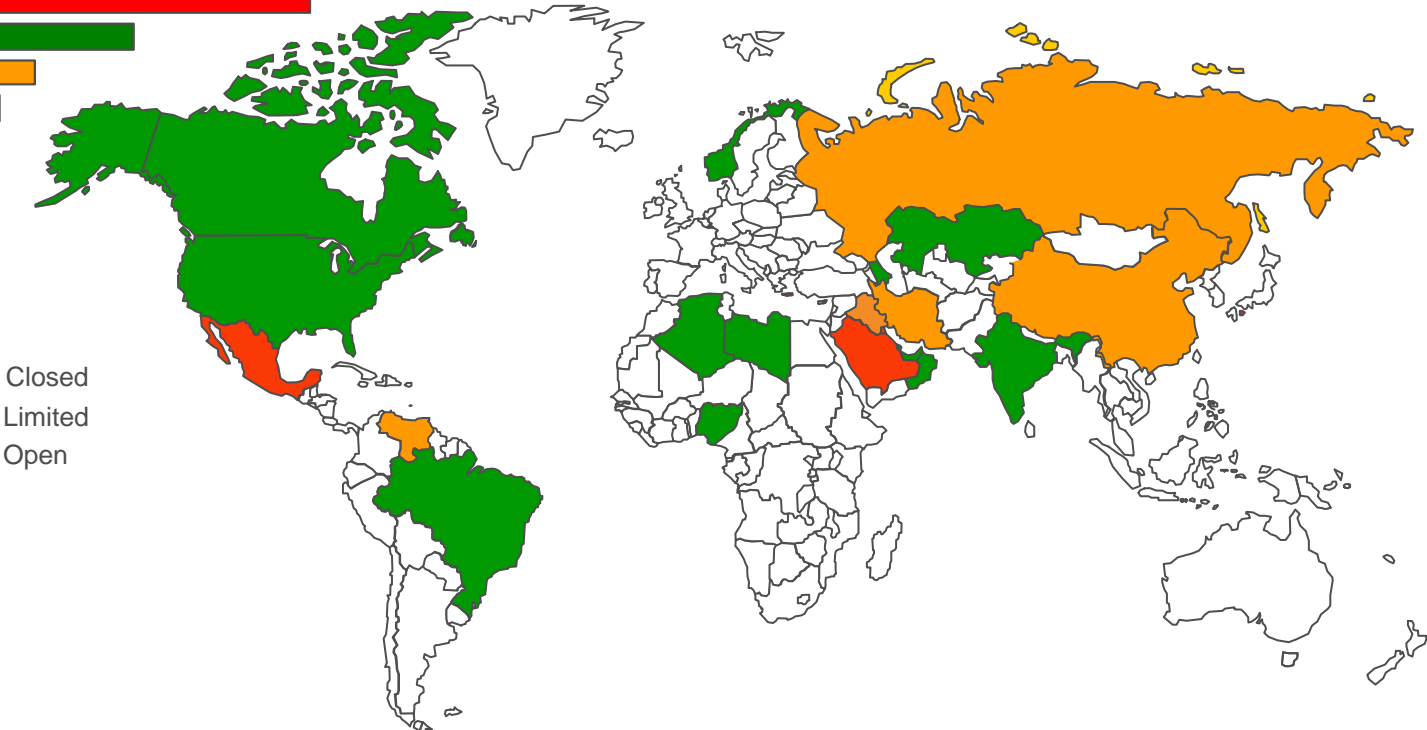
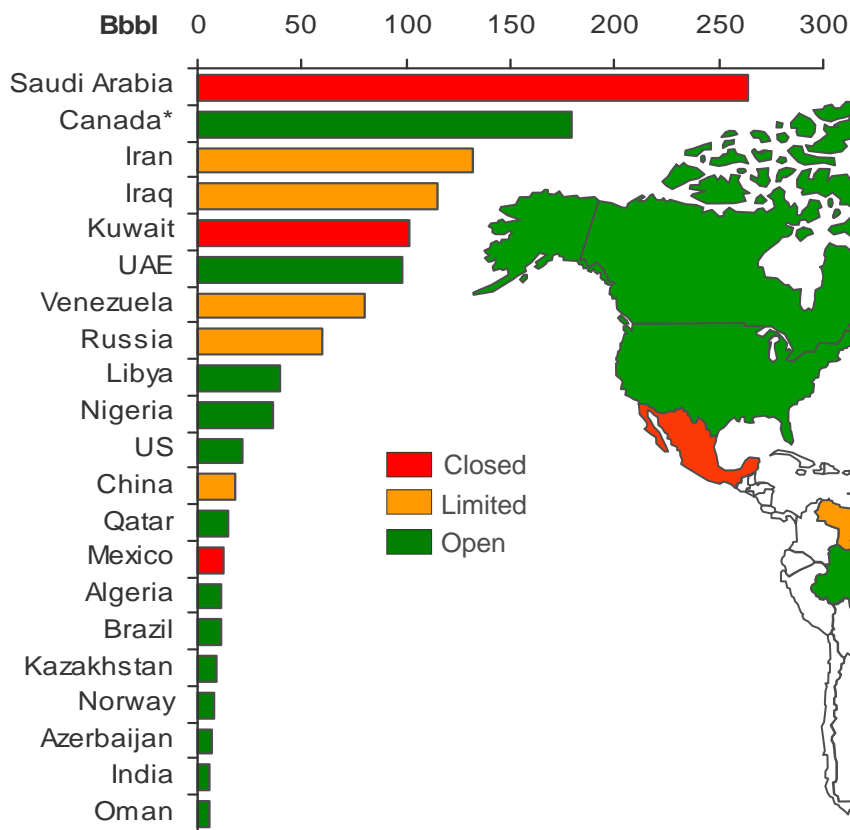


