



# The Future of Energy: Global Challenges, Diverse Solutions

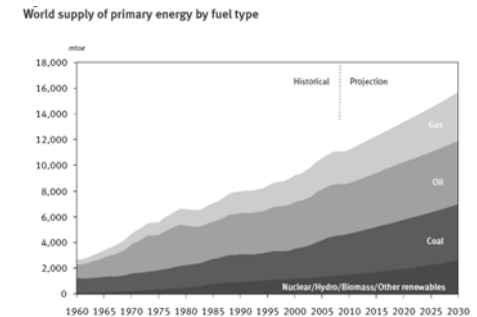
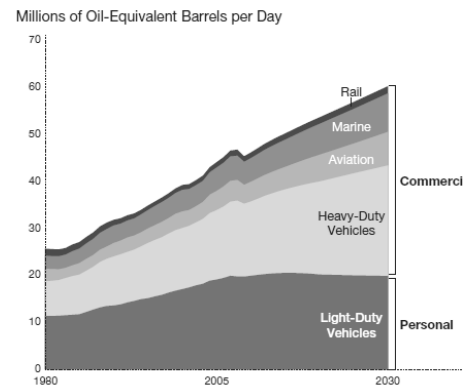
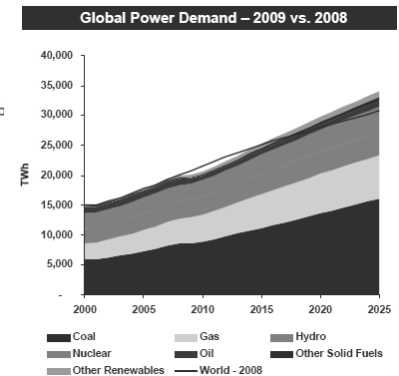
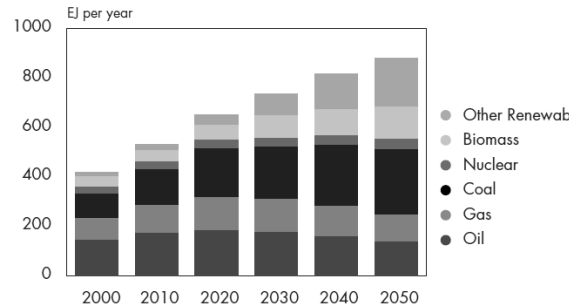
33rd IAEE International Conference, Rio de Janeiro  
Dual Plenary Session

Ivan Sandrea

VP International E&P Strategy

# A world with less fossil fuels (FF)?

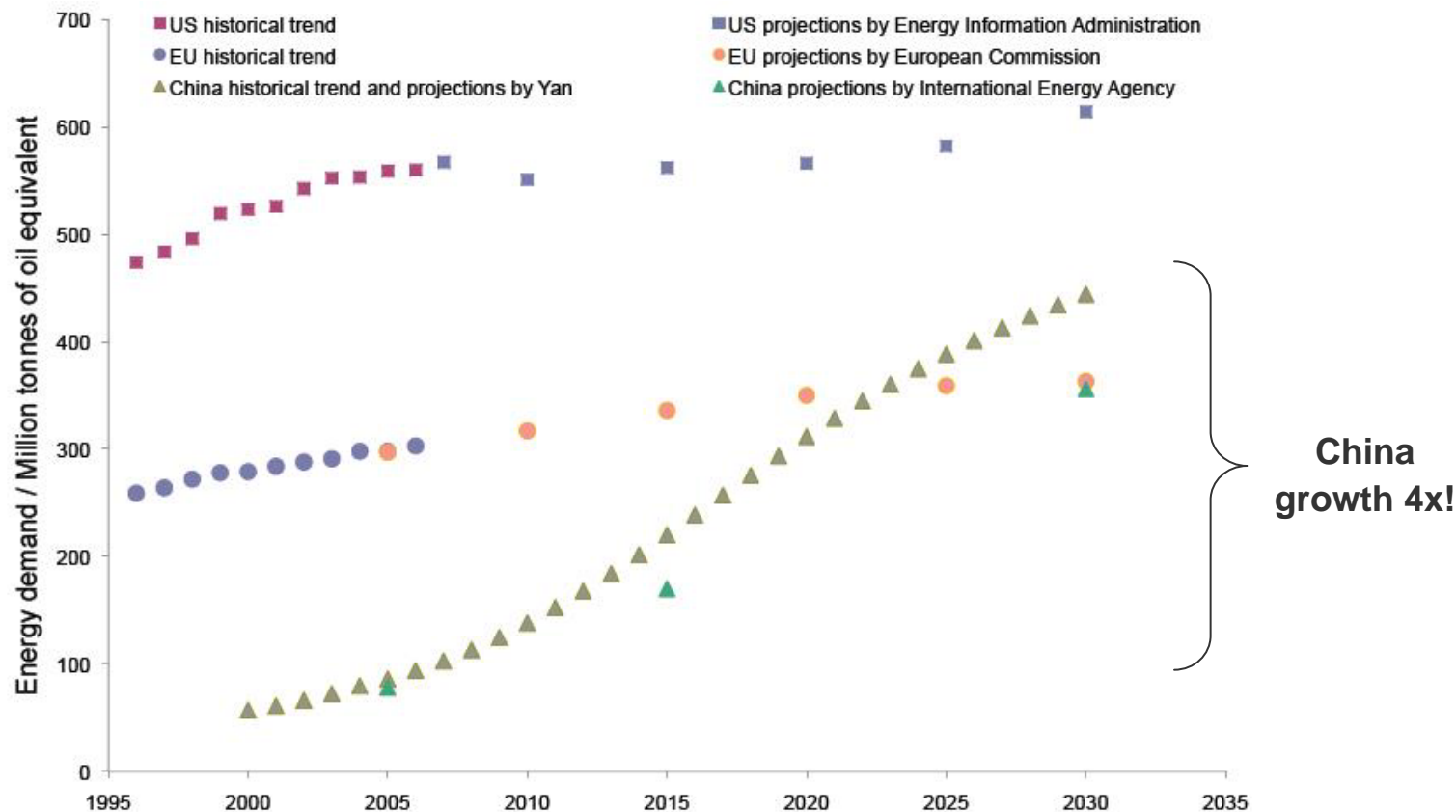
- No forecast, scenarios points to a dramatic phase out/shortage of FF
- But most show “new” emerging trends ...a gradual erosion of FF relative to non FF, lower demand for oil, etc
- Non FF entering competitive range with FF (for electricity conversion)



