International Energy Agency

World Energy Outlook 2009

European Geosciences Union GIFT WORKSHOP

ENERGY PERSPECTIVES 2020/2030

Austria Center Vienna

3 May 2010

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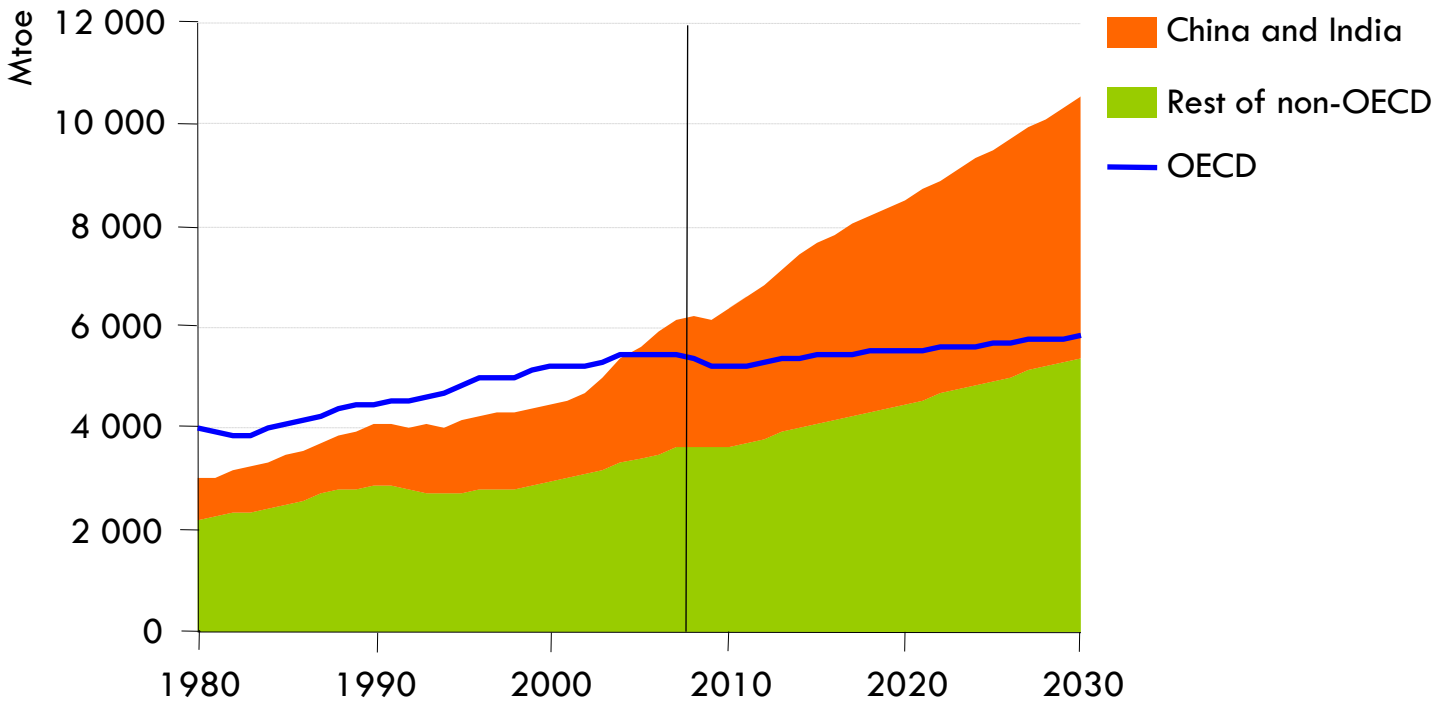
The context

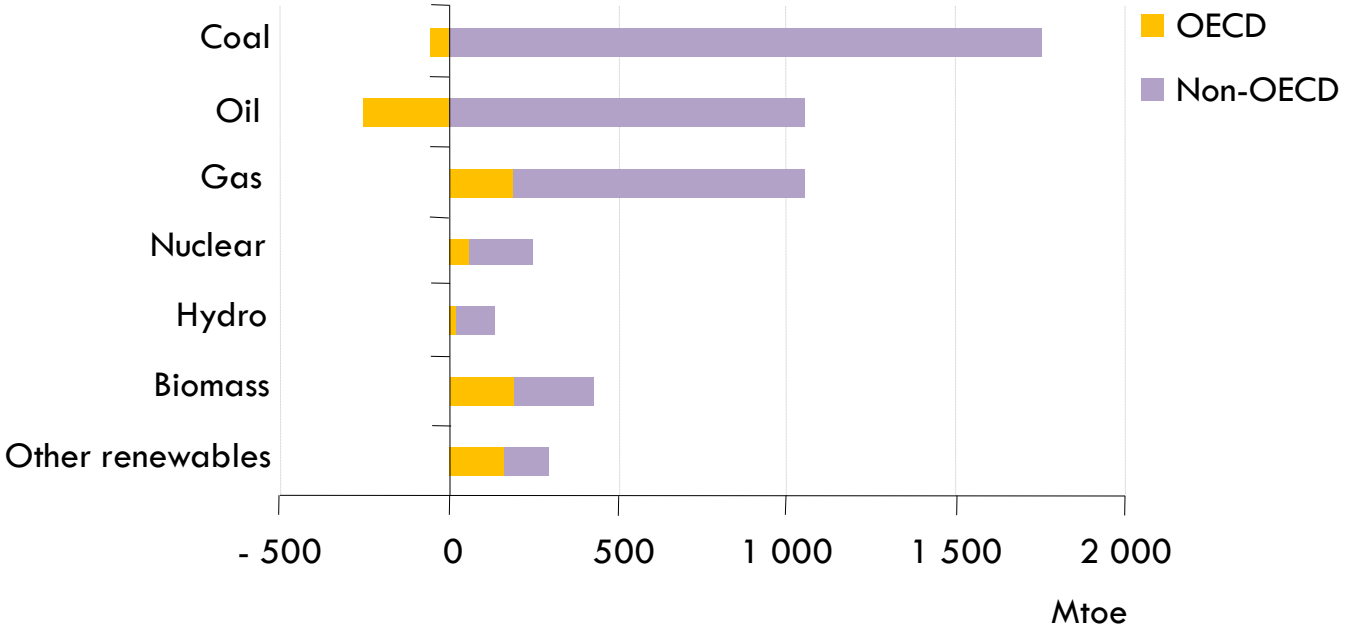
- The worst economic slump since the 2nd World War & signs of recovery – *but how fast?*
- An oil price collapse & then a rebound – *rising marginal costs point to higher prices in the longer term, but are current levels sustainable?*
- A slump in energy investment due to the financial & economic crisis – *will it bounce back quickly enough to avert a supply squeeze later?*
- Difficult negotiations on a post-2012 climate deal – *what is needed to avert catastrophic climate change?*

World primary energy demand in the Reference Scenario



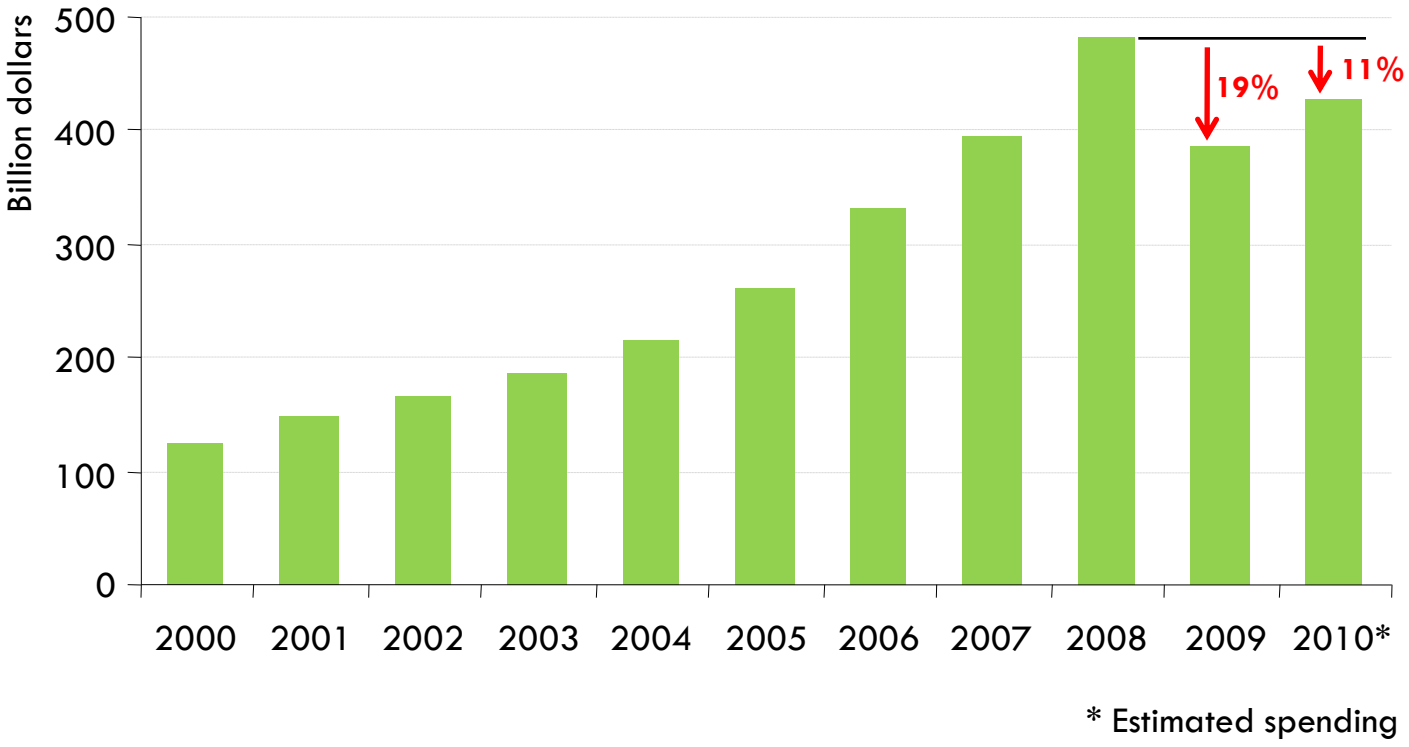
Non-OECD countries account for 93% of the increase in global demand between 2007 & 2030, driven largely by China & India