*~ 50 Mbb/d of new production is required from 2009 to 2018*

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

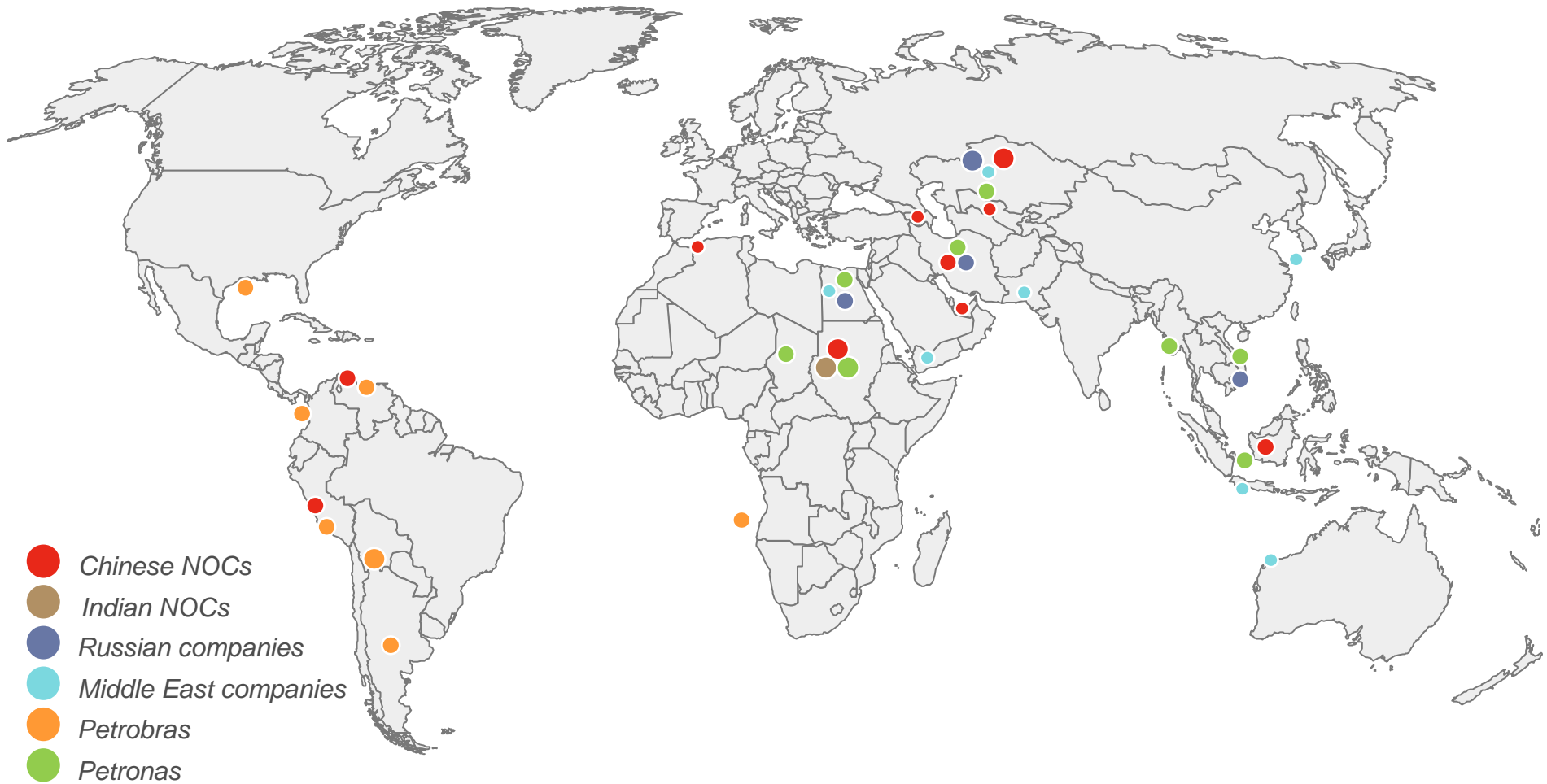
Source: OGJ

\*: Canada including extra-heavy oil



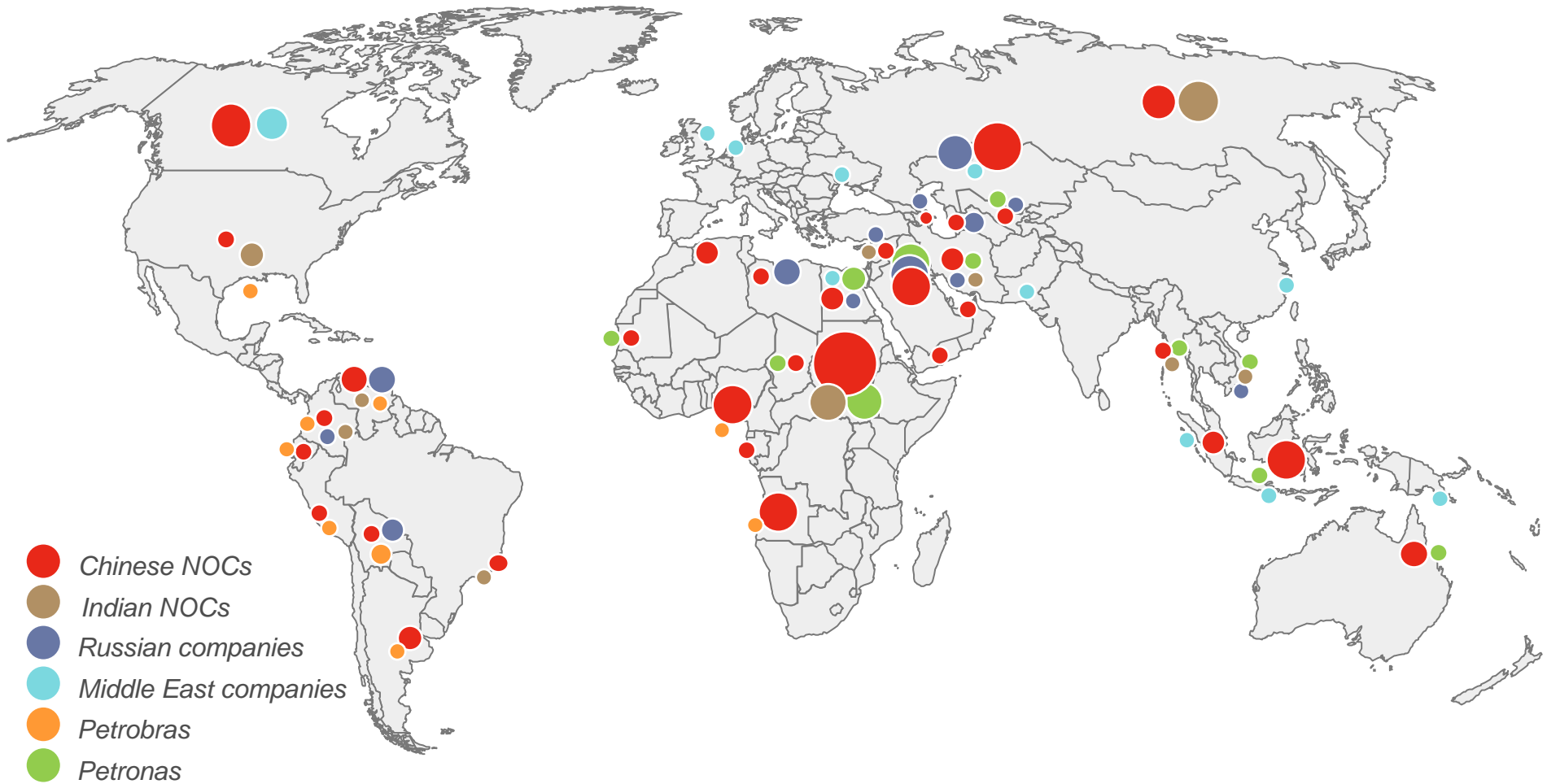
# Un développement très rapide des compagnies nationales ... hors de leurs frontières

2003



## ... hors de leurs frontières

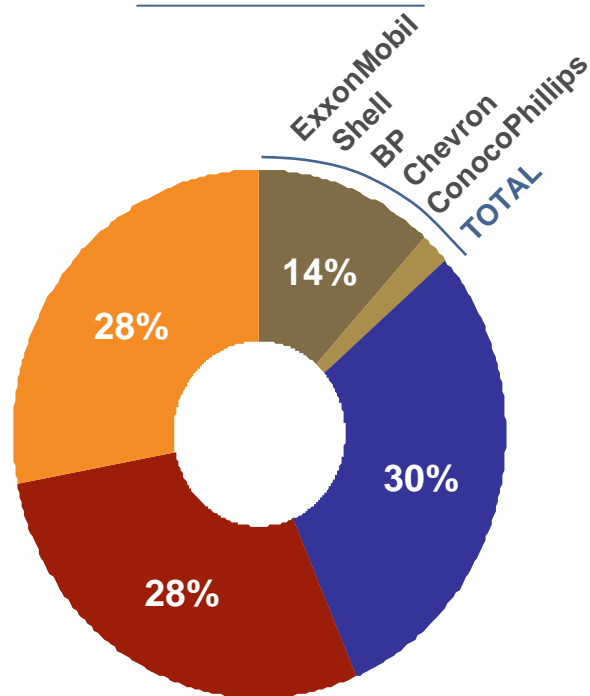
Juin 2010



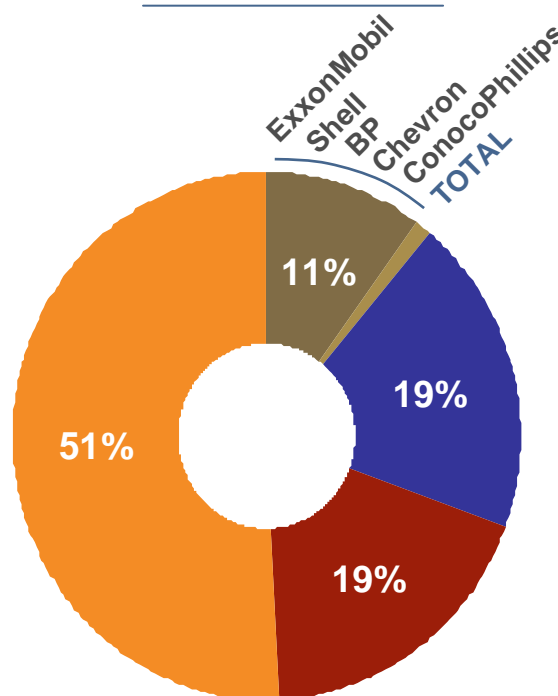
*L'accompagnement des NOCs : une voie de croissance décisive pour une IOC...*

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

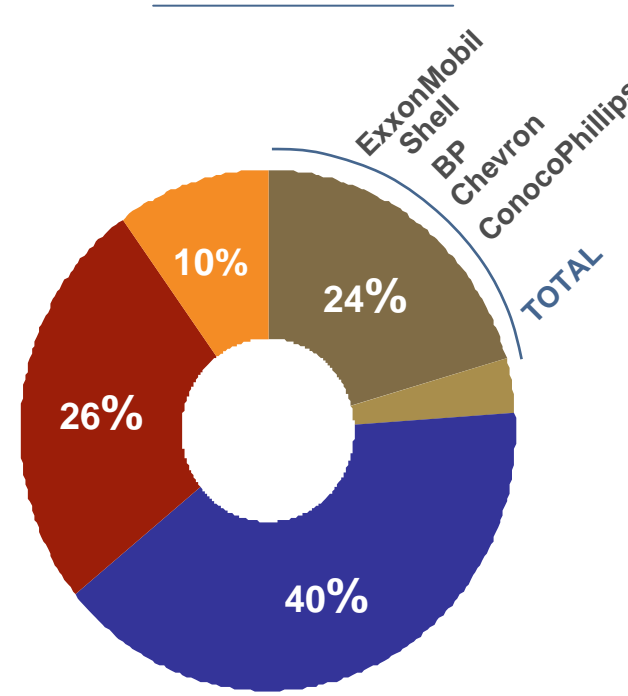
World Production  
Oil & Gas  
2008  
133 Mboe/d (oil = 81.8 Mbd)