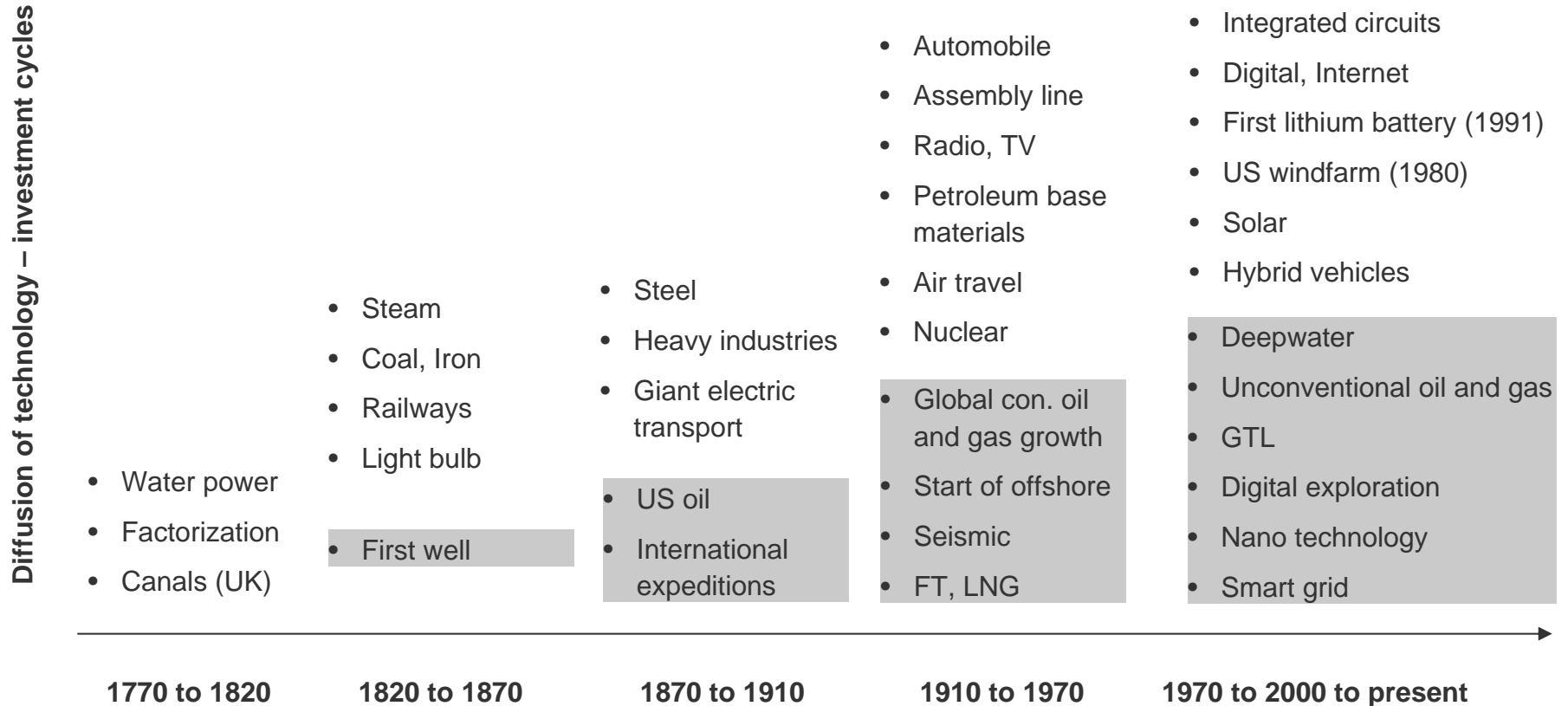
Sources: WM (Power Demand); OPEC WOO (World supply of primary energy); Shell (Primary energy sources); XON (Transport demand),