Change in primary energy demand in the Reference Scenario, 2007-2030



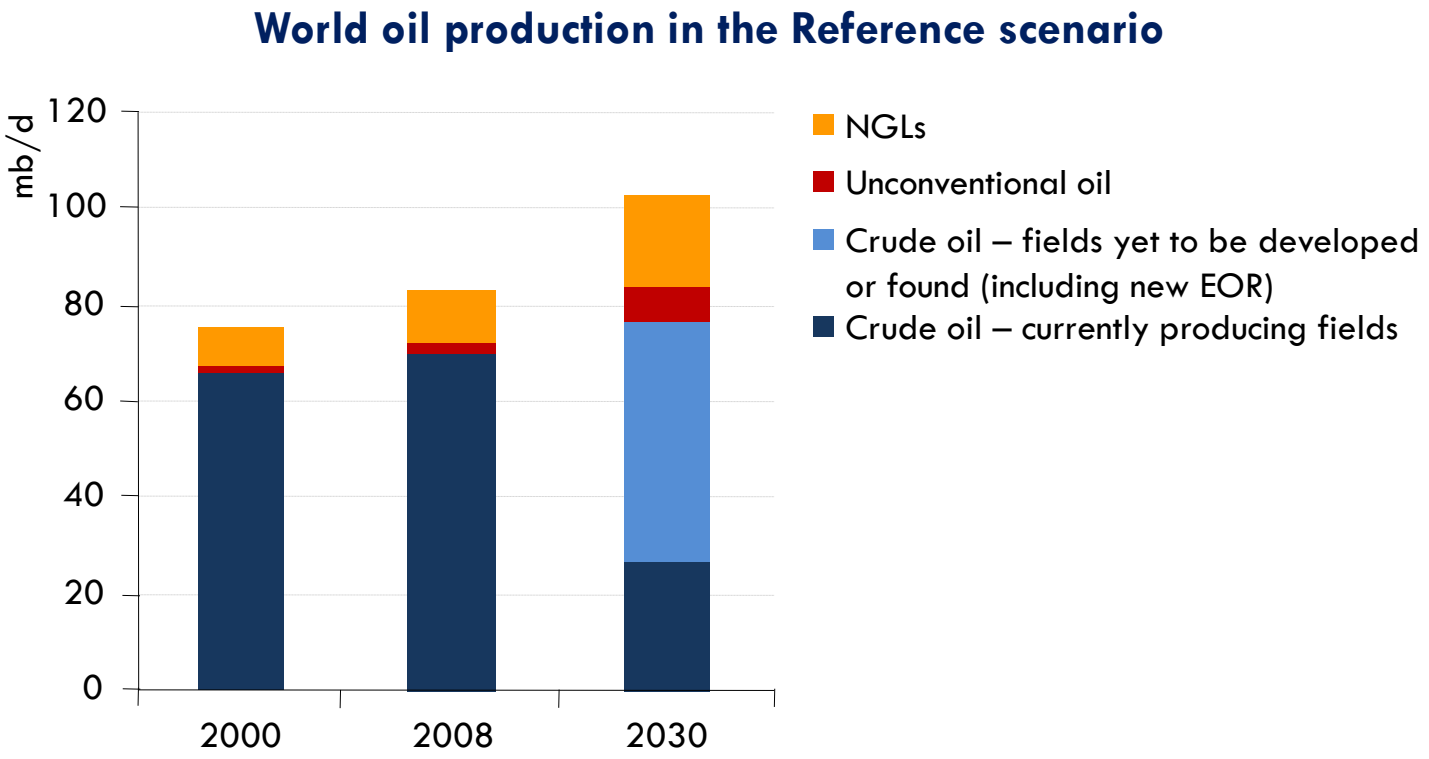
Fossil fuels account for 77% of the increase in world primary energy demand in 2007-2030, with oil demand rising from 85 mb/d in 2008 to 88 mb/d in 2015 & 105 mb/d in 2030

Worldwide upstream oil & gas capital expenditures



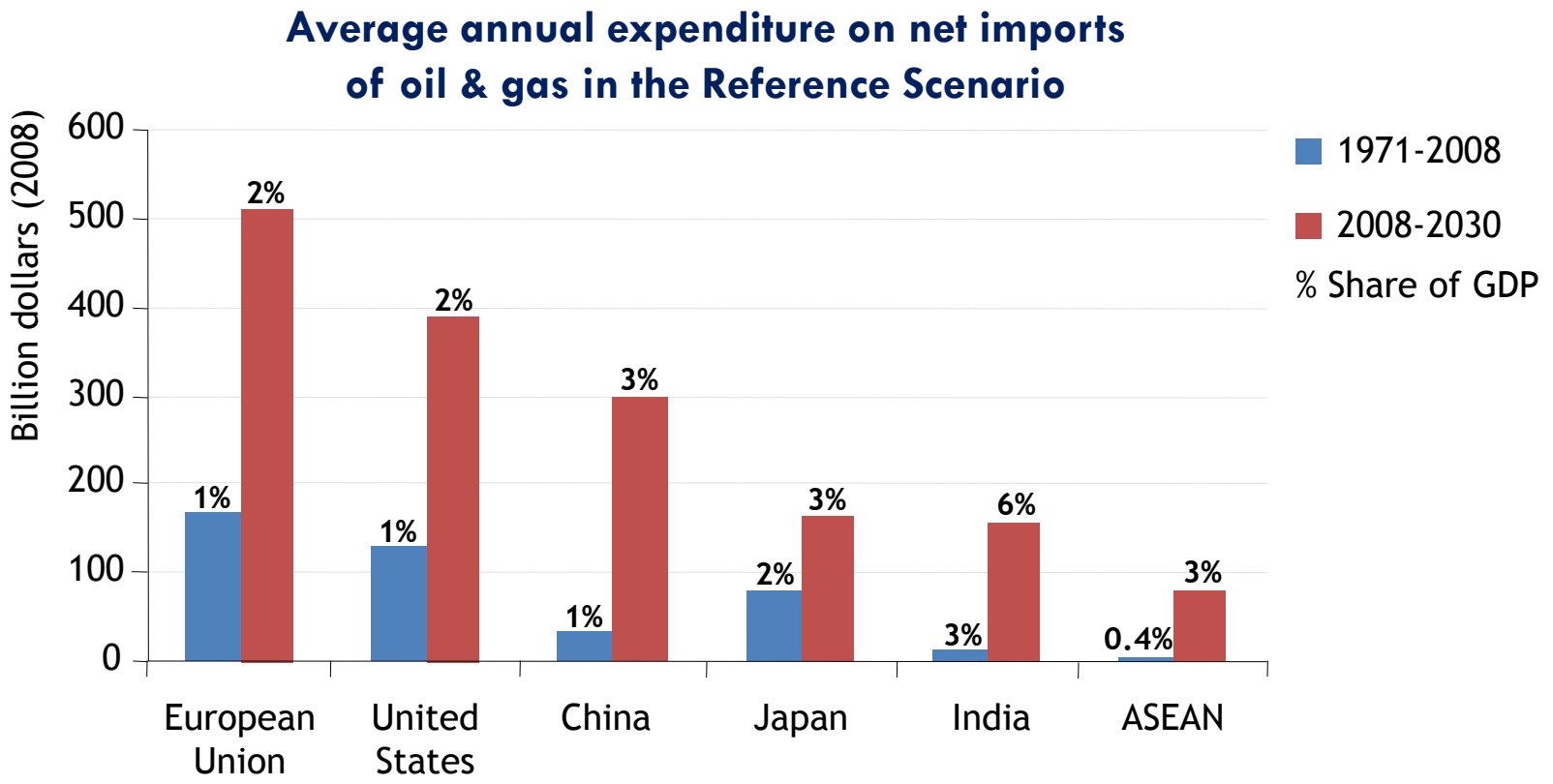
Global upstream spending fell in 2009, for the first time in a decade, by over $90 billion in 2009, but is set to bounce back by around 10% in 2010 on current plans

Decline rates are of critical importance to future upstream oil investment needs



Sustained investment is needed mainly to combat the decline in output at existing fields, which will drop by almost two-thirds by 2030

The era of cheap energy is over

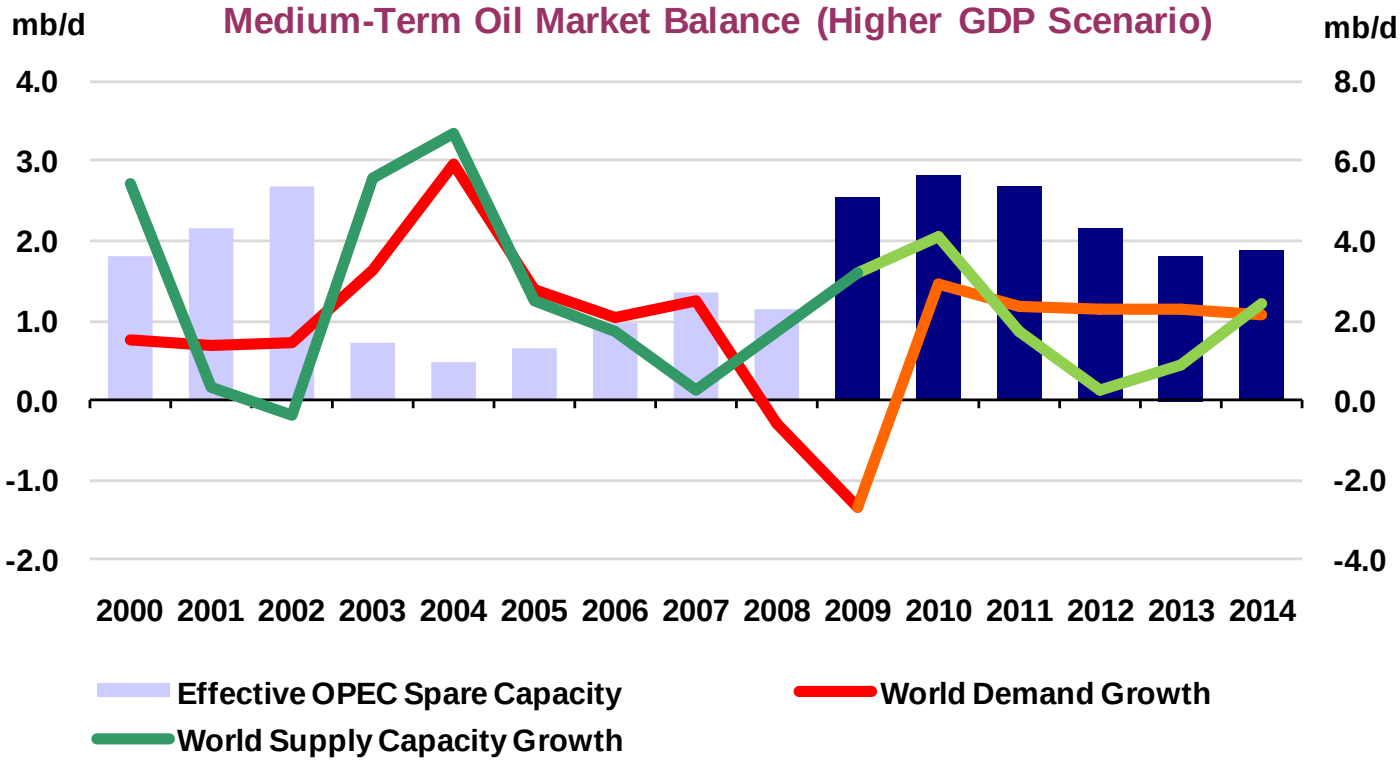


The Reference Scenario implies persistently high spending on oil & gas imports – another key reason to pursue alternative energy policies