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

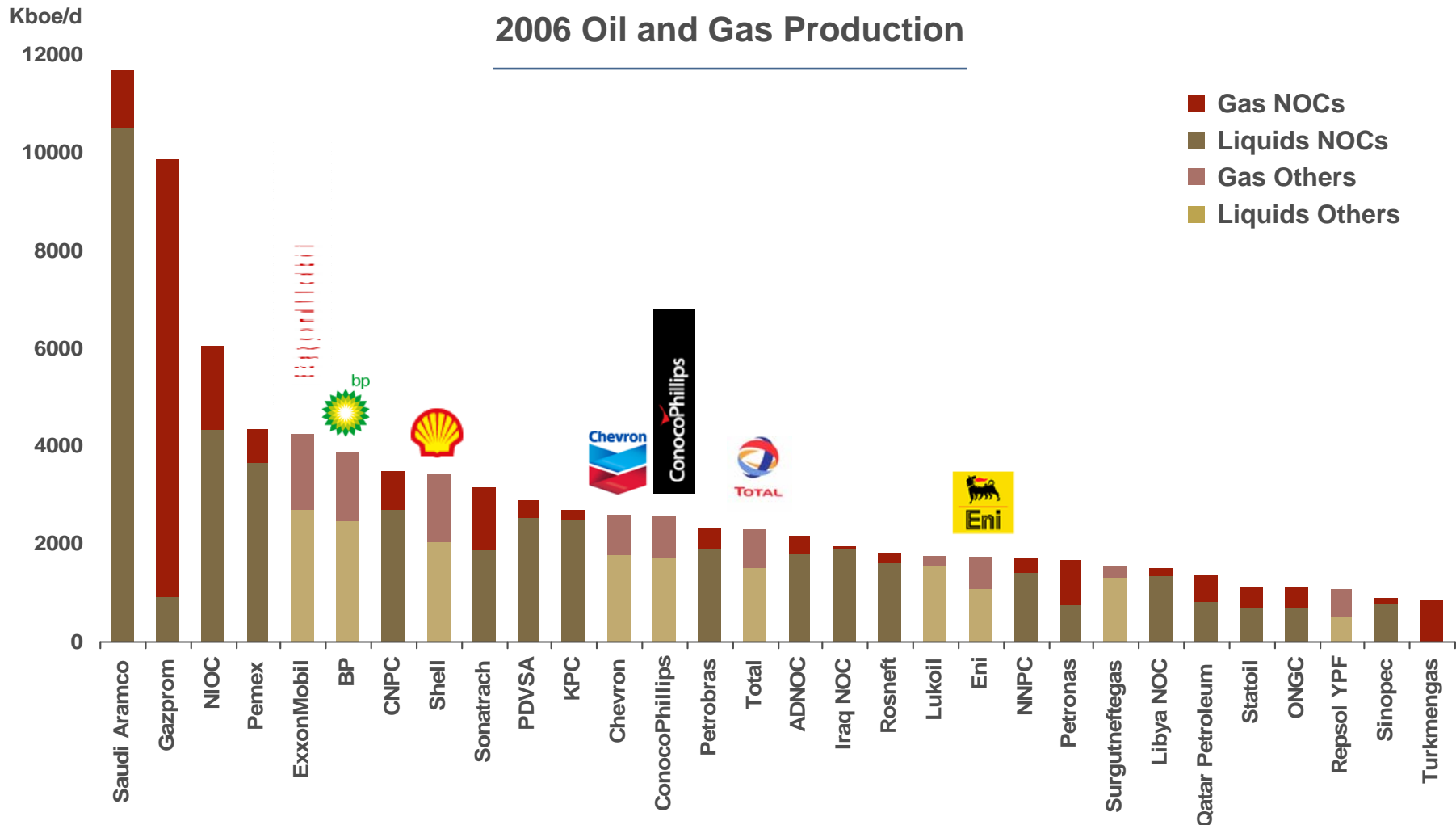
OPEC NOCs: Saudi Aramco, PDVSA, NNPC, QatarPetroleum, Sonatrach, NIOC, ADNOC, NOC, KPC, Sonangol, PetroEcuador,TAQA

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,



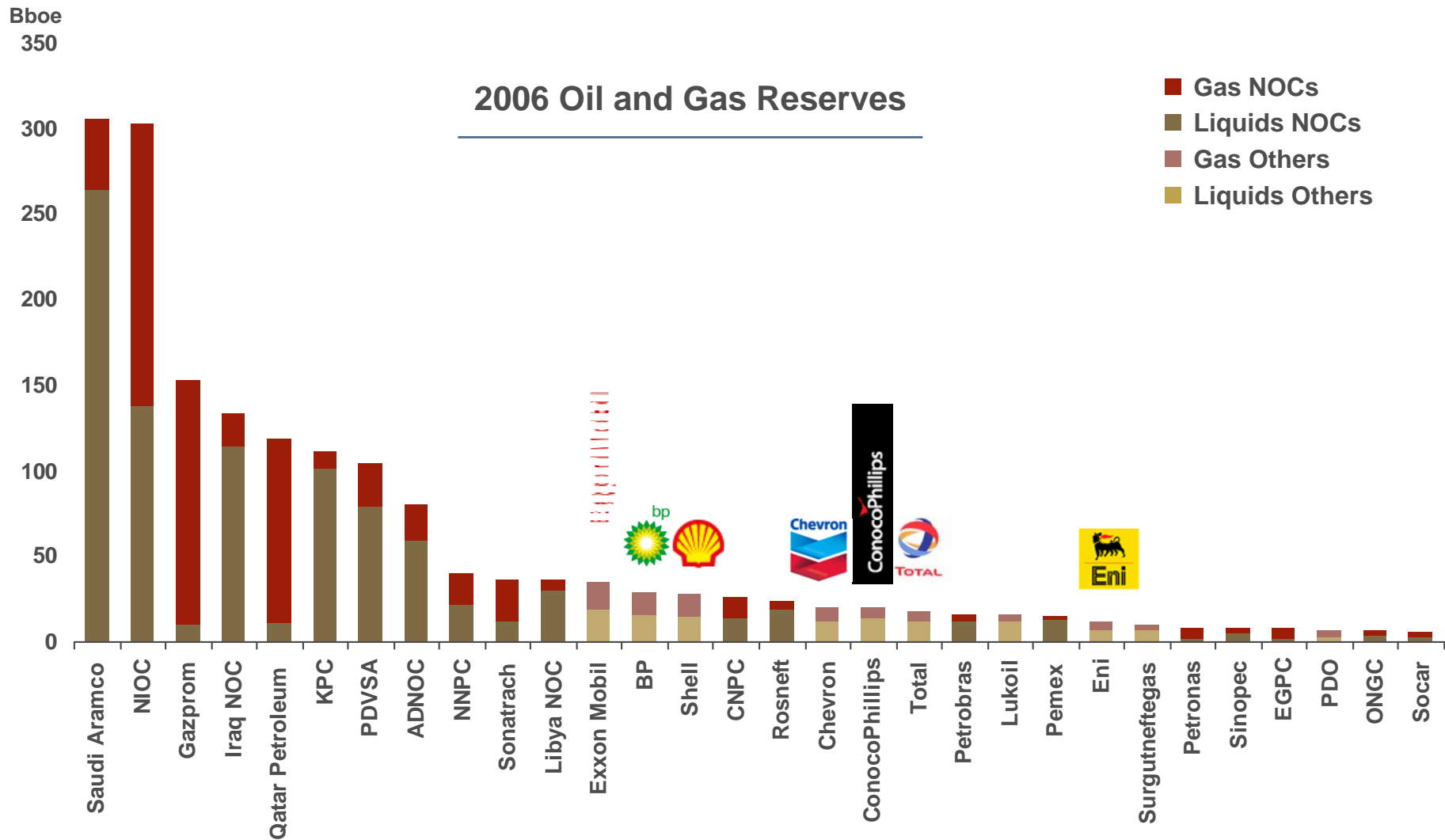
# But NOCs dominate oil and gas production...



**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



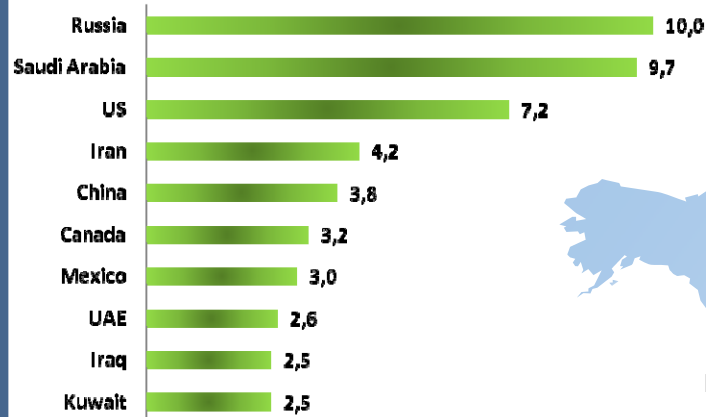
**NOCs 73% of world reserves (OPEC NOCs 54%), versus 15% for IOCs**