# Transport sector remains dependent on oil; challenge is to reduce GHG without affecting mobility...

Energy demand from the road transport sector

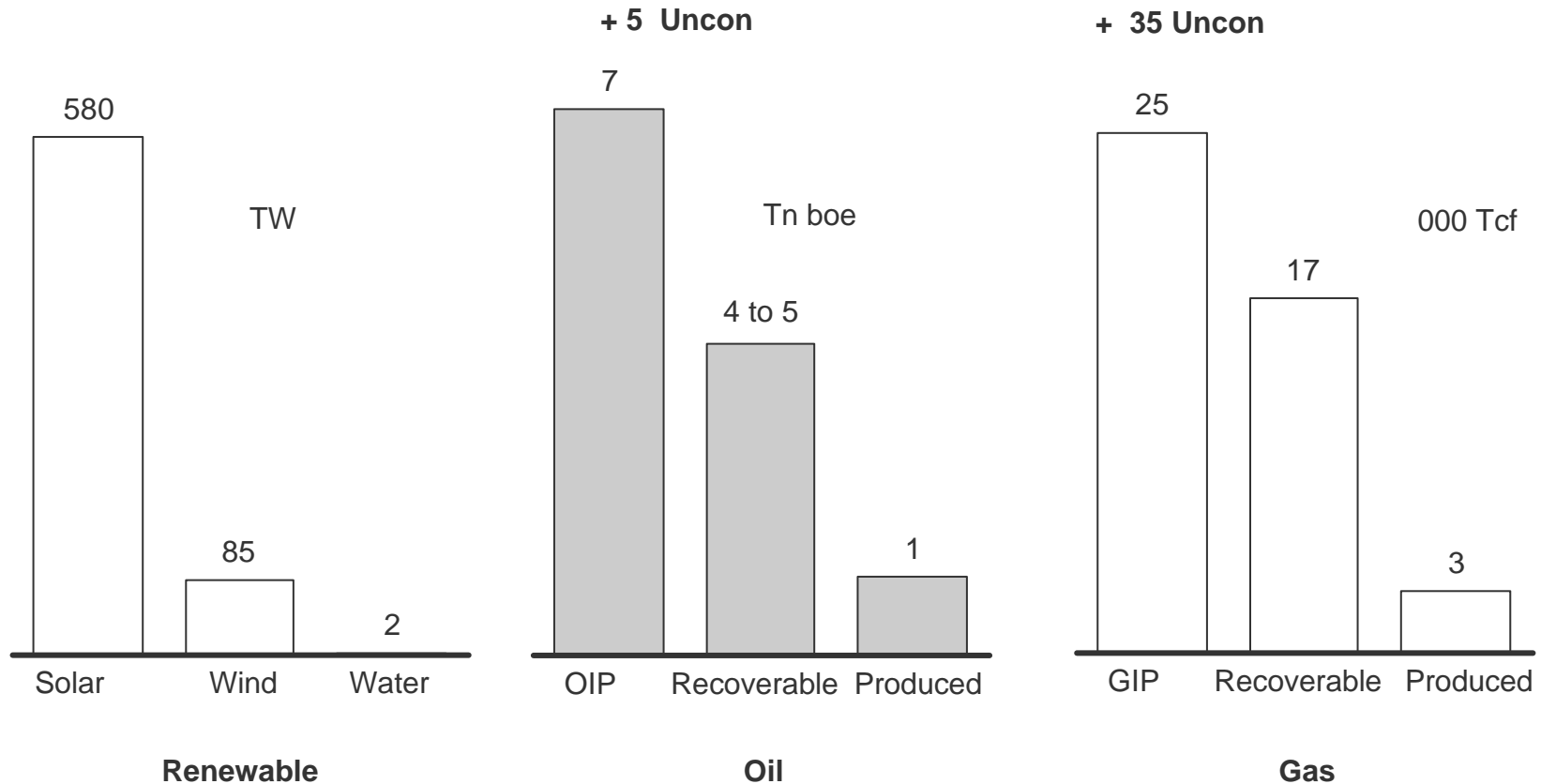


# Technology revolutions and the O&G industry...



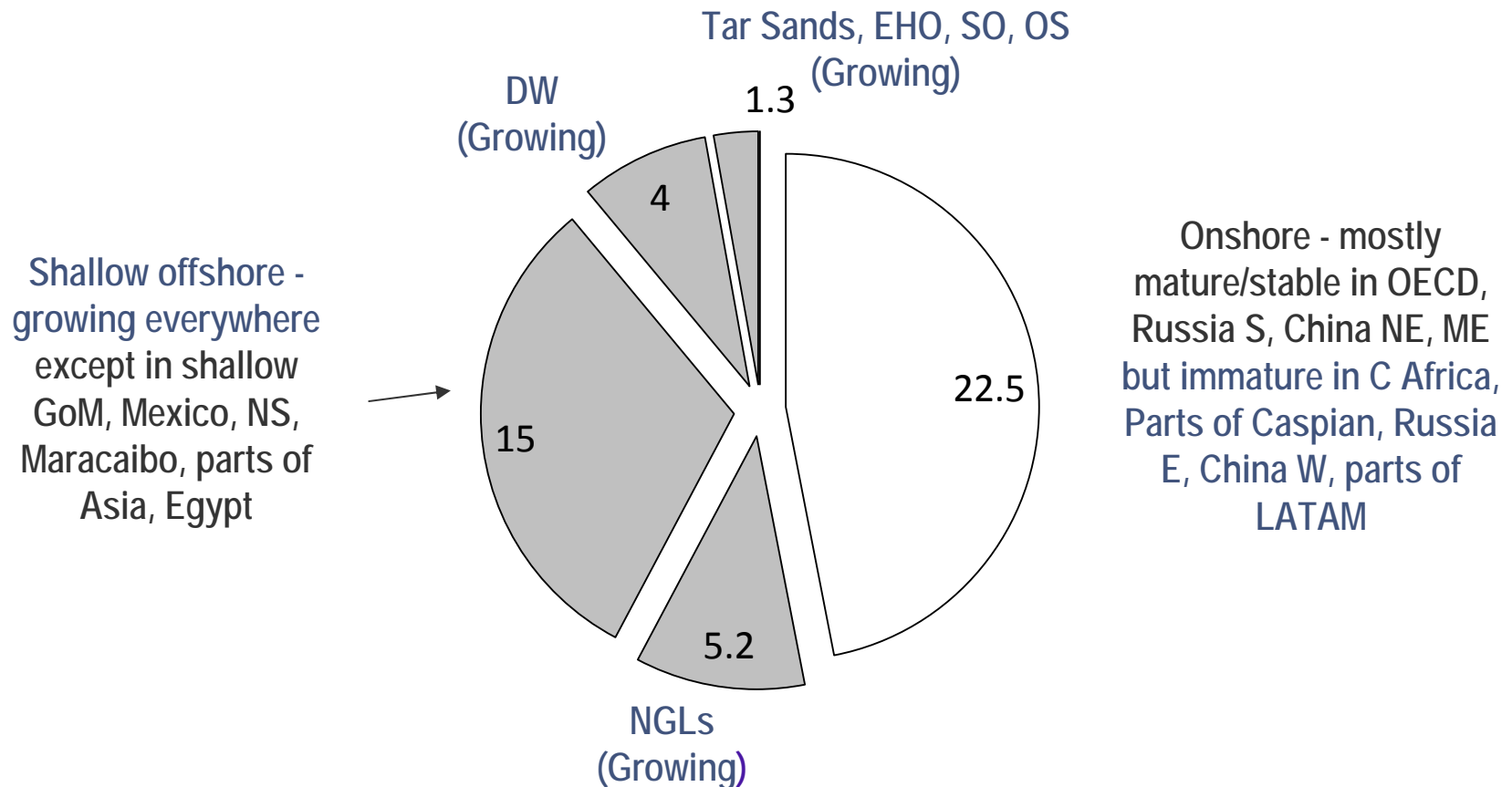
Source: Statoil internal; The New Golden Age (Strategy and Business); Carlota Perez, Technological revolutions and financial capital (2003)

# Do we have resource limitations?



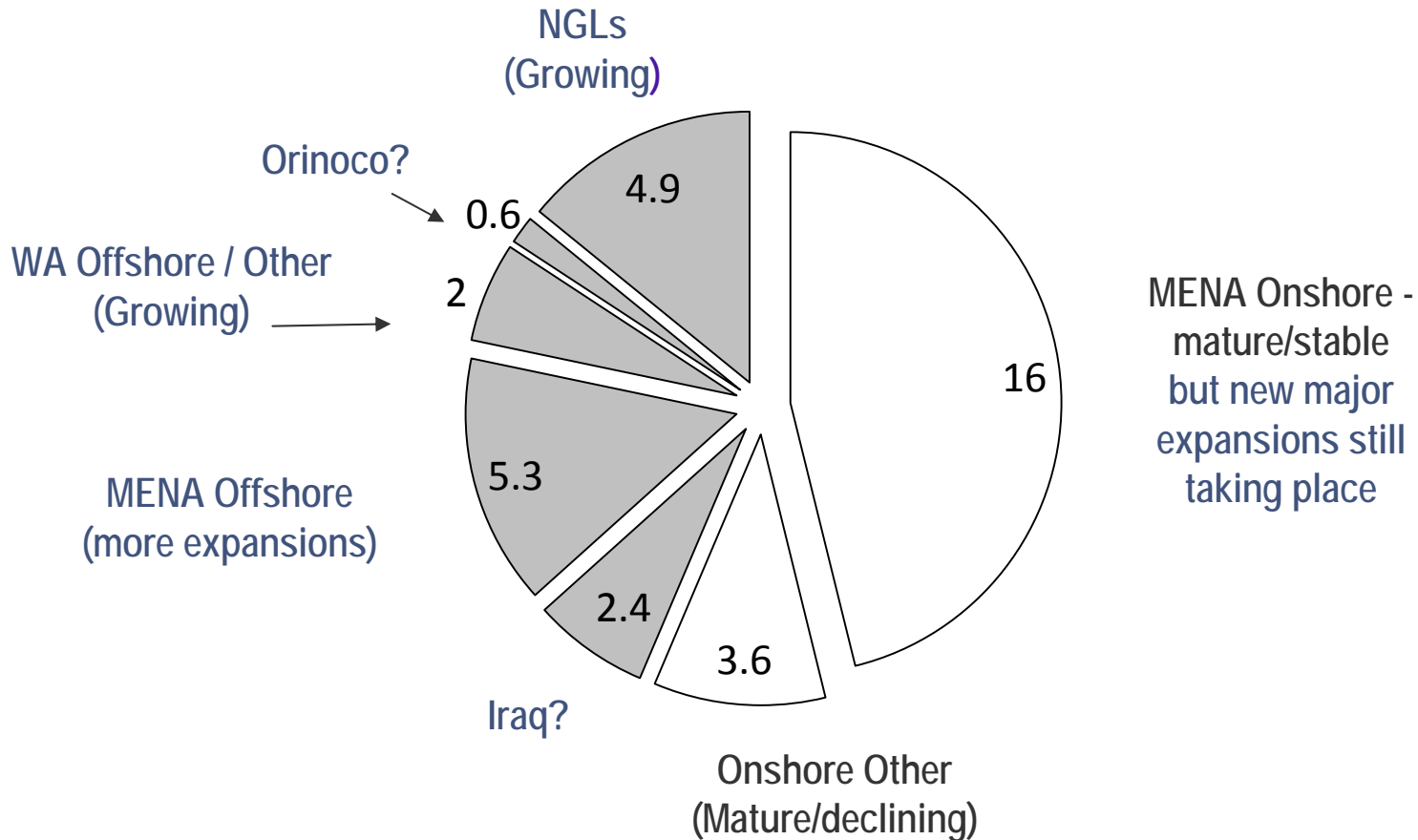
Source: Scientific American; Various publications; Oil and Gas includes estimates for unconventional  
Coal: 1000 Gt reserves, produced 80 Gt