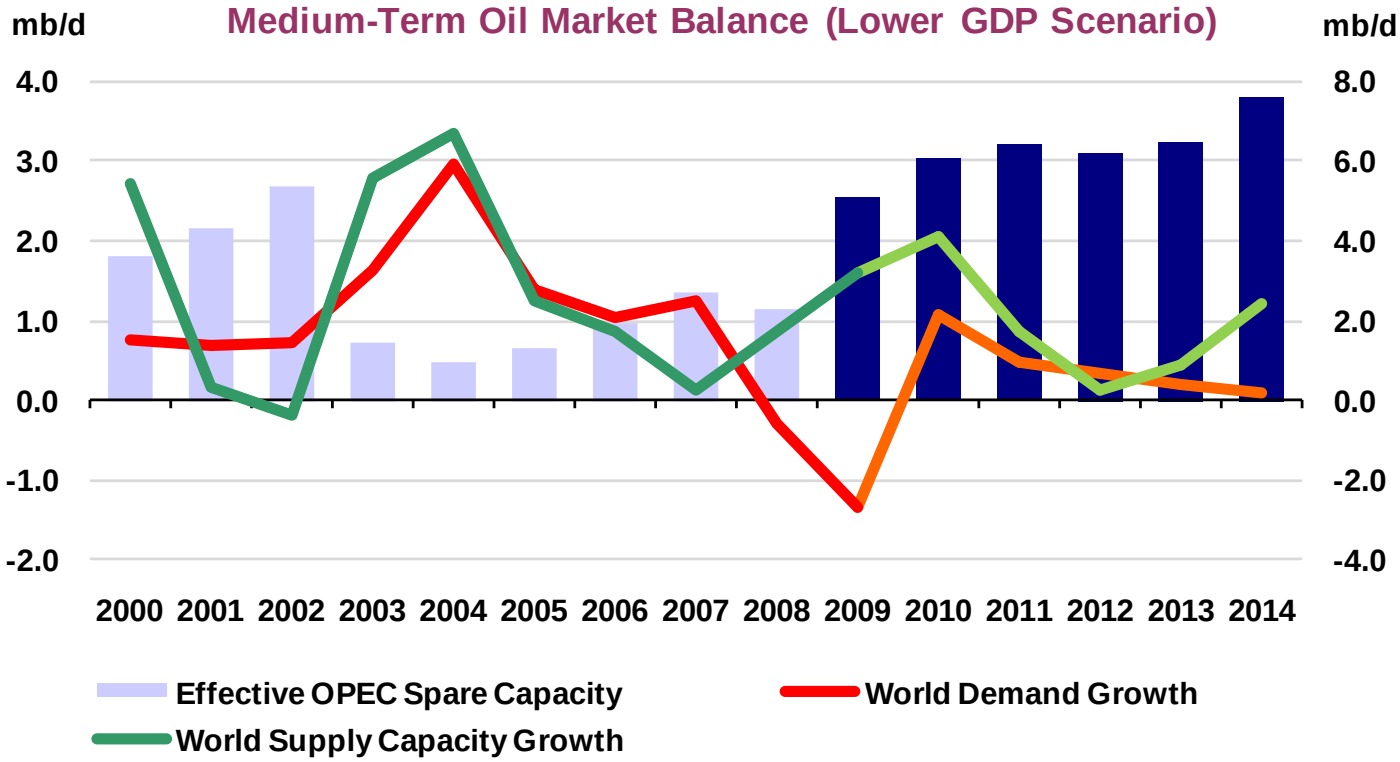
An uncertain future for Iraqi oil

- Iraq: a decisive driver of global oil markets in the coming decade?
- Iraqi oilfields are mostly technically straightforward and relatively cheap to develop
- The very rapid capacity expansion claimed by politicians is overly optimistic
- But even a modest achievement – e.g. a doubling of current production – would have a significant impact on global oil markets
- Main challenges: security, infrastructure, water and personnel

Medium-term oil market balance

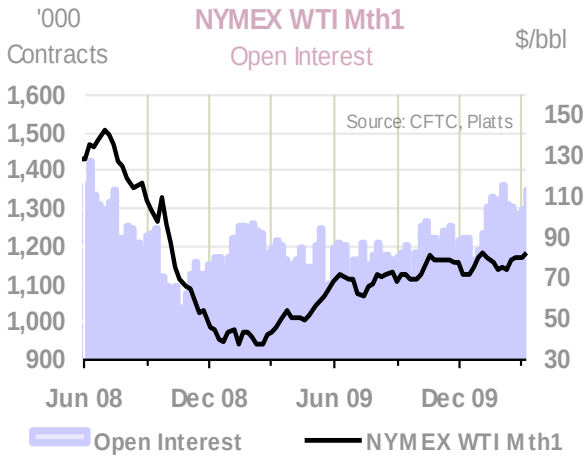


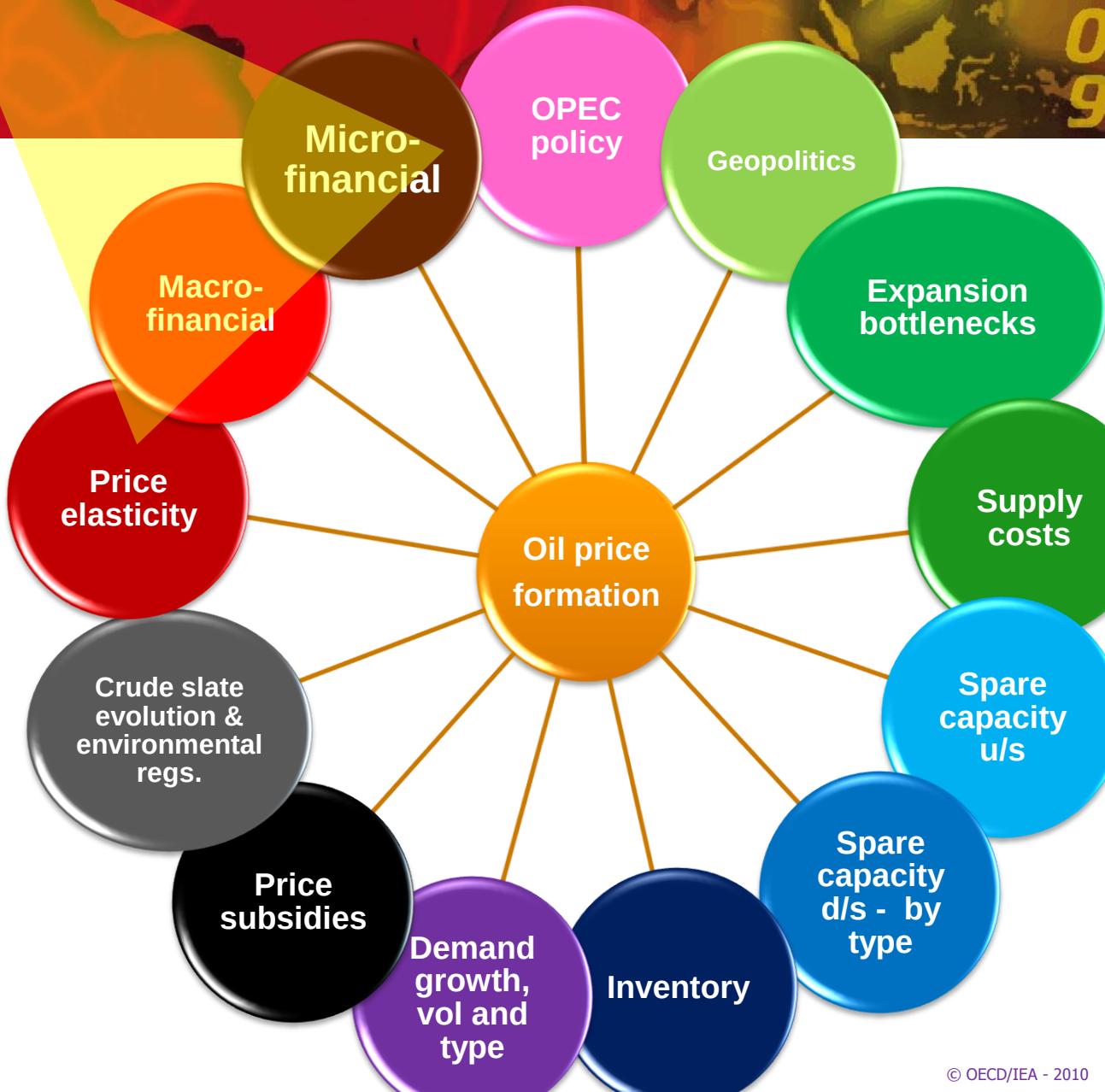
Medium-term oil market balance



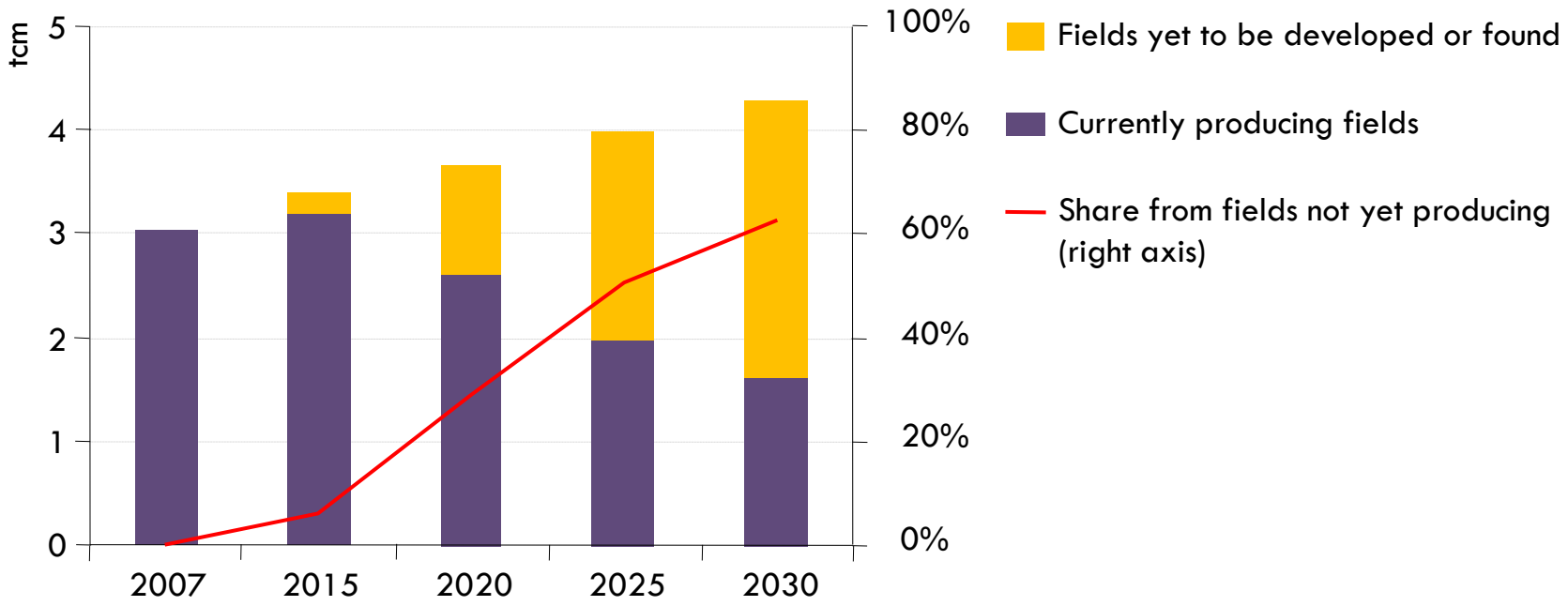
Current spotlight on financial markets
but price formation remains multi-faceted

- Macro/micro-financial trades can affect price short term
- But price inelasticity of demand/supply also amplifies price swings.