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

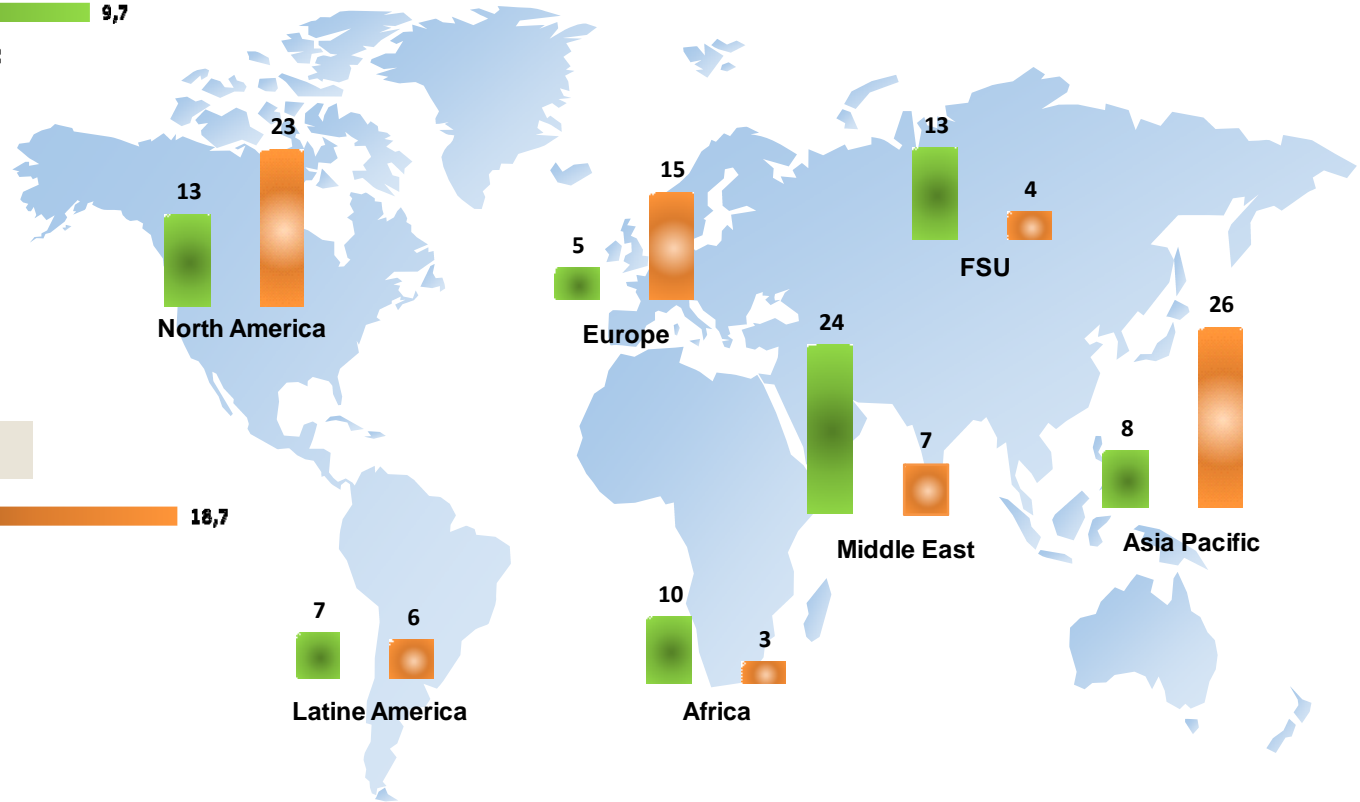
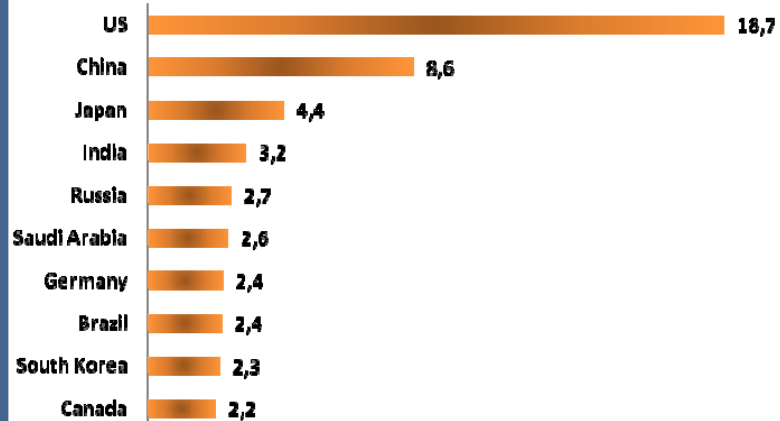


# Worldwide oil production and consumption

## Top 10 producing countries



## Top 10 consuming countries



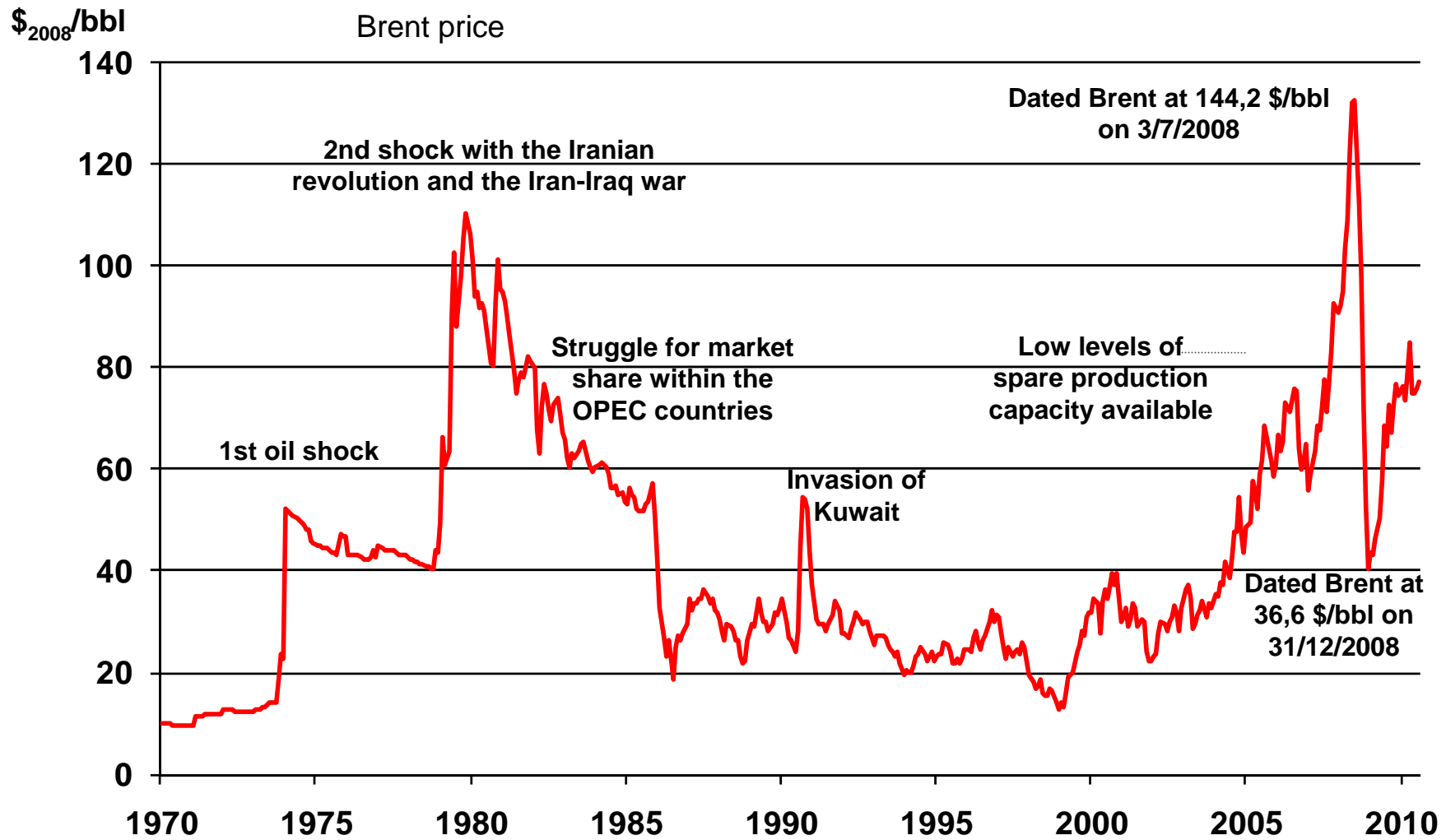
Million barrels per day

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

Sources: BP SR 2010



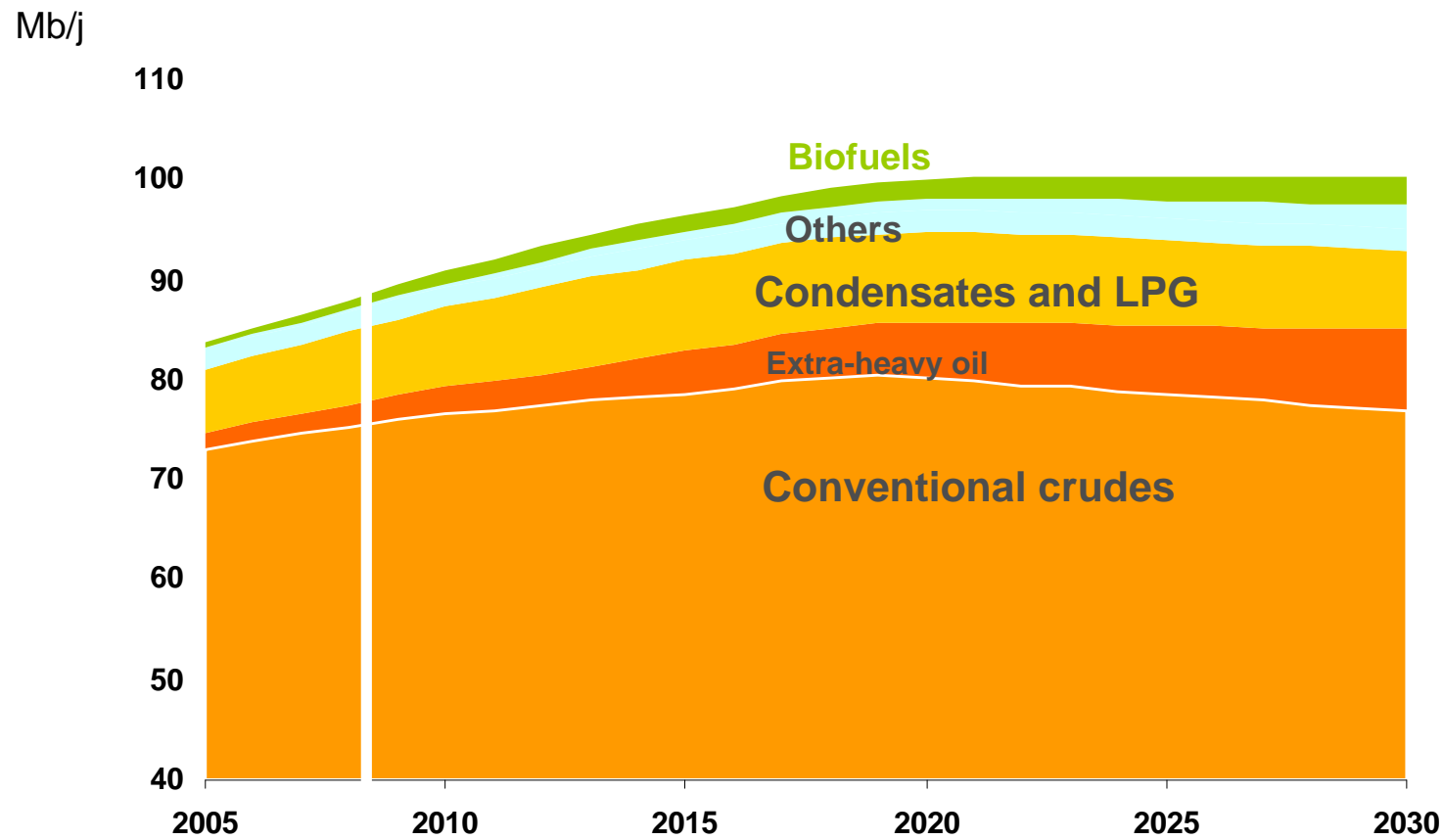
# Historically strong volatility in oil prices