# Oil – non OPEC supply system (status today)



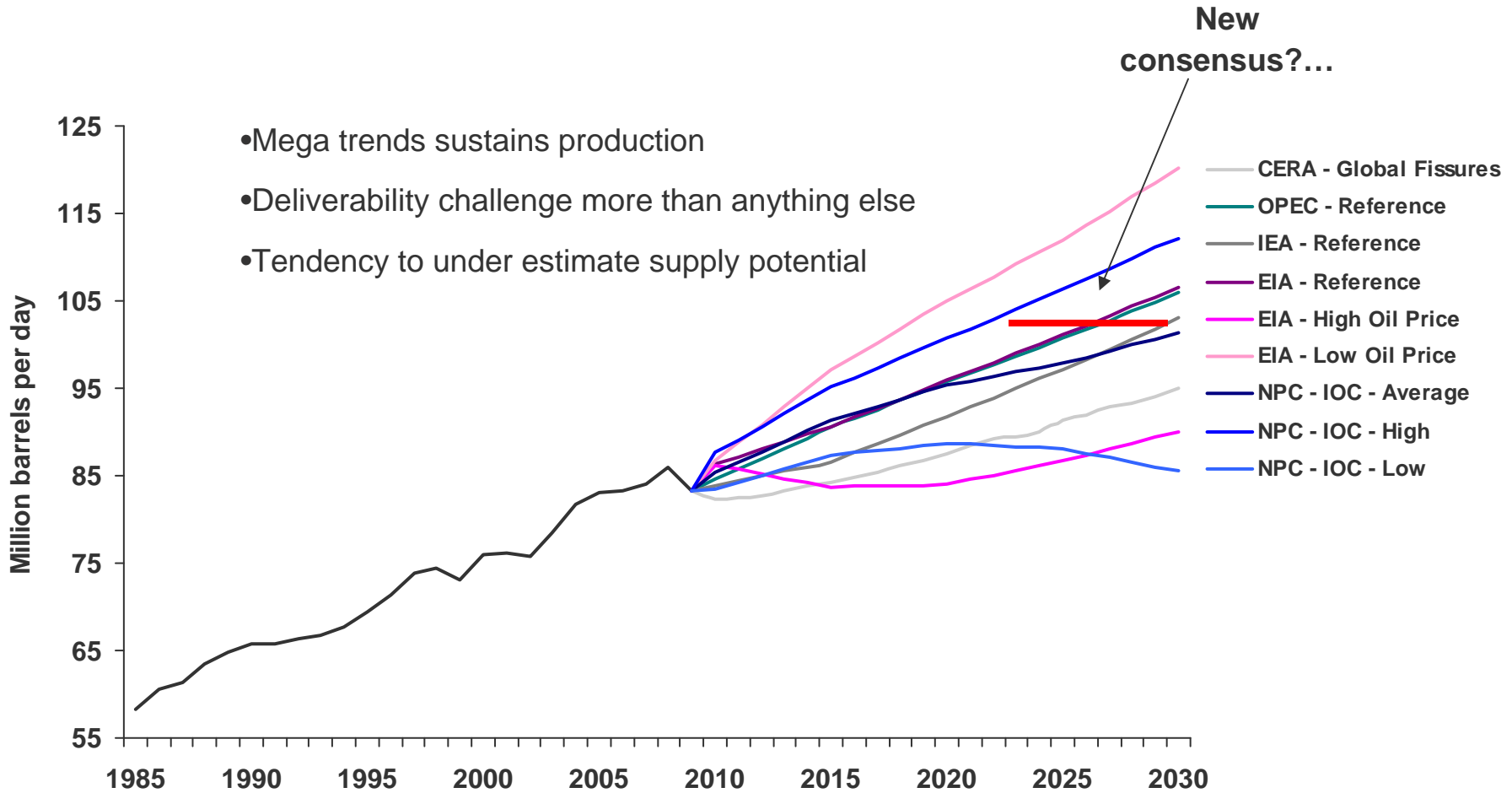
Excludes biofuels – 1 mb/d; excludes PG – 2 mb/d, inc Angola and Ecuador; units mbpd  
Deepwater >500 m; shallow water/onshore continues fields

# Oil – OPEC supply system (status today)



All liquids; excludes Angola and Ecuador, PG; units mbpd  
Onshore Other includes Venezuela Maracaibo

# World liquid supply outlooks

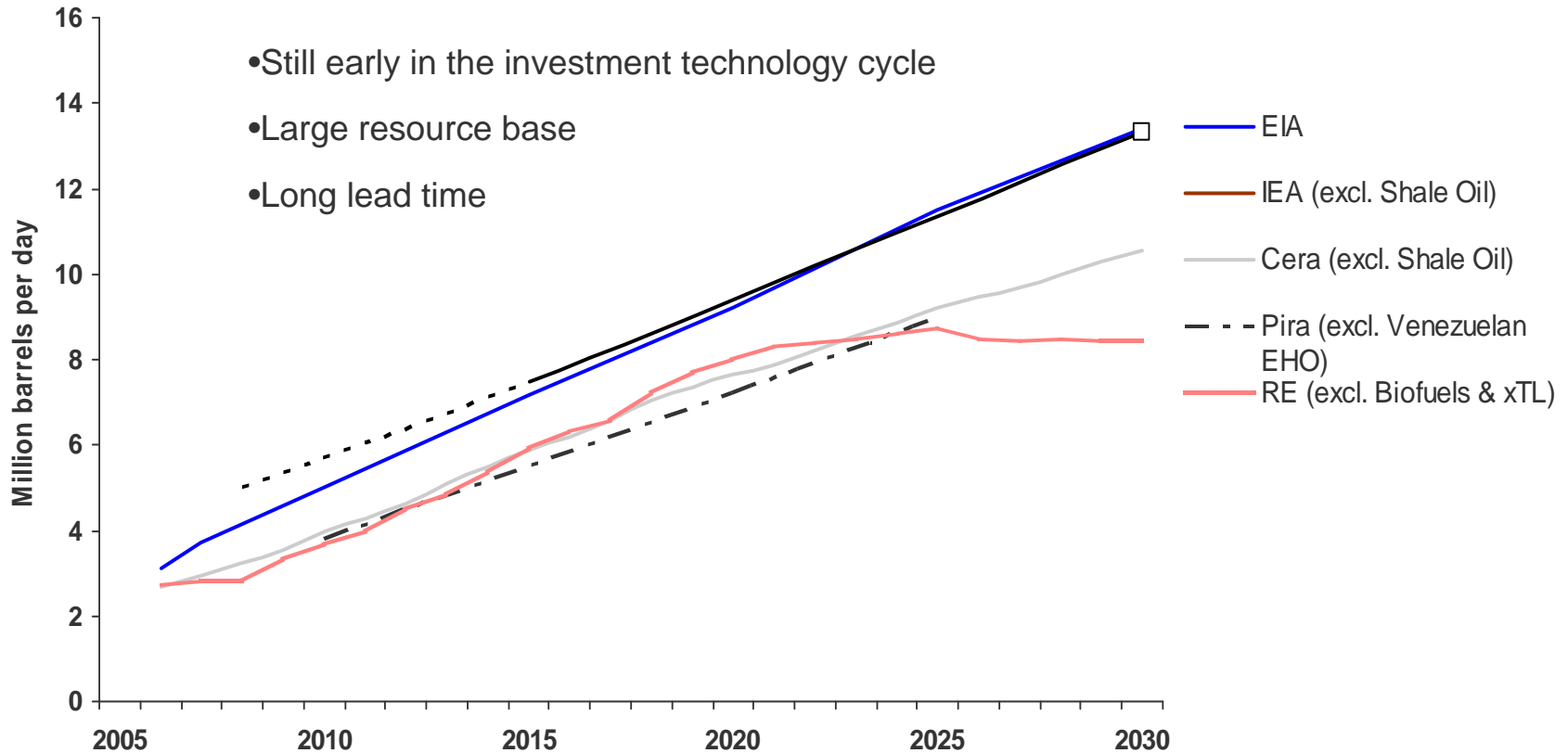


Source: CERA, IEA World Energy Outlook 2009, EIA International Energy Outlook 2009, OPEC World Oil Outlook 2009, NPC – Hard Truths – 2007

Notes: EIA provides total liquids production figures which include crude oil, natural gas plants liquids, other liquids and refinery processing gains. CERA definition of liquids include crude oil, condensate, natural gas liquids, and nontraditional liquids (biofuels, extra-heavy oil, GTL, CTL and oil shale). IEA definition of Oil includes crude oil, condensates, natural gas liquids, refinery feedstocks and additives, other hydrocarbons (including emulsified oils, synthetic crude oil mineral oils extracted from bituminous minerals such as oil shale, bituminous sand and oils from coal liquefaction).