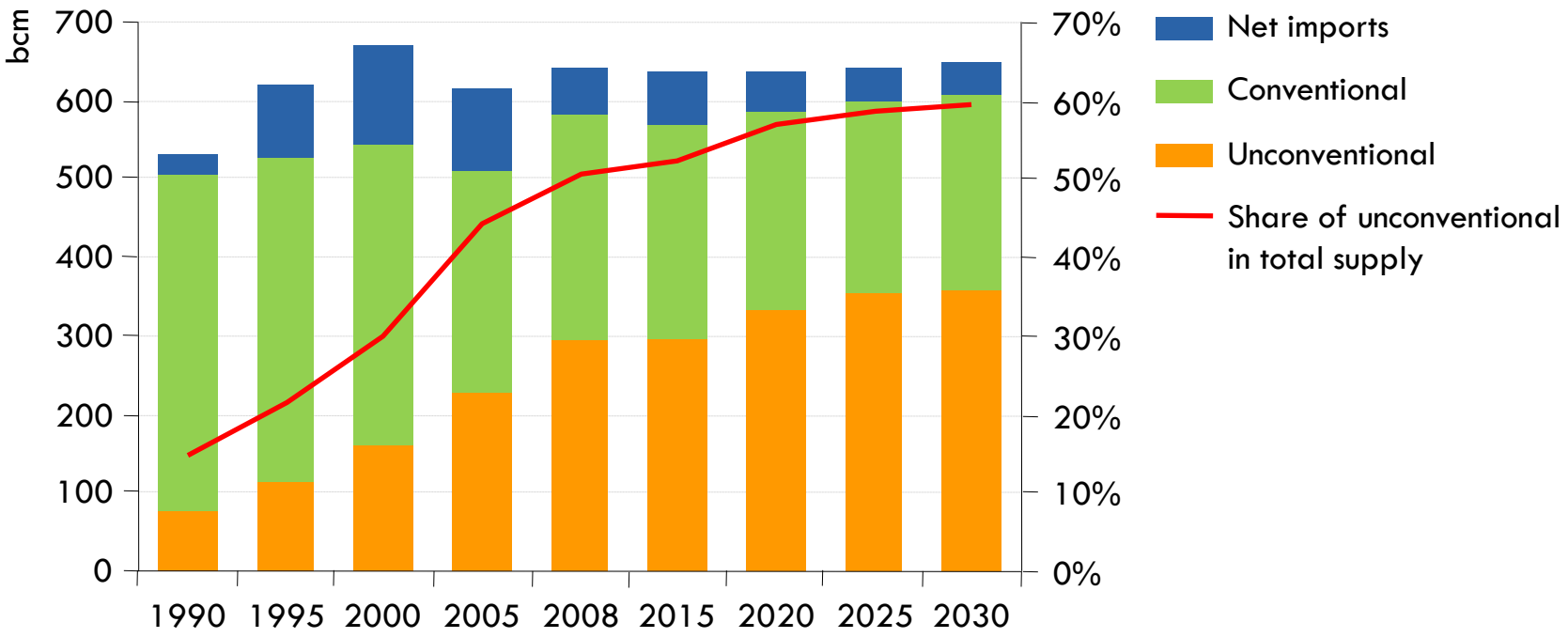


Impact of decline on world natural gas production in the Reference Scenario



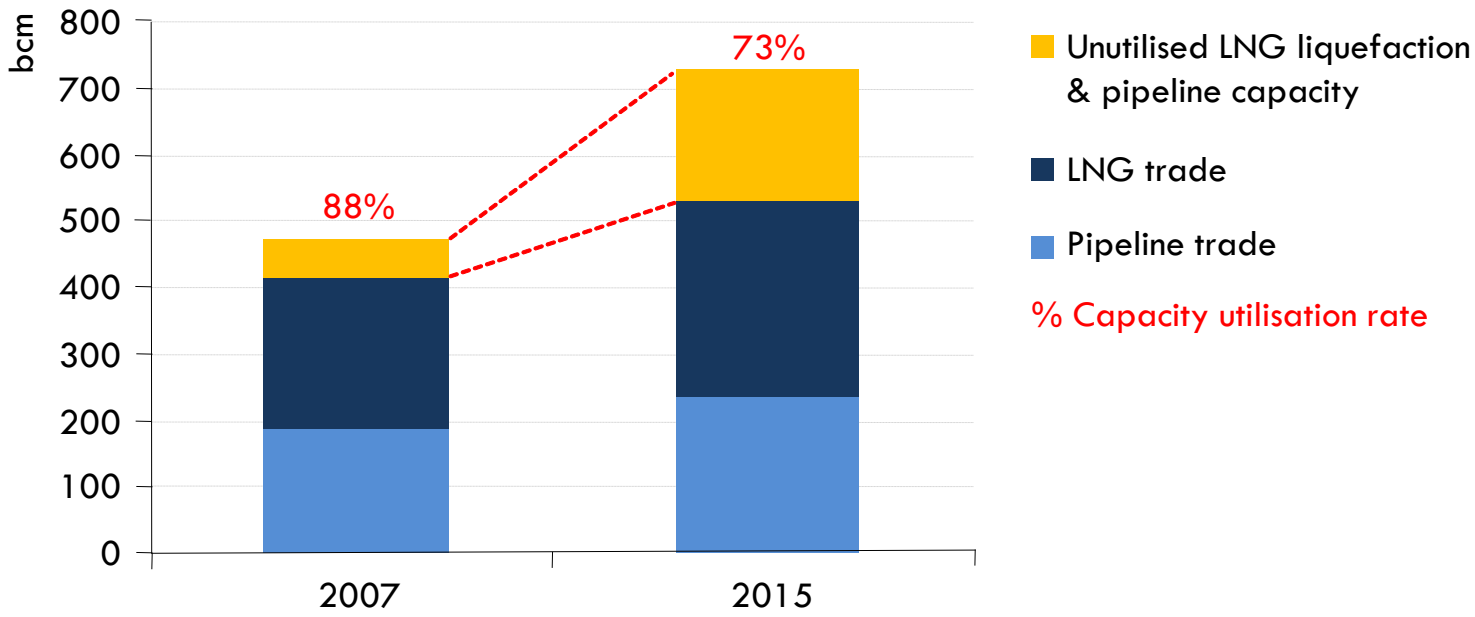
Additional capacity of around 2 700 bcm, or 4 times current Russian capacity, is needed by 2030 – half to offset decline at existing fields & half to meet the increase in demand

US natural gas supply in the Reference Scenario



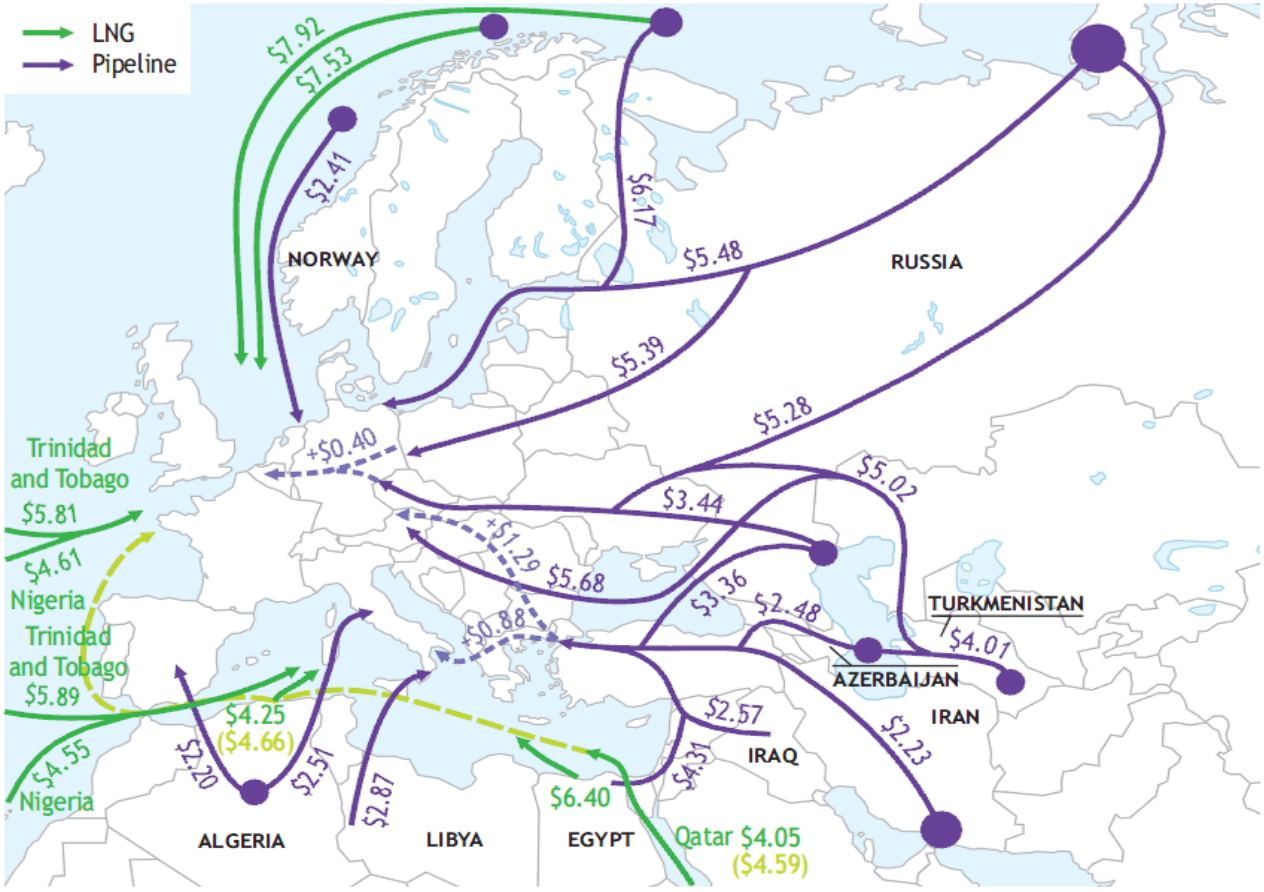
Thanks mainly to shale gas, US gas output grows gradually through to 2030, outstripping demand & squeezing imports