Sources : IEA, US BLS



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



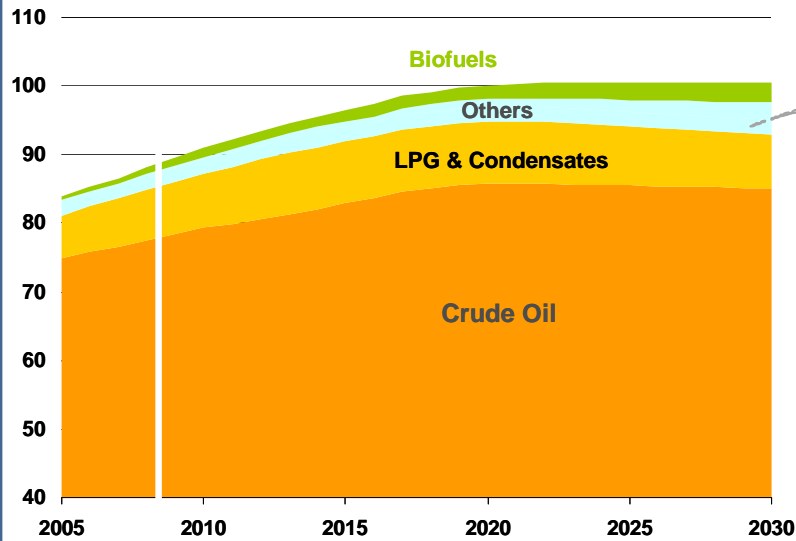
\* Others = GtL + CtL + refinery gains

25 - Bruno Weymuller - November 2010

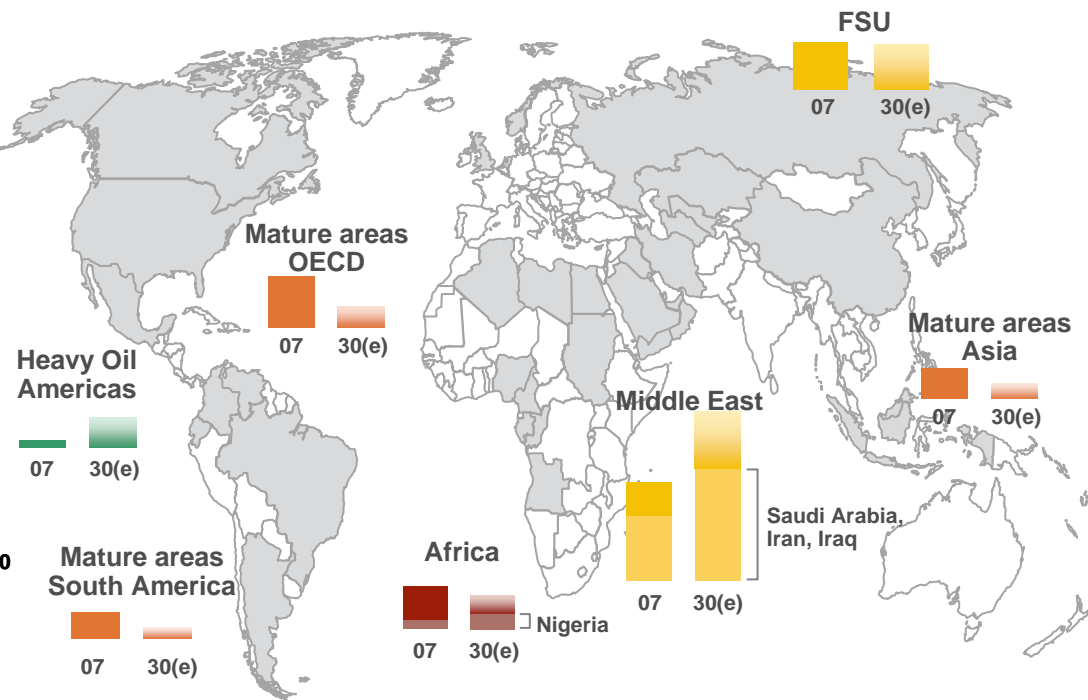


# Oil production to remain below 95 million barrels per day by 2020

Oil production



Oil production by area



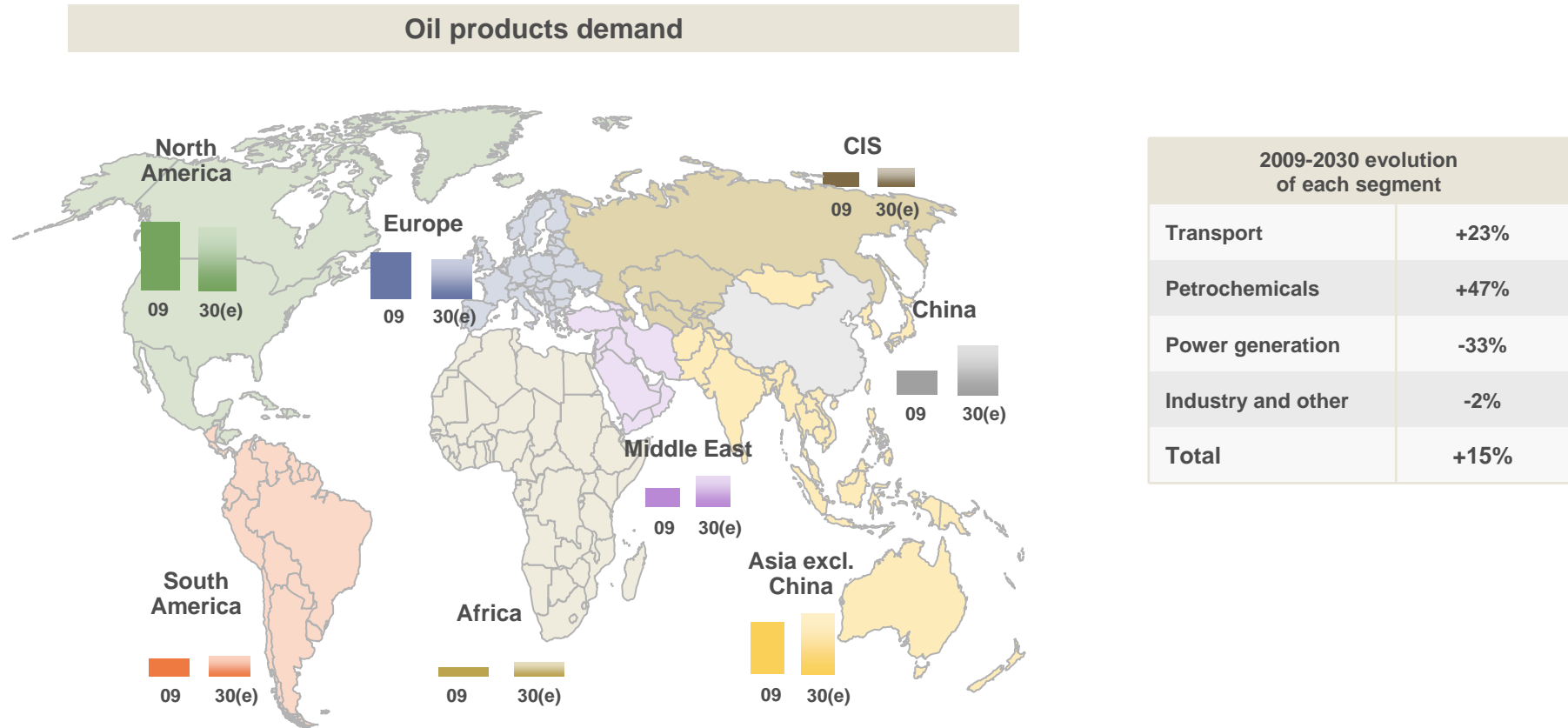
- ▶ Geopolitical uncertainties delaying development of new capacities
- ▶ Stronger role for OPEC