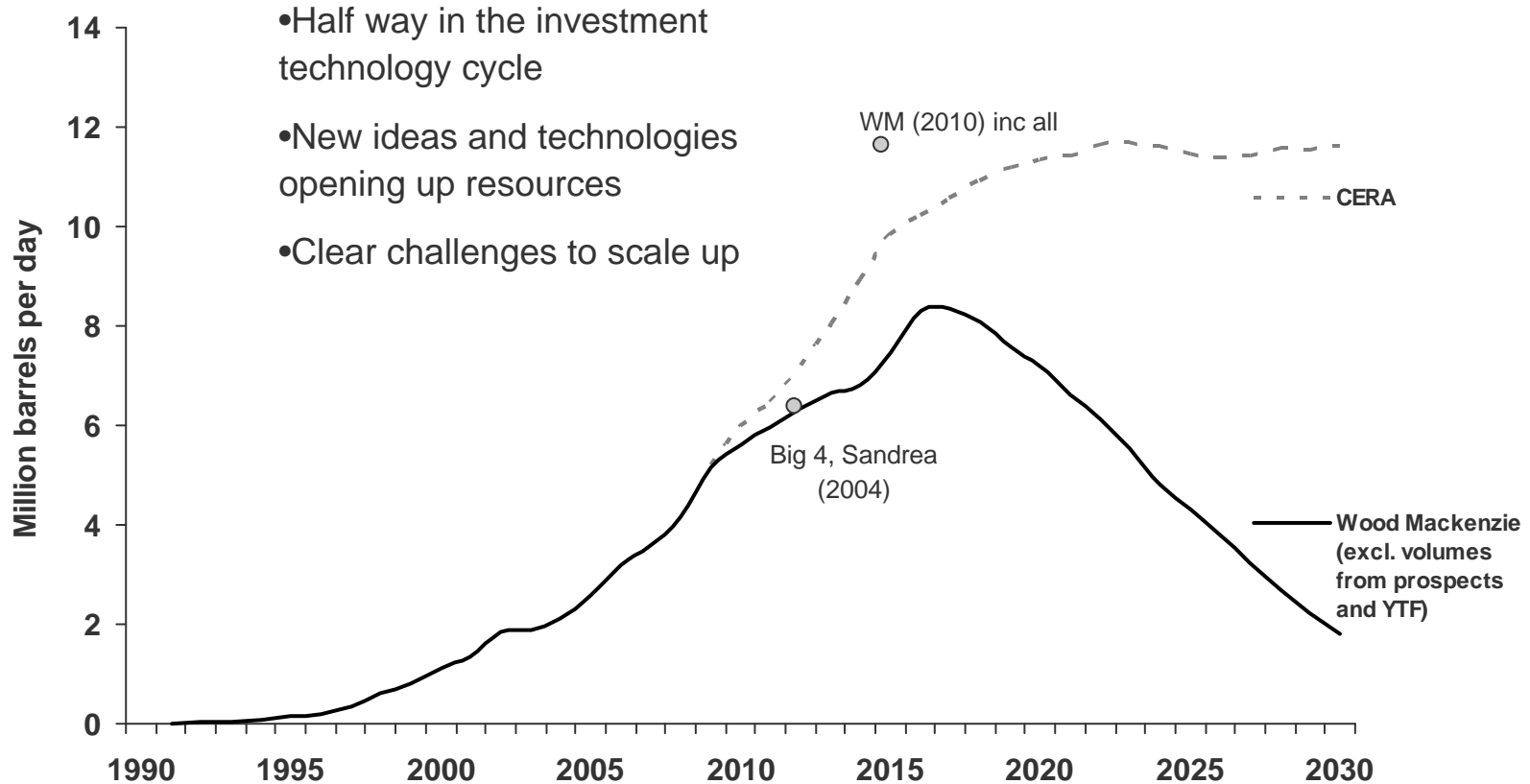
# World unconventional liquids supply outlooks



Source: CERA, IEA World Energy Outlook 2009, EIA International Energy Outlook 2009, Rystad Energy and PIRA; Includes Oil Sands, EHO, Oil Shale, GTL, Biofuels



# World deepwater supply outlooks



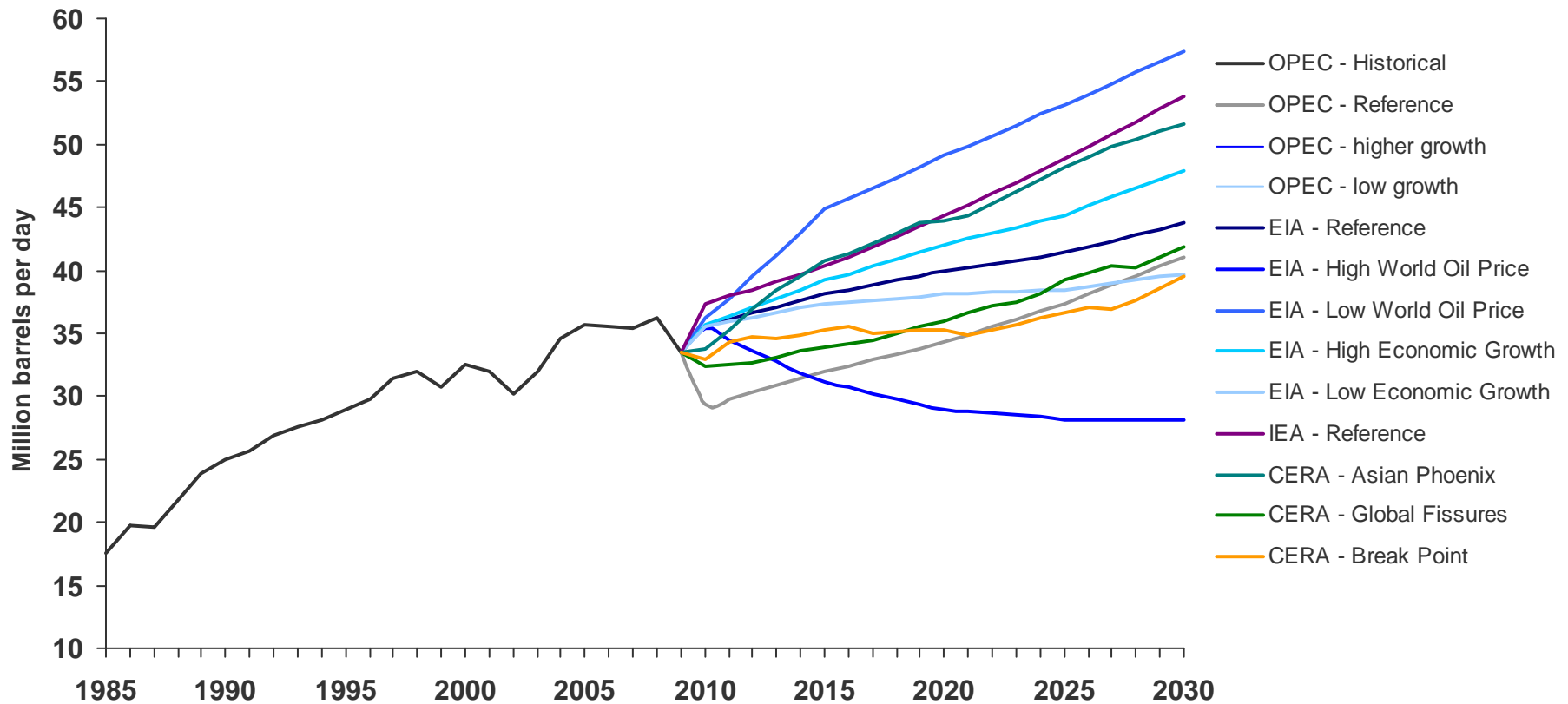
Source: CERA and Wood Mackenzie

Note: Wood Mackenzie production figures only include production from fields currently on-stream, under development and probable developments (i.e. where sufficient certainty/ data exists). Liquids include crude oil, LPG and condensate production.