Natural gas transportation capacity



A glut of gas is developing – reaching 200 bcm by 2015 – due to weaker than expected demand & plentiful US unconventional supply, with far-reaching implications for gas pricing

Indicative costs for potential new sources of gas delivered to Europe, 2020 ($/MBtu)



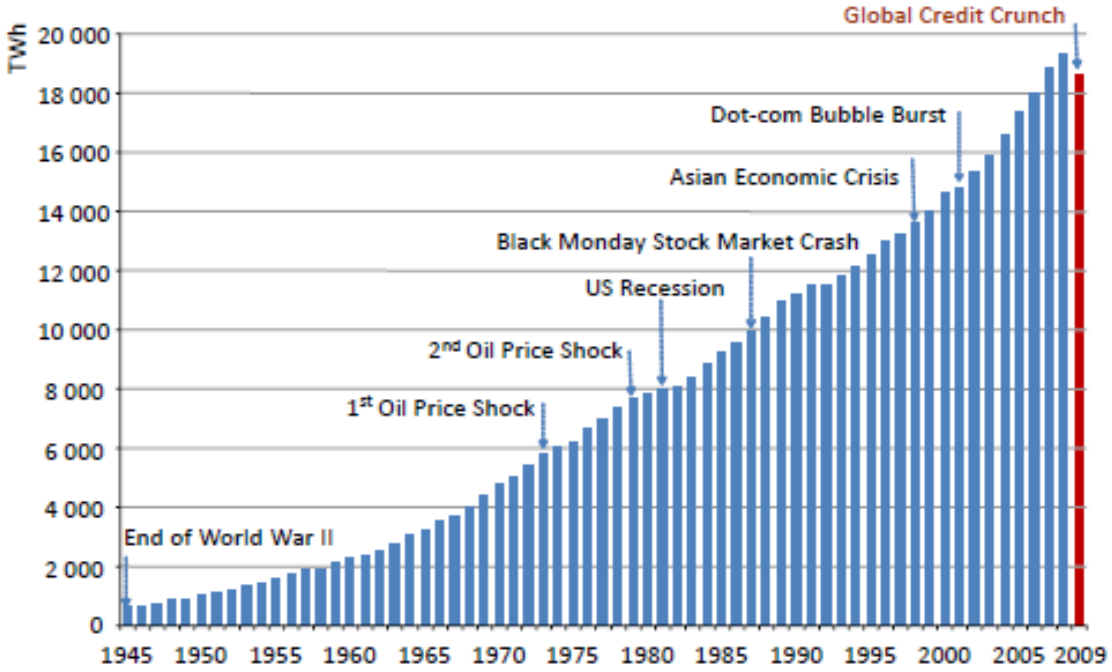
The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Although indigenous resources are limited & output is declining, Europe is geographically well placed to secure gas supplies from a variety of external sources

More on natural gas

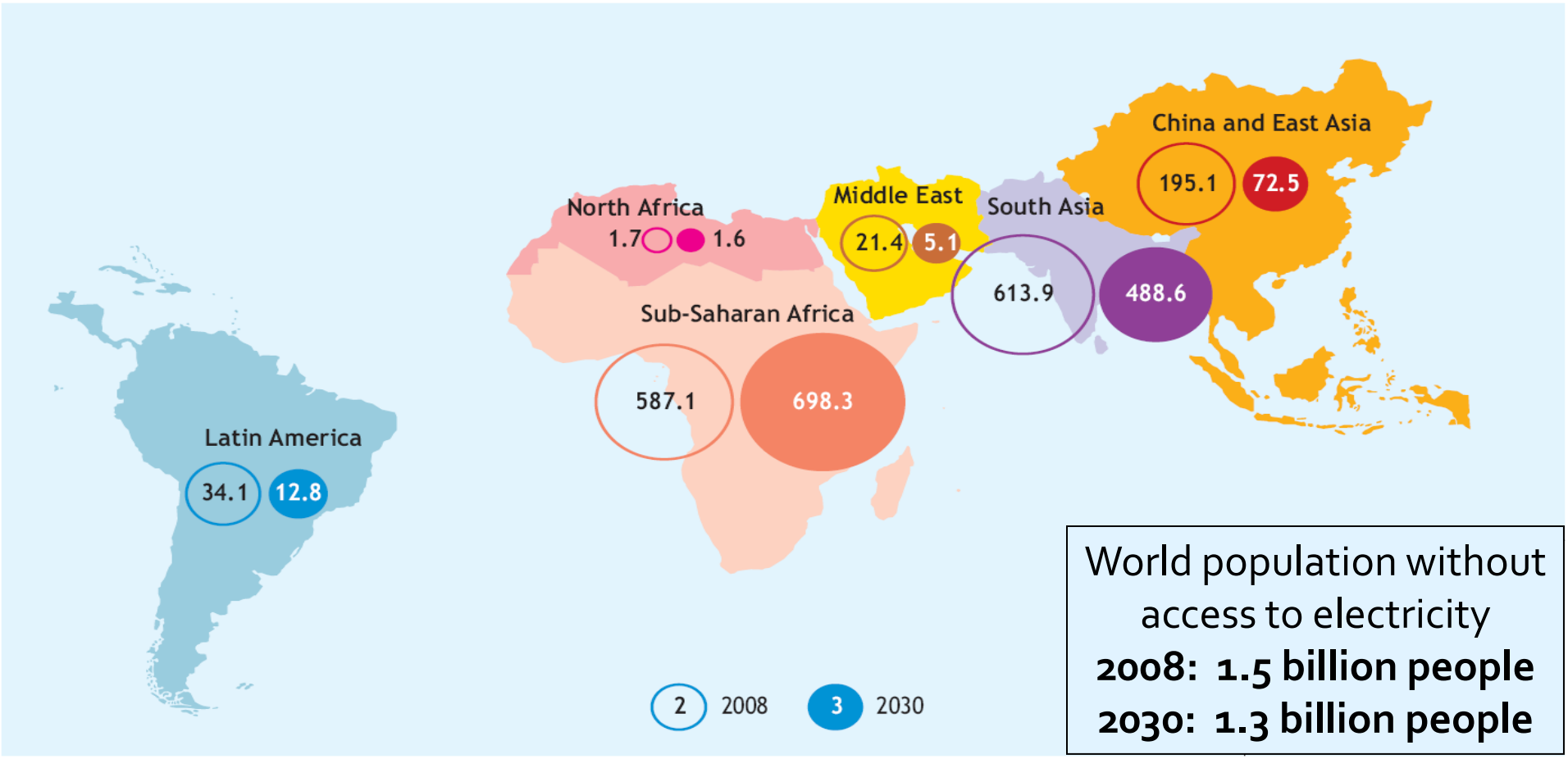
- North American gas prices – downward pressure to continue?
- Pressure on oil-indexed pricing – more innovative gas pricing formulae?
- Growing interest in LNG in Europe and Asia
- More unconventional gas: can the North American success story be replicated elsewhere ?
- Pace of global economic recovery is key to gas and electricity demand prospects

Demand uncertainty: How strong will be the economic recovery?



Global electricity consumption could drop by as much as 3.5% in 2009 – the first annual contraction since the end of the Second World War

Number of people without access to electricity in the Reference Scenario (millions)



World population without access to electricity

2008: 1.5 billion people

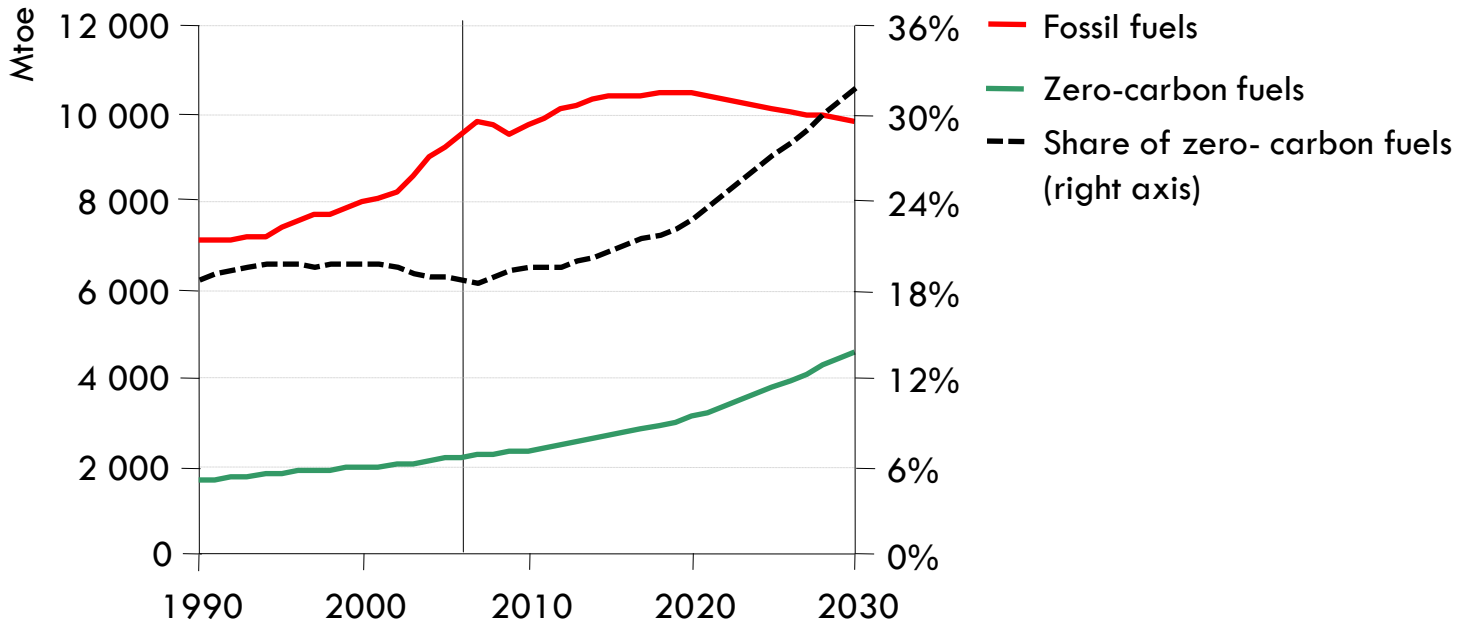
2030: 1.3 billion people

$35 billion per year more investment than in the Reference Scenario would be needed to 2030 – equivalent to just 5% of global power-sector investment – to ensure universal access