sources : Total estimates

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



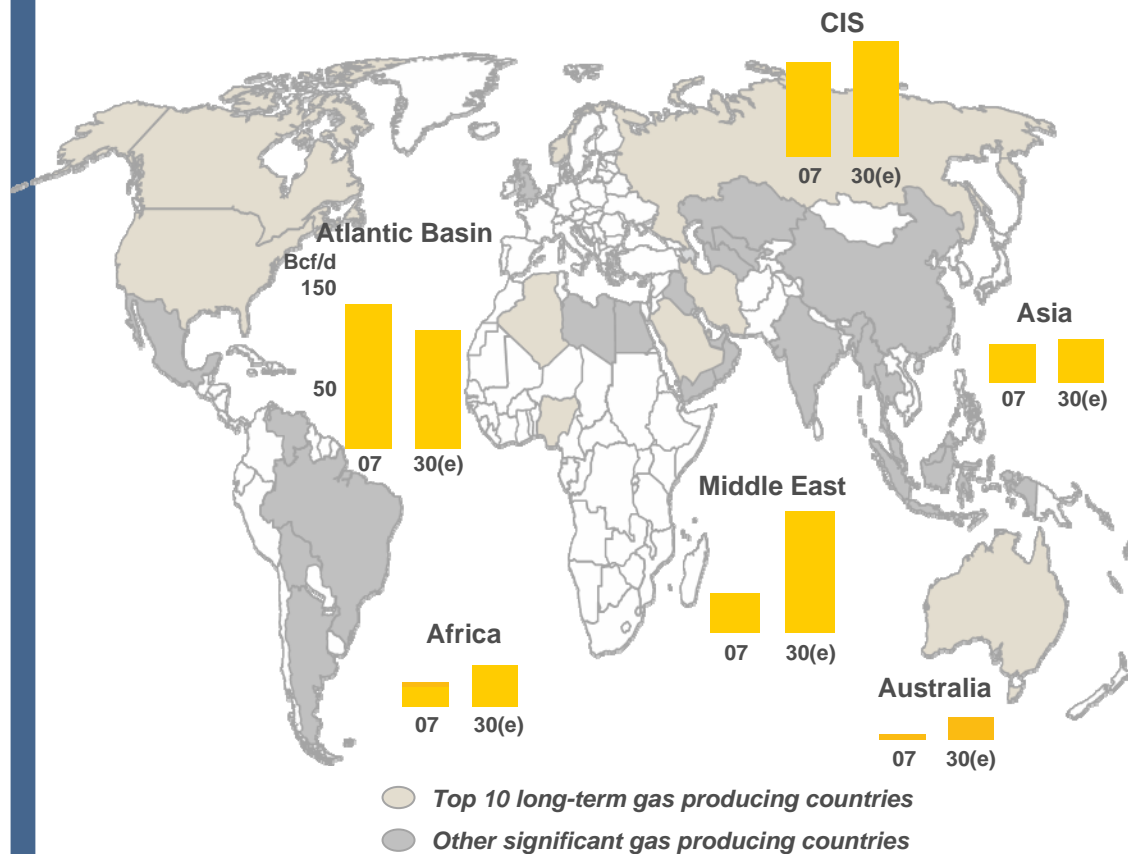
# Oil demand driven by transport and growth in emerging countries



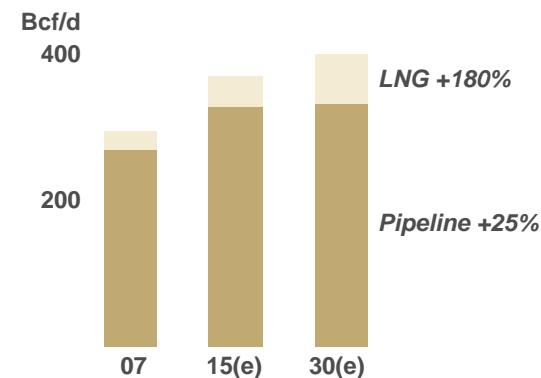
*Increasing demand for light products :  
 naphtha for petrochemicals, gasoline and diesel for transport  
 Necessary to upgrade refining and petrochemical plants to curb oil demand*

# Gas demand to grow by 1.5% per year through 2030

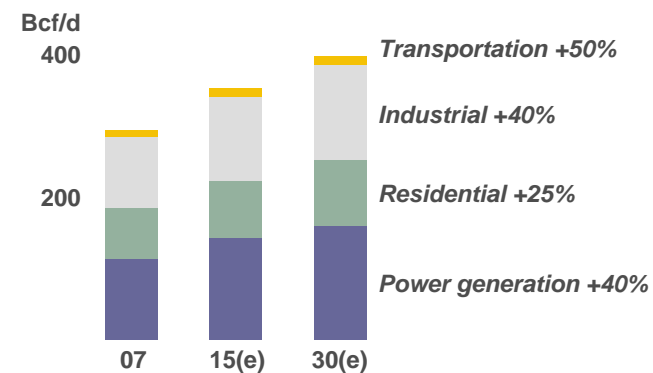
Gas production



Gas production



Gas demand by sector

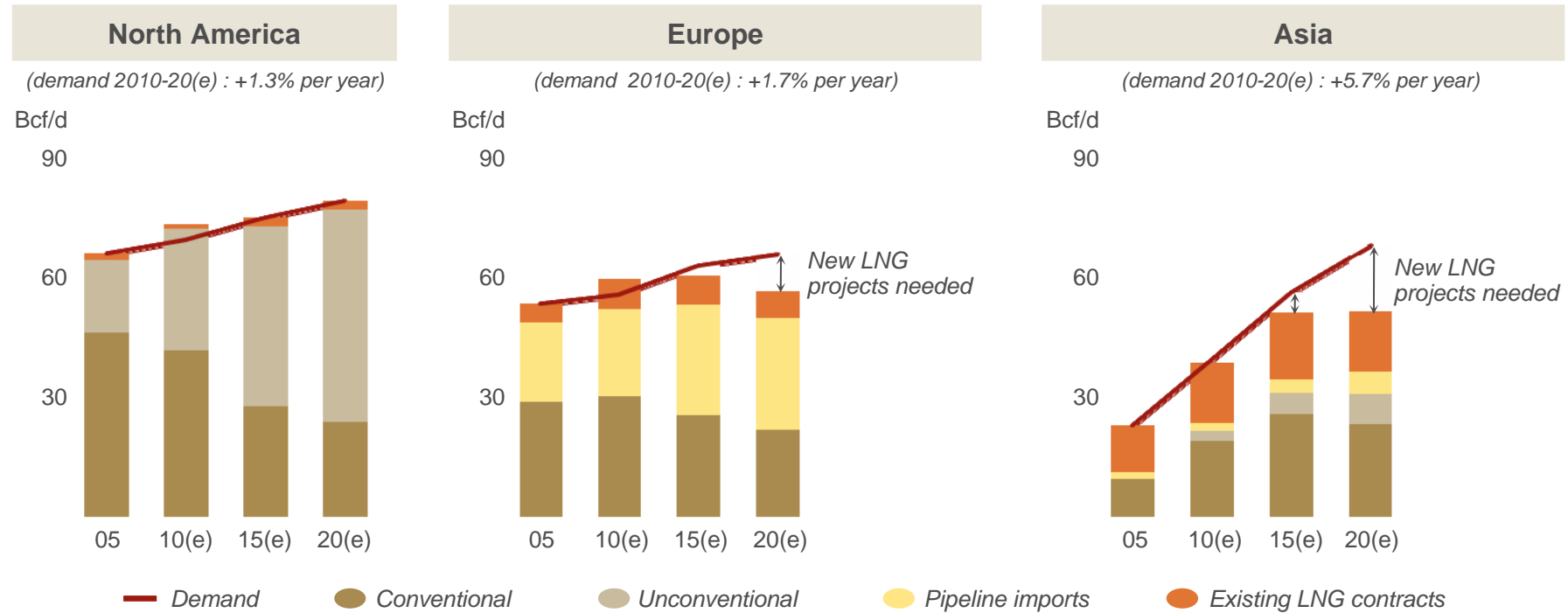


**Gas demand mainly driven by power generation, Asia and Middle East**  
**Growth of gas supply driven by LNG expansion**