Blue dot. Sandre prediction from Big 4 in 2004



# OPEC liquids supply outlooks



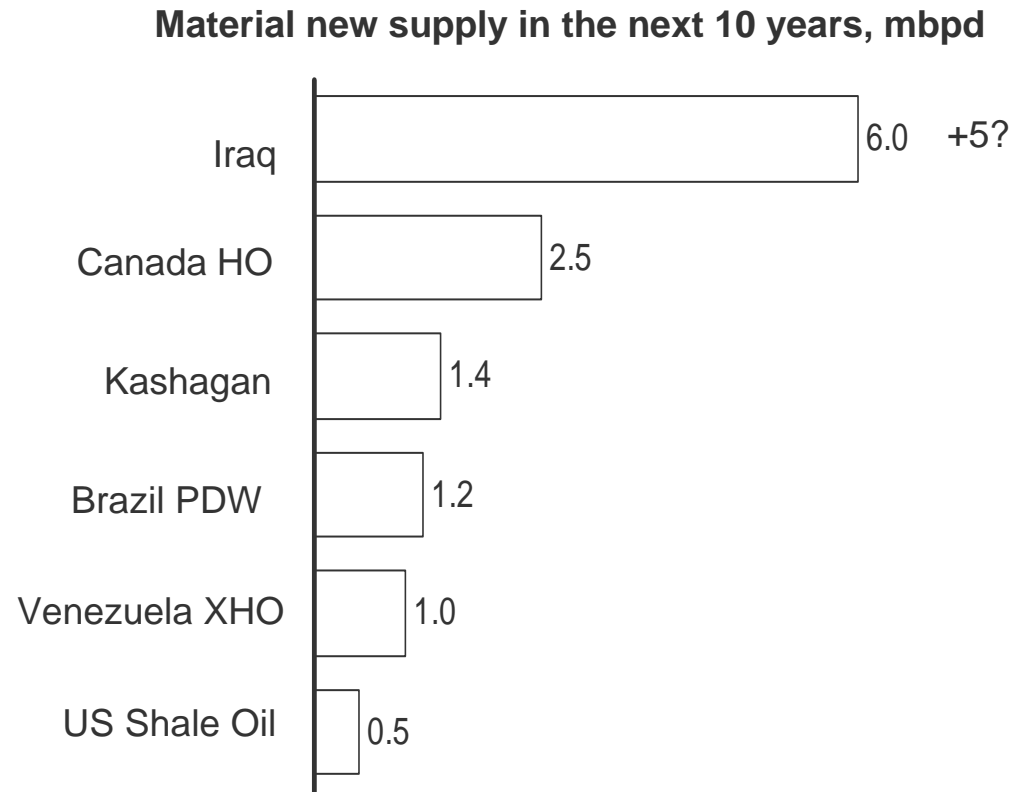
Source: CERA, IEA World Energy Outlook 2009, EIA International Energy Outlook 2009, OPEC World Oil Outlook 2009.

Notes: EIA provides total liquids production figures which include crude oil, natural gas plants liquids, other liquids and refinery processing gains. CERA definition of liquids include crude oil, condensate, natural gas liquids, and nontraditional liquids (biofuels, extra-heavy oil, GTL, CTL and oil shale). IEA definition of Oil includes crude oil, condensates, natural gas liquids, refinery feedstocks and additives, other hydrocarbons (including emulsified oils, synthetic crude oil mineral oils extracted from bituminous minerals such as oil shale, bituminous sand and oils from coal liquefaction). OPEC reference case projections include Angola. OPEC reference case excludes NGLs, GTLs, Biofuels, Oil sands and other non conventionals.



# Rapid increases in supply are still possible...

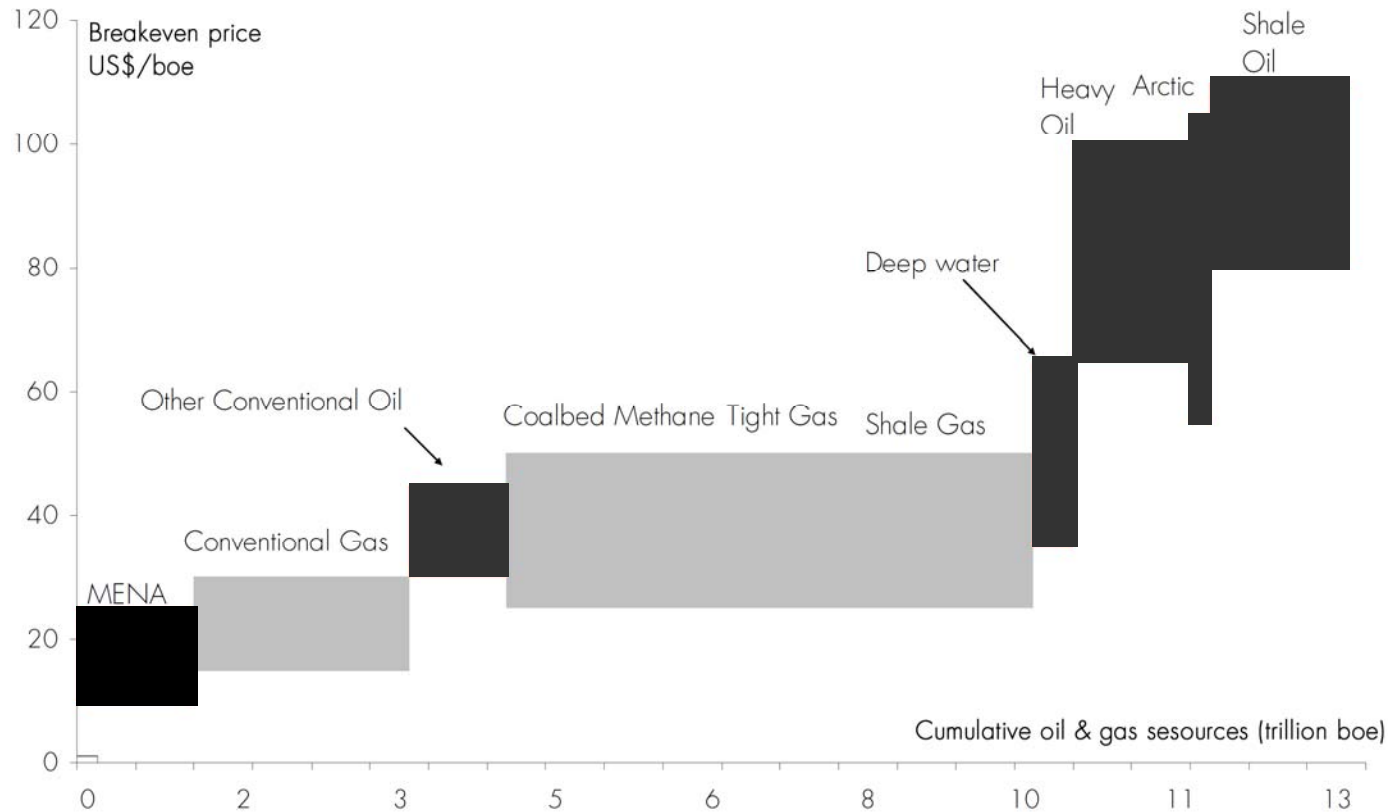
- Supply “shocks” tend to occur every decade
- Price impact depending on demand / supply context
- Price, technology and politics can work both ways!