The policy mechanisms in the 450 Scenario

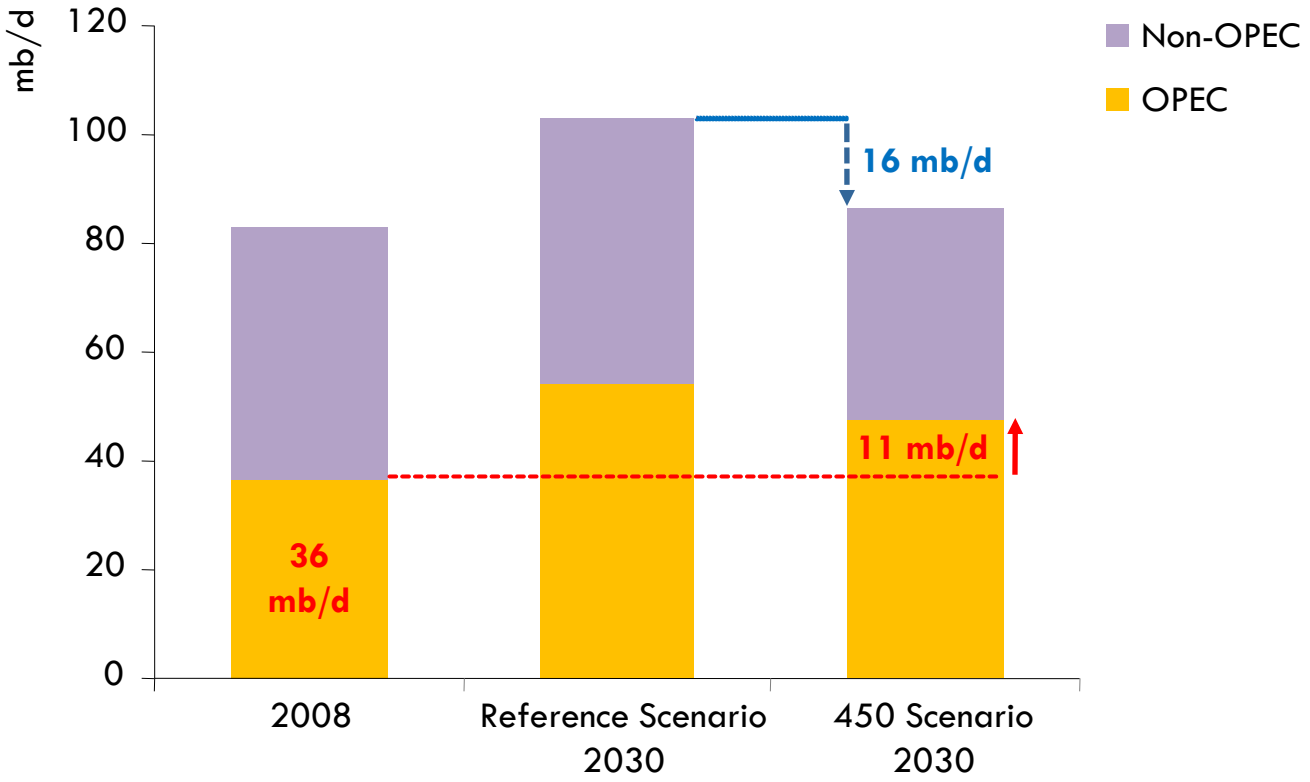
- A combination of policy mechanisms, which best reflects nations' varied circumstances & negotiating positions
- We differentiate on the basis of three country groupings
  - *OECD+: OECD & other non-OECD EU countries*
  - *Other Major Economies (OME): Brazil, China, Middle East, Russia & South Africa*
  - *Other Countries (OC): all other countries, including India & ASEAN*
- A graduated approach
  - *Up to 2020, only OECD+ have national emissions caps*
  - *After 2020, Other Major Economies are also assumed to adopt emissions caps*
  - *Through to 2030, Other Countries continue to focus on national measures*
- Emissions peaking by 2020 will require
  - *A CO_2 price of $50 per tonne for power generation & industry in OECD+*
  - *Investment needs in non-OECD countries of $200 billion in 2020, supported by OECD+ through carbon markets & co-financing*

World primary energy demand by fuel in the 450 Scenario



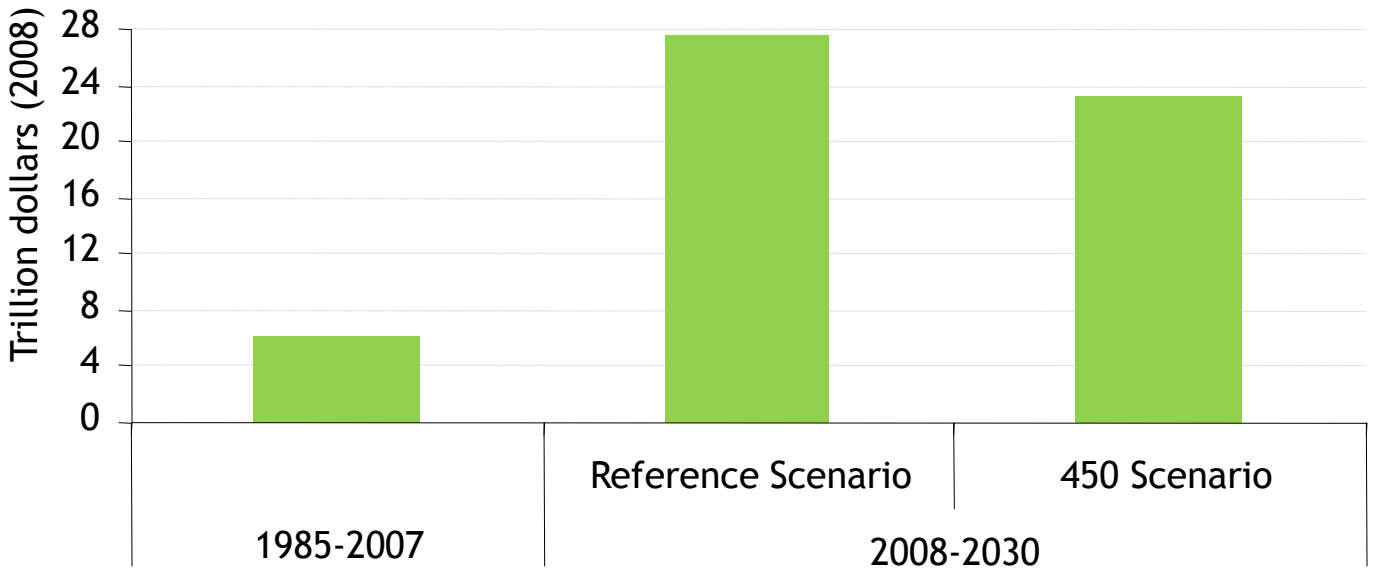
In the 450 Scenario, demand for fossil fuels peaks by 2020, and by 2030 zero-carbon fuels make up a third of the world's primary sources of energy demand

World oil production by scenario



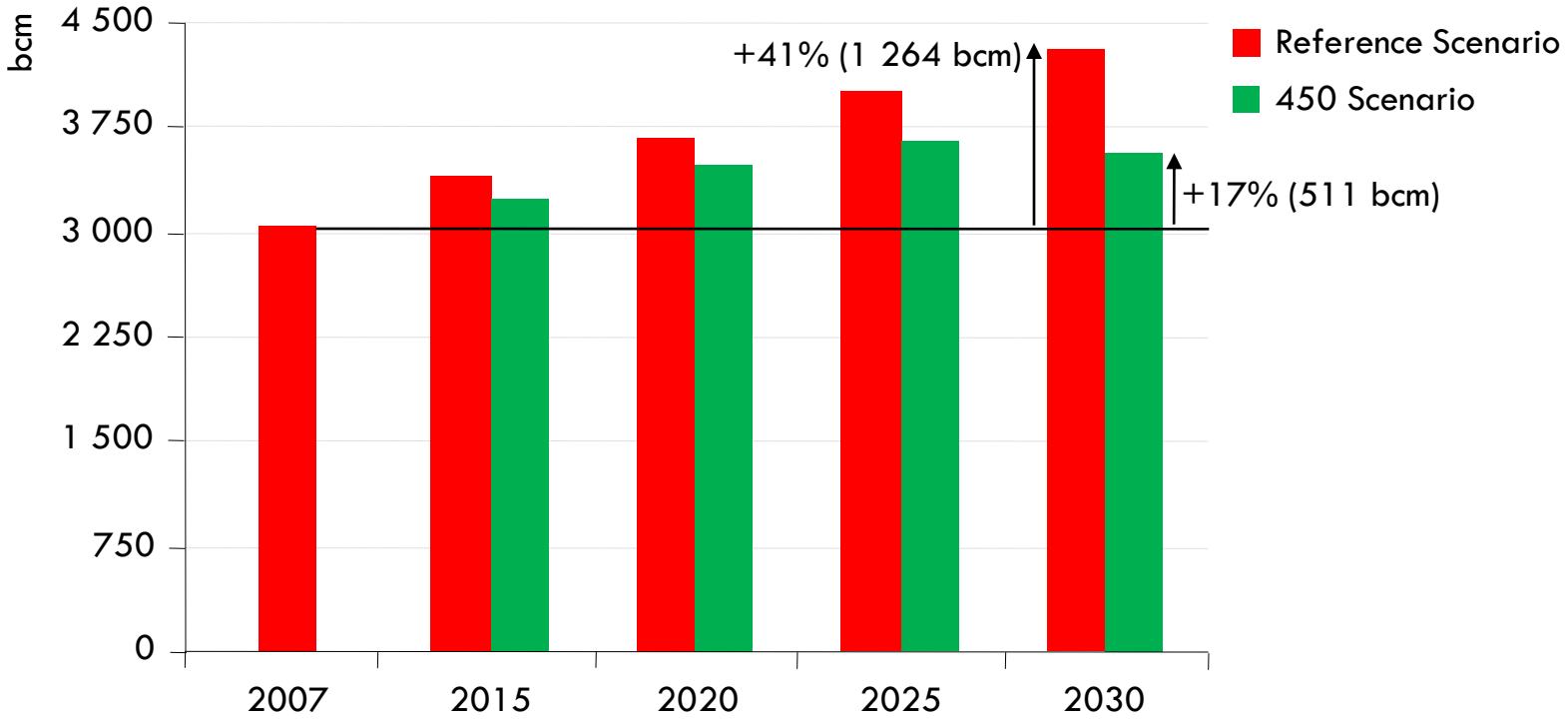
Curbing CO_2 emissions would also improve energy security by cutting oil demand, but even in the 450 Scenario, OPEC production increases by 11 mb/d between now and 2030