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

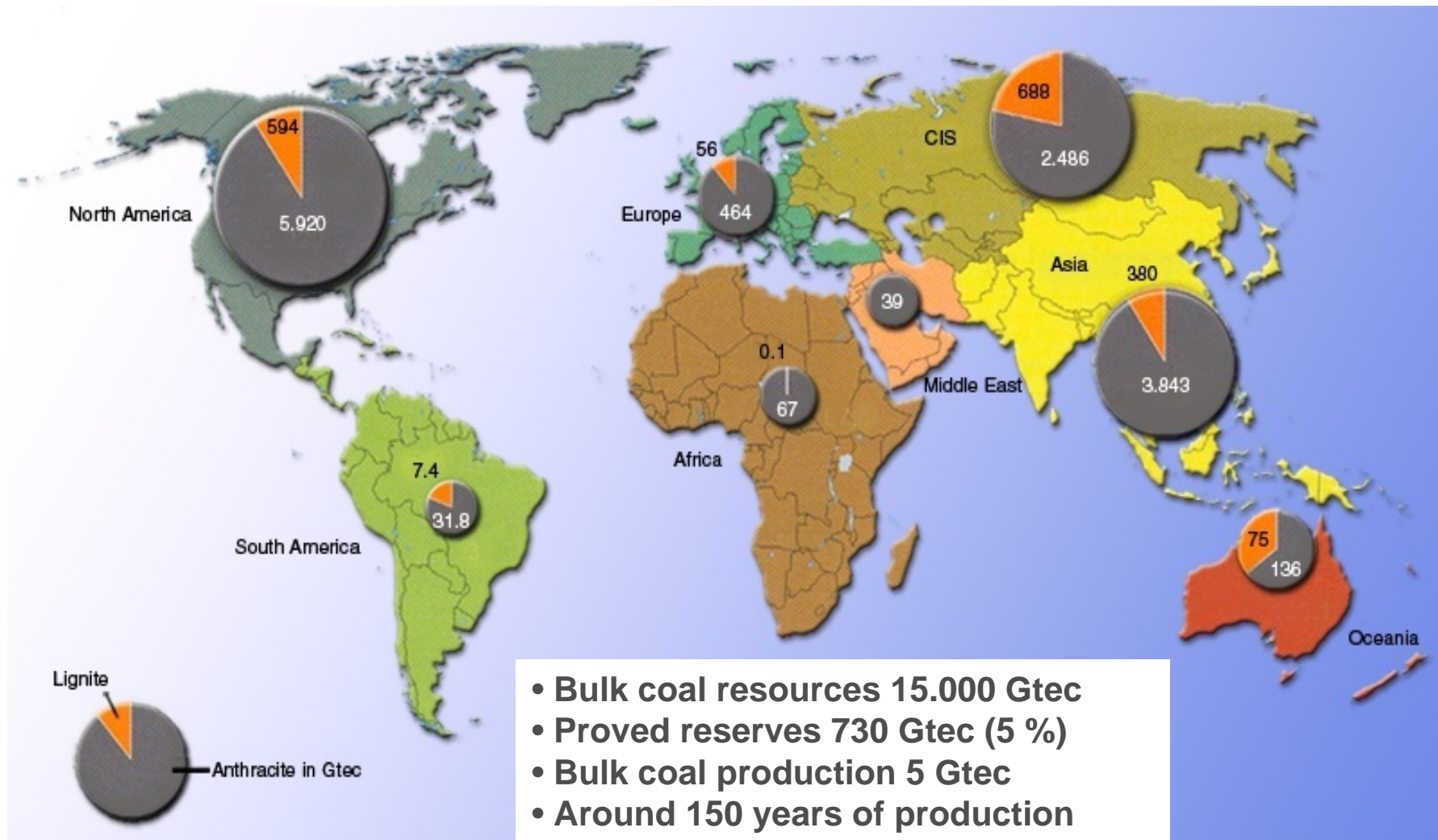
> Unconventional gas still limited by 2020(e)

**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 CO<sub>2</sub> 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

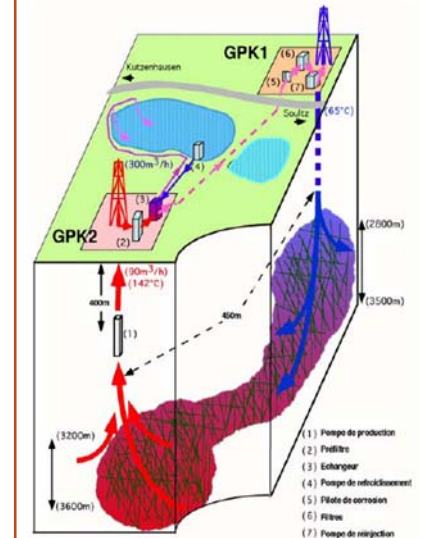


Schéma Simplifié de la circulation test conduite à SOULTZ en 1997 (© TOTAL non respectées)

Hydroelectricity



Ocean



Solar thermal



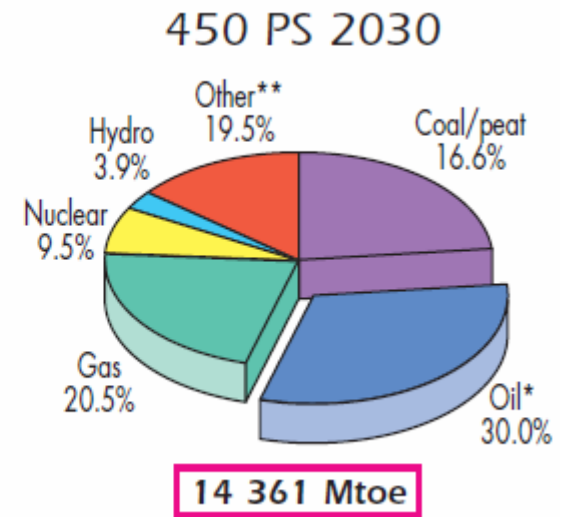
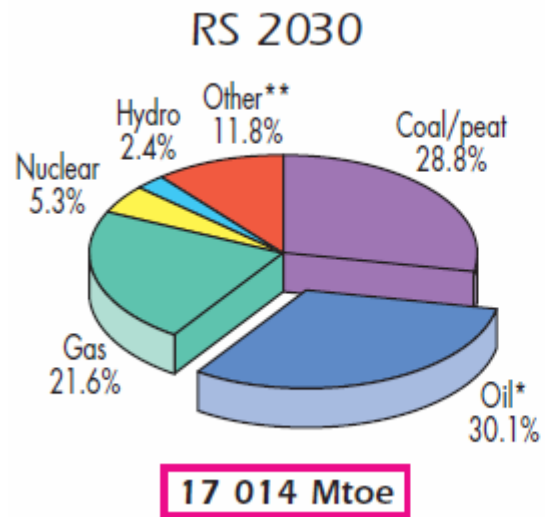
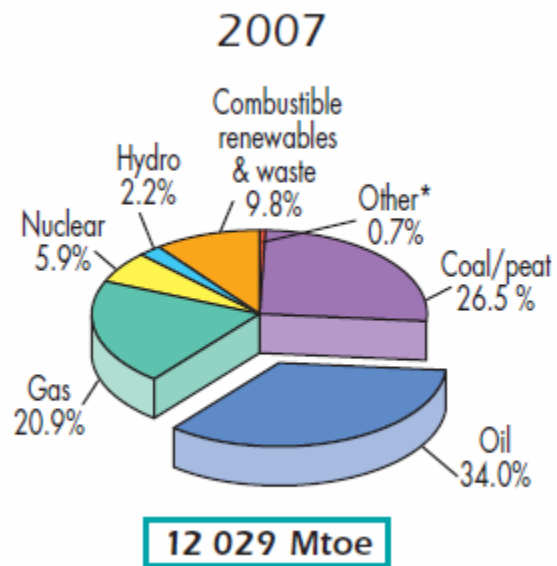
Biomass



Concentrating Solar



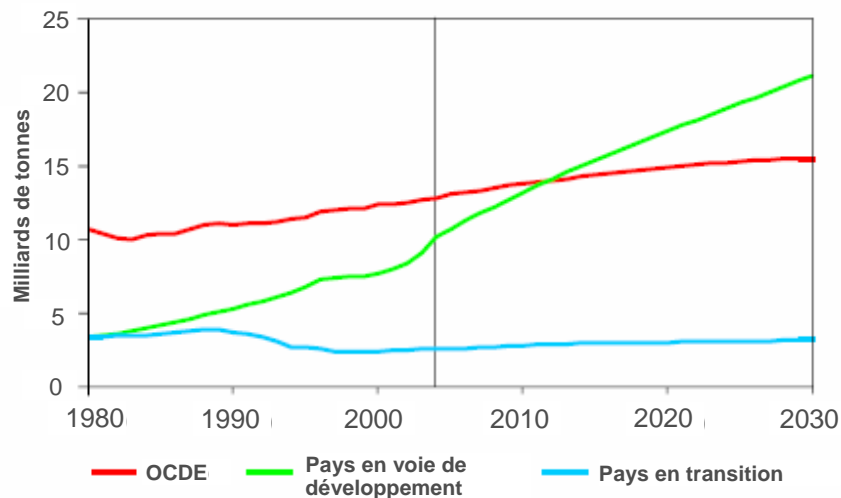
# World energy outlook (IEA)



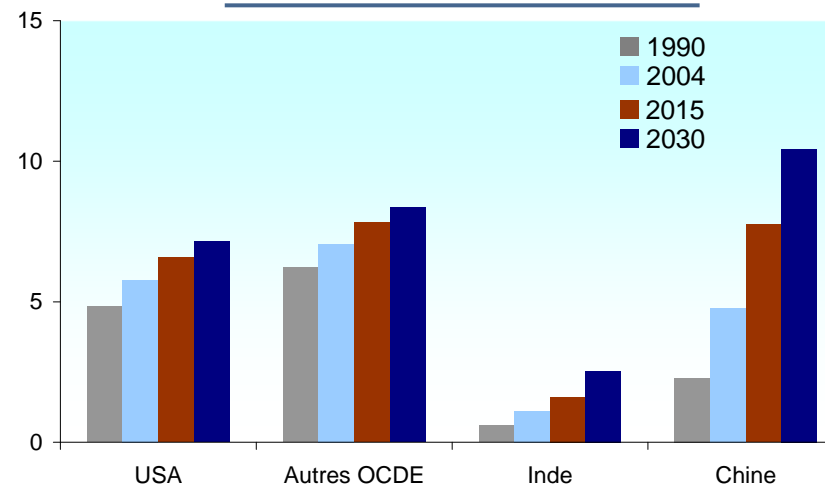
**Still 70 % ( 450 PS) to 80% (RS) of the energy mix still derived from fossil fuels in 2030**