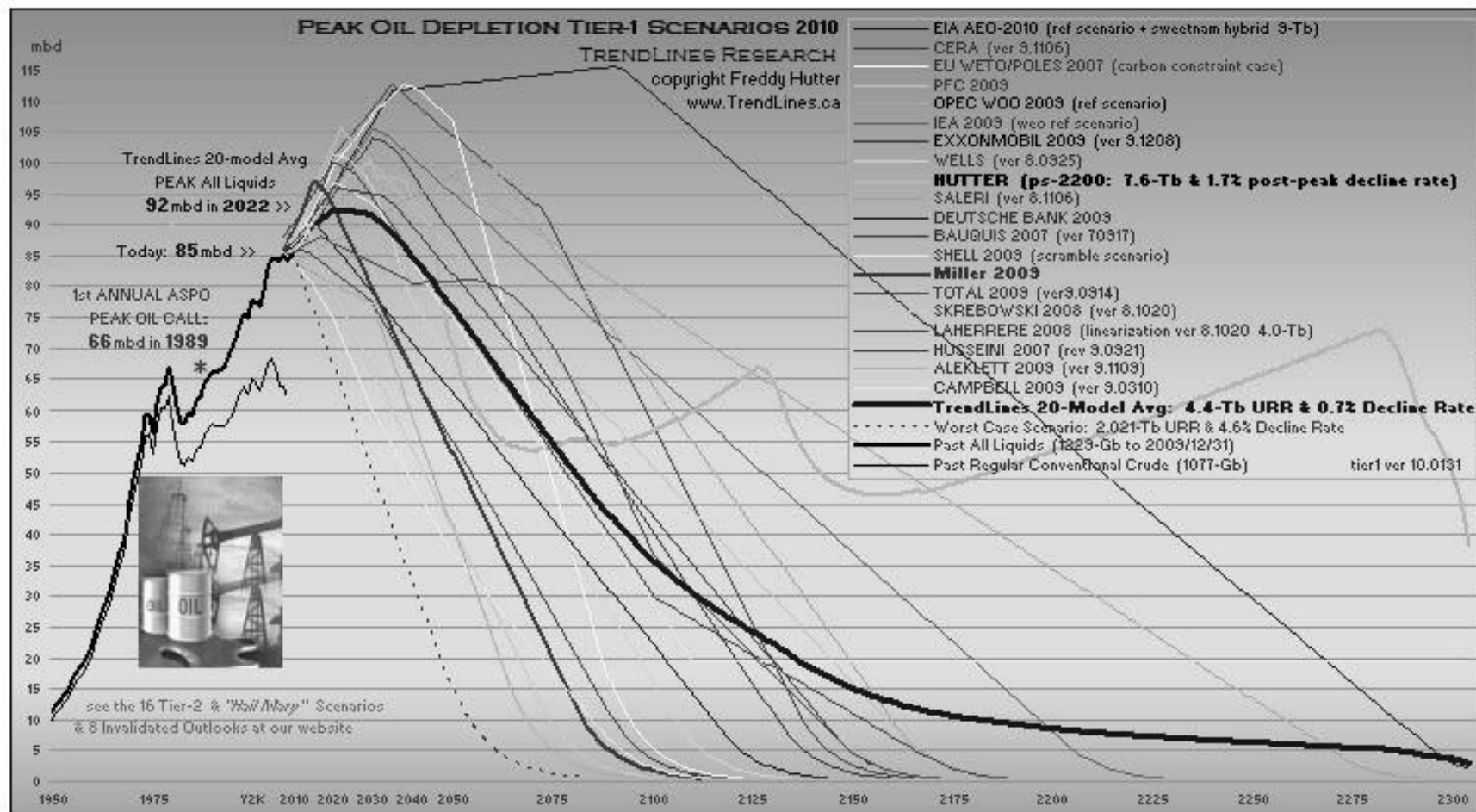
Source: Recent announcements, research reports