Cumulative OPEC oil export revenues by scenario



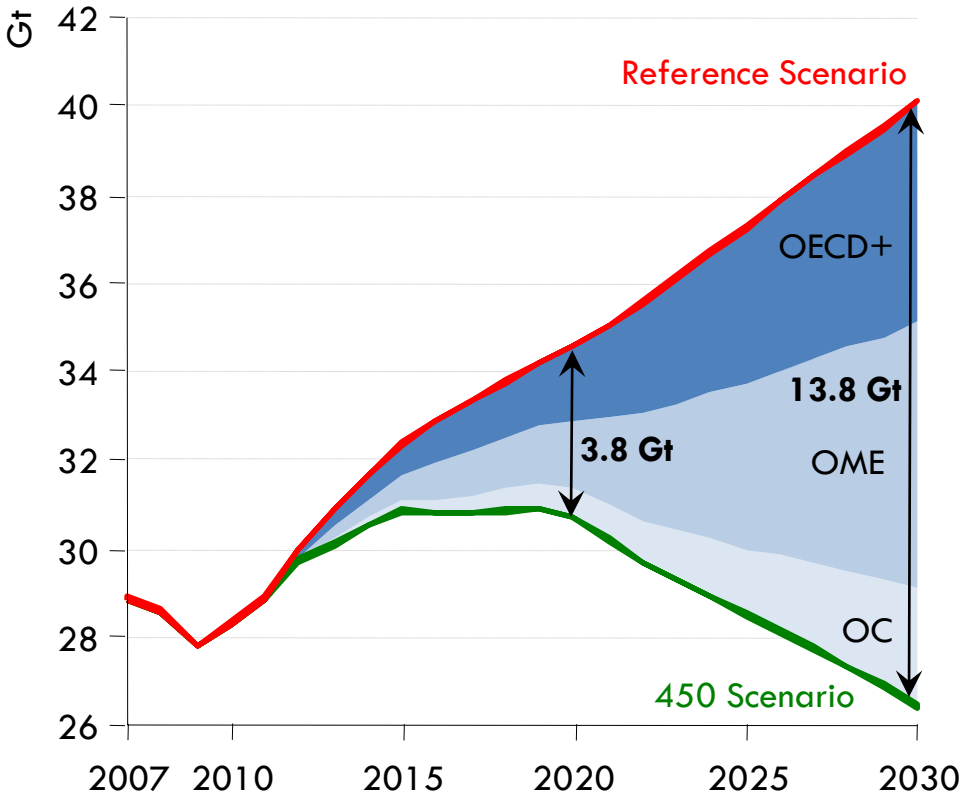
Though slightly lower than in the Reference Scenario, OPEC revenues in the 450 Scenario are over four times as high as in the last 20 years

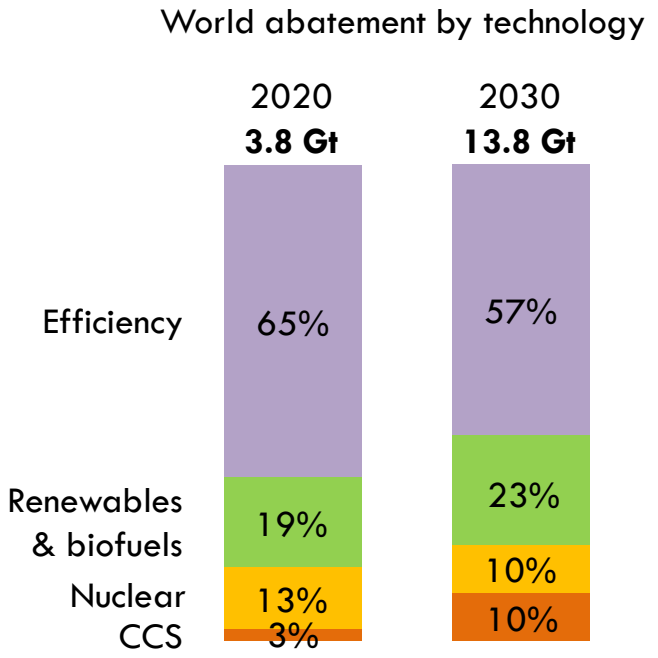
World primary natural gas demand by scenario



Gas demand continues to grow in both scenarios, peaking by around 2025 in the 450 Scenario & highlighting the potential role of gas as a transition fuel to a clean energy future

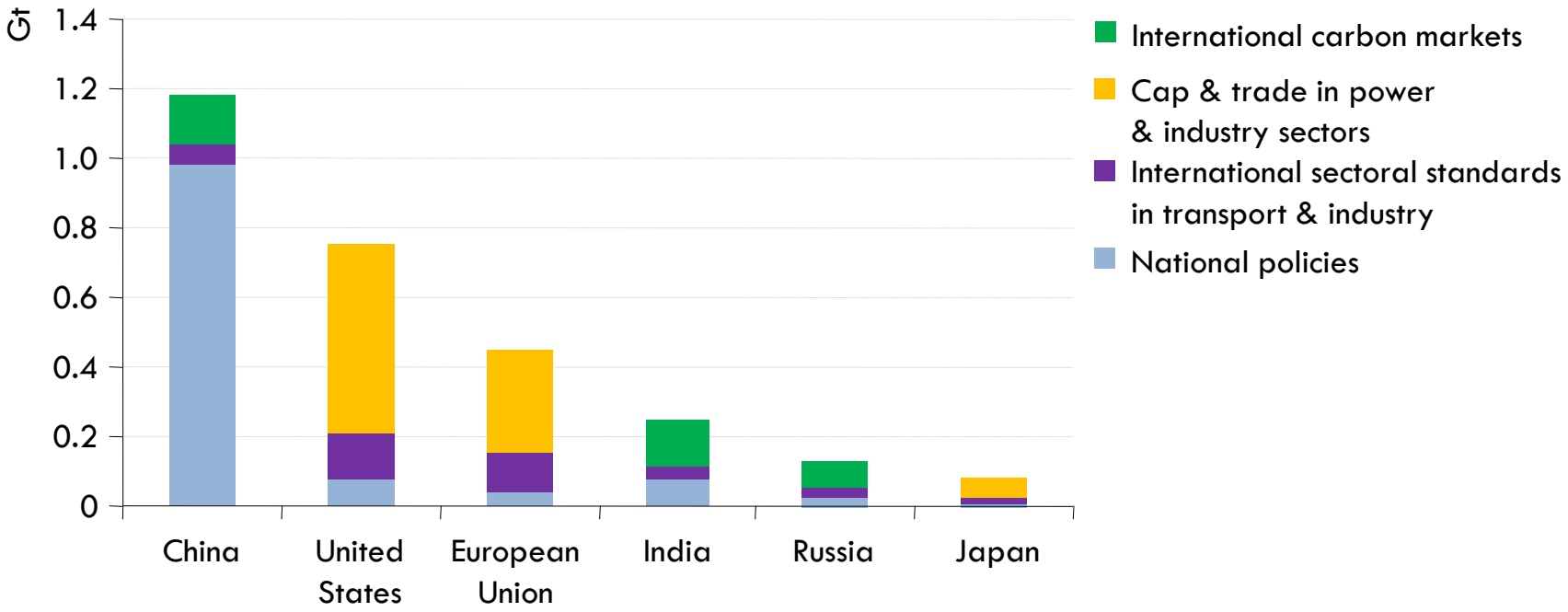
World abatement of energy-related CO_2 emissions in the 450 Scenario





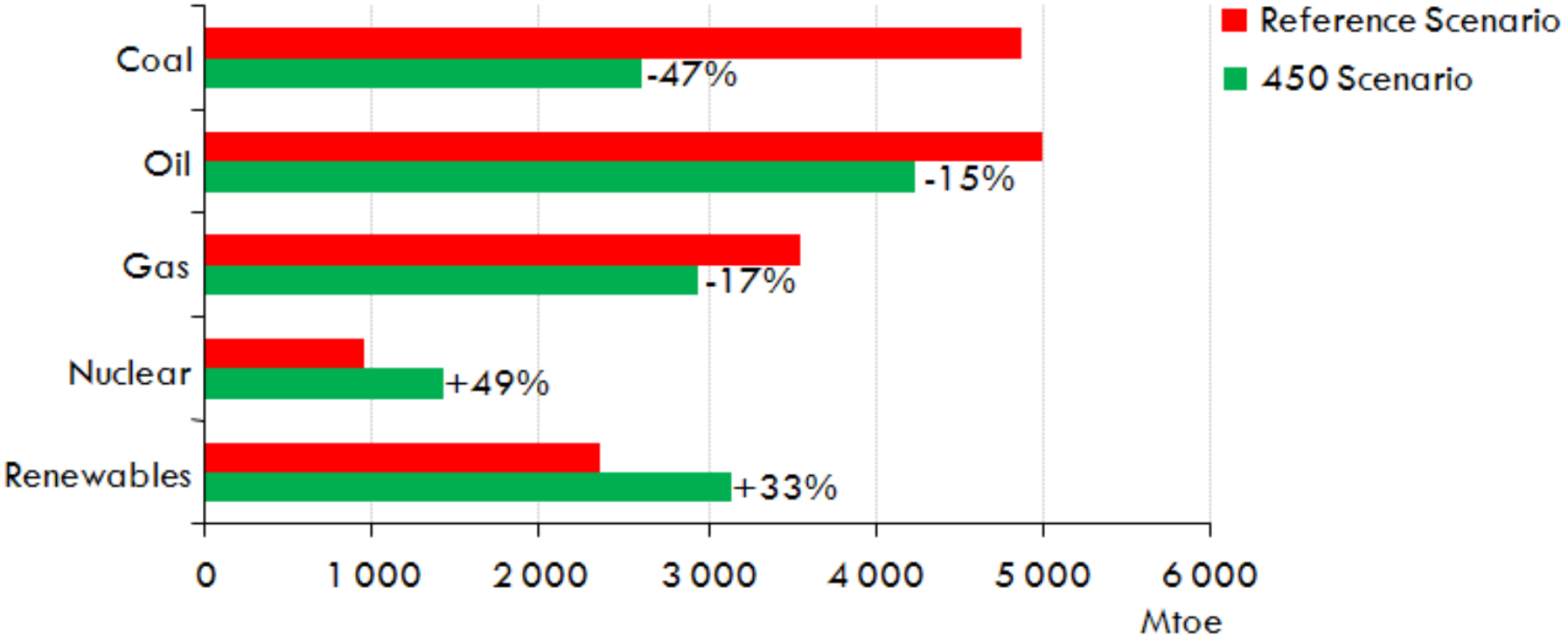
An additional $10.5 trillion of investment is needed in total in the 450 Scenario, with measures to boost energy efficiency accounting for most of the abatement through to 2030