# Croissance des émissions de CO<sub>2</sub> 1980-2030

*Émissions de CO<sub>2</sub> par région*

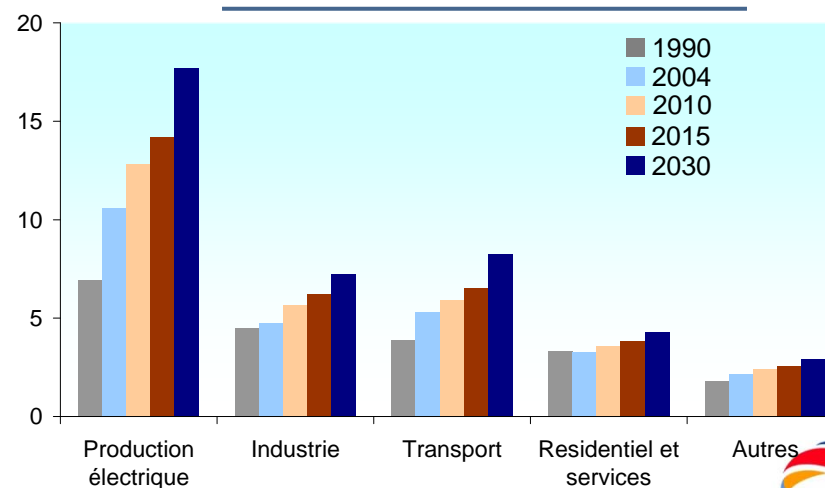


*Émissions de CO<sub>2</sub> par pays en GT/an*



- Les émissions de CO<sub>2</sub> augmenteront plus rapidement dans les pays en voie de développement, surpassant celles des pays développés dès 2020.
- Les émissions de CO<sub>2</sub> liées à la production d'électricité et au transport augmenteront le plus.

*Émissions de CO<sub>2</sub> par secteur en GT/an*

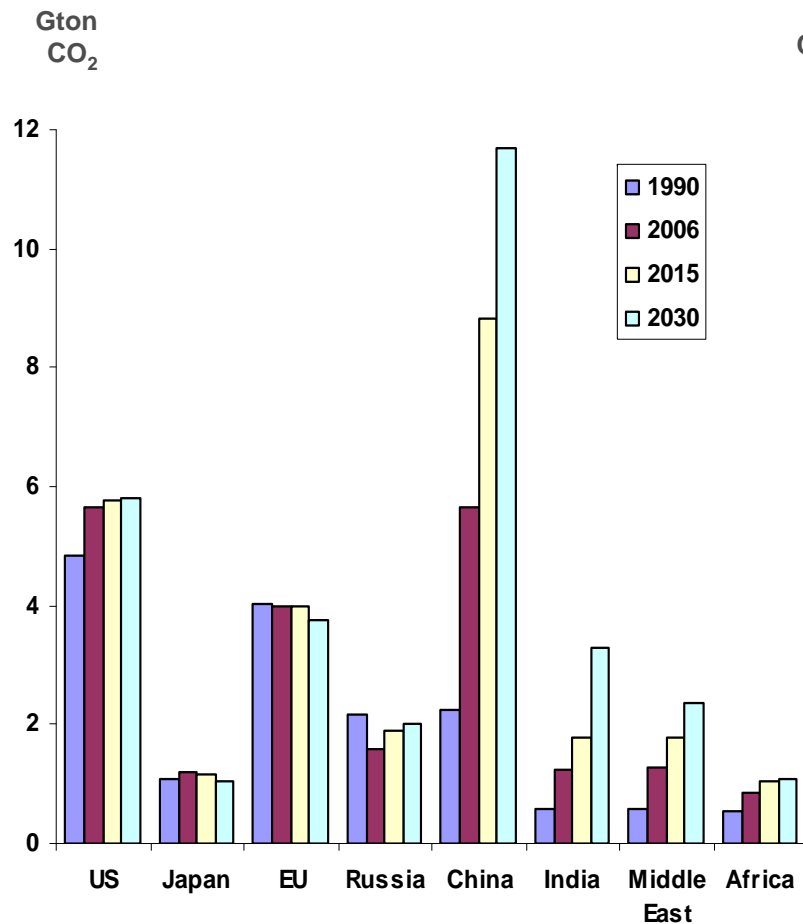


Source: AIE 2006

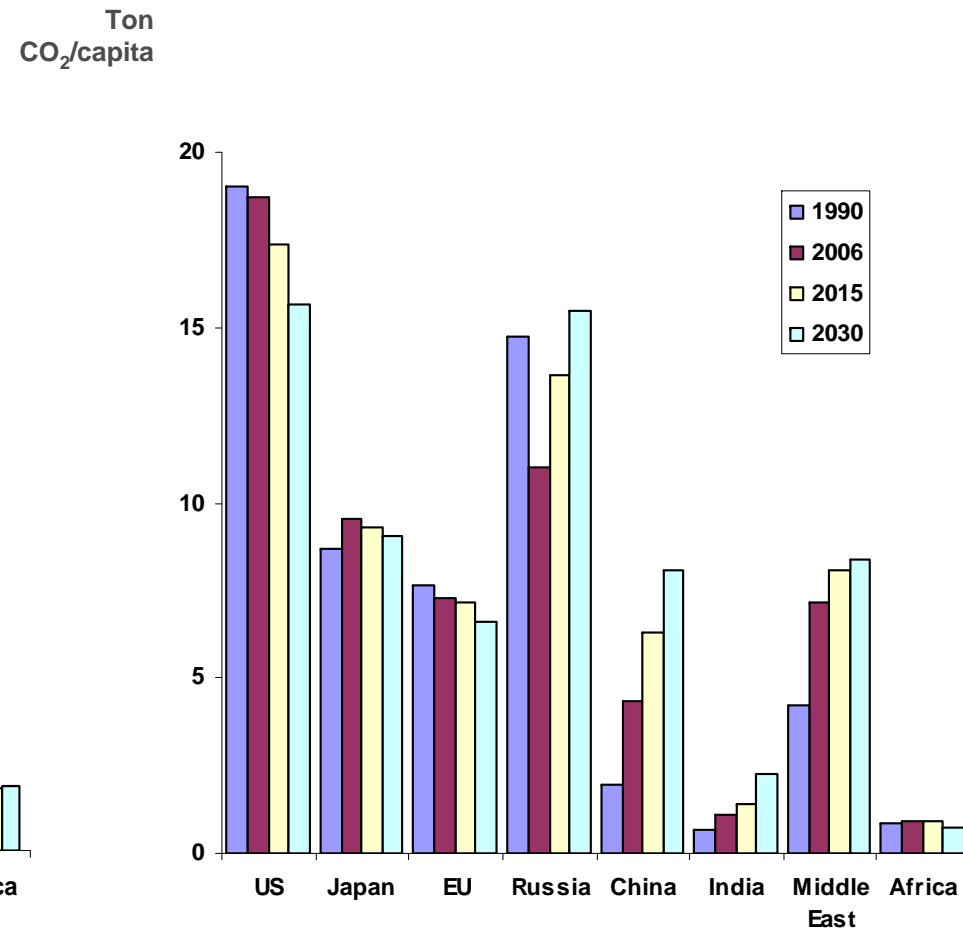


# Greenhouse gas emissions: a major issue for sustainable growth

CO<sub>2</sub> emissions by countries

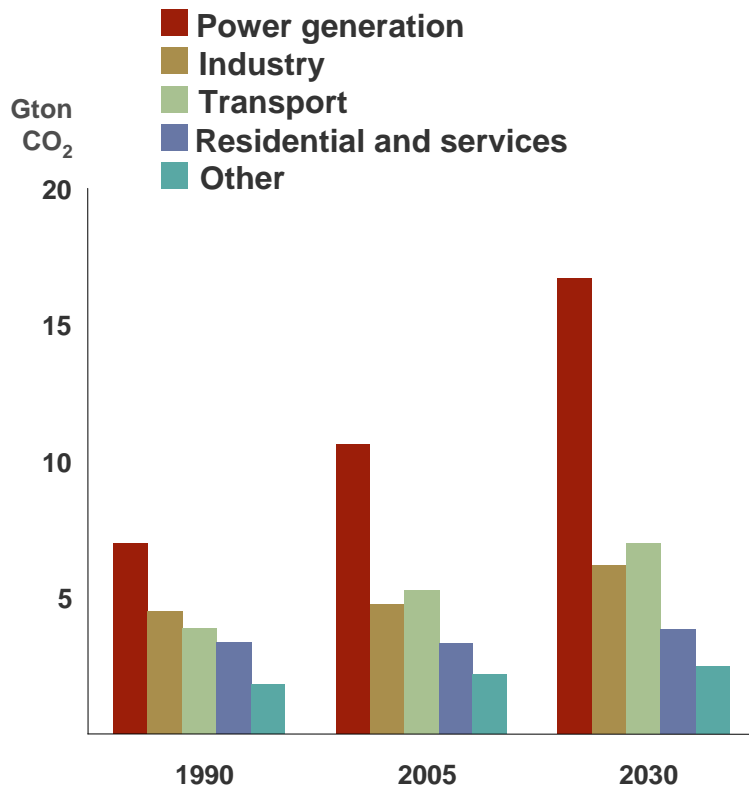


CO<sub>2</sub> emissions/capita by countries



# Greenhouse gas emissions: a major issue for sustainable growth

CO<sub>2</sub> emissions by sector



CO<sub>2</sub> emissions : Potential reduction