US Shale gas increased by 7 bcf in the last 5 years

# Building capacity in a new cost structure

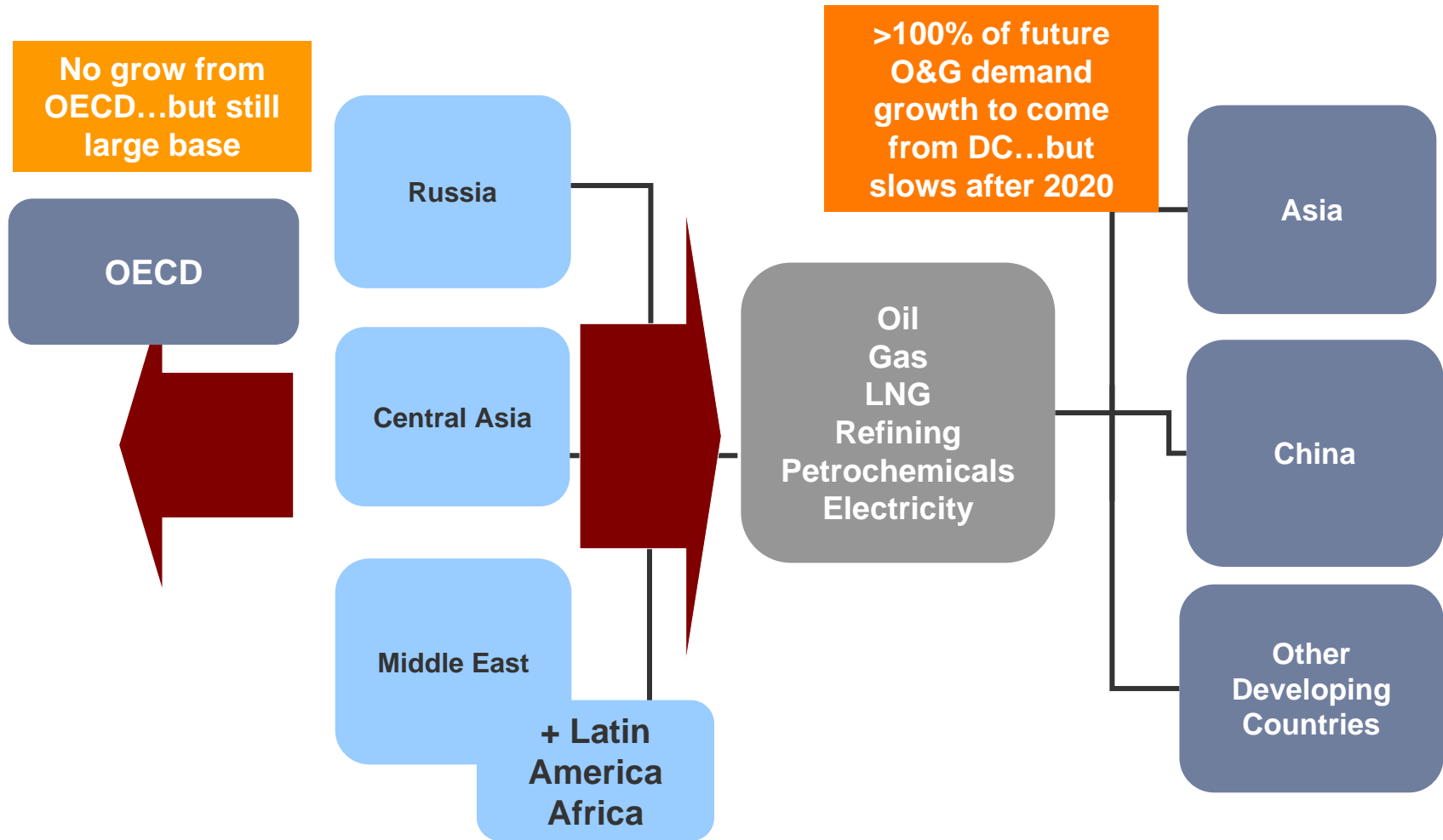


# About peak oil (and gas)



Source: PFC

# Industry evolving to meet future energy flows...

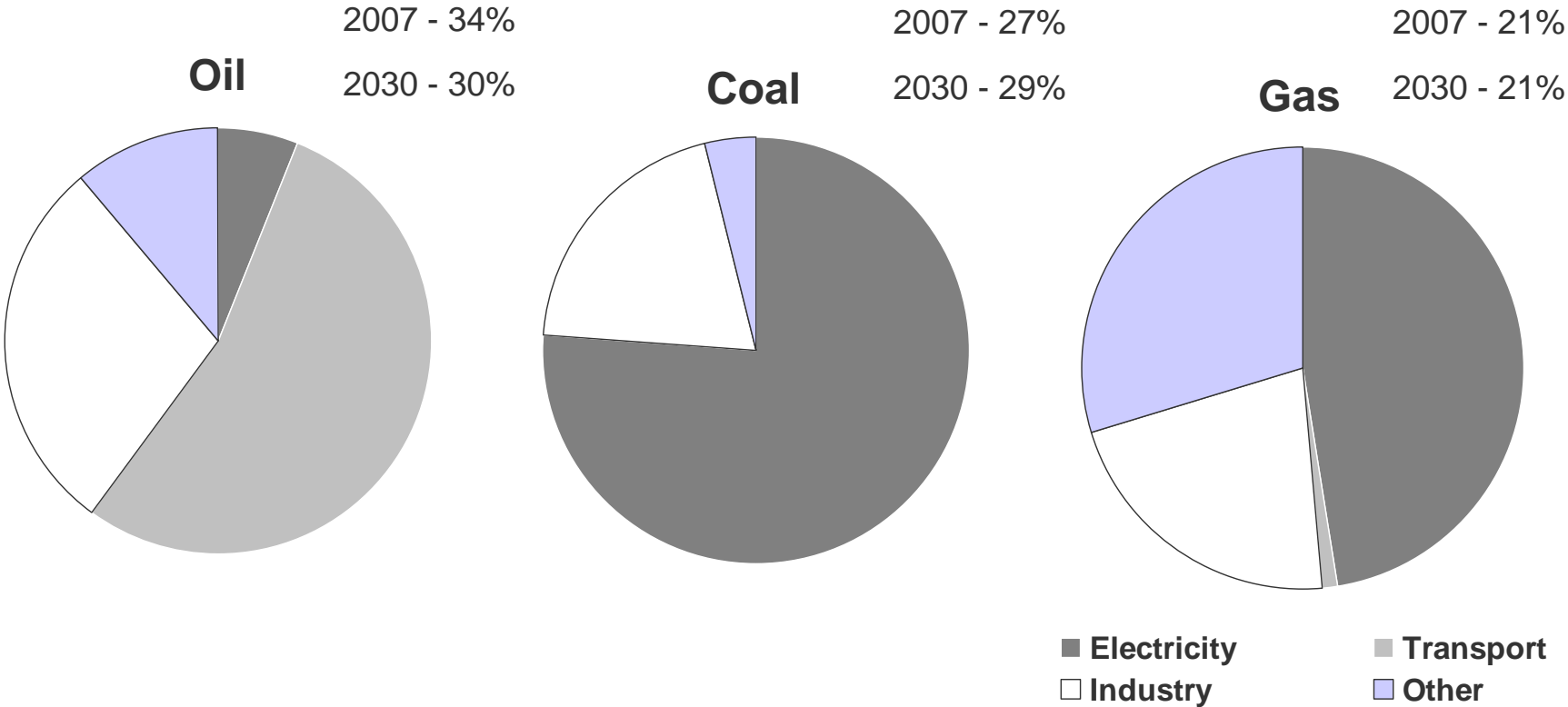


There is no shortage of resources..., only a temporary shortage of human imagination.

Thank you

Ivan Sandrea  
[www.statoil.com](http://www.statoil.com)

# A world with less fossil fuels?



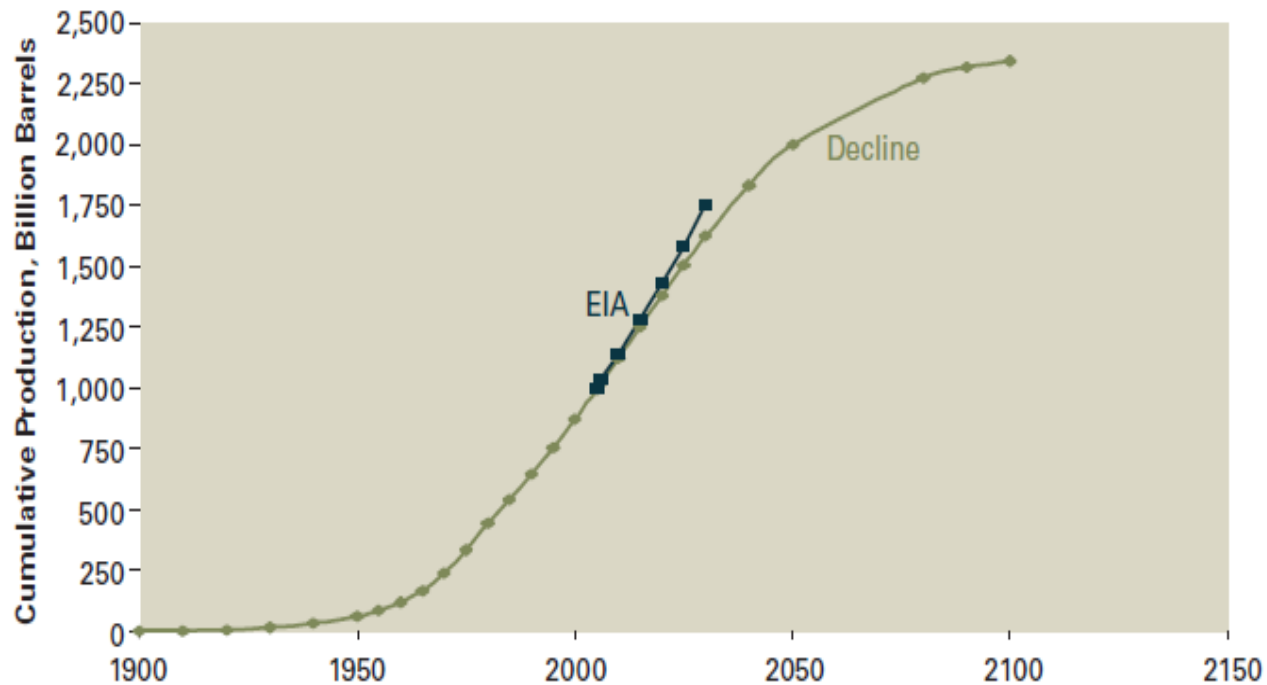
Source: IEA; share of total primary energy demand



# Production outlook for petroleum

WORLD CRUDE OIL PRODUCTION OUTLOOK: DECLINE & EIA MODELS

Fig. 7-2



# Production outlook for gas

WORLD NATURAL GAS PRODUCTION OUTLOOK: DECLINE AND EIA MODELS

Fig. 7-4