Abatement in the 450 Scenario by key emitters, 2020

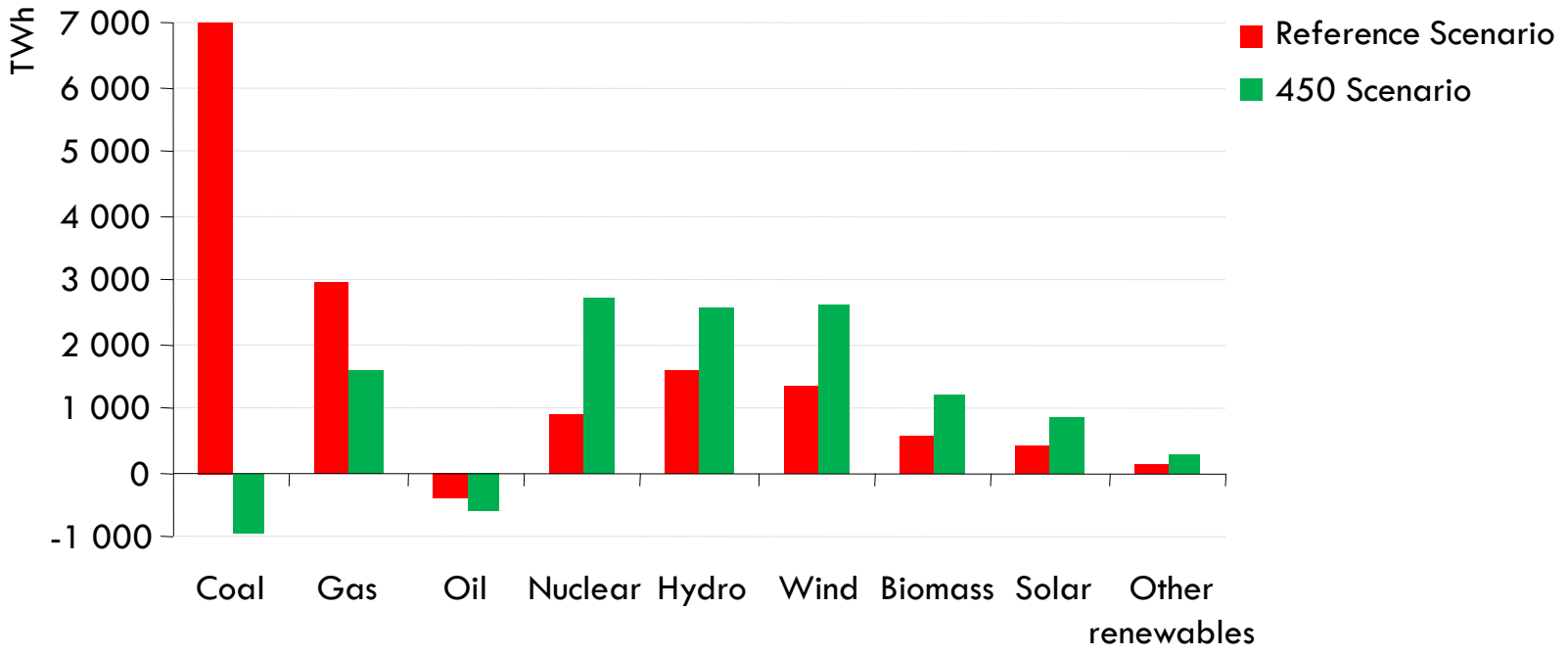


China, the United States, the European Union, India, Russia & Japan account for almost three-quarters of the 3.8 Gt reduction in the 450 Scenario

World primary energy demand by fuel and scenario in 2030

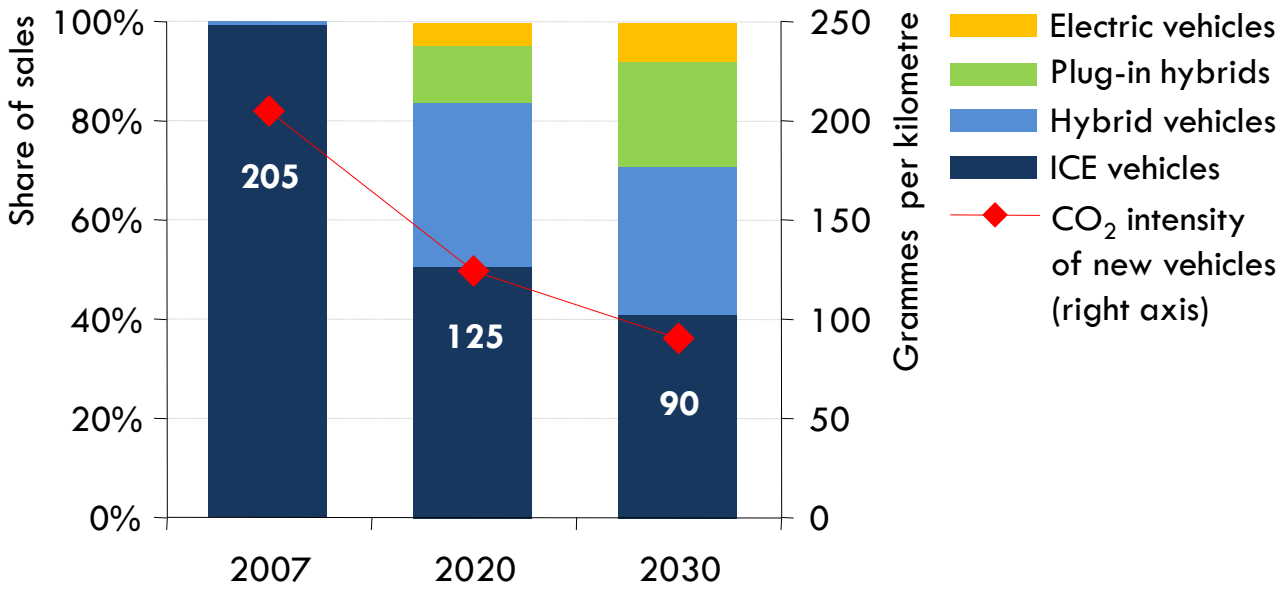


Incremental world electricity production in the Reference and 450 Scenarios, 2007-2030



Renewables, nuclear and plants fitted with CCS account for around 60% of electricity generation globally in 2030 in the 450 Scenario, up from less than one-third today

World passenger vehicle sales & average new vehicle CO_2 intensity in the 450 Scenario



Improvements to the internal combustion engine & the uptake of next-generation vehicles & biofuels lead to a 56% reduction in new-car emission intensity by 2030

COP15 - A failure or success?

No binding target. Convention takes note of Copenhagen Accord, *but*

(+)

For the first time: Dg countries pledges (+US)

Substantial finance pledged to support vulnerable countries and trigger emission reductions

2ºC target is a step forward…

(-)

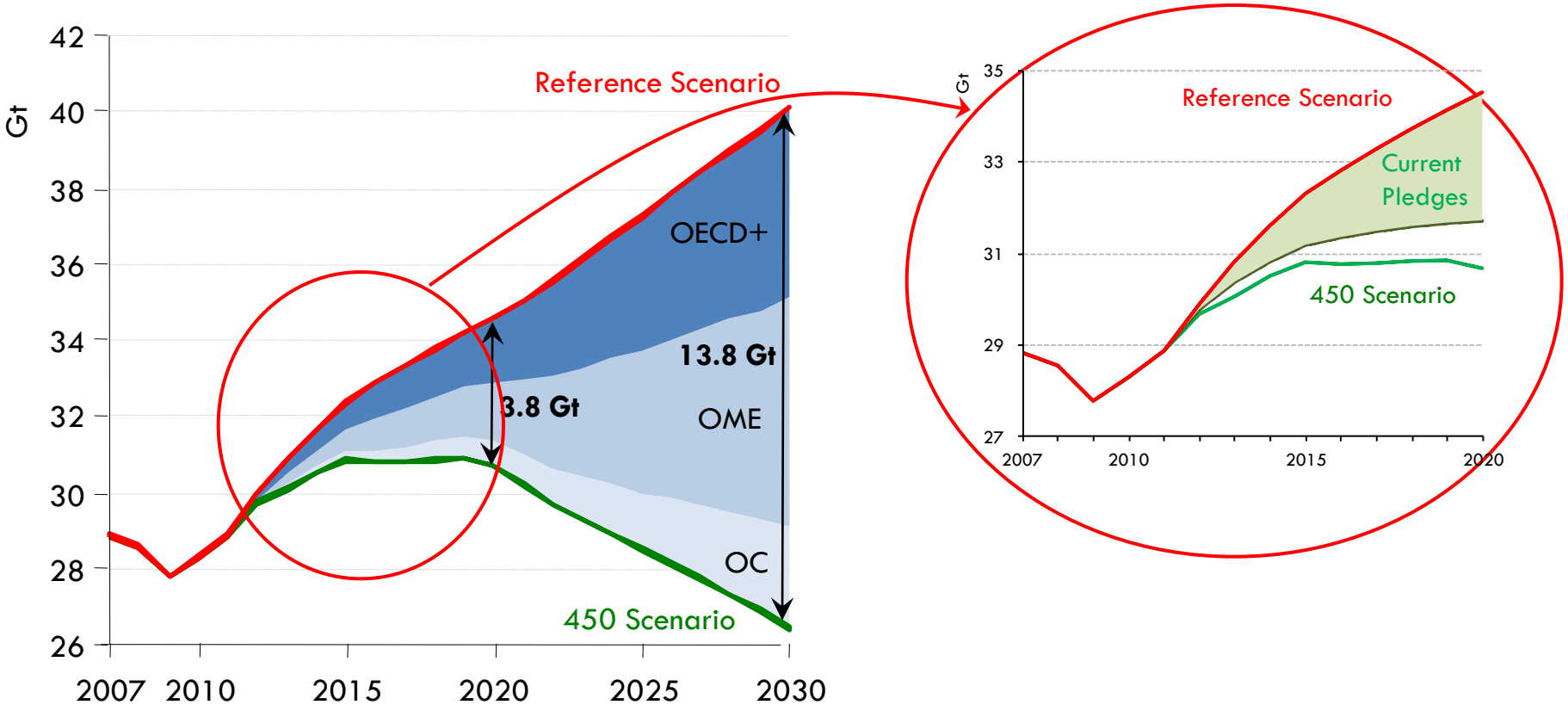
…but pledges will likely fall short

Some loss of confidence in UNFCCC process

- **Can other processes (Major Economies Forum? G20?) move more effectively?**

Huge efforts still needed to curb CO_2

Copenhagen and the 450 Scenario



Current pledges point in the right direction but further efforts would be needed to close the gap and reach the 450 Scenario

Source: **IEA analysis based on pledges as of 11 December 2009**, and World Energy Outlook 2009

Summary & conclusions

- The financial crisis has halted the rise in global fossil-energy use, but its long-term upward path will resume soon *on current policies*
- Tackling climate change & enhancing energy security require a massive decarbonisation of the energy system
  - > We are now on course for a 6°C temperature rise & rising energy costs
  - > Limiting temperature rise to 2°C will require big emission reductions in all regions
- A 450 path towards 'Green Growth' would bring substantial benefits
  - > Avoiding the worst effects & costs of climate change
  - > Energy-security benefits, lower oil & gas imports & reduced energy bills
  - > Much less air pollution & huge health benefits
- Natural gas can play a key role as a bridge to a cleaner energy future
- The challenge is enormous – but it can and must be met
  - > Improved energy efficiency & technology deployment are critical
  - > Each year of delay adds $500 bn to mitigation costs between today & 2030